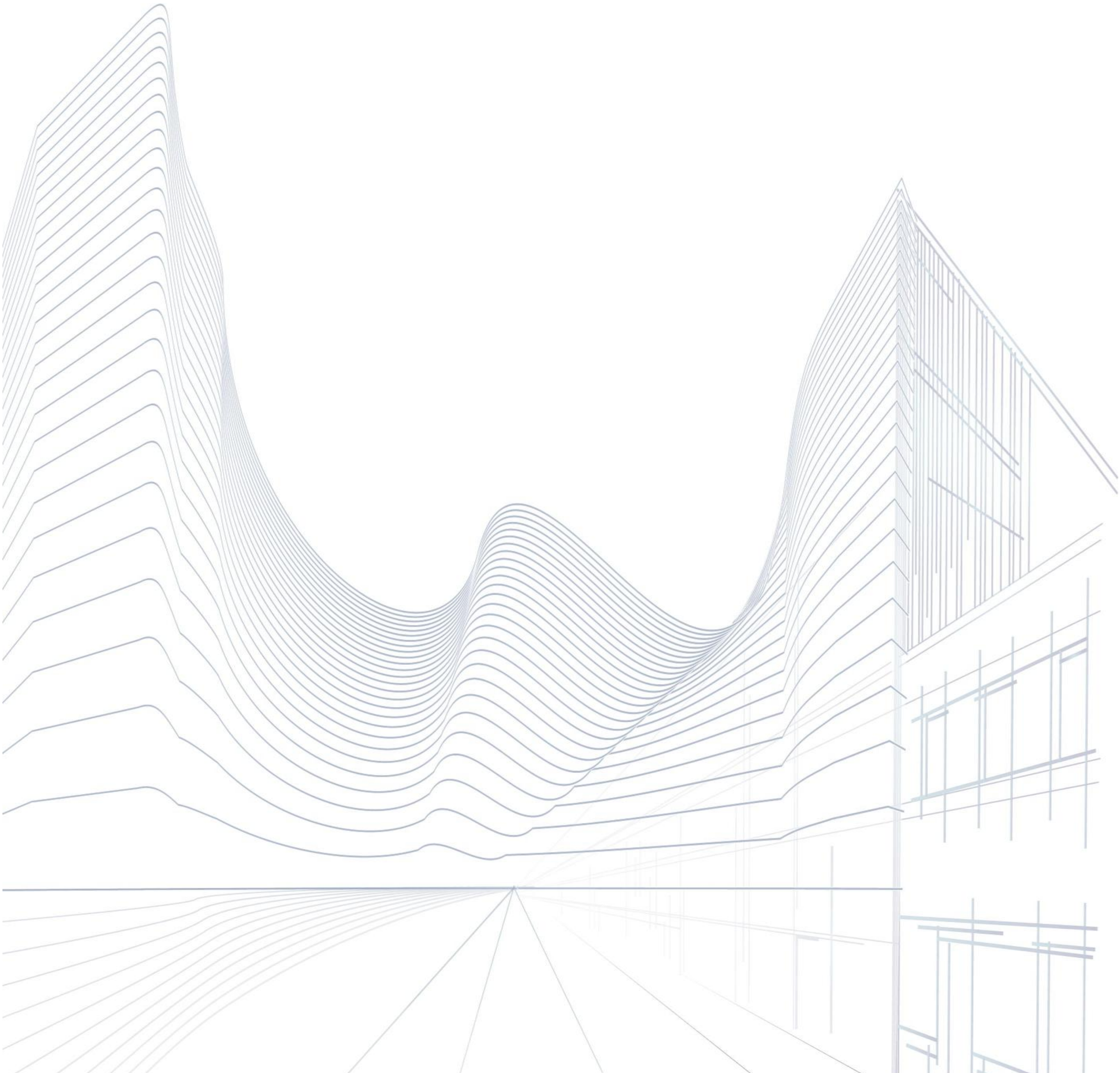

Environmental Impact Assessment (EIA) of the Project:

CO2 Storage Unit in Prinos

Date: November 2024

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Project	CO2 Capture and Storage (CCS) Unit in Prinos		
STUDY STAGE	Environmental Impact Assessment (EIA)		
STUDY CODE	CCP - 2902		
DATE	25.11.2024		
VERSION	v.01		
REVISION	v.01		
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ABBREVIATIONS – ACRONYMS

Abbreviation – Acronym	Explanation
ABP	Animal By-products
ADA	Aquaculture Development Areas
AG	Acid Gas
AH	Absolute Hazardous
ALARP	As-Low-As-Reasonably-Practicable
AMC	Act of the Ministerial Council
AMS	Alternative Management System
ANH	Absolute Non Hazardous
AONB	Areas of Outstanding Natural Beauty
API	American Petroleum Institute
APPMMECA	Action Plan for the Protection of the Mediterranean Marine Environment and Coastal Areas
ATEX	Explosive Atmospheres
BioCCS	Bioenergy with Carbon Capture and Storage
BOD	Biochemical Oxygen Demand
BoG	Bank of Greece
BOP	Blowout Preventer
BOP	Blowout Preventer
BTU	Biowaste Treatment Unit
BW	Biowaste
BWM	Ballast Water Management
C	Circular
CAMS	Collective Alternative Management System
CBPAK-TMR	Complex Biodiversity Protection Area of the Kavala–Thasos Marine Region
CCH	Critical Cetacean Habitat
CCR	Central Control Room
CCS	Carbon Capture Storage
CCU	Carbon Capture and Utilization
CELC	Central Environmental Licensing Council
CLC	Corine Land Cover
CM	Cambisols
CO_2	Carbon Dioxide
COD	Chemical Oxygen Demand
COPC	Contaminants of Primary Concern
CPEPD	Civil Protection and Emergency Planning Department
CS	Civil Society

Abbreviation – Acronym	Explanation
DACCS	Direct Air Capture with Carbon Storage
DDP	Detailed Drilling Plan
DNV	Classification Society Det Norske Veritas
Draft SEP	Draft Stakeholder Engagement Plan
EAP	Environmental Action Programme
EBRD	European Bank for Reconstruction and Development
EBSA	Ecologically or Biologically Significant Areas
EC	European Community
ECDW	Excavation, Construction and Demolition Waste
EE	European Union
EER	Electronic Environmental Register
EIA	Environmental Impact Assessment
EIA	Environmental Impact Assessment
ELD	Environmental Licensing Directorate
ELD	Environmental Liability Directive
EMAS	Eco-Management and Audit Scheme
EMP	Environmental Monitoring Program
EMR	Environmental Monitoring Report
EMS	Environmental Management System
EOR	Enhanced oil Recovery
ES	Environmental and Social
ESDV	Emergency Shut Down Valves
ESP	Electrical Submersible Pumps
ESS	Environmental and Social Standards
ET	Environmental Terms
ETAD	Environmental Terms Approval Decision
ETS	Emissions Trading System
EU ETS	EU Emissions Trading System
EUOAG	European Union Offshore Oil & Gas Authorities Group
EWC	European Waste Catalogue
EWR	Electronic Waste Register
FEIR	Foundation for Economic and Industrial Research
FRA	Fisheries Restricted Areas
FRMP	Flood Risk Management Plan
GDP	Gross Domestic Product
GDPR	General Data Protection Regulation
GES	Good Environmental Status
GET	Green Economy Transition
GFSPSD	General Framework for Spatial Planning and Sustainable Development

Abbreviation – Acronym	Explanation
GG	Government Gazette
GHG	Greenhouse Gases
GHGs	Greenhouse Gases
GIIP	Good International Industry Practice
GNAPD	Greek National Action Plan against Desertification
GNCHR	Greek National Commission for Human Rights
GOP	Good Oilfield Practice
GS	Groundwater Systems
GUP	General Urban Plan
HEDNO	Hellenic Electricity Distribution Network Operator
HHERMC	Hellenic Hydrocarbon and Energy Resources Management Company
HHW	Hazardous Healthcare Waste
HMGS	Hellenic Military Geographical Service
HNMS	Hellenic National Meteorological Service
HONECC	Hellenic Organization for Natural Environment and Climate Change
HP	Horsepower
HRA	Hellenic Recycling Agency
HSA	Hellenic Statistical Authority
HSCZ	Habitat and Species Conservation Zone
HTSD	Hellenic Transmission System Operator
HV	High Voltage
I	Interchange
IA	Industrial Area
IAMS	Individual Alternative Management Systems
IBA	Important Bird Areas
ICCPR	International Covenant on Civil and Political Rights
ICESCR	International Covenant on Economic, Social and Cultural Rights
ICZM	Integrated Coastal Zone Management
IDS	Illegal Dumping Sites
IEA	International Energy Agency
IEAGHG	IEA Greenhouse Gas
IFC	International Finance Corporation –
IHW	Industrial Hazardous Waste
ILO	International Labour Organization
IMMA	Important Marine Mammal Areas
IMO	International Maritime Organization
IP	Industrial Park
IPAM	Independent Project Accountability Mechanism
IPCC	Intergovernmental Panel on Climate Change

Abbreviation – Acronym	Explanation
IPPC	International Plant Protection Convention
ISPS Code	International Ship and Port Facility Security Code
ISRA	Important Shark and Rays Areas
IV	International Value
JMD	Joint Ministerial Decision
KBA	Key Biodiversity Areas
L	Lagoon
L	Law
LAT	Lowest Astronomical Tide
LEPL	Legal Entities of Public Law
LER	Local Equipment Room
LGA	Local Government Authority
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
LSP	Local Spatial Plan
LULUCF	Land Use, Land-Use Change, and Forestry
LWMP	Local Waste Management Plan
LWMP	Local Waste Management Plan
LAeq	Equivalent Continuous Sound Pressure Level
MAP	Mediterranean Action Plan
MD	Ministerial Decision
MEE	Ministry of Environment and Energy
MH	Mirror Hazardous
MHHW	Mean Higher High Water
MHLW	Mean Higher Low Water
MLHW	Mean Lower High Water
MM	Mass Media
MNH	Mirror Non Hazardous
MNLW	Mean Neap Low Water
MS	Meteorological Station
MSAD	Minimum Safe Abandonment Depth
MSF	Marine Spatial Frameworks
MSFD	Marine Strategy Framework Directive
MSHW	Mean Spring High Water
MSL	Mean Sea Level
MSP	Marine Spatial Planning
MSW	Municipal Solid Waste
Mt	Million Tonnes
MTPA	Million Tonnes per Annum

Abbreviation – Acronym	Explanation
MU	Municipal Unit
MW	Municipal Waste
MWSSCK	Municipal Water Supply and Sewerage Company of Kavala
NAPCD	National Action Plan to Combat Desertification
NBA	National Observatory of Athens
NCESD	National Center for the Environment and Sustainable Development
NECP	National Energy and Climate Plan
NGL	Natural gas liquids
NGOs	Non-Governmental Organizations
NHWMP	National Hazardous Waste Management Plan
NORM	Naturally Occurring Radioactive Material
NPL	Non-Performing Loans
NPZ	Nature Protection Zone
NR	National Road
NRCC	Nothern Rhodope Core Complex
NRWAP	National Register of Water Abstraction Points
NSCCA	National Strategy for Climate Change Adaptation
NSS	National Spatial Strategy
NTUA	National Technical University of Athens
NV	National Value
NWMP	National Waste Management Plan
NWPP	National Waste Prevention Program
NZIA	Net Zero Industry Act
OCMF	Organization of Central Markets and Fisheries
OEUK	Offshore Energies UK
OPC	Overpressured Clay Formations
PAHs	Polycyclic Aromatic Hydrocarbons
PAMA	Protected Area Management Authority
PAMU	Protected Areas Management Units
PCB	Plastic Carrier Bags
PCB	Polychlorinated Biphenyls
PCI	Project of Common Interest
PCSU	Production, Configuration, Supply and Use
PCT	Polychlorinated Triphenyls
PD	Presidential Decree
PERD	Preliminary Environmental Requirements Determination
PFI	Private Finance Initiative
PGC	Public Gas Corporation
PHFRZ	Potential High Flood Risk Zone

Abbreviation – Acronym	Explanation
POP	Persistent Organic Pollutant
PPE	Personal Protective Equipment
PW	Packaging Waste
QRA	Quantitative Risk Assessment
RB	River Basin
RBMPs	River Basin Management Plans
RCCAP	Regional Climate Change Adaptation Plans
RCI	Regional Competitiveness Index
RCP	Representative Concentration Pathways
RELC	Regional Environmental Licensing Council
REMT	Region of Eastern Macedonia and Thrace
RES	Renewable Energy Sources
RF-SPSD	Regional Framework for Spatial Planning and Sustainable Development
RG	Regosols
RM	Recyclable Materials
RMSC	Recyclable Materials Sorting Centers
ROP	Rate of Penetration
RRP	Recovery and Resilience Plan
RRU	Recovery and Recycling Units
RSF	Regional Spatial Framework
RSS	Rotary Steerable System
RU	Regional Unit
RV	Regional Value
RWMP	Regional Waste Management Plan
S/S	Substation
SA	Study Area
SACROC	Scurry Area Canyon Reef Operating Committee
SCI	Sites of Community Importance
SCZ	Special Conservation Zone
SDG	Sustainable Development Goals
SDS	Safety Data Sheets
SEAS	Special Ecological Assessment Study
SEIS	Strategic Environmental Impact Study
SEP	Stakeholder Engagement Plan
SFSPSD	Special Frameworks for Spatial Planning and Sustainable Development
SHPF	Safety and Health Plan and File
SIMOPS	Simultaneous operations
SLR	Sea Level Rise
SLS	Sanitary Landfill Sites

Abbreviation – Acronym	Explanation
SNRMZ	Sustainable Natural Resources Management Zone
SOP	Standard Operating Procedure
SPA	Special Protection Area
SPA	Specially Protected Areas
SQHW	Small Quantities of Hazardous Waste
SQRA	Semi-quantitative risk assessment
SRCC	Southern Rhodope Core Complex
SS	Source Separation
SSF	Special Spatial Framework
SSW	Special Secretariat for Water
SUPs	Single-Use Plastic Products
SWC	Social Welfare Centers
SWMA	Solid Waste Management Authority
TCG	Technical Chamber of Greece
TDS	Top Drive System
TOP	Top of Pipe
UAA	Utilized Agricultural Area
UCZ	Urban Control Zone
UN	United Nations
UN	United Nations
UNCLOS	United Nations Convention on the Law of the Sea
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UVT	Used Vehicle Tires
VAT	Value Added Tax
VOCs	Volatile Organic Compounds
WD	Water District
WDU	Water Softening Unit
WEBA	Waste Electrical Batteries & Accumulators
WEEE	Waste Electrical and Electronic Equipment
WFD	Water Framework Directive
WFD	Water Framework Directive
WLO	Waste Lubricating Oils
WM	Waste Management
WMP	Waste Management Plan
WMP	Weyburn–Midale CO_2 Monitoring and Storage Project
WO	Waste Oils
WR	Wildlife Refuge
WTP	Wastewater Treatment Plant

Abbreviation – Acronym	Explanation
WTU	Waste Treatment Unit

CONTENTS

TABLES

FIGURES

1 INTRODUCTION

1.1 PROJECT TITLE

The title of the proposed project under assessment is: **"Carbon Dioxide (CO_2) Storage Unit in Prinos."**

The proposal includes the installation of a full-scale carbon dioxide (CO_2) storage unit in Prinos (the "Project"). The proposed CO_2 storage site is located within the Prinos Basin, in the Gulf of Kavala, in the Northeastern Aegean. The area of interest for the storage is located offshore, within the Prinos Concession Area, where **Energean Oil & Gas SA ("Energean"), an affiliated company of EnEarth**, holds 100% of the participation rights and management rights and has been carrying out oil and natural gas exploration and production activities since 2007. The proposed CO_2 storage location is situated within the Prinos structure and the underlying aquifer.

The Environmental Impact Assessment (EIA) of the Project is being prepared in accordance with the applicable provisions of Greek legislation and the relevant European Directives.

1.2 TYPE AND SIZE OF THE PROJECT

The operation of the facility is planned to be developed in two distinct phases based on capacity (Phase 1 and Phase 2), for reasons of scalability and adaptation to market conditions.

- Phase 1: The initial nominal capacity of the Project will be up to **1 MTPA** for a duration of 20 years (starting in late 2025 to early 2026). The CO_2 will be primarily supplied in bulk via a third-party pipeline, arriving on-site under suitable conditions for injection. Small quantities of CO_2 will also be received at the onshore Sigma facilities from trucks as part of pilot projects.
- Phase 2: The Project is planned to gradually expand to a final nominal capacity of up to **3 MTPA**. The facility will be modified to accept liquefied CO_2, which will be delivered via marine carriers to a newly constructed jetty. For this purpose, offshore berthing and unloading facilities for liquefied CO_2 will be constructed, along with new storage and processing facilities (including pumping and heating) within the premises of the Sigma plant operations. The liquefied CO_2 will be temporarily stored, processed onshore and then transported to the offshore facilities via the pipeline constructed during Phase 1
- The present study focuses on **Phase 1** of the Project

The new facilities and wells planned for the operation of Phase 1 of the CO_2 storage Project include:

- Onshore facilities: modification of a designated area within the existing premises of the Sigma plant for the construction of the CO_2 reception manifold and an unloading and compression area.
- Offshore pipeline: a subsea pipeline connecting the Sigma plant area with the offshore Beta platform, approximately 20 km in length.
- Offshore platforms: modification and/or use of the existing offshore facilities at Prinos (Beta and Delta platforms) to receive CO_2 from the new subsea pipeline and CO_2 shipments in containers for injection into the new wells, as well as for the treatment of produced water (Delta platform).
- Wells: Two (2) CO_2 injection wells and two (2) water production wells on the existing Beta platform of the offshore Prinos complex.

In the marine area of the Kavala Gulf, Energean's **offshore hydrocarbon extraction facilities** operate, which include a complex of production platforms (Alpha, Beta, Kappa) and a processing platform (Delta), subsea pipelines transporting sour natural gas and crude oil from the platforms to the onshore unit, sweet natural gas from the onshore unit to the platforms, as well as underwater electric power cables.

Additionally, Energean's **onshore industrial Sigma** unit includes facilities for the reception, desalination, dehydration, stabilization and desulfurization of produced crude oil, the conversion of produced sour gas into sweet gas, the production of liquid and solid sulfur as well as the required facilities for the safe storage and handling of produced crude oil, natural gas and sulfur. The unit is classified as a top-tier establishment according to Ministerial Decision 172058/2016 complying with Directive 2012/18/EU (Seveso III), as it includes onshore storage facilities for stabilized crude oil and liquefied fuel gas.

Energean holds, among other rights, the exploration and exploitation rights for hydrocarbons in the offshore area of the Prinos oil fild (Law 2779/1999, Government Gazette 296/A/30.12.1999). Within the framework of years of conducting Oil Operations (exploration and exploitation) within the Prinos Exploitation Area, Energean has collected geological, geophysical and drilling data for the Prinos geological basin and specifically for the **Prinos and Epsilon structures**, from which it is demonstrated that these specific structures are, in principle, eligible as CO_2 storage sites. With Decision No. EDEYEP 14577 "Activation of the Exploration Right for CO_2 Storage" by EDEYEP S.A. (Government Gazette 5247//11.10.2022), **the preliminary eligibility of the storage site was confirmed, which is located within the boundaries of the Prinos concession and includes the structures of the Prinos and Epsilon fields as well as the underlying aquifer**. As the studies for the Project progressed, it was determined that limiting CO_2 storage to the Prinos structure would be more effective.

The storage site (**Figure** 1-1) refers to a specific volume within a geological formation that is selected and configured for the purpose of CO_2 storage. The Prinos storage site covers an area of approximately 20.16 km^2, with a perimeter of 26.77 km.

The storage complex (**Figure** 1-1) includes the storage site as well as the syrrounding geological fromations, the nature of which is crucial for the effectiveness ans safety of CO_2 storage. These fromations contribute to the overall storage capacity and the integrity of the CO_2 storage project. The Prinos complex covers an area of approximately 256.86 km^2, with a perimeter of approximately 72.99 km.

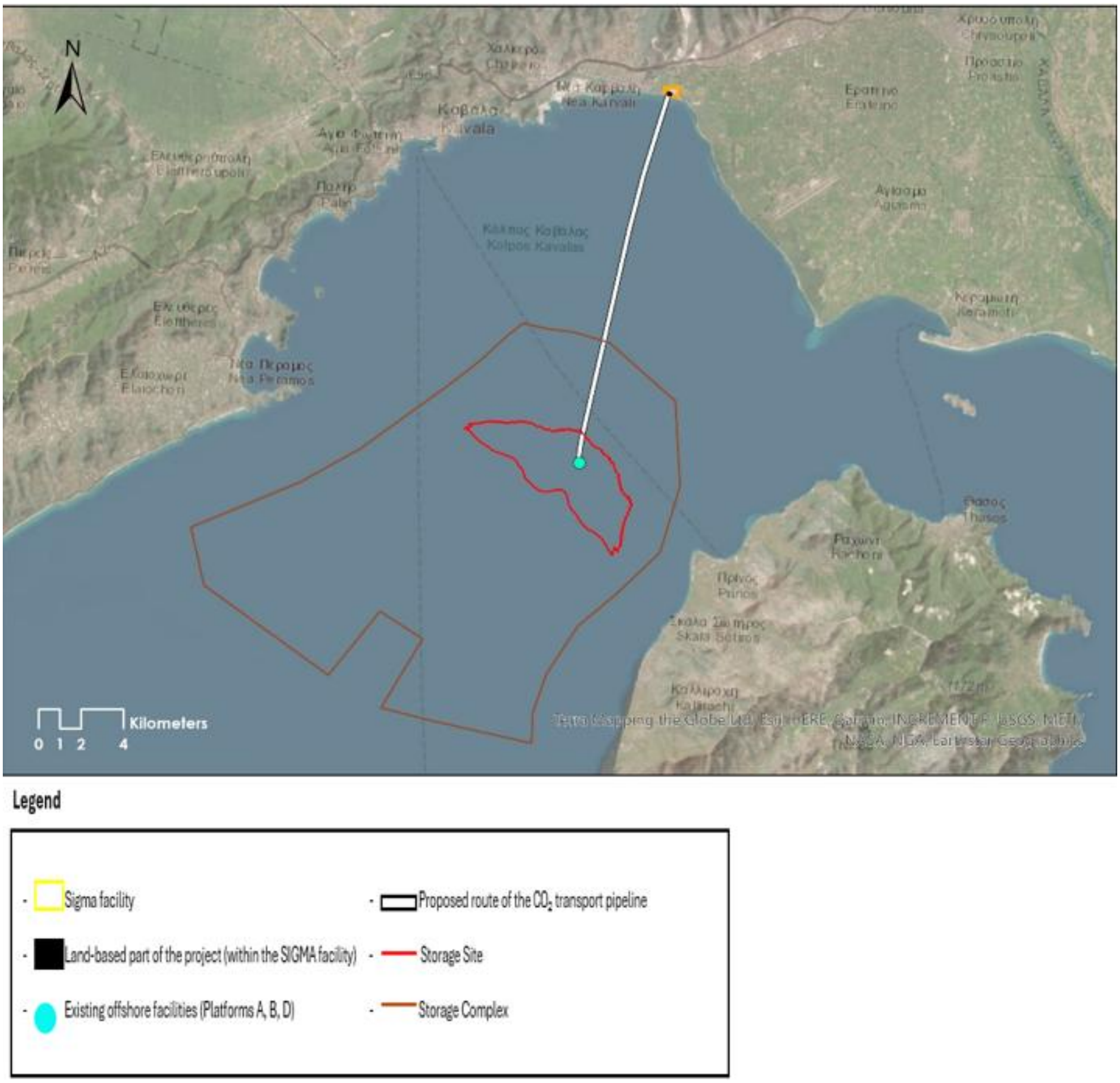

Figure 1-1: CO_2 Storage Complex and Site at Prinos

1.3 GEOGRAPHICAL LOCATION AND ADMINISTRATIVE JURISDICTION OF THE PROJECT

1.3.1 Project Location

The CO_2 storage site under study is located within the Prinos basin, in the Gulf of Kavala, in the Northern Aegean. The existing offshore facilities and the total area of the planned and potential future development of Prinos are situated in the Gulf of kavala, 8 km west of Thasos island and 18 km south of the Kavala coastline.

The fields in this area have been explored since the 1970s, followed by oil production from three fields within the Prinos Concession, as well as natural gas production from the South Kavala Concession, starting from the 1980s.

The onshore facilities of the proposed CO_2 storage Project are located within the operational area of Energean's Sigma facilities, within the boundaries of the Municipality of Kavala, approximately 2.4 km easte of the settlement of Nea Karvali.

Figure 1-2 presents the project details in a satellite imagery view.

Figure 1-2: Satellite imagery of the Project

1.3.2 Administrative Jurisdiction of the Project

The onshore facilities of the proposed CO_2 storage Project are located within the operational area of Energean's Sigma facilities and fall administratively under the Municipality of Kavala, within the Regional Unit of Kavala, in the Region of Eastern Macedonia and Thrace, bordering the Municipality of Nestos (according to Law 3852/2010 (A'87) of the ''Kallikratis'' Program), as shown in **Figure 1-3**.

Energean's existing offshore facilities at Prinos and the proposed offshore CO_2 storage facilities are located in the Gulf of Kavala.

Figure 1-3: Administrative Jurisdiction of the Project

1.3.3 Geographical Coordinates of the Project

The coordinates of the existing offshore platforms and the CO_2 storage complex at Prinos, the new subsea pipeline and the onshore facilities are presented in the following tables.

It should be noted that for the onshore facilities of the Project, the coordinates were extracted as the centroid of the site, for the platfors from the central point of each respective platform and for the new subsea pipeline coordinates were provided for its start, midpoint and end.

Table 1-1: Coordinates of the CO_2 Storage Complex in UTM Zone 35N and WGS 84

UTM Zone 35N		WGS 84	
X	Y	Lat (oN)	Lon (oE)
279453	4512372	40,732752	24,388267
277020	4509345	40,704857	24,360561
271165	4513610	40,741631	24,289770
270546	4516366	40,766258	24,281436
275694	4518510	40,786972	24,341597
278502	4520077	40,801835	24,374287

UTM Zone 35N		WGS 84	
282475	4522958	40,828824	24,420334
284177	4524272	40,841099	24,440044
285451	4525453	40,852062	24,454734
286197	4526041	40,857549	24,463374
287328	4525784	40,85553	24,476868
288558	4525629	40,854453	24,4915
290269	4525124	40,850348	24,51195
293368	4522358	40,82624	24,549599
293598	4518334	40,790081	24,553655
292650	4515169	40,761356	24,543479
290556	4513167	40,742807	24,519363
288786	4511682	40,72899	24.49892
287305	4509419	40,708241	24,482166
286657	4507571	40,691442	24,475131
286593	4506115	40,678322	24,474869
281658	4507241	40,687164	24,41614
279506	4507795	40,691577	24,390504
281466	4511071	40,721581	24,412536
279453	4512372	40,732752	24,388267

Table 1-2: Coordinates of the CO_2 Storage Site in UTM Zone 35N and WGS 84

UTM Zone 35N		WGS 84	
X	Y	Lat (oN)	Lon (oE)
282179	4521234	40,813231	24,417429
282460	4520425	40,806025	24,42104
289570	4514682	40,756191	24,507186
290106	4515480	40,76351	24,513262
291607	4517969	40,786293	24,5302
291708	4519568	40,80071	24,530863
289462	4522144	40,823321	24,503392
286651	4522616	40,826843	24,469928
284123	4521177	40,813232	24,440476

Table 1-3: Coordinates of the existing offshore platforms of the Project in WGS84 UTM Zone 35N, WGS 84 and ΕΓΣΑ 87

	UTM Zone 35N		WGS 84		ΕΓΣΑ 87	
	X	Y	Lat (φ)	Lon (λ)	X	Y
Alpha	288857,07	4519496,74	40° 47′ 57.62′′N	24° 29′ 49.64′′E	547186,80	4516315,55
Beta	288964,60	4519423,14	40° 47′ 55.34′′N	24° 29′ 54.31′′E	541896,72	4516245,70
Delta	288869,28	4519413,33	40° 47′ 54.94′′N	24° 29′ 50.26′′E	541801,85	4516232,65

Table 1-4: Coordinates of the new subsea pipeline of the Project in WGS84 UTM Zone 35N, WGS 84 and ΕΓΣΑ 87

	UTM Zone 35N		WGS 84		ΕΓΣΑ 87	
	X	Y	Lat (φ)	Lon (λ)	X	Y
Start *	293069,290	4537067,796	40,958554	24,5411604	545392,53	4534011,65
Midpoint	292877,822	4528686,074	40,883070	24,54168558	545488,62	4525632,42
End **	289555,024	4540394,628	40,987597	24,4983086	541767,94	4537214,24

The starting point is considered to be the entry of the pipeline into the proposed onshore CO_2 storage facilities.

** *The endpoint is considered to be the connection point of the pipeline at the existing Beta platform.*

Table 1-5: Coordinates of the proposed onshore facilities of the Project (centroid) in WGS84 UTM Zone 35N, WGS 84 and ΕΓΣΑ 87

	UTM Zone 35N		WGS 84		ΕΓΣΑ 87	
	X	Y	Lat (φ)	Lon (λ)	X	Y
Proposed Onshore Facilities	293090,229	4536912,162	40,957159 (°N)	24,541461 (°E)	545418,79	4533856,91

1.4 ENVIRONMENTAL CLASSIFIATION OF THE PROJECT

According to Ministerial Decision DIPA/37674/10-8-2016, as amended by Ministerial Decisions 2307/2018 and YPEN/DIPA/17815/1069/2022 (government Gazette 841/B' 24.2.2022) and currently in force, the Project falls under **Category 11** ''Transportation of energy, fuels and chemical substances'', **item 6 ''Infrastructure for the transportation and storage of carbon dioxide streams in geological formations''**, in accordance with Directive 2009/31/EC.

- Transportation pipelines, including associated pressure boosting stations
- Storage sites
- Capture facilities for the purpose of storage in geological formations

And it is classified under **Subcategory A1.**

Subcategory A1 includes projects that may have significant environmental impacts and therefore:

- A detailed Environmental Impact Assessment (EIA) Study is required, in accordance with the specifications defined in Annex 2 of Ministerial Decision 170225/2014.
- The competent authority for issuing the permit is the Ministry of Environment and Energy (YPEN), specifically the Directorate of Environmental Licensing (DIPA), according to Law 4014/2011.
- The licensing procedure for a subcategory A1 project is defined in Article 3 of Law 4014/2011.
- The consultation authorities during the ESIA process are defined in Joint Ministerial Decision (JMD) 1649/45/2014, titled: ''Specification of the procedures for obtaining opinions and informing the public and the participation of the interested public in the public consultation during the environmental permitting of projects and activities of Category A, pursuant to the decision of the Ministry of Environment, Energy and Climate Change No. 1958/2012 (Government Gazette 21/A), in accordance with the provisions of Article 19, paragraph 9 of Law 4014/2011 (Government Gazette 209/A), as well as any other relevant detail''.
- The Environmental Impact Assessment (EIA) will include Forms T and Y, which define the identity of the activity subject to environmental permitting, as well as information related to the environmental permitting activity, in accordance with Ministerial Decision 167563 (Government Gazette 964/B/19-04-2013), titled: ''Specification of the procedures and specific criteria for the environmental permitting of projects and activities under Articles 3, 4, 5, 6 and 7 of law 4014/2011, as provided in Article 2, paragraph 13, the specific forms for the aforementioned procedures and any other matter related to these procedures''.

The environmental permitting process for the Project I governed by law 4014/2011, as amended by Law 4685/2020, titled: ''Modernization of environmental legislation, transposition into Greek law of Directives 2018/844 and 2019/692 of the European Parliament and of the Council and other provisions'' (Government Gazette 92/A/7.5.2020). The content and level of detail of the Environmental Impact Assessment (EIA) are defined in Joint Ministerial Decision (JMD) 170225/2014.

1.5 PROJECT OWNER

The Project Owner (Operator) is the company EnEarth Greece Single member S.A. (Address: 32 Kifisias Avenue, 151 25 Maroussi, Tel: +30 2108174200). EnEarth is a Greek Société Anonyme (S.A.) whose main objective is the development of CO_2 storage activities in Greece and specifically the implementation of this Project. EnEarth is part of the Energean group of companies and is an affiliated company of Energean Oil & Gas S.A., which operates the Prinos, North Prinos and Epsilon fields in the Gulf of Kavala, the only hydrocarbon production sites in the country.

The persons responsible for the ESIA, on behalf of the Project Owner, are:

Vasilis Tsetoglou	HSE Director of ENERGEAN Group
Vasilis Zenios	Head of Facilities Projects - Egypt, Italy, Greece, Croatia, UK
Eleni Chalasti	Junior Process Engineer
Paschalia Kiomourtzi	Subsurface Lead, Greece
Eftasthios Skarvelas	Well Delivery Manager

Kostas Aggelidis	Head of Technical Inspection & Energy Projects
Kostas Dimotzikis	Technical Services Superintendent
Giannis Karagiannis	Environmental Engineer
Katerina Athitsou	Legal Counsel
Theodora Charalampidi	Legal Counsel

The Energean Group, headquartered in London, is engaged in the exploration and production of hydrocarbons, focusing on the sustainable development of the Mediterranean's natural resources with an emphasis on natural gas. It is committed to achieving net-zero total emissions by 2050 and strives to implement the 17 UN Sustainable Development Goals through its daily operations and a wide range of corporate social responsibility activities.

Energean (LSE: ENOG, TASE:אנאג) is an independent hydrocarbon exploration and production company headquartered in London, focusing on the sustainable development of the Mediterranean's natural resources with an emphasis on natural gas.

The company is committed to achieving net-zero greenhouse gas emissions by 2050 and aims to implement the 17 UN Sustainable Development Goals through its daily operations and a wide range of corporate social responsibility initiatives.

With an excellent track record in Health, Safety and Environment is hydrocarbon production, development and exploration and top ratings in the ESG sector, Energean holds 1.115 billion barrels of proven (2P) oil equivalent reserves, of which 83% is gas.

The Group's production comes from Israel, Egypt, Italy, Greece, Croatia, and the United Kingdom. In 2023, production averaged 123 thousand barrels of oil equivalent (kboe) per day, while in the first quarter of 2024, a new increase was recorded at 142 kboe per day, with 82% of this being natural gas. On June 20, 2024, the company announced a strategic agreement to sell its assets in Egypt, Italy, and Croatia to Carlyle, for a price between $820 million and $945 million, which is more than three times the acquisition cost from four years ago.

In Greece, Energean manages the Prinos, North Prinos and Epsilon fields in the Gulf of Kavala, which provide the country's only hydrocarbon production. Given the market conditions, Energean has implemented a restructuring and modernization program for Prinos, aiming for its gradual decoupling from oil price fluctuations and further reduction of its environmental footprint through carbon dioxide (CO_2) storage.

In the context of its long-standing oil operations (exploration and exploitation) within the Prinos Exploitation Area (as defined in the Contract dated 23.11.1999, Law 2779/1999, as amended and in force), Energean has collected geological, geophysical and drilling data for the Prinos geological basin, specifically for the Prinos and Epsilon structures, which demonstrate that these structures are, in principle, suitable as CO_2 storage sites. Therefore, within the framework of its activities in the Area, Energean proceeded with the design and permitting process for a CO_2 Storage facility in prinos, making use of Article 173 of Law 4964/2022. More specifically, according to Law 4964/2022 (Government Gazette A 150/30.07.2022), titled ''Provisions for the simplification of environmental permitting, establishment of a framework for the development of Offshore Wind Farms, addressing the energy crisis, environmental protection and other provisions'' and in particular under Article 173, entities that have been granted by the Hellenic State (pursuant to Law 2289/1995 (A' 27)) the right or license for the exploration and exploitation of hydrocarbons in a specific area and which possess sufficient data (especially geological, geophysical and drilling data) to demonstrate the preliminary eligibility of a geological formation or formations located beneath the surface of the granted area (onshore or offshore) as a potential CO_2 storage site, are granted (under the conditions of the said article) the right to continue and complete the investigation process of that area in order to determine its suitability for CO_2 storage

Based on the above, on 31.08.2022, Energean submitted a request to HEREMA (Hellenic Hydrocarbon and Energy Resources management Company) for the activation of its right to continue and complete the investigation of the structures of the Prinos and Epsilon fields and the underlying aquifer (the ''Area'') in order to determine their suitability as CO_2 storage sites. The said request was accepted through the Decision for the Activation of the Right to Investigate for CO_2 Storage (as approved by Decision No. 14577/29.09.2022 of HEREMA, published in Government Gazette 5247/B/11.10.2022), which approved the preliminary eligibility of the storage site. The site is located within the boundaries of the Prinos concession and includes the structures of the Prinos and Epsilon fields, as well as the underlying acquifer. The decision also approved the continuation and completion of the investigation of the Area as a CO_2 storage site for a period of twenty-two (22) months, starting from October 1, 2022 by Energean.

According to paragraph 5 of Article 173 of Law 4964/2022, following the completion of the suitability investigation and prior to the expiration of the right to complete said investigation, the interested entity must submit an application to HEREMA in order for the suitability of the geological formation as a CO_2 storage site to be confirmed and for the entity's right to storage to be activated. The term ''interested entity'' refers either to the holder of the right to continue and complete the investigation (in this case, Energean) or to an affiliated company whose sole purpose is CO_2 storage activities (in this Case, EnEarth).

With the progress and completion of the investigation procedures for the Area as a potential CO_2 storage site, EnEarth, as an affiliated company of Energean, submitted an application on 30.06.2024 to confirm the suitability of the geological formation as a CO_2 storage site and to activate the entity's storage right, in accordance with paragraph 5 of Article 173 of Law 4964/2022. Energean, as the holder of the right to continue and complete the investigation, co-signed the above application.

Furthermore, according to paragraph 5, point (e) of Article 173 of Law 4964/2022, facilities used by the operator for the purposes of hydrocarbon exploration and exploitation activities may also be utilized within the scope of CO_2 storage operations. The companies EnEarth and Energean have included in the aforementioned application a detailed description of the facilities (both existing and new) that are intended to be used for the CO_2 storage activity.

Following the issuance of the decision confirming the suitability of the geological formation as a CO_2 storage site and the activation of EnEarth's storage right in accordance with paragraph 5 of Article 173 of Law 4964/2022, Energean will transfer to EnEarth those facilities (onshore and offshore) from its existing infrastructure that are necessary for the development of the CO_2 storage activity. At the same time, Energean will provide EnEarth with technical support through its personnel.

1.6 ENVIROMENTAL CONSULTANT FOR THE PROJECT

This study was prepared by **LDK Consultants S.A – Environment and Water Department,** in collaboration with the company **WSP Italia srl.**

The contact details of the companies are as follows:

Table 1-6: Details of the consulting companies

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The interdisciplinary tam involved in the preparation of this Environmental Impact Assessment Study, as well as the supporting studies (EIA, EMP, etc) is presented in the table below.

Table 1-7: Study Team LDK – WSP

Name	Specialization	Company
Overall Project Coordination		
Kostis Nikolopoulos	MSc Environmental Engineer, Project Manager / Environmental Permitting of Infrastructure Projects	LDK Consultants SA
Anna Borroni	Biological Science, Animal Biology, PhD / ESIA & Permitting, Biodiversity	WSP Italia srl
EIAS – EIA Team and Supporting Studies		
Mina Paidousi	MSc Chemical Engineer / EIAS	LDK Consultants SA
Diamantis Saliaris	MSc Biologist / Natural Environment, Impact Assessment, Environmental Management	LDK Consultants SA
Eleni Avramidi	MSc Environmental Engineer, Marine Biology Researcher / EIA Coordinator, Natural and marine environment, Environmental Management of a protected site	LDK Consultants SA
Theodoti Vergou	MSc Civil Engineer / Project Compatibility with Environmental Commitments, Project vulnerability, Climate change, Environmental impacts	LDK Consultants SA
Katerina Mpoutsikou	MSc Chemical Engineer / Waste management	LDK Consultants SA

Name	Specialization	Company
Elena ioannaki	MSc Environmental Engineer / EIA, natural environment, Impact assessment	LDK Consultants SA
Konstantina Kousta	MSc Mining Engineer, natural biotic and abiotic environment, Environmental management	LDK Consultants SA
Petros Vitalis	MSc Environmental Scientist – GIS, Environmental management	LDK Consultants SA
Melina Mikelis	MA in International Comparative Law/ Sociology/ Socio-economic impacts	LDK Consultants SA
Chrysanthi Synodinou	MSc Economist	LDK Consultants SA
Jakob Fric	Physicist / SEA – Avifauna - Chiroptera	LDK Consultants SA (Partner)
Margarita Tzali	MSc Environmental Engineer / SEA –avifauna	LDK Consultants SA (Partner)
Efstratios Bourdakis	Forester / SEA – Avifauna	LDK Consultants SA (Partner)
Dimitrios Bousmpouras	Biologist / SEA – amphibians – reptiles – terrestrial mammals – terrestrial habitat	LDK Consultants SA (Partner)
Panagiotis Mendrinos	PhD Biologist / SEA – Marine Environment– Marine mammals	LDK Consultants SA (Partner)
Kimon Koemtzopoulos	MSc Biologist / SEA – Marine environment – Marine mammals	LDK Consultants SA (Partner)
Odysseas Paxinos	MSc Oceanographer / SEA – Marine environment – Marine mammals	LDK Consultants SA (Partner)
Livia Manzone	Geology, Underground Engineering Resources, PhD / ESIA & Permitting	WSP Italia srl
Marco Donato	Environmental Science Marine Env Sc. / Marine biology & permitting	WSP Italia srl
Rano Ficher	Environmental Management & Global Political Economy / Social impact assessment	WSP Italia srl
Emanuele Bobbio	Architect / Sustainability services	WSP Italia srl
Hugo Siddle	MSc Risk and Safety Management, BSc (Hons) Mathematics and Physics / Process safety	WSP Italia srl
Laura Dugdale	MSc (Hons) - Environmental Management, BSc (Hons) - Environmental Science / Assessment of accidents and disasters	WSP Italia srl
Suzanne Knights	BSc (Hons) Chemistry / Process safety, Assessment of major accidents and disasters	WSP Italia srl
Nathan Philpott	MPhys Physics / Process safety	WSP Italia srl
Jon Sandhu	MEng Chemical Engineering / Process safety	WSP Italia srl
Morag Armstrong	MSc Process Safety and Loss Prevention, BSc (Hons) Chemical Engineering / Process safety, Assessment of major accidents and disasters	WSP Italia srl
Jack Davy	MChem BSc (Hons) Chemistry / Process Safety, Assessment of major accidents and disasters	WSP Italia srl

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2.1 KEY PROJECT DETAILS

2.1.1 Background

In the context of the long-standing execution of Petroleum Operations (exploration and production) within the Prinos Exploitation Area (as defined in the relevant Concession Agreement), Energean has collected geological, geophysical, and drilling data concerning the Prinos geological basin, and specifically the Prinos and Epsilon structures. These data substantiate that the specific structures are, in principle, eligible as carbon dioxide (CO_2) storage sites.

Therefore, within the framework of its activities in the area, the company proceeded with the design and permitting maturation of a **CO_2 Storage Unit in Prinos**, making use of Article 173 of Law 4964/2022 (Government Gazette A 150/30.07.2022). More specifically, based on this Article, entities that have been granted, by the Hellenic Republic (pursuant to Law 2289/1995 (A' 27)), the right or license to explore and exploit hydrocarbons in a specific area, and that possess sufficient data (in particular geological, geophysical, and drilling data) to substantiate the preliminary eligibility of a geological formation or formations located beneath the surface of the granted area (onshore or offshore) as a site for carbon dioxide (CO_2) storage, acquire (under the conditions set out in the aforementioned Article) the right to continue and complete the investigation process for the area in question in order to determine its suitability for CO_2 storage.

Based on the above, Energean submitted a request to HEREMA on 31.08.2022 for the activation of the right to continue and complete the investigation of the Prinos and Epsilon field structures and the underlying aquifer (the "Area") in order to determine their suitability as CO_2 storage sites. This request was accepted with the Decision on the Activation of the Right to Investigate for CO_2 Storage (as approved by HEREMA decision no. 14577/29.09.2022, Government Gazette 5247/B/11.10.2022), which confirmed the preliminary eligibility of the storage site located within the boundaries of the Prinos concession and comprising the Prinos and Epsilon field structures and the underlying aquifer. It also approved the continuation and completion of the investigation of the Area as a CO_2 storage site for a period of twenty-two (22) months, starting from 1 October 2022, by Energean.

With the progress and completion of the procedures for investigating the Area as a CO_2 storage site, EnEarth, as an affiliated company of Energean, submitted on 30.06.2024 an application to determine the suitability of the geological formation as a CO_2 storage site and to activate the storage right of the operator in accordance with paragraph 5 of Article 173 of Law 4964/2022. Energean, as the holder of the right to continue and complete the investigation, co-signed the aforementioned application.

Following the issuance of the decision confirming the suitability of the geological formation as a CO_2 storage site and the activation of EnEarth's storage right pursuant to paragraph 5 of Article 173 of Law 4964/2022, Energean will transfer to EnEarth those existing facilities (onshore and offshore) that are necessary for the development of the CO_2 storage activity.

2.1.2 Summary Description

The project under consideration concerns the installation of a full-scale carbon dioxide (CO_2) storage facility at Prinos (the "Project"). The planned CO_2 storage site is located within the Prinos Basin, in the Gulf of Kavala, in the Northern Aegean. The area of interest for CO_2 storage lies within the Prinos Concession, where Energean Oil & Gas S.A. ("Energean"), an affiliated company of EnEarth, has held 100% interest and operatorship for oil and gas exploration and production activities since 2007. The potential CO_2 storage site is located within the Prinos structure and the underlying aquifer.

The operation of the facility is planned to be developed in two distinct phases based on capacity (Phase 1 and Phase 2), for scalability and adaptation to market conditions.

- **Phase 1** with an initial nominal capacity of up to **1 MTPA** for 20 years (starting around the end of 2025 to early 2026). The CO_2 will be mainly supplied in bulk, via a third-party pipeline that will reach the site boundaries under appropriate conditions for injection. Additionally, small quantities of CO_2 will be received at the Sigma onshore facilities in containers transported by trucks, as part of pilot CO_2 capture projects.

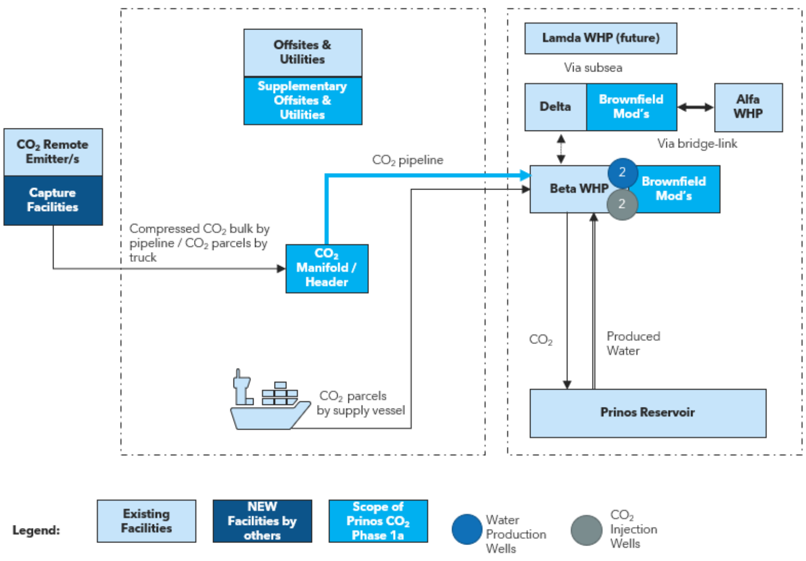

Figure 1 - Schematic Representation of Phase 1 of the Project

- **Phase 2** foresees an expansion up to the final nominal capacity of 3 MTPA. The facility will be modified to additionally accept liquefied CO_2, which will be received via marine transport at a newly constructed jetty. For this purpose, marine infrastructure for mooring, unloading, storage, and processing (pumping, heating) of the liquefied CO_2 will be constructed within the onshore operational area of the Sigma plant. The CO_2 will be transported to the offshore facilities through the subsea pipeline that will have been constructed as part of Phase 1. To support Phase 2, an upgrade of the facilities will be required, as follows:

- Upgrade/expansion of the onshore facilities for the storage and handling of liquefied CO_2, including the mooring and unloading facilities for liquefied CO_2, as well as auxiliary infrastructure.
- Potential installation of a new offshore platform to accommodate the maximum capacity of Phase 2.
- At least four new CO_2 injection wells and four new water production wells.
- Potential expansion of the water treatment facility.

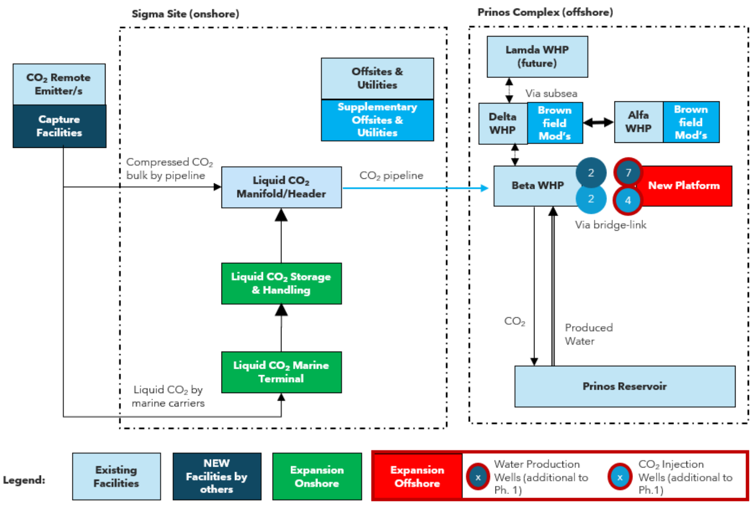

Figure 2 - Schematic Representation of Phase 2 of the Project

The present study focuses on **Phase 1 of the Project**.

2.1.3 Environmental Classification

According to Ministerial Decision DIPA/37674/10-8-2016, as amended by Ministerial Decisions 2307/2018 and YPEN/DIPA/17185/1069/2022 (Government Gazette 841/B` 24.2.2022) and currently in force, the Project falls under **Category 11:** "Transport of energy, fuels and chemical substances," **item 6**: "Infrastructure for the transport and storage of carbon dioxide streams in geological formations, pursuant to Directive 2009/31/EC":

- Transport pipelines, including associated pressure boosting stations
- Storage sites
- Capture facilities for the purpose of storage in geological formations

and is classified under **Subcategory A1**.

2.1.4 Geographical Location and Administrative Jurisdiction

The **CO_2 storage site** under study is located within the Prinos Basin, in the Gulf of Kavala, in the Northern Aegean. The existing offshore facilities, as well as the entire area of planned and potential future development of Prinos, are situated in the Gulf of Kavala, 8 km west of Thasos and 18 km south of the Kavala coastline. The hydrocarbon deposits in this area have been explored since the 1970s, followed by the development of oil production from three fields within the Prinos Concession, and natural gas production from the South Kavala Concession, since the 1980s.

The **onshore facilities of the CO_2 storage Project** are located within the activity area of the Energean Sigma facilities, within the boundaries of the Municipality of Kavala, approximately 2.4 km east of the settlement of Nea Karvali. Administratively, they fall under the Municipality of Kavala, Regional Unit of Kavala, Region of Eastern Macedonia and Thrace, near the border with the Municipality of Nestos (according to Law 3852/2010 (A'87), the "Kallikratis" Program).

The project elements are presented in satellite view in **Figure 2-1.**

Legend: SIGMA Installation

Onshore project section *(within SIGMA installation)*

Existing offshore facilities *(Wellhead Platforms A, B, D)*

Proposed CO_2 pipeline route

Figure 3 - Satellite Depiction of the Project

2.2 PURPOSE AND RATIONALE OF THE PROJECT

In the context of the **energy transition**, the reduction of Greenhouse Gas (GHG) emissions, and ultimately the achievement of **climate neutrality**, EnEarth has proceeded with the design of a full-scale CO_2 Storage facility in Prinos (the "Project"), capable of achieving the storage of a significant quantity of CO_2, thereby resulting in a correspondingly significant reduction of atmospheric CO_2, both at regional and national level. The proposed CO_2 Storage project in Prinos is expected to play a critical role in meeting national GHG emission reduction targets, as well as to substantially support the fulfillment of the country's commitments and obligations under international treaties and agreements regarding the limitation of GHG emissions and the achievement of climate neutrality, as it constitutes the first such initiative in Greece and the Eastern Mediterranean for CO_2 storage.

The Project aims to provide CO_2 storage services for CO_2 produced by both local and remote third-party industrial activities. By operating as a central storage hub for Greece and the Eastern Mediterranean, the Project will receive and store CO_2 from emitters that cannot easily reduce their emissions through other mitigation initiatives.

The anticipated benefits from the implementation of the Project at **national level** can be considered significant and summarized as follows:

- Reduction of CO_2 emissions from industrial processes. The construction and operation of the proposed Project is expected to directly contribute to the reduction of CO_2 emissions from industrial processes, as documented in the revised National Energy and Climate Plan (Revised NECP, August 2024).
- The operation of the CO_2 storage Project also entails a significant saving of financial resources due to the reduction of the "shadow cost" of carbon. In the case of the Project, the carbon emission balance is negative, as evidenced by the carbon footprint analysis. These are emissions that are avoided from being released into the atmosphere through the operation of this CO_2 storage Project.
- Fulfillment of the European and International Obligations of the country, which have been incorporated into the National Strategy for Climate Change Adaptation (NSCCA) (Article 45 of Law 4414/2016 (Government Gazette A' 149)).
- It is also important to note that the "Prinos CO_2 Storage" project has been included in the 6th list of Projects of Common Interest (PCI), in accordance with the *Commission Delegated Regulation (EU) 2024/1041 of 28 November 2023*, amending Regulation (EU) 2022/869 of the European Parliament and of the Council as regards the Union list of Projects of Common Interest and Projects of Mutual Interest, and more specifically under Priority Thematic Area 13 (Cross-border carbon dioxide network). Projects of Common Interest (PCIs) are key infrastructure projects aimed at completing the European internal energy market and contributing to the EU's energy and climate objectives—namely, the provision of affordable, secure, and sustainable energy for all Europeans, and the achievement of a climate-neutral economy by 2050.
- According to the *Implementing Decision of the Council of the European Union "on the approval of the assessment of the Recovery and Resilience Plan of Greece"* (10152/06.07.2021), the first phase of the Project's development is eligible for funding under the *Recovery and Resilience Facility (RRF)* (Investment: Produc-E Green, measure identifier: 16831).

2.3 PROJECT COMPATIBILITY

This section provides a summary of the legislative framework governing the Project, as well as the Project's compatibility in relation to spatial planning, land uses, and the environmental sensitivity features of the Project area.

2.3.1 Legislative Framework

- The storage of carbon dioxide (CO_2) in geological formations was introduced in Europe through Directive 2009/31/EC. According to this Directive, carbon capture and storage (CCS) in geological formations is considered a bridging technology that will contribute to climate change mitigation. It involves capturing CO_2 from industrial facilities, transporting it to a storage site, and injecting it into suitable underground geological formations for permanent storage.
- Through Joint Ministerial Decision (hereinafter JMD) 48416/2037/E.103/2011 (Government Gazette 2516/B/7.11.2011), Directive 2009/31/EC was transposed into national legislation. This JMD sets out measures and conditions for the storage of carbon dioxide in geological formations. The methodology for the preparation of this Environmental and Social Impact Assessment (ESIA) is in line with the requirements and guidelines of both the Directive and the corresponding JMD.
- The Project complies with the provisions of Law 4964/2022 titled "Provisions for the simplification of environmental permitting, establishment of a framework for the development of Offshore Wind Farms, addressing the energy crisis, environmental protection, and other provisions," in order to receive environmental approval and for the operator to be granted exploitation rights.

2.3.2 Spatial Planning

The spatial planning framework applicable to the wider study area is defined by the following approved instruments:

- The **General Framework for Spatial Planning and Sustainable Development (GFSPSD)**, which was approved by Decision No. 6876/4871/2008 of the Parliament (Government Gazette 128/A/03-07-2008), pursuant to Article 12(3) of Law 4447/2016, as in force. This framework serves as the National Spatial Strategy and includes a set of texts and maps that record and assess the factors influencing the long-term spatial development and structure of the national territory. It evaluates the spatial impacts of international, European, and national policies and identities, with a 15-year outlook, the key priorities and strategic directions for integrated spatial development and sustainable organization of the national space. Given the severe problems caused by climate change, this legislative document sets objectives for the country's adaptation to these new conditions. The Project aims to mitigate the impacts of climate change through the capture and storage of carbon dioxide and does not conflict with the objectives established by the GFSPSD for the same purpose.

- In the **Region of Eastern Macedonia and Thrace**, within the framework set by Law 4447/2016, the Regional Spatial Planning Framework (RSPF) of Eastern Macedonia and Thrace was approved by Ministerial Decision ΥΠΕΝ/ΔΧΩΡΣ/68605/1092 (Government Gazette 248/AAP/25-10-2018). The RSPF of Eastern Macedonia and Thrace aims to establish a comprehensive, strategic, executive program of spatial policies for the region, serving as the principal framework for spatial, urban planning, and development choices throughout its validity period. Simultaneously, the RSPF is environmentally approved by the Region itself, as it revises and replaces the previous Regional Framework for Spatial Planning and Sustainable Development. The city of Kavala is designated as a Secondary National Pole and as a gateway of international and interregional importance for the Region, particularly in relation to Bulgaria and the Eastern Balkans, as well as Central Europe. Article 19 of the RSPF stipulates that the planning and implementation of projects and actions under the Plan must consider the guidelines for addressing and adapting to climate change.

- The **Special Framework for Spatial Planning and Sustainable Development for Industry** states, among other things, that the sectors of petroleum and coal products are stagnant (Section B.9), while in Section B.17 it emphasizes that "the adequacy of supply of industrial and other professional facilities and storage units with the necessary electric power (conventional or from RES) and fuels is of fundamental importance." According to this framework, the Regional Unit of Kavala is classified among the High Priority Areas for manufacturing activities.
- The **Special Framework for Spatial Planning and Sustainable Development for Aquaculture** was issued under Government Gazette 2505/B'/2011 and addresses spatial planning at two levels: The spatial sitting and planning of units in the marine area; and the spatial sitting and planning of the main production activities, as well as accompanying and supporting facilities on land. The standard sitting model for marine aquaculture units includes installations either within Aquaculture Development Areas (ADAs) or as individual units. According to the Plan of the Special Spatial Framework for the organization of aquaculture activities (Government Gazette 2505 B/04.11.2011), part of the Project falls within ADA B14 "Agiasma–Keramoti–Erasmio" (fish farming, shellfish farming, other aquatic organisms) and lies 10.6 km from ADA B13 "Iraklitsa–Nea Peramos." These ADAs are classified as Category B, meaning aquaculture development areas with potential for further expansion.
- At present, the competent Ministry of Environment and Energy has initiated the process for drafting the **Special Framework for Spatial Planning and Sustainable Development (SFSP-SD) for Mineral Raw Materials.** The objective of this framework is to develop policy directions for the spatial structure of the sector, in relation to existing land uses, based on sustainable development principles. It aims to highlight the country's comparative advantages, preserve and protect cultural and natural heritage, and establish a spatial organization model that: Promotes and strengthens competitiveness, enhances the development of strategically important resources, aligns with the national strategic planning for the utilization of mineral wealth and ensures legal activity – an essential condition for attracting investments.

2.3.3 Land Use

The SIGMA onshore facilities of the Project are located within the Land Use Control Zone (ZOE) of the Municipality of Kavala (Government Gazette 437-D/1989). Within the broader onshore area of the Project, the following have been established:

- The General Urban Plan (GUP) of the Municipality of Kavala (Decision No. 5248π.ε./04-02-2013), published in Government Gazette 69/AAP/11-03-2013. According to the GUP, the area of the Project's onshore facilities falls within a Zone of Organized Development of Productive Activities (PODPA) of the Secondary Sector.
- For the community of Nea Karvali in the Regional Unit of Kavala, a Local Urban Plan has been approved and published in Government Gazette 487/D/1989-08-07, under the title: "Approval of a local urban plan in the community of Nea Karvali, Kavala Prefecture, for the designation of a site for the establishment of a regional market."
- Land Use Control Zone (ZOE): The area falls within a ZOE that applies to out-of-plan and out-of-settlement-limit regions predating 1923 within the Municipality of Kavala (Kavala Prefecture), as well as the communities of Amisiana, Amygdaleonas, Nea Karvali, Chalkero, and Kokkinoxoma, according to the Presidential Decree of 14-06-1989 (Government Gazette 437-D-1989), as amended by Government Gazette 326/D/1995.
- General Urban Plan (GUP) of Chrysoupoli: The GUP for the settlement of Chrysoupoli was published in Government Gazette 814/D/26-08-1987.

- **At the national level**, no comprehensive maritime spatial uses have been institutionalized, with the sole exception being the *Special Framework for Spatial Planning and Sustainable Development*

(SFSP&SD) for Aquaculture, established in **November 2011 (Government Gazette 2505/B/2011)**. Due to the absence of a dedicated *Maritime Spatial Plan (MSP)* and relevant *Marine Spatial Planning Tools (MSPTs)*, the spatial planning framework in the marine area of the proposed project is governed by the **currently applicable sectoral Special and Regional Spatial Planning Frameworks**, which address specific economic sectors (e.g. RES, industry, aquaculture, etc.). These frameworks include **spatial planning guidelines** for the development of each sector **within terrestrial, coastal, and to a lesser extent, marine environments.**

- The entirety of the onshore and offshore installations of the proposed project will be developed in locations with existing infrastructure or in areas already subject to restrictions due to the presence of the offshore hydrocarbon extraction project of Prinos (e.g. the CO_2 transport pipelines will be installed within an already established designated zone).

2.3.4 Environmental Sensitivity Elements of the Project Area

- The project under assessment is located within the **Natura 2000** protected area SAC & SPA GR1150014 “Marine Area of Kavala – Thasos.” In the broader study area, the following Natura 2000 sites are also identified: SCI GR1150010 “Nestos Delta and Keramoti Lagoons – Wider Area,” SPA GR1150001 “Nestos Delta and Keramoti Lagoons and Thasopoula Island,” and SPA GR1150012 “Thasos (Mount Ypsario and coastal zone).”
- Regarding **forest coverage**, the SIGMA onshore facilities of the Project are located within areas with the following codes: AA: Other forms – coverage in older aerial photographs and PA: Finalized acts and characterization decisions – non-forested, which are not subject to the restrictions of forest legislation.
- The marine area of the Gulf of Kavala, where all offshore facilities (existing and new) are located, has been thoroughly investigated and there are no indications of significant underwater **archaeological findings**. Over time, the shallow waters and seabed do not allow for the preservation of possible ruins. Within the study area, two designated **archaeological sites and monuments** are identified. The onshore archaeological site of Nea Karvali, which is protected under Government Gazette: 527/B/1967-08-24, as well as the monument “Remains of the ancient city of Akontisma, Nea Karvali,” which is protected under Government Gazette: 527/B/1967-08-24.

2.4 PROJECT DESCRIPTION

The new facilities and wells planned for the operation of Phase 1 of the CO_2 storage Project, and which are the subject of the present study include:

- <u>Onshore facilities</u>: modification of a designated area within the existing premises at the Sigma plant for the construction of the CO_2 reception manifold and an unloading and compression area.
- <u>Offshore pipeline</u>: subsea pipeline connecting the Sigma plant area with the offshore Beta platform, approximately 20 km in length.
- <u>Offshore platforms</u>: modification and/or use of the existing offshore installations of Prinos (Beta and Delta platforms) for the reception of CO_2 from the new subsea pipeline and CO_2 cargoes in containers, the injection into the new wells, and the treatment of the produced water (Delta platform).
- <u>Wells</u>: 2 CO_2 injection wells and 2 water production wells on the existing Beta platform of the Prinos offshore complex.

The CO_2 sources and the main reception processes during Phase 1 of the CO_2 storage Project will be as follows:

- Bulk CO_2 supply under appropriate conditions for injection via a third-party pipeline to an onshore reception station within the activity area of the Sigma facilities.
- Reception of CO_2 cargoes from trucks with ISO containers at the Sigma onshore facilities. The containers will be loaded onto supply vessels/barges using a crane, transported, and unloaded at the existing Beta platform of the Prinos offshore installations. It is noted that provision is also made for the direct injection of CO_2 cargoes into the onshore reception manifold via a compression station during unloading from the trucks.

2.4.1 Construction Phase

2.4.1.1 Onshore installations – structural work and site configurations, CO2 reception and handling equipment

The planned equipment will be prefabricated off-site and delivered by trucks to the construction site, where it will be offloaded by crane. The work on the construction of the onshore installations will include the following:

- Geotechnical sampling and data collection.
- Ground preparation for equipment foundations.
- Concrete works of 0.5 m thickness for base slab foundations.
- The excavation area will be limited to the locations where the onshore equipment foundations will be placed and is estimated at approximately 50 m^2. The estimated excavation area for the onshore section of the pipeline is 200 m^2, with a depth of 3 m.
- Once the pipeline area is excavated, the area will be backfilled with the same material.
- Installation of pipework assemblies and welding. The pipes will be installed on the ground atop the new foundations, without requiring protective coverings, as is common practice for onshore installation piping.
- Connection and testing of electrical network and instruments.

2.4.1.2 CO_2 Transport Pipelines to Storage

The subsea pipeline will be buried along its entire length for protection against fishing activities (trawlers) in the area. In the onshore section, for the first 500 m, the burial depth will be 2 m from the top of the pipeline (Top of Pipe – TOP), and in the offshore section the burial depth will be 1 to 1.5 m (TOP).

The pipeline construction works will be carried out in five phases:

Phase 1	Geophysical and geotechnical surveys along the pipeline route (1 month).
Phase 2	Works for the pipeline's shore approach, with dredging of a 500 m section from the shoreline in the area of the pipeline reception manifold at the Sigma plant. The trench will have a depth of approximately 3 m along its entire length and will terminate at seabed level at the end of the 500 m zone (6 months).
Phase 3	Installation of the subsea pipeline and hydraulic testing using a specialized pipe-laying vessel (2 – 3 weeks).

Phase 4 Installation of the riser on the existing Beta platform and diving operations to connect the riser with the end of the subsea pipeline (1 week).

Phase 5 Final testing and commencement of operation (1 month).

2.4.1.3 Drillings

The construction phase of the wells includes the implementation of the following individual tasks:

- Preparation for the killing of the initial (donor) wells.
- Permanent sealing and abandonment of the initial (donor) wells.
- Opening of a “window” for the new well.
- Well drilling.
- Well completion.

The total duration of drilling and completion works for the wells is estimated at 248 days, and the number of personnel on the drilling rig is estimated at approximately 90 people.

In order to minimize the environmental footprint of the drilling operation, a 2500 hp drilling rig will be used, equipped with a Top Drive System (TDS) and three high-pressure mud pumps. The rig will include the necessary equipment for the temporary storage of generated waste and fuels. The rig (indicative type CROSCO Labin or of similar specifications) will be designed and constructed in accordance with the API 4F standard and the latest European regulations, including low-emission specifications, and will be fully ATEX certified. The rig will be transported to the well location using suitable tugboats.

The wells will be drilled using an RSS (Rotary Steerable System) method.

The drilling stages for each section up to the final measured depth of 3,700 m include, in summary:

- 16” diameter drilling to a measured depth of approximately ~2,200 m (vertical depth 1,850 m).
- 12-1/4” diameter drilling to a measured depth of approximately ~3,150 m (vertical depth 2,667 m).
- 8-1/2” diameter drilling to a measured depth of approximately ~3,700 m (vertical depth 2,800 m).

The design of the wells will be completed in such a way that the density of the drilling fluids ensures sufficient hydrostatic pressure—greater than the formation pore pressure, but not so high as to cause formation fracturing and consequent loss of mud into the formation. Following the well design study, appropriate depths will be selected for the casing setting, in order to isolate the "weak" geological formations from the subsequent sections of the well that will be drilled using higher-density mud. To avoid a kick—with the worst-case scenario being a blowout due to hydrocarbon leakage to the surface—there will be at least three control mechanisms. In more detail:

- The first and primary mechanism for well control is the sufficient hydrostatic pressure of the drilling mud during the drilling process. Fluids such as gas, water, or oil under pressure (formation pressure) greater than the hydrostatic pressure of the mud can lead to a kick.

- The second control mechanism is the drilling procedures and good practice guidelines that must be followed throughout the drilling process. The procedure for kick detection and response will be detailed in the Detailed Drilling Plan (DDP). Furthermore, the good practice guidelines will be based on national and European legislation.
- The third well control mechanism is the BOP valve assembly. The Blowout Preventer (BOP) assembly is installed at the top of the well and is designed to seal the wellbore and prevent a kick from escalating into a blowout due to hydrocarbon leakage to the surface.

2.4.2 Operation Phase

The operation of the facility is planned to be developed in two distinct phases (Phase 1 & Phase 2), for scalability purposes and adaptation to market conditions, each of which has synergistic prospects that can achieve significant CO_2 reductions.

This study focuses on **Phase 1 of the Project**, during which CO_2 will be primarily supplied in bulk, via a third-party pipeline that will reach the boundaries of the onshore facility under suitable conditions for injection. Additionally, CO_2 loads will be received in small quantities at the Sigma onshore facilities from trucks as part of pilot CO_2 capture projects.

2.4.2.1 Onshore CO_2 Reception Facilities and Unloading Operations

The CO_2 that will enter the facility **via a third-party onshore pipeline** during Phase 1 is expected to be at a pressure and temperature suitable for injection into the storage site, without the need for further processing. The CO_2 will be routed to the reception manifold, from which it will be exported to the Prinos complex via the subsea CO_2 pipeline.

ISO container trucks will transport **CO_2 loads** from the emission source to the Sigma plant dock. The containers will be offloaded from the trucks, lifted onto the deck of supply vessels/transport barges using a crane, and transported to the offshore facilities at the existing Beta platform.

With regard to the quantities of CO_2 expected to be received as discrete loads and the reception frequencies, the following assumptions are made:

- Assuming a quantity of 400 tons from Pilot Program 11 under the Horizon Europe program of the EU, 19 trips will be required by a truck with a capacity of 21,375 kg (indicatively, 18 trips at 100% loading capacity and 1 trip at 71% loading capacity) to deliver the total amount of CO_2 loads. A frequency of 1 truck per week is assumed for a period of nearly 5 months (19 weeks).
- Assuming a quantity of 40 tons from Pilot Program 22 under the Horizon Europe program of the EU, 2 trips will be required by a truck with a capacity of 21,375 kg (indicatively, 1 trip at 100% loading capacity and 1 trip at 87% loading capacity) to deliver the total amount of CO_2 loads. A frequency of 1 truck every 3 months is assumed.

There is also provision for the direct injection of CO_2 loads from the ISO containers into the pipeline reception manifold at the onshore facilities. This configuration creates the need for a compression station during unloading from the trucks next to the reception manifold area. In this case, t trucks will unload the ISO containers next to the reception manifold area. A flexible hose will be used for discharging the contents of the ISO containers into the compressor, from where the CO_2 will be routed to the reception manifold, ensuring that all safety measures are followed for safe operation.

2.4.2.2 CO_2 Transport to the Prinos Offshore Storage Facilities

During Phase 1, according to the pre-FEED study, CO_2 will be delivered under suitable conditions for injection. It will be connected to the new facilities via a flange at the reception manifold and routed to the Prinos offshore complex through the new subsea CO_2 transport pipeline, with a length of 20 km, a diameter of 12–16", and a pressure class of 1500#.

The CO_2 pipeline will initially handle a capacity of up to 1 MTPA of compressed CO_2, but it is also adequate for the future planned capacity of the Project (3 MTPA CO_2). The pipeline riser at the offshore jacket will be equipped with Emergency Shutdown Valves (ESDVs) for isolation.

As for the CO_2 loads, it is assumed that the supply vessel/barge transporting the ISO containers will connect to the piping on the platform via a flexible hose system. From there, the CO_2 loads will undergo further processing (as described below) to meet the correct specifications/conditions for injection into the well.

2.4.2.3 CO_2 Injection

The main CO_2 load processing equipment on Beta platform will include a compression station installed on the open deck, to reach the required injection conditions. During the initial start-up, in order to avoid low temperatures in the piping and the formation of hydrates/salts near the well area, the installation of an electric start-up heater and a methanol injection system is foreseen.

CO_2 injection will target Zones B and C of the reservoir using two injection wells during the period 2025–2035 and will then be extended to the entire reservoir by the end of the Project.

During the first three years of operation of the storage site, the CO_2 injection rate will gradually increase from 0.25 to 0.5, then to 0.75 and finally to 1.0 MTPA.

For Phase 1, according to the pre-FEED study, the required injection conditions at the well are 101 barg pressure and 20°C temperature.

2.4.2.4 Water Production

The water production wells on Beta platform will be equipped with Electrical Submersible Pumps (ESPs) and will extract water from the reservoir to enable active reservoir pressure management.

According to simulation studies, the two water production wells will operate with a production rate of up to 7,500 bwpd each during the period 2025–2030 (6 years). Water production will increase to 9,000 bwpd per well in 2031 and remain at that level until the end of the Project.

The 7,500 bwpd/well rate corresponds to ESP operation at 83% of capacity, while the 9,000 bwpd/well rate corresponds to 100% ESP capacity.

Produced water will be treated on the existing Delta platform.

2.4.3 Decommissioning - Restoration

The decommissioning of the CO_2 storage Project under study, with priority given to the plugging of the wells and reservoir safety, will be carried out in accordance with best practices and guidelines (Offshore Energies United Kingdom (OEUK), 2022).

For the permanent abandonment of the wells, cement is considered the most suitable material; however, other materials may also be used. To qualify as a permanent barrier, the material must ensure long-term integrity and must not degrade significantly during the design life of the barrier, while continuing to meet the design criteria. If cement is used as the barrier, then a minimum cement column of 30 m is required in order to constitute a permanent barrier.

The pipelines within the onshore section of the CO_2 pipeline transport system will be depressurized, cleaned, and purged with nitrogen to ensure safety. The onshore section will be isolated from the offshore pipeline using a sealed flange, dismantled, and the area will be restored to its original state. The offshore pipeline and riser will be depressurized, cleaned using standard pigging operations, and then inerted by introducing nitrogen. The pipeline will subsequently be isolated from the offshore platform, sealed with welded caps or flanges, and left in place in accordance with international standards. The pipework from the top of the riser to the wellheads will also be depressurized and filled with nitrogen to inert the system, disconnected from the wellheads, sealed, and left in place.

Subsequent monitoring of the Project will focus on detecting potential leaks to minimize environmental impacts and ensure compliance with regulations. Geological surveys of the reservoir formations will be conducted to identify potential leakage pathways or geological hazards, and to minimize the risk of CO_2 leakage into the marine environment. Monitoring parameters such as pressure, temperature, and composition at the wells will also be tracked to ensure leak safety.

2.5 ALTERNATIVE SOLUTIONS

The investigation of alternatives focuses on the development options of the proposed CO_2 storage Project, which were examined during the design stages in accordance with international best practices. An analysis of alternative solutions was conducted regarding the implementation of the CO_2 storage Project in the Prinos reservoir, including the **drilling options**, offshore **delivery of CO_2 loads** to the storage site, and the routing **alternatives of the CO_2 pipeline** to the injection wells. A dedicated justification highlights the reasons for rejecting the "**zero option**."

Zero Option

The zero option refers to the existing situation, i.e., not implementing the proposed CO_2 storage project in the study area. Under this scenario, no actions would be taken to enable CO_2 storage in the Prinos reservoir, resulting in the failure to achieve the Project's objectives and purpose. Non-implementation of the Project would lead to a **loss of economic opportunities, environmental benefits, and competitiveness** in emerging low-carbon technology markets. The absence of CO_2 storage infrastructure would negatively affect the **achievement of the country's European and international obligations**, as incorporated into the National

Strategy for Climate Change Adaptation (NSCCA) (Article 45 of Law 4414/2016 (A' 149)), as well as the **national targets for overall reduction of greenhouse gas emissions and the attainment of climate neutrality by 2050** (including compensation for residual emissions post-2050), in line with the revised NECP and the Long-Term Strategy for 2050 of the Hellenic Ministry of Environment and Energy. The permanent storage of greenhouse gases in underground formations or in materials is considered to ensure climate neutrality, while CO_2 storage captured from the air or biomass is considered a negative emission.

2.5.1 Drillings

For the purposes of the CO_2 storage Project, four new wells will need to be drilled: two CO_2 injection wells and two water production wells. The wells will be drilled using the sidetracking method, which requires meticulous planning in selecting the donor wells. The selection process is critical, as it affects both the technical feasibility and the economic performance of the drilling operations.

In the case of the proposed Project, the design phase was a complex and detailed process during which the target depths of zones B and C of the reservoir were identified, and the **donor well locations** were evaluated based on **technical data, environmental conditions, viability parameters**, etc.

The main reasons for **selecting Platform Beta over Platform Alpha** for the drilling of the new wells are summarized as follows:

- Drilling the wells from Platform Beta constitutes a safe and conventional solution with lower environmental risk and a smaller environmental footprint compared to drilling from Platform Alpha, as:
  - The drilling time and completion of the wells will be of shorter duration.
  - No additional specialized equipment will be required for the fishing of the donor well.
  - A high-capacity drilling rig (>2,500 hp) will not be required.
- The drilling time and completion of the wells will be of shorter duration and will require less energy (fuel) consumption, thus resulting in lower atmospheric pollutants (CO, NOx, TSP) and greenhouse gas emissions.
- The drilling process will be safer and involve relatively simple procedures, thereby reducing the risk of accidental pollution.
- Only basic well equipment and relatively simple drilling procedures are required compared to those for Platform Alpha.
- It has a lower construction cost compared to Option A2, which is critically important for the viability of the project and the achievement of its objectives.

2.5.2 CO_2 Pipeline Routing to the Injection Wells

At the initial design stage of the Project (PRE-FEED), alternative routing options for the CO2 pipeline from the onshore facilities to the offshore facilities and injection wells were examined, as follows:

- Alternative 1: a 31 km route that crosses 3 existing pipelines and 2 cables, north of the Prinos complex.
- Alternative 2: a 29 km route that bypasses the (under-construction) Lambda platform and crosses one pipeline south of the Prinos complex, originating from the Kappa platform.
- Alternative 3: a direct 20 km route that terminates at the Prinos complex (Beta platform).

Alternative 3 is the **shortest route**, located within the existing pipeline corridor of the Prinos complex, and **avoids crossings with existing pipelines**, whereas Alternatives 1 and 2 require a longer route (due to the ~2.5 km curvature radius requirement) and crossings with existing pipelines to the north or south of the Prinos complex.

It is also noted that the construction of the CO_2 pipeline to the offshore facilities of Prinos affects the Natura 2000 area "Marine Area of Kavala – Thasos" (GR1150014). To preserve the environment, it is necessary to minimize intervention and avoid pollution or accidents during both the construction and operational phases of the pipeline. The shorter pipeline route has fewer environmental impacts. Alternative 3 is preferable as it remains **within the existing corridor** and **avoids the use of new areas.**

2.5.3 CO_2 Load Management

Alternative solutions were examined regarding the proposed approach for CO_2 loads at the Beta platform for injection, as follows:

- Alternative 1: Direct injection from the shuttle carrier to the injection well. In this design, CO_2 conditioning is performed **on the vessel**.
- Alternative 2: The vessel unloads to a **temporary storage arrangement** anchored near the platform. In this configuration, CO_2 conditioning takes place **on the platform.**
- Alternative 3: The containers are lifted by crane onto the platform, where they undergo further conditioning to meet the required injection conditions. In this design, CO_2 conditioning is performed on the platform.

The key reasons for selecting Alternative 3 — conditioning and direct injection from the platform — are summarized as follows:

- Smaller environmental footprint due to the absence of new storage tanks and the construction and installation of cranes.
- Rapid unloading of CO_2, which reduces transport time and energy consumption, thereby resulting in lower atmospheric emissions (CO, NO_x, TSP) and greenhouse gases.
- Shorter unloading time contributes to minimizing disturbance.
- Lower CAPEX due to the lack of new storage tanks, and lower OPEX due to the reduced unloading duration.

2.6 CURRENT ENVIRONMENTAL CONDITIONS

2.6.1 Natural Environment

The **climate** of the coastal zone of the Regional Unit of Kavala, where the Project under study is located, is classified as Mediterranean, with hot, dry summers (influenced by subtropical and warm dry air masses), and cold, wet winters (influenced by relatively cool air masses from the temperate zone), with annual precipitation around 300–400 mm. The corresponding inland part of the Regional Unit tends to differ, exhibiting a continental climate characterized by cool, wet winters, dry summers, and approximately double the precipitation compared to the coastal zone.

The Region of Eastern Macedonia and Thrace (hereinafter REMT) is **morphologically** characterized by strong heterogeneity, comprising numerous mountainous areas, coastal zones, rivers, wetlands, and plains. Of its total area, 34% is classified as mountainous, 26% as semi-mountainous, and 40% as lowland (ELSTAT, 2011). Specifically, the terrain of the Regional Unit (RU) of Kavala consists of 55% mountainous, 24% semi-mountainous, and 21% lowland areas. The area includes the foothills of the mountain ranges of Eastern Macedonia, such as Mount Pangaio (1,956 m), Mount Symvolo (694 m), and the Lekani Mountains (1,298 m).

The **elevation distribution** of the Water District (WD) of Thrace is as follows: 21.89% of the district lies above 600 m, 30.15% between 200 and 600 m, and 49.77% lies below 200 m. The lowland sections of the Region cover significant areas and are separated from one another by either hilly terrain or mountainous massifs.

The **morphology of the coastal zone** in the immediate study area is characterized by extended sandy beaches with lakes, lagoons, and narrow land strips. The Nestos River Delta is the dominant morphological and topological feature in the area. The lagoons closest to the project under study are those of Erateino and Vasova. Rainwater forms numerous streams flowing toward the plain. In the past, these streams created marshes in the lower-lying parts of the plain; today, their waters reach the sea via drainage canals.

As regards human intervention in the **topological and morphological features** of the broader area, it should be noted that the most significant impacting projects are the Kavala Airport, located to the east of the onshore facilities, and the road infrastructure (Egnatia Motorway and the Kavala–Xanthi National Road), which are routed to the north of the facilities.

The Regional Unit of Kavala is situated in the Rhodope geotectonic zone and forms part of the Tertiary-period tectonic depressions of Nestos and Vistonida.

The Prinos basin is a small extensional basin within a broader array of Neogene basins extending from Northern Greece, Southern Bulgaria, and North Macedonia to Eastern Albania, which comprise the extensional system of the Southern Balkans.

The chronostratigraphic column of the Prinos basin is characterized by three well-defined main sequences: the Pre-Evaporitic sequence, the Evaporitic sequence, and the Post-Evaporitic sequence.

Grain size analysis of the sediments in the Gulf of Kavala shows that the majority is covered by fine-grained sediments, with silt–clay fractions ranging between 85% and 95% (Lykousis, 1984). Elevated levels of sand and silt with high concentrations of mica and silicon dioxide were found in the southeastern part and along the northeastern and eastern shores of the Gulf. The main source of these fine-grained materials is considered to be the Nestos River.

With regard to the **seismicity** of the broader region, both the onshore and offshore project area fall within Seismic Hazard Zone I, i.e. the lowest risk category (see map below), according to the "Amendment of the Provisions of the Greek Seismic Code EAK 2000 due to Revision of the Seismic Hazard Map (Government Gazette 1154/B/12.08.2003)". Based on available data, the closest recorded earthquake to the activity under study occurred on 08/12/2017, with an epicenter located 28.3 km northwest of Serres and a magnitude of 3.8 on the Richter scale.

The project's study area lies within the River Basin Districts (RBDs) of Eastern Macedonia (EL11) and Thrace (EL12), for which River Basin Management Plans (RBMPs) have been developed in accordance with the specifications of Directive 2000/60/EC, implemented by Law 3199/2003 and Presidential Decree 51/2007. These plans were approved by Decision 1005/12-09-2013 of the National Water Committee.

The 2nd Revision of the River Basin Management Plan for the Eastern Macedonia RBD (EL11) was approved and published in Government Gazette A 82/12.06.2024, while the 2nd Revision of the RBMP for the Thrace RBD (EL12) was approved and published in Government Gazette A 81/12.06.2024.

The Eastern Macedonia RBD (EL11) includes a single river basin, the Strymonas River Basin (EL1106), as per Decision No. 706/2010 (Government Gazette 1383/B/2.9.2010) of the National Water Committee. The Thrace RBD (EL12) includes five (5) River Basins: Nestos (EL1207), Remnants of Xanthi – Dry Stream (EL1208), Remnants of Komotini – Loutrou Evros (EL1209), Evros (EL1210), and Thasos – Samothraki (EL1242), according to the same decision.

The terrestrial facilities of the proposed project are located entirely within the River Basin District of the Nestos River (EL1207), while the proposed route of the pipeline falls within both the RBD of the Nestos and the RBD of the Strymonas (EL1106).

Within the study area of the Project, the riverine water body Asprochoma R. (EL1106R0009010092N) is recorded, with a total length of 17.21 km. It is located west of the terrestrial facilities of the Project, at a distance of approximately 1.7 km. No lacustrine water bodies have been recorded within the study area. Within the study area, the transitional water body L.T. Wider Area of Keramoti (EL1207T0001N) is located, with a total area of 7.7 km². The study area, and specifically part of the proposed route of the project's pipeline, falls within two coastal WBs of the RBDs of Nestos and Strymonas. Specifically, it is located within the coastal WB Western Kavala Gulf (EL1106C0004N) and the coastal WB Eastern Kavala Gulf (EL1207C0001N).

Regarding the **quality of the coastal water bodies** in the wider area of the Project, a study team from LDK carried out seawater sampling in November 2023 at six (6) locations in the Kavala Gulf. More specifically, these samplings and sample analyses were conducted within the framework of the Annual Environmental Monitoring Report 2023 (EEMR 2023), which concerns the implementation of the environmental control program of the Prinos Offshore Development, in accordance with the requirements of the Environmental Terms Approval Decision (ETAD) 8413/24.04.2018/Ministry of Environment and Energy.

Based on the results of the samplings and analyses, it is estimated that the ecological status and the chemical status of the surface waters examined are assessed as "good".

Within the study area, the beach "Nea Karvali" (ELBW119012008) is identified, which according to the Ministry of Environment and Energy belongs to the Kavala Gulf and more specifically forms part of the wider Valtos Bay, which has a southern orientation. The coastline is entirely sandy, has a length of 1,700 m, while its average width is estimated at 20 m. The coastal zone is natural, with sparse and low surface vegetation.

The study area falls within three (3) groundwater bodies:

- In the GWB (Groundwater Body) of Nestos Delta (EL1200060).
- In the GWB of Oreoi Basin (EL1200070).
- In the GWB of Symbolo – Kavala (EL1100130).

The terrestrial facilities fall entirely within the Nestos Delta GWB.

The Nestos Delta GWB (EL1200060) is an alluvial aquifer system with an area of 555.11 km². The waters of the GWB are mainly used for irrigation needs and, secondarily, for water supply, livestock farming, and industrial needs.

According to data from the National Air Pollution Monitoring Network (NAPMN) and the Annual Air Quality Report (2022), the nearest air pollution monitoring station is located in Kavala (Projection System WGS84 – Latitude: 40.93666 and Longitude: 24.412419) at an elevation of 2 m-asl. Based on this, it is estimated that the concentrations of air pollutants in the broader area of the Project remain at low levels compared to regulated limits.

As part of the **2021 Annual Monitoring Report for the Prinos Offshore Development Project**, continuous monitoring of H_2S gas emissions and explosive mixtures was conducted using installed sensors to ensure the safety of facility personnel. No exceedances of H_2S or explosive gas concentrations were recorded.

The current state of the acoustic environment in the wider area of the project is moderate, given the industrial nature of the terrestrial section of the study area.

The main sources of noise in the area are industrial noise from the operating facilities (Energean Oil and Gas, Hellenic Fertilizers and Chemicals ELFE S.A., quarries), noise from activity at the commercial port Philippos B, vehicle traffic on the regional road network, including heavy vehicles due to industrial activity, sea traffic, and typical urban activities in nearby settlements.

2.6.2 Biotic Environment

According to the vegetation and land use map of the Geospatial Information Portal of the Ministry of Environment and Energy (YPEN), the study area includes barren land (BAR), the settlement of Karvali (SET), meadows – sparse woody vegetation (MEA), shrubs (SHR), and agricultural crops (AGR).

According to the ESIA of the Project, the terrestrial mammal species occurring in the wider area of the Project include the European hedgehog (*Erinaceus roumanicus*), the mole (*Talpa caeca* or *Talpa europaea*), the golden jackal (*Canis aureus*), the red fox (*Vulpes vulpes*), the beech marten (*Martes foina*), the otter (*Lutra lutra*), and the wildcat (*Felis silvestris*). A detailed description is provided in Section 1.1.B1.ii.1 of the ESIA.

According to the ESIA of the Project, two (2) bat species and six (6) species groups of bats were recorded in the wider area. These groups were formed when, due to the significant overlap in the characteristics of the recorded echolocation calls among different species, it was not possible to precisely identify each species. The defined species groups are as follows: *Myotis myotis/blythi*, *Myotis capaccinii/daubentonii*, *Pipistrellus kuhlii/Pipistrellus nathusii*, *Pipistrellus pipistrellus/Miniopterus schreibersii*, *Pipistrellus pipistrellus/Pipistrellus pygmaeus/Miniopterus schreibersii*, and *Pipistrellus pygmaeus/Miniopterus schreibersii*. Significant bat activity was also recorded in the area of the fish farm located west of the Sigma plant. Near the plant, the following species were recorded: *Hypsugo savii*, *Myotis capaccinii/Myotis daubentonii*, and *Pipistrellus kuhlii/Pipistrellus nathusii*. The exact locations of species recordings are presented in detail in Section 1.1. B1.ii.2 of the Project's ESIA.

Two (2) species of amphibians and fifteen (15) species of reptiles occur in the study area. These amphibian and reptile species are mainly found in springs, ditches, and sand dunes. The Greek tortoise (*Testudo graeca*) is observed in high densities in the sand dunes east of the Project's onshore facilities, while ditches and irrigation networks serve as important habitats for the Balkan terrapin. Finally, the extensive sand dune systems in the area are suitable nesting grounds for loggerhead sea turtles (*Caretta caretta*).

According to geospatial data assessing the distribution of seagrass meadows (Panayiotidis et al. 2022, Topouzelis et al. 2018), the presence of marine seagrass meadows is estimated in the wider study area of the Project. Based on fieldwork conducted in the broader area during the periods 06.11.2023 – 09.11.2023, 26.06.2021 – 27.06.2021, and 11.10.2015 – 19.10.2015, soft substrate areas (mainly sandy) have been recorded, with vegetation of the marine seagrass *Cymodocea nodosa*, which is occasionally dense, as well as soft substrate areas without vegetation. During on-site observations carried out in the context of the Project's ESIA, no *Posidonia oceanica* meadows were observed in the eastern part of the Project's onshore facilities.

The proposed Project is located within the marine protected Natura 2000 area SCI & SPA GR1150014 "Marine Area of Kavala – Thasos". In the broader study area, the following Natura 2000 sites are also identified: SCI GR1150010 "Nestos Delta and Keramoti Lagoons – Wider Area", SPA GR1150001 "Nestos Delta and Keramoti Lagoons and Thasopoula Island", and SPA GR1150012 "Thasos (Mount Ypsario and coastal zone)".

The marine area of the Project is also included in the Important Bird Area (IBA) with code GR250, named "Kavala Gulf and Thasos Marine Area", while the area GR012 named "Nestos Delta and Coastal Lagoons" is also located within the study area.

As part of the ESIA, the required number of fieldwork days was carried out for the relevant Natura 2000 sites during the periods March–June and September–October 2024. Additionally, recent monitoring data were utilized, provided by the Non-Governmental Organizations (NGOs) Hellenic Ornithological Society and ARCHELON. Existing data were also provided by the Natural Environment and Climate Change Agency (NECCA).

Regarding the avifauna, field surveys covered the end of the wintering season, the spring migration, the breeding season, and, for some species (e.g. European Shag), the post-breeding period. The autumn period was also recorded, while the wintering period was covered through literature review.

A detailed description of the terrestrial and marine habitats, terrestrial and marine mammals, marine mammals and turtles, amphibians and reptiles, and benthic communities in the study area is provided in the Project's ESIA.

By Decision No. 385085/31-10-2022 of the Secretary General of Forests of the Ministry of Environment and Energy (Official Gazette 777/D/7-11-2022), the Forest Maps of the Regional Units of Kavala and Thasos were ratified. The onshore facilities are located within areas classified under codes:
AA – "Other form/land cover in older aerial photographs" and
PA – "Final rulings and classification decisions – non-forest areas," which are not subject to the restrictions of the forestry legislation.

The new subsea pipeline falls within the boundaries of Zone 9 of Accobams in the Northeastern Mediterranean (Thracian Sea) and within the Important Marine Mammal Area (IMMAs) named "Northern Coast and Islands of the Thracian Sea," with a total area of 5,441 km². In addition, the entire region of the Northern Aegean has been recognized as one of the three Ecologically or Biologically Significant Areas (EBSAs) in Greece and is included within the MID 17 EBSA zone according to geospatial data. The Project area lies within the Important Shark and Ray Area (ISRAs) titled "Thracian Sea Shelf," with a total area of 9,980.6 km². The marine area of the Project is also included within the Important Bird Area (IBA) with code GR250, named "Kavala Gulf and marine area of Thasos," while nearby lie the areas with codes GR016 ("Island of Thasos and Xironisi") and GR012 ("Nestos Delta and Coastal Lagoons"). The Project area does not include a designated Wildlife Refuge (WR) as defined in paragraph 3 of Article 6 of Law 3937/2011. However, within the immediate vicinity of the Project, within the boundaries of the Municipality of Nestos, there is one (1) Ramsar Wetland, which is also included in the Montreux Record, named "Nestos Delta and adjacent lagoons."

Near the Project site lies part of the National Park of Eastern Macedonia and Thrace, as well as its Peripheral Zone, as designated by Joint Ministerial Decision (JMD) 44549/2008 (Official Gazette 497/A/17-10-2008). No Landscapes of Particular Natural Beauty (LPNB) are identified within the Project study area.

The existing installations and the entire area of the proposed Project are located within the Kavala Gulf, approximately 8 km west of Thasos and 18 km south of the Kavala coastline. The Kavala Gulf is located in the Northeastern Aegean and forms part of the Thracian Sea.

The Project's onshore SIGMA installations are located within the Spatial Planning Zone (ZOE) of the Municipality of Kavala, as defined by Official Gazette 437/D/1989, and fall under Area 1d, which corresponds to "existing nuisance-generating uses" of said ZOE.

In the wider terrestrial area of the Project, the following have been designated:

- The General Urban Plan (GUP) of the Municipality of Kavala (decision ref. 5248p.e./04-02-2013), published in Government Gazette 69/AAP/11-03-2013.
- For Nea Karvali in the Prefecture of Kavala, a Local Urban Plan has been approved and published in Government Gazette 487/D/1989-08-07, titled "Approval of Local Urban Plan in the community of Nea Karvali, Prefecture of Kavala, for the designation of a site for the construction of a regional market."
- A Residential Control Zone (RCZ) in the off-plan area and outside the boundaries of settlements existing prior to 1923 in the Municipality of Kavala (Prefecture of Kavala) and the communities of Amisiana, Amygdaleonas, Nea Karvali, Chalkero, and Kokkinoxoma (Prefecture of Kavala),

according to Presidential Decree 14-06-1989 (Government Gazette 437/D/1989), as amended by Government Gazette 326/D/1995.
- The General Urban Plan (GUP) of the settlement of Chrysoupoli, published in Government Gazette 814/D/26-08-1987.

According to the General Urban Plan (GUP) of the Municipality of Kavala (Government Gazette 69/AAP/11-03-2013), the terrestrial facilities of the Project fall within the area designated as "Secondary Sector Activities Development Zone."

According to the Special Spatial Planning Framework for Aquaculture Activities (Government Gazette 2505/B/04.11.2011), part of the Project lies within the Aquaculture Development Area (ADA) B14 "Agiasma – Keramoti – Erasmio" (fish farming, shellfish farming, other aquatic organisms), while it is located 10.6 km from Area B13 "Iraklitsa – Nea Peramos."

The marine area of the Kavala Gulf, where all offshore installations (existing and new) are located, has been thoroughly investigated and there are no indications of significant underwater archaeological findings. Over time, the shallow waters and the type of seabed do not permit the preservation of any possible ruins. Within the study area, two archaeological sites – monuments are identified: the terrestrial archaeological site of Nea Karvali (Government Gazette 527/B/1967-08-24) and the monument "Remains of the ancient city of Akontisma" (Government Gazette 527/B/1967-08-24).

According to the Hellenic Statistical Authority, the Region of Eastern Macedonia and Thrace has a permanent population of 562,201 inhabitants, making it the 6th most populous region in the country. At the level of Regional Units, a greater population decline is observed in the Regional Unit of Kavala compared to the Regional Unit of Thasos (-7% and -4.8% respectively), and at the municipal level, the largest decrease concerns the Municipality of Nestos (-9%).

According to Phase A of the Operational Program for the Municipality of Kavala (2023), the Municipality is served for its water supply needs by the Municipal Water and Sewerage Company of Kavala (DEYAK), which has been operating since 1984. Within the terrestrial facilities of the Project, one (1) active water abstraction point is identified (EMS Code 1200011770795), which falls within the Nestos River Basin District (RBD) and is classified as a coastal water abstraction point. In the Nestos RBD (EL1207), the total annual water abstractions for agriculture (irrigated areas), which is the primary water user, were estimated at 165.40×10^6. According to Phase A of the Operational Program for the Municipality of Kavala (2023), 35 boreholes related to irrigation needs are identified within the Municipality.

For the solid waste management needs of the Municipality of Kavala, the Kavala Landfill Site (LFS) and the Kavala Waste Treatment Plant (WTP) are in operation.

It is noted that the expansion of the existing Kavala LFS by 31,000 m^3 in an adjacent plot above the current operational area is expected to be completed.

Finally, the main sources of pressure near the Project are:

- Wastewater Treatment Plants (WWTPs)
- Industries and facilities subject to the provisions of the SEVESO Directive (such as the “Hellenic Fertilizers ELFE S.A.” plant).
- Industries and facilities subject to the requirements of the IPPC Directive (such as the livestock facility “Afoi Kioutsoukkosta – Kreka S.A.” in Chrysoupoli, Kavala).
- Illegal landfills (ΧΑΔΑ) and Sanitary Landfills (ΧΥΤΑ)
- Other polluting facilities, such as pig farms, poultry farms, slaughterhouses, etc.

2.7 ENVIRONMENTAL AND SOCIAL IMPACTS

2.7.1 Identification and Assessment of Key Environmental Parameters

The following **table** provides a summary of the **Valued Environmental Receptors (VERs)** as assessed during the environmental and social impact evaluation process of the Project's implementation phase, as thoroughly analyzed in **Chapter 10** of this document. The VERs are categorized based on their **environmental value**, as derived from the data presented in **Chapter 8 on the Existing Environmental Conditions** and—where possible—their **sensitivity to the Project activities**.

Based on the above, the VERs are classified into Low, Medium, and High Importance. The importance of each VER is considered as a **weighting factor** in the final impact evaluation during the Environmental and Social Impact Assessment (ESIA) process. Thus, the same impact is ultimately assessed as **more significant** when affecting a **High Importance VER** compared to one of **Low Importance**.

Table 1 - Summary of Significant Environmental Parameters (SEP or Valued Receptors-VRs)

Significant Environmental Parameter (SEP).			SEP importance
Abiotic Natural Environment	Climatic and bioclimatic characteristics	Climate, microclimate and bioclimate	Moderate
		Climate change	High
	Morphological and topological characteristics	Morphology	Low
		Topography	Moderate
	Geological, tectonic and pedological characteristics	Geology	Low
		Tectonics	Moderate
		Soil	Low
		Seabed	Moderate
	Water bodies	Surface waters (excluding sea water)	Moderate
		Sea water	Moderate
		Groundwater	Moderate
	Atmospheric environment	Air quality	Low
	Acoustic environment and vibration & radiation emissions	Acoustic Environment	Moderate
		Vibrations	Moderate
		Electromagnetic radiation	Low
Biotic Natural Environment	Terrestrial Habitat	Terrestrial habitat types	Moderate
		Terrestrial mammals	Low

Significant Environmental Parameter (SEP).			SEP Importance
		Amphibians and reptiles	Μέτρια
	Marine Habitat	Marine habitat types	Low
		Marine mammals	High
		Sea turtles	Moderate
		Ichthyofauna (Fish species)	Moderate
	Avifauna	Avifauna	High
	National System of Protected Areas	Protected Areas	High
		Forests and forested areas	Low
		Other important natural areas	High
Human Environment	Spatial planning and land use	Spatial planning and land use	Low
	Structure and functions of the anthropogenic environment	Structure and functions of the anthropogenic environment	Moderate
	Cultural heritage	Cultural heritage	Low
	Socio – economic environment	Socio – economic environment	High
	Social infrastructure	Health	High
	Technical infrastructure	Technical infrastructure	Low

2.7.2 Assessment of Potentially Significant Impacts from the Normal / Routine Activities of the Project

The following **tables** provide a summary of the **potential environmental and social impacts** during each phase of the Project—**Construction, Operation, and Decommissioning/Closure**—as they were assessed and evaluated in **Chapter 10** of the present report.

Table 2 - Summary of characteristics, importance, magnitude, and Final Impact Assessment of affected environmental parameters during the Construction Phase of the proposed project

CONSTRUCTION – Activity	Receptor	Nature of Impact	Impact Magnitude	SEP Importance	Final Impact Assessment	Final Residual Impact Assessment
CLIMATIC AND BIOCLIMATIC CHARACTERISTICS						
Emissions of GHGs from the construction of onshore facilities	Climate / Climate Change	-	Low	High	Moderate	Low
Emissions of GHGs from construction of CO_2 transport pipeline	Climate / Climate Change	-	Low	High	Moderate	Low
Emissions of GHGs from drilling operations	Climate / Climate Change	-	Low	High	Moderate	Low
MORPHOLOGICAL AND TOPOLOGICAL CHARACTERISTICS						
Construction of Onshore facilities	Morphology of land area	-	Low	Low	Negligible	Negligible
Construction of Onshore facilities	Topography	-	Low	Moderate	Low	Low

CONSTRUCTION – Activity	Receptor	Nature of Impact	Impact Magnitude	SEP Importance	Final Impact Assessment	Final Residual Impact Assessment
Construction of CO_2 transport pipeline	Morphology of seabed	-	Low	Low	Negligible	Negligible
Construction of CO_2 transport pipeline	Topography	-	Low	Moderate	Low	Low
Drilling operations	Morphology of seabed	-	Low	Low	Negligible	Negligible
Drilling operations	Topography	-	Low	Moderate	Low	Low
GEOLOGICAL, TECTONIC AND PEDOLOGICAL CHARACTERISTICS						
Construction of Onshore facilities	Geological Characteristics	-	Low	Low	Negligible	Negligible
Construction of Onshore facilities	Soil characteristics	-	Low	Low	Negligible	Negligible
Construction of CO_2 transport pipeline	Qualitative characteristics and structure of seabed	-	Low	Moderate	Low	Low
Drilling operations	Qualitative characteristics and structure of seabed	-	Low	Moderate	Low	Low
Drilling operations	Geological characteristics and subsea geological formations	-	Minor	Low	Negligible	Negligible
NATURAL BIOTIC ENVIRONMENT						
Construction of CO_2 transport pipeline	Terrestrial habitat types	-	Minor	Moderate	Minor	Minor
Construction of the onshore section of the CO_2 pipeline	Terrestrial mammals	-	Minor	Low	Negligible	Negligible
Construction of the onshore section of the CO_2 pipeline	Amphibians and reptiles	-	Minor	Moderate	Minor	Minor
Construction of CO_2 transport pipeline	Marine habitat types	-	Minor	Low	Negligible	Negligible
Drilling operations	Marine habitat types	-	Minor	Low	Negligible	Negligible
Construction of CO_2 transport pipeline	Marine mammals	-	Minor	High	Moderate	Minor
Drilling operations	Marine mammals	-	Minor	High	Moderate	Minor
Construction of CO_2 transport pipeline	Sea turtles	-	Minor	Moderate	Minor	Minor
Drilling operations	Sea turtles	-	Low	Moderate	Minor	Minor
Construction of CO_2 transport pipeline	Avifauna	-	Minor	Moderate	Minor	Minor

CONSTRUCTION – Activity	Receptor	Nature of Impact	Impact Magnitude	SEP Importance	Final Impact Assessment	Final Residual Impact Assessment
Drilling operations	Avifauna	-	Minor	Moderate	Minor	Minor
Construction of CO_2 transport pipeline	Avifauna	-	Minor	High	Moderate	Minor
Drilling operations	Avifauna	-	Minor	High	Moderate	Minor
Construction of CO_2 transport pipeline	Areas of the National System of Protected Areas	-	Minor	HIgh	Moderate	Minor
Drilling operations	Areas of the National System of Protected Areas	-	Minor	High	Moderate	Minor
Construction of CO_2 transport pipeline	Other Significant Natural Areas	-	Minor	High	Moderate	Minor
Drilling operations	Other Significant Natural Areas	-	Minor	High	Moderate	Minor
ANTHROPOGENIC ENVIRONMENT						
Offshore CO_2 transport pipeline: Definition of exclusion zones due to installation works of offshore CO_2 transport pipeline (and related works/activities)	Marine uses	-	Minor	Low	Negligible	Negligible
Installation of offshore facilities (excluding the offshore CO_2 transport pipeline): Definition of exclusion zones due to installation works and drilling operations	Marine uses	-	Minor	Low	Negligible	Negligible
Movement of heavy vehicles, construction machinery, machinery and freight transport vehicles, as well as support vehicles during construction that emit: Dust (PM_{10}, $PM_{2,5}$), air pollutants (CO, VOC and NO_x) and noise	Structure and Functions of the Anthropogenic Environment	-	Negligible	Moderate	Negligible	Negligible
Mobilization / Engagement (recruitment, employment) of local workforce	Structure and Functions of the Anthropogenic Environment	+	Positive	Moderate	Positive	Positive
Implementation of Corporate Social Responsibility actions	Structure and Functions of the Anthropogenic Environment	+	Positive	Moderate	Positive	Positive
Construction of onshore facilities – Emissions, air pollutants and noise	Tourism	-	Negligible	High	Minor	Minor
Mobilization / Engagement (recruitment,	Other economic activities	+	Positive	High	Positive	Positive

CONSTRUCTION – Activity	Receptor	Nature of Impact	Impact Magnitude	SEP Importance	Final Impact Assessment	Final Residual Impact Assessment
employment) of local workforce						
Supply chain issues and procurement of required construction materials, resources and services related to the implementation of the project	Other economic activities	+	Positive	High	Positive	Positive
Mobilization / Engagement (recruitment, employment) of local workforce	Employment and labor force	+	Positive	High	Positive	Positive
Supply chain issues and procurement of required construction materials, resources and services related to the implementation of the project	Employment and labor force	+	Positive	High	Positive	Positive
Construction work	Occupational health and safety	-	Negligible	High	Minor	Minor
Construction activities	Public Health	+	Positive	High	Positive	Positive
TECHNICAL INFRASTRUCTURE						
Installation of CO_2 transport pipelines and other offshore installations (including transport operation support works and support vessel movements)	Marine Transport / Traffic	-	Minor	Low	Negligible	Negligible
Maintenance and use of the marine exclusion zone	Marine Transport / Traffic	-	Minor	Low	Negligible	Negligible
Movement on the road network of heavy vehicles, construction machinery, vehicles and freight trucks due to implementation of construction works of the examined project	Road Network / Transport / Traffic	-	Minor	Low	Negligible	Negligible
Generation of liquid and solid waste due to implementation of construction works	Waste collection, transport, disposal and management systems for liquid and solid waste	-	Minor	Low	Negligible	Negligible
AIR QUALITY						
Emissions of air pollutants from the construction of onshore facilities	Atmospheric environment	-	Minor	Low	Negligible	Negligible
Emissions of air pollutants from the construction of the CO_2 transport pipeline	Atmospheric environment	-	Minor	Low	Negligible	Negligible
Emissions of air pollutants from drilling works	Atmospheric environment	-	Minor	Low	Negligible	Negligible

CONSTRUCTION – Activity	Receptor	Nature of Impact	Impact Magnitude	SEP Importance	Final Impact Assessment	Final Residual Impact Assessment
ACOUSTIC ENVIRONMENT						
Construction of CO_2 transport pipeline	Underwater noise	-	Minor	Moderate	Minor	Minor
Drilling work	Underwater noise	-	Minor	Moderate	Minor	Minor
Drilling work	Vibrations	-	Minor	Moderate	Minor	Minor
Construction of onshore facilities	Acoustic environment	-	Minor	Moderate	Minor	Minor
Construction of CO_2 transport pipeline	Acoustic environment	-	Minor	Moderate	Minor	Minor
Drilling work	Acoustic environment	-	Minor	Moderate	Minor	Minor
WATER						
Construction work of onshore facilities	Quality characteristics of marine and coastal water	-	Minor	Moderate	Minor	Minor
Construction work of subsea CO_2 pipeline	Quality characteristics of marine and coastal waters	-	Minor	Moderate	Minor	Minor
Construction work of above-ground facilities (excluding the above-ground section of the CO_2 transport pipeline)	Quality characteristics of marine and coastal waters	-	Minor	Moderate	Minor	Minor
Construction work of onshore facilities	Quantitative characteristics of the area's water resources	-	Minor	Moderate	Minor	Minor
Construction work of subsea CO_2 pipeline	Quantitative characteristics of the area's water resources	-	Minor	Moderate	Minor	Minor
Construction work of above-ground facilities (excluding the above-ground section of the CO_2 transport pipeline)	Quantitative characteristics of the area's water resources	-	Minor	Moderate	Minor	Minor

Table 3 - Summary of characteristics, significance, magnitude, and Final Impact Assessment of impacts, on affected environmental parameters during the Operation Phase of the proposed project

OPERATION – Activity	Receptor	Nature of Impact	Impact Magnitude	SEP Importance	Final Impact Assessment	Final Residual Impact Assessment
CLIMATIC AND BIOCLIMATIC CHARACTERISTICS						
Emissions of GHGs from the transport of CO_2 to the	Climate / Climate change	-	Minor	High	Moderate	High

OPERATION – Activity	Receptor	Nature of Impact	Impact Magnitude	SEP Importance	Final Impact Assessment	Final Residual Impact Assessment
offshore storage facilities in Prinos						
Emissions of GHGs from CO_2 injection	Climate / Climate change	-	Minor	High	Moderate	Minor
Emissions of GHGs from water pumping	Climate / Climate change	-	Minor	High	Moderate	Minor
Emissions of GHGs from maintenance activities and performance of infrastructure and equipment	Climate / Climate change	-	Minor	High	Moderate	Minor
Emissions of GHGs from the daily movement of vessels due to the operation of the Project (including the transport of workers and movement of support vessels)	Climate / Climate change	-	Minor	High	Moderate	Minor
CO_2 storage during the operation of the Project	Climate / Climate change	+	Positive	High	Positive	Positive
MORPHOLOGICAL AND TOPOLOGICAL CHARACTERISTICS						
Physical presence – Operation of onshore facilities	Morphology of land surface	-	Minor	Low	Negligible	Negligible
Physical presence – Operation of onshore facilities	Topography	-	Minor	Moderate	Minor	Minor
GEOLOGICAL, TECTONIC AND SOIL CHARACTERISTICS						
Physical presence – Operation of onshore facilities	Soil characteristics	-	Minor	Low	Negligible	Negligible
Physical presence and operation of facilities – CO_2 injection into geological formations	Tectonic	-	Minor	Moderate	Minor	Minor
PHYSICAL BIOTIC ENVIRONMENT						
CO_2 transport to the offshore storage facilities in Prinos (*pipeline section to be installed on the shore*)	Terrestrial habitats	-	Minor	Moderate	Minor	Minor
Water abstraction from the reservoir and discharge of treated water into the marine environment during the operation of the Project	Marine habitats	-	Minor	Low	Negligible	Negligible
Definition / maintenance of anchor and fishing exclusion zones during the operation of the Project	Marine habitats	+	Positive	Low	Positive	Positive
Water abstraction from the reservoir and discharge of treated water into the marine environment during the operation of the Project	Marine mammals	-	Minor	High	Moderate	Minor

OPERATION – Activity	Receptor	Nature of Impact	Impact Magnitude	SEP Importance	Final Impact Assessment	Final Residual Impact Assessment
Definition / maintenance of anchor exclusion and fishing exclusion zones during the operation of the Project	Marine mammals	+	Positive	High	Positive	Positive
Seawater intake from the reservoir and discharge of treated water into the marine environment during project operation	Sea turtles	-	Minor	Moderate	Minor	Minor
Daily vessel movements due to project operation (including personnel transport and vessel support operations)	Sea turtles	-	Minor	Moderate	Minor	Minor
Definition / maintenance of anchoring and fishing exclusion zone during project operation	Sea turtles	+	Positive	Moderate	Positive	Positive
Water intake from the reservoir and discharge of the treated water into the marine environment during the operation of the Project	Ichthyofauna	-	Minor	Moderate	Minor	Minor
Definition / maintenance of anchoring and fishing exclusion zone during the operation of the Project	Ichthyofauna	+	Positive	Moderate	Positive	Positive
Water intake from the reservoir and discharge of the treated water into the marine environment during the operation of the Project	Avifauna	-	Minor	High	Moderate	Minor
Marine traffic: Definition of access exclusion zones due to the operation of the project	Avifauna	+	Positive	High	Positive	Positive
Water abstraction from the reservoir and discharge of the treated water into the marine environment	Areas of the National System of Protected Areas	-	Minor	High	Moderate	Minor
Daily vessel traffic due to the operation of the project (including the transport of personnel and the movement of support vessels)	Areas of the National System of Protected Areas	-	Minor	High	Moderate	Minor
Marine traffic: Definition of access exclusion zones due to the operation of the project	Areas of the National System of Protected Areas	+	Positive	High	Positive	Positive
Water abstraction and discharge activities of the treated water into the marine environment	Other Important Natural Areas	-	Minor	High	Moderate	Minor
Daily vessel traffic due to the operation of the project (including the transport of personnel and the movement of support vessels)	Other Important Natural Areas	-	Minor	High	Moderate	Minor

OPERATION – Activity	Receptor	Nature of Impact	Impact Magnitude	SEP Importance	Final Impact Assessment	Final Residual Impact Assessment
Marine traffic: Definition of access exclusion zones due to the operation of the project	Other Important Natural Areas	+	Positive	High	Positive	Positive
ANTHROPOGENIC ENVIRONMENT						
Physical presence and siting of marine infrastructures of the project	Marine uses	-	Minor	Low	Moderate	Moderate
Marine traffic: Definition of access exclusion zones due to the operation of the project.	Marine uses	-	Minor	Low	Negligible	Negligible
Mobilization / Engagement (recruitment, employment) of local workforce	Structure and Functioning of the Anthropogenic Environment	+	Positive	Moderate	Positive	Positive
Implementation of Corporate Social Responsibility actions	Structure and Functioning of the Anthropogenic Environment	+	Positive	Moderate	Positive	Positive
Marine traffic – Definition of access exclusion zones for fisheries / aquaculture, local fish populations	Fisheries / Aquaculture / Local fish population	+	Positive	High	Positive	Positive
Operation of the Project – Offshore installations (excluding the offshore CO_2 transport pipeline)	Tourism	-	Negligible	High	Minor	Minor
Emissions of air pollutants and noise during CO_2 delivery	Tourism	-	Negligible	High	Minor	Minor
Mobilization / Engagement (recruitment, employment) of local workforce	Other economic activities	+	Positive	High	Positive	Positive
Supply chain issues and procurement of required materials, resources and services related to the operation of the project	Other economic activities	+	Positive	High	Positive	Positive
Mobilization / Engagement (recruitment, employment) of local workforce	Employment and labor force	+	Positive	High	Positive	Positive
Supply chain issues and procurement of required materials, resources and services related to the operation of the project	Employment and labor force	+	Positive	High	Positive	Positive
Operation work	Occupational health and safety	-	Negligible	High	Minor	Minor
Operation activities	Public Health	+	Positive	High	Positive	Positive
TECHNICAL INFRASTRUCTURE						
Daily vessel traffic due to the operation of the project (including transfer of	Marine Transport / Traffic	-	Minor	Low	Negligible	Negligible

OPERATION – Activity	Receptor	Nature of Impact	Impact Magnitude	SEP Importance	Final Impact Assessment	Final Residual Impact Assessment
workers and movement of support vessels)						
Compliance and use of marine exclusion zone	Marine Transport / Traffic	-	Minor	Low	Negligible	Negligible
Load on the road network due to the operation of the project	Road Network / Transport / Traffic	-	Minor	Low	Negligible	Negligible
Generation of liquid and solid waste due to the operation of the project	Systems for collection, transport, disposal, and management of liquid and solid waste	-	Minor	Low	Negligible	Negligible
AIR QUALITY						
Atmospheric emissions during CO_2 delivery and transport to the offshore storage facilities in Prinos	Atmospheric environment	-	Minor	Low	Negligible	Negligible
Air pollutants from CO_2 injection	Atmospheric environment	-	Minor	Low	Negligible	Negligible
Air pollutants from water pumping	Atmospheric environment	-	Minor	Low	Negligible	Negligible
Air pollutants from infrastructure and equipment maintenance and repair activities	Atmospheric environment	-	Minor	Low	Negligible	Negligible
Air pollutants from daily vessel traffic due to the operation of the project (including transfer of workers and movement of support vessels)	Atmospheric environment	-	Minor	Low	Negligible	Negligible
ACOUSTIC ENVIRONMENT						
Reception of CO_2 via containers (CO_2 parcels) Transport of CO_2 to the offshore storage facilities in Prinos CO_2 injection Water pumping	Underwater noise	-	Minor	Moderate	Minor	Minor
Marine traffic	Underwater noise	-	Minor	Moderate	Minor	Minor
Reception of CO_2 via containers (CO_2 parcels) Transport of CO_2 to the offshore storage facilities in Prinos CO_2 injection Water pumping	Acoustic environment	-	Minor	Moderate	Minor	Minor
Marine traffic	Acoustic environment	-	Minor	Moderate	Minor	Minor
WATER						
Maintenance of the offshore CO_2 transport pipeline	Quality characteristics of	-	Minor	Moderate	Minor	Minor

OPERATION – Activity	Receptor	Nature of Impact	Impact Magnitude	SEP Importance	Final Impact Assessment	Final Residual Impact Assessment
	marine & coastal waters					
Operation of offshore facilities	Quality characteristics of marine & coastal waters	-	Minor	Moderate	Minor	Minor
Operation of the project	Quantitative characteristics of water resources	-	Minor	Moderate	Minor	Minor

Table 4 - Summary of characteristics, significance, magnitude, and Final Impact Assessment of impacts, on specific environmental parameters during the Decommissioning / Restoration Phase of the proposed project

DECOMMISSIONING / RESTORATION – Activity	Receptor	Nature of Impact	Impact Magnitude	SEP Importance	Final Impact Assessment	Final Residual Impact Assessment
CLIMATIC AND BIOCLIMATIC CHARACTERISTICS						
GHG emissions from decommissioning of onshore facilities – restoration of onshore areas	Climate / Climate change	-	Minor	High	Moderate	Minor
GHG emissions from the cessation of operation / decommissioning of the offshore CO_2 transport pipeline	Climate / Climate change	-	Minor	High	Moderate	Minor
GHG emissions from the cessation of operation / decommissioning of offshore facilities (excluding the offshore CO_2 transport pipeline)	Climate / Climate change	-	Minor	High	Moderate	Minor
MORPHOLOGICAL AND TOPOLOGICAL CHARACTERISTICS						
Decommissioning of onshore facilities	Morphology of land surface	-	Minor	Low	Negligible	Negligible
Restoration of onshore areas of the project's facilities	Morphology of land surface	+	Positive	Low	Positive	Positive
Decommissioning of onshore facilities	Landscape	-	Minor	Moderate	Minor	Minor
Restoration of onshore areas of the project's facilities	Landscape	+	Positive	Moderate	Positive	Positive
GEOLOGICAL, TECTONIC AND SOIL CHARACTERISTICS						
Generation of solid and liquid waste during decommissioning	Soil characteristics	-	Minor	Low	Negligible	Negligible

DECOMMISSIONING / RESTORATION – Activity	Receptor	Nature of Impact	Impact Magnitude	SEP Importance	Final Impact Assessment	Final Residual Impact Assessment
Restoration of the project's onshore areas	Soil characteristics	+	Positive	Low	Positive	Positive
Cessation of operation / Decommissioning of offshore CO_2 transport pipelines	Qualitative characteristics and structure of seabed	-	Minor	Moderate	Minor	Minor
Cessation of operation / Decommissioning of offshore facilities (excluding the offshore CO_2 transport pipeline)	Qualitative characteristics and structure of seabed	-	Minor	Moderate	Minor	Minor
PHYSICAL BIOTIC ENVIRONMENT						
Cessation of operation / Decommissioning of offshore facilities (excluding the offshore CO_2 transport pipeline)	Marine habitats	-	Minor	Low	Negligible	Negligible
Cessation of operation / Decommissioning of offshore facilities (excluding the offshore CO_2 transport pipeline)	Marine mammals	-	Minor	High	Moderate	Minor
Cessation of operation / Decommissioning of offshore facilities (excluding the offshore CO_2 transport pipeline)	Sea turtles	-	Minor	Moderate	Minor	Minor
Cessation of operation / Decommissioning of offshore facilities (excluding the offshore CO_2 transport pipeline)	Ichthyofauna	-	Minor	Moderate	Minor	Minor
Cessation of operation / Decommissioning of offshore facilities (excluding the offshore CO_2 transport pipeline)	Avifauna	-	Minor	High	Moderate	Minor
Cessation of operation / Decommissioning of offshore facilities (excluding the offshore CO_2 transport pipeline)	Areas of the National System of Protected Areas	-	Minor	High	Moderate	Minor
Cessation of operation / Decommissioning of offshore facilities (excluding the offshore CO_2 transport pipeline)	Other Important Natural Areas	-	Minor	High	Moderate	Minor
ANTHROPOGENIC ENVIRONMENT						
Cessation of operation / Decommissioning of offshore CO_2 transport pipelines: Definition of access exclusion zones due to offshore pipeline decommissioning activities	Marine uses	-	Minor	Low	Negligible	Negligible
Cessation of operation / Decommissioning of offshore facilities (excluding the offshore	Marine uses	-	Minor	Low	Negligible	Negligible

DECOMMISSIONING / RESTORATION – Activity	Receptor	Nature of Impact	Impact Magnitude	SEP Importance	Final Impact Assessment	Final Residual Impact Assessment
CO_2 transport pipeline): Definition of access exclusion zones due to offshore facility decommissioning activities						
Movement of heavy vehicles, construction machinery, vehicles and freight trucks, and supporting vehicles during decommissioning activities: Dust (PM10, PM2.5) Air pollutants (CO, VOC and NOx) Noise	Structure and functioning of the anthropogenic environment	-	Negligible	Moderate	Negligible	Negligible
Cessation of operation / Decommissioning of offshore facilities (excluding the offshore CO_2 transport pipeline): Marine traffic - Definition of access exclusion zones due to offshore facility decommissioning activities	Fisheries / Aquaculture	+	Positive	High	Positive	Positive
Emissions of air pollutants and noise during the decommissioning of onshore facilities – restoration of the onshore facility areas	Tourism	-	Negligible	High	Minor	Minor
Mobilization (recruitment, employment, involvement) of workforce	Other economic activities	+	Positive	High	Positive	Positive
Supply chain and procurement issues of required materials, resources, and services related to the cessation of operation / decommissioning of the project	Other economic activities	+	Positive	High	Positive	Positive
Decommissioning: Mobilization / Engagement (recruitment, employment) of local workforce	Employment and labor force	+	Positive	High	Positive	Positive
Decommissioning: Supply chain and procurement issues of required construction materials, resources, and services related to the implementation of the project	Employment and labor force	+	Positive	High	Positive	Positive
Cessation of operation: Termination of workforce activities	Employment and labor force	-	Minor	High	Moderate	Minor
Decommissioning work	Occupational health and safety	-	Negligible	High	Minor	Minor

DECOMMISSIONING / RESTORATION – Activity	Receptor	Nature of Impact	Impact Magnitude	SEP Importance	Final Impact Assessment	Final Residual Impact Assessment
Decommissioning activities	Public health	+	Positive	High	Positive	Positive
TECHNICAL INFRASTRUCTURE						
Decommissioning of offshore facilities (including transfer of workers and movement of support vessels)	Marine Transport / Traffic	-	Minor	Low	Negligible	Negligible
Compliance and use of the marine exclusion zone	Marine Transport / Traffic	-	Minor	Low	Negligible	Negligible
Movement of heavy vehicles, construction machinery, vehicles, and freight trucks on the road network for waste transfer, due to the implementation of the project's decommissioning work	Road Network / Transport / Traffic	-	Minor	Low	Negligible	Negligible
Generation of liquid and solid waste due to decommissioning activities	Systems for collection, transport, disposal, and management of liquid and solid waste	-	Minor	Low	Negligible	Negligible
AIR QUALITY						
Air pollutants from the decommissioning of onshore facilities – Restoration of onshore facilities of the Project	Atmospheric environment	-	Minor	Low	Negligible	Negligible
Cessation / plugging of offshore CO_2 transport pipeline	Atmospheric environment	-	Minor	Low	Negligible	Negligible
Cessation of offshore facilities (excluding offshore CO_2 pipeline)	Atmospheric environment	-	Minor	Low	Negligible	Negligible
ACOUSTIC ENVIRONMENT						
Disassembly of equipment and removal of offshore installations	Underwater noise	-	Minor	Moderate	Minor	Minor
Marine transport and transfers (personnel, equipment, and materials) in the context of the decommissioning works of the offshore installations of the examined Project	Underwater noise	-	Minor	Moderate	Minor	Minor
Disassembly of equipment and removal of onshore installations	Acoustic environment	-	Minor	Moderate	Minor	Minor
Road transport and transfers (personnel, equipment, and materials) in the context of the decommissioning works of the examined Project and restoration of the	Acoustic environment	-	Minor	Moderate	Minor	Minor

DECOMMISSIONING / RESTORATION – Activity	Receptor	Nature of Impact	Impact Magnitude	SEP Importance	Final Impact Assessment	Final Residual Impact Assessment
terrestrial intervention area						
Disassembly of equipment and removal of offshore installations	Acoustic environment	-	Minor	Moderate	Minor	Minor
Marine transport and transfers (personnel, equipment, and materials) in the context of the decommissioning works of the offshore installations of the examined Project	Acoustic environment	-	Minor	Moderate	Minor	Minor
Decommissioning of the examined Project and restoration of the terrestrial intervention area	Acoustic environment	+	Positive	Moderate	Positive	Positive
WATER						
Cessation of operation and decommissioning of the onshore installations of the Project	Qualitative characteristics of marine & coastal waters	-	Minor	Moderate	Minor	Minor
Decommissioning of the onshore installations of the Project and restoration of their spatial arrangement	Qualitative characteristics of marine & coastal, surface and groundwater	+	Positive	Moderate	Positive	Positive
Cessation of operation of the subsea CO_2 pipeline	Qualitative characteristics of marine & coastal waters	-	Minor	Moderate	Minor	Minor
Cessation of operation and decommissioning of offshore installations (including the CO_2 transmission pipeline)	Qualitative characteristics of marine & coastal waters	-	Minor	Moderate	Minor	Minor
Activities for the cessation and decommissioning of the onshore installations of the Project	Qualitative characteristics of local water resources	-	Minor	Moderate	Minor	Minor

During the Construction Phase of the Project, as indicated in the **tables** above, negligible to minor adverse impacts are expected—all of which are compatible with environmental protection objectives—on the following environmental parameters:

- Climatic and Bioclimatic Characteristics (minor impacts)
- Morphological and Topological Characteristics (negligible to minor impacts)
- Geological, Tectonic, and Soil Characteristics (negligible to minor impacts)
- Natural - Biotic Environment (negligible to minor impacts)
- Anthropogenic Environment (negligible to minor impacts)
- Technical Infrastructure (negligible impacts)
- Air Quality (negligible impacts)
- Acoustic Environment and Vibrations (minor impacts)
- Water Resources (minor impacts)

It is important to highlight that the final assessment of impacts from the routine activities during the implementation phase of the proposed Project did not exceed the "**Minor**" classification, with the exception of the following, which were assessed as "**Moderate**":

- Impacts on Climate/Climate Change due to greenhouse gas emissions from the construction of onshore facilities, the CO_2 transport pipeline, and drilling activities.
- Impacts on the Natural Biotic Environment due to the construction of the CO_2 transport pipeline and drilling activities.

Positive impacts are expected on the anthropogenic environment due to the mobilization / engagement (recruitment, employment, engagement) of the workforce, supply chain issues, and the procurement of necessary construction materials, resources, and services related to the implementation of the Project, as well as from the application of Corporate Social Responsibility (CSR) actions.

During the Operation Phase of the Project, negligible to minor adverse impacts are anticipated (in all cases consistent with environmental protection objectives) on the following environmental parameters:

- Morphological and Topological Characteristics (negligible to minor impacts)
- Geological, Tectonic, and Soil Characteristics (negligible to minor impacts)
- Natural – Biotic Environment (negligible to minor impacts)
- Anthropogenic Environment (negligible to minor impacts)
- Technical Infrastructure (negligible impacts)
- Air Quality (negligible impacts)
- Acoustic Environment and Vibrations (minor impacts)
- Water Resources (minor impacts)

The final assessments of impacts during the routine activities of the Operation Phase of the proposed Project did not exceed the classification of **"Minor"**, with the exception of the following, which were evaluated as **"Moderate"**:

- Impacts on climate and climate change from greenhouse gas (GHG) emissions resulting from the transport of CO_2 to the offshore Prinos storage facilities, CO_2 injection, water abstraction, infrastructure and equipment maintenance and repair activities, and daily vessel traffic related to Project operations (including crew transport and support vessel movements).
- Impacts on the biotic environment due to water abstraction from the reservoir and discharge of treated effluent into the marine environment during Project operation, as well as from daily vessel traffic associated with the operation of the Project (including crew transport and support vessel movements).

Positive impacts are expected on the following environmental parameters:

- Climate and climate change, due to CO_2 storage resulting from the operation of the Project.
- Natural – biotic environment, from the designation and maintenance of an anchoring and fishing exclusion zone.
- Anthropogenic environment, primarily due to the mobilization/engagement (hiring, employment, involvement) of the workforce, as well as logistics and supply of necessary materials, resources, and services related to the operation of the Project, and from the implementation of Corporate Social Responsibility (CSR) actions.

During the Decommissioning / Project Dismantling Phase, negligible and minor negative impacts are expected (in all cases compliant with environmental protection objectives) on the following environmental parameters:

- Morphological and topological characteristics (negligible and minor impacts).
- Geological, tectonic, and soil characteristics (negligible and minor impacts).
- Natural – biotic environment (negligible and minor impacts).
- Anthropogenic environment (negligible and minor impacts).
- Technical infrastructure (negligible impacts).
- Air quality (negligible impacts).
- Acoustic environment and vibrations (minor impacts).
- Water bodies (minor impacts).

The final assessments of the impacts from the routine activities during the decommissioning phase of the proposed Project did not exceed the "**Minor**" significance rating, except for the following, which were rated as "**Moderate**", as follows:

- Impacts on climate and climate change, due to GHG emissions from the dismantling and decommissioning of Project facilities, and the decommissioning of the offshore CO_2 transport pipeline.
- Impacts on the biotic environment, from the dismantling and decommissioning of Project facilities.
- Impacts on employment and the workforce, due to cessation of activities.

Positive impacts are expected on the following environmental parameters:

- Morphological and topological characteristics, due to the restoration of the terrestrial area occupied by the Project facilities.
- Soil characteristics, due to the restoration of the terrestrial area occupied by the Project facilities.
- Anthropogenic environment, mainly due to the mobilisation (recruitment, employment, involvement) of the workforce, and logistics and procurement of the necessary resources, materials, and services related to the Project's decommissioning.
- Acoustic environment and vibrations, due to the decommissioning of terrestrial facilities and restoration of their location area.
- Water bodies, due to the decommissioning of terrestrial facilities and restoration of their location area.

For the impacts that were assessed as "**Moderate**", after the implementation of the mitigation measures proposed in **Chapter 11** of this study, the residual impacts are ultimately assessed as "**Minor**". Therefore, the Project is considered compatible with the environmental protection objectives which constitute prerequisites of this Environmental and Social Impact Assessment.

2.7.3 Assessment of Potentially Significant Impacts Resulting from the Vulnerability of the Project to Accident or Disaster Risks Related to the Project (Emergency Conditions / Unplanned Events)

The assessment of potential impacts arising from the vulnerability of the proposed Project to the risks of major accidents or disasters includes, among others, the following elements:

i. Hazard investigation
ii. Exposure assessment
iii. Impact assessment
iv. Hazard characterization

Below is a summary of the findings from the assessments concerning the worst-case accident scenarios at the **terrestrial facilities** of the Project, the **CO_2 transmission pipeline**, and the **offshore installations**:

- Based on the Impact Modelling Study for risk assessment related to CO_2 leakage from the onshore facilities of the CO_2 storage unit in Prinos, it was determined that, in the worst-case accident scenario, the maximum hazard distance for 1% lethality in the terrestrial environment is estimated at 782 meters, a condition that could result from a major leak from the CO_2 pipeline. Consequently, the geographical distribution of the simulation results indicates that **even in the worst-case accident scenario at the onshore project facilities, no sensitive receptors of the natural or human environment (e.g. settlements, individual residences outside the project area, or public infrastructure) are expected to be affected.**

- On the contrary, impacts in the event of an accident at the onshore project facilities would pose risks primarily to personnel working at the Project site, who will, however, be adequately trained and equipped to implement immediate emergency response measures (e.g. shutdown of gas flow), in accordance with the **Health and Safety Management Plans** of the Project, as required by applicable **legislation** and detailed in the relevant Sections of **Chapter 11**.

- According to the results of the CO_2 release simulation conducted using Phast v9 software for the evaluation of risks associated with a CO_2 leak from the Project's subsea CO_2 transmission pipeline, in the **worst-case scenario**, at sea level, the maximum distance with a CO_2 concentration corresponding to a 1% lethality level is approximately 1 km in the direction of the prevailing wind. In the initial stages of the leak (t = <60 s), a high plume is expected that may temporarily exceed the platform deck level; however, downwind distances at these altitudes are limited. As the pipeline depressurizes, the plume height is significantly reduced and disperses (less than 2 m above the sea surface at distances greater than ~100 m downwind), meaning that **the risk to vessel personnel is reduced in these scenarios, as is the risk of potential adverse effects on the natural environment.** It is noted that with the **implementation of preventive measures** (as required by legislation and provided for in the health and safety plans applicable to the implementation and operation of the project), **this scenario becomes extremely rare**.
- Regarding the offshore installations, the simulation results indicate that the risk distances associated with the defined lethality thresholds are limited to the **immediate surroundings** of the Beta platform. The maximum risk distance for 1% lethality is estimated at 80 m at the elevation of the Beta platform deck, resulting from a pipeline rupture leading to a CO_2 leak, which constitutes the **worst-case scenario**. Similarly to the subsea pipeline case, the simulation results showed that at sea level, the maximum distance with a CO_2 concentration corresponding to a 1% lethality level is approximately 1 km in the direction of the prevailing wind. In the initial stages of the leak (t = <60 s), a high plume is expected that may temporarily exceed the platform deck level; however, downwind distances at these altitudes are limited. As the pipeline depressurizes, the plume height is significantly reduced and disperses (less than 2 m above the sea surface at distances greater than ~100 m downwind), **meaning that the risk to vessel personnel is reduced in these scenarios, as is the risk of potential adverse effects on the natural environment**. It is noted that with the implementation of preventive measures (as required by legislation and provided for in the health and safety plans applicable to the implementation and operation of the project), **this scenario becomes extremely rare**.

In summary, according to the hazard assessments and simulations conducted within the framework of this project, it is estimated that the toxic effects of CO_2, which could potentially cause adverse environmental and social (E&S) impacts in the event of a major accident related to the project or a disaster, would extend to:

- ~780 m from the CO_2 reception point of the onshore pipeline (or approximately 300–350 m from the boundaries of the Sigma industrial facility), covering areas that include adjacent agricultural fields, the nearby fish farm, and the quay, but would not reach residential areas or public facilities.
- ~1000 m above sea level and a few meters of radius within the sea, from a point along the subsea CO_2 transport pipeline that could potentially rupture or from the location of the offshore installations.

Furthermore, according to the data collected over the years by Energean, it has been demonstrated that the depleted hydrocarbon fields and associated structures have proven storage capacity, a verified impermeable cap rock preventing potential leakage of stored fluids, a defined volume of resources suitable for CO_2 storage and are located in tectonically stable regions. It is also noted that the Prinos Basin is a **tectonically stable area**, as required for CO_2 storage sites in relation to tectonic (seismic) activity. Therefore, the scenario of CO_2 leakage from the reservoir itself during the operation of the Project (the consequences of which would be mostly catastrophic) is considered unlikely. Regarding potential leakage from the pipeline, this can be prevented through the scheduled inspection by an intelligent tool (pigging), which measures the wall thickness of the pipeline (every 5 years or in other cases of system shutdown), and through the designed monitoring system (**Annex 16.2**). In any case, the consequences depend on the quantity and duration of the leak.

2.7.4 Impacts from Anticipated Climate Risks

The analysis of the project's resilience to climate change is carried out according to the procedure defined in the European Commission's document titled *"Technical guidance on the climate proofing of infrastructure in the period 2021-2027"* (2021/C 373/01).

The objective of the sensitivity analysis is to identify the **sources of risk (hazards)** for the specific type of infrastructure, based on its construction and operational characteristics, **regardless of its geographical location**. According to the computational tool provided by the General Secretariat for Public Investments & NSRF (ESPA), the findings are summarized in the following **table (Hazard Sources Table).**

Table 5 - Sensitivity Analysis for the Examined Project

Risk Source	Sensitivity				
	Construction	Operation	Service Outputs	Integration in Area	Total Sensitivity
Heatwave	Low	Low	Low	Low	**Low**
Cold Wave	Low	Low	Low	Low	**Low**
Frost (Number of Days with Tmin<0)	Low	Low	Low	Low	**Low**
Forest Fire	High	High	High	Moderate	High

Risk Source	Sensitivity				
	Construction	Operation	Service Outputs	Integration in Area	Total Sensitivity
Cyclone, Strong Storms, Hurricane	Moderate	Moderate	Moderate	Low	Moderate
Storm (including snowstorms, dust storms)	Low	Low	Low	Low	Low
Tornado / Strong Winds	Moderate	Moderate	Moderate	Low	Moderate
Drought	Low	Low	Low	Low	Low
Heavy Rainfall (rain, hail, snow/ice)	Low	Low	Low	Low	Low
Floods (in coastal areas, rivers, due to rain or surface water)	Moderate	Moderate	Moderate	Moderate	Moderate
Soil Erosion / Degradation	Low	Low	Low	Low	Low
Subsidence	Low	Low	Low	Low	Low
Change in Mean Air Temperature	Low	Low	Low	Low	Low
Urban Heat Island	Low	Low	Low	Low	Low
Thermal Discomfort	Low	Low	Low	Low	Low
Temperature Variability	Low	Low	Low	Low	Low
Solar Radiation Variability	Low	Low	Low	Low	Low
Wind Characteristics Variability	Low	Low	Low	Low	Low
Variability of Rainfall Characteristics and Types (rain, hail, snow/ice)	Low	Low	Low	Low	Low
Rainfall or Hydrological Variability	Low	Low	Low	Low	Low
Change in the average temperature of water in water bodies	Low	Low	Low	Low	Low
Ocean acidification / salinity of seawater	Low	Low	Low	Low	Low
Saltwater intrusion, salinization of surface and groundwater	Low	Low	Low	Low	Low
Sea level rise	High	High	High	Low	High
Availability and depletion of water resources	Low	Low	Low	Low	Low
Coastal erosion	Low	Low	Low	Low	Low
Soil degradation, change in salt concentration, desertification	Low	Low	Low	Low	Low
Changes in the duration of cultivation and growing seasons	Low	Low	Low	Low	Low

The purpose of the exposure analysis is to identify the **sources of risk (hazards)** for the intended geographical location of the infrastructure (or its alternative locations), for both the near and distant future, **regardless of the type of infrastructure.** The exposure analysis for the project under assessment, according to the computational tool of the General Secretariat for Public Investments & NSRF (ESPA), is summarized in the following **table**.

Table 6 - Exposure Analysis for the examined project

Risk Source	Exposure		
	Existing Conditions	Future Conditions	Total Exposure
Heatwave	Low	Moderate	Moderate
Cold wave	Low	Moderate	Moderate
Frost (Number of Days with Tmin < 0)	Low	Low	Low
Forest fire	Low	Low	Low
Cyclone, Severe Storms, Hurricane	Low	Low	Low
Storms (including snowstorms, dust storms)	Low	Low	Low
Tornado / Gale-force Winds	Low	Low	Low
Drought	Low	Moderate	Moderate
Severe rainfall (rain, hail, snow/ice)	Low	Moderate	Moderate
Floods (in coastal areas, rivers, due to rainfall, underground waters)	Moderate	Moderate	Moderate
Landslide / Soil erosion	Low	Low	Low
Subsidence	Low	Low	Low
Change in average air temperature	Low	Low	Low
Urban heat island	Low	Low	Low
Thermal discomfort	Low	Low	Low
Temperature variability	Low	Low	Low
Change in solar radiation	Low	Low	Low
Change in wind characteristics	Low	Low	Low
Change in characteristics and types of precipitation (rain, hail, snow/ice)	Low	Low	Low
Precipitation variability or hydrological variability	Low	Low	Low
Change in average water temperature in water bodies	Low	Low	Low
Acidification/salinity of seawater	Low	Low	Low
Intrusion of saline water, contamination of surface and groundwater	Low	Low	Low
Sea level rise	Low	Low	Low
Availability and depletion of water resources	Low	Low	Low
Coastal erosion	Low	Low	Low
Soil degradation, change in salinity levels, desertification	Low	Low	Low
Changes in the duration of growing seasons	Low	Low	Low

The vulnerability analysis combines the exposure and sensitivity assessments to identify which **risk sources** (hazards) are relevant to the specific infrastructure, **based on both its type and geographical location**. The vulnerability analysis for the project under assessment, according to the computational tool of the General Secretariat for Public Investments & NSRF (ESPA), is summarized in the following **table**.

Table 7 - Vulnerability Analysis for the examined project

Risk Source	Sensitivity	Exposure	Vulnerability
Heatwave	Low	Moderate	Low
Cold wave	Low	Moderate	Lowή
Frost (Number of Days with Tn<0)	Low	Low	Low
Forest fire	High	Low	High
Cyclone, Severe Storm, Tornado	Moderate	Low	Moderate
Storm (including snowstorms, dust storms)	Low	Low	Low
Gale / Strong Winds	Moderate	Low	Moderate
Drought	Low	Moderate	Low
Heavy precipitation (rain, hail, snow/ice)	Low	Moderate	Low
Floods (in coastal areas, rivers, due to rain, groundwater)	Moderate	Moderate	Moderate
Landslide / Soil erosion	Low	Low	Low
Subsidence	Low	Low	Low
Change in average air temperature	Low	Low	Low
Urban heat island	Low	Low	Low
Thermal discomfort	Low	Low	Low
Temperature variability	Low	Low	Low
Change in solar radiation	Low	Low	Low
Change in wind characteristics	Low	Low	Low
Change in precipitation characteristics and types (rain, hail, snow/ice)	Low	Low	Low
Precipitation variability or hydrological variability	Low	Low	Low
Change in average water temperature in water bodies	Low	Low	Low
Ocean acidification / seawater salinity	Low	Low	Low
Intrusion of saline water, contamination of surface and groundwater	Low	Low	Low
Sea level rise	High	Low	High
Water availability and depletion of water resources	Low	Low	Low
Coastal erosion	Low	Low	Low
Soil degradation, change in salinity content, desertification	Low	Low	Low
Changes in the duration of cultivation periods	Low	Low	Low

From the above analysis, moderate or high levels of vulnerability have been identified for the following risk sources: forest fire, cyclone, severe storm, hurricane, tornado / gale-force winds, flooding (in coastal areas, riverine, due to rainfall, groundwater), and sea level rise. As a result, a **detailed risk assessment** was carried out, which includes the following steps:

- Risk analysis
- Measures to enhance climate change adaptation / Monitoring program

The results of the analysis and the proposed measures are presented in the following **tables**.

Table 8 - Intrinsic Risk Scale Assessment for the Project under Consideration

Risk Source	Likelihood of Occurrence	Consequence Magnitude	Intrinsic Risk	
			Grade	Description
Forest fire	Rare	Catastrophic	10	Moderate
Cyclone, Severe Storms, Tornado	Unlikely	Moderate	3	Low
Tornado / Gale-force Winds	Rare	Minor	4	Low
Drought	Almost certain	Negligible	5	Low
Flooding (in coastal areas, rivers, due to rainfall, underground water)	Moderate	Moderate	9	Moderate
Sea level rise	Unlikely	Significant	4	Low

Table 9 - Proposed Measures for Achieving Additional Adaptation and Enhanced Resilience to Climate Change and Calculation of Residual Risk

Risk Source	Likelihood of Occurrence	Consequence Magnitude	Intrinsic Risk		Adaptation Measures	Risk Reduction	Residual Risk	
			Grade	Description			Grade	Description
Forest Fire	Rare	Catastrophic	10	Moderate	1 Appropriate organization of the surrounding area to prevent the spread of fire (e.g., use of non-combustible construction and decorative materials; creation of firebreaks in critical locations to halt the potential spread of a forest fire; installation of firefighting water tanks and other fire suppression equipment in accordance with site-specific fire protection studies and the instructions of the competent fire service, etc.). 2 Systematic cleaning and maintenance of the project site and surrounding area to prevent the outbreak and spread of fire (e.g., regular removal of litter potentially dispersed by project personnel or occasional visitors to the wider area; routine clearing of biomass waste generated from vegetation management in adjacent plots; systematic inspection and monitoring of the condition of infrastructure networks, etc.). 3 Ανάπτυξη αποτελεσματικού συστήματος πυρόσβεσης. Οι νομικές απαιτήσεις για πυρασφάλεια και πυρόσβεση είναι πιθανό να μην αρκούν και να πρέπει να ληφθούν επιπλέον μέτρα. Για παράδειγμα εγκατάσταση περισσότερων δεξαμενών νερού πυρόσβεσης, εγκατάσταση εφεδρικών πυροσβεστήρων, κλπ. 4 Development of a fire response protocol, including the organization of fire safety procedures, personnel training for emergency situations involving fire risk, and coordination with the local fire department. 5 Provision of a sufficient number of facilities for the collection of solid waste (hazardous and non-hazardous), as well as an adequate supply of modern absorbent materials (e.g., oil, chemical, and general-purpose spill kits, granular absorbents, etc.), aimed at the adsorption and subsequent containment of potentially leaking fuels, lubricants, or other hazardous and/or flammable substances. After use, these absorbent materials must be	6	4	Low

Risk Source	Likelihood of Occurrence	Consequence Magnitude	Intrinsic Risk		Adaptation Measures	Risk Reduction	Residual Risk	
			Grade	Description			Grade	Description
					collected in watertight metal containers and disposed of through legally compliant waste management processes.			
Flooding (in coastal areas, rivers, due to rainfall, groundwater)	Moderate	Moderate	8	Moderate	1 Any earthworks for construction and maintenance shall be carried out during the summer period when rainfall does not occur, in order to prevent soil washout. In the event of heavy rainfall during the excavation phase, it is recommended that work be suspended. 2 During the execution of earthworks, all necessary measures shall be taken to prevent any form of soil destabilization or dispersion of earthmoving and inert construction materials, such as landslides, slope erosion, or washout of stockpiled inert materials, etc. 3 The technical interventions included in the implementation of the project and related to the effective drainage of the project site, as well as the hydraulic connectivity between areas on either side of the site, shall be regularly inspected, cleaned, and maintained at systematic intervals. 4 The effectiveness of the technical interventions (included in the project implementation and related to the effective drainage of the project site and the hydraulic connectivity between the adjacent areas) shall be systematically evaluated in terms of their design and performance, based on new scientific data or corresponding updates of relevant Plans (RBMPs, FRMPs, etc.). 5 Development of an emergency response plan, which shall include the organization of dedicated response teams, personnel training for emergency situations involving the risk of heavy rainfall events, and coordination with the competent authorities (fire department, civil protection, etc.). 6 Readiness of equipment and resources for responding to such incidents, in accordance with the provisions of the relevant emergency response procedure. 7 Systematic inspection and monitoring of the condition of infrastructure, coastline, and soil, in order to detect potential issues related to flooding, landslides, and erosion at an early stage and to address them promptly and effectively.	4	4	Low

Risk Source	Likelihood of Occurrence	Consequence Magnitude	Intrinsic Risk		Adaptation Measures	Risk Reduction	Residual Risk	
			Grade	Description			Grade	Description
					8 Systematic inspection, cleaning, and monitoring of the condition of rainwater collection and drainage systems, in order to address potential flooding incidents promptly and effectively.			

2.7.5 Assessment of Cumulative and Synergistic Impacts

The proposed CO_2 capture and storage project in Prinos represents the **first initiative of its kind** in Greece and the Southeastern Mediterranean. As such, it **does not demonstrate interactions with other projects of the same nature and comparable scale at the** national level, since **no such projects currently exist, are being implemented, or are planned** at this time**.**

According to the revised National Energy and Climate Plan (NECP), **two CO_2 capture projects** (IRIS and IFESTOS) have already been approved for co-financing by the Innovation Fund. However, these are in **very early planning stages**, and it is currently not possible to assess potential impacts in conjunction with the proposed project. Nonetheless, it is important to highlight that—**due to the nature and general technical characteristics** of the aforementioned projects, **any potential cumulative environmental and social impacts are expected to be predominantly positive**.

As part of the **national and European coordinated effort** focused on the energy transition, the reduction of GHG emissions, and the achievement of climate neutrality, **EnEarth has designed and plans to implement a full-scale CO_2 storage facility in Prinos**, capable of storing a significant volume of CO_2, thereby achieving a correspondingly noteworthy emission offset, both at regional and national levels. As a result, the Project exhibits **strong direct and indirect interactions with a broad range of actions, activities, and infrastructures aimed at combating climate change and achieving climate neutrality**.

In conclusion, although no interaction is expected between the Project and other projects of similar nature and scale at the national level (as such projects do not currently exist, are being implemented, or planned), it is nevertheless clear that the Project has **strong direct and indirect synergies** with a wide range of initiatives (at national, European, and international level) **targeting climate change mitigation and climate neutrality**, particularly with regard to their **environmental footprint**.

As for **interactions with other projects or activities**, based on the documentation provided in the **sections assessing potential impacts** for each Environmental Parameter, it is concluded that **no significant adverse synergistic effects are expected in the context of the proposed Project.**

2.7.6 Assessment of Transboundary Impacts

Based on the conducted analysis—which, among other aspects, examines the likelihood of transboundary impacts for each Environmental Parameter collectively—it is determined that **no adverse transboundary impacts are expected from the implementation of the interventions associated with the Proposed Project**.

On the contrary, the **operation of the proposed project is expected to generate positive transboundary impacts**, as it involves the **significant storage of CO_2 volumes until 2046**, with corresponding CO_2 emissions estimated to have a **negative balance**, remaining stable and **exceeding 900,000 tons of CO_2 equivalent per year**.

Therefore, it is evident that the operation of the Proposed Project will contribute both to the **achievement of international greenhouse gas emission reduction targets** and the **realization of climate neutrality by 2050,** while also supporting the **offsetting of any residual emissions beyond 2050.**

In conclusion, the implementation and operation of the project under review is **expected to generate strong positive transboundary impacts.**

2.8 PROPOSED MITIGATION MEASURES FOR THE IMPACTS

In addition to the measures already integrated into the design of the proposed Project, the present **Environmental and Social Impact Assessment** has identified the need for additional mitigation measures. The following **Tables** present the proposed measures for addressing and minimizing the potentially significant impacts of the Project on the natural and human environment within the study area.

Table 10 - Prevention, Minimization and Mitigation Measures for Potential Adverse Environmental and Social Impacts during the Construction Phase of the Proposed Project

Environmental Parameter		Mitigation Measures during Construction (MAC)
Non-living Natural Environment	Climatic and Bioclimatic Characteristics	MAC 1. To protect the exhaust systems of machinery and vehicles working on the project, regular maintenance is required, which is, in any case, essential. It is noted that maintenance must be performed on-site.
		MAC 2. The vehicles and machinery participating in the project's construction must also comply with EU emission specifications. Machinery of outdated technology with increased pollutant emissions shall not be used.
		MAC 3. Vessels to be used shall fully comply with the provisions of MARPOL 73/78 Convention, Annex VI "Regulations for the Prevention of Air Pollution from Ships." Annex VI sets limits for emissions of nitrogen oxides (NOx), sulfur oxides (SOx), and Volatile Organic Compounds (VOCs).
		MAC 4. The drilling rig shall be designed and constructed according to API 4F standards and the latest European regulations, including low emission specifications.
		MAC 5. Transport of materials: Prefer sea transport of construction materials and waste over road transport, wherever technically feasible and safe.
	Morphological and Topological Characteristics	MAC 6. Permanent non-permitted coverage with impermeable material (e.g., asphalt, concrete) of surfaces that do not serve the essential operational needs of the project is prohibited. All other surfaces must be designed with permeable cover, to the extent possible, and harmonized with the immediate environment of the project.
		MAC 7. The plant should be installed within the designated industrial area SIGMA. If not feasible, all installations shall comply with TENEM specifications. Unauthorized construction outside the approved limits for worksites and work areas is prohibited, especially where this may lead to aesthetic degradation and landscape alteration (e.g., unauthorized parking, storage of machinery, etc.).
		MAC 8. Unauthorized disposal of surplus materials in adjacent areas is prohibited. If disposal of materials is unavoidable, it must take place only in approved disposal sites. Technical interventions included in project implementation, particularly those related to hydraulic communication of the two sides of the project site, must be systematically checked and maintained regularly. The effectiveness of technical interventions (e.g., hydraulic communication of areas on either side of the site) must be systematically evaluated based on the design and functionality.
		MAC 9. Systematic maintenance of the infrastructure and preservation of the cleanliness of the Project area is required.
		MAC 10. Collection points for solid waste at the construction site must be designated, as well as their regular collection, in order to avoid degradation of the landscape.
		MAC 11. Any storage, even temporary, of materials outside the Project site area is prohibited.
		MAC 12. The work execution schedule must be configured so that temporary material deposits are utilized as quickly as possible.

Environmental Parameter		Mitigation Measures during Construction (MAC)
		MAC 13. Any type of construction site installation (machinery, temporary structures, any kind of waste, etc.) must be removed after the end of the specific phase of the project, regardless of the ownership status of the construction site.
		MAC 14. Excavations and extractions of soil material must be carried out using conservative methods and in harmony with the natural morphology of the soil. In addition, a low intensity level of works must be maintained..
		MAC 15. Works must not be carried out on days when weather conditions, the intensity, and direction of sea currents favor the dispersion of suspended solids.
		MAC 16. All technically feasible measures must be taken to contain suspended solids (placement of filters / curtains for suspended solid retention or other suitable equipment), in order to reduce the dispersion of suspended solids during construction works of offshore project components (with emphasis on the CO_2 transport pipeline) and potential material disposal in the sea. During the execution of works for the implementation of the proposed project, at a minimum, the use of modern equipment for the containment of suspended solids (such as floating fences – debris containment booms, siltation curtains, etc.) around the areas of execution must be ensured, so that they are not affected by construction activities, water quality, and seabed transparency due to large-scale suspended solids, as well as materials reaching large distances on the seabed. If the above measure is deemed partially adequate during the construction phase of the project, additional supplementary measures must be taken in accordance with the findings of the relevant monitoring program.
		MAC 17. Implementation of the Environmental Monitoring Program is recommended.
	Geological, Tectonic and Pedological Characteristics	The measures for minimizing the impacts on Morphological and Topological Characteristics (MAC 5 to MAC 13) also apply to the minimization of impacts on Geological, Tectonic, and Soil Characteristics.
		MAC 18. Earthworks shall mainly be carried out during the time of year when heavy rainfall and extreme wave conditions do not occur, in order to avoid soil runoff and the creation of suspended particulates accordingly. The work schedule must include provisions to avoid heavy earthworks during periods of intense rainfall and sea storms and to suspend earthworks on days when rainfall and strong wave activity are expected. In the exceptional case of intense rainfall or sea storms during the short period of excavation, suspension of the works and placement of geotextile on the slopes is recommended, provided that geotechnical requirements deem it necessary.
		MAC 19. During the construction phase, methods and techniques must be applied to minimize compaction of uncovered soils, such as restricting access during rainfall periods and using low ground pressure vehicles and machinery. For the formation of storage areas within the construction site, appropriate water-permeable materials shall be used in order to limit stormwater runoff from the construction site.
		MAC 20. For all waste and residues resulting from construction activities during the project's implementation (solid and liquid, hazardous or non-hazardous), appropriate management must be applied with care by the Project Contractor, in accordance with the legislation, in order to prevent pollution of the area (soil, subsoil, surface and groundwater) from uncontrolled disposal or possible leaks. A "Waste Management Plan" is applied during the construction / operation / decommissioning phases, examining all aspects of the project and the generated waste, aiming to ensure that the generated waste (hazardous, non-hazardous) is properly managed.

Environmental Parameter		Mitigation Measures during Construction (MAC)
		MAC 21. The construction sites should be equipped with waste bins of appropriate type for collecting workers' waste at the construction sites. These wastes should be collected by the competent Local Authority or the collection and transport entity – in case this is not feasible, the deposition of the waste by the Project Operator to an established collection system of the local authority is foreseen. It is noted that all necessary measures should be taken so that solid non-hazardous waste does not contain rubble or hazardous materials, the disposal of which must be carried out in accordance with the applicable legislation on hazardous waste categories.
		MAC 22. For the management of the sewage of the construction personnel, the installation of chemical toilets and the transport and disposal thereof to the nearest licensed Wastewater Treatment Plant (WWTP) and/or the use of sanitary facilities of the company's existing installations in the area is recommended.
		MAC 23. Liquid and solid waste containing hazardous or potentially hazardous substances must be transported immediately in sealed containers, which will be stored (temporarily until minor relevant work is completed) in a sealed space with a floor made of impervious industrial concrete and with the necessary secondary containment systems. The transport and final disposal or processing thereof shall be carried out by a specialized and appropriately licensed company, according to best available practices.
		MAC 24. The management of any surplus excavation materials, as well as Construction and Demolition Waste (CDW) (non-hazardous) resulting from construction works shall be carried out in accordance with the provisions of Joint Ministerial Decision 36259/1757/E103 (Government Gazette 1312/24-08-2011) "Measures, terms and programs for the alternative management of excavation, construction and demolition waste (CDW)." Materials that cannot be reused/recycled within the project must be delivered to a licensed Alternative Waste Management System (AWMS), approved by the Hellenic Recycling Agency (HRA). The management of CDW in the project area shall be implemented according to the provisions of Joint Ministerial Decision 36259/1757/E103/2010 via one of the following licensed AWMS (based on the registry of the Hellenic Recycling Agency - EOAN): • HRA "Recycling of Aggregates Northern Greece S.A.", under the trade name "AN.A.B.E. S.A." • HRA "Recycling of CDW Central Macedonia S.A.", under the trade name "ANA.KE.M." • HRA "Recycling of CDW of Central Greece S.A.", under the trade name "Σ.AN.K.E. & E.Π.E." • HRA "ΠΕΔΜΕΔΕ ECO Statewide Responsibility," under the trade name "ΠΕΔΜΕΔΕ ECO ΜΕΠΕ."
		MAC 25. In the event that, during the implementation of the proposed project, this is not within the geographical scope of a specific system approved by the Hellenic Recycling Agency (EOAN) Alternative Waste Management System, the surplus material must be disposed of at the nearest approved Alternative Waste Management System (AWMS) or in an appropriate spoil heap, after submission and approval of the Technical Environmental Study (TEPEM) by the competent licensing authority, in accordance with paragraph 2 of Article 7 of Law 4014/2011 (Government Gazette 209/A 21.09.2011). In this case, the spoil disposal site proposed by the contractor will be approved by the competent authority and according to the provisions set out in specification ELOT TP 1501-02-05-00-00. In selecting the site of the spoil disposal area, attention must be given to the following: • The siting of the spoil disposal area must not be within the boundaries of an ecologically sensitive or protected area. • Areas with natural vegetation or fauna habitats should be avoided. • The siting must be avoided on arable land or in locations with surface water bodies. • Siting should be avoided in locations that would affect the landscape of the area or conflict with existing anthropogenic land uses and activities.

Environmental Parameter		Mitigation Measures during Construction (MAC)
		It is preferable that the siting of the spoil disposal area be on an already degraded site, which would have positive effects on the environment of the project area. The disposal method and layout of the spoil disposal areas shall be defined in the relevant TEPEM, which shall be prepared and submitted to the competent licensing authority prior to the commencement of the respective works, in accordance with paragraph 2 of Article 7 of Law 4014/2011 (Government Gazette 209/A 21.09.2011).
		MAC 26. The construction sites must be equipped with Material Recycling Bins in which mixed recyclable materials such as paper/cardboard, plastic, metal, and glass will be collected. These wastes will be collected by the Competent Municipality or the waste collection and transport body – if this is not feasible, the disposal of the wastes by the Project Entity to the nearest collection system of the Municipality (Material Recycling Sorting Centre - MRSC) shall be provided.
		MAC 27. Separate collection of special waste streams such as Waste of Electrical and Electronic Equipment (WEEE), Waste of Batteries (batteries) & Accumulators (A&H), Waste of Photovoltaic Panels, Lamps and Small Devices of WEEE and collection by licensed collection, transport and management bodies shall be carried out. If this is not feasible, the disposal of the waste by the Project Entity to appropriate collection points of the AWM system shall be provided.
		MAC 28. The management of used mineral oils shall be carried out as provided for in PD 82/25.2.2004 (GG 64/A/2.3.2004) on "Specification of measures and terms for the management of used mineral oils", which replaced Joint Ministerial Decision 98012/2001/96. The waste mineral oils (WMO) and liquid fuels of any kind shall be collected separately by category so as to be delivered to a certified Alternative Waste Management System (AWMS) of the Hellenic Recycling Agency.
		MAC 29. The management of hazardous waste shall be carried out in accordance with the provisions of Joint Ministerial Decision 13588/725/2006 (GG 383B/28-3-2006) "Replacement of Joint Ministerial Decision 19396/1546/97 (GG 604B/18-7-1997)".
		MAC 30. The storage of fuels, machinery and construction site materials shall be carried out in such a way as to minimise the risk of pollution of soil and water resources. Chemicals, fuels and lubricants shall be stored in appropriately shaped and covered areas away from water receptors. Collection containers shall be used on static machinery to prevent soil and groundwater pollution from oils and lubricants.
		MAC 31. The maintenance of the construction and transport machinery and equipment shall be carried out in an organised workshop within the project area and not elsewhere. The contractor shall organise an appropriate maintenance schedule for the project site machinery so that oil changes and routine maintenance are performed in organised workshop areas. The oils, filters and other by-products of the machinery, as well as parts from earthworks and other machinery, shall be collected and disposed of appropriately, as required by the legislation (PD 82/2004, GG 64/A/2.3.2004).
		MAC 32. Within the construction site, frequent washing and cleaning of equipment and vehicles shall take place in specially designed areas to prevent leakage of hazardous substances through the produced liquid waste. To reduce the volume of liquid waste from this area, it is proposed that cleaning of vehicles be carried out using dry methods (e.g., brushes, squeegees, etc.). Additionally, low-water consumption washing equipment, such as pressure systems, should be used.
		MAC 33. The liquid or slurry concrete residues inside the concrete mixers must not be discharged into the environment. The rinsing and washing of the residuals from the concrete drums shall be done in the industrial supply area of the ready-mix concrete.
		MAC 34. The control of accidental pollution avoidance shall be implemented by the contractor; all preventive measures shall be taken to avoid petroleum product leaks due to damage, negligence, etc., and appropriate handling shall be ensured to minimise such incidents. Moreover, incident response measures shall be included in the contractor's program for the entire work area. Accordingly, the contractor shall provide in the workshop appropriate materials to respond to accidental pollution incidents on land or at sea. The contractor shall have appropriate absorbent materials on site (e.g., products, sand) in sufficient quantities to ensure rapid absorption and containment of spilled fuels and lubricants. After use, the absorbents shall be collected and managed as hazardous waste.

Environmental Parameter		Mitigation Measures during Construction (MAC)
		It is also required that all vessels participating in the construction works are equipped with means of containment, such as appropriate machinery and materials for the containment of oil spills. All relevant measures must be included in the contractor's obligation agreement and implemented under the supervision of the competent authority.
		MAC 35. For works approaching the pipeline (location of the specific section of the pipeline along a length of approximately 500 m, a width of about 5 m, and a depth of 3 m), the volume of excavated material to the seabed is estimated at approximately 7,500 m^3. These materials will be relocated on the seabed along the trench line. In addition, no major earthworks are foreseen near the pipeline during periods of intense rainfall or severe wave activity.
		MAC 36. The procurement of raw materials (aggregate materials) required during construction shall be carried out from legally operating quarries and designated environmentally approved quarry areas.
		MAC 37. The cuttings from the section of the drillings up to a depth of 2,200 m shall not contain hazardous substances and shall be disposed of on the seabed. In this specific section, a drilling fluid will be used consisting of a slurry based on seawater and barite, which is biocompatible, without adverse environmental impacts. Regarding the products of the drilling operations from the section of the drillings up to a depth of 2,200 m, they may be disposed of provided that the analyses to be conducted during the construction phase confirm that they do not contain pollutant loads and can be disposed of in the marine environment, following the positive opinion of an appropriate laboratory. For the disposal of these **seabed sediments** in the marine environment, the following conditions must be met: • The disposal site must be located at a great distance from Posidonia seagrass meadows. • The disposal site must be located at a short distance from their excavation point and at the greatest possible depth (ideally at a depth greater than 50 m), to avoid large transport distances. • The materials must be homogeneous in accordance with the above conditions. • The disposal must take place downhill and as deep as possible from the sea surface.
		MAC 38. The cuttings from the drillings below a depth of approximately 2,200 m, from which drilling fluids will be returned to the borehole, shall be removed and the cuttings and slurry shall be subjected to appropriate processing.
		MAC 39. Separate collection of cuttings containing hazardous substances. Temporary storage within the Project and disposal to licensed collection, transport, and management entities. For the generated cuttings that may contain hazardous substances, immediate characterization is foreseen by a specialized and certified body, followed by the prompt collection, packaging, and disposal by a suitable specialized and certified entity in appropriately licensed facilities or AWMS.
		It is recommended to implement the Environmental Monitoring Program (MAC 17).
	Air Quality	MAC 40. Surface wetting of surfaces and materials should be carried out in order to limit dust emission during the execution of earthworks.
		MAC 41. The operation of machinery working on site should be conducted with careful handling, and the movement of trucks should be done at low speeds to limit dust emissions.
		MAC 42. Coverage of construction materials and excavation waste deposits with tarpaulins, until their use or removal, respectively.
		MAC 43. Trucks transporting granular materials must carry special covering in accordance with applicable regulations and avoid overloading the material transport trucks.

Environmental Parameter		Mitigation Measures during Construction (MAC)
		MAC 44. In each construction or worksite activity where there is a possibility of dust, suspended particles or gas emissions, procedures and equipment should be adopted that ensure the effective reduction of these emissions, while the duration of these procedures should be minimized
		MAC 45. For the construction of the CO_2 pipeline, the construction vessel and any support vessels should use marine gas oil (Marine Gasoil DMA ISO 8217:2012), with a maximum sulfur content of 0.1% (m/m). Furthermore, for construction works, the application of the previously mentioned measures MAC 1 to MAC 5 is recommended.
		Furthermore, for construction works, the implementation of the aforementioned measures MAC 1 to MAC 5 is recommended.
	Noise and Vibrations	MAC 46. The contractor shall select the layout and scheduling of partial works so that there is no simultaneous operation of many machines in adjacent positions, thereby minimizing the potential disturbance to the anthropogenic environment of the immediate area of the project.
		MAC 47. The operation of the construction site and the movement of trucks on the urban road network within the settlements of the project's area shall be avoided as much as possible during the hours of common quiet (YA 1023/2/37/96 (Government Gazette 15/B/12.1.96)).
		MAC 48. Construction machinery to be used shall comply with the provisions of the legislation "on measures and conditions for noise emissions into the environment from outdoor equipment" (Joint Ministerial Decision 37393/2028/2003, Government Gazette 1418/B/2003, as amended by Joint Ministerial Decision 9272/471/2007, Government Gazette 286/B/2007) and shall bear the CE marking of conformity as provided for by the above legislation.
		In any case, it is recommended to systematically monitor noise levels at the project boundaries during the construction phase (implementation of the Environmental Monitoring Program (MAC 17)) and if exceedances are found, additional measures shall be taken. In addition, the measured levels of emitted noise shall be taken into account regarding their impact on the project's workers and the appropriate protective equipment shall be provided (such as earplugs, etc.).
		MAC 49. In all cases, all activities and works to be implemented shall be in accordance with the applicable provisions of Greek legislation, as listed below: • YA 2640/270 (Government Gazette 689/B/18.8.78), on the use of construction compressors. • Presidential Decree 1180/81 (Government Gazette 293/A/6.10.81), on the regulation of matters related to the establishment and operation of industrial, handicraft, and all types of mechanical installations and their environmental disturbances in general, as amended and in force. • YA 56206/1613 (Government Gazette 570/B/9.9.86), Determination of noise emission levels of construction machinery and devices in accordance with the guidelines 79/113/EEC, 81/1051/EEC and 85/405/EEC. • YA 69001/1921 (Government Gazette 751/B/18.10.1988), EC type approval for the maximum noise level of construction machinery and vibrating equipment and specifically the type of noise of pneumatic hammers, welding sets, and trucks with breaking and compression equipment and compressors, as amended. • YA 10399/91 (Government Gazette 359B/91), Setting the noise limit of firecrackers in addition to YA 69001/1921. • YA 765/91 (Government Gazette 81B/21-2-91), Setting the noise limits of underwater pumps, pumps with hoses for fuel supply, and trucks – excavators, as amended by Joint Ministerial Decision 11481/523/97 (Government Gazette 295B/97). • Joint Ministerial Decision 37393/2028/2003 "Measures and conditions for noise emissions into the environment from outdoor equipment" (Government Gazette 1418B) as amended by Joint Ministerial Decision 9272/471/2007.

Environmental Parameter		Mitigation Measures during Construction (MAC)
		• Presidential Decree 149/06, which incorporates Directive 2003/10/EC "On the minimum health and safety requirements regarding the exposure of workers to risks arising from physical agents (noise) during their work," in accordance with Directive 2003/10/EC.
		MAC 50. Furthermore, the provisions below shall also be taken into account: ▪ BS 5228 "Code of Practice for noise control on construction and demolition Sites" regarding the determination of methodology for the prediction of noise and vibrations during construction works and the applicable indicators and limits. ▪ BS 6472 Vibration dose value – *vdv* regarding the determination of the maximum allowable dose of vibration, related to human disturbance due to construction activities. ▪ BS 7385 regarding the determination of the maximum permissible vibration levels for the protection of buildings from structural damage. ▪ YA 13586/724/06 (Government Gazette 384/B/28.3.2006) Determination of measures, terms and methods for the assessment and management of noise in the environment, in accordance with the provisions of Directive 2002/49/EC "on the assessment and management of environmental noise" of the Council dated 25.6.2002. ▪ YA 211773/2012 (Government Gazette 1367/B/2012), Determination of Evaluation and Maximum Permissible Limits of Environmental Noise Indices from the operation of transport projects, technical specifications of special acoustic study reports and implementation of (EAMYE) anti-noise protection measures, with reference to environmental noise indices and their limits.
		MAC 51. Residents, users, and visitors of the area shall be informed of the machine operation hours that may cause potential disturbance.
	Water	MAC 52. To meet the project's water needs, drinking water for workers will be supplied with commercially bottled water. The water requirements for construction site operations and concrete curing will be covered by installing water tanks at the construction site, which will be filled with water transported from the SIGMA Industrial Facility's water supply network.
		Construction of ditches and other hydraulic interventions shall be carried out as planned in the project designs, so that the surface water flow remains unobstructed (MAC 8).
		The uncontrolled disposal of surplus materials into the immediate or broader area is prohibited. Under no circumstances is the disposal of such materials into streambeds, rivers, or other water bodies allowed (MAC 8).
		Systematic maintenance of the infrastructure and cleanliness of the Project area is required (MAC 9).
		Designated collection points for solid waste at the construction site shall be determined, as well as their regular collection to avoid landscape degradation (MAC 10,11,21).
		The schedule for executing works shall be organized so that temporary material deposits are used as soon as possible and are avoided during rainfall events (MAC 9,15,18).
		The storage of fuel, machinery, and construction materials shall be done so as to minimize the risk of soil and water pollution. Chemicals, fuels, and lubricants shall be stored in properly shaped and sealed areas, away from water bodies. Sealed containers shall be used on static machinery to prevent pollution of soil and groundwater from oil and lubricants (MAC 30).
		Liquid or semi-liquid concrete residues inside concrete mixing trucks must not be disposed of into the environment. The truck drum washouts shall take place at the ready-mix concrete supplier's industrial facility (MAC 33).

Environmental Parameter		Mitigation Measures during Construction (MAC)
		MAC 53. The waters resulting from drilling or excavations during the construction works for the installation of land infrastructure shall be removed using appropriate systems (pumps or wells) and, after their characterization (followed by appropriate sampling and relevant laboratory analyses), their planned treatment/disposal will be determined, in water bodies existing in the project's area.
		A key factor for the overall protection of the wider environment during construction works is the proper organization and sound operation of the construction site. For the protection of water quality, the implementation of the measures from MAC 6 to MAC 8, MAC 11, MAC 13 is proposed.
		For the protection of water quality from activities related to management, disposal, and use of construction materials and waste and vehicle/equipment maintenance, the implementation of measures from MAC 20 to MAC 22, MAC 29, MAC 31 to MAC 32 and MAC 38 to MAC 39 is proposed.
		For the protection of water quality from improper practices, damages, or negligence, the implementation of MAC 34 is proposed.
		Application of the Environmental Monitoring Program is recommended (MAC 17).
		MAC 53. Implementation of prevention and mitigation measures related to emergency risks associated with potential CO_2 leakage, as included in **Table 12 4:** Measures for the Prevention of Significant Adverse Events of the present **Chapter**.
		MAC 55. Compliance with international guidelines and the International Safety Management Code (ISM) of the IMO for the safe operation of ships and the prevention of marine pollution, as well as strict compliance with procedures related to navigation, communication, and safety.
		MAC 56. Compliance with the requirements of MARPOL for waste and sewage, with emphasis on the following: Annex I Regulations for the prevention of pollution from petroleum, Annex III Regulations for the prevention of pollution from harmful substances transported in packaged form, Annex IV Regulations for the prevention of pollution from sewage from ships, Annex V Regulations for the prevention of pollution from solid waste from ships.
		MAC 57. All means used to serve the needs of the project shall comply with the International Regulations for Preventing Collisions at Sea 1972 (COLREGs).
		MAC 58. Implementation of the ballast water management procedures in accordance with the applicable national regulations and vessel specifications.
		MAC 59. All emergency measures for the management of marine pollution, as well as any additional measures that may be required by the competent Port Authority, must be taken during operations at sea, in accordance with Law No. 743/77 (Government Gazette A 319), as codified in Presidential Decree 55/98 (A' 58) and any applicable laws.
		A “Waste Management Plan” shall be implemented during the construction/operation/closure phases, examining all aspects of the project and the generated waste, ensuring that all generated waste (hazardous, non-hazardous) is managed properly (MAC 20).
		MAC 60. A Chemical Use Plan shall be implemented, which shall include: (i) The chemical substances that the operator intends to use during the work. A list of the ecotoxicity of said substances. (ii) The purpose(s) for which the operator intends to use the chemical substances. (iii) The maximum concentrations of the chemical substances that the operator intends to use within any other substances, as well as the maximum quantities intended to be used over any specified period. (iv) The area within which the chemical substance may escape into the marine environment.
		MAC 61. Specific biocides and antifouling agents shall be used that meet the requirements of the applicable national and Union legislation and comply with the international conventions for the protection of the marine environment, especially the Barcelona Convention. The substances to be used for the aforementioned

Environmental Parameter		Mitigation Measures during Construction (MAC)
		purposes must be selected from the "OSPAR List of Substances Used and Discharged Offshore which Are Considered to Pose Little or No Risk to the Environment (PLONOR)" of its current edition. The use of substances included in the "OSPAR List of Substances of Possible Concern (LSPC)" is not permitted.
		MAC 62. It shall be ensured that the construction and maintenance materials of the project (paints, coatings, claddings, etc.) do not contain substances referred to in the decision of the Higher Chemical Council 1100/91/91 (OGG B΄ 1008/12-12-1991) and in Joint Ministerial Decision 475/2002/03 (OGG B΄ 208/2003) and 121/2003/03 (OGG B΄ 1045/2003), as currently in force, namely compounds of mercury, arsenic, and organochlorine compounds, and other chemicals considered hazardous according to the relevant legislation on hazardous substances and for which restrictions apply regarding their circulation and use both in the marine and the general aquatic environment.
		All technically possible measures must be taken for the containment of suspended solids (placement of filters / silt curtains / other suitable equipment), aiming to reduce their transport during the works of installing the underwater sections of the project (e.g., installation of CO_2 transport pipeline) and possible discharge of materials into the sea. During the execution of the construction works of the proposed project, the use of modern equipment for the containment of suspended solids (especially floating fragments – debris containment booms, siltation curtains, etc.) during underwater works must be ensured, so that the quality of the water is not affected by the construction activities and the sedimentation of solid materials over a large area of the seabed is avoided. In the event that the measure is proven to be insufficient during the construction phase of the project, additional measures must be taken in accordance with the findings of the monitoring program (MAC 16).
Natural Biotic Environment	Flora, fauna, habitats and protected areas	MAC 63. During the construction phase of the terrestrial section, which is located in areas of the Natura network but with sand dunes, it is proposed: • (A) The avoidance of disturbance and impact on the habitat of the dunes during the breeding season of turtles and nesting birds. Especially <u>avoidance of the period from mid-April to late</u> June for excavation and placement works of the pipeline in the area of the dunes. With this restriction, disturbance during the breeding period and possible abandonment / destruction of bird or turtle nests will be avoided. • (B) In order to maintain the habitat of the dunes during the installation of the pipeline, surface sand should be removed (surface sand layer) and stored separately from the deeper material. After the pipeline is placed, the surface sand and the seeds it contains must be placed back to enable the re-establishment of the dune vegetation. • (C) If storage is required, the location of material deposition within dune areas should be avoided to prevent soil compaction and destruction of the dune habitat.
		MAC 64. Implementation of a Biodiversity and Wildlife Management Plan and an Environmental Monitoring Program (MAC 17) with specific actions, indicators, frequencies, and fieldwork/methodology for recording environmental parameters
		MAC 65. Vessel speed involved in the project must not exceed 20 knots to reduce collision risks with marine mammals and turtles.
		MAC 66. On the support vessel for the installation of the subsea pipeline of 20 km length using the S-lay method (Phase 3) and its laying (Phase 5), 2 certified marine mammal observers (MMOs) must embark. Before the commencement of construction works, the presence of marine mammals within 500 m from the point of activity must be examined by the MMO. Construction works must not begin if marine mammals are detected within this radius and until at least 20 minutes have passed since the last sighting. For periods of darkness or poor visibility (such as fog), the MMO must use night vision binoculars or passive acoustic monitoring devices.
		The Chemical Use Plan (MAC 60) shall be implemented and the suitability of the chemical substances to be used shall comply with MAC 61 and MAC 62.

Environmental Parameter		Mitigation Measures during Construction (MAC)
		MAC 67 Any vessel collision with marine mammals must be reported to the Ministry of Environment's relevant department.
		MAC 68. It is recommended to avoid the implementation of the construction phase in the marine environment during the reproduction period of the loggerhead sea turtle (*Caretta caretta*) (period February – May).
		A key factor for the overall protection of the environment of the wider area during the execution of construction works is the appropriate organization and proper operation of the construction site. For the protection of water quality, it is recommended to apply the measures (MAC 6 to MAC 8, MAC 11, MAC 13).
		MAC 69. The storage of all hazardous materials of the construction site shall be carried out in a manner that prevents their access by fauna. Containers with oil or fuel shall be closed and deep pits or large holes on the ground shall be covered. Additionally, during the construction period, special care shall be taken to avoid trapping or killing of fauna species.
		MAC 70. Proper organization of the project's environmental area is required so that the spread of fire is prevented (for example, use of fireproof materials in building and fencing works, creation of firebreaks in key locations before the transport of potentially flammable materials, installation of fire-fighting tanks and other fire-fighting equipment in accordance with the fire protection studies of the area and the instructions of the competent fire-fighting service, etc.).
		MAC 71. Systematic cleaning and maintenance of the environmental area and of the facilities within the project site shall be carried out, so that ignition and spread of fire are avoided (for example, systematic cleaning from waste that may be scattered by workers or occasional visitors of the wider area, systematic cleaning from biomass waste resulting from vegetation management in adjacent areas, systematic control and monitoring of the condition of utility networks, etc.).
		MAC 72. Development of an effective fire protection system. Legal requirements for fire prevention and fire protection may not be sufficient, and additional measures should be taken. For example, installation of additional fire water tanks, installation of portable fire extinguishers, etc.
		MAC 73. Intensification of fire response procedures, which will include the organization of fire safety procedures, training of personnel for emergency situations, including fire risk, and cooperation with the local fire department.
		For the protection of the biotic environment from activities related to the management, disposal, and use of construction materials and wastes, as well as the cleaning and maintenance of vehicles and equipment, the application of the measures from MAC 20 and MAC 29, MAC 31 to MAC 32, and MAC 38 to MAC 39 is recommended.
		Potential incidents of accidental pollution that could have an immediate impact on the soil and thus on the biotic environment of the area should be controlled and avoided. For the protection of the quality of the biotic environment from improper practices, negligence, or omission, the implementation of MAC 34 is recommended.
		MAC 74. Detailed information shall be provided to workers, both during the construction and operation phases, so that all environmental terms are respected, especially those relating to the natural biotic environment.
Anthropogenic Environment	Spatial Planning – Land Use	MAC 75. Compliance with the requirements of the applicable spatial planning and best practices.
		MAC 76. Special care shall be taken during the execution of work and the movement of machinery/vehicles near infrastructures and buildings to avoid causing damages.
		The contractor is obliged to remove all facilities created for the construction needs and to restore the area to its previous condition before the start of work. Consequently, the application of MAC 13 is recommended.
	Structure and Operation of the Anthropogenic Environment	Proper planning and sound operation of the works shall contribute to the limitation of the nuisance caused to the anthropogenic activities of the area and the temporary visual pollution generated. Furthermore, the fencing of the construction site and work areas shall be carried out in a decent manner, so as to limit the temporary degradation of the visual appearance of the area. For the protection of the anthropogenic environment, the implementation of the measures (MAC 6 to MAC 8, MAC 11, MAC 13) is recommended.

Environmental Parameter		Mitigation Measures during Construction (MAC)
		MAC 77. Works shall be scheduled outside peak hours, so that the intense pressures from anthropogenic activities are avoided and the application of measures aimed at reducing negative impacts (e.g. from other parameters) proposed analytically in the relevant sections is ensured.
		MAC 78. Full implementation of the Stakeholder Engagement Plan in accordance with PR1 / PR4 / PR5 / PR8 / PR10 of the ESIA, including the Stakeholder Engagement Mechanism (SEM) for the creation of strong, constructive and flexible relationships between the project and interested parties, and for the social inclusion (including vulnerable groups, minority groups, women and organizations of the Project area), and the appointment of adequately trained staff for the implementation of the Stakeholder Engagement Plan, and the monitoring and reporting on the implementation of the Stakeholder Engagement Plan.
		MAC 79 According to the Stakeholder Engagement Plan and the requirements for grievance management, response/feedback provision to stakeholders and affected communities, and the implementation of appropriate adjustments to the Project as a result of consultations and grievances.
	Cultural Heritage – Underwater Cultural Heritage	MAC 80. Compliance with the specifications and requirements of the applicable national legislation and best practices such as PR8 of the ESIA (Cultural Heritage).
		MAC 81. Prior to the commencement of construction works, the competent Archaeological Services shall be notified in a timely and written manner, so that the supervision of the works by a designated official can be arranged. The opinions and observations of the competent Archaeological Services must be considered. Any objections from the archaeological services must also be considered, and where deemed necessary, appropriate modifications must be made to the project design or construction methodology. In the event of findings, construction activities shall be suspended and the procedure for accidental discoveries required by Greek legislation (Law 3028/2002 as amended and in force), EU legislation and best practices such as PR8 of the ESIA (Cultural Heritage), shall be applied.
	Socio-economic Environment	Measures concerning the reduction of negative impacts on the socio-economic environment (indirectly through other parameters) are proposed in detail in the relevant sections on noise, air pollution, dust, etc.
		MAC 82. Exploitation of the potential of the local workforce and technical personnel and preference for suppliers from the wider area of the Project for the strengthening of local employment and economy.
		MAC 83. A particularly effective practice for dealing with and avoiding any complaints from local residents is the prior to the commencement of works, provision of information to residents by the competent authority and the Contractor regarding the type and duration of works. Therefore, the implementation of measures MAC 78 and 79 is recommended.
	Health and Safety	MAC 84. Implementation of legal framework on labor and development and implementation of a dedicated Human Resources Management Plan for the Project.
		MAC 85. Strict compliance with the safety regulations provided for by legislation.
		MAC 86. Given that construction works inherently carry the risk of causing accidents, it is recommended that: • Strict compliance with health and safety regulations on construction sites be ensured. • An Occupational Risk Assessment (ORA) be prepared. • A Health and Safety Plan (HSP) and Health and Safety File (HSF) be established and strictly followed, in compliance with national legislation and as required by PR4 of the ESIA. The HSP and HSF shall be updated depending on the progress of work and in any case shall contain actual and up-to-date information.
		MAC 87. Employment of a Health and Safety Coordinator and provision of Occupational Health Services.

Environmental Parameter		Mitigation Measures during Construction (MAC)
		MAC 88. Development of a policy on the prevention and management of violence and harassment at work, based on gender and inclusion in the Human Resources Management Plan.
		MAC 89. As part of the Human Resources Management Plan, implementation of a grievance reporting procedure and mechanism.
		MAC 90. Information and training of workers in an appropriate manner regarding the risks, prevention, protection, and obligations concerning the prevention of violence and harassment at work and gender-based violence and harassment.
		MAC 91. Ensuring the integration of requirements related to the prevention of violence and harassment at work and gender-based violence and harassment based on gender or contractor and subcontractor obligations.
		MAC 92. Implementation of internal policies and actions on Occupational Health and Safety (e.g. training and certification in safe work performance, “Work Interruption Policy”, “Occupational Health, Safety, Environmental & Social Responsibility Policy”, “Equal Opportunity Policy”, “Diversity and Inclusion Policy”, “Code of Ethics”, etc.)
		MAC 93. Provision to all personnel of the required personal protective equipment according to Law 3850/2010 and the H&S Plan. Special equipment shall be defined in accordance with the Fire Prevention Plan and the Waste Management Plan.
		MAC 94 The worksite shall be fenced to prevent public access at points where the works are incomplete.
		MAC 95. There shall be appropriate signage to inform the public of the risks and at the same time prevent access to the worksite areas.
	Technical Infrastructure	For the protection of technical infrastructure from handling, disposal, and use of construction materials and waste, and cleaning and maintenance of vehicles and equipment, it is recommended to implement the measures from MAC 20 to MAC 29, MAC 31 to MAC 32 and MAC 38 to MAC 39.
		MAC 96. Cooperation between the proponent, the competent authorities, and navigation stakeholders to identify safe navigation routes around the designated area for project development. This includes the timely notification of competent port authorities regarding anticipated works.
		MAC 97. Works shall be planned in a way that minimizes their impact on existing navigation routes, such as scheduling activities, where possible, during periods of lower maritime traffic to avoid periods of intense fishing, commercial, or tourist activity.
		MAC 98. Regular inspections shall be carried out to ensure compliance with regulations and set limits, to avoid potential risks to navigation safety.
		MAC 99. During transport and movement through the wider road network, special care shall be taken by vehicle operators to follow designated routes to avoid damage to road networks.
		MAC 100. If deemed necessary, information signs and appropriate road safety signage shall be installed at key points of the road network and around the Project area, in collaboration with the competent Road Traffic Authority. Where feasible, information may also be provided via digital applications (e.g., traffic management platforms, GPS) for user guidance through the road network.
		MAC 101. Optimization and minimization of vehicle movements, optimization of the required travel distances, and maximization of vehicle usage rate are the principles that apply to passenger, goods, and waste transport vehicles during construction.
		MAC 102. The transport of bulky equipment items across the road network shall be carried out following consultation with the competent Traffic Departments and after considering their recommendations (e.g. escort vehicles, alternative routes, transport schedules, etc.).

Environmental Parameter		Mitigation Measures during Construction (MAC)
		MAC 103. Collaboration between the proponent of the Project and the competent transport authorities for the coordination of the construction schedules with public works or other infrastructure work.
		MAC 104. Transport scheduling so as to avoid, as far as possible, peak hours or periods when the road transport network is congested.
		MAC 105. Application of good energy management practices. Monitoring and inspection of heating, ventilation, and air conditioning systems, as well as information and communication systems. Installation of energy-saving lighting.
		MAC 106. Timely notification by the contractor of all utility network operators whose infrastructure passes through the immediate area and may potentially be affected.

Table 11 - Measures for the prevention, minimization and mitigation of potential adverse environmental and social impacts, during the operation phase of the proposed Project

Environmental Parameter		Mitigation Measures During Operation (MMO)
Natural Abiotic Environment	Climatic and Bioclimatic Characteristics	MMO 1. For the protection from the exhaust gases of machinery, vessels and vehicles operating for the project, regular maintenance is required, which is in any case necessary. It is noted that maintenance must not take place within the worksite area.
		MMO 2. The vehicles, vessels and machinery participating in the operation of the project must also comply with the EU emission standards for such engines and not be of old technology emitting increased pollutants.
		MMO 3. The vessels to be used must fully comply with the international standards of the MARPOL 73/78 Convention, Annex VI “Regulations for the Prevention of Air Pollution from Ships.” Annex VI regulates the emissions of ozone-depleting substances, sulfur oxides (SOx), nitrogen oxides (NOx) and volatile organic compounds (VOCs).
		MMO 4. All machinery and devices that use electricity must be of energy class.
		MMO 5. Unnecessary operation of machinery and vessels approaching the Project site shall be avoided.
		MMO 6. Vehicle movements within the boundaries of the Project shall be minimized and unnecessary operation of engines of machinery and vehicles associated with the operation of the Project shall be avoided.
		MMO 7. Unnecessary operation of exterior lighting shall be avoided.
		MMO 8. All interior lighting fixtures shall be LED and shall be controlled by an automation system that regulates intensity based on exterior lighting.
		MMO 9. It is recommended to implement the Environmental Monitoring Programme, as specified in the present document, which shall mandatorily include the annual calculation of the Project’s carbon footprint..
		MMO 10. Systematic maintenance of terrestrial and coastal installations of the Project.

Environmental Parameter		Mitigation Measures During Operation (MMO)
	Geomorphological and Topological Characteristics	MMO 11. Maintenance of cleanliness in both the terrestrial and marine zones of the Project.
		MMO 12. For the management of solid waste originating from material/equipment handling and maintenance operations and from cleaning materials, personnel hygiene, and consumables, bins shall be placed at suitable locations within the installation. Furthermore, waste shall be transported off-site at regular time intervals.
		MMO 13. Waste arising from maintenance (parts of electromechanical equipment, pipelines, batteries, etc.) shall be transported off-site under the responsibility of the technical maintenance personnel and recycled.
		MMO 14. The management of hazardous waste (collection, transport, storage, treatment, recovery, or disposal) must be carried out by a natural or legal person (public or private law entity) duly licensed to perform such operations. Handover of hazardous waste shall take place under authorization from the Project Contractor to an approved alternative waste management system.
		MMO 15. The temporary storage of hazardous waste (within the Project facilities until their collection) shall be carried out using special containers compliant with UN specifications for solid waste.
		MMO 16. Disposal of other (non-hazardous) waste shall be done in agreement with the competent Municipal Authorities and approved appliance recycling organizations and in accordance with general provisions governing waste management and recycling of paper, glass, aluminum, etc., and always in accordance with Law 4819/2021. MMO 17. In the event of potential incidents, the Project Owner shall be responsible both for addressing the issue and for the restoration of potentially adverse environmental impacts resulting therefrom.
		MMO 18. Regarding fire hazard, all necessary fire prevention and firefighting measures shall be implemented in accordance with national legislation and the guidance of the Fire Service.
		MMO 19. It is prohibited to store (even temporarily) any waste or construction materials (e.g., maintenance activities) outside the boundaries of the Project area.
		MMO 20. In case of detected failures, the Project Owner shall be responsible both for addressing the issue and for restoring any potentially adverse environmental impacts resulting therefrom.
		It is recommended to implement the Environmental Monitoring Program as defined in the present document (MMO 9).
	Geological, Geotechnical, and Pedological Characteristics	The measures from MMO 11 to MMO 19 apply accordingly to geological, geotechnical, and pedological characteristics.
		MMO 21. Waste shall be managed in accordance with the Waste Management Plan and applicable legislation. In the terrestrial area of the Project, clearly marked (by type and size) bins shall be installed for waste. Recycling bins with clear signage shall also be placed to facilitate proper usage.
		MMO 22. The Project Owner shall ensure that the disposal of solid waste from vessels and other users of the Project directly into the sea is strictly prohibited.
		MMO 23. It shall be ensured that the maintenance materials used for the offshore sections of the Project do not contain substances listed in the decision of the Supreme Chemical Council 1100/91/91 (OGG B' 1008/12–12–1991) and in Ministerial Decisions 475/2002/03 (OGG B' 208/2003) and 121/2003/03 (OGG B' 1045/2003), as applicable, i.e., compounds of mercury, arsenic and organ halogen compounds, as well as other chemical substances classified as hazardous according to the relevant legislation on hazardous substances, and for which restrictions apply regarding their circulation and use in the marine and broader aquatic environment.
		MMO 24. Liquid and solid waste containing hazardous or potentially hazardous substances shall be transported immediately in sealed containers, which shall be stored (temporarily and for a short duration) in a covered space with a floor made of impermeable industrial-type concrete and the required secondary containment systems. Such waste shall be managed in accordance with the Waste Management Plan and based on applicable legislation.

Environmental Parameter		Mitigation Measures During Operation (MMO)
		MMO 25. The operation of the offshore installations of the Project is expected to increase the traffic of floating vessels within the bay, thus increasing the risk of accidental pollution of the marine environment. Therefore, the Project Owner shall implement measures to prevent accidental pollution. All precautionary measures shall be taken to avoid fuel leaks due to damage, negligence, etc., and appropriate handling procedures shall be implemented to minimize such incidents. Furthermore, for managing accidents (which cause environmental impacts, such as fuel spills from vessels) along the entire length of the Project, a response plan and the necessary materials for addressing marine pollution accidents on both land and sea must be in place. The Project Owner shall provide the Project with the appropriate absorbent materials (e.g., pads, sand) in sufficient quantities, through which the spread of and concentration of spilled fuel shall be prevented and controlled. After use, absorbent materials shall be managed properly in accordance with the applicable legislation on hazardous waste.
		MMO 26. The storage of fuels, lubricants, and chemical materials shall be done in a way that minimizes the risk of soil and water pollution. Chemicals, lubricants, and fuels shall be stored in covered and waterproofed spaces, away from water bodies, and always in impermeable basins, so as to avoid the leaching of hazardous substances into the soil and surface or groundwater.
		Implementation of the Environmental Monitoring Program is recommended, as described herein, which shall mandatorily include the annual calculation of the Project's carbon footprint (MMO 9).
	Air Quality	For the protection against exhaust gases from the Project's machinery and CO_2 transport vehicles, the implementation of the aforementioned measures MMO 1 to MMO 8 is recommended.
		The implementation of the Environmental Monitoring Program is recommended, as specified in this document (MMO 9).
	Noise and Vibrations	MMO 27. To avoid noise emissions from the Project equipment, vessels and CO_2 transport vehicles, regular maintenance is required, which is in any case necessary.
		MMO 28. The Project machinery, vessels and CO_2 transport vehicles must comply with the noise emission specifications according to EU standards.
		MMO 29. Implementation of appropriate noise insulation measures in equipment within the compression station, so that the legal noise limits at the boundaries of residential areas are met.
		MMO 30. Operation of exhaust equipment (pumps, electric heaters) based on low-noise emission specifications. In case that through the implementation of the Environmental Monitoring Program or from complaints of concerned parties, exceedances of the noise emission limits are identified, corrective measures shall be taken in the form of interventions in the Project operation process or by using appropriate equipment (e.g. silencers).
		MMO 31. Installation of noise insulation on noisy parts of the machinery and equipment in the exhaust systems.
		To avoid noise emissions, implementation of the previously mentioned measures MMO 1 to MMO 8 is also recommended.
		Implementation of the Environmental Monitoring Program is recommended, as specified in this document (MMO 9).
	Water	MMO 32. Under the responsibility of the Project Owner, the direct discharge of liquid waste (untreated sewage, lubricant, oil and fuel residues) from vessels approaching the Project into the sea must be strictly prohibited.
		MMO 33. In case of liquid waste discharge (untreated sewage, lubricant, oil and fuel residues), the Project Owner must provide a plan and the appropriate materials to address pollution incidents both on land and in the marine area.

Environmental Parameter	Mitigation Measures During Operation (MMO)
	MMO 34. Implementation of emergency risk prevention and mitigation measures related to potential CO_2 leakage as included in **Table 12-4:** Measures for the Prevention of Major Accidents of the current **Chapter**.
	MMO 35. Compliance with international guidelines and the International Safety Management Code (ISM) by the IMO for the safe operation of vessels and the protection of the environment, as well as strict compliance with navigation, communication and safety procedures.
	MMO 36. Compliance with MARPOL requirements for waste and sludge, specifically: Annex I Regulations on oil pollution prevention, Annex III Regulations on pollution prevention by harmful substances carried in packaged form, Annex IV Regulations on pollution prevention by sewage from ships, and Annex V Regulations on pollution prevention by garbage from ships.
	MMO 37. A Chemical Use Plan shall be implemented, which shall include: (i) The chemical substances that the operator intends to use during operations, along with an ecotoxicity list of those substances. (ii) The purpose(s) for which the operator intends to use the chemical substances. (iii) The maximum concentrations of the chemical substances the operator intends to use within any other substances, as well as the maximum quantities intended for use within any defined time period. (iv) The area within which the chemical substance may be released into the marine environment.
	MMO 38. Approved biocides and antifouling agents that meet the requirements of applicable national and EU legislation shall be used, and they shall comply with international marine protection conventions, in particular the Barcelona Convention. Substances to be used for the aforementioned applications must be selected from the “OSPAR List of Substances Used and Discharged Offshore which Are Considered to Pose Little or No Risk to the Environment (PLONOR)” in its latest edition. The use of substances listed in the “OSPAR List of Substances of Possible Concern (LSPC)” is not permitted.
	It shall be ensured that materials used for the construction and maintenance of the project (coatings, insulations, linings, etc.) do not include substances listed in the decision of the Supreme Chemical Council 1100/91/91 (Official Gazette B' 1008/12-12-1991) and in JMD 475/2002/03 (Official Gazette B' 208/2003) and 121/2003/03 (B' 1045/2003), as applicable, i.e. mercury, arsenic and organohalogen compounds, as well as other chemical substances considered hazardous under applicable legislation on dangerous substances and for which restrictions apply in their circulation and use in the marine and generally aquatic environment (MMO 23).
	MMO 39. The floating vessels to be used for the needs of the project must comply with the International Regulations for Preventing Collisions at Sea 1972 (COLREGs).
	MMO 40. Implementation of fuel bunkering procedures in accordance with applicable national regulations and vessel specifications.
	MMO 41. All necessary measures shall be taken to prevent marine pollution during the construction phase, as well as any additional measures required by the competent Port Authority, in accordance with Regulation No. 743/77 (Official Gazette A 319), as codified by Presidential Decree 55/98 (A’ 58), as applicable.
	A Waste Management Plan shall be implemented to ensure that the generated waste (hazardous and non-hazardous) is managed appropriately. (MMO 21)

Environmental Parameter		Mitigation Measures During Operation (MMO)
		MMO 42. The water abstracted from the drilling shall be directed to suitable treatment systems before being discharged to the delta outlet, which has the capacity to meet the required limit values. In cases where treatment is not feasible, additional investigation shall be carried out, including sampling and analysis of the water to determine the appropriate discharge method.
		MMO 43. The rainwater from paved surfaces (cleaning and rinsing) shall be discharged through suitable oil-water separation and treatment systems, in accordance with the International Convention for the Prevention of Pollution from Ships (MARPOL).
		It is recommended that the Environmental Monitoring Program be implemented, as specified within the framework of the present document (MMO 9).
Natural Biotic Environment	Flora, Fauna, Habitats and Protected Areas	MMO 44. Implement a Biodiversity and Wildlife Management Plan and an Environmental Monitoring Program (MAC 17), with specific actions and indicators, frequency and methodology for conducting surveys/fieldwork/measurements for each environmental parameter.
		A Chemical Use Plan (MMO 35) shall be implemented, and for the suitability of the chemical substances to be used, MMO 23 and MMO 38 shall be followed.
		MMO 45. In case of a collision of project vessels with marine mammals, the incident shall be reported to the competent Directorate of Natural Environment and Biodiversity of the Ministry of Environment and Energy and the relevant Management Unit of the Natural Environment and Climate Change Agency (OFYPEKA/YPEN).
		MMO 46. Proper organization of the environmental area to prevent the spread of fire (e.g. avoiding the use of flammable building and decoration materials, placement of fire extinguishing animals at key positions, installation of fire tanks and other firefighting equipment according to the fire protection studies and fire department instructions, etc.).
		MMO 47. Systematic cleaning and maintenance of the environment and project installations, so as to prevent flammable materials and waste from accumulating (e.g. systematic cleaning of biomass waste produced by workers or visitors, management of vegetation on adjacent plots, systematic inspection and monitoring of infrastructure networks, etc.).
		MMO 48. Develop an effective fire suppression system. Legal requirements for fire protection may not be sufficient and additional measures may be required. For example, installation of more fire suppression tanks, installation of mobile fire extinguishers, etc.
		MMO 49. Prepare a fire response procedure including a fire safety plan, personnel training in fire emergencies, and cooperation with the local fire service.
		MMO 50. Provide detailed information to workers, including during the operational phase, so that all environmental risks, particularly those related to the biotic environment, are addressed.
		It is recommended that the Environmental Monitoring Program be implemented, as specified within the framework of the present document (MMO 9).
Anthropogenic Environment	Spatial Planning – Land Uses	MMO 51. Comply with the current spatial planning legislation and best practices.
	Structure and Functions of the Anthropogenic Environment	MMO 52. Implementation of a Grievance Mechanism (GM) for the development of strong, constructive, and flexible relationships with the stakeholders and for building understanding through the active participation of individuals, groups, and organizations in the Project, and designation of adequately trained personnel (including a grievance mechanism officer), for the management, monitoring, and reporting regarding its implementation.
		MMO 53. According to the Grievance Mechanism and the requirements for complaint management, response/provision of feedback to stakeholders and affected communities and implementation of appropriate adaptations to the Project as a result of consultations and complaints.

Environmental Parameter		Mitigation Measures During Operation (MMO)
	Cultural Heritage	MMO 54. In case of findings during construction works, in the operation phase the procedure for chance finds required by Greek legislation ((Law 3028/2002 as amended and in force, Law 4858/2021 as amended and in force), EU law and in accordance with best practices such as PR8 of the EBRD (Cultural Heritage)) shall be followed.
	Socio-economic Environment	MMO 55. Measures aimed at reducing negative impacts on the socio-economic environment (indirectly from other parameters) are proposed in detail in the relevant sections on noise, air pollution, shading, etc.
		MMO 56. To the extent possible, make use of local labor and technical resources and give preference to suppliers from the wider area of the project to boost local employment and economy.
	Health and Safety	MMO 57. Implementation of legal framework for labor and development and application of special labor policies for the Project's Human Resources Management Plan and Human Resources Policy.
		MMO 58. All health and safety regulations provided for by legislation shall be applied.
		MMO 59. Employment of Health and Safety Coordinators and the provision of Occupational Health and Safety Technicians.
		MMO 60. Development of a policy for the prevention of violence and harassment at work and gender-based violence and integration into the Human Resources Management Plan.
		MMO 61. As part of the Human Resources Management Plan and the grievance mechanism, implementation of a procedure for reporting incidents of violence and harassment.
		MMO 62. Provision of information and training to employees on appropriate forms of conduct, prevention, protection, and their obligations concerning the prevention of violence and harassment at work, including gender-based violence and harassment.
		MMO 63. Development of internal Health and Safety Policies and actions (e.g., training and certification on safe work execution, “Occupational Health and Safety Policy”, “Environmental and Social Responsibility Policy”, “Policy for Equal Opportunities”, “Diversity and Inclusion Policy”, “Code of Ethics”, etc.).

Table 12 - Measures for prevention, minimization, and management of potential adverse environmental and social impacts during decommissioning – mitigation measures for the proposed Project

Environmental Parameter		Mitigation Measures During Decommissioning (MMD)
Natural Abiotic Environment	Climatic and Bioclimatic Characteristics	MMD 1. For the protection from exhaust gases of machinery and vehicles used for the decommissioning of the project, regular maintenance is required, which is in any case necessary. It is noted that maintenance should not be carried out within the workers' area.
		MMD 2. The machinery, vehicles, and equipment participating in the project’s decommissioning should also comply with the EU emission standards for exhaust gases and should not be outdated technology that emits elevated pollutants.

Environmental Parameter		Mitigation Measures During Decommissioning (MMD)
		MMD 3. Any vessels to be used shall fully comply with the international standard of MARPOL 73/78 Convention, Annex VI "Regulations for the Prevention of Air Pollution from Ships". Annex VI regulates emissions of ozone-depleting substances, nitrogen oxides (NOx), sulfur oxides (SOx), and Volatile Organic Compounds (VOCs).
		MMD 4. Transport of materials: Preference should be given to the transport of construction materials and waste by sea rather than by road, where technically feasible and applicable.
	Morphological and Topographical Characteristics	MMD 5. The site is proposed to be installed within the designated area inside the SIGMA industrial facility. Otherwise, the worksite installations must be determined after approval of the relevant TENEM. All activities outside the predetermined boundaries of the work areas and construction site are prohibited, especially those likely to cause aesthetic degradation or landscape alteration (disposal of useless materials, parking of machinery, etc.).
		MMD 6. Uncontrolled disposal of surplus materials either directly or indirectly to the wider area is strictly prohibited. In no case is the disposal of materials into nearby natural land depression allowed. Technical interventions related to the project's decommissioning and concerning the effective drainage of the construction site, hydraulic communication of adjacent areas, etc., must be regularly monitored and systematically maintained.
		MMD 7. Systematic maintenance of the site and upkeep of the project's land cleanliness is required.
		MMD 8. Fixed solid waste collection points must be determined at the site, along with regular waste collection, to prevent landscape degradation.
		MMD 9. Any storage, even temporary, of decommissioning materials outside the worksite is strictly prohibited.
		MMD 10. The scheduling of material storage must be properly managed to allow for the timely removal of stored materials during the restoration period.
		MMD 11. All types of installations at the site (machinery, construction materials, etc.) should be removed after the completion of the specific decommissioning phase, respecting the proprietary boundaries of the worksite.
		MMD 12. Low-intensity levels of work are required to be maintained.
		MMD 13. All technically feasible measures must be taken for the containment of suspended solids (e.g. placement of filters / silt curtains / debris containment booms or other suitable equipment), with the aim of minimizing sediment dispersion during the decommissioning of the offshore sections of the project and the potential disposal of materials into the sea. During the execution of the decommissioning works of the proposed project, the use of modern equipment for the containment of suspended solids (especially floating barriers – debris containment booms, silt curtains, etc.) around the active work areas is recommended, so that the construction activities do not affect the quality and transparency of water at great distances, and to avoid deposition of solid materials over a large area of the seabed. If this measure is found to be only partially adequate during the construction phase of the project, additional measures must be taken, according to the findings of the relevant environmental monitoring program.
		MMD 14. Implementation of the Environmental Monitoring Program is recommended.

Environmental Parameter		Mitigation Measures During Decommissioning (MMD)
	Geological, tectonic and soil characteristics	The measures for minimizing impacts on Morphological and Topographical Characteristics also apply to the minimization of impacts on Geological, Tectonic and Soil characteristics (MMD 5 through MMD 10).
		MMD 15. Earthworks should mainly take place during periods of the year without heavy rainfall and extreme weather conditions, to avoid soil erosion and generation of suspended particles accordingly. The scheduling of works should include provisions to avoid intensive earthworks during periods of heavy rainfall and sea turbulence, especially during days with forecasted storms and strong wave action. In exceptional cases of intense rainfall or marine storms during excavation phases, work stoppage and placement of geotextiles on slopes is recommended, if deemed geotechnically necessary.
		MMD 16. During the decommissioning phase, methods and techniques should be applied to minimize the compaction of uncovered soils, such as restricting access during and after rainfall events and use of low ground pressure machinery and vehicles. For shaping areas after backfilling, surface water drainage works should be used to limit runoff from the site as much as possible.
		MMD 17. All waste and materials from the project's decommissioning activities (solid and liquid, hazardous and non-hazardous) must be managed in accordance with current legislation to avoid pollution of the area (soil, subsurface, surface and groundwater, and underground utilities). A Waste Management Plan must be implemented during the construction / operation / decommissioning phase, addressing all aspects of the project and the resulting waste, to ensure that the generated waste (hazardous, non-hazardous) is managed appropriately.
		MMD 18. Construction sites must be equipped with waste bins for the collection of municipal-type waste generated by workers on-site. This waste must be collected by the Competent Local Authority (OTA) or an authorized waste collection and transportation service. – In the event that this is not feasible, the Project Entity must ensure the disposal of waste through the existing collection system of the respective OTA. It is noted that particular care must be taken to ensure that such solid waste does not include debris or hazardous materials, the disposal of which must be carried out in accordance with the applicable legislation governing the respective waste categories.
		MMD 19. For the management of the wastewater of the project's decommissioning personnel, the installation of chemical toilets is recommended, as well as the transport and disposal of the waste to the nearest licensed WWTP and/or the use of the sanitary facilities of the company's existing installations in the region.
		MMD 20. Liquid and solid waste containing hazardous or potentially hazardous substances must be transported immediately in sealed containers, which will be stored (temporarily, for the short duration of said works) in a sealed space with the necessary secondary containment systems. The transport and final disposal or treatment must be carried out by a licensed and appropriate company, in accordance with the best available practices.
		MMD 21. The management of any excess excavation materials and of the non-hazardous excavation, construction, and demolition waste (ECDW) generated during decommissioning must be conducted in accordance with the provisions of JMD 36259/1757/E103 (Gov. Gazette 1312B/24-08-2011) "Measures, terms and program for the alternative management of waste from excavations, construction and demolitions (ECDW)." Materials that can be reused/recycled within the project shall be delivered to an approved Collective System for Alternative Management (CSAM) by the Hellenic Recycling Organization (HRA), https://www.eoan.gr. The management of ECDW in the project area is carried out in accordance with JMD 36259/1757/E103/2010 via the following CSAMs: • CSAM "Recycling of Inert Materials Northern Greece S.A." under the title "ANA.B.E. A.E." • CSAM "Recycling of ECDW Central Macedonia S.A." under the title "ANA.KE.M."

Environmental Parameter		Mitigation Measures During Decommissioning (MMD)
		• CSAM "Recycling System of Central Greece P.C." under the title "S.AN.K.E.E.P.C." • CSAM "PELMADES ECO Extended Producer Responsibility Company" under the title "PELMADES ECO MEPE."
		MMD 22. In the event that, at the time of decommissioning of the proposed Project, the Project lies outside the geographical coverage of a Collective System for Alternative Management (CSAM) approved by the Hellenic Recycling Organisation (HRO), any excess material shall be delivered to the nearest approved CSAM or to a suitable spoil heap, following submission and approval of a Technical Environmental Study (TES) by the competent permitting authority, pursuant to paragraph 2 of Article 7 of Law 4014/2011 (Gov. Gazette 209/A/21.09.2011). In this case, the on-shore area proposed by the Contractor shall be approved by the competent authority and in accordance with Technical Specification HOS ΤΠ 1501-02-05-00-00. When selecting the location of the spoil heap, attention shall be paid to the following: • The siting of the spoil heap shall not be within the boundaries of an ecologically sensitive or protected area. • Areas with natural vegetation or fauna habitats shall be avoided. • Siting on productive land or in locations with surface water bodies shall be avoided. • Siting in locations that would affect the landscape of the area or conflict with existing anthropogenic land uses and activities shall be avoided. Preference shall be given to locating the spoil heap in an already disturbed area, which would have positive effects on the environment of the study area. The disposal method and the arrangement of the spoil deposits shall be defined in the relevant TES, which shall be prepared and submitted to the competent permitting authority prior to commencement of the associated works, in accordance with paragraph 2 of Article 7 of Law 4014/2011 (Gov. Gazette 209/A/21.09.2011).
		MMD 23. Construction sites must be equipped with Recyclable Materials bins, in which recyclable materials such as paper/cardboard, plastic, metal, and glass will be collected. These wastes shall be collected by the Competent Municipality or other authorized collection and transport operator—or, if this is not feasible, arrangements must be made for their disposal by the Project entity through the existing collection system of the relevant Municipality (Materials Recovery Facility - MRF).
		MMD 24. Separate collection of specific waste streams, such as Waste Electrical and Electronic Equipment (WEEE), Waste Batteries & Accumulators, Waste Photovoltaic Panels, Lamps and Small Devices (WEEE), must be carried out by authorized collection, transport, and management operators. If this is not feasible, disposal shall be arranged by the Project entity at appropriate recycling collection points of the Alternative Management Systems (AMS).
		MMD 25. The management of used mineral oils shall be carried out in accordance with the provisions of Presidential Decree 82/25.2.2004 (Government Gazette 64/A/2.3.04) on "Definition of measures and conditions for the management of used mineral oils," which replaced Joint Ministerial Decision 98012/2001/96. Waste lubricating oils (WLO) and other liquids of each type shall be collected separately by category and delivered to a certified Collective System for Alternative Management (CSAM) by the Hellenic Recycling Organisation.
		MMD 26. The management of hazardous waste shall be carried out in accordance with the provisions of JMD 13588/725/2006 (Government Gazette 383B/28-3-2006) on "Hazardous Waste Management" and its amendment by JMD 13996/1546/97 (Government Gazette 604B/18-7-1997).
		MMD 27. Maintenance of decommissioning machinery and transport of materials shall be carried out in organized local workshops and not on the Project site. The Contractor shall organize an appropriate maintenance program for site machinery, including oil changes and routine maintenance in designated workshop facilities. Waste oils, filters, and other parts from mechanical equipment shall be collected and disposed of appropriately, in accordance with PD 82/2004 (Gov. Gazette 64/A/2.3.2004).
		MMD 28. Within the site, designated washing and cleaning areas for machinery and vehicles shall be established to avoid the dispersion of pollutants via wastewater.

Commented [GE1]: Hellenic Organization of Standardization

Environmental Parameter		Mitigation Measures During Decommissioning (MMD)
		To reduce the volume of this wastewater, primary cleaning shall be carried out using manual methods, such as brushes, brooms, etc. Furthermore, low-water-consumption equipment such as pressure systems shall be used.
		MMD 29. The Contractor shall implement a **control system for the prevention of accidental pollution**, taking all necessary preventive measures to avoid leakage of petroleum products due to malfunction, negligence, etc., and shall carry out appropriate handling procedures to minimize such incidents. In addition, accident response measures along the entire length of the work shall be foreseen in the Contractor's work plan. Accordingly, the Contractor shall equip the worksite with appropriate absorbent materials (e.g. sawdust, sand) in sufficient quantities, in order to ensure the adsorption, containment, and limitation of the spread of spilled fuels and lubricants. After use, these absorbent materials must be managed properly as hazardous waste, in accordance with applicable legislation. Furthermore, at least one of the vessels involved in the decommissioning works shall be equipped with oil spill containment equipment, as well as appropriate oil absorption and chemical dispersion equipment for oil spill response. All of the above shall be explicitly stated in the Contractor's obligations contract, and their implementation must be properly supervised during decommissioning.
		It is recommended to implement the Environmental Monitoring Program – (MMD 14)
	Air Quality	MMD 30. Watering of surfaces and materials shall be carried out in order to limit dust emissions during earthworks.
		MMD 31. The operation of machinery used at the site shall be conducted with cautious handling, and truck movements shall be carried out at low speeds in order to minimize dust generation.
		MMD 32. Excavation waste stockpiles shall be covered with tarpaulin until their removal.
		MMD 33. Trucks transporting bulk materials must have appropriate coverings in accordance with current regulations, and overloading must be avoided.
		MMD 34. For every construction site activity where there is a likelihood of dust, suspended particles, or other emissions, procedures and equipment that ensure effective reduction of emissions shall be adopted. The duration of these processes shall be minimized.
	Noise and Vibrations	MMD 35. The contractor shall choose the layout and scheduling of the relevant works such that the simultaneous operation of multiple machines in close proximity is avoided and that minimum disturbance is caused to the human environment in the immediate vicinity of the project.
		MMD 36. The operation of the construction site and the movement of trucks on the urban road network within the settlements of the project area shall be avoided during the legally designated quiet hours, in accordance with YA 1023/2/37/96 (Government Gazette 15/B/12.1.96).
		MMD 37. Construction machinery to be used must comply with the provisions of the legislation "on measures and terms for noise emissions to the environment from equipment for outdoor use" (Joint Ministerial Decision 37393/2028/2003, Government Gazette 1418/B/2003, as amended by JMD 9272/471/2007, Government Gazette 286/B/2007) and bear CE marking as required by the aforementioned legislation.
		MMD 38. In all cases, systematic monitoring of noise levels from the project during the decommissioning phase is recommended (implementation of the Environmental Monitoring Program), and additional measures shall be taken in the event of exceedance of the permitted limits. Moreover, special attention shall be given to the noise exposure of workers, and suitable personal protective equipment (e.g., ear protectors, etc.) shall be provided.
		MMD 39. In any case, all activities and operations to be carried out shall comply with the applicable provisions of Greek legislation as listed below: • Ministerial Decision 2640/270 (Gov. Gazette 689/B/18.8.78), on the use of muffled pneumatic hammers. • Presidential Decree 1180/81 (Gov. Gazette 293/A/6.10.81), on the regulation of issues related to the establishment and operation of industries, workshops, all types of mechanical installations and warehouses, and the general environmental protection arising from them, as amended and in force.

Environmental Parameter		Mitigation Measures During Decommissioning (MMD)
		• Ministerial Decision 56206/1613 (Gov. Gazette 570/B/9.9.86), Determination of the sound emission of construction machinery and equipment in compliance with Directives 79/113/EEC, 81/1051/EEC, and 85/405/EEC. • Ministerial Decision 69001/1921 (Gov. Gazette 751/B/18.10.1988), EC type approval for the noise emission limit of construction machinery and equipment, in particular motor compressors, tower cranes, generator-welders, and portable concrete breakers and pneumatic hammers, as amended. • Ministerial Decision 10399/91 (Gov. Gazette 359/B/91), Determination of the noise emission limit of tower cranes as a supplement to M.D. 69001/1921/88. • Ministerial Decision 765/91 (Gov. Gazette 81/B/21.2.91), Determination of the noise emission limits for hydraulic shovels, cable-operated shovels, bulldozers, loaders, and loader-excavators, as amended by JMD 11481/523/97 (Gov. Gazette 295/B/97). • Joint Ministerial Decision 37393/2028/01.10.2003, Measures and conditions for noise emissions into the environment from equipment intended for outdoor use (Gov. Gazette 1418/B), as amended by JMD 9272/471/2007. • Presidential Decree 149/06 (Gov. Gazette 159/A/28.7.2006), "Minimum health and safety requirements regarding the exposure of workers to risks arising from physical agents (noise)," in harmonization with Directive 2003/10/EC.
		MMD 40. Furthermore, the following shall be taken into consideration: • BS 5228 "Code of Practice for noise control on construction and demolition sites" with respect to the determination of the methodology for the prediction of noise and vibrations during construction works, and the applicable indicators and limits. • BS 6472 Vibration Dose Value – VDV, regarding the determination of the maximum permissible vibration dose concerning human annoyance due to construction activities. • BS 7385, regarding the determination of the maximum permissible vibration level for the protection of buildings against structural damage. • Ministerial Decision 13586/724/06 (Gov. Gazette 384/B/28.3.2006), Determination of measures, conditions, and methods for the assessment and management of environmental noise, in compliance with the provisions of Directive 2002/49/EC "relating to the assessment and management of environmental noise" of the Council of 25.6.2002. • Ministerial Decision 211773/2012 (Gov. Gazette 1367/B/2012), Determination of Environmental Noise Assessment Indicators and Maximum Permissible Limits of Indicators resulting from the operation of transport infrastructure projects, technical specifications of specialized acoustic studies for calculation and implementation (EAMYE) of noise barriers, specifications for environmental noise monitoring, and other provisions.
		MMD 41. Residents, users, and visitors of the area shall be informed about the working hours of the machinery that may cause potential disturbance.
	Water	MMD 42. For the water needs of the Project, potable water for the workers shall be sourced from the commercial market. The water required for the construction site operations, including surface wetting for dust suppression, shall be supplied by installing water tanks at the construction site. These needs shall be met via water trucks or from the network of the existing industrial facilities of SIGMA.
		Uncontrolled disposal of surplus materials in the immediate or wider area is prohibited. Under no circumstances is the disposal of such materials into streambeds or other water recipients allowed (MMD 6).
		Systematic maintenance of the access road and cleanliness of the Project site area is required (MMD 7).
		MMD 43. Locations for the collection of solid waste at the construction site must be designated, and their regular collection must be ensured so as to avoid landscape degradation.
		The work schedule must be designed in such a way that temporary storage of materials is minimized, and spillage is avoided (MMD 10).

Environmental Parameter		Mitigation Measures During Decommissioning (MMD)
		MMD 44. A key factor for the general protection of the environment in the wider area during the construction phase is the proper organization and effective operation of the construction site. To protect water quality, the implementation of the corresponding measures already referenced in the previous Environmental Parameters is proposed.
		MMD 45. To protect water quality from material handling, disposal, and use of construction materials and waste, as well as from vehicle and machinery maintenance and cleaning, the implementation of the corresponding measures already referenced in the previous Environmental Parameters is proposed.
		To protect water quality from poor practices, negligence, or accidental spills, the implementation of the relevant measures already referenced in the previous Environmental Parameters is proposed.
		The implementation of the Environmental Monitoring Program is recommended (MMD 14).
		MMD 46. In compliance with international guidelines and the International Safety Management Code (ISM) of the IMO, for the safe operation of vessels and the prevention of marine pollution, the proper application of shipping procedures, communications, and safety is proposed.
		MMD 47. In compliance with MARPOL requirements for waste and ballast water, the following shall apply: Annex I of the Regulation on oil pollution prevention, Annex III of the Regulation on the prevention of pollution from harmful substances carried in packaged form.
		MMD 48. The floating vessels that will be used for the needs of the project shall comply with the International Regulations for Preventing Collisions at Sea 1972 (COLREGs).
		MMD 49. Implementation of fuel refueling procedures in accordance with the applicable national regulations and the specifications of the vessel.
		MMD 50. All necessary measures must be taken to prevent marine pollution during the construction phase, as well as any additional measures imposed by the competent Port Authority, in accordance with Law 743/77 (Gov. Gazette A 319), as codified by Presidential Decree 55/98 (A' 58), and as currently in force.
		The "Waste Management Plan" shall be implemented during construction / operation / decommissioning stages, examining all aspects of the project and the generated waste, to ensure that the generated waste (hazardous or non-hazardous) is managed properly (MMD 17).
		MMD 51. A Chemical Usage Plan shall be implemented, which shall include: i. The chemical substances the contractor intends to use during work. Relevant Material Safety Data Sheets for said substances. ii. The purpose(s) for which the contractor intends to use the chemical substances. iii. The maximum concentrations of chemical substances the contractor intends to use, the total quantity of each substance, as well as the maximum quantity the contractor intends to use per defined time period. iv. The area within which the chemical substance can potentially be discharged into the marine environment.
Natural Biotic Environment	Flora, fauna, habitats and protected areas	MMD 52. During the decommissioning phase on the land section located outside Natura sites but with sand dunes, it is recommended: A. To avoid disturbance and impacts to the habitat of sand dunes and during the reproduction period of turtles and bird species. Particularly, avoid the period from mid-April to the end of June. This restriction will prevent work during the reproduction period of birds and turtle nesting. B. That no construction site be developed on the sand dunes to avoid soil compaction and vegetation degradation.

Environmental Parameter		Mitigation Measures During Decommissioning (MMD)
		MMD 53. A Biodiversity and Wildlife Management Plan and Environmental Monitoring Program shall be implemented, with specific actions and indicators, frequency and methodology of field surveys / measurements per environmental parameter.
		MMD 54. Η ταχύτητα κίνησης όλων των σκαφών που σχετίζονται με την απεγκατάσταση του Έργου δεν θα πρέπει να υπερβαίνει τους 20 κόμβους, προκειμένου να ελαχιστοποιηθεί η πιθανότητα σύγκρουσης με θαλάσσια θηλαστικά και θαλάσσιες χελώνες.
		MMD 55. The Project support vessel during offshore decommissioning activities shall carry 2 certified observers of marine mammals (MMOs). Prior to the commencement of decommissioning works, MMOs must assess the presence of marine mammals within 500 m from the work site. If marine mammals are present within this zone, work shall only commence after at least 20 minutes from the last sighting. In case of nighttime or low-visibility conditions (e.g., fog), MMOs must use night vision binoculars or passive acoustic monitoring devices.
		MMD 56. In the event of vessel collision with marine mammals, the incident must be reported to the competent Directorate of Natural Environment and Biodiversity of the Ministry of Environment and to the relevant Management Unit of OFYPEKA/YPEN.
		MMD 57. It is recommended to avoid the implementation of the offshore decommissioning phase during the marine mammal reproduction period (February – May).
		MMD 58. The storage of all hazardous materials at the construction site shall be done in a way that prevents access by fauna. Containers with oil or fuel shall be tightly sealed, and deep pits or large excavations in the soil must be covered. Additionally, during the decommissioning period, special care shall be taken to avoid trapping or killing fauna species.
		MMD 59. Proper organization of the surrounding area shall be ensured to prevent the spread of fire (e.g., by avoiding the use of highly flammable materials for building and decoration, avoidance of storing flammable animal feed at locations that may contribute to fire spread, installation of fire-fighting tanks and other fire protection equipment in accordance with the site's fire protection studies and fire brigade guidance, etc.).
		MMD 60. Systematic cleaning and maintenance of the surrounding area and project installations shall be carried out to prevent fire outbreaks and spread (e.g., systematic cleaning from debris that may be spread by construction workers or accumulated during operations, removal of biomass waste from vegetation management, monitoring and maintenance of utility networks, etc.).
		MMD 61. Preparation of a fire emergency response plan, including fire protection procedures, training of personnel for emergency response, risk identification and coordination with the local fire service.
		MMD 62. Potential environmental pollution incidents with adverse effects on soil and, consequently, on the area's biotic environment, shall be identified and avoided. In order to protect the quality of the biotic environment, best practices shall be applied, avoiding mistakes, damage, or negligence.
		MMD 63. Detailed information shall be provided to employees during the decommissioning phase to ensure compliance with all environmental terms, particularly those relating to the natural biotic environment.
Anthropogenic Environment	Spatial Planning – Land Use	MMD 64. Compliance with the requirements of applicable spatial planning legislation and best practices.
		MMD 65. Particular care shall be taken when carrying out work and vehicle/machinery movements near roads and buildings to avoid damage.
		MMD 66. The contractor shall be obliged to remove all temporary installations used for construction purposes and to return the area to its original state after project completion.

Environmental Parameter		Mitigation Measures During Decommissioning (MMD)
	Infrastructure and Operation of the Anthropogenic Environment	MMD 67. Proper planning of works shall aim to minimize disturbance from anthropogenic activities in the area, and the aesthetic pollution caused. Additionally, the fencing of the construction site and work areas shall be done in an orderly manner to minimize visual alteration of the area's image.
		MMD 68. The works shall be scheduled in such a way as to avoid excessive pressure on productive anthropogenic activities, and measures aimed at mitigating adverse impacts (indirectly from other parameters) proposed in detail in the relevant fields shall be implemented.
	Socio – economic environment	Measures aimed at mitigating adverse impacts on the socio-economic environment (indirectly from other parameters) are proposed in detail in the relevant fields regarding noise, air pollution, dust, etc.
		MMD 69. Utilisation, to the extent possible, of local labour and technical personnel, and preference for suppliers from the wider project area, in order to boost local employment and the economy.
		MMD 70. A particularly effective practice for addressing and avoiding any complaints from the residents of the area is prior to the commencement of work, informing the residents by the supervising authority and the contractor regarding the nature and duration of the works.
		MMD 71. Implementation of mitigation measures for alternative employment opportunities for the workforce after the completion of the decommissioning process, such as: • Internal relocation (Identification of other projects within the company where the skills of the affected employees can be utilized), • Cross-training (providing training programs to equip employees with the skills needed for other positions within the company or the sector), • Outplacement services (providing job search support in collaboration with recruitment agencies, training on resume writing, interview techniques, etc., to improve employability and job prospects). A key mitigation measure is also the implementation of the **Stakeholder Engagement Plan**, to enhance open and transparent communication with interested parties regarding the process of ceasing operations and decommissioning, the timelines, and potential impacts. Regular briefings and meetings with local stakeholders can assist in managing expectations, building trust, and mitigating potential negative impacts.
	Health and Safety	MMD 72. Implementation of the legal framework on labor and development and application of specific provisions for the Project Human Resources Management Plan and Human Resources Policy.
		MMD 73. Strict compliance with the safety regulations provided by the legislation.
		MMD 74. Given that construction works inherently involve the possibility of accidents, it is recommended to: • Strictly comply with the safety regulations for construction sites as prescribed by law. • Conduct an Occupational Risk Assessment (ORA). • Establish a Health and Safety Plan and File (HSP and HSF) and strictly adhere to the requirements, in compliance with national legislation and the provisions of PR4 of the EBRD. The HSP and HSF must be updated according to the development of works and must always contain accurate and updated information.
		MMD 75. Employment of a Health and Safety Coordinator and provision of services by a Safety Technician and Occupational Physician.
		MMD 76. As part of the Human Resources Management Plan and for construction site personnel, implementation of procedures for reporting incidents of violence and harassment.

Environmental Parameter		Mitigation Measures During Decommissioning (MMD)
		MMD 77. Information and training of employees in accessible forms regarding the types of risks, prevention, protection and their obligations regarding the prevention of violence and harassment and gender-based violence and harassment.
		MMD 78. Implementation of internal Occupational Health and Safety policies and actions (e.g. training and certification in safe work execution, “Stop Work Policy”, “Stop Work Authority”, “Health, Safety, Environmental & Social Responsibility Policy”, “Equal Opportunities Policy”, “Diversity and Inclusion Policy”, “Code of Ethics”, etc.).
		MMD 79. Provision to all personnel of the necessary protective equipment in accordance with Law 3850/2010 and the Health and Safety Plan (HSP), as well as the specific equipment specified in the Fire Protection Plan and the Waste Management Plan.
		MMD 80. The construction site must be fenced to prevent public access and at points where the project is partially active.
		MMD 81. Appropriate signage must be in place to inform the public of hazards and simultaneously restrict access to the construction site.
	Technical Infrastructure	MMD 82. Cooperation between the proponent, competent authorities, and maritime agencies to determine safe navigation routes around the designated area for decommissioning activities. This includes timely notification of port authorities on planned activities and expected impacts.
		MMD 83. Decommissioning works shall be planned to minimize their impact on existing navigation routes, avoiding peak periods of intense fishing, commercial, or tourist maritime activity.
		MMD 84. Regular inspections must be carried out to ensure compliance with all regulations and specified requirements, to prevent any risk to maritime traffic.
		MMD 85. During the transport and movement of equipment on the public road network, special care must be taken by machinery operators and heavy vehicle drivers to avoid damage to infrastructure.
		MMD 86. If necessary, in the immediate project area, informative signs and proper traffic safety signage shall be installed. Traffic regulations shall be implemented under the responsibility of the contractor. Where possible, real-time digital platforms (e.g. traffic management or GPS) shall be used to inform road users
		MMD 87. Optimization and minimization of vehicle movement, improvement of transport planning and travel times, and maximizing vehicle load efficiency (equipment, materials, and waste) during decommissioning activities.
		MMD 88. Transportation of oversized or heavy equipment components to be decommissioned across the road network shall take place only after consultation with the relevant Traffic Police Departments, considering the issued permits, alternative route instructions, and transport schedule.
		MMD 89. Transport activities shall be scheduled to avoid, as much as possible, peak traffic hours, seasons, or high congestion periods on the road network.
		MMD 90. Timely notification of all responsible public utility providers conducting work in the immediate project area that may be affected.

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3 SUMMARY DESCRIPTION OF THE PROJECT

3.1 BASIC PROJECT INFORMATION

3.1.1 General Information

The project under study concerns the installation of a full-scale carbon dioxide (CO_2) storage unit in Prinos (the "Project"). The planned CO_2 storage site is located within the Prinos basin, in the Gulf of Kavala, in the Northern Aegean. The area of interest for CO_2 storage lies within the Prinos Concession, where Energean Oil & Gas SA ("Energean"), an affiliated company of EnEarth, holds 100% of the interests and management rights for oil and natural gas exploration and production activities since 2007. The potential CO_2 storage site is located within the Prinos structure and the underlying aquifer.

The operation of the facility is planned to be developed in two distinct phases based on capacity (Phase 1 and Phase 2), for reasons of scalability and adaptation to market conditions.

- **Phase 1** with an initial nominal capacity of up to **1 MTPA** for 20 years (starting around the end of 2025 to early 2026). The CO_2 will be mainly supplied in bulk via third-party pipelines reaching the facility boundaries under suitable conditions for injection. Additionally, small quantities of CO_2 will be received at the Sigma onshore facilities in containers, transported by trucks, as part of pilot CO_2 capture projects.

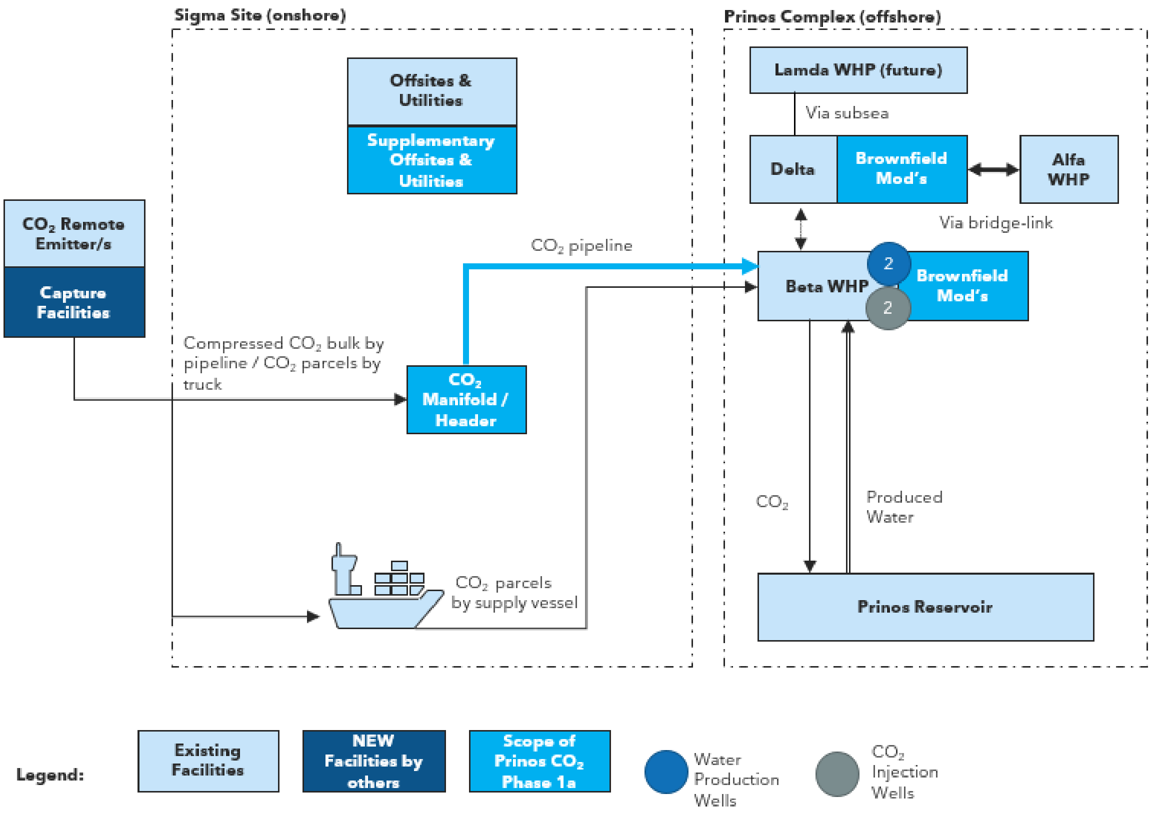

Figure 3-1: Schematic representation of Phase 1 of the Project

- In **Phase 2**, an expansion is planned to reach a final nominal capacity of up to **3 MTPA**. The facility will be modified to also accept liquefied CO_2, which will be delivered via maritime transport to a newly constructed jetty. For this purpose, marine facilities for docking, unloading, storage and processing (pumping, heating) of the liquefied CO_2 will be built within the onshore area of the Sigma plant activities. The CO_2 will be transported to the offshore facilities through the subsea pipeline constructed during Phase 1. To support Phase 2, the facilities will require the following upgrades:
    - Upgrade/expansion of the onshore liquefied CO_2 storage and management facilities, the docking and unloading facilities for liquefied CO_2 and auxiliary installations.
    - Possible installation of a new platform to accommodate the maximum capacity of Phase 2..
    - At least four new CO_2 injection wells and four new water production wells.
    - Possible expansion of the water treatment facility.

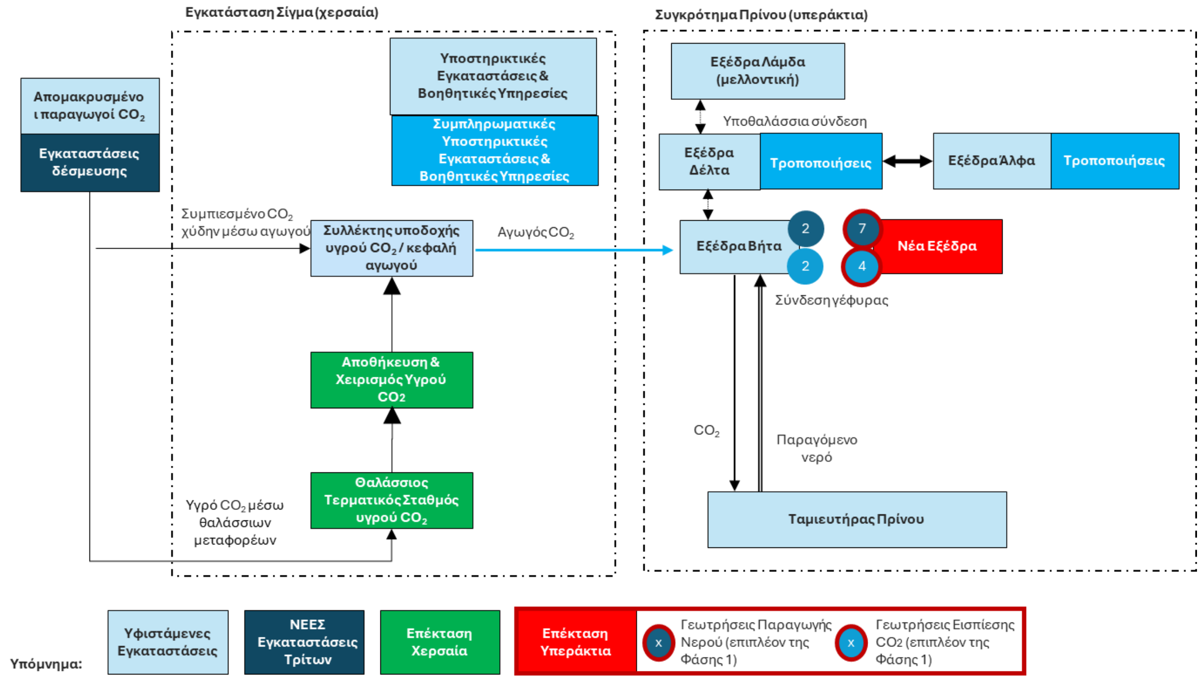

Figure 3-2: Schematic representation of Phase 2 of the Project

This study focuses on **Phase 1** of the Project.

The new facilities and wells planned for the operation of Phase 1 of the CO_2 storage Project, which are the subject of this study, include:

- Onshore facilities: modification of a specific area within the existing Sigma plant site for the construction of the CO_2 reception manifold and an unloading and compression area.
- Offshore pipeline: a subsea pipeline connecting the Sigma plant area to the Beta offshore platform, approximately 20 km in length.
- Offshore platforms (**Figure 3**): modification and/or use of the existing offshore facilities at Prinos (Beta and Delta platforms) for receiving CO_2 from the new subsea pipeline and CO_2 container shipments, injecting CO_2 into the new wells, and processing the produced water (Delta platform).
- Wells: 2 CO_2 injection wells and 2 water production wells on the existing Beta platform of the Prinos offshore complex.

The sources of CO_2 and the main reception processes during Phase 1 of the CO_2 storage Project will be as follows:

- Bulk CO_2 supply under suitable conditions for injection via a third-party pipeline to an onshore reception station within the Sigma facilities area.
- Reception of CO_2 shipments from trucks carrying ISO containers at the Sigma onshore facilities. The containers will be loaded onto supply vessels/barges using a crane, transported and unloaded at the existing Beta platform of the Prinos offshore facilities. It is noted that there is also provision for the direct injection of CO_2 shipments into the onshore reception manifold via a compression station during unloading from the trucks.

Figure 3-3: Existing Onshore and Offshore Facilities Related to the CO_2 Storage Project Under Study

3.1.2 Existing Facilities

According to the current Environmental Terms Approval Decision (ΑΕΠΟ) DIPA/8413/24.04.2018 (ADA: ΨΓΛ14653Π8-Ζ79), the **Prinos Offshore Development project** concerns the existing offshore oil and natural gas extraction and production facilities located in the Gulf of Kavala in the Northeastern Aegean, as well as its expansion with two new platforms, one of which is planned for the long term. The total production capacity is 27,000 barrels per day of stabilized crude oil.

The existing offshore project consists of the following individual facilities:

- **Kappa** platform located at the sweet natural gas reservoir, not originating from an oil field, in South Kavala.
- A 12 km, 6" pipeline (operating pressure 8-12 barg) that transports sweet natural gas and condensate from South Kavala (Kappa platform) to the Delta platform at Prinos.
- **Alpha** and **Beta** production platforms, each with twelve wellheads, which are part of the Prinos complex, connected by bridges to the Delta platform and designed to accommodate suitable drilling rigs for drilling, repair and maintenance of the wells.
- **Delta** processing platform, which contains all the offshore initial processing facilities and currently receives oil, natural gas, water and condensate produced from the Prinos, North Prinos, Epsilon and South Kavala fields. The Delta platform is connected by bridges to the Alpha and Beta platforms as well as to its flare stack. According to the existing permits, new vertical connection risers may be added to the Delta platform to receive produced fluids from the Lambda platform (and possibly the Omicron platform) and to send natural gas (gas lift) and water for injection to the Lambda platform. Additionally, a vertical protective conduit may be installed for the multi-conductor cable that will transmit power, data, communications and auxiliary fluids to the Lambda platform.
- **Flare stack** of the Prinos platform complex.
- An 18 km, 12" pipeline (operating pressure 8 barg) for transporting sour natural gas from the Delta platform to the onshore facilities.
- An 18 km, 8" pipeline (operating pressure 20-40 barg) for transporting crude oil from the Delta platform to the onshore facilities.
- An 18 km, 5.3" pipeline for transporting sweet natural gas (gas lift) from the onshore facilities to the Delta platform.
- Two subsea electric power cables, each with a capacity of 10 kVA, from the onshore facilities to the Prinos platform complex.

The onshore Sigma industrial unit includes facilities for desalination, dehydration, desulfurization and stabilization of the produced crude oil; conversion of the produced sour gas into sweet gas; production of liquid and solid sulfur; as well as the necessary facilities for the safe storage and handling of the produced crude oil, natural gas and sulfur.

3.1.3 New Facilities Under Study

3.1.3.1 Storage Site

Energean holds, among other rights, the exploration and exploitation rights for hydrocarbons in the offshore area of the Prinos oil fields (Law 2779/1999, Government Gazette 296/A/30.12.1999). Through years of carrying out Oil Operations (exploration and exploitation) within the Prinos Exploitation Area, Energean has collected geological, geophysical, and drilling data on the Prinos geological basin—specifically regarding the Prinos and Epsilon structures. These data support the preliminary suitability of these structures as CO_2 storage sites. By Decision No. EDEYEP 14577 titled “Activation of the Right to Investigate CO_2 Storage” issued by EDEYEP S.A. (Government Gazette 5247/B/11.10.2022), **the preliminary suitability of the storage site was confirmed. This site lies within the boundaries of the Prinos concession and includes the structures of the Prinos and Epsilon fields, as well as the underlying aquifer**. As the studies for the Project progressed, it was determined that CO_2 storage would be more effective if limited to the Prinos structure

The storage site refers to a specific volume within a geological formation that is selected and configured for the purpose of CO_2 storage. The Prinos storage site covers an area of approximately 20.16 km^2, with a perimeter of 26.77 km.

The storage complex includes the storage site itself as well as the surrounding geological formations, the nature of which is critical to the effectiveness and safety of CO_2 storage. These formations contribute to the overall storage capacity and to the integrity of the CO_2 storage project. The Prinos storage complex extends over an area of approximately 256.86 km^2, with a perimeter of about 72.99 km.

3.1.3.2 Drillings

As part of the development of the carbon dioxide (CO_2) storage Project, EnEarth plans to drill a total of four wells—two of which will be used as CO_2 injection wells, and two as water production wells to support pressure balancing within the reservoir. All wells will be drilled laterally, using existing wells as starting points (donors) from the Beta platform.

Table 3-1 presents the depths for drilling the lateral wells.

Table 3-1 Start-up wells (donors) and the respective start-up depths of the lateral wells

Well type	Name	Starter well (donor)	Starting depth of new well (m)
CO_2 injection well	PBC-1	PB-17A	1000
CO_2 injection well	PBC-2	PB-24	1000
Water production well	PBW-1	PB-22	1000
Water production well	PBW-2	PB-23A	1000

The wells target zones B and C of the reservoir for both water production and CO2 injection. The recorded pore pressure in the Prinos reservoir from key wells is shown in **Figure 3-4**.

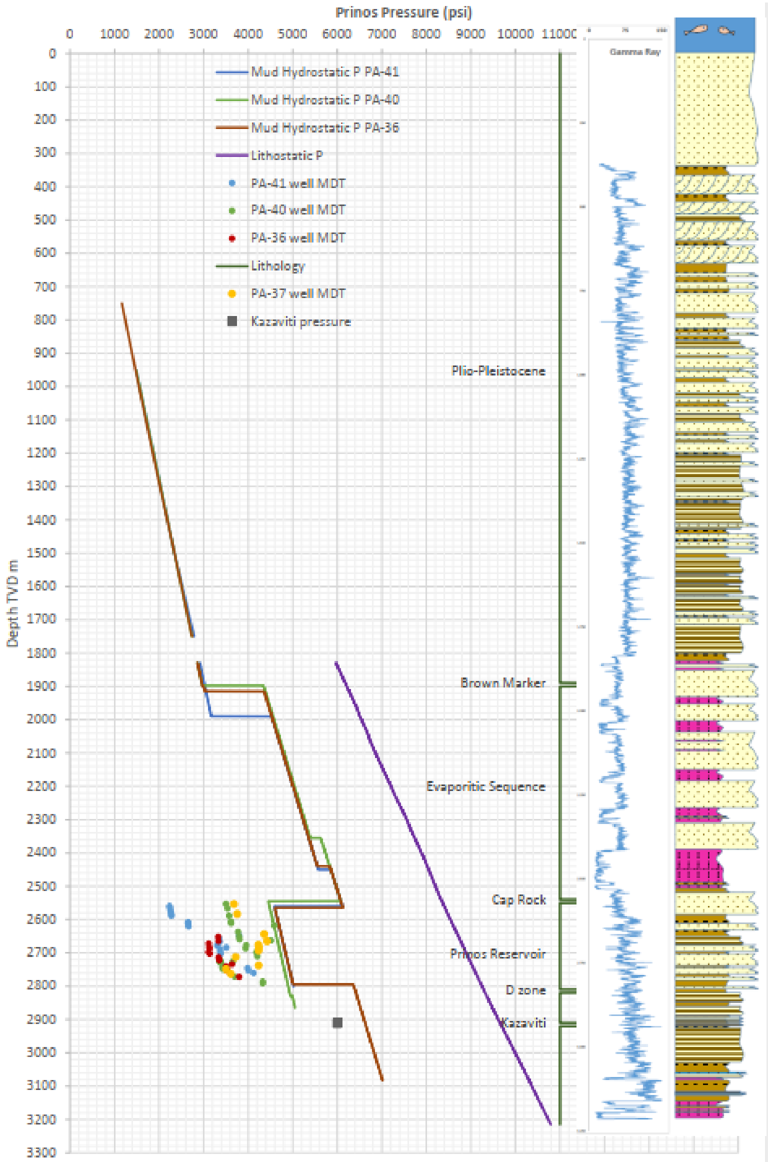

Figure 3-4: Recorded pressure in the reservoir pores at Prinos from key wells

The Prinos reservoir is a Miocene-aged sandstone reservoir. It consists of three stacked zones, A, B and C, which are separated by thin clay layers. **Table 3-2** presents the expected depth of the formations encountered along the new wells.

Table 3-2: Formation depths along the new wells

Formation	Well			
(All depths are in TVDSS, RT=0)	PBC-1	PBC-2	PBW-1	PBW-2
Brown Marker (Clay)	1822	1817	1922	1911
Top of 1st evaporite layer	1990	1991	2052	1964
Base of 1st evaporite layer	2021	2020	2055	1970
Top of 2nd evaporite layer	2087	2081	2108	2011

Formation	Well			
Base of 2nd evaporite layer	2140	2138	2128	2042
Top of 3rd evaporite layer	2220	2210	2145	2078
Base of 3rd evaporite layer	2242	2222	2152	2091
Top of 4th evaporite layer	2371	2342	2295	2239
Base of 4th evaporite layer	2431	2402	2356	2303
Top of upper main salt layer	2590	2539	2497	2462
Base of upper main salt layer	2636	2578	2537	2530
Top of lower main salt layer	2727	2652	2605	2656
Base of lower main salt layer	2975	2760	2715	2842
Top of 1st layer (reservoir A1)	2986	2773	2733	2855
Top of 4th layer (reservoir A2)	3053	2881	2819	3000
Top of reservoir B	3152	3020	2882	3035
Top of reservoir C	3180	3060	3000	3080
Target	3200	3080	3031	3115

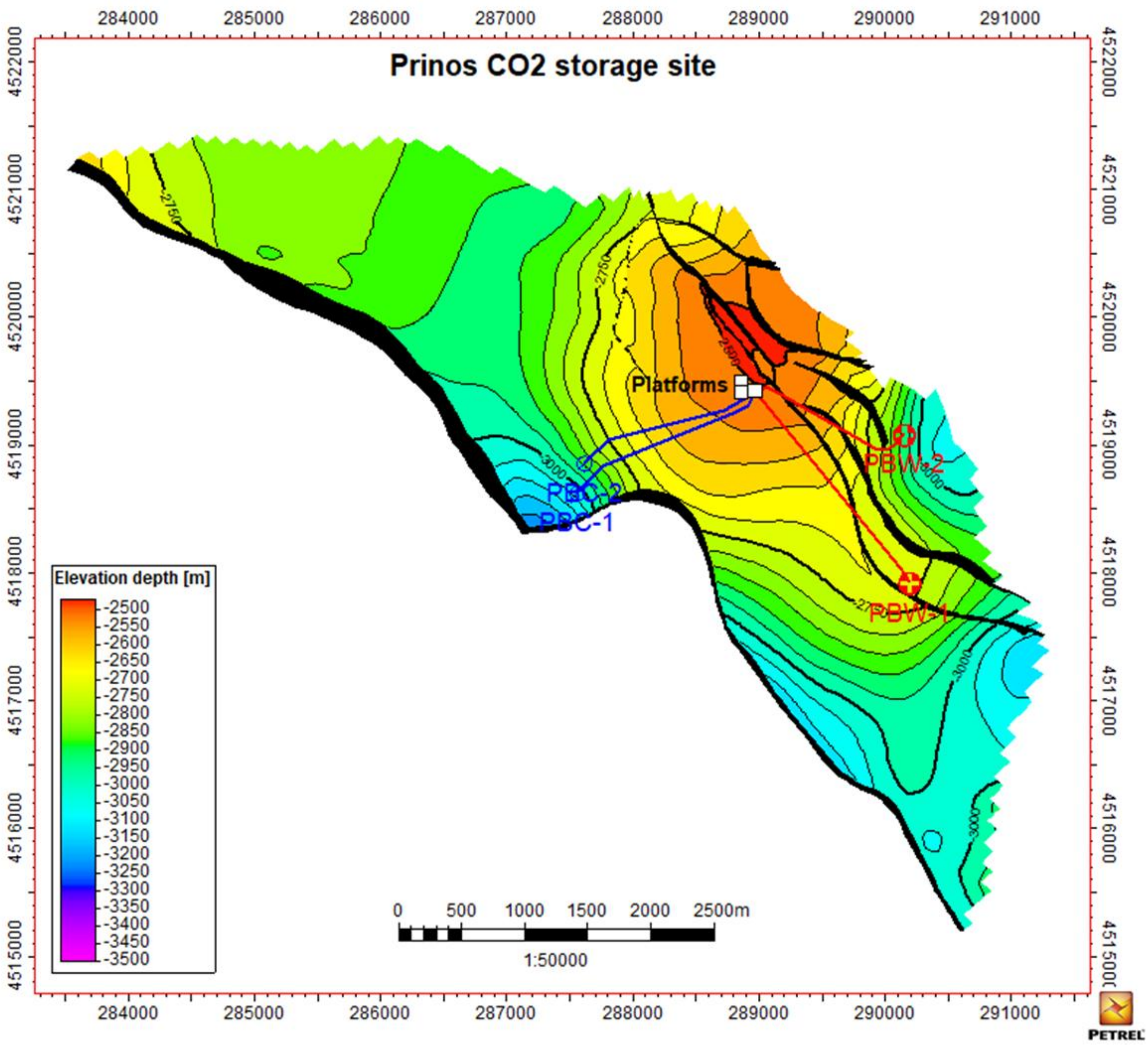

Figure 3-5: Map of the top of the CO_2 storage structure in the Prinos reservoir

3.2 KEY ELEMENTS OF THE CONSTRUCTION, OPERATION AND DECOMMISSIONING PHASES

3.2.1 Construction Phase

3.2.1.1 Onshore facilities – structural constructions and configurations, CO_2 reception and handling equipment

The planned equipment will be prefabricated off-site and delivered by trucks to the construction site, where it will be unloaded using a crane. The works for the construction of the onshore facilities will include the following:

- Geotechnical sampling and data collection.
- Ground preparation for the equipment foundation
- Concrete works with a thickness of 0.5 m for the foundation of base plates.

- The excavation area will be limited to the points where the bases of the onshore equipment will be placed and is estimated at approximately 50 m². The estimated excavation area for the onshore section of the pipeline is 200 m², with a depth of 3 m.
- Once the excavation of the pipeline area is completed, the area will be backfilled with the same material.
- Installation of piping assemblies and welding. The pipes will be installed on the ground on the new foundations, without the need for protective covers, as is customary for pipes in onshore facilities.
- Connection and testing of the electrical network and instruments.

3.2.1.2 CO_2 Transport Pipelines for Storage

The subsea pipeline will be buried along its entire length to protect it from fishing activities (trawling) in the area. In the onshore section, for the first 500 meters, the burial depth will be 2 meters from the top of the pipe (Top of Pipe - TOP), and in the offshore section, the burial depth will be between 1 and 1.5 meters (TOP).

The pipeline construction works will be carried out in five phases:

Phase 1: Geophysical and geotechnical surveys along the pipeline route (1 month).

Phase 2: Works for approaching the pipeline to the shore, including dredging a 500 m section from the coastline, in the area of the pipeline reception manifold at the Sigma plant. The trench will be approximately 3 m deep along its entire length and will reach the seabed level at the end of the 500 m zone (6 months).

Phase 3: Installation of the subsea pipeline and hydraulic testing using a specialized pipe-laying vessel (2–3 weeks).

Phase 4: Installation of a riser pipeline on the existing Beta platform and diver operations to connect the riser with the end of the subsea pipeline (1 week).

Phase 5: Final testing and start of operation (1 month).

3.2.1.3 Wells

The drilling construction phase includes the implementation of the following individual tasks:

- Preparation for the killing (shutting-in) of the donor (starting) wells.
- Permanent sealing and abandonment of the donor wells.
- Opening of the “window” for the new well.
- Drilling of the new well.
- Completion of the well.

The total duration of the drilling and completion works for the wells is estimated at 248 days, with the number of personnel on the drilling rig estimated to be approximately 90 people, as detailed in Section 6.4. To minimize the environmental footprint of the drilling, a 2500 hp drilling rig will be used, equipped with a Top Drive System (TDS) and three high-pressure drilling mud pumps. The drilling rig includes the necessary equipment for the temporary storage of generated waste and fuels. The drilling rig (of indicative type CROSCO Labin or with similar specifications) will be designed and manufactured according to the API 4F standard and the latest European regulations, including low-emission specifications, and will be fully certified according to ATEX. The transportation of the drilling rig to the drilling site will be carried out using appropriate tug vessels.

The drilling of the wells will be carried out using the RSS (Rotary Steerable System) method.

The drilling stages for each section up to the final measured depth of 3,700 m include briefly:

- Drilling with a diameter of 16” to a measured depth of approximately 2,200 m (vertical depth 1,850 m).
- Drilling with a diameter of 12-1/4” to a measured depth of approximately 3,150 m (vertical depth 2,667 m).
- Drilling with a diameter of 8-1/2” to a measured depth of approximately 3,700 m (vertical depth 2,800 m).

3.2.1.3.1 Well Casing

Within the framework of the proposed Project, the following tubing work scope will be carried out in order to complete the well with 3 ½’’ or 4 ½’’ production tubing:

- Intermediate casing 13 5/8’’
  13 5/8’’, 68 lb/ft, L80 grade with TSH BLUE connection
- Production casing 9 5/8’’
  9 5/8’’, (wight missing), or 53.5 9 7/8’’, 69.9 lb/ft, L80 grade with TSH BLUE connection
- Production tubing/tubing liner 7’’
  7’’, 32.0 lb/ft, L80/13Cr grade with TSH BLUE connection

The approximate lengths of the well sections and the final measured depth are presented in the following **table**.

Table 3-3: Characteristics of drilling sections and casing

Section	Measured Depth (m)	Vertical Depth (m)	Section Length	Wellbore Diameter (in)	Casing Diameter (in)
I	2,250	1,850	1,900	16	13 5/8
II	3,150	2,667	900	12 1/4	9 5/8
III	3,700	2,900	550	8 1/2	7

3.2.1.3.2 Ensuring Resistance to Pressure or Other Forces During Drilling to Prevent Accidents

The well design will be completed in such a way that the density of the drilling fluids ensures sufficient hydrostatic pressure—i.e., greater than the formation pore pressure but not so high as to cause blockages resulting in lost circulation of the drilling fluid into the formation. After the well design study, appropriate depths for casing placement will be selected to isolate the "weak" geological formations from the subsequent sections of the well, which will be drilled with higher-density mud. To prevent a flow kick—with the worst-case scenario being a blowout caused by hydrocarbon leakage at the surface—there will be at least three mitigation mechanisms. More specifically:

- The first and main mechanism for well control is maintaining sufficient hydrostatic pressure of the drilling mud during the drilling process. Fluids such as gas, water, or oil under pressure (formation pressure) greater than the hydrostatic pressure of the mud can cause a flow kick.
- The second control mechanism consists of the drilling procedures and best practice guidelines that must be followed throughout the drilling process. The procedure for drilling and managing a flow kick will be detailed in the Detailed Drilling Plan (DDP). Additionally, the best practice guidelines will be based on national and European legislation.
- The third control mechanism for the well is the Blowout Preventer (BOP) system. The BOP valves are installed at the top of the well and are designed to seal the well, preventing a flow kick from escalating into a blowout caused by hydrocarbon leakage at the surface.

3.2.2 Operational Phase

The operation of the facility is planned to be developed in two distinct phases (Phase 1 & Phase 2), for reasons of scalability and adaptation to market conditions, each of which has synergistic prospects that can achieve significant CO_2 reductions.

This study focuses on **Phase 1** of the Project, during which CO_2 will be mainly supplied in bulk, via third-party pipelines reaching the boundaries of the onshore facility under suitable conditions for injection. Additionally, CO_2 loads will be received in small quantities at the Sigma onshore facilities from trucks through pilot CO_2 capture projects.

3.2.2.1 Onshore CO_2 Reception Facilities and Unloading Operations

3.2.2.1.1 Bulk CO_2 Reception via Pipeline

The CO_2 entering the facility via a third-party onshore pipeline during Phase 1 is expected to be at a pressure and temperature suitable for injection into the storage site, without the need for further processing.

The CO_2 will be routed to the reception header, from where it will be transferred to the Prinos complex via the subsea CO_2 pipeline.

3.2.2.1.2 Reception of CO_2 shipments via containers

ISO container trucks will transport the CO_2 shipments from the emission source to the dock of the Sigma plant. The containers will be unloaded from the trucks, loaded onto the deck of supply vessels or transport barges using a crane, and transported to the offshore facilities at the existing Beta platform.

Regarding the quantities of CO_2 expected to be received in shipments and the reception frequencies, the following assumptions are made:

- Assuming a quantity of 400 tons from Pilot Program 1[1] under the Horizon Europe program of the EU, 19 trips will be required by a truck with a capacity of 21,375 kg (for example, 18 trips at 100% load capacity, 1 trip at 71% load capacity) to deliver the total amount of CO2 loads. A frequency of 1 truck per week is considered for a duration of almost 5 months (19 weeks).
- Assuming a quantity of 40 tons from Pilot Program 2[2] under the Horizon Europe program of the EU, 2 trips will be needed by a truck with a capacity of 21,375 kg (for example, 1 trip at 100% load capacity, 1 trip at 87% load capacity) to deliver the total amount of CO2 loads. A frequency of 1 truck every 3 months is considered.

There is also provision for the direct injection of CO_2 loads from the containers into the pipeline receiving manifold at the onshore facilities. This setup creates the need for a compression station during unloading from the trucks next to the receiving manifold area. In this case, the trucks will unload the ISO containers next to the receiving manifold area. A flexible hose will be used to unload the contents of the ISO containers into the compressor, from where the CO_2 will be directed to the receiving manifold, ensuring that all safety measures for safe operation are followed.

3.2.2.2 Transport of CO_2 to the Prinos offshore storage facilities

During Phase 1, according to the pre-FEED study, the CO_2 will be supplied under suitable conditions for injection. It will be connected to the new facilities via a flange connection at the receiving manifold and will be transported to the Prinos offshore facilities through the new 20 km long subsea CO_2 transport pipeline, with a diameter of 12-16 inches, class 1500#.

The CO_2 pipeline will initially handle a capacity of up to 1 MTPA of compressed CO_2 but is also sufficient for the project's future planned capacity (3 MTPA CO_2). The jacket riser pipe for the CO_2 pipeline will be equipped with Emergency Shutdown Valves (ESDV) for isolation.

Regarding the CO_2 loads, it is assumed that the supply vessel/barge transporting the containers will connect to the piping on the platform via a flexible hose system. From there, the CO_2 loads will undergo further processing (as described below) to meet the correct specifications/conditions for injection into the well.

3.2.2.3 Injection of CO_2

The main processing equipment for the CO_2 loads on the Beta platform will include a compression station for the required injection conditions, installed on the open deck of the platform. At startup, to prevent low temperatures in the pipeline and the formation of hydrates/ice near the well area, the installation of an electric startup heater and a methanol injection system is planned.

CO_2 injection will target Zones B and C of the reservoir with two injection wells during the period 2025–2035 and will then expand to cover the entire reservoir by the end of the Project.

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[1] HERCCCULES/HORIZON-CL5-2022-D3-01 Call (Project no. 101096691)
[2] COREU/ HORIZON-CL5-2023-D3-01 (Project No. 101136217)

During the first 3 years of storage site operation, the CO2 injection rate will gradually increase from 0.25 to 0.5, then to 0.75 and finally to 1.0 MTPA.

For Phase 1, according to the initial design study (pre-FEED), the required injection conditions at the well are a pressure of 101 barg and a temperature of 20°C.

3.2.2.4 Water Pumping

The water wells on the Beta platform will be equipped with Electrical Submersible Pumps (ESPs) and will extract water from the reservoir to provide a means of active pressure management of the reservoir.

According to simulation studies, the two water production wells will operate with a production rate of up to 7,500 bwpd each during the period 2025-2030 (6 years). Water production will increase to 9,000 bwpd per well in 2031 and continue at that rate until the end of the Project.

The capacity of 7,500 bwpd per well corresponds to the operation of the Electrical Submersible Pump (ESP) at 83% of its capacity, while the capacity of 9,000 bwpd per well corresponds to operation of the ESP at 100% of its capacity.

The produced water will be processed at the existing Delta platform.

3.2.3 Shutdown – Restoration

The decommissioning of the CO_2 storage Project under study, with priority given to well closure and reservoir safety, will be carried out in accordance with best practices and guidelines (Offshore Energies United Kingdom (OEUK), 2022).

For the permanent abandonment of the wells, cement is considered the most suitable material, although other materials can also be used. To be considered a permanent barrier, the long-term integrity of the material must be ensured, with no significant degradation during the design life of the barrier, while continuing to meet the design criteria. If cement is used as the barrier, then a cement column of at least 30 meters is required to constitute a permanent barrier.

<u>The pipelines within the onshore section</u> of the CO2 transport system will be depressurized, cleaned, and purged with nitrogen for securing. The onshore section will be isolated from the offshore pipeline with a sealed flange, dismantled and the area will be restored to its original condition. The <u>offshore pipeline</u> and riser will be depressurized, cleaned using standard pigging operations and then decommissioned by nitrogen injection. Subsequently, the pipeline will be isolated from the offshore platform, sealed with welded end caps or flanges and will remain in place according to international standards. The piping from the top of the riser to the wellheads will be depressurized and filled with nitrogen to inert the system, disconnected from the wellheads, covered and left in place.

The subsequent <u>monitoring</u> of the Project will focus on detecting potential leaks to minimize environmental impacts and ensure compliance with regulations. Geological surveys of the reservoir layers will be conducted to identify possible leakage pathways or geological hazards and to minimize the risk of CO2 leakage into the marine environment. Monitoring parameters of the wells, such as pressure, temperature and composition, will be supervised to ensure safety against leaks.

3.3 REQUIRED QUANTITIES OF RAW MATERIALS, WATER, AND ENERGY

3.3.1 Construction Phase

3.3.1.1 Material requirements

During the construction of the onshore facilities, the main materials required will be steel pipes and protective casings, concrete (for pipe coatings, foundations, pipe support, temporary access) and copper cables.

For the subsea CO_2 pipeline, the main materials needed will be carbon steel pipes, concrete (for pipe coatings), materials for anti-corrosion coating and anodes for cathodic protection of the pipelines.

For the interventions on the existing Beta and Delta platforms, the main materials required are steel pipes and protective casings, valves, piping fittings, flanges, and copper cables.

The main materials used for the preparation of drilling fluids are

- Bentonite and barite (to increase the specific gravity of the drilling mud/slurry and to balance hydrostatic pressure)
- POLYPAC (water-soluble polymer for controlling fluid loss)
- Lime (as a source of calcium - alkalinity)
- CMC HV (to control drilling mud/slurry fluid loss on the borehole walls and the fluidity of the water-based slurry)
- POLYDRILL (polymer for controlling fluid loss and slurry rheology)
- KLA-CURE (organic blend that reduces swelling and dispersion of reactive clay formations)
- FLO-VIS (biopolymer to improve the rheological properties of drilling mud/slurry)
- FLO-TROL (starch derivative for controlling fluid loss and viscosity)
- SAFE-SCAN HS (reacts with hydrogen sulfide and remains soluble even after chemical reaction)
- SAFE-CARB (calcium carbonate as a binder in drilling, treatment, and completion fluids)
- Calcium carbonate (to increase the specific gravity of drilling mud/slurry and to reduce fluid influx into drilling fluids)
- Natural resin VESATROL (for high-pressure, high-temperature filtration control)
- EDC 95-11 (the main component of LTOBM, also known as base oil; highly pure with very low aromatic hydrocarbon content)
- CONQOR (corrosion inhibitor for addressing calcium salt deposits)
- Sodium carbonate (alkalinity agent to increase the pH of the drilling fluid)

The above materials will be procured from legally operating businesses, quarries, or other lawful sources in the wider area, which must hold the required environmental terms approval decision (in the case of quarries). Additionally, the chemicals will be sourced from certified suppliers. A detailed list of the aforementioned materials and chemicals is presented in **Section 6.4.5.1** of this Environmental Impact Assessment (EIA) report.

3.3.1.2 Water Requirements

The water consumption for the construction of the Project under study is expected to arise from:

- The living needs of the workers, the wetting of materials and the production of concrete for the construction of the onshore facilities.
- The living needs of the workers and other uses on the vessel for the construction of the CO_2 pipeline.
- Significant water demand is expected at the offshore facilities during the construction period of the new wells.

The above water consumptions are estimated in **Section 6.4.5.2** of this EIA report.

3.3.1.3 Energy and Fuel Requirements

The range of average <u>power consumption</u> during drilling operations is as follows:

- Maximum average power: 3,870 kW
- Minimum average power: 1,500 kW

Therefore, the total indicative energy consumption for drilling operations is estimated at 1,006,200 kW.

These needs will be met by the rig's diesel-powered generator.

Fuel consumption mainly concerns the drilling operations, the drilling rig, and one supply vessel. The average daily fuel consumption is expected to be 5.5 tons, with a total consumption for the four wells of approximately 1,500 tons

3.3.2 Operational Phase

3.3.2.1 Material Requirements

For the operational phase of the CO_2 storage facilities, the required materials and consumables will be used as needed, mainly for the routine maintenance of the facilities.

3.3.2.2 Water Requirements

For the operational phase of the CO_2 storage facilities, no demand for fresh water is expected, except for the personnel's living needs, similar to the current operation of the facilities.

3.3.2.3 Energy and Fuel Requirements

Regarding the electrical energy needs of the new facilities, no increase in energy demand is expected for the onshore facilities, as no processing of the CO_2 loads is planned there for the quantity delivered via pipelines.

At the new offshore facilities during the operational phase, power will be required for the processing of CO_2 at the Beta platform to achieve the appropriate injection conditions (pressure and temperature). Based on the initial estimate of the expected energy consumption for compressing the CO_2 loads, as well as heating bulk CO_2 during startup, the power demand is expected to be approximately 1.6 MW.

For the extraction of produced water from the water wells at the Beta platform, two Electric Submersible Pumps (ESPs) with a power rating of approximately 0.5 to 1 MW each are planned.

Subsequent development phases will require the installation of additional water wells, corresponding ESPs, and transmission systems, resulting in a proportional increase in the required power capacity.

Fuel consumption during the operation phase will concern the movement of trucks and vessels for the transport of CO_2 cargoes, as well as the usual transportation of personnel and supplies, which will be similar to that of the existing activity at the Sigma onshore facilities and the offshore facilities of Prinos

- The delivery of CO_2 cargoes is estimated to take place via 21 truck routes, each with a capacity of 21,375 kg (indicative calculation, **Section 3.2.2.1.2**). The distance traveled by the trucks per route to deliver the CO_2 cargoes to the Sigma facilities can be considered as 150 km (Pilot Program 1), and 700 km (Pilot Program 2), respectively.
- The frequency of deployment of the supply vessel/barge for the transport of CO_2 cargoes will correspond to that of the trucks delivering the cargoes (**Section 3.2.2.1.2**). Fuel consumption for the supply vessel is estimated to be 1,300 tonnes over the total duration of the Project.Εκροές αποβλήτων

3.4 WASTE OUTPUTS

3.4.1 Construction Phase

3.4.1.1 Municipal-Type Waste

3.4.1.1.1 Municipal-Type Waste

It is estimated that both non-hazardous and hazardous Municipal Solid Waste (MSW) will be generated by the Project, as well as certain other waste streams that fall under alternative management schemes (management through Collective Alternative Management Systems - CAMS).

The categories of waste that are expected to be produced during the construction phase of the Project, based on the European Waste Catalogue (EWC) (Decision 2001/118/EC, as amended and in force), are presented in the following table. It is noted that codes marked with an asterisk (*) in addition to the number represent waste classified as hazardous.

Table 3-4: Classification of municipal-type waste according to the EWC (European Waste Catalogue)

EWC Code	EWC Description
15	**WASTE FROM PACKAGING, ABSORBENTS, WIPING CLOTHS, FILTER MATERIALS AND PROTECTIVE CLOTHING NOT OTHERWISE SPECIFIED**
15 01	Packaging (including separately collected municipal packaging waste)
15 01 01	Paper and cardboard packaging
15 01 02	Plastic packaging
15 01 04	Metal packaging
15 01 05	Composite packaging[3]
15 01 06	Mixed packaging
15 01 07	Glass packaging
15 01 10*	Packaging containing residues of or contaminated by hazardous substances
19	**19 WASTE FROM WASTE MANAGEMENT FACILITIES, OFF-SITE WASTEWATER TREATMENT PLANTS AND THE PREPARATION OF WATER INTENDED FOR HUMAN CONSUMPTION AND WATER FOR INDUSTRIAL USE**
19 08	wastes from wastewater treatment plants not otherwise specified
19 08 05	sludges from urban wastewater treatment
20	**MUNICIPAL WASTE (HOUSEHOLD WASTE AND SIMILAR WASTE FROM COMMERCIAL ACTIVITIES, INDUSTRIES AND INSTITUTIONS), INCLUDING SEPARATELY COLLECTED FRACTIONS**
20 01	**Separately collected fractions** (excluding those mentioned in 15 01)
20 01 01	Paper and cardboard
20 01 02	Glass
20 01 13*	Solvents
20 01 14*	Acids
20 01 15*	Alkaline waste
20 01 19*	Pesticides
20 01 21*	Fluorescent tubes and other waste containing mercury
20 01 23*	Discarded equipment containing chlorofluorocarbons (CFCs)
20 01 25	Edible oils and fats
20 01 27*	Paints, inks, adhesives, and resins containing hazardous substances
20 01 29*	Detergents containing hazardous substances
20 01 33	Batteries and accumulators referred to in 16 06 01, 16 06 02 or 16 06 03 and mixed batteries and accumulators containing such batteries
20 01 34	Batteries and accumulators other than those mentioned in 20 01 33
20 01 35*	Discarded electrical and electronic equipment other than those mentioned in 20 01 21 and 20 01 23 containing hazardous components
20 01 36	Discarded electrical and electronic equipment other than that mentioned in 20 01 21, 20 01 23 and 20 01 35
20 01 37*	Wood containing hazardous substances
20 01 39	Plastics
20 01 40	Metals
20 03	Other municipal waste
20 03 01	Mixed municipal waste
20 03 04	Septic tank sludge

It is noted that the classification of waste—i.e., the identification of hazardous properties through the assessment of waste hazards and ultimately their classification as hazardous or non-hazardous—will be

[3] Beverage packaging (e.g., Tetra Pak), snack packaging (e.g., chips, cheese puffs), blister packaging

carried out in accordance with the provisions of the *"Commission Notice on Technical Guidance on the Classification of Waste"* (2018/C 124/01), based on the *Waste Framework Directive 2008/98/EC*, which has been incorporated into Greek legislation by Law 4819/2021 (Government Gazette 129/A/23.07.2021), and the *CLP[4] Regulation—Regulation (EC) No. 1272/2008 on classification, labeling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No. 1907/2006*.

The following table presents the waste stream management approach for municipal waste, based on the requirements of the applicable legislation. It is noted that the comprehensive Waste Management Plan for the Project is provided in **Annex 17.3**.

Table 3-5: Mapping of the integrated waste management system – Municipal Waste

EWC Code	Description of EWC	Description of waste type	Waste Stream Management		
			Collection/Temporary Storage within the Project	Temporary Storage Equipment within the Project	Collection (Transport) / Treatment[5]
20 03 01	Mixed municipal waste	Mixed municipal waste	Mixed municipal waste collection separately / Temporary storage within the Project	Mixed Waste Bin (plastic bin EN 840-2/5/6, capacity from 80 up to 1100 liters)	Responsible Local Authority (OTA) or collection agency for collection and transport – if not feasible, disposal by the Project operator into the existing OTA collection system / Kavala landfill
19 08 05	Sludge from municipal wastewater treatment	Sigma WWTP sludge from the treatment of the project's municipal wastewater	-	-	Licensed entity for collection, transport and management
15 01 01	Packaging made of paper and cardboard	Mixed recyclable materials from paper/cardboard, plastic, metal, and glass[6]	Separate collection of recyclables / Temporary storage within the Project	Recyclable Materials Bin (plastic bin EN 840-2/5/6, capacity 80 to 1100 liters)	Responsible Local Authority (OTA) or collection and transport entity – if not feasible, the Project entity will deposit the waste in the existing collection system of the OTA / Recycling Sorting Center (KDAY) of Xanthi
15 01 02	Plastic packaging				
15 01 04	Metal packaging				
15 01 05	Composite packaging[7]				

[4] Current consolidated version: 01/12/2023: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02008R1272- 20231201

[5] "Treatment": Recovery or disposal operations, including preparation prior to recovery or disposal (Law 4819/2021).

[6]https://www.eoan.gr/%ce%b5%ce%bd%ce%b7%ce%bc%ce%ad%cf%81%cf%89%cf%83%ce%b7/%cf%84%ce%b9-%cf%85%ce%bb%ce%b9%ce%ba%ce%ac-%ce%b1%ce%bd%ce%b1%ce%ba%cf%85%ce%ba%ce%bb%cf%8e%ce%bd%ce%bf%cf%85%ce%bc%ce%b5/

[7] Beverage packaging (e.g., Tetra Pak), snack packaging (e.g., chips, cheese puffs), blister packaging.

EWC Code	Description of EWC	Description of waste type	Waste Stream Management		
			Collection/Temporary Storage within the Project	Temporary Storage Equipment within the Project	Collection (Transport) / Treatment[5]
15 01 06	Mixed packaging[8]				
15 01 07	Glass packaging				
20 01 01	Paper and cardboard				
20 01 02	Glass				
20 01 39	Plastics				
20 01 40	Metals				
20 01 25	Edible oils and fats	Edible oils and fats. No permanent production is expected during the implementation of the Project. In any case, if the need arises, the produced quantities should be temporarily stored in the Project's temporary waste storage area.	Separate collection of edible oils and fats / Temporary storage within the Project *If needed	Collection container for edible oils and fats (Intermediate Bulk Container (IBC) or UN HDPE drum, capacity from 30 to 220 liters) *If needed	Licensed entity for collection, transport, and management *If needed
20 01 23*	Discarded equipment containing chlorofluorocarbons (CFCs)	Waste Electrical and Electronic Equipment (WEEE). Permanent production of WEEE during the implementation of the Project is not expected. In any case, if necessary, the quantities produced should be temporarily stored in the Project's waste storage area.	Separate collection of WEEE / Temporary storage on-site *if necessary	WEEE bin (plastic bin EN 840-2/5/6, capacity 80 to 1100 liters or WEEE bin from a contracted Producer Responsibility Organization - PRO) *if necessary	Collection and transport entity / WEEE PRO - if not feasible, provision should be made for the disposal of waste by the Project entity at appropriate WEEE recycling points of the PRO. *if necessary
20 01 35*	Discarded electrical and electronic equipment, excluding those referred to in 20 01 21 and 20 01 23 that contain hazardous components				
20 01 36	Discarded electrical and electronic equipment, excluding those referred to in 20 01 21, 20 01 23 and 20 01 35.				

[8] Composite packaging: packaging made up of two or more layers of different materials which cannot be separated by hand and form a single integrated unit consisting of an inner receptacle and an outer casing, which is filled, stored, transported, and emptied as a single unit, DIRECTIVE (EU) 2018/852.

EWC Code	Description of EWC	Description of waste type	Waste Stream Management		
			Collection/Temporary Storage within the Project	Temporary Storage Equipment within the Project	Collection (Transport) / Treatment[5]
20 01 33	Batteries and accumulators referred to in 16 06 01, 16 06 02, or 16 06 03, and mixed batteries and accumulators containing these batteries.	Waste Batteries & Accumulators (WBA)	Separate collection of WBA / Temporary storage on-site	WBA bin (WBA bin from a contracted Producer Responsibility Organization - PRO)	Collection and transport entity / WBA PRO
20 01 34	Batteries and accumulators other than those referred to in 20 01 33.				
20 01 21*	Fluorescent tubes and other waste containing mercury.	Waste from Lighting Fixtures, Lamps, and Small Electrical Appliances (WEEE). Permanent production of WEEE during project implementation is not expected. In any case, if necessary, the generated quantities must be temporarily stored at the project's waste storage area.	Separate collection of lighting fixtures, lamps, and small appliances / Temporary storage on-site *if necessary*	WEEE bin for Lighting Fixtures and Lamps (WEEE bin from a contracted Producer Responsibility Organization - PRO) *if necessary*	Collection and transport entity / WEEE PRO – if not feasible, disposal of waste by the Project entity at appropriate WEEE recycling points of the PRO. *if necessary*
20 01 13*	Solvents	Small Quantities of Hazardous Waste in Municipal Waste (SQHW in MSW). Permanent production during the Project implementation is not anticipated. In any case, if necessary, the generated quantities must be temporarily and separately stored by type in the Project's temporary waste storage area.	Separate collection / Temporary storage within the Project *if necessary*	Appropriate separate container for each type (plastic bin EN 840-2/5/6, capacity from 80 to 1100 liters or UN HDPE drum, UN metal drum, etc.) *if necessary*	Licensed entity for collection, transport, and management of Hazardous Waste *if necessary*
20 01 14*	Acids				
20 01 15*	Alkaline wastes				
20 01 19*	Pesticides				
20 01 27*	Colors, inks, adhesives, and resins containing hazardous substances				
20 01 29*	Detergents containing hazardous substances				
20 01 37*	Wood containing hazardous substances				
15 01 10*	Packaging containing residues of hazardous	Empty containers of paints, solvents, etc. Permanent production during	Separate Collection / Temporary Storage within the Project	UN HDPE Drum, UN Metal Drum *if necessary*	Licensed entity for the collection, transport, and management of

EWC Code	Description of EWC	Description of waste type	Waste Stream Management		
			Collection/Temporary Storage within the Project	Temporary Storage Equipment within the Project	Collection (Transport) / Treatment[5]
	substances or contaminated by them	the implementation of the Project is not anticipated. In any case, if necessary, the quantities produced must be temporarily and separately stored for each type in the Project's temporary waste storage area and managed as hazardous waste.	Site **if necessary*		Hazardous Waste **if necessary*
20 03 04	Septic tank sludge	Wastewater from construction site chemical toilets	-	-	Collection and Transport Entity

It is noted that, through the electronic services of the Electronic Waste Registry (HMA)[9], it is possible to search by EWC code(s) for the corresponding licensed waste collection and transport entities by Regional Unit.

The quantities of municipal-type waste are analyzed in **Section 6.4.6.**

3.4.1.1.2 Wastewater and Other Aqueous Waste During Construction

During the construction phase at the onshore project site, municipal wastewater will be generated from workers' living activities. The existing infrastructure of the Sigma facilities will be used to serve the personnel; alternatively, chemical toilets may be installed within the construction site. These will be regularly emptied and maintained by a licensed company, under the responsibility of the project's main contractor.

During the construction phase of the CO_2 pipeline, municipal wastewater will be generated onboard the vessel from workers' living activities. This wastewater will be treated in an onboard biological treatment system.

Other aqueous waste expected to be generated on the vessel during the construction of the CO_2 pipeline includes bilge water and ballast water.

- Water from the ship's engine room may contain grease and/or oil (bilge water). The management of bilge water will be carried out in accordance with Annex I of MARPOL 73/78 (Regulations for the Prevention of Pollution by Oil) and its relevant amendments. The treatment equipment (bilge water separator) will comply with the specifications outlined in the IMO Guidelines (Guidelines and Specifications for Pollution Prevention Equipment for Machinery Space Bilges of Ships, IMO Resolution MEPC.107(49)).
- The discharge of ballast water, used to stabilize ships at sea, is subject to the requirements of Annex I of MARPOL 73/78 and the International Convention for the Control and Management of Ships' Ballast

[9] https://wrm.ypeka.gr/eka-search-form

Water and Sediments (Ballast Water Management – BWM). The onboard ballast water treatment system will comply with the D-2 standard, which pertains to the treatment of marine ballast water.

During the drilling phase, municipal wastewater will be generated from workers' living activities. Domestic-type wastewater from the platform complex is transferred and stored in special tanks located on each platform. These tanks are periodically emptied into a barge or the tank of the support vessel. The tank contents are then transported by the barge to the onshore facilities for biological treatment.

The quantities of wastewater and other aqueous wastes are estimated in **Section 6.4.6.**

3.4.1.2 Construction Work Waste

The integrated management of Construction and Demolition Waste (CDW) related to the construction works and excavation activities in the Project will be carried out in accordance with Joint Ministerial Decision 36259/1757/E103/2010 (Government Gazette 1312/B/24.08.2010) "Measures, conditions, and program for the alternative management of waste from excavation, construction and demolition (CDW)" and the relevant provisions of Law 4819/2021, as amended and currently in force.

It is estimated that the Project will generate Construction and Demolition Waste (CDW) subject to alternative management (Extended Producer Responsibility – EPR) as well as other wastes, hazardous and non-hazardous, such as construction residues (e.g., concrete, metals, packaging materials, etc.) and surplus materials from site preparation and construction activities.

The wastes generated from construction activities and estimated to potentially arise during the Project's construction are presented in the following Table, based on the European Waste Catalogue (Decision 2001/118/EC, as amended and in force). It should be noted that codes marked with an asterisk (*) represent wastes classified as hazardous.

Table 3-6: Classification of Construction Waste According to the European Waste Catalogue (EWC)

EWC Code	Description
08	**WASTE FROM THE PRODUCTION, FORMULATION, SUPPLY AND USE (PFSU) OF COATINGS (PAINTS, VARNISHES, AND GLASS ENAMELS), ADHESIVES, SEALANTS AND PRINTING INKS**
08 01	Waste from the production, formulation, supply, and use (PFSU), as well as the removal of paints and varnishes
08 01 11*	Waste from paints and varnishes containing organic solvents or other hazardous substances
08 04	Waste from the PFSU of adhesives and sealants (including waterproofing products)
08 04 09*	Waste from adhesives and sealants containing organic solvents or other hazardous substances
10	**WASTE FROM THERMAL PROCESSES**
10 13	Waste from the production of cement, quicklime and lime mortar, as well as objects and products manufactured from them
10 13 14	Waste concrete and concrete slurry
13	**WASTE OILS AND WASTE LIQUID FUELS** (excluding edible oils and those included in Chapters 05, 12, and 19)
13 01	Waste hydraulic oils
13 01 11*	Synthetic hydraulic oils

EWC Code	Description
13 02	Waste oils from engines, gearboxes and lubrication
13 02 06*	Synthetic oils from engines, gearboxes and lubrication
13 05	Contents of oil/water separators
13 05 07*	Oily water from oil/water separators
15	**WASTE FROM PACKAGING; ABSORBENT MATERIALS, WIPING CLOTHS, FILTER MATERIALS, AND PROTECTIVE CLOTHING NOT OTHERWISE SPECIFIED**
15 02	Absorbent materials, filter materials, wiping cloths, and protective clothing
15 02 02*	Absorbent materials, filter materials (including oil filters not otherwise specified), wiping cloths, and protective clothing contaminated by hazardous substances
17	**WASTE FROM CONSTRUCTION AND DEMOLITION (INCLUDING EXCAVATED SOIL FROM CONTAMINATED SITES)**
17 01	Concrete, bricks, tiles and ceramics
17 01 01	Concrete
17 02	Wood, glass, and plastic
17 02 01	Wood
17 02 04*	Glass, plastic and wood containing or contaminated by hazardous substances
17 04	Metals (including their alloys)
17 04 05	Iron and steel
17 04 09*	Metal waste contaminated by hazardous substances
17 05	Soil (including excavated soil from contaminated sites), stones and excavation rubble
17 05 04	Soil and stones other than those mentioned under code 17 05 03
17 05 06	Excavation rubble other than those mentioned under code 17 05 05

It is noted that the classification of waste—that is, the determination of hazardous properties through the assessment of waste hazard and ultimately their classification as hazardous or non-hazardous—will be carried out in accordance with the provisions of the **"Commission Notice on technical guidance for the classification of waste" (2018/C 124/01)**, based on the Waste Framework Directive 2008/98/EC (WFD). This directive has been incorporated into Greek legislation by Law 4819/2021 (Government Gazette 129/A/23.07.2021) and the **CLP[10] Regulation (Regulation (EC) No 1272/2008)** on the classification, labeling, and packaging of substances and mixtures, which amends and repeals Directives 67/548/EEC and 1999/45/EC and modifies Regulation (EC) No 1907/2006.

The presentation of the waste stream management methods, based on the requirements of the applicable legislation, is provided in the following Table.

It is noted that the overall Waste Management Plan for the Project is presented in **Appendix 17.3.**

[10] Current consolidated version: 01/12/2023: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02008R1272-20231201

Table 3-7: Mapping of the integrated waste management system for construction activities

EWC Code	EWC Description	Description of Waste Type	Waste Stream Management		
			Collection/Temporary Storage Within the Project Site	Temporary Storage Equipment Within the Project Site	Collection (Transportation) / Treatment[11]
17 01 01	Concrete	Concrete from demolitions. Production during the Project implementation is not anticipated. In any case, if needed, the generated quantities should be temporarily stored in the Project's temporary waste storage area.	Separate collection of demolition concrete / Temporary storage within the Project *if needed	Concrete skip container (Skip Lift Container) *if needed	Reuse - recycling on-site or authorized collection and transport entity / Alternative Management System (AMS) *if needed
17 02 01	Wood	Wood. Production during the Project implementation is not anticipated. In any case, if needed, the generated quantities should be temporarily stored in the Project's temporary waste storage area.	Separate collection of wood / Temporary storage within the Project *if needed	Wood skip container (Skip Lift Container) *if needed	Reuse on-site or authorized collection and transport entity / Alternative Management System (AMS) *if needed
17 02 04*	Glass, plastic, and wood containing hazardous substances or contaminated by them	Wood containing hazardous substances or contaminated by them. Production during the Project implementation is not expected. In any case, if the need arises, the produced quantities must be temporarily stored in the waste temporary storage area of the Project and managed as hazardous waste.	Separate collection of hazardous wood / Temporary storage within the Project *if needed	Hazardous wood container (Skip Lift Container) *if needed	Licensed entity for collection, transport, and management of Hazardous Waste *if needed
17 04 05	Iron and steel	Iron and steel (metal waste)	Separate collection of iron/steel / Temporary storage within the Project	Iron/steel container (Skip Lift Container or metal container EN 840-2/5/6)	Reuse within the Project or licensed collection and transport entity / SSED (System for the Alternative Management of Packaging Waste)
17 04 09*	Metals contaminated with hazardous substances	Metals contaminated with hazardous substances. Production during Project implementation is not expected. In any case, if needed, the generated quantities should be temporarily stored in the Project's temporary waste storage area and managed as hazardous waste.	Separate collection of hazardous metals / Temporary storage within the Project *if needed	Hazardous metals container (Skip Lift Container or metal container EN 840-2/5/6) *if needed	Licensed entity for the collection, transport, and management of Hazardous Waste *if needed

[11] "Treatment": Recovery or disposal operations, including preparation prior to recovery or disposal (Law 4819/2021).

EWC Code	EWC Description	Description of Waste Type	Waste Stream Management		
			Collection/Temporary Storage Within the Project Site	Temporary Storage Equipment Within the Project Site	Collection (Transportation) / Treatment[11]
17 05 04	Soils and stones other than those mentioned in point 17 05 03	Earthy excavation waste	Separate collection of excavated materials / Temporary storage within the Project	Bulk – Temporary storage area near the Project site	Reuse within the Project or collection and transport entity / Disposal in approved suitable sites (e.g., quarries, landfills) according to the Project's Environmental Terms Approval (ΑΕΠΟ) or Collective Waste Management System (ΣΣΕΔ)
08 01 11*	Waste from paints and varnishes containing organic solvents or other hazardous substances	Permanent production during the implementation phase of the Project is not expected. In any case, if necessary, the quantities produced should be temporarily and separately stored for each type in the Project's temporary waste storage area.	Separate collection / Temporary storage within the Project	Suitable separate container for each type (plastic bin EN 840-2/5/6, capacity from 80 up to 1100 liters, or UN HDPE drum or UN metal drum, etc.) *if necessary	Licensed entity for collection, transport, and management of Hazardous Waste *if necessary
08 04 09*	Waste from adhesives and sealants containing organic solvents or other hazardous substances				
10 13 14	Concrete and concrete sludge waste	Waste from concrete production. Production during the implementation phase of the Project is not expected. In any case, if necessary, the quantities produced should be temporarily stored in the Project's temporary waste storage area and managed as hazardous waste.	Separate waste collection / without temporary storage *if necessary	-	Collection and management by the contractor supplier or Licensed collection and transport entity / Producer Responsibility Organization (ΣΣΕΔ)
13 01 11*	Synthetic hydraulic oils	Waste Lubricating Oils (WLO)	Separate collection of Lubricating Oils / Temporary storage within the Project site	Lubricating Oils Container (Metal UN Drum)	Collection and transport entity / Lubricating Oils Alternative Management System (ΑΛΕ)
13 02 06*	Synthetic oils for engines, gearboxes and lubrication.				
13 05 07*	Oily water from oil/water separators.				
15 02 02*	Absorbent materials, filter materials (including oil filters not otherwise	Oil sludge, oil filters. Permanent production during project implementation is not expected. In any case, if necessary, the produced	Separate collection / Temporary storage within the Project *if necessary	UN HDPE barrel, UN metal barrel, portable pollution control unit containing mega bags for	Licensed entity for collection, transport, and management of hazardous waste *if necessary

EWC Code	EWC Description	Description of Waste Type	Waste Stream Management		
			Collection/Temporary Storage Within the Project Site	Temporary Storage Equipment Within the Project Site	Collection (Transportation) / Treatment[11]
	specified), wiping cloths, protective clothing contaminated by hazardous substances	quantities must be temporarily and separately stored by type in the project's temporary waste storage area and managed as hazardous waste.		waste placement **if necessary*	
-	-	Other construction waste not included in the present plan and which may contain small amounts of hazardous or toxic materials (e.g., solvent-based concrete additives, adhesives, tar-based emulsions, paints and coatings, packaging, etc.). In the event that such waste is produced during the implementation of the Project, it must be classified according to the EWC, temporarily stored in the Project's designated temporary waste storage area and managed as hazardous waste.	Separate collection of each type / Temporary storage within the Project **if necessary*	Suitable equipment for temporary storage of hazardous waste (Intermediate Bulk Container (IBC), UN HDPE drum, etc.) **if necessary*	Licensed entity for the collection, transport, and management of Hazardous Waste **if necessary*

It is noted that through the electronic services of the Electronic Waste Registry (HMA, https://wrm.ypeka.gr), it is possible to search for the corresponding licensed waste collection and transport entities per Regional Unit, based on the EWC code or codes.

The management of Construction and Demolition Waste (CDW) in the Project area is carried out in accordance with the provisions of Joint Ministerial Decision 36259/1757/E103/2010 through Alternative Management Systems (based on the data of the Hellenic Recycling Agency (EOAN), https://www.eoan.gr) that are active in the area:

- Alternative Management System (AMS) "Recycling of Inert Materials of Northern Greece S.A.", under the trade name **"AN.A.V.E. S.A."**
- AMS "Recycling of C&D Waste of Central Macedonia S.A.", under the trade name **"ANA.KE.M"**
- AMS "Central Greece Recycling System L.P." under the trade name **"S.AN.K.E. L.P."**
- AMS "PEDMEDE ECO Limited Liability Company", under the trade name **"PEDMEDE ECO LLP"**

The quantities of construction waste are analyzed in **Section 6.4.6**.

3.4.1.3 Waste from Drilling Works

the drilling operations, extractive waste is generated — both hazardous and non-hazardous — consisting primarily of drill cuttings and drilling mud.

The drilling muds are classified according to their base component, which may include petroleum derivatives, water, or synthetic substances. The formulation of drilling mud involves a combination of materials and chemical additives to achieve the desired properties (such as specific gravity, viscosity, etc.). For the implementation of the Project, water/lime-based, oil-based, and oil/water-based drilling muds will be used. The drill cuttings consist of fragments of the geological formations penetrated by the drill string. These are separated during the removal of solids from the recirculating drilling mud flow through a series of physical processes and are temporarily stored in special closed containers. Subsequently, the drilling muds are temporarily stored in dedicated mud tanks and are reused during the drilling process until they are no longer needed or have been depleted.

It is noted that the initial section of the drilling will have a diameter of 16 inches and will be drilled from approximately 350 m down to a depth of 2,200 m. In this section, a water-based drilling fluid made from seawater and lime will be used. This fluid is biodegradable and poses no adverse environmental effects. The geological formation in this section is uniform and consists of sandstone and clay layers. Based on all previous drilling operations conducted in the area, no traces of hydrocarbons have ever been observed at these depths. The cuttings from this section will be deposited on the seabed, while below the depth of approximately 2,200 meters, the drilling fluids will return to the surface, where the cuttings will be removed and the drilling mud will be treated. It will be ensured that the components of the water-based muds are not harmful to the environment, and a record of these components along with their safety data sheets (MSDS) will be maintained. Provided these conditions are met, the cuttings produced using these water-based muds may be disposed of on the seabed.

Regarding the cuttings that contain hydrocarbons due to the oil-based mud, they will be separated at the drilling unit and transported to a management system located within the drilling facility. The cuttings undergo centrifugation to remove the majority of the mud and are then dried. The dry cuttings are placed in containers and transported onshore for further management through a certified waste management contractor. The drilling muds are temporarily stored in special mud tanks and reused in the ongoing drilling process until they are no longer needed or have been "exhausted." The exhausted mud is transported to onshore facilities, and the final disposal is carried out by a licensed collection, transport, and waste management entity.

The categories of mining wastes that are estimated to be generated during the construction of the Project, based on the European Waste Catalogue (EWC), are presented in the following table. It is noted that the codes which, besides the number, also have an asterisk (*), represent wastes that are considered hazardous.

Table 3-8: Classification of drilling waste according to the European Waste Catalogue (EWC)

EWC Code	Description of EWC
01	WASTES FROM EXPLORATION, MINING, QUARRYING AND PHYSICAL AND CHEMICAL MINERAL PROCESSING
01 05	Drilling muds and other drilling wastes
01 05 04	Muds and wastes from water drilling (fresh water drilling muds and wastes — applies to water-based mud/fluids)
01 05 05*	Muds and wastes from drilling containing oil (oil-containing drilling muds and wastes)
01 05 06*	Drilling muds and other drilling wastes containing hazardous substances

EWC Code	Description of EWC
01 05 07	Muds and wastes from drilling containing barite, other than those referred to in points 01 05 05 and 01 05 06
01 05 08	*chloride-containing drilling muds and wastes other than those mentioned in 01 05 05 and 01 05 06)*
17	**WASTES FROM CONSTRUCTION AND DEMOLITION (INCLUDING EXCAVATED SOIL FROM CONTAMINATED SITES)**
17 01	Concrete, bricks, tiles and ceramics
17 01 01	Concrete

It is noted that the classification of waste, meaning the determination of hazardous properties through the hazard assessment of the waste and ultimately their classification as hazardous or non-hazardous, will be carried out according to the provisions of the "Commission Communication on technical guidance for the classification of waste" (2018/C 124/01), based on the Waste Framework Directive 2008/98/EC (WFD), which has been incorporated into Greek legislation by Law 4819/2021 (Government Gazette 129/A/23.07.2021), and the CLP[12] Regulation “Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labeling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006.”

Table 3.9 presents the waste management methods for the waste streams that may be generated based on current legislation. It is noted that the overall Waste Management Plan of the Project is presented in **Appendix 17.3.**

Table 3-9: Mapping of the integrated waste management system from drilling operations

EWC Code	Description of EWC	Description of waste type	Waste Stream Management		
			Collection/Temporary Storage on Site	Temporary Storage Equipment on Site	Collection (Transportation) / Treatment[13]
01 05 04	Water drilling muds and wastes	Muds (water-based drilling fluids)	Separate collection of mud / Temporary storage on-site	Mud tanks	Licensed waste collection, transport, and management entity
		Drill cuttings from water-based drilling fluids	Separate collection of cuttings / Temporary storage on-site	-	Disposal on the seabed
		Spacer fluid	separate collection of liquid / temporary storage on-site *if needed	Metal storage tanks 5-25 m^3	Licensed collection, transport and management entity

[12] Current consolidated version: 01/12/2023: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%

[13] “Treatment”: Recovery or disposal operations, including preparation prior to recovery or disposal (Law 4819/2021).

EWC Code	Description of EWC	Description of waste type	Waste Stream Management		
			Collection/Temporary Storage on Site	Temporary Storage Equipment on Site	Collection (Transportation) / Treatment[13]
01 05 05*	Oil-containing drilling muds and wastes	Muds (oil-based drilling muds)	Separate mud collection / Temporary storage on-site	Mud tanks	Licensed collection, transportation and management entity
		Drilling cuttings from oil-based drilling muds	Separate collection of cuttings / Temporary storage on-site	Cutting tanks	Licensed collection, transportation and management entity
		Separator fluid - spacer	Separate liquid collection / Temporary storage on-site *if needed	Metal storage tanks 5-25 m^3	Licensed collection, transportation and management entity
01 05 06*	Drilling muds and other drilling wastes containing hazardous substances	Muds (drilling fluids containing hazardous substances)	Separate mud collection / Temporary on-site storage	Mud tanks	Licensed collection, transport and management entity
		Drill cuttings containing hazardous substances	Separate cuttings collection / Temporary on-site storage	Cutting tanks	Licensed collection, transport and management entity
		Separator fluid - spacer	Separate collection of liquid / Temporary storage within the Project *if needed	Metal storage tanks 5-25 m^3	Licensed entity for collection, transport and management
01 05 07	Drilling muds and wastes containing barite, except those referred to in points 01 05 05 and 01 05 06	Muds containing barite (water-based drilling slurries)	Separate collection of mud / Temporary storage within the Project	Mud tanks	Licensed entity for collection, transport and management
		Drilling cuttings containing barite from water-based drilling slurries	Separate collection of cuttings / Temporary storage within the Project	Cutting tanks	Entity for collection and transport or disposal at approved suitable recipients according to the Project's Environmental Impact Assessment (EIA)
01 05 08	Drilling muds and wastes containing chlorides, except those referred to in points 01 05 05 and 01 05 06	Muds containing chlorides (water-based drilling slurries)	Separate collection of mud / Temporary storage within the Project	Mud tanks	Licensed entity for collection, transport and management
		Drilling cuttings containing chlorides from water-based drilling slurries	Separate collection of cuttings / Temporary storage within the Project	Cutting tanks	Entity for collection and transport or disposal at approved suitable recipients according to the Project's Environmental Impact Assessment (EIA)

EWC Code	Description of EWC	Description of waste type	Waste Stream Management		
			Collection/Temporary Storage on Site	Temporary Storage Equipment on Site	Collection (Transportation) / Treatment[13]
		Separator fluid - spacer	Separate collection of liquid / Temporary storage within the Project *if needed	Metal storage tanks 5-25 m^3	Licensed entity for collection, transport, and management
17 01 01	Concrete	Excess cement slurry	Separate collection of solidified cement / Temporary storage within the Project *if needed	Metal storage container	Reuse within the Project or entity for collection and transport / ESD (Extended Producer Responsibility System)

It is noted that, through the electronic services of the Electronic Waste Registry (EWR)[14], it is possible to search for the corresponding licensed entities for waste collection and transport by EWC code(s) per Regional Unit.

The quantities of drilling wastes are analyzed in **Section 6.4.6.**

3.4.2 Operational Phase

3.4.2.1 Municipal-type waste

3.4.2.1.1 Urban waste

It is estimated that the Project will generate both non-hazardous and hazardous Urban Waste (UW), as well as certain other waste streams subject to alternative management (management through EPR systems).

The categories of waste expected to be generated during the operation of the Project, based on the European Waste Catalogue (EWC) (Decision 2001/118/EC, as amended and in force), are presented in the following table. It should be noted that codes marked with an asterisk (*) represent wastes classified as hazardous.

Table 3-10: Classification of municipal-type waste according to the EWC (European Waste Catalogue)

EWC Code	Description of EWC
15	WASTE FROM PACKAGIN: ABSORBENT MATERIALS, WIPING CLOTHS, FILTER MATERIALS AND PROTECTIVE CLOTHING NOT OTHERWISE SPECIFIED
15 01	Packaging (including separately collected municipal packaging waste)
15 01 01	Packaging made of paper and cardboard

[14] https://wrm.ypeka.gr/eka-search-form

EWC Code	Description of EWC
15 01 02	Plastic packaging
15 01 04	Metal packaging
15 01 05	Composite packaging[15]
15 01 06	Mixed packaging
15 01 07	Glass packaging
15 01 10*	Packaging containing residues of hazardous substances or contaminated by them
19	**19 WASTE FROM WASTE MANAGEMENT UNITS, LIQUID WASTE TREATMENT FACILITIES OUTSIDE THE POINT OF PRODUCTION, AND THE PREPARATION OF WATER INTENDED FOR HUMAN CONSUMPTION AND INDUSTRIAL USE**
19 08	Waste from liquid waste treatment facilities not otherwise specified
19 08 05	Sludges from urban wastewater treatment
20	**URBAN WASTE (HOUSEHOLD WASTE AND SIMILAR WASTE FROM COMMERCIAL ACTIVITIES, INDUSTRIES, AND INSTITUTIONS), INCLUDING SEPARATELY COLLECTED FRACTIONS**
20 01	Separately collected fractions (except those referred to in 15 01)
20 01 01	Paper and cardboard
20 01 02	Glass
20 01 13*	Solvents
20 01 14*	Acids
20 01 15*	Alkaline wastes
20 01 19*	Pesticides
20 01 21*	Fluorescent tubes and other wastes containing mercury
20 01 23*	Discarded equipment containing chlorofluorocarbons
20 01 25	Edible oils and fats
20 01 27*	Paints, inks, adhesives and resins containing hazardous substances
20 01 29*	Detergents containing hazardous substances
20 01 33	Batteries and accumulators referred to in 16 06 01, 16 06 02, or 16 06 03 and mixed batteries and accumulators containing these batteries
20 01 34	Batteries and accumulators other than those referred to in 20 01 33
20 01 35*	Discarded electrical and electronic equipment, except those referred to in 20 01 21 and 20 01 23, containing hazardous components
20 01 36	Discarded electrical and electronic equipment, except those referred to in 20 01 21, 20 01 23, and 20 01 35
20 01 37*	Wood containing hazardous substances
20 01 39	Plastics
20 01 40	Metals
20 03	Other urban wastes
20 03 01	Mixed urban wastes

The following table presents the management method for the urban waste streams based on the requirements of the applicable legislation.

It is noted that the overall Waste Management Plan of the Project is presented in **Appendix 17.3.**

[15]Beverage packaging (e.g., Tetra Pak), snack packaging (e.g., chips, cheese puffs), blister packaging

Table 3-11: Mapping of the integrated waste management system – Municipal Waste

EWC Code	Description of EWC	Description of waste type	Waste Stream Management		
			Collection / Temporary Storage within the Project	Temporary Storage Equipment within the Project	Collection (Transport) / Treatment[16]
20 03 01	Mixed urban waste	Mixed urban waste	Separate collection of mixed urban waste / Temporary storage within the Project	Mixed Waste Bin (plastic bin EN 840-2/5/6, capacity 80 to 1100 liters)	Competent Local Authority (OTA) or collection and transport entity – if not feasible, provision for disposal of the waste by the Project entity into the existing collection system of the OTA / Kavala landfill
19 08 05	Sludges from urban wastewater treatment	Sigma WWTP sludges from the treatment of the Project's urban wastewater	-	-	Licensed entity for collection, transport, and management
15 01 01	Packaging made of paper and cardboard	Mixed recyclable materials made of paper/cardboard, plastic, metal and glass[17]	Separate collection of recyclable materials / Temporary storage within the Project	Recyclable Materials Bin (plastic bin EN 840-2/5/6, capacity 80 to 1100 liters))	Competent Local Authority (OTA) or collection and transport entity – if not feasible, provision for disposal of the waste by the Project entity into the existing collection system of the OTA / Recycling Sorting Center (KDAY) of Xanthi
15 01 02	Plastic packaging				
15 01 04	Metal packaging				
15 01 05	Composite packaging[18]				
15 01 06	Mixed packaging[19]				
15 01 07	Glass packaging				
20 01 01	Paper and cardboard				
20 01 02	Glass				
20 01 39	Plastics				
20 01 40	Metals				
20 01 25	Edible oils and fats	Edible oils and fats. No permanent production is expected during the	Separate collection of edible oils and fats / Temporary	Collection container for edible oils and fats (Intermediate Bulk Container	Licensed entity for collection, transport, and management

[16] "Treatment": Recovery or disposal operations, including preparation prior to recovery or disposal (Law 4819/2021).

[17] https://www.eoan.gr/%ce%b5%ce%bd%ce%b7%ce%bc%ce%ad%cf%81%cf%89%cf%83%ce%b7/%cf%84%ce%b9-%cf%85%ce%bb%ce%b9%ce%ba%ce%ac-%ce%b1%ce%bd%ce%b1%ce%ba%cf%85%ce%ba%ce%bb%cf%8e%ce%bd%ce%bf%cf%85%ce%bc%ce%b5/

[18] Beverage packaging (e.g., Tetra Pak), snack packaging (e.g., chips, cheese puffs), blister packaging.

[19] Composite packaging: packaging made up of two or more layers of different materials which cannot be separated by hand and form a single integrated unit consisting of an inner receptacle and an outer casing, which is filled, stored, transported, and emptied as a single unit, DIRECTIVE (EU) 2018/852.

EWC Code	Description of EWC	Description of waste type	Waste Stream Management		
			Collection / Temporary Storage within the Project	Temporary Storage Equipment within the Project	Collection (Transport) / Treatment[16]
		implementation of the Project. In any case, and if necessary, the quantities produced should be temporarily stored in the Project's temporary waste storage area.	storage within the Project *if needed	(IBC) or UN HDPE drum, capacity from 30 to 220 liters) *if needed	*if needed
20 01 23*	Discarded equipment containing chlorofluorocarbons (CFCs)	Waste Electrical and Electronic Equipment (WEEE). No permanent production of WEEE is expected during the implementation of the Project. In any case, and if necessary, the quantities produced should be temporarily stored in the Project's temporary waste storage area	Separate collection of WEEE / Temporary storage within the Project *if necessary	WEEE Bin (plastic bin EN 840-2/5/6, capacity 80 to 1100 liters, or WEEE Bin from a contracted Producer Responsibility Organization (PRO)) *if necessary	Collection and transport entity / WEEE PRO – if not feasible, provision should be made for the disposal of the waste by the Project entity at appropriate WEEE recycling points of the PROs. *if necessary
20 01 35*	Discarded electrical and electronic equipment, excluding those referred to in 20 01 21 and 20 01 23, which contain hazardous components				
20 01 36	Discarded electrical and electronic equipment, excluding those referred to in 20 01 21, 20 01 23, and 20 01 35				
20 01 33	Batteries and accumulators referred to in 16 06 01, 16 06 02, or 16 06 03 and mixed batteries and accumulators containing these batteries	Waste Electrical Cells (batteries) & Accumulators (WCA)	Separate collection of WCA / Temporary storage within the Project	WCA Bin (WCA Bin from a contracted Producer Responsibility Organization (PRO))	Collection and transport entity / WCA PRO
20 01 34	Batteries and accumulators other than those referred to in 20 01 33				
20 01 21*	Fluorescent tubes and other mercury-containing waste	Waste from Lighting Equipment, Lamps, and Small WEEE Appliances. Permanent production of WEEE during the Project implementation is not expected. In any case, if necessary, the produced	Separate collection of lighting equipment, lamps, and small appliances / Temporary storage within the Project *if necessary	Lighting-Lamp Bin (WEEE Bin from a contracted Producer Responsibility Organization (PRO)) *if necessary	Collection and transport entity / WEEE PRO – if not feasible, provision should be made for disposal of the waste by the Project entity at appropriate WEEE recycling points of

EWC Code	Description of EWC	Description of waste type	Waste Stream Management		
			Collection / Temporary Storage within the Project	Temporary Storage Equipment within the Project	Collection (Transport) / Treatment[16]
		quantities must be temporarily stored in the Project's temporary waste storage area.			the PROs. *if necessary
20 01 13*	Solvents	Small Quantities of Hazardous Waste in Municipal Waste (MPEA): Permanent production during the project implementation is not expected. In any case, if necessary, the generated quantities must be temporarily and separately stored for each type, in the project's temporary waste storage area.	Separate collection / Temporary storage within the Project *if necessary	Suitable separate container for each type (plastic container EN 840-2/5/6, capacity 80 to 1100 lt or UN HDPE drum, UN metal drum, etc.) *if necessary	Licensed waste collection, transport, and hazardous waste management operator *if necessary
20 01 14*	Acids				
20 01 15*	Alkaline wastes				
20 01 19*	Pesticides				
20 01 27*	Paints, inks, adhesives, and resins containing hazardous substances				
20 01 29*	Detergents containing hazardous substances				
20 01 37*	Wood containing hazardous substances				
15 01 10*	Packaging containing residues of hazardous substances or contaminated by them	Empty containers of paints, solvents, etc. Permanent production during the Project implementation is not anticipated. In any case, if the need arises, the quantities produced must be temporarily and separately stored by type in the Project's temporary waste storage area and managed as hazardous waste.	Separate collection / Temporary storage within the Project *if necessary	UN HDPE drum, UN metal drum *if necessary	Licensed hazardous waste collection, transport, and management entity *if necessary

It is noted that through the electronic services of the Electronic Waste Registry (HMA)[20], it is possible to search for the corresponding licensed waste collection and transportation entities by the code or codes of the European Waste Catalogue (EWC) per Regional Unit.

The quantities of municipal waste are analyzed in **Section 6.5.5.**

[20] https://wrm.ypeka.gr/eka-search-form

3.4.2.1.2 Wastewater and other aqueous wastes

The water extracted from the reservoir to provide an active pressure management method for the reservoir will be treated at the Delta platform and discharged into the sea through a disposal caisson. All the extracted water is expected to undergo treatment similar to the current produced water at the existing facilities on the Delta platform, without the need for new installations on the platform. It is important to note that this assumption is subject to further evaluation once samples of the groundwater are obtained.

Rainwater on the platforms, which may potentially contain hydrocarbons, enters the closed drainage system through the bunded areas. To minimize these quantities, the size of the bunded areas has been reduced and protected from rainfall where possible.

3.4.2.2 Operational / Maintenance Waste of the Facility

It is estimated that during the operation and maintenance of the underground CO_2 storage facility, both non-hazardous and hazardous waste will be generated.

Given the early stage of the Project study, it is not possible to accurately estimate the types and quantities of hazardous and non-hazardous waste that may be generated. However, it can be noted that hazardous waste from the existing facilities is produced on the Delta platform. These are wastes generated during the general maintenance of the facilities, which lasts 15 days every 30 months. The hazardous waste generated from the cleaning of containers V-101 A/B, V-107, and V-102 related to water treatment on the Delta platform consists of oily sludge (mixtures of heavy hydrocarbons mainly containing asphaltenes), rags, absorbent materials, etc. Both hazardous and non-hazardous waste may arise from the processing of CO_2.

Indicatively, the categories of waste estimated to be generated from the operation and maintenance of the underground storage facility, based on the European Waste Catalogue (EWC), are presented in the following table. It should be noted that codes marked with an asterisk (*) represent waste classified as hazardous.

Table 3-12: Indicative types of waste from the operation and maintenance of the underground facility according to the EWC (European Waste Catalogue)

EWC Code	Description
13	WASTE OILS AND WASTE LIQUID FUELS (excluding edible oils and those included in chapters 05, 12, and 19)
13 02	waste oils from engines, gearboxes and lubrication
13 02 05*	non-chlorinated waste oils from engines, gearboxes and lubrication based on mineral oils
14	WASTES FROM ORGANIC SUBSTANCES USED AS SOLVENTS, REFRIGERANTS AND PROPELLANTS (excluding chapters 07 and 08)
14 06	waste from organic substances used as solvents, refrigerants and foam/aerosol propellants
14 06 01*	chlorofluorocarbons, HCFC, HFC
14 06 03*	other solvents and solvent mixtures
15	WASTES FROM PACKAGING; ABSORBENT MATERIALS, WIPING CLOTHS, FILTER MATERIALS AND PROTECTIVE CLOTHING NOT OTHERWISE SPECIFIED

EWC Code	Description
15 02	absorbent materials, filter materials, wiping cloths and protective clothing
15 02 02*	absorbent materials, filter materials (including oil filters not otherwise specified), wiping cloths, protective clothing contaminated by hazardous substances
16	WASTES NOT OTHERWISE SPECIFIED IN THE CATALOG
16 05	gases in pressure containers and discarded chemical substances
16 05 06*	laboratory chemical materials consisting of or containing hazardous substances, including mixtures of laboratory chemical materials
16 10	aqueous liquid wastes intended for off-site treatment
16 10 01*	aqueous liquid wastes containing hazardous substances
16 10 02	aqueous liquid wastes other than those included under item 16 10 01
17	WASTES FROM CONSTRUCTION AND DEMOLITION
17 04	metals (including their alloys)
17 04 05	iron and steel
17 04 09*	metal wastes contaminated with hazardous substances

The management of the above-mentioned hazardous and non-hazardous wastes, as well as any other wastes potentially generated during the operation and maintenance phase of the facility, will be carried out in accordance with the applicable legislation. The generated wastes will be collected separately by type in containers suitable for their safe temporary storage on-site, following safety and environmental protection regulations and their management will be performed by licensed waste collection, transport and management entities.

Hazardous wastes such as rags, absorbent materials, etc., related to this Project and originating from the shared use of the water separation system of the Delta platform, e.g., water separator V-102, are already included in the existing operation of the Delta platform.

3.4.3 Decommissioning Phase – Restoration

Waste management during the decommissioning and dismantling phase will be carried out in accordance with the applicable legislation. The waste generated will be collected separately by type in containers suitable for their safe temporary storage at the Project site, in compliance with safety and environmental protection regulations, and their management will be carried out by licensed waste collection, transport and management entities.

At this stage of the Project, it is not possible to estimate the types and quantities of waste generated. Indicatively, the most significant source of waste is the removable equipment, the management of which will be carried out appropriately depending on the decommissioning method applied. Priority in its management will be given to reuse, followed by recycling, and finally the safe disposal of materials that cannot be reused or recycled.

Also, a waste stream during decommissioning arises from the growth of marine organic matter in the support pipelines, the quantities of which will be possible to estimate once the exact time of the Project's shutdown is known.

Apart from the above, it is expected, indicatively, the production of municipal waste, packaging waste, construction and demolition waste (CDW), WEEE (Waste Electrical and Electronic Equipment), waste oils, etc.

3.5 WASTE OUTPUTS

3.5.1 Construction Phase

Atmospheric pollutants from the construction activities of the proposed Project arise from:

- Exhaust gases from the operation of the drilling rig during drilling activities. Emissions into the atmosphere will be produced by the Jack-up drilling rig and the support vessels during drilling operations. Given the limited emissions and the distance from receptors, these emissions are not considered to significantly contribute to the deterioration of air quality.
- Atmospheric pollutants from the construction of the CO_2 pipeline. The main sources of gaseous emissions during pipeline construction will be the diesel engines and generators of the vessels. The emissions include greenhouse gases (GHGs): carbon dioxide (CO_2), methane (CH_4), and nitrogen oxide (NO), as well as contaminants of primary concern (COPC): carbon monoxide (CO), nitrogen oxides (NOx), sulfur oxides (SOx), and particulate matter (PM).
- Atmospheric pollutants from the construction of the onshore facilities
    - Exhaust gases from employee transportation to and from the Project site.
    - Exhaust gases from truck movements to the Project site and construction machinery within the Project area.
    - Dust emissions from truck movements to the Project site and construction machinery within the Project area.

Section 6.4.7 calculates the emissions of major air pollutants (CO, HC, NO_x, SO_2, TSP) and greenhouse gas emissions (CO_2) from the above activities during the Project's construction phase.

3.5.2 Operational Phase

Emissions into the atmosphere during the operation of the Project will mainly come from the operation of trucks transporting the CO_2 loads, the operation of cranes, the operation of supply vessels, as well as the processing of bulk CO_2 loads (heating and pumping).

Typical air pollutant emissions from transport trucks include pollutants such as carbon dioxide (CO_2), nitrogen oxides (NO_x), particulate matter (PM), volatile organic compounds (VOCs), sulfur dioxide (SO_2), and carbon monoxide (CO). These emissions result from the fuel consumption in the truck engines.

Air pollutant emissions from crane operations arise from fuel consumption in their engines, similar to trucks.

Emissions from the operation of supply vessels used for transporting CO_2 cargo and personnel include exhaust gases from the vessel's movement and engine operation, as well as emissions from fuel pumping and other equipment.

Section 6.5.6 calculates the emissions of main air pollutants (CO, HC, NO_x, SO_2, TSP) and greenhouse gases (CO_2) from the above activities during the Project's operational phase.

3.5.3 Decommissioning Phase – Restoration

Atmospheric emissions during the decommissioning stage will mainly originate from the operation of supply vessels and equipment/waste transport ships. These emissions will include exhaust gases from vessel movement and engine operation, as well as emissions from internal combustion engines of other equipment.

3.6 NOISE AND VIBRATION EMISSIONS

3.6.1 Construction Phase

During the construction phase of the Project, noise emissions from activities at the onshore facilities will mainly originate from the operation of trucks and construction machinery, based on the indicative construction site composition.

Certain phases of the drilling operations could generate noise levels exceeding the natural background noise levels in the marine environment. Although the Jack-up type drilling rig will introduce elevated noise levels above the natural baseline, these levels are not expected to be higher than the noise produced by other marine vessels operating in the area, including those servicing the existing platforms.

The pipeline construction vessel and the accompanying/support vessels will generate underwater noise during operations, primarily due to the operation of machinery and equipment (propellers, thrusters, engines – motors).

Section 6.4.8 provides calculations of the noise emissions and vibrations resulting from the above activities during the construction phase of the Project.

3.6.2 Operational Phase

During the operational phase, vibrations or noise may occur. Vibrations may result from the operation of rotating machinery such as compressors or pumps. While operational vibrations are generally less intense than those caused by construction activities, they may pose risks to surrounding infrastructure or sensitive equipment. Operational noise emissions primarily originate from the continuous operation of machinery and equipment on the platforms (compressors/pumps, electric heaters).

Although noise emissions during the operational phase are continuous, their prevention and mitigation are feasible through equipment design modifications, installation of sound insulation in noisy parts of the facilities, and routine equipment maintenance practices.

3.6.3 Decommissioning – Restoration Phase

The abandonment of the new CO_2 storage facilities is expected to have limited impacts, as the installations will either be lifted and relocated to a new site or dismantled onshore. Therefore, noise emissions during the decommissioning phase will primarily originate from the activities of support vessels operating in the area, including those serving the existing platforms.

3.7 EMISSIONS OF ELECTROMAGNETIC RADIATION AND RADIOACTIVITY

During the construction phase, specifically during the drilling of the wells, the Naturally Occurring Radioactive Material (NORM) is not expected to differ from that associated with the Prinos formations. Most of the drilling cuttings historically produced from the Prinos wells have radioactivity levels comparable to background levels.

During the operation and decommissioning – restoration phases, emissions of electromagnetic radiation and radioactivity are not expected.

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4 OBJECTIVE AND PURPOSE OF PROJECT IMPLEMENTATION

4.1 OBJECTIVES AND PURPOSE

4.1.1 Objective and Purpose of Project Implementation

In light of the **energy transition**, the reduction of Greenhouse Gas (GHG) emissions, and ultimately the achievement of **climate neutrality**, EnEarth has proceeded with the design of a full-scale CO_2 Storage facility at Prinos (the "Project"), capable of storing a significant amount of CO_2, resulting in a correspondingly notable reduction of atmospheric CO_2 both at the regional and national level. The proposed CO_2 Storage Project at Prinos is expected to play a significant role in achieving the national targets for reducing greenhouse gas (GHG) emissions, as well as strongly contribute to fulfilling the country's commitments and obligations under international conventions and agreements related to limiting GHG emissions and achieving climate neutrality. It represents the first such initiative in Greece and the Eastern Mediterranean for CO_2 storage.

The Project aims to provide CO_2 storage services for emissions generated by both local and remote industrial activities of third parties. By operating as a central storage hub for Greece and the Eastern Mediterranean, the Project will receive and store CO_2 from emitters who are unable to significantly reduce their emissions through other initiatives. The operation of the facility is planned to be developed in two (2) distinct phases (**Phase 1 & Phase 2**), for reasons of project viability, scalability, and adaptability to the evolving needs and supply of CO_2 producers. Each of these phases is expected to achieve significant reductions in atmospheric CO_2. It is important to note that the present Environmental Impact Assessment (EIA) Study concerns Phase 1 of the Project, which is described in the following sections of this EIA. The environmental permitting of modifications and subsequent phases of the Project, which are mentioned by name below, is not within the scope of this study and will be carried out at the appropriate stage of their design maturity. This will be done through new and standalone Environmental Impact Assessment (EIA) studies, which will appropriately amend the Project, having assessed the full range of environmental impacts for each parameter under consideration.

More specifically, the capacities of the proposed Project per phase are as follows:

- Phase 1: The initial nominal capacity of the Project will be up to **1 million tonnes per annum (MTPA)** for a period of 20 years (starting at the end of 2025 or early 2026). The CO_2 will primarily be delivered in bulk via a third-party pipeline arriving on-site under suitable conditions for injection. Small quantities of CO_2 will also be received at the onshore Sigma facilities by truck through pilot projects.
- Phase 2: The Project is expected to gradually expand to a final nominal capacity of up to **3 million tonnes per annum (MTPA)**. The facility will be modified to accept liquefied CO_2, which will be delivered via marine carriers to a newly constructed jetty. For this purpose, offshore mooring and unloading facilities for the liquefied CO_2 will be built, along with new storage and processing

installations (pumping, heating) within the operational area of the Sigma plant. The liquefied CO_2 will be temporarily stored, processed onshore, and then transported to the offshore facilities via the pipeline constructed during Phase 1.

To support the capacity of Phase 2, further upgrades to the Project's facilities will be required as follows:

- Upgrade of the onshore liquefied CO_2 storage and handling facilities, the mooring and unloading facilities for liquefied CO_2, and auxiliary installations.
- Potential installation of a new platform to accommodate the maximum capacity of Phase 2.
- At least four new CO_2 injection wells and four new water production wells.
- Possible expansion of the water treatment facility.

However, it is important to note that **the present Environmental Impact Assessment (EIA) Study concerns Phase 1 of the Project,** which is described in the following sections. The permitting of the next phase of the Project (Phase 2) is not within the scope of this study and will be carried out at the appropriate stage of its development.

4.1.2 Project Feasibility

The feasibility and sustainability of the Project are confirmed and strengthened by the long-standing successful operation of Energean's onshore and offshore oil and gas facilities, a related company of EnEarth, which has held the exclusive rights for oil and gas exploration and production in Prinos since 2007. The proposed CO_2 storage facility will be integrated into the existing infrastructure, operating as an independent unit. The extensive knowledge and experience from the existing facilities and wells will be incorporated into the new design, ensuring excellent integration and functionality.

From a technical standpoint, the viability of the Project is further strengthened by the preliminary technical feasibility studies already conducted by Energean. Specifically, the following studies have been carried out to date:

- **Preliminary Front-End Engineering Design (Pre-FEED)** study with the following objectives: selection of the general design concept, comparison of techno-economic risks between technically feasible scenarios, cost estimation, project implementation scheduling, and evaluation of scalability from 1 MTPA to 3 MTPA. The Pre-FEED study was completed in November 2022.
- **Subsurface/Storage Site Studies** aimed at investigating and simulating the subsurface related to the Prinos storage field. These studies examined the following issues: CO_2 storage and permanent sequestration, storage constraints, injection strategies, water production, profiles (water, CO_2, water and hydrocarbon transport, etc.). The initial Subsurface/Storage Site Studies were completed in December 2022 and were carried out in three stages, evaluating different aspects of the Project:
- **Stage I – Preliminary Risk:** The storage field was evaluated based on modeling the migration of the CO_2 plume within the basin. Additionally, an analysis of potential CO_2 leaks through faults was conducted, and the associated risk of CO_2 leakage was assessed. Preliminary leakage scenarios were also examined and evaluated, total CO_2 storage volumes were calculated and an initial risk register was created.

- **Stage II – Storage Site & Storage Complex Characterization:** Static models were applied to the CO_2 storage site and the CO_2 storage complex.
- **Stage III –** Three-dimensional simulation models were developed, and various CO_2 storage development scenarios were designed. 3D and 4D geomechanical models were simulated, and the maximum injection pressure was determined to prevent CO_2 leakage risks. A comprehensive risk register was compiled for the subsurface and the storage field.
- **Geochemical study** evaluating the geochemical reaction of CO_2 with the minerals of the rocks and the fluids of the geological formation, which demonstrated that the expected geochemical changes will be minimal due to the characteristics of the geological formations.
- Additionally, a study was completed to assess the existing old wells in order to determine the likelihood that they could provide potential leakage pathways for CO_2.
- The technical team of Energean has conducted a series of **specialized studies and three-dimensional subsurface simulations** to evaluate CO_2 storage within the geological formations beneath the Prinos reservoir, including the underlying aquifer. These simulations also demonstrate the impermeable overlying caprock, the structural boundaries consisting of bounding faults and geological terminations and the volume of the aquifer.
- The technical team of Energean is developing and implementing scenarios involving the estimated CO_2 to be stored, potential CO_2 sources, the CO_2 transport network, and related synergies. During the first half of 2024, a series of additional subsurface studies were carried out, which advanced the maturity of the Project and helped identify and mitigate its associated risks.

The feasibility of the Project has also been assessed from an economic perspective. An economic analysis, including calculations of Net Present Value (NPV), Internal Rate of Return (IRR), payback period, and other relevant financial indicators, has been conducted in order to determine the Project's financial performance.

4.1.3 Expected Benefits at Local, Regional and National Level

The expected benefits from the exploitation of the reservoirs at the **local** and **regional** level can be considered significant and may be summarized as follows, distinguished into **direct** and **indirect** benefits:e

- **Regarding the direct benefits** arising from the implementation of the Project, the following are noted:
  - Employment opportunities for the local labor market. Specifically, the professions expected to be engaged during the construction works and operational activities of the proposed Project include engineers, geologists and geophysicists, surveyors, designers, machine operators, technicians, drivers, material transporters, security personnel, laborers and others.
  - Supply of construction materials for the Project and goods and services for the living needs of the workers from the local market. Specifically, within the framework of the Project's implementation, purchases will be made from the local market for building and construction materials (e.g., concrete, aggregates, etc.), as well as goods and services for the workers' living needs (e.g., food products, hospitality services, etc.).
- **Regarding the indirect benefits** arising from the creation of the Project, the following are noted:

- The development of ancillary activities in the secondary sector (such as catering, apartment rentals, provision of services like maintenance, inspections, supply of materials and goods from the local market, etc.) will significantly contribute to the economic development of the Kavala Regional Unit.
- To estimate the economic benefit from the development of the proposed Project in the Kavala Regional Unit and the local community, an indicative example is provided based on the company's existing activities in Kavala. There, the local community receives approximately €12 million annually, primarily through the salaries of about 200 employees who mainly spend locally, as well as through supplies of materials, goods, transportation, room and apartment rentals, machinery maintenance and other related services.
- Creation of additional sources of development, employment, and income, tailored to the needs and orientation of the local community. Based on international experience as well as the company's activity to date in Kavala, for every direct job created, approximately three more jobs are generated within a local community hosting development of facilities similar to those of the proposed Project, which includes the operation of offshore infrastructures.
- Implementation of Corporate Social Responsibility (CSR) initiatives in coordination with local authorities and based on an assessment of local needs, aimed at supporting the social development of the Regional Unit of Kavala (strengthening social structures, environmental actions, sports activities, etc.).
- The infrastructure and networks in the wider area are expected to be upgraded, which will have a positive impact on the daily lives of the citizens.
- The protection of public health, as well as the integrity of public infrastructure and private properties, is expected to be enhanced due to the mitigation of climate change phenomena, to which the Project contributes both in slowing down these phenomena and addressing their related impacts.

The expected benefits from the implementation of the Project at the **national level** can be considered significant and can be summarized as follows:

- Reduction of CO_2 emissions from industrial processes. The construction and operation of the proposed Project is expected to directly contribute to the reduction of CO_2 emissions from industrial processes, as documented in the revised National Energy and Climate Plan (revised NECP, August 2024), where it is noted that:

"….The reduction of CO_2 emissions from industrial processes, where two-thirds are attributed to the production of construction materials, is facilitated in the medium term by the capture of emitted CO_2, its use for synthetic fuel production (up to 2040), and **storage in geological formations**. Nevertheless, the complete elimination of these emissions by 2050 appears challenging and requires further analysis….

…

Carbon dioxide capture from industrial flue and exhaust gases is the only way to reduce the carbon footprint of certain industrial sectors, at least until alternative technologies based on production or product redesign are developed. The captured CO_2 can be used for the synthesis of synthetic fuels at least until 2040, according to EU environmental legislation (to reduce the use of new fossil fuels in transport). It can also be stored in sealed geological formations.

In this context, and given that the industry is subject to international competition, investment incentives are provided for the capture of CO_2 emitted from these industrial facilities (in Greece, refineries and cement industries).

Three projects have already been approved for co-financing by the Innovation Fund: i) The IRIS project for the capture of approximately 0.5 Mt of CO_2 annually at a hydrogen production unit using natural gas reforming at a refinery in Corinth, ii) the IFESTOS project for the capture of 1.9 Mt of CO_2 annually at a cement plant in Kamari, Viotia, and iii) the OLYMPUS project for the capture of 1.0 Mt of CO_2 annually at a cement plant in Milaki, Evia. At the same time, the first CO2 storage unit in Prinos, Kavala has already been included in the TAA for co-financing and is progressing through the permitting process. During the first phase, it will store 1 Mt of CO_2, and at full operation, 3 to 4 Mt of CO_2. The total storage capacity is estimated at 60-70 Mt of CO_2. The first phase (with a capacity of approximately 1 Mt per year) is planned to be completed by the end of 2025, and the second phase (full capacity) by the end of 2027. The completion of the relevant licensing and regulatory framework for the capture, transport, use, and storage of CO_2 is also underway. Responsibility for supervising the construction and operation of these projects has also been assigned to a specialized public company (EDEYEP).

- Apart from the reduction of CO_2 emissions from industrial processes, which is facilitated in the medium term by the storage of captured CO_2 in geological formations, the proposed Project is expected to contribute to the **strengthening of the national economy**, especially if it is considered as part of the broader national strategy aimed at developing more "green" and "climate-friendly" development models. In the event of the Project's implementation, both direct economic benefits at the national level (such as tax revenues, related fees, etc.) and indirect benefits are expected, as the Project ensures that the transition to a climate-friendly development model can be achieved in a less abrupt manner, which is anticipated to reduce the economic cost of the transition.
- The operation of the CO_2 storage Project also entails **significant savings of financial resources**, due to the reduction of the shadow cost of carbon. In the case of the Project, the balance of the related CO_2 emissions is negative, as shown by the carbon footprint analysis (see Section 4.5.1). It should be noted that these are emissions whose release into the atmosphere is avoided through the operation of the aforementioned storage Project. Therefore, they constitute "removals" of carbon emissions from the existing energy system, which is costly both economically and environmentally, based on the shadow cost of carbon (see Section 4.5.2).
- The operation of the proposed CO_2 capture and storage Project is expected to contribute to the functioning of both the **Compliance Market and the Voluntary Carbon Offset Credit Market**, as proposed within the framework of the revised National Energy and Climate Plan (NECP). More specifically, within the framework of the revised NECP, the development of the Voluntary Carbon Offset Credit Market in Greece is being explored, as this measure will further support a series of objectives:
    - «...It will provide private sector companies with additional opportunities to achieve net-zero emissions, beyond those required by the EU Emissions Trading System (EU ETS).

- It will create opportunities to support local efforts for reducing and removing carbon emissions and will also strengthen capital flows into programs that enable carbon offsetting.
- The voluntary market will strengthen the response to climate change issues and the implementation of policies for the reduction and avoidance of greenhouse gas emissions.

With the establishment of a Voluntary Carbon Offset Credits Market, for the first time within the EU, access will be provided to products and services related to voluntary CO_2 emission offsetting, in addition to mandatory participation in the EU Emissions Trading System (EU ETS). ..."

From the above, it follows that the construction and operation of the Project is expected to strongly and positively contribute to the functioning of both the Compliance Market and the Voluntary Carbon Market mechanisms for CO_2 emission offsetting.

- **Achievement of the European and International Obligations of the country**, which have been incorporated into the National Strategy for Climate Change Adaptation (NSCCA) (Article 45 of Law 4414/2016 (Government Gazette A' 149)). The NSCCA sets out the general objectives, guiding principles, and means of implementing a modern, effective, and developmental strategy for adapting to climate change within the framework defined by the United Nations Framework Convention on Climate Change, European policies and international experience. In order to mitigate Climate Change, Greece is fully aligned with the policies and commitments of the European Union. Within this framework, the target has been set to reduce net greenhouse gas emissions by 55% by the year 2030 compared to the emissions of 1990 at the European level.

  The revised National Energy and Climate Plan (NECP) foresees that this target for the year 2030 will be achieved at approximately 52% reduction without taking into account the CO_2 absorption from the Land Use, Land Use Change, and Forestry (LULUCF) sector, and that the reduction could reach up to 59% if a greater contribution from LULUCF is achieved. This target is significantly higher than that of the existing NECP. The NECP target for the reduction of greenhouse gas emissions by 2040 is set at -72% without considering LULUCF and can reach -80% when including the contribution of the LULUCF sector. The corresponding target for 2050, according to the simulated scenario, is -88% without LULUCF and -98% with LULUCF, a performance that closely approaches the climate neutrality goal for 2050.

  However, as stated in the NECP and its corresponding revision, "...there will still be small emissions in certain sectors by 2050 where complete elimination is difficult. These emissions require offsetting through negative emissions (i.e., removal of CO_2 from the atmosphere), primarily through absorption within the framework of LULUCF...".

  According to the Long-Term Strategy for 2050 by the Ministry of Environment and Energy (YPEN), "climate neutrality" (Net Zero) is equivalent to achieving zero total greenhouse gas emissions, where zero emissions mean the balance of positive and any negative emissions. "Carbon neutrality" is a similar concept but refers only to CO_2 emissions. Climate neutrality of an energy form requires zero greenhouse gas emissions at all stages of production, conversion, transportation, and use. Permanent storage of greenhouse gases, either in underground formations or in materials, is considered to ensure climate neutrality, while the storage of carbon dioxide captured from the air or biomass is regarded as a negative emission.

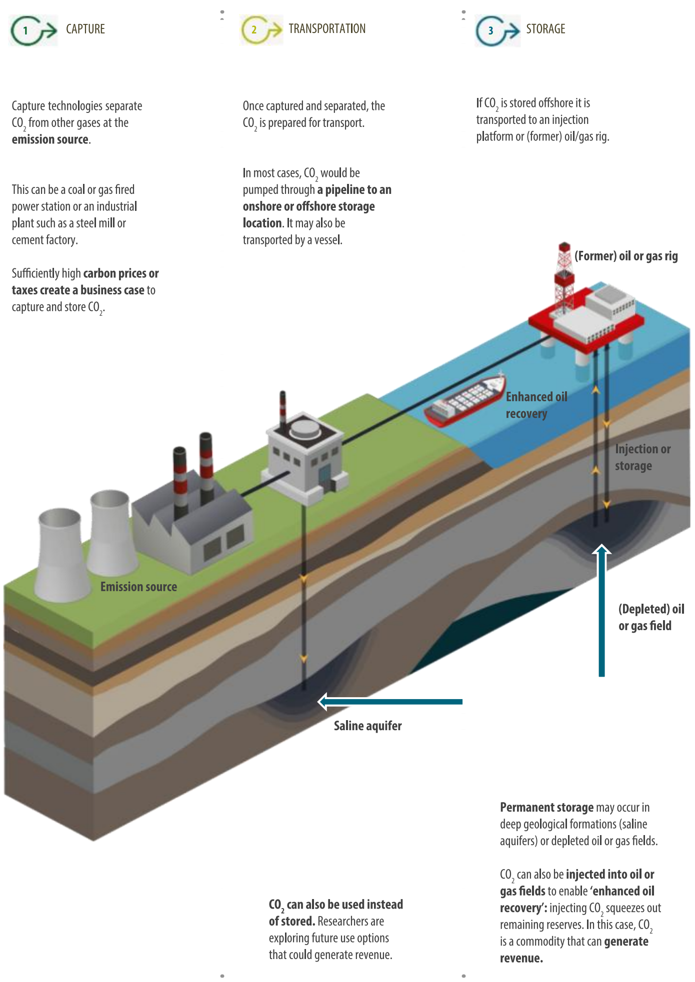
The operation of the proposed Project also entails significant storage of CO_2 quantities, as the related CO_2 emissions have a negative balance (see Section 4.5.1). As is evident, the Project's operation contributes both to achieving the overall greenhouse gas emissions reduction targets and climate neutrality by 2050, as well as to offsetting any remaining emissions beyond 2050.

- It is also important to mention that the "Prinos CO_2 Storage" project has been included in the **6th list of Projects of Common Interest (PCI),** according to the "Commission Delegated Regulation (EU) 2024/1041 of 28 November 2023, amending Regulation (EU) 2022/869 of the European Parliament and of the Council regarding the Union list of projects of common interest and mutual interest," and specifically within Priority Thematic Area 13 (Cross-border carbon dioxide network). Projects of Common Interest (PCI) are key infrastructure projects aimed at completing the European internal energy market and contributing to the achievement of the EU's energy and climate goals. These goals include providing affordable, secure, and sustainable energy for all Europeans and achieving a climate-neutral economy by 2050.
- According to the European Union Council's Executive Decision "on the approval of the assessment of **Greece's Recovery and Resilience Plan**" (10152/06.07.2021), the first phase of the Project's development is eligible for funding under the Recovery and Resilience Facility (RRF) (Investment: Produc-E Green, measure ID: 16831).
- To The CO_2 Storage Project is expected to positively contribute to reshaping the country's development direction, adding an important alternative development hub that will significantly support the advancement of more "green" and "climate-friendly" development models. The implementation of sustainable and environmentally friendly projects (within which the Project, as it concerns a CO_2 Storage Unit, is included) constitutes an interesting and realistic option that will positively contribute to the productive restructuring of the country.

4.2 DEVELOPMENT OF CCS: SUMMARY OVERVIEW

4.2.1 History – International Experience in CCS Projects

The idea of carbon dioxide capture and storage (CCS) began to take shape in the 1960s, when it was discovered that CO_2 could be profitably used for Enhanced Oil Recovery (EOR). Shortly thereafter, towards the end of the 20th century, the concept of using CCS technology as a potential solution to mitigate climate change by reducing CO_2 emissions from industrial sources started to develop. The CCS process is briefly outlined below:



(Source: https://op.europa.eu/webpub/eca/special-reports/climate-action-24-2018/el/)

Figure 4–1: Capture and Storage of CO_2

The initial research and the first pilot EOR projects were conducted in the United States and Canada. The first large-scale project, the "Scurry Area Canyon Reef Operating Committee" (SACROC), was implemented by Chevron in Scurry County, Texas, where over 175 million tons (Mt) of CO_2 were stored from 1972 to 2009 at SACROC[1].

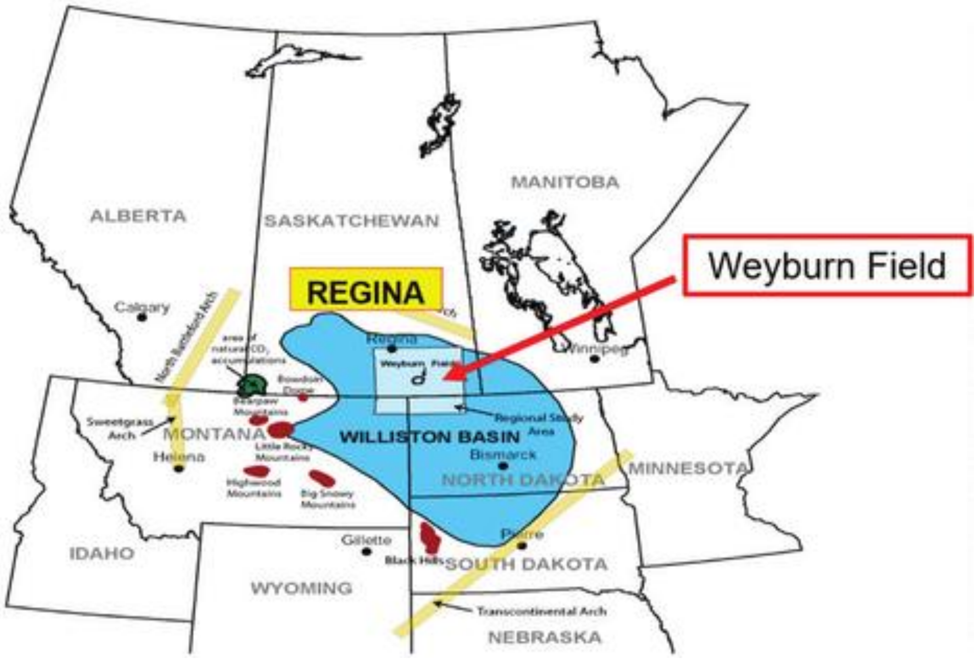
The concept of carbon dioxide (CO_2) capture, transport, and storage in its modern form—as a means of reducing anthropogenic CO_2 emissions—was first proposed by Cesare Marchetti in 1977[2]. The CCS project "Sleipner," which began in 1996 in Norway and the Greenhouse Gas Research and Development Programme of the International Energy Agency (IEAGHG), the "Weyburn–Midale CO_2 Monitoring and Storage Project"

[1] Carbon Capture and Storage: History and the Road Ahead, https://doi.org/10.1016/j.eng.2021.11.024

[2] C. Marchetti, C. On geoengineering and the CO2 problem. published 1977 in Climatic Change, 1 (1), 59-68. 10.1007/BF00162777

(WMP), which started in 2000 in Canada, were among the first large-scale projects for the capture and storage of anthropogenic CO_2[3] emissions.

WMP: This international research project, which began in 2000 and was completed in September 2012, studied CO_2 injection and geological storage in depleted oil reservoirs. It was conducted in conjunction with two commercial CO_2-EOR projects near Weyburn, Saskatchewan. The first phase of the project, completed in 2004, aimed to verify that the Weyburn oil reservoir could safely store CO_2, while the second phase sought to contribute to the establishment of a framework for measuring and monitoring the stored CO_2 and to promote the global implementation of geological storage. As part of the WMP, approximately 22 Mt of CO_2 were injected between 2000 and 2012, making it one of the first studies in the world to examine CO_2 storage in geological reservoirs. The project was able to provide evidence for the safe geological storage of CO_2 and deliver real-world data and scientific insights for the development of advanced CO_2 measurement, monitoring and verification technologies[4,5,6]



(Source: CO_2-capture research and Clean Energy Technologies Research Institute (CETRI) of University of Regina, Canada: history, current status and future development, DOI:10.1093/ce/zkab056)

Figure 4–1: WMP Research and Development Program of the IEAGHG

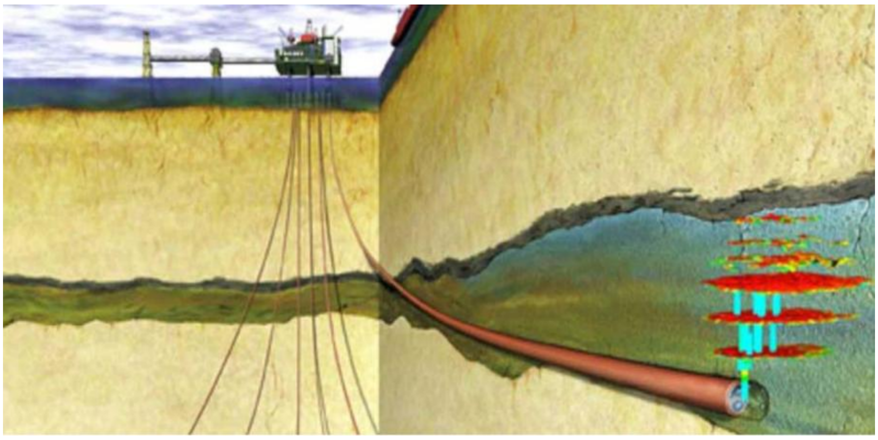
3 Carbon Capture and Storage: History and the Road Ahead, https://doi.org/10.1016/j.eng.2021.11.024

4 IEA GHG Weyburn-Midale CO_2 monitoring and storage project–moving forward with the Final Phase, https://doi.org/10.1016/j.egypro.2009.01.228

5 https://natural-resources.canada.ca/energy/publications/16459

6 https://ccsknowledge.com/pub/co2-stored-underground-ieaghg-weyburn-midale-co2-monitoring-storage-project.pdf

Sleipner: For nearly 30 years, Statoil (now Equinor) has been separating CO_2 from the gas extracted at the Sleipner field and injecting it into the Utsira sandstone formation, more than 800 meters below the seabed. Approximately 1 Mt of CO_2 is stored each year, and since 1996, more than 23 Mt of CO_2 have been reinjected in total into a deep saline aquifer in the Norwegian sector of the North Sea, in parallel with natural gas production from the Sleipner Vest reservoir. Detailed monitoring techniques and methods (repeated seismic surveys, gravity measurements, marine surveys, and seabed investigations) have been applied to ensure the safe storage of CO_2. **These surveys confirmed that the injected CO_2 remains stable within the geological formation**. Directive 2009/31/EC of the European Parliament and of the Council, concerning the storage of carbon dioxide in geological formations, as well as the amendments to the London Protocol and the OSPAR Convention to allow CO_2 storage in offshore geological formations, have also used Sleipner as a reference point.[7,8,9,10]



(Πηγή: Offshore CO_2 Storage: Sleipner natural gas field beneath the North Sea, Statoil Research Centre, British Geological Survey)

Figure 4–2: Schematic diagram of the CO_2 injection infrastructure at Sleipner and the CO_2 plume

Since then, significant progress and development have been made worldwide in CCS project technology. In September 2022, the total capacity of CCS projects under development was 244 million tonnes of CO_2 per year (MTPA), representing a 44% increase from 2021, and is expected to reach 416 MTPA by 2024 (see the **figure** below). The USA leads the global landscape with the highest number of operational CCS facilities (19)[11].

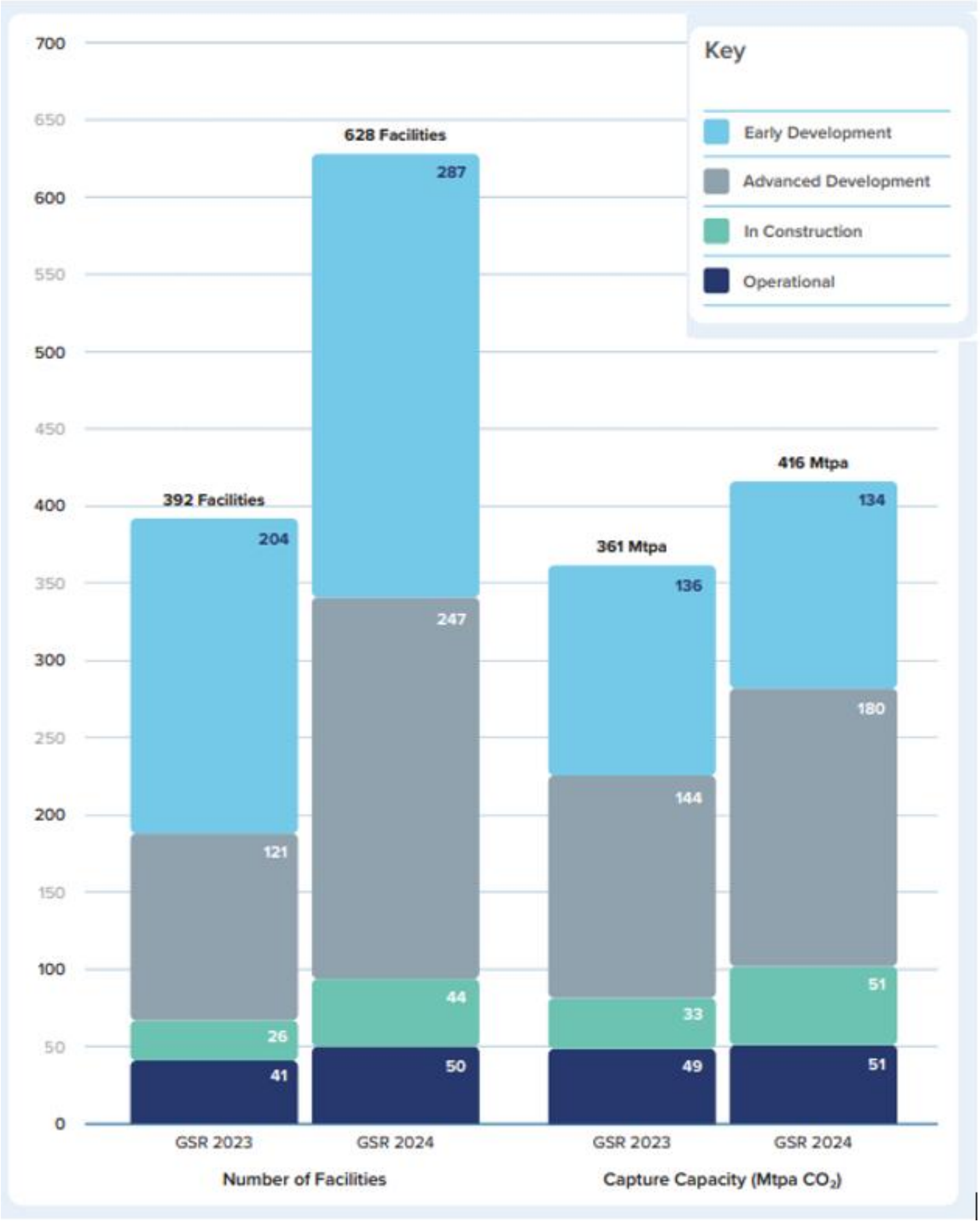
[7] 20 Years of Monitoring CO_2-injection at Sleipner, https://doi.org/10.1016/j.egypro.2017.03.1523

[8] https://ccreservoirs.com/the-sleipner-ccs-project-an-active-case-history-for-co2-storage-in-a-saline-aquifer/#:~:text=The%20Sleipner%20CCS%20Project%20in,1)

[9] https://www.equinor.com/news/archive/2019-06-12-sleipner-co2-storage-data

[10] https://www.ice.org.uk/engineering-resources/case-studies/sleipner-carbon-capture-and-storage-project

[11] Global Status of CCS 2024, Global CCS Institute



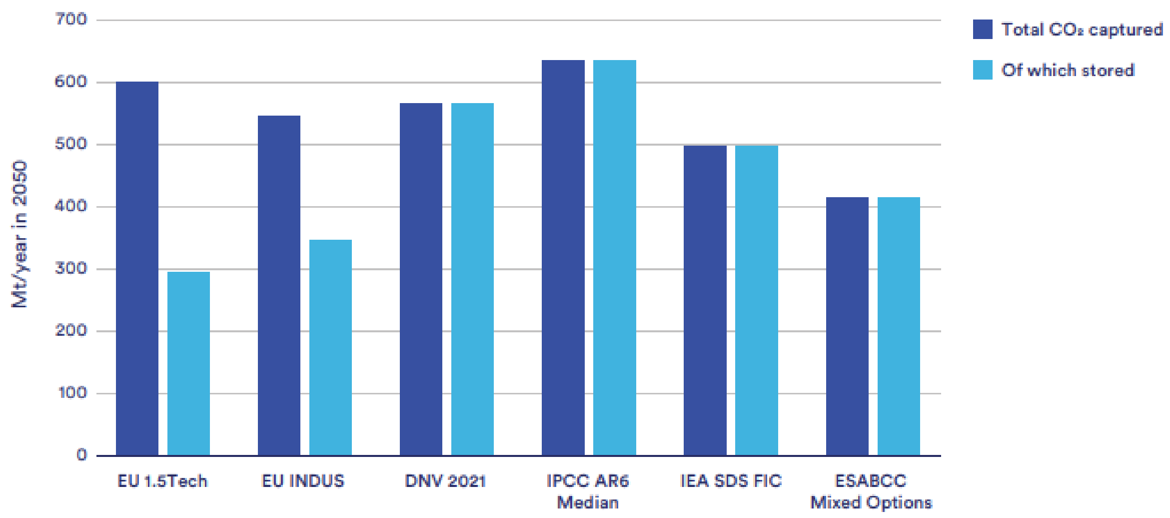
* The CO_2 capture, transport, and storage facilities are currently in active operation.

(Source: Global Status of CCS 2024, Global CCS Institute)

Figure 4–3: Number and Capacity of CCS Facilities

4.2.2 Development of CCS Projects in Europe

CCS initiatives in the European Union (EU) began in the late 1990s and are gradually gaining momentum as part of broader climate strategies. European climate legislation requires the EU to achieve net-zero CO_2 emissions by 2050, a target aligned with the recommendation of the Intergovernmental Panel on Climate Change (IPCC) to keep global warming below 1.5 °C. Studies, including analyses by the IPCC, the International Energy Agency (IEA), and the European Scientific Advisory Board on Climate Change, on how Europe can achieve net-zero CO_2 emissions on time, highlight the significant role of CCS technologies both in reducing CO_2 emissions from industry and in removing CO_2 from the atmosphere. The **figure** below presents estimates of the amounts of CO_2 that need to be captured to achieve net-zero CO_2 emissions in Europe by 2050, according to studies by the European Commission, DNV, the IPCC, the IEA and the European Scientific Advisory Board on Climate Change.



(Source: Clean Air Task Force 2024)

Figure 4–4: Amounts of CO_2 to be captured in Europe to achieve net-zero CO_2 emissions by 2050

Although the majority of the effort to achieve net-zero CO_2 emissions in the coming years will come from reducing current emission levels, technologies capable of capturing CO_2 will also be necessary. Therefore, the EU has set ambitious targets for CO_2 storage, focusing on enhancing the sustainability and scalability of CCS technologies. It is developing key infrastructure projects to improve CCS capabilities, viewing CCS as an important technology that contributes to the transition to a low-carbon dioxide emissions energy system in the EU.

The European Commission already provides a regulatory framework for the safe transport and storage of CO_2 through Directive 2009/31/EC on the geological storage of carbon dioxide (the CCS Directive). Carbon Capture and Utilization (CCU) is regulated by Directive (EU) 2018/2001 for the promotion of the use of energy from renewable sources, which encourages renewable fuels of non-biological origin, including fuels produced from captured CO_2. Additionally, the EU Emissions Trading System (EU ETS) puts a price on CO_2 emissions and, since 2013, has provided incentives for capturing CO_2 for permanent storage. The EU also contributes to the funding of industrial carbon management projects through the Innovation Fund — which already supports the capture of 10 million tonnes of CO_2 annually from 2027 for permanent storage. In 2022, the European Commission approved a proposal for a voluntary EU-wide framework for carbon removal certification, which is expected to particularly strengthen innovative industrial carbon removal technologies, such as bioenergy with carbon capture and storage (BioCCS) and direct air capture and storage of CO_2 (DACCS).[12]

It is also worth noting that in the Net Zero Industry Act (NZIA), aimed at boosting EU production of technologies needed for carbon emission removal, the European Commission proposed the development of CO_2 storage capacity of at least 50 MTPA by 2030 within the EU. Based on the impact assessment related to the EU's climate target for 2040, this figure should increase to approximately 280 MTPA by 2040.[13]

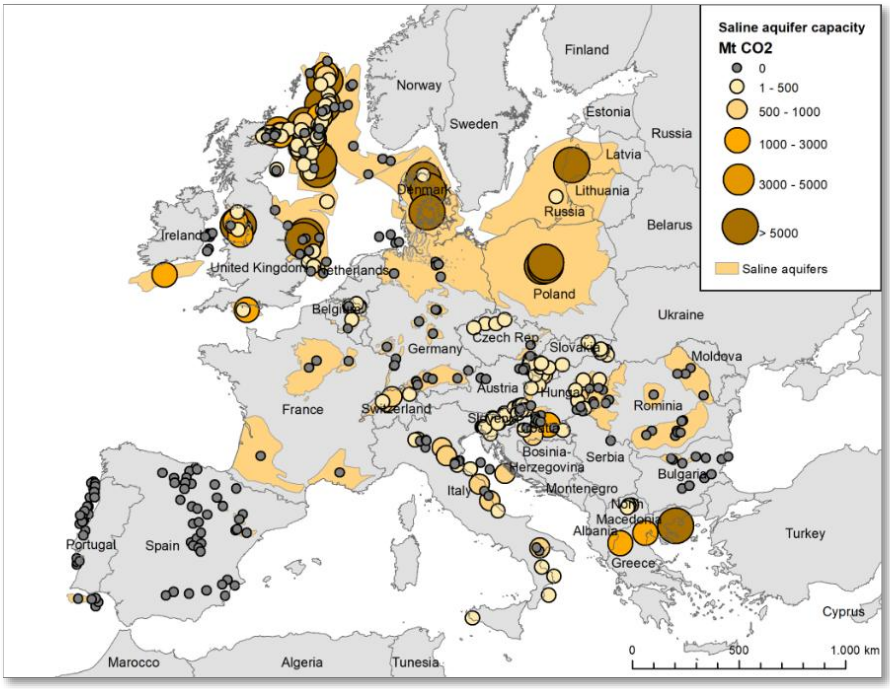
In this context, research and development related to CO_2 storage capacity in the EU has advanced significantly in recent years. CO_2 storage takes place at great depths (greater than 800 meters), where high pressures ensure that the CO_2 remains trapped. For geological CO_2 storage, deep saline aquifers or reservoirs and (semi-)depleted hydrocarbon fields are typically considered. Several studies have been conducted to assess and map the CO_2 storage potential of European countries.[14] According to the CO_2StoP[15] Project, the storage capacity in the 418 mapped saline aquifers is estimated to be around 482 Gt, while the capacity in the 134 mapped reservoirs ranges between 31 and 54 Gt. In the 513 mapped hydrocarbon fields—most of which are located in the North Sea Basin—the storage capacity is estimated at 25 Gt. The **figures** below illustrate the locations and the estimated storage capacity of the mapped saline aquifers, reservoirs, and hydrocarbon fields.

[12] https://ec.europa.eu/commission/presscorner/detail/el/ip_24_585

[13] https://ec.europa.eu/commission/presscorner/detail/el/ip_24_585

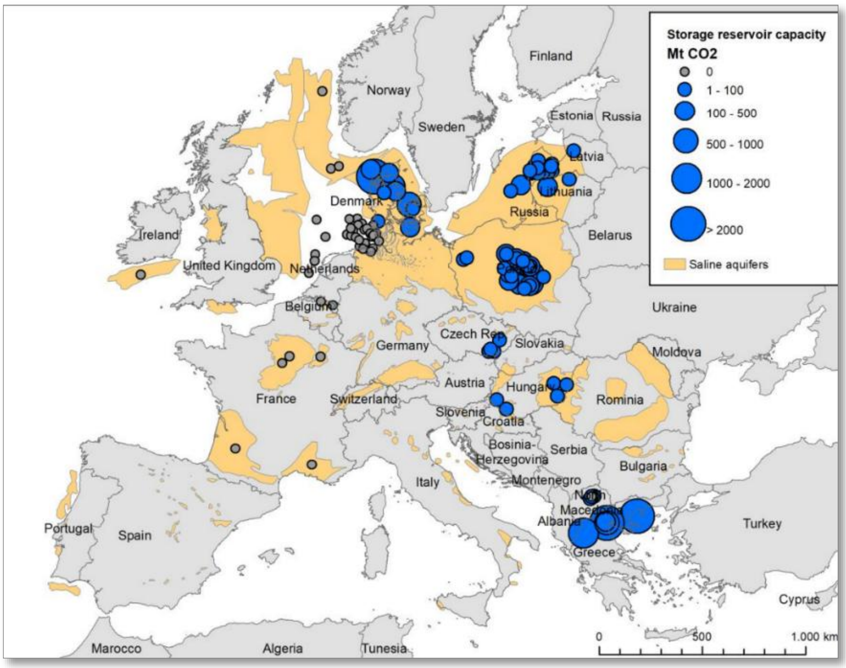
[14] Joule II project (Holloway et al. 1996), GESTCO project (Christensen & Holloway, 2004), CASTOR project (2006), EU GeoCapacity project (Vangkilde-Pedersen et al.2009), CO2StoP project (Poulsen et al. 2014)

[15] CO2StoP Final Report, Assessment of CO_2 storage potential in Europe, European Commission Contract No ENER/C1/154-2011-SI2.611598, Niels Poulsen - The Geological Survey of Denmark and Greenland (GEUS), Sam Holloway – The British Geological Survey (BGS), Filip Neele - Geological Survey of the Netherlands (TNO), Nichola Ann Smith (BGS) and Karen Kirk (BGS) (2014)



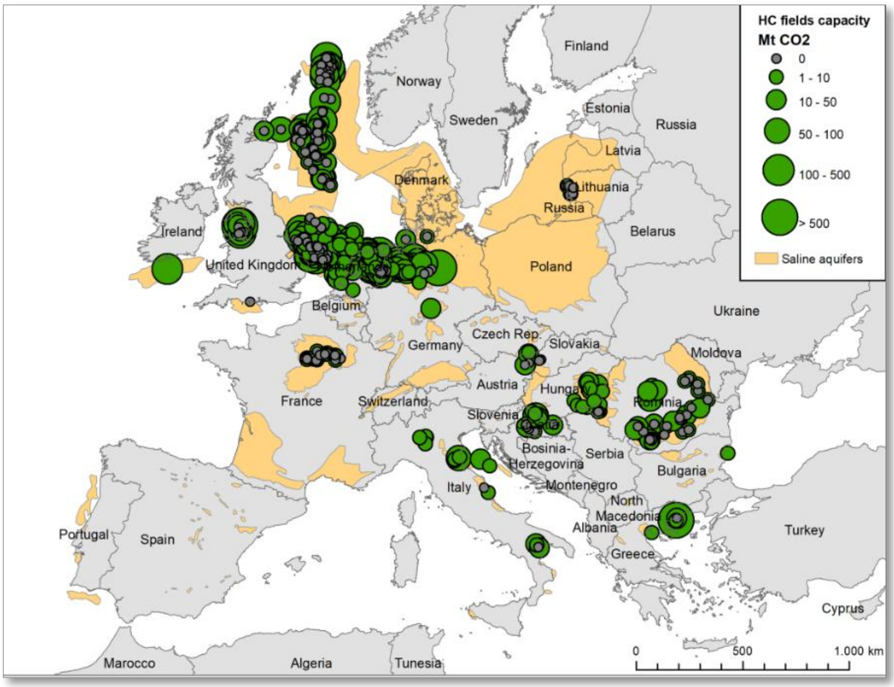
(Source: EU Geological CO_2 storage summary, Prepared by the Geological Survey of Denmark and Greenland for Clean Air Task Force, Danish Ministry of Climate, Energy and Utilities, 2021)

Figure 4–5: Locations and estimated storage capacity of the mapped saline aquifers



(Source: EU Geological CO_2 storage summary, Prepared by the Geological Survey of Denmark and Greenland for Clean Air Task Force, Danish Ministry of Climate, Energy and Utilities, 2021)

Figure 4–6: Locations and estimated storage capacity of the mapped reservoirs



(Source: EU Geological CO_2 storage summary, Prepared by the Geological Survey of Denmark and Greenland for Clean Air Task Force, DANISH MINISTRY OF CLIMATE, ENERGY AND UTILITIES, 2021)

Figure 4–7: Locations and estimated storage capacity of the mapped hydrocarbon fields

The finding that many Member States have significant storage capacity to use CCS for reducing CO_2 emissions—or to assist other countries in doing so—has had a major impact on the development of CCS projects. It has also strengthened research efforts and prompted governments to establish supportive regulatory frameworks.

Below are the existing and planned CO_2 storage projects in the EU and more broadly in Europe as of March 2024[16]. It should be noted that the EU—along with Norway and the United Kingdom—has a comprehensive legal framework regulating CO_2 storage activities. This framework requires thorough assessment of new storage sites for their suitability before granting a CO_2 storage permit, as well as continuous monitoring of the storage site.

[16] https://iogpeurope.org/resource/map-of-eu-ccus-projects/

Projects in Operation
Projects supported by the EU Innovation Fund
Projects of Mutual Interest
Projects of Common Interest

BULGARY
1. ANRAV

CROATIA
1. Petrokemija Kutina
2. Bio-Refinery Project
3. CCGeo
4. **CO_2 EOR Project Croatia**
5. Geothermal CCS project

THE CZECH REPUBLIC
1. CO_2 - SPICER

DENMARK
1. **Greensand**
2. Bifrost
3. Stenlille demo CO_2 storage
4. Norne
5. Ruby

FRANCE
1. Pycasso*

GREECE
1. Prinos CCS

HUNGARY
1. MOL-Hungary CCS Project

ICELAND
1. **Orca**
2. **Silverstone**
3. Coda Terminal
4. Mammoth

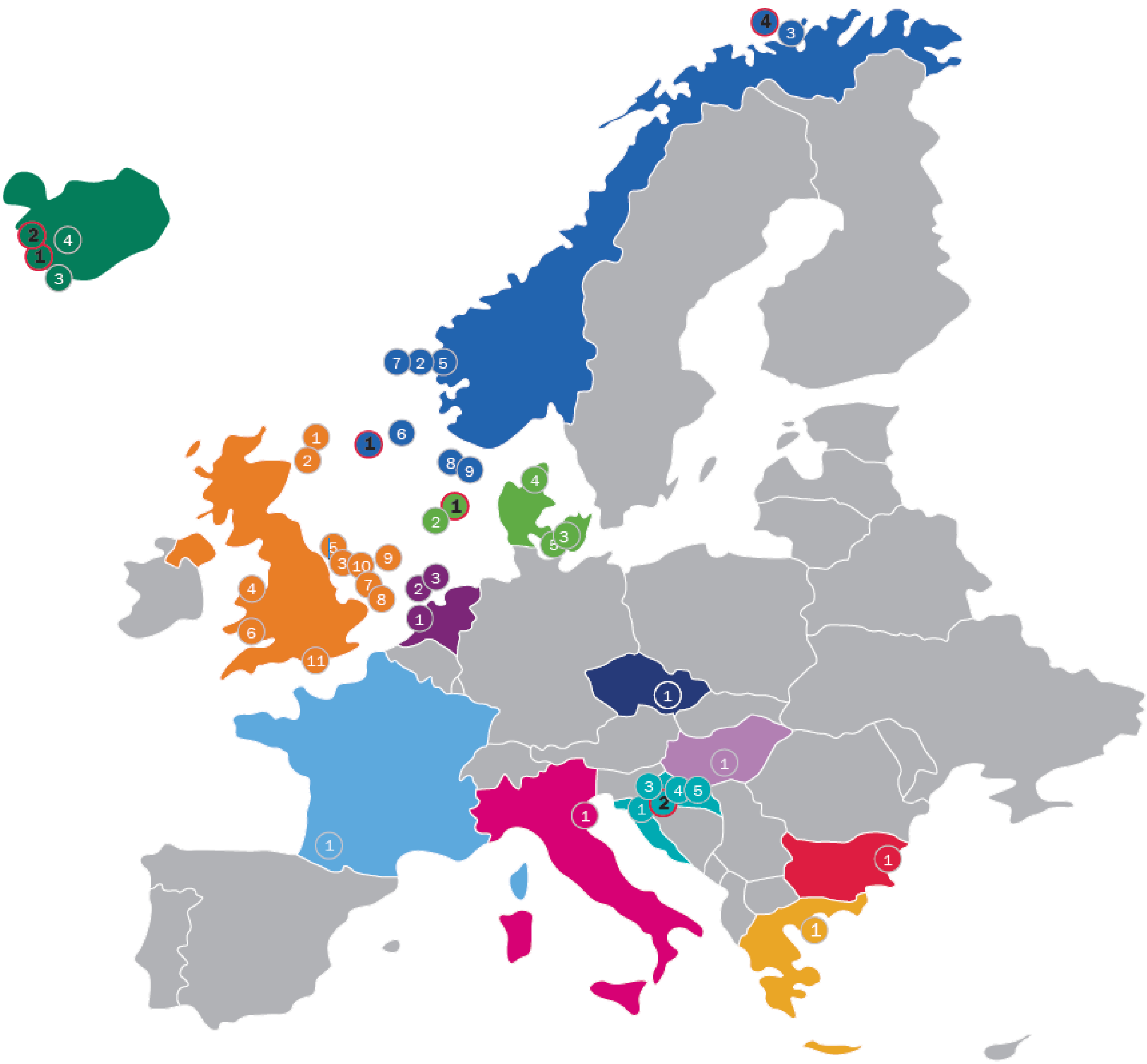
ITALY
1. Ravenna CCS (includes Callisto)

THE NETHERLANDS
1. Porthos
2. Aramis
3. L10 CCS

NORWAY
1. **Sleipner**
2. Longship (includes Northern Lights)
3. Barents Blue (includes Polaris)
4. **Snøhvit**
5. Smeaheia
6. Trudvang
7. Luna
8. Havstjerne
9. Poseidon (NO)

UNITED KINGDOM
1. Acorn
2. Caledonia Clean Energy
3. Zero Carbon Humber
4. HyNet
5. Net Zero Teesside
6. South Wales Industrial Cluster
7. Bacton Thames Net Zero initiative
8. Poseidon (UK)
9. Viking CCS
10. Orion
11. Solent Cluster

EU	19 projects - 42 $MtCO_2$/year by 2030
EUROPE	43 projects - 141 $MtCO_2$/year by 2030



(Source: https://iogpeurope.org/resource/map-of-eu-ccus-projects/, Own processing)

Figure 4-8: Existing and Planned CO_2 Storage Projects in Europe (03/2024)

As shown in the **figure above**, the North Sea region is evolving as a central hub for CO_2 storage. However, research on CO_2 storage capacity across the entire EU has revealed a significant opportunity to expand CO_2 storage capabilities.

Many CO_2 storage projects are currently **under construction or development** in Europe. Below is a brief overview of this development in selected European countries.[17]

[17] État des lieux et perspectives de déploiement du CCUS en France, Direction générale des Entreprises, Direction générale de l'Energie et du Climat, Ministère de L'Economie, des Finances et de de la Souveraineté Industrielle et Numérique, 07/2024

- Norway:

Norway is one of the most advanced countries in terms of CCS, with a related strategy established in 2014 as a result of over 25 years of research and experience in the field, as well as a very favorable legislative and economic environment for the sector's development. The country participates in 9 CCS projects that currently allow for the storage of 1.7 $MtCO_2$ annually, with a projected storage capacity of over 40 $MtCO_2$ per year by 2030. H Norway, despite its relatively low greenhouse gas emissions compared to other developed countries (36 $MtCO_2$ annually), has large storage capacities (estimated at 80 Gt, exclusively offshore). Therefore, this potential represents an opportunity for third countries seeking to store CO_2 in Norway.

- Denmark

Denmark has implemented a €5 billion strategy for the development of an integrated CCS value chain, as well as for the capture and storage of 3.2 Mt of CO_2 annually starting in 2030. Denmark's storage potential by 2035 is estimated at 45 Mt of CO_2 per year. The total storage capacity in Denmark's subsurface is estimated to range from 12 to 25 Gt, both onshore and offshore. The country has already signed bilateral agreements with France, Belgium, Germany, the Netherlands, Norway, and the United Kingdom. Denmark is currently carrying out five geological storage projects:

Greensand (1,5 $MtCO_2$/year in 2025 and 8 Mt CO_2/year in 2030)
Bifrost (16 $MtCO_2$/year in 2032)
Stenllile (0,5 $MtCO_2$/year in 2025)
Norne (2 $MtCO_2$/year in 2027 and subsequently 20 Mt in 2030)
Rodby (1 $MtCO_2$/year in 2027 and subsequently 5-10 Mt in 2030)

- The Netherlands

The Netherlands aims to capture 7.2 Mt of CO_2 annually at the national level, representing 50% of the country's industrial emissions. Three offshore CCS projects are under development, with relatively high levels of maturity:

Porthos (2,5 $MtCO_2$/year in 2026)
Aramis (5 $MtCO_2$/year in 2030 and 7,5 Mt overall), which include significant pipeline networks.
L10, dedicated exclusively to storage (5 $MtCO_2$/year after 2030 and a total of 9 Mt).

- Italy

The only storage project currently in operation in Italy is the one in Ravenna, which aims to become the CCS reference hub in the Mediterranean. It involves a group of hydrocarbon fields that are gradually reaching the end of their production life and will be progressively converted into CO_2 storage sites, starting in 2024 (25 kt CO_2/year). Storage capacities will then increase to 4 Mt by 2027 and 16 Mt from 2030 onward. The total storage capacity is estimated at 500 Mt. Ravenna is integrated into the "Callisto" project of common European interest, which plans to develop infrastructure from 2029 for the transport and storage in Italy of emissions from industrial sites in third countries.

- Greece

In Greece, the Prinos project could become a key storage site for Southeastern Europe. Greece is collaborating with France and Italy within the framework of a non-binding strategic regional plan signed in early 2023, aiming to create a framework that includes, among other objectives, the establishment of a CO_2 storage hub in Southeastern Europe and seeks to strengthen cooperation among Mediterranean countries on CCS technologies. Bulgaria, Cyprus, Croatia and Slovenia have also expressed interest in the Prinos project. The Prinos project is part of a broader strategy to reduce industrial emissions in Greece, as well as a wider regional framework where cooperation between Greece and other countries is vital to maximize the effectiveness of efforts to eliminate carbon emissions in Europe. The Prinos project is recognized as a Project of Common Interest (PCI) by the European Union, allowing access to financial support and increased visibility within the framework of European climate policies.

By the end of 2024, **seven CO_2 storage projects will be operational in Europe.** Two of the CO_2 storage projects already in operation in Europe, specifically in Norway, are Sleipner in the North Sea (briefly presented above) and Snøhvit in the Barents Sea. In both projects, CO_2 is separated from natural gas—a process carried out before the gas is sold—and stored in underground geological formations

Snøhvit *(Equinor, Petoro, TotalEnergies, Neptune Energy and Wintershall DEA):* After the CO_2 is separated from the extracted natural gas, it is returned to the field via a pipeline, where it is stored 2,600 meters beneath the seabed, while the LPG, LNG and condensates are sent to the market. The CO_2 is injected into a sandstone formation called Tubåen. A shale cap located above the sandstone ensures that the CO_2 remains securely stored without leaking to the surface. CO_2 storage began in 2008, and 0.7 Mt of CO_2 are stored annually, equivalent to the emissions from 400,000 cars.[18,19]

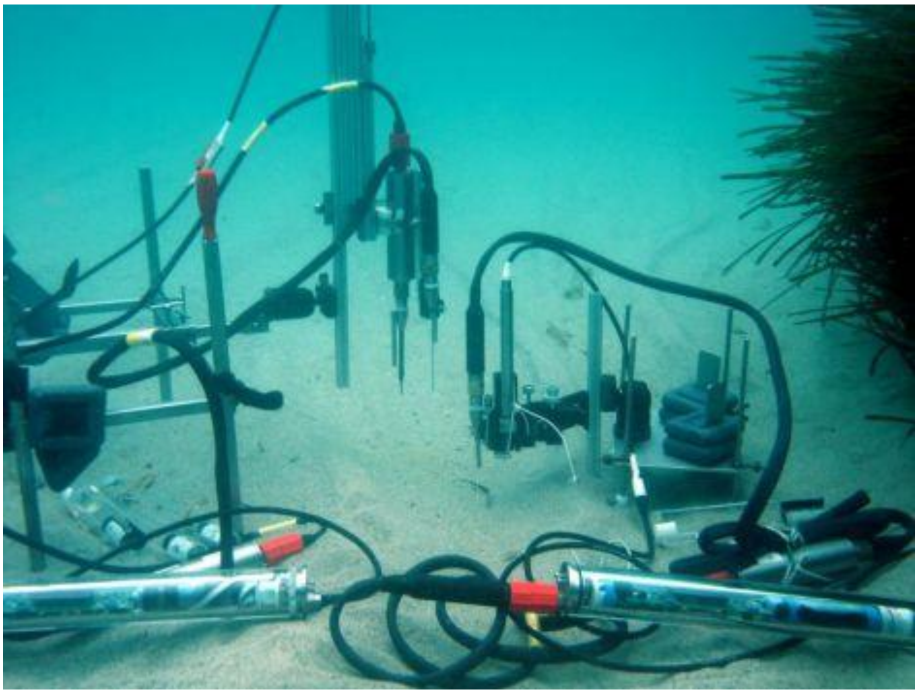
(Source: Equinor)

Figure 4–9: Map of the Snøhvit field

[18] https://www.equinor.com/energy/snohvit

[19] https://www.equinor.com/news/archive/2008/04/23/CarbonStorageStartedOnSnhvit

The Sleipner and Snøhvit projects were even the subject of scientific research on the impacts of CO_2 storage on marine ecosystems on the seabed, through the ECO2 project. ECO2 was funded by the EU under the 7th Framework Programme (FP7) for Research and Technological Development and was implemented over four years by a consortium of 27 members from 9 European countries. ECO2 conducted a comprehensive offshore field research program at the Sleipner and Snøhvit storage sites, as well as at several natural CO_2 leak locations, in order to identify potential CO_2 leakage pathways, monitor seepage points on the seabed, track the spread of CO_2 in the water column and study the impact of CO_2 on benthic organisms. ECO2 drew on scientific expertise from three fields of knowledge, including biology—focusing on the impacts of ocean acidification on marine flora and fauna, geoscience related to natural gas leakage on the seabed—and CCS experience from both research and industry sectors, to jointly and interdisciplinarily investigate the impact of CO_2 storage on marine ecosystems. Additionally, the consortium attracted experts from countries outside Europe (Japan and Australia) specializing in CO_2 storage on the seabed. The project concluded that the environmental risks of CO_2 storage on the seabed—determined by the impacts and the likelihood of leakage—are expected to be low, even if a large number of CO_2 storage sites are developed in European offshore areas. Among other achievements, the project developed a methodology for monitoring potential changes in the marine environment due to possible CO_2 leakage, as well as a new approach for assessing environmental risk for storage sites on the seabed.[20,21,22]



(Source: https://www.eco2-project.eu/, M.Weber/HYDRA)

[20] https://cordis.europa.eu/project/id/265847/reporting

[21] https://www.eco2-project.eu/ECO2(265847)%20Final%20Publishable%20Summary%20Report.pdf

[22] https://oceanrep.geomar.de/id/eprint/29213/1/ECO2%20D7.4.pdf

Figure 4–10: Fieldwork in the Mediterranean

The RISCS project ("Research into Impacts and Safety in CO_2 Storage"), also funded by the EU under the 7th Framework Programme (FP7) for Research and Technological Development, focused on assessing the impact of CO_2 leaks on coastal and offshore ecosystems using fieldwork, modeling and observations of natural CO_2 emissions. In Italy, the Netherlands, Norway, and the United Kingdom, the impact of CO_2 on various species and communities—including microorganisms—was examined. The project also studied the potential for recovery of marine sediments after exposure to CO_2 and the effects of such exposure. The main findings from the study have been compiled into a guide on the potential impacts of CO_2 storage leaks, providing a solid foundation for selecting suitable CO_2 storage sites and implementing safety measures. This project also contributes to ecosystem impact management. It is worth noting that, overall, the project concludes that the environmental impact of a CO_2 leak is relatively limited and naturally depends on the location, scale, timing and duration of the leak.[23]

(Source: The RISCS Guide, http://www.riscs-co2.eu/SciPublicationsData.aspx?IdPublication=22&IdType=183)

Figure 4–11: Investigation of natural CO_2 leakage, southern Italy

Projects such as ECO2 and RISCS have significantly contributed to the development of CO_2 storage initiatives in the EU by enhancing knowledge, establishing best practices and informing policy frameworks. In the specific case of the CO_2 storage project in Prinos, these projects complement the environmental assessment evaluations of the project.

CO_2 storage projects are also underway in several EU Member States, demonstrating the growing momentum behind CCS technologies as part of the EU's broader efforts to reduce greenhouse gas emissions. Some projects are already operational, such as Greensand in the North Sea off Denmark and the Ravenna project in Italy.

[23] https://cordis.europa.eu/article/id/92987-estimating-the-impact-of-carbon-storage/fr

Greensand: The consortium consists of 23 Danish and international partners who contribute expertise in CO_2 transport, storage, and monitoring. Its members include private companies, research institutions, universities, and start-ups. The project is the world's first cross-border CCS initiative and is supported by the EU through the NextGenerationEU program. Pilot activities officially began in 2023. Greensand will be able to store 1.5 MTPA (million tonnes per annum) of CO_2 by 2025 and up to 8 MTPA by 2030. The CO_2 is permanently stored at Nini West, a depleted oil field located approximately 1,800 meters beneath the North Sea seabed. Data has been collected at the Nini field for over 20 years, providing valuable knowledge for the effective and safe storage of CO_2.[24,25,26,27,28]

(Source: INEOS Energy)

Figure 4–12: Greensand Project

Ravenna: The project was developed by ENI in collaboration with Snam and is located offshore from Ravenna, Italy. Phase 1 of the project involves the capture, transport, and storage of 25,000 tonnes of CO_2

[24] https://www.projectgreensand.com/hvad-er-project-greensand

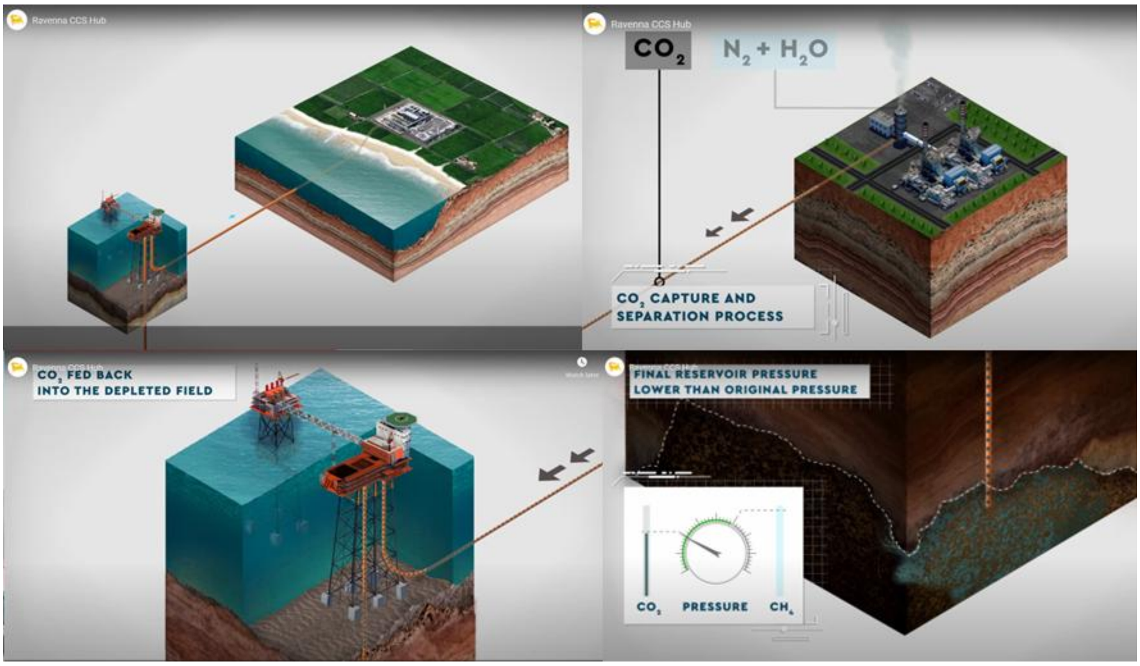
[25] https://www.globalccsinstitute.com/news-media/latest-news/denmarks-project-greensand-begins-groundbreaking-cross-border-co2-injection/

[26] https://www.ineos.com/news/shared-news/denmarks-first-co2-storage-facility-is-now-ready-to-receive-large-amounts-of-co2/

[27] https://eudp.dk/en/node/16466

[28] https://www.dnv.com/news/dnv-has-verified-the-safety-of-all-aspects-of-project-greensand-s-co2-storage-in-the-north-sea-244503/

per year from ENI's natural gas processing plant in Casalborsetti, Ravenna. The CO_2 is transported via pipelines—previously used for natural gas—to the offshore platform Porto Corsini Mare Ovest, where it is injected into a depleted gas reservoir at a depth of approximately 3,000 meters. Phase 2 of the project, set to begin in 2027, is expected to store up to 4 MTPA of CO_2, in line with Italy's Integrated National Energy and Climate Plan. The project is supported by the EU and is included in the European list of Projects of Common Interest (PCI). This designation allows the project to receive funding through the Connecting Europe Facility (CEF). It also participates in the international research initiative HERCCULES, which aims to accelerate CO_2 capture and storage in the Mediterranean countries of Europe. The project collaborates with various research bodies, including universities and research centers.[29,30,31,32,33]



(Source: enivideochannel)

Figure 4–13: CCS Project in Ravenna

Greece is actively pursuing the development of CCS technologies as part of its strategy to reduce greenhouse gas emissions and transition to a more sustainable energy system. Related projects are underway in the broader field of CO_2 capture and storage, such as Motor Oil's IRIS project and TITAN Cement's IFESTOS project. At the same time, as a robust regulatory framework is being developed and significant support is provided by the EU through funding mechanisms aimed at promoting CCS technologies, Greece aims to

[29] https://www.eni.com/en-IT/actions/global-activities/Italy/ravenna.html
[30] https://ravennaccs.com/en-IT/technology/what-is-ccs
[31] https://ravennaccs.com/en-IT/project
[32] https://www.ogj.com/energy-transition/article/55137438/eni-starts-ravenna-ccs-co2-injection
[33] https://jpt.spe.org/eni-injects-first-co2-in-offshore-ravenna-ccs-project

establish a leading position in CO_2 management in Europe, with the CO_2 storage project at Prinos being the first of its kind in the country.

4.3 HISTORICAL DEVELOPMENT OF THE PROJECT

«Energean Oil & Gas – Energean Aegean Hydrocarbon Exploration and Production S.A. (hereinafter “Energean”), an affiliated company of EnEarth, holds, among other rights, the exploration and exploitation rights for hydrocarbons in the offshore area of the Prinos oil fields, based on the contract dated 23.11.1999 with the Hellenic Republic, ratified by Law 2779/1999 (Government Gazette A 296/30.12.1999) and as currently in force. Following the initial contract and its ratification, a number of legal acts have taken place to reflect various amendments from the original agreement. These specific acts are presented in the **table** below.

Table 4–1: Legal Acts Governing the Concession Agreement

Legal Act	Reference Number	Subject
Law 2779/1999	Government Gazette 296/30.12.1999	Ratification of the Contract dated 23.11.1999 between the Hellenic Republic and Kavala Oil S.A., along with Annexes I and II, for the exploitation of the offshore area of the Thracian Sea, ratified by Law 2779/1999 (Government Gazette A’ 296).
Law 4135/2013	Government Gazette 69/19.3.2013	Ratification of the first amendment contract dated 31.10.2012 between the Hellenic Republic and the contracting companies Kavala Oil S.A. and Energean Oil & Gas S.A. for the modification of the contract dated 23.11.1999 regarding the exploitation of the offshore area of the Thracian Sea, which was ratified by Law 2779/1999 (Government Gazette A’ 296).
Law 4296/2014	Government Gazette 214/2.10.2014	Ratification of the second amendment contract dated 30.12.2013 between the Hellenic Republic and the contracting companies Kavala Oil S.A., Energean Oil & Gas S.A., and HELLENIC PETROLEUM for the modification of the contract dated 23.11.1999 regarding the exploitation of the offshore area of the Thracian Sea, which was ratified by Law 2779/1999 (Government Gazette A’ 296).
Law 4296/2014	Government Gazette 214 / 2.10.2014	Ratification of the third amendment contract dated 11.09.2014 between the Hellenic Republic and the contracting companies Kavala Oil S.A. and Energean Oil & Gas S.A. for the modification of the contract dated 23.11.1999 regarding the exploitation of the offshore area of the Thracian Sea, which was ratified by Law 2779/1999 (Government Gazette A’ 296).
Law 4409/2016	Government Gazette 136 / 28.07.2016	Ratification of the fourth amendment contract dated 22.11.2015 between the Hellenic Republic and the contracting companies Kavala Oil S.A. and Energean Oil & Gas S.A. for the modification of the contract dated 23.11.1999 concerning the exploitation of the offshore area of the Thracian Sea, which was ratified by Law 2779/1999 (Government Gazette A’ 296).
Law 4585/2018	Government Gazette 216 / 24.12.2018	Ratification of the fifth amendment contract dated 20.11.2018 between the Hellenic Republic and the contracting companies Energean Oil & Gas S.A. and Kavala Oil S.A. for the modification of the contract dated 23.11.1999 regarding the exploitation of the offshore area of the Thracian Sea, which was ratified by Law 2779/1999 (Government Gazette A’ 296).

Legal Act	Reference Number	Subject
Law 4952/2022	Government Gazette 130 / 07.07.2022	Ratification of the sixth amendment agreement dated 19.06.2024 between the Hellenic Republic and the contracting company Energean Oil & Gas SA for the modification of the contract dated 23.11.1999 regarding the exploitation of the offshore area of the Thracian Sea, which was ratified by Law 2779/1999 (Government Gazette A' 296).
Law 5115/2024	Government Gazette 98 / 01.07.2024	Ratification of the seventh amendment agreement dated 15.03.2024 between the Hellenic Republic and the contracting company Energean Oil & Gas SA for the modification of the contract dated 23.11.1999 regarding the exploitation of the offshore area of the Thracian Sea, which was ratified by Law 2779/1999 (Government Gazette A' 296).

Within the framework of years of conducting Oil Operations (exploration and exploitation) within the Prinos Exploitation Area (as defined in the contract dated 23.11.1999 of Law 2779/1999, as amended and currently in force), Energean has collected geological, geophysical, and drilling data for the Prinos geological basin, and more specifically for the Prinos and Epsilon structures. These data demonstrate that these particular structures are initially eligible as sites for CO2 storage (for the reasons discussed in **Section 4.4** of this document).

Consequently, within the scope of its activities in the area, Energean proceeded with the design and permitting process for **a CO2 Storage Unit in Prinos**, making use of Article 173 of Law 4964/2022. More specifically, according to Law 4964/2022 (Government Gazette A 150/30.07.2022) titled "Provisions for the simplification of environmental permitting, establishment of a framework for the development of Offshore Wind Farms, addressing the energy crisis, environmental protection, and other provisions," and more precisely based on its Article 173, entities that have been granted by the Greek State (according to Law 2289/1995 (A' 27)) the right or license for hydrocarbon exploration and exploitation in a specific area, and that possess sufficient data (especially geological, geophysical, and drilling data) to substantiate the preliminary eligibility of a geological formation or formations located in the subsurface of the granted area (onshore or offshore) as a site for carbon dioxide (CO2) storage, acquire (under the conditions of the said article) **the right to continue and complete the investigation process of that specific area in order to determine its suitability for CO2 storage.**

Based on the above, on 31.08.2022, Energean submitted a request to HHRM S.A. (Hellenic Hydrocarbons and Energy Resources Management Company) to activate its right to continue and complete the investigation of the Prinos and Epsilon field structures, as well as the underlying aquifer (the "Area"), in order to determine their suitability as CO_2 storage sites. The said application was accepted through the **Decision for the Activation of the Right to Investigate CO_2 Storage** (as approved by Decision No. 14577/29.09.2022 of HHRM S.A., published in Government Gazette 5247/B/11.10.2022). This decision approved the **preliminary eligibility of the storage site**, which is located within the boundaries of the Prinos concession and includes the Prinos and Epsilon field structures, as well as the underlying aquifer. It also granted approval for **the continuation and completion of the investigation of the Area as a CO_2 storage site** for a period of twenty-two (22) months, starting from October 1, 2022, by Energean.

According to paragraph 5 of Article 173 of Law 4964/2022, *following the completion of the investigation into suitability and before the expiration of the right to complete the investigation*, the interested party must submit an application to HHRM S.A. (Hellenic Hydrocarbons and Energy Resources Management Company) in order to confirm the suitability of the geological formation as a CO_2 storage site, and activate the entity's right to store CO_2. As the interested entity is defined either as the holder of the right to continue and complete the investigation (in this case, Energean) or as an affiliated company whose exclusive purpose is the activity of CO_2 storage (in this case, EnEarth), and with the progress and completion of the procedures for investigating the Area as a CO_2 storage site, EnEarth, as an affiliated company of Energean, submitted on 30.06.2024 an application in order to determine the suitability of the geological formation as a CO_2 storage site and activate the entity's right to CO_2 storage in accordance with paragraph 5 of Article 13 of Law 4964/2022.

4.4 JUSTIFICATION OF THE SITE SUITABILITY FOR CARBON DIOXIDE STORAGE FACILITIES

According to the data collected over several years by Energean, it is demonstrated that the depleted hydrocarbon fields and the associated structures are, in principle, eligible areas for CO_2 storage, as these geological formations (as reservoirs) meet the following criteria:

- They have a proven storage capacity.
- They possess a proven impermeable overlying cap rock to prevent potential leakage of the stored fluids.
- They have a defined pore volume suitable for CO_2 storage and are located in tectonically stable areas.

Therefore, <u>the structure of the Prinos reservoir, being a semi-depleted oil field, is also, in principle, a suitable area for CO_2 storage.</u>

In summary, the main characteristics that define the Prinos structure as an appropriate CO_2 storage site are the following:

- The geological formations have a <u>defined porosity</u> to provide CO_2 storage capacity.
- The geological formations have a <u>defined permeability</u>, meaning that the pores within the rocks are sufficiently connected, allowing CO_2 to be injected at a good rate and to move and spread within the formation.
- There is a proven impermeable overlying cap rock above the permeable formation (reservoir) to prevent potential CO_2 leakage.
- <u>The volume of the reservoir is significant</u> for CO_2 storage (the thickness and area of the structure are estimated to be sufficient for storing a large volume of CO_2).
- <u>The depth of the structure is adequate</u>. CO_2 must be stored as a supercritical fluid (a fluid with characteristics of both liquid and gas, i.e., compressible and with fluid-like densities). This is achieved at depths greater than 800 meters below the surface. The CO_2 storage site in the Prinos basin is at a depth of over 2 km.
- The presence of <u>hypersaline aquifers</u> underlying and overlying the oil/gas reservoirs within the Prinos basin.
- The Prinos basin is a <u>tectonically stable area</u>, as required for CO_2 storage sites in terms of tectonic (seismic) activity.

The evaluation of the available data and the corresponding studies of the Project to date demonstrate the suitability of the Prinos structure as a CO_2 storage site. The suitability of the storage location is thoroughly documented in **Sections 6.3.1.3 and 6.3.1.4** of this Environmental Impact Assessment (EIA), which address the capacity adequacy as well as the long-term safety of the CO_2 storage site under study.

4.5 CARBON FOOTPRINT OF THE PROJECT

4.5.1 CO_2 Emissions During the Operation of the Project

According to the pre-assessment checklist of the Technical Guidance[34], for projects of any category or scale of infrastructure works where the absolute and/or relative emissions could exceed 20,000 tons of CO_2e/year (positive or negative) during the operational phase, a **carbon footprint** assessment is generally required. In this case, according to the technical design of the Project, the storage of a quantity of CO_2 equal to 1,000,000 tons annually is anticipated. Therefore, based on the above, the calculation of the carbon footprint is deemed necessary (Phase 1: pre-assessment, Phase 2: detailed analysis).

The **Project's related emissions** are calculated as the difference between the emissions in the baseline scenario (scenario without the Project, baseline emissions) and the absolute emissions of the Project.

(Related Emissions) = (Absolute Emissions) – (Baseline Emissions) (1)

Absolute greenhouse gas emissions are the annual emissions calculated for an average year of the Project's operation. They include both direct and indirect emissions. **Direct** emissions result from on-site fuel consumption during the operation of the Project, while **indirect** emissions are related to energy consumption during the Project's operation or can be considered a consequence of the Project's activities but are not produced on-site at the Project.

In this case, the **direct** emissions during the operation of the Project relate to fuel consumption as follows:

- Emissions from tanker vehicles transporting CO_2 from pilot projects during the first year of the Project's operation (detailed analysis in **Section 6.5.1.1.2**). For a traveled distance of 4,250.0 km, the emissions generated from Diesel use are calculated at **3,678.0 tons of CO_2.**[35]

[34] Commission Communication "Technical guidance on the climate proofing of infrastructure in the period 2021–2027" (2021/C 373/01) (hereinafter referred to as the Technical Guidance). This is the main guidance document that sets the direction for assessing climate resilience.

[35] The calculations are carried out using the UNFCCC Greenhouse Gas (GHG) Emissions Calculator, Document version: 01.3, Publication date: May 2021 (https://unfccc.int/documents/271269).

- Emissions from the supply vessel. The fuel consumption for the supply vessel is estimated at 1,300 tons for the entire duration of the Project. The total CO_2 emissions for the entire Project duration from the consumption of marine fuel (Marine Gasoil DMA ISO 8217:2012 / Max. Sulphur Content 0.1% (M/M)) are calculated at **4,195.37 tons of CO_2.**[36]

The **indirect** emissions during the operation of the Project relate to energy consumption for the following activities:

- Compression/pumping of CO_2 loads and heating of bulk CO_2 stream (within the Project). During the operation phase of the Project, a power demand of approximately 1.6 MW is required for CO_2 processing to achieve the appropriate injection conditions (pressure and temperature). This power demand includes the requirements for compressing/pumping CO_2 loads as well as heating the bulk CO_2 during startup. This power demand is mainly due to the operation of the electric heater needed at startup, which serves to prevent low temperatures in the pipeline and the formation of hydrates/ice near the well area. Assuming operation of 16.0 hours per day (2 shifts), the total electricity consumption is estimated at **9,344.0 MWh/year.**
- Pumping of produced water. For pumping the produced water from the water wells at the Beta platform, two Electric Submersible Pumps (ESPs) with a power of approximately 0.5 to 1 MW each are planned. Assuming continuous 24-hour operation of the pumps and considering an average power value of 0.75 MW, the required energy amounts to **13,140 MWh/year.**

- Compression, cooling, and transportation of bulk CO_2 via pipeline (outside the Project). The majority of the CO_2 quantity will be transported in the future to the reservoir through a pipeline system, originating from industries in the wider region of Northern Greece (from Volos, Larissa to Alexandroupoli). Accordingly, the energy requirements during the Project's operation will consist of consumption for compression (approximately 100 kWh/t CO_2), cooling (approximately 144 Mcal/t CO_2, with a conversion factor of 1.16 kWh/Mcal), and transportation of CO_2 from the producers to the storage site. Based on the above, the total energy consumption in the pipeline is expected to be approximately 267.4 kWh/t CO_2, which corresponds to **267,360.0 MWh/year** for a capacity of 1 million tons per annum (1 MTPA).

From the above, a total electricity consumption of 289,844.0 MWh/year results. For the calculation of the Absolute Emissions from energy production, the following fundamental emissions calculation equation is used:

(Emissions) = (Energy Production) × (Emission Factor)   (2)

According to the emission factor of the residual energy mix, as published by DAPEEP[37] and based on equation (2), the annual emissions are:

[36] The calculations are performed using the UNFCCC Greenhouse Gas (GHG) Emissions Calculator, Document version: 01.3, Publication date: May 2021 (https://unfccc.int/documents/271269).

[37] Chart 2, Annex 1, Annual Report of DAPEEP 2021

CO_2 emissions = energy production × emission factor =
= 289,844.0 MWh/year × 436.889 kg/MWh = 126,629.6 tons CO_2/year

Therefore, the total **absolute CO_2 emissions** are calculated as follows:

- For the 1st year of operation: **134,503.0 tons CO_2/year**
- For the subsequent years of operation (years 2–25): **130,825.0 tons CO_2/year**

Baseline greenhouse gas emissions are the emissions that would be generated annually according to the zero-project scenario, meaning if the Project were not implemented. In this case, **1,000,000 tons of CO_2** per year would remain unsequestered in the atmosphere.

So, according to equation (1), the **related CO_2 emissions** are calculated as follows:

(Related CO_2 Emissions) = (Absolute CO_2 Emissions) – (Quantity of CO_2 to be stored)

1st year of operation:
(Related CO_2 Emissions) = 134,503 – 1,000,000 = –865,497.0 tons CO_2

Subsequent years of operation:
(Related CO_2 Emissions) = 130,825 – 1,000,000 = –869,175.0 tons CO_2

The following **table** summarizes the calculation of the related CO_2 emissions for an average year of the Project's operation.

Table 4–2: Calculation of Related CO_2 Emissions for an Average Year of the Project's Operation

		Units
A. Direct CO_2 Emissions		
CO_2 Transport Trucks from Pilot Projects[38]	3.678,0	$tnCO_2$/year
Supply Vessel	4.195,4	$tnCO_2$/year
B. Indirect CO_2 Emissions		
Compression / Pumping and Heating (within the Project)	9.344,0	MWh/year
Produced Water Pumping	13.140,0	MWh/year
Energy Consumption in Pipeline (outside the Project)	289.844,0	MWh/year
Total Indirect Emissions	**126.629,6**	**$tnCO_2$/year**
Γ. Absolute CO_2 Emissions (A + B)	**130.825,0**	**$tnCO_2$/year**
Δ. Negative Emissions from CO_2 Storage	**-1.000.000,0**	**$tnCO_2$/year**
E. Related CO_2 Emissions (C + D)	**- 869.175,0**	**$tnCO_2$/year**

[38] The land transport of CO_2 by trucks within the framework of the Pilot Projects will take place only during the first year of the Project's operation. Therefore, it is not taken into account in the calculation of CO_2 emissions for an average year of the Project's operation.

4.5.2 Economic Valuation of Emissions

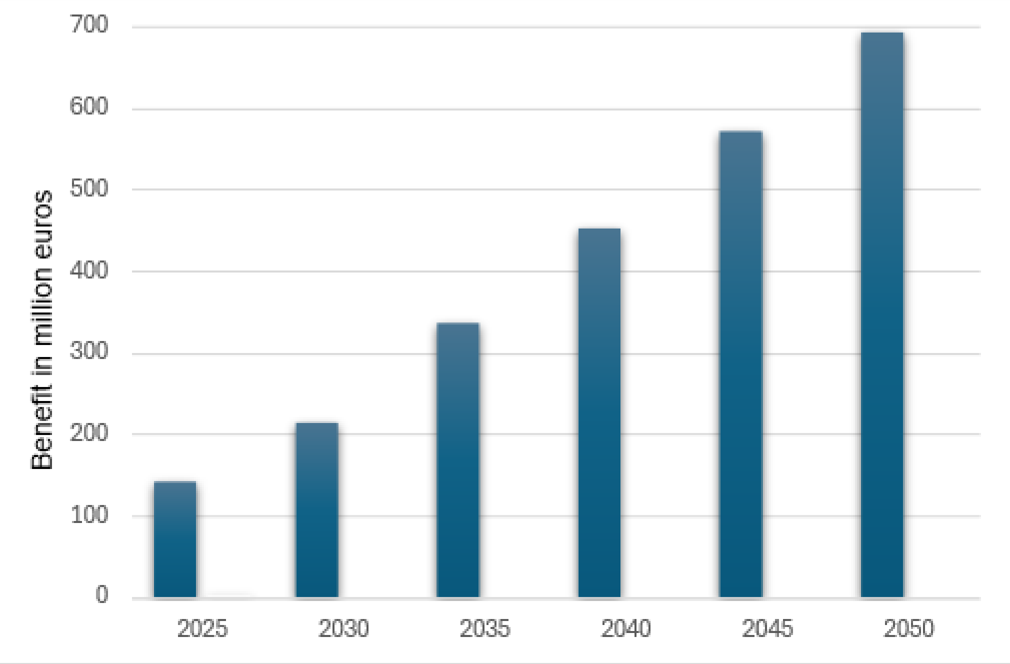
The **shadow price of carbon**, as referenced in the **Technical Guidance** (Table 6 of the Technical Guidance), is used in the economic valuation of projects. It reflects amounts not spent to achieve the goals of the Paris Agreement, resulting in **significant savings of financial resources.**

In the case of the proposed Project, construction is planned to be completed by 2025, with operations beginning in early 2026. Additionally, the related emissions are **negative** and considered **stable** at **–869,175 tons CO_2 equivalent per year**, as calculated above. Therefore, these are "negative" emissions, and the corresponding calculated cost actually represents a gain for the country's energy system.

Thus, based on the proposed shadow carbon price referenced in Table A6 of the EIB Group Climate Bank Roadmap 2021–2025[39], the benefit from the avoided emissions over the Project's lifetime is calculated.

Table 4–3: Calculation of Shadow Carbon Cost for Emissions and GHG Reductions from the Operation of the Project

Year	€/tn CO_2	million euros/year
2025	165	142,8
2030	250	216,4
2035	390	337,5
2040	525	454,4
2045	660	571,2
2050	800	692,4



[39] European Investment Bank, EIB Group climate bank roadmap 2021-2025, European Investment Bank, 2020, https://data.europa.eu/doi/10.2867/503343

Figure 4–14: Economic Benefit from Avoided Emissions Due to Project Operation (in million €)

As also highlighted in the Technical Guidance[1], these values are used solely to estimate the value of net carbon savings or emissions within the context of cost-benefit analyses from a societal perspective. They do not take into account forecasts for demand or other relevant aspects of economic analysis or the financial viability of the projects.

4.6 ECONOMIC DATA

The total budget of the Project is estimated at €517.62 million, excluding VAT. Of this amount, the total cost of the facilities amounts to €83.17 million, the capital development cost is €43.00 million. the total cost of drilling operations is €225.00 million, the total contingency cost is €138.95 million, the costs for insurance/certifications/inspections and payments (PMT) amount to €27.50 million. The table below provides a breakdown of the cost components by category.

Table 4–4: Economic Data of the Project

Facilities Cost	Amount (million €)
Supplementary External and Auxiliary Facilities (including the Monitoring and Control System)	13,34
Pipeline Connection (12-16" CO_2 pipeline, 20 km, shore approach and excavation)	51,30
Modifications to the existing Beta platform	9,84
Onshore facilities (works and access on land, pipe racks, wellheads, piping, emergency valves)	4,09
CO_2 processing onshore and offshore (compression, heating) and truck unloading area onshore	4,60
Total Capital Cost of Facilities	**83,17**
Drilling Cost	**Amount (million €)**
Drilling of wells (2 injection wells and 2 produced water wells)	74,00
Pump maintenance (ESPs) (replacement every 3 years for 20 years)	39,00
Isolation of zones B and C of the reservoir	15,00
Monitoring costs (3 wells converted to monitoring wells and monitoring added to 2 high-risk wells (P-1 and P-6))	25,00
Intervention on old wells (2 wells)	42,00
Relocation/removal of drilling rig	15,00
End of project – plugging and abandonment (7 wells: 2 injection, 2 produced water, and 3 monitoring wells)	15,00
Total Drilling Cost	**225,00**

Project Owner's Cost, Contingencies	Amount (million €)
Geological and Geophysical studies, Well and reservoir studies (simulation models, data acquisition and interpretation, feasibility studies for monitoring methods, assessments of possible leaks, etc.)	20,00
Design studies (FEED) and Environmental Impact Assessment (EIA)	15,00
Other studies (feasibility, marine traffic, analyses, consultants, etc.)	8,00
Licensing, Inspection, and Certification	6,00
Insurance – C.A.R. (only infrastructure) / 3.00% and drilling	3,50
PMT	15,00
Training	3,00
Contingencies (only infrastructure) – 30.0%	24,95
Contingencies for resolving issues with problematic old wells	114,00
Total Cost of the Project Operator, Contingencies	209,45
TOTAL COST (million €)	517,62

4.7 COMPARISON WITH OTHER PROJECTS

The planned CO_2 storage field is located within the Prinos basin, in the Gulf of Kavala, in the Northern Aegean Sea. The area of interest for the CO_2 storage exploration lies within the Prinos Concession, where Energean holds 100% ownership and management rights for oil and natural gas exploration and development activities since 2007. The potential CO_2 storage site is situated within the Prinos structure and the underlying aquifer.

The operation of the facility is planned to be developed in two distinct phases (Phase 1 and Phase 2) for reasons of scalability and adaptation to market conditions

- Phase 1: The initial nominal capacity of the Project will be up to **1 MTPA** (million tonnes per annum) for 20 years (starting late 2025 to early 2026). The CO_2 will be mainly supplied in bulk via third-party pipelines delivered onsite under suitable conditions for injection. Small quantities of CO2 will also be received at the Sigma onshore facilities by trucks through pilot projects.
- Phase 2: A gradual expansion of the Project is planned to reach a final nominal capacity of up **to 3 MTPA**. The facility will be modified to receive liquefied CO_2, which will be delivered via marine carriers to a newly constructed jetty. For this purpose, marine berthing and unloading facilities for the liquefied CO_2 will be built, along with new storage and processing installations (pumping, heating) within the Sigma plant activity area. The liquefied CO_2 will be temporarily stored, processed onshore and then transported to the offshore facilities through the pipeline constructed as part of Phase 1.

To serve the capacity of Phase 2, further upgrades to the Project's facilities will be required as follows:

- Upgrade of onshore storage and liquefied CO_2 handling facilities, mooring and unloading facilities for liquefied CO_2, and auxiliary installations.

- Possible installation of a new platform to accommodate the maximum capacity of Phase 2.
- At least four new CO_2 injection wells and four new produced water wells.
- Possible expansion of the water treatment facility.

However, as has already been noted, **the scope of this Environmental Impact Assessment (EIA) Study concerns Phase 1 of the Project,** which is described in the following sections. The licensing of the next phase of the Project (Phase 2) is not within the scope of this study and will be implemented at the appropriate stage of the project's design maturity.

The CO_2 sources and the main reception processes during Phase 1 of operation will be as follows:

- Supply of bulk CO_2 via pipeline, through an onshore reception station within the Sigma facilities.
- Reception of CO_2 loads from trucks using ISO containers at the Sigma onshore facilities. The ISO containers will be loaded onto ships by cranes, transported, and unloaded at the existing Beta platform of the offshore Prinos facilities.

The proposed Project may interact with other projects or activities on three levels:

- Level 1: Interaction with future infrastructures and activities that are planned to be developed at a later stage of the overall Project's maturity, of which the current Project under consideration is a part.
- Level 2: Interaction with other projects and activities existing in the immediate or broader area of the Project.
- Level 3: Interaction with projects of the same nature and similar scale that are being implemented or planned at the national level.

The above levels of interaction will be analyzed in more detail in the following paragraphs. Specifically:

Level 1. Interaction with future infrastructures and activities that are planned to be developed at a later stage of the overall Project's maturation, a part of which also constitutes the Project under examination within the framework of the present study.

After the exploitation phase, the project enters the stage of dismantling the installations, related infrastructure, and corresponding equipment, their removal and the restoration of the area.

Although, as has been repeatedly emphasized, the subject of the current Environmental Impact Assessment (EIA) study concerns Phase 1 of the Project (the permitting of Phase 2 is not included in this study and will be implemented at the appropriate stage of its design maturity, through a request for modification of the approved environmental terms and a new, standalone EIA), nevertheless, information is provided regarding the implementation of the entire Project. This is done, on one hand, to present a comprehensive overview of the development of the overall planned Project, and on the other hand, to help understand the scale and scope of the proposed intervention in relation to the overall long-term development, as well as the full range of prospects and future opportunities opened by the Project's implementation.

Level 2. Interaction with other projects and activities existing in the immediate or wider area of the Project. In the **immediate vicinity of the Project**, the **offshore development project of Prinos** and the **onshore industrial facility Sigma** are located, as described below.

According to the valid Environmental Terms Approval (ΑΕΠΟ) DIPA/8413/24.04.2018 (ADA: ΨΓΛ14653Π8-Ζ79), the **Prinos Offshore Development project** concerns the existing offshore oil and natural gas extraction facilities located in the Gulf of Kavala, in the Northeastern Aegean, and its expansion with two new platforms, one of which is planned for the long term. The total production capacity is 27,000 barrels per day of stabilized crude oil.

The existing offshore project consists of the following individual facilities:

- The **Kappa** platform is located at the sweet natural gas reservoir, which is not associated with an oil reservoir, in South Kavala.
- A 12 km, 6-inch pipeline (operating pressure 8-12 barg) transports the sweet natural gas and condensate from South Kavala (Kappa platform) to the Delta platform of Prinos.
- Production platforms **Alpha** and **Beta**, each with twelve wellheads, are part of the Prinos complex. They are connected by bridges to the Delta platform and are designed to accommodate drilling rigs for drilling, repairs, maintenance and any other suitable rigs.
- The **Delta** processing platform contains all the offshore initial processing facilities and, to date, receives the oil, natural gas, water, and condensate produced from the Prinos, North Prinos, and Epsilon fields. The Delta platform is connected by bridges to the Alpha and Beta platforms as well as to its own flare stack. New vertical connection risers are being added at the Delta platform to enable the reception of produced fluids from the Lambda platform (and possibly the Omicron platform) and to send natural gas (gas lift) and water for injection to the Lambda platform. Additionally, a vertical protective conduit is being installed to accommodate a multi-conductor cable that will transmit power, data, communications, and auxiliary fluids to the Lambda platform.
- There is also a **flare stack** serving the entire Prinos platform complex.
- An 18 km, 12-inch pipeline (operating pressure 8 barg) for transporting sour natural gas from the Delta platform to the onshore facilities..
- An 18 km, 8-inch pipeline (operating pressure 20-40 barg) for transporting crude oil from the Delta platform to the onshore facilities.
- An 18 km, 5.3-inch pipeline for transporting sweet natural gas (gas lift) from the onshore facilities to the Delta platform.
- Two underwater electric power cables, each with a capacity of 10 kVA, from the onshore facilities to the Prinos platform complex.

The onshore industrial facility Sigma includes installations for desalination, dehydration, stabilization and desulfurization of the produced crude oil, conversion of the produced sour gas into sweet gas, production of liquid and solid sulfur as well as the necessary facilities for the safe storage and handling of the produced crude oil, natural gas and sulfur.

Consequently, the Project exhibits direct interaction with elements of the Prinos offshore development project and the onshore Sigma industrial facility and therefore the scope and intensity of these interactions will be examined in the relevant Sections of Chapters 9 and 11 of this report.

In the wider study area (which, for the purposes of this Section, consists of the Gulf of Kavala), a variety of infrastructures and activities have been identified that could potentially interact with the proposed Project, more specifically the following:

- The ports of Kavala (commercial port "Philippos B'" and passenger port "Apostolos Pavlos").
- Passenger port of Keramoti.
- Section of the PATHE motorway (Patras–Athens–Thessaloniki–Evzones highway).
- Wastewater treatment plants (WWTPs):
  - Kavala WWTP (GR115001016) with discharge into the sea.
  - Palaios Tsiflikiou WWTP (GR1150010117) with discharge into the sea.
  - Filippon WWTP (GR1150100118) with flow discharge.
  - Nea Peramos WWTP (GR1150030115) with flow discharge.
  - Chrysoupoli WWTP (GR115011018) with flow discharge.
  - Limenas Thassos WWTP (GR1150040116) with discharge into the sea.
- Hellenic Fertilizers (ELFE), originally established in 1961 (as the Phosphoric Fertilizers Industry S.A. (PFI)) and began operations in Nea Karvali in 1965. The facilities include:
  - Ammonia production unit.
  - Nitric acid and nitrate fertilizers production unit.
  - Sulfuric acid production unit.
  - Phosphoric acid production unit.
  - Compound fertilizers production unit.
- Coral Oil, located adjacent to the SIGMA facilities and Revoil, about 1.5 km to the north, operate as fuel storage and distribution sites

The majority of the aforementioned projects are neither directly nor indirectly related to the Project. However, the fuel storage and distribution sites can have negative impacts in the event of an accident, mainly due to fire. For this reason, all necessary preventive and emergency mitigation measures that are prescribed for the existing facilities and presented in Chapters 11 and 12 must be taken. Nevertheless, no impacts from CO_2 leakage are expected at these sites.

The industrial facility Ελληνικά Λιπάσματα (ELFE) could present strong positive synergies with the Project, as it is a significant producer of CO_2 that could be captured and stored in the Project, resulting in mutually beneficial effects.

Similarly, mostly positive interactions are expected with the transportation infrastructures of the wider area (the commercial port “Philippos B'”, the passenger port “Apostolos Pavlos” and a section of the PATHE motorway), as part of the CO_2 loads in ISO container trucks will be transported through these facilities.

Therefore, the above projects and activities are considered likely to contribute to the overall environmental impacts in the wider area of the Project (mostly as a factor of positive interactions), and as such, the scope and intensity of these interactions will be examined in the relevant Sections of **Chapters 9 and 11** of the present study.

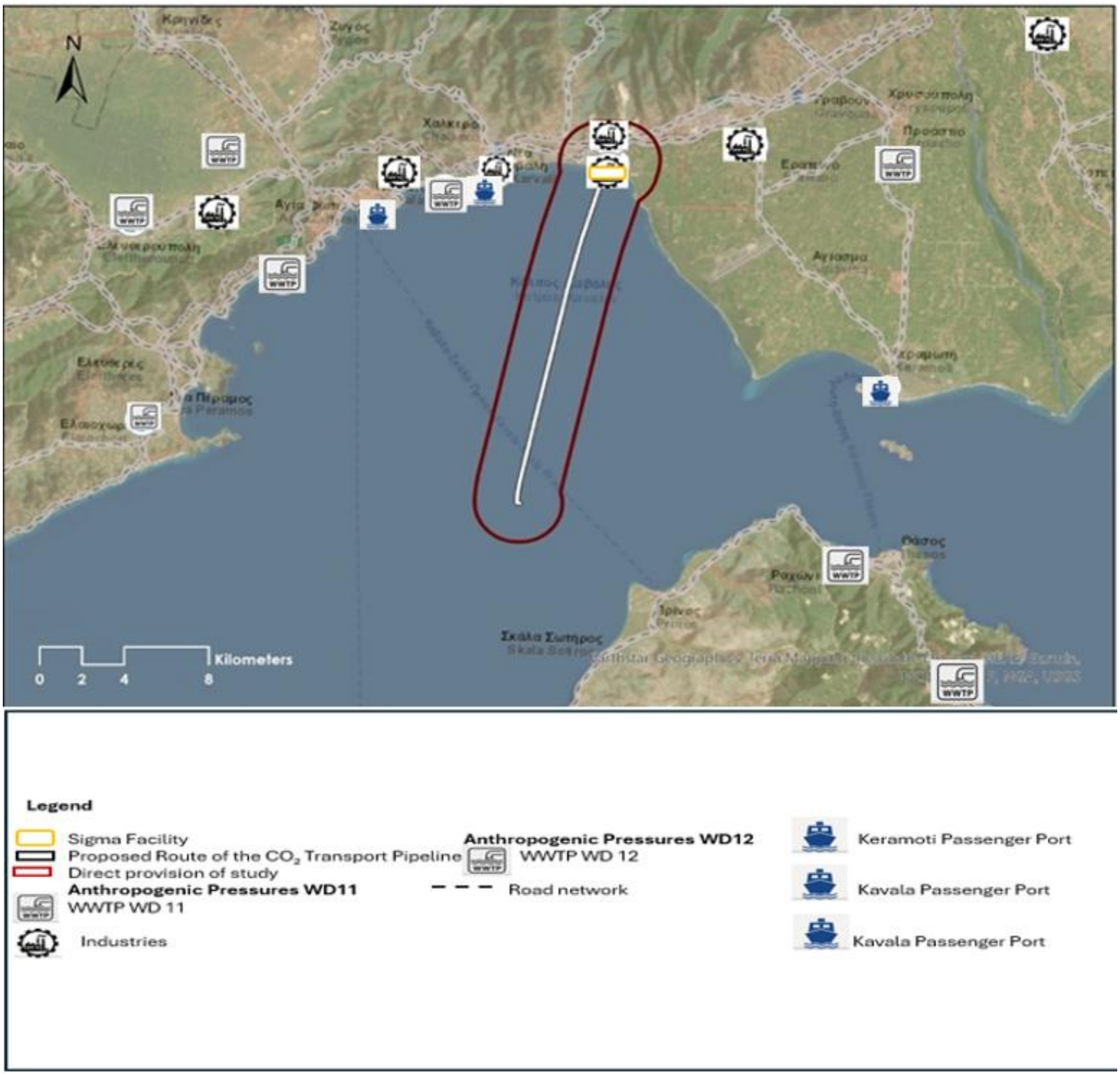


Figure 4–15: Infrastructure and other activities in the wider area of the Project

Level 3: Interaction with projects of the same nature and comparable scale that are being implemented or planned at the national level.

The proposed CO_2 capture and storage project in Prinos is the first initiative of its kind in Greece and the Southeastern Mediterranean. Therefore, it cannot demonstrate interactions with other projects of the same nature and comparable scale at the national level, as such projects do not currently exist, are not being implemented, and are not planned at this time. According to the revised National Energy and Climate Plan (NECP), two projects have already been approved for co-financing by the Innovation Fund: the IRIS project for CO_2 capture at the hydrogen production unit of a refinery in Corinth, and the IFESTOS project for CO_2 capture at a cement production plant in Boeotia. However, since these projects are still at a very early stage of planning, it is not possible to assess the potential cumulative impacts in conjunction with the proposed project. Nevertheless, it is important to note that, in any case, due to the nature and general technical characteristics of these projects, any potential cumulative environmental and social impacts are expected to **be mostly positive**.

In recent times, a coordinated effort has been unfolding at the **national level** [National Climate Law (Law 4936, Government Gazette A 105/27.5.2022), as amended and in force, the NECP, the Long-Term Strategy 2050, Regional Climate Change Adaptation Plans, etc.], at the **European** level [European Green Deal, 2030 Climate and Energy Framework, EU Strategy on Adaptation to Climate Change], and at the **international** level [Paris Agreement under the United Nations Framework Convention on Climate Change (UNFCCC)], focusing on the energy transition, the reduction of greenhouse gas emissions, and ultimately the achievement of climate neutrality.

In this context, EnEarth has designed and plans to implement a full-scale CO_2 Storage facility in Prinos, capable of storing a significant amount of CO_2, thereby achieving a correspondingly substantial offset of emissions at both the regional and national level. As such, the Project demonstrates a strong direct and indirect interaction with a broad range of actions, activities, and infrastructures aimed at combating climate change and achieving climate neutrality.

In conclusion, although there is no interaction between the Project and other projects of the same nature and comparable scale at the national level—since such projects do not currently exist, are not being implemented, nor are they planned—it is nonetheless clear that the Project demonstrates strong direct and indirect interaction with a wide range of actions, activities, and infrastructures (at national, European, and international levels) aimed at addressing and mitigating climate change and achieving climate neutrality, particularly from the perspective of their environmental footprint.

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TABLES

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5 PROJECT COMPATIBILITY WITH THE EXISTING REGULATORY PROVISIONS OF THE AREA

5.1 ENVIRONMENTAL PERMITTING OF EXISTING PROJECT FACILITIES

H "Energean Oil & Gas – Energean Aegean Energy Société Anonyme for Hydrocarbon Exploration and Production" (hereinafter referred to as "Energean"), an affiliated company of EnEarth, holds, among others, the rights for hydrocarbon exploration and exploitation in the offshore exploitation area of the Prinos oil fields pursuant to the contract dated 23.11.1999 with the Hellenic Republic, as ratified by Law 2779/1999 (Government Gazette A 296/30.12.1999) and as subsequently amended and currently in force. Following the initial contract and its ratification, a number of legal acts have been carried out in order to reflect several deviations from the original terms. These specific acts are presented in **Table 5.1** below.

Table 5-1: Legal acts governing the concession agreement

Legal Act	Reference Number	Subject
Law 2779/1999	Government Gazette A 296/30.12.1999	Ratification of the Contract dated 23.11.1999 between the Hellenic Republic and Kavala Oil S.A., including Annexes I and II, for the exploitation of the offshore area of the Thracian Sea, ratified by Law 2779/1999 (A'296).
Law 4135/2013	Government Gazette A 69/19.3.2013	Ratification of the first amending agreement dated 31.10.2012 between the Hellenic Republic and the contracting companies Kavala Oil S.A. and Energean Oil & Gas S.A. for the amendment of the 23.11.1999 agreement for the exploitation of the offshore area of the Thracian Sea, ratified by Law 2779/1999 (A'296).
Law 4296/2014	Government Gazette A 214/2.10.2014	Ratification of the second amending agreement dated 30.12.2013 between the Hellenic Republic and the contracting companies Kavala Oil S.A., Energean Oil & Gas S.A., and HELLENIC PETROLEUM for the amendment of the 23.11.1999 agreement for the exploitation of the offshore area of the Thracian Sea, ratified by Law 2779/1999 (A'296).
Law 4296/2014	Government Gazette A 214/2.10.2014	Ratification of the third amending agreement dated 11.09.2014 between the Hellenic Republic and the contracting companies Kavala Oil S.A. and Energean Oil & Gas S.A. for the amendment of the 23.11.1999 agreement for the exploitation of the offshore area of the Thracian Sea, ratified by Law 2779/1999 (A'296).
Law 4409/2016	Government Gazette A 136/28.07.2016	Ratification of the fourth amending agreement dated 22.11.2015 between the Hellenic Republic and the contracting companies Kavala Oil S.A. and Energean Oil & Gas S.A. for the amendment of the 23.11.1999 agreement for the exploitation of the offshore area of the Thracian Sea, ratified by Law 2779/1999 (A'296).
Law 4585/2018	Government Gazette A 216/24.12.2018	Ratification of the fifth amending agreement dated 20.11.2018 between the Hellenic Republic and the contracting companies Energean Oil & Gas S.A. and Kavala Oil S.A. for the amendment of the 23.11.1999 agreement for the exploitation of the offshore area of the Thracian Sea, ratified by Law 2779/1999 (A'296).

Legal Act	Reference Number	Subject
Law 4952/2022	Government Gazette A 130/07.07.2022	Ratification of the sixth amending agreement dated 19.06.2024 between the Hellenic Republic and the contracting company Energean Oil & Gas S.A. for the amendment of the 23.11.1999 agreement for the exploitation of the offshore area of the Thracian Sea, ratified by Law 2779/1999 (A'296).
Law 5115/2024	Government Gazette A 98/01.07.2024	Ratification of the seventh amending agreement dated 15.03.2024 between the Hellenic Republic and the contracting company Energean Oil & Gas S.A. for the amendment of the 23.11.1999 agreement for the exploitation of the offshore area of the Thracian Sea, ratified by Law 2779/1999 (A'296).

As previously mentioned, the facilities and wells foreseen for the operation of the proposed CO_2 storage project include:

- **Onshore facilities:** Modification of a designated area within the existing Sigma onshore facility for the construction of the CO_2 reception manifold and an unloading and compression area.
- **Offshore pipeline:** Subsea pipeline connecting the Sigma plant area with the Beta offshore platform, approximately 20 km in length.
- **Offshore platform**: Modification of the existing offshore installations at Prinos (Beta and Delta platforms) to receive CO_2 from the new subsea pipeline and CO_2 cargo containers, for injection into the new wells, and treatment of the produced water.
- **Wells:** Two (2) CO_2 injection wells and two (2) water production wells at the existing Beta platform of the Prinos offshore complex.

Therefore, the operation of the existing offshore installations, which will form part of the proposed project, is governed by the conditions of the Environmental Terms Approval (ETA) of the Prinos Offshore Development project (ETA DIPA/8413/24.04.2018 (ADA: ΨΓΛ14653Π8-Ζ79)).

Similarly, the onshore installations to be constructed as part of the proposed project are located within the Sigma Onshore Industrial Unit, the operation of which is governed by the conditions of the relevant ETA (Ministerial Decision 213450/2013).

As part of its years-long oil extraction (exploration and production) activities within the Prinos Exploitation Area (as defined in the 23.11.1999 Contract ratified by Law 2779/1999, as amended and in force), Energean has collected geological, geophysical, and drilling data for the Prinos basin, and in particular for the Prinos and Epsilon structures, which demonstrate that these structures are in principle eligible as CO_2 storage sites (for the reasons discussed in **Section 4.3** of this document).

Consequently, within the context of its activities in the area, Energean proceeded with the design and permitting maturation of a **CO_2 Storage Unit in Prinos** in compliance with the provisions of Article 173 of Law 4964/2022. Specifically, according to Law 4964/2022 (Official Gazette A 150/30.07.2022) titled "Provisions for the simplification of environmental permitting, establishment of a framework for the development of Offshore Wind Farms, addressing the energy crisis, environmental protection, and other provisions", and more specifically based on Article 173 thereof, entities that have been granted by the Hellenic State (pursuant to Law 2289/1995 (A' 27)) the right or license for hydrocarbon exploration and exploitation in a specific area and that possess sufficient data (particularly geological, geophysical, and drilling data) to substantiate the preliminary eligibility of a geological formation or formations located beneath the subsoil of the concession area (onshore or offshore) as a potential CO_2 storage site, are granted (under the conditions of said article) **the right to continue and complete the investigation process for the area in order to determine its suitability for CO_2 storage.**

Based on the above, on 31.08.2022, Energean submitted a request to HEREMA for the activation of the right to continue and complete the investigation of the Prinos and Epsilon fields and the underlying aquifer (the "Area") to assess their suitability as CO_2 storage sites. This request was approved through the **Decision on Activation of the Right for CO_2 Storage Investigation** (as approved by HEREMA Decision No. 14577/29.09.2022 (Official Gazette 5247/B/11.10.2022)), which confirmed the preliminary eligibility of the storage site, located within the boundaries of the Prinos concession and including the Prinos and Epsilon fields and the underlying aquifer, and approved the continuation and completion of the investigation of the Area as a storage site for a period of twenty-two (22) months starting from October 1, 2022, by Energean.

According to paragraph 5 of Article 173 of Law 4964/2022, following completion of the suitability investigation and prior to the expiration of the validity of the right to complete the investigation, the interested entity shall submit a request to HEREMA to determine the suitability of the geological formation as a CO_2 storage site and to activate the storage right of the entity. The interested entity shall mean either the holder of the right to continue and complete the investigation (in this case, Energean), or an affiliated company, the sole purpose of which is CO_2 storage activities (in this case, EnEarth).

With the progress and completion of the procedures for investigating the Area as a CO_2 storage site, EnEarth, as an affiliated company of Energean, submitted on 30.06.2024 an application to determine the suitability of the geological formation as a CO_2 storage site and to activate the storage right of the entity in accordance with paragraph 5 of Article 173 of Law 4964/2022.

5.2 LEGISLATIVE FRAMEWORK

5.2.1 Legislation on CO_2 Storage in Geological Formations

5.2.1.1 Directive 2009/31/EC on the Geological Storage of Carbon Dioxide

The storage of carbon dioxide (CO_2) in geological formations was introduced in Europe through **Directive 2009/31/EC**. According to the Directive, **the capture and storage of carbon dioxide in geological formations (CCS)** is considered a bridging technology that will contribute to mitigating climate change. It involves the capture of carbon dioxide (CO_2) from industrial installations, its transportation to a storage site, and its injection into suitable underground geological formations for permanent storage.

According to the initial estimates regarding the impact of the proposed Directive, as included in the Commission's impact assessment, it was estimated that by 2020 up to seven million tonnes of CO_2 could be stored and up to 160 million tonnes by 2030, provided that greenhouse gas emissions are reduced by 20% by 2020 and that CCS technology receives national and EU support and proves to be environmentally safe. The CO_2 emissions avoided in 2030 would represent approximately 15% of the emission reductions required in the EU.

The objective of this Directive is to establish a legal framework for the environmentally safe storage of CO_2 in geological formations in order to combat climate change. The aim of environmentally safe storage of CO_2 in geological formations is the permanent isolation of CO_2 in a manner that prevents and, where this is not possible, eliminates as far as possible negative effects and any risks to the environment and human health.

The Directive applies to the storage of CO_2 in geological formations within the territory of Member States, their exclusive economic zones, and their continental shelves, in accordance with the United Nations Convention on the Law of the Sea (UNCLOS).

According to **Article 3** of the Directive, the following definitions, among others, are provided:

- *"Storage of CO_2 in geological formations" means the injection accompanied by storage of CO_2 streams in underground geological formations*
- *"Storage site" means a defined volume area within a geological formation used for the storage of CO_2 in geological formations, including associated surface and injection facilities*
- *"Storage complex" means the storage site and surrounding geological domain which can have an effect on overall storage integrity and security (i.e., secondary containment formations)*
- *Geological formation" means a lithostratigraphic subdivision within which distinct layers of rock are present and can be mapped*
- *"Storage permit" means a written and reasoned decision (or set of decisions) authorizing the storage of CO_2 in geological formations at a specific storage site by the operator, and setting out the conditions under which the activity can be conducted, issued by the competent authority in accordance with the requirements of this Directive*
- "Transport network" means the network of pipelines, including associated booster stations, for the transport of CO_2 to the storage site

According to **Article 6**, Member States must ensure that no storage site is operated without a storage permit, that there is only one operator per storage site, and that conflicting uses of the site are not permitted.

According to **Article 13**, Member States must ensure that the operator carries out monitoring of the injection facilities, the storage complex (including, where possible, the CO_2 plume), and, where appropriate, the surrounding environment for the purposes of:

- comparing actual and modeled behavior of CO_2 and formation water at the storage site
- detecting significant irregularities
- detecting migration of CO_2
- detecting leakage of CO_2
- detecting significant adverse effects on the surrounding environment, in particular on drinking water, human populations, or users of the surrounding biosphere
- assessing the effectiveness of any corrective measures taken pursuant to Article 16
- providing data to update the assessment of short- and long-term storage site safety and integrity, including whether the stored CO_2 will be completely and permanently contained.

The methodology followed for the preparation of this Environmental Impact Assessment (EIA) is consistent with the requirements and guidelines of this Directive.

5.2.1.2 Ministerial Decision 48416/2037/E.103/2011 (Government Gazette 2516/B/7.11.2011)

Joint Ministerial Decision (hereinafter "JMD") 48416/2037/E.103/2011 (Government Gazette 2516/B/7.11.2011) transposes Directive 2009/31/EC into national legislation and sets out measures and conditions for the storage of carbon dioxide in geological formations.

According to Article 14 of the JMD, the monitoring of the activity is based on a Monitoring Plan prepared by the operator in accordance with the requirements of Annex II of the JMD, including details on monitoring according to the guidelines laid down in Article 10 of JMD no. 54409/2632/2004, as in force.

Specifically, the operator is required to carry out monitoring of the injection facilities, the storage complex, and, where applicable, the surrounding environment, as also referred to in the above section.

The Monitoring Plan referred to in Article 14, paragraph 2.2, is drawn up in accordance with the risk assessment analysis carried out in Phase 3 of Annex I and is updated according to the criteria in **Annex II.**

According to Article 17, in the event of leakage or significant irregularities, the operator is required to immediately notify the competent authority and take the necessary corrective measures, including measures related to health protection. In the event of leaks and significant irregularities that involve the risk of leakage, the operator shall also notify the competent authority in accordance with JMD no. 54409/2632/2004, as amended by JMD no. 9267/468/2007 (B' 286) and JMD no. 57495/2959/2010 (B' 2030)

According to Article 18, a storage site shall be closed if the conditions of the storage permit have been fulfilled, following a substantiated request by the operator and subsequent approval by the competent authority, or if the competent authority decides to do so after the revocation of the storage permit under Article 12, paragraph 3. After the closure of a storage site, the operator remains responsible for:

- monitoring, reporting, and taking corrective measures in accordance with the requirements of this Decision,
- taking preventive or remedial measures in accordance with Articles 8 to 11 of Presidential Decree 148/2009, until the liability for the storage site is transferred to the competent authority in accordance with Article 19, paragraphs 1 to 5 of this Decision,
- sealing the storage site and removing the injection facilities.

The characterization and assessment of potential storage complexes and the surrounding area are carried out in three phases in accordance with **Annex I** of the JMD:

- Phase 1: Data collection
- Phase 2: Development of a three-dimensional static geological earth model

  Phase 3: Characterization of the dynamic behavior of the storage, sensitivity characterization, risk assessment
  - Characterization of the dynamic behavior of the storage
  - Sensitivity characterization
  - Risk assessment

5.2.2 Institutional Framework for Environmental Permitting

5.2.2.1 Directive 2011/92/EU on the Assessment of the Effects of Certain Public and Private Projects on the Environment (EIA Directive)

The **Environmental Impact Assessment (EIA)** procedure was first introduced in Europe in 1985 by the EIA Directive (85/337/EEC) and constitutes the main instrument of the European Union's environmental policy that establishes the obligation to assess the environmental impacts of projects/activities during the decision-making phase. Key features of the EIA Directive include:

- The wide range of projects and activities, from industrial and other production activities to infrastructure projects, such as roads, dams, and ports, mainly in the form of public investments.
- The requirement for an ex-ante assessment of the impacts, so that environmental issues can be fully integrated into the design, implementation, and operation of projects.
- The openness of the process to the public, who may request to be informed and participate in the decision-making.
- The requirement for detailed and understandable information on environmental impacts—in other words, the need for an Environmental Impact Study.

The EIA process, as defined in the relevant Directive, can be summarized in the following **stages**:

A. The project developer may request from the competent environmental authority to define the issues to be covered by the environmental impact assessment and the related information that must be provided by the developer (scoping).

B. The developer must provide the required information on the environmental impacts of the project (Environmental Impact Assessment Study – EIA Study, Annex IV) to the competent authority.

C. The competent environmental authorities, the public (and the affected Member States) must be informed and express their opinion on the EIA Study.

D. The competent environmental authority decides whether to approve the project, taking into account the outcome of the EIA consultation. The public is informed of the decision, which can also be contested before a court.

The EIA Directive applies to a wide range of public and private projects, as defined in Annexes I and II thereof. Projects listed in Annex I are considered to have significant environmental impacts and are subject to the full EIA process. For projects listed in Annex II, it is up to the national authorities—through a screening procedure—to decide whether an EIA is required, taking into account thresholds/criteria or case-by-case examination as well as the criteria set out in Annex III.

Twelve years after the adoption of the EIA Directive, and following the development of an entirely new market of environmental impact assessment services and conclusions drawn from the implementation experience up to that point, the EIA Directive was amended by Directive 97/11/EC, in order to:

- Align with the Espoo Convention on Environmental Impact Assessment in a Transboundary Context.
- Expand the scope of projects and activities subject to the EIA procedure.
- Improve and broaden the criteria under which a project is subject to the EIA requirement.

Subsequently, the Directive was amended two more times through Directive 2003/35/EC (on public participation procedures aligned with the Aarhus Convention provisions) and Directive 2009/31/EC (regarding specifications for CO_2 transport and storage projects). It was eventually codified by Directive 2011/92/EU of 13 December 2011.

The most recent update was made by Directive 2014/52/EU, which entered into force on 15 May 2014, aiming to simplify the rules for evaluating the potential environmental impacts of projects. Member States were required to have transposed the Directive into their legal frameworks by 16 May 2017. This update is in line with the promotion of smarter regulation in order to reduce administrative burdens. It also improves the level of environmental protection and aims to make business decision-making for public and private investments more certain, predictable, and sustainable in the long term. The new approach places greater emphasis on threats and challenges that have emerged since the original rules came into force approximately 25 years ago. This means greater attention is now given to areas such as resource efficiency, climate change, and disaster prevention, which are now better integrated into the assessment process.

The key changes in the latest update to the EIA Directive include:

- Member States are now required to streamline their various procedures for environmental impact assessments.
- Timetables are introduced for the various stages of environmental assessments: screening decisions should be made within 90 days (although an extension is possible), and public consultation must last at

least 30 days. Member States must also ensure that final decisions are taken within a “reasonable timeframe”.

- The screening procedure determining whether the EIA process is required is simplified. Decisions must be duly justified in light of the updated screening criteria.
- EIA Studies are to be made more understandable for the public, especially regarding the assessments of the current state of the environment and the alternatives considered for the project/activity.
- The quality and content of reports will be improved. Competent authorities must also demonstrate their objectivity in order to avoid conflicts of interest.
- The reasons for permitting decisions must be clear and more transparent to the public. Member States may also establish timeframes for the validity of any reasoned conclusions or opinions issued under the EIA process.

If projects involve significant adverse effects on the environment, the project developers—and by extension the planners—will be obliged to take the necessary measures to avoid, prevent, or reduce these impacts. Such projects must be monitored through procedures defined by the Member States. In order to avoid double monitoring and unnecessary costs, the use of existing monitoring arrangements is permitted. According to Article 1 of the Directive, this shall apply to the environmental impact assessment of public and private projects that are likely to have significant effects on the environment. Although specific procedures may differ considerably between Member States, the main stages of the EIA process are common throughout the European Union. Figure 5-1 provides a summary flowchart of the EIA procedure stages, indicating the mandatory phases (highlighted in yellow) and the optional EIA processes (not highlighted).

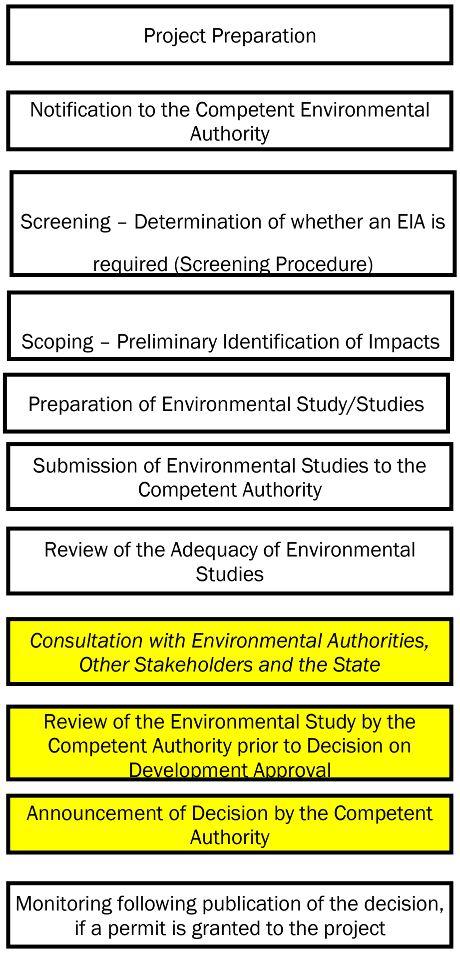


Figure 5–1: Flow chart of the EIA procedure according to the EU Directive

The methodology adopted in the preparation of the present Environmental Impact Assessment Study (EIA Study) is consistent with the requirements and guidelines not only of the said Directive, but also of the applicable national and Community legal framework for the EIA process.

5.2.2.2 Law 4014/2011 on the Environmental Permitting of Projects and Activities

The national legislative framework was first enriched for the protection of the environment in 1986 with Law 1650/1986, which approached the first EIA Directive while also regulating a series of environmental issues that were considered quite radical for the time. The approach was rather detailed, and for the matters where a degree of flexibility was allowed for Member States, the law leaned toward the stricter interpretation. Amendments to the Directive brought changes to national legislation, which were established through Law 3010/2002. The main changes introduced included compliance with the new Directive, decentralization, and the establishment of the screening procedure. Later, the legal framework was revised with Law 4014/2011, which was accompanied by a series of Joint Ministerial Decisions (JMDs), Ministerial Decisions, and Circulars, all aiming, along with the main law, at improving the overall outcome and increasing the added value of the procedures. In particular, Law 4014/2011 and Ministerial Decision No. oik. 5688/2018 (Government Gazette 988/B/21-03-2018), which amended it, introduced important fundamental improvements and changes.

The Environmental Impact Assessment process in Greece, for projects such as the proposed one, is summarized in the following phases (according to the current legislation) and is also presented diagrammatically in the flow chart that follows:

1 **Environmental Impact Assessment Study:** The project developer submits the EIA[1] Study of the project to the Ministry of Environment and Energy (YPEN), Directorate of Environmental Permitting (DIPA)[2].

2 **Completeness Check:** DIPA/YPEN checks the EIA Study for completeness and may request additional information before forwarding it for consultation.

3 **Institutional Consultation:** Opinion/response from Central Authorities or other competent Ministries, Regional Authorities, and other organizations[3].

4 **Public Consultation:** The project is presented before the Regional Council during an open hearing where people may express their views.

5 **Decision on the Approval of Environmental Terms (AEPO):** DIPA/YPEN examines the results of the consultation (institutional and public) and issues its decision, co-signed by the other competent Ministries.

6 **Publication of Decision:** The decision is published through the competent Regional Council.

The procedure for amending and renewing the approved AEPOs of Category **A1 projects** is provided for in Articles 5 and 6 respectively of Law 4014/2011, as applicable.

[1] **The content of the Environmental Impact Assessment (EIA) is determined based on** (a) **the classification of the project** (in accordance with Ministerial Decision ΔΙΠΑ/οικ. 37674/27-07-2016, as amended by the following Ministerial Decisions: οικ. 2307 (Government Gazette 439/B/2018), Y.A. ΥΠΕΝ/ΔΙΠΑ/64001/2029 (GG 4420/B/2018), Y.A. ΥΠΕΝ/ΔΙΠΑ/94321/3907 (GG 5798/B/2018), Y.A. ΥΠΕΝ/ΔΔΥ/24593/2902/2020 (GG 1482/B/2020), ΥΠΕΝ/ΔΙΠΑ/74463/4562 (GG 3291/B/2020), Y.A. οικ. 92108/1045/Φ.15/2020 (GG 3833/B/2020), Y.A. ΥΠΕΝ/ΔΙΠΑ/99398/6484/2020 (GG 4656/B/2020), YA ΥΠΕΝ/ΔΙΠΑ/17185/1069 (GG 841/B/2022), YA ΥΠΕΝ/ΔΙΠΑ/64712/4464 (GG 3636/B/2022), Y.A. ΥΠΕΝ/ΔΙΠΑ/53510/3616 (GG 3327/B/2023)), and (b) **the detailed specifications set out in Joint Ministerial Decision 170225/2014 and its amendment by Ministerial Decision οικ. 1915/2018, for each type of project/activity.**

2 The content of the EIA Study is determined by (a) the project classification (in accordance with Ministerial Decision 1958/2012) and (b) the detailed specifications defined in Joint Ministerial Decision 170225/2014 for each type of project/activity.

3 The consultants are predetermined by Joint Ministerial Decision 1649/45/2014 for each type and category of project.

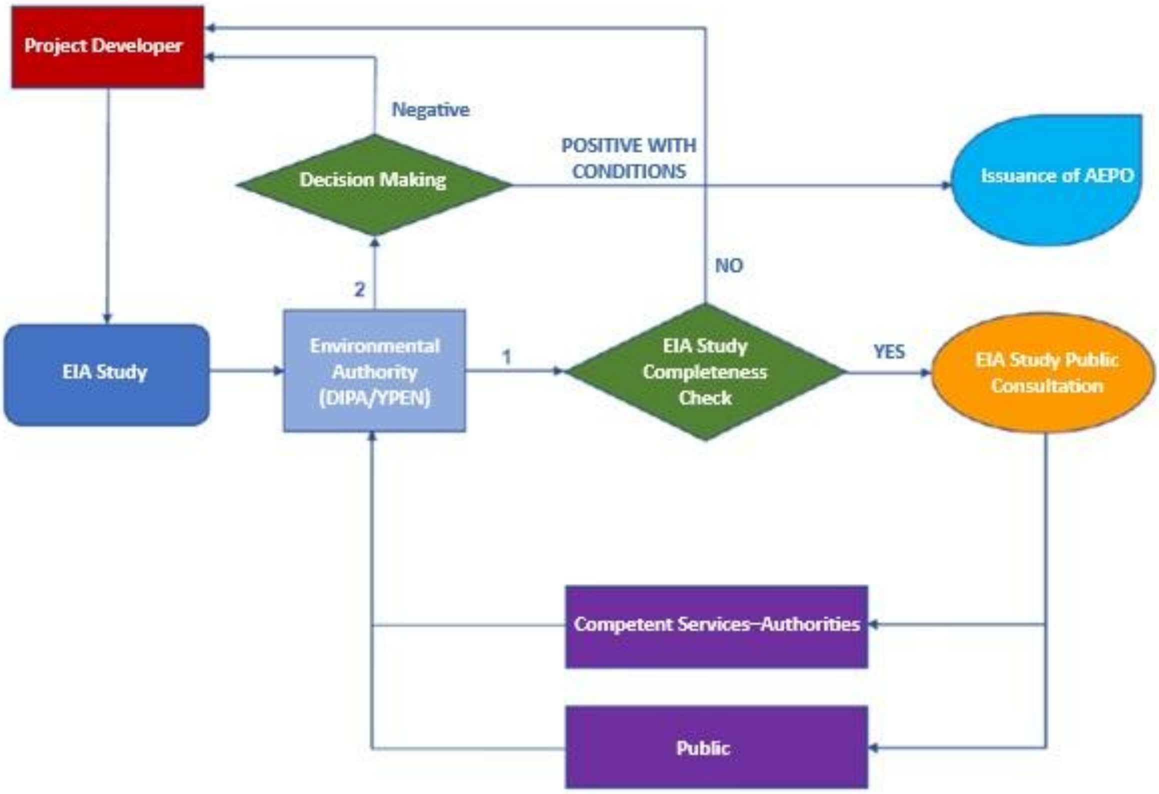


Figure 5–2: Flow chart of the EIA procedure according to the National Legal Framework

With regard to the consultation procedure for the assessment of the EIA Study and the institutional information of the interested public, the provisions of Joint Ministerial Decision 1649/45/2014 apply, which define and specify the provisions of Article 19, paragraph 19 of Law 4014/2011 regarding:

- Means of consultation among the various authorities, and
- Ways of informing the public, as well as its participation in the public consultation during the environmental permitting procedure.

The aforementioned JMD further determines the consultation procedures following the implementation of Article 18, paragraph 5 of Law 4014/2011 regarding the electronic environmental register. However, given that a transitional period is foreseen for the establishment of this register, the relevant procedures are also provided for within this period.

In addition, the authorities to be consulted are also defined and listed in Annex B of the JMD.

<u>It should be noted that the present Study has been drafted in accordance with the above-mentioned provisions of Law 4014/2011 on Environmental Permitting, as amended and currently in force.</u>

5.2.2.3 Law 4685/2020 – Modernisation of Environmental Legislation and Other Provisions

Environmental permitting in Greece, despite the amendments made to the legislation and the improved quality of studies by private consultants, remains a time-consuming administrative process and, therefore, a significant obstacle to the promotion of investments. Specifically, the environmental permitting process for new projects, which are vital for the development of the Greek economy, significantly exceeds the timeframes provided by the applicable legislation across all project categories. Additionally, the permitting process for existing investments—namely the renewal or modification of the Environmental Terms Approval Decision (AEPO)—also far exceeds the statutory timelines. Indicatively, in 40% of cases, new opinions are requested from the competent services. As a result, existing investments are treated as new ones, incurring the corresponding delays. To accelerate and simplify the procedures in order to address longstanding operational problems and to create an investment-friendly environment in Greece, the provisions of Law 4685/2020 were enacted. These provisions constitute a horizontal reform within the framework of EU legislation and introduce a faster, safer, and more efficient environmental permitting system. This chapter (5.2.2) shortens and simplifies the environmental permitting process, while fully respecting environmental protection. The new regulations regarding the validity period of AEPOs, as well as the process for their issuance, renewal, and modification, simplify the business environment and reduce the administrative burden on public authorities, which is further alleviated by allowing the engagement of private MPE evaluators, thus activating and strengthening a provision that had already existed under the original Law 4014/2011 (Official Gazette A' 209). The key principle underpinning this law, in terms of environmental permitting, is to relieve both public authorities and businesses of procedural burdens that do not contribute meaningfully to environmental protection.

More specifically, the main changes introduced by the new law in the field of environmental permitting are as follows:

Article 1: This provision extends the validity period of AEPOs and introduces favourable conditions for Project Developers with environmental certification (EMAS and ISO 14001), as these ensure better compliance with environmental legislation and permit terms, while also providing a strong incentive to maintain environmental certification. In particular, with the amendment of point (a) of paragraph 8 of Article 2 of Law 4014/2011, the validity period of the AEPO is set at fifteen years instead of the previous ten, provided that no changes occur based on the data on which the decision was issued. Additionally, the AEPO validity is extended by six years for projects or activities implementing an Environmental Management System (EMS) according to the Eco-Management and Audit Scheme (EMAS), for as long as the EMS remains in effect. For projects or activities implementing an EMS according to ISO 14001 or a similar standard, the AEPO validity is extended by four years. Under the previous legislation, these extensions were four years and two years respectively for EMAS and ISO 14001. These extensions are granted by a formal confirmation act. The AEPO automatically expires if the renewal of the above EMS is not carried out in time during the extension period. Additionally, the Project Developer must maintain a valid EMS for at least one year prior to the AEPO renewal deadline. A notable provision in this article is that the new deadlines also apply to all AEPOs in force at the time of the publication of this law.

Article 2: Due to the delays in issuing AEPOs for new projects or activities in both Category A1 and Category A2, it became necessary to amend the existing legislative framework to simplify procedures, shorten timeframes, attract investors, and facilitate the responsible authorities. This provision shortens the deadlines at various stages of maintaining environmental permits. It is in line with EU law, which sets a minimum 30-day period for public consultation (Article 6, para. 7 of Directive 2011/92, as amended by Directive 2014/52), while also requiring the competent authority to make a decision within a maximum of

90 days from the submission of all required information by the project owner (Article 4, para. 6 of Directive 2011/92). Referral to KESPA or PESPA is established, as applicable, if essential opinions are delayed (e.g. forestry, archaeology, appropriate assessment for protected areas), so that the process is not derailed by the inaction of a single authority. Essential opinions are clarified as those from public authorities whose responsibilities are directly related to the characteristics of the project and its potential environmental impacts. To reduce delays caused by the submission of supplementary data, the provision clearly states that the submission of such data by the Project Developer, upon request from the competent environmental authority, is mandatory at any stage of the process but does not interrupt the aforementioned deadlines. It is evident that the above changes significantly simplify the permitting process for both A1 and A2 category projects.

Article 8: This article establishes that, from 1 January 2021 onwards, the entire environmental permitting process is carried out through the Electronic Environmental Registry (EER), thus ensuring full transparency and faster processing. Specifically, the obligation to upload all documents related to the environmental permitting process on the EER is introduced. This obligation starts from 1.1.2021 and includes documents regarding the issuance, renewal, or modification of AEPOs and PPAs, including applications, Environmental Impact Studies, opinions of administrative services, draft AEPOs, and all relevant correspondence. Furthermore, all document transmission and public consultation processes (where required) are exclusively conducted through the EER. This digitisation makes the transmission of permitting files and data faster and simpler, following the model of other European countries.

Regarding changes in the management of protected areas (CHAPTER C): Until now, protected areas in Greece have been managed by Protected Areas Management Bodies (PAMB), which are legal entities under private law.

In order to implement a new and modern governance system for Protected Areas, a comprehensive and unified planning framework was deemed necessary, through a scientific, advisory, and coordinating body for the effective organisation of governance and management of these areas. To this end, a unified body was established—the Organisation for Natural Environment and Climate Change (OFYPEKA)—with a coordinating and executive role, collaborating with other competent authorities (Ministries, regional and local governments, environmental NGOs, civil society, local production bodies). The existing PAMB were incorporated into this Organisation as 24 Protected Area Management Units, functioning as departmental-level units responsible for implementing management plans at the local level.

Article 26: This article defines the Governance System for Protected Areas, which consists, at the national level, of the Ministry of Environment and Energy and the newly established OFYPEKA, as well as the Ministries of Interior, Rural Development, Digital Governance, Maritime Affairs and Island Policy, and Tourism. At the regional level, this system includes the Protected Area Management Units, Decentralised Administrations, Regional Governments, and Municipalities, supported by academic and research institutions, environmental organisations, and non-profit entities. This framework outlines the new model for managing protected areas through collaboration between all relevant stakeholders.

Regarding Article 27: Article 27 establishes the Organisation for Natural Environment and Climate Change (OFYPEKA), into which the Legal Entity under Private Law named "National Centre for Environment and Sustainable Development" (EKPAA), established by Law 2742/1999 (Official Gazette A' 207), is integrated.

Furthermore, two departments are established: the Protected Area Management Department and the Climate Change Department. OFYPEKA is responsible for implementing the policy defined by the Ministry of Environment and Energy regarding the management of protected areas in Greece, addressing climate change, and promoting and implementing sustainable development actions. Its main responsibilities include, among others: a) the central coordination for the implementation of strategies and policies related to the management of Protected Areas as well as Climate Change mitigation, b) the conduct of scientific research and the preparation of studies for all public entities within its areas of competence, c) the submission of reports and statements to international bodies in line with the country's obligations, and representation of Greece in international and European groups and committees. An important addition is the competence of OFYPEKA to organise the special open-access web portal provided in paragraph 2 of Article 18 of Law 3937/2011 (Official Gazette A' 60), through which all available information on the conservation status and protection regime of Greek biodiversity is published. This includes the collection of scientific information and reliable statistical data from all involved stakeholders, including data derived from Environmental Impact Assessments (EIAs) and Environmental Permitting Studies (EPS), which are then structured into an appropriate infrastructure of thematic and spatial databases concerning protected areas. A critical responsibility of OFYPEKA is the issuance of opinions for the appropriate assessment of the impacts of any project and/or activity in the protected areas under its jurisdiction, in cases where the integrity of the area and its protected assets may be affected. This competence is activated, in accordance with paragraph 8 of Article 43, following the partial staffing of the Organisation.

Regarding Article 34: Article 34 **provides for the establishment of 24 Protected Area Management Units, operating at the departmental level. These Units are the evolution of the former Protected Area Management Bodies and are integrated into the hierarchical structure of OFYPEKA.** In this way, the issue of lack of coordination among the former Management Bodies is addressed, while also serving the need to connect the Central Organisation with local structures. The management of protected areas must be carried out on two levels: a central, operational, and administrative level, and a local level. Simultaneously, with the coordination and logistical support of the Central Organisation, the Regional Units will be better positioned to participate in and attract additional funding from European Programmes. Among other responsibilities, the Units are tasked with implementing and monitoring the management plans of the protected areas within their territorial jurisdiction, monitoring the species and habitat types of Community interest in these areas, and conducting consultations with local communities, production stakeholders, and any other relevant entities, whenever necessary, with the aim of integrated management, effective protection, and showcasing the values of the protected areas. They are also responsible for integrating environmental considerations into local development standards and programmes, raising public and stakeholder awareness on issues related to the objectives and mission of the Management Units, organising and participating in training and education programmes, as well as conferences, workshops, seminars, and other outreach events to promote and highlight the goals of protected area management. Furthermore, they participate in local fire prevention planning within their areas of responsibility, in cooperation with the Ministry of Environment and Energy and the Ministry of Citizen Protection.

<u>It is noted that this Study has been prepared in accordance with the aforementioned provisions of Law 4685/2020.</u>

5.2.2.4 Law 4964/2022 "Provisions for the simplification of environmental permitting, establishment of a framework for the development of Offshore Wind Farms, addressing the energy crisis, environmental protection and other provisions"

According to Article 173 of the Law "Carbon dioxide storage by entities holding a right or license for hydrocarbon exploration and exploitation", the following are defined, among others:

"1. Entities that have been granted by the Hellenic State, under Law 2289/1995 (A' 27), a right or license for hydrocarbon exploration and exploitation in a specific area and possess sufficient data, in particular geological, geophysical, and drilling data, for substantiating the preliminary eligibility of a geological formation or formations located in the subsoil of the concession area (onshore or offshore) as a potential CO_2 storage site, acquire, under the conditions of this Law, the right to continue and complete the investigation process of the specific area in order to determine its suitability for CO_2 storage. If the suitability of the specific geological formation as a CO_2 storage site is confirmed, following relevant environmental assessment and permitting, these entities or their affiliated companies, as per paragraph 5, acquire the right of CO_2 storage under this Law. ...."

"2. The duration of the storage right is initially set at twenty-five (25) years from the issuance of the decision in paragraph 6 and may be extended by amending said decision....."

"3. To activate the rights of paragraph 1, the entity shall submit an application to the Hellenic Hydrocarbon and Energy Resources Management Company S.A. (HEREMA S.A.) within twelve (12) months from the entry into force of this Law........"

....

In areas where a strategic environmental assessment has been carried out for the hydrocarbon exploration and exploitation program, for its adaptation to CO_2 storage, the environmental pre-assessment procedure of Article 5 of the Joint Ministerial Decision no. YPEXODE/EYPE/oik.107017/28.8.2006 (B' 1225) by the Ministers of Interior, Public Administration and Decentralization, Economy and Finance, and Environment, Spatial Planning and Public Works shall apply. If the site is found to be preliminarily eligible and the necessary proposals, measures and guidelines for preventing, mitigating, and, as far as possible, addressing any environmental impacts are approved, the entity's right to continue and complete the investigation of the site's suitability for CO_2 storage shall be activated.

....

"5. Following the completion of the investigation of suitability and prior to the expiration of the right to complete the investigation, the interested entity shall submit an application to HEREMA, in order to verify the suitability of the geological formation as a CO_2 storage site, to approve the relevant environmental terms, and to activate the entity's CO_2 storage right.

The application shall include, in particular, the following:

a) Name and address of the interested entity. If the applicant is an affiliated company of the entity holding the right to complete the investigation, the application shall also include a detailed description of the corporate structure and its relationship with the aforementioned entity.

b) Documentation proving the technical capability and adequacy of the entity in relation to the CO_2 storage activity.

c) Technical report substantiating the suitability of the proposed site and CO_2 storage complex and evaluating the expected storage safety, in accordance with the criteria of Annex I of Joint Ministerial Decision no. H.P. 48416/2037/E.103/2011.

d) The total quantity of CO_2 to be injected and stored, the expected sources and methods of transport, the composition of the CO_2 streams, the injection rates and pressures, and the location of the injection facilities.

e) Detailed description of any construction works and installations required within the framework of the CO_2 storage activity. Installations used by the operator to support the exploration and exploitation activities under the hydrocarbon license may also be used for the CO_2 storage activity, without however being subject to the obligations imposed on facilities used exclusively for CO_2 storage after the closure of a storage site, as provided in paragraph 2 of Article 18 of Joint Ministerial Decision no. H.P. 48416/2037/E.103/2011.

f) The proposed provisional post-closure plan for the storage site, pursuant to paragraph 3 of Article 18 of Joint Ministerial Decision no. H.P. 48416/2037/E.103/2011.

g) Documentation proving that the financial guarantee of Article 20 of Joint Ministerial Decision no. H.P. 48416/2037/E.103/2011 is valid and effective prior to the start of injection."

For the environmental permitting, Chapter A of Law 4014/2011 (A' 209) applies. For the issuance of the Environmental Terms Approval Decision (AEPO), the interested entity shall submit an Environmental Impact Assessment (EIA) to the competent authority, which shall also include: ***a) description of the measures for the prevention of significant irregularities, b) proposed monitoring plan of paragraph 2 of Article 14 and proposed corrective measures plan of paragraph 2 of Article 17 of Joint Ministerial Decision no. H.P. 48416/2037/E.103/2011, which are included in an annex to the EIA as integral parts thereof and are approved by the AEPO, c) any other element and necessary information substantiating that there is no significant risk of CO_2 leakage or significant risk to the environment or health from the permitted activity, and d) assessment of the cumulative and synergistic impacts from the simultaneous exercise of both hydrocarbon exploration and exploitation activities and CO_2 storage.***

6. Within two (2) months from the submission of the application and following the issuance of the AEPO, provided that the conditions of Article 9 of Joint Ministerial Decision no. H.P. 48416/2037/E.103/2011 are met, HEREMA shall issue a decision which:

a) establishes that the proposed geological formation is suitable for use as a CO_2 storage site, in accordance with the criteria of Annex I of Joint Ministerial Decision no. H.P. 48416/2037/E.103/2011. A geological formation is selected as a storage site only if, under the proposed conditions of use, there is no significant risk of leakage, nor any significant risk to the environment or health, and

b) activates the entity's right to store CO_2 in the geological formation deemed suitable for this purpose. HEREMA's decision shall contain the elements of paragraph 1 of Article 10, excluding those in point (i), of Joint Ministerial Decision no. H.P. 48416/2037/E.103/2011. The decision also specifies the amount of the financial guarantee to be paid and maintained by the project entity, in accordance with Article 20 of the *same Joint Ministerial Decision. The decision shall serve as the storage permit under Article 6 of Directive 2009/31/EC.*

....

<u>The proposed project follows the provisions of this Law in order to be environmentally permitted and for the entity to acquire the exploitation right.</u>

5.2.2.5 Directive 2008/98/EC on Waste and Repealing Certain Directives (Waste Framework Directive)

The Waste Framework Directive provides the primary legislative framework for the collection, transport, recovery, and disposal of waste. Waste is defined as "any substance or object which the holder discards or intends or is required to discard", while "waste treatment" is defined as "any recovery or disposal operation, including preparation prior to recovery or disposal". According to the Waste Framework Directive, a distinction must be made between:

- The temporary storage of waste pending its collection,
- The collection of waste, and
- The storage of waste pending treatment.

Additionally, "installations or undertakings which collect waste during their activities should not be considered to be engaged in waste management and should not be subject to a permit for the storage of their waste pending collection". This means that offshore installations are only required to obtain a permit if they themselves carry out the treatment of waste (wastewater, solid waste).

Further distinguishing between collection and treatment, it is noted that "the temporary storage of waste included in the definition of collection refers to the activity of storing waste pending its collection at facilities where it is unloaded, with the purpose of preparing it for further transport to recovery or disposal elsewhere". With regard to the objective of this Directive, a distinction must be made between temporary storage of waste pending collection and storage of waste pending treatment, depending on the type of waste, the scale and duration of storage, and the purpose of collection.

The storage of waste prior to recovery for a period of three years or more, and the storage of waste prior to disposal for a period of one year or more, are subject to Directive 1999/31/EC of the Council of 26 April 1999 on the landfill of waste.

It should be noted that Article 2, paragraph (2), point (d) of the Waste Framework Directive provides that, insofar as they are covered by other EU legislation, "waste resulting from prospecting, extraction, treatment and storage of mineral resources and the working of quarries which is covered by Directive 2006/21/EC" is excluded from the scope of the Directive. Nevertheless, according to Article 2, paragraph (2), point (b) of Directive 2006/21/EC on the management of waste from extractive industries (and amending Directive 2004/35/EC), "waste resulting from offshore prospecting, extraction and treatment of mineral resources" (emphasis added by the author) is excluded from the scope of that Directive.

As a result, since the waste produced at offshore installations (and transported onshore) is not covered by the more specific Directive concerning extractive industry waste, operators of offshore oil and gas installations must comply with the requirements of the more general Waste Framework Directive. This means that the "original waste producer or other holder" (in practice: the operator) will be required to carry out the treatment of waste themselves or to assign the treatment to a waste collector, agent, or establishment or undertaking carrying out waste treatment operations, in accordance with Articles 4 and 13 (Article 15 paragraph (1)).

The Project is in line with the provisions of Directive 2008/98/EC on waste. It is noted that waste management under this Project will be carried out in accordance with the provisions of the Waste Management Plan (WMP) accompanying the Environmental Impact Assessment (EIA).

5.2.3 Legislative Framework for Impact Assessment

The framework for impact assessment – permitting is governed by the following (including the ratification of the aforementioned conventions, as applicable), as presented in the table below.

Table 5-2: Applicable legislative framework for the impact assessment – permitting of offshore installations

Law/Decision and relevant European (EU)/International documents	Reference Number	Subject
Law 4014	Government Gazette 209/A/21-09-2011	On environmental permitting
Law 4685	Government Gazette 92/A/07-05-2020	On environmental permitting
Law 1650	Government Gazette 160/A/18-10-1986	On environmental protection
Law 3010	Government Gazette 91/A/25-04-2002	Harmonization of Law 1650 with Directives: 96/61/EC and 97/11/EC
Law 3937	Government Gazette 60/A/31-03-2011	On biodiversity conservation
Ministerial Decision 1958 (as amended and in force, see Section 5.2.1.2 above for details)	Government Gazette 21/B/13-01-2012	On the environmental classification of projects and activities
Law 4936	Government Gazette 105/A/27-05-2022	National Climate Law
Law 4519	Government Gazette 25/A/20-02-2018	Management Bodies for Protected Areas and other provisions
Joint Ministerial Decision 50743	Government Gazette 4432/B/2017	Revision of the national list of the European Natura 2000 Ecological Network
Joint Ministerial Decision 15393/2332	Government Gazette 1022/B/05-08-2002	Only Annex II in force: on categories of activities and projects subject to Integrated Pollution Prevention and Control (IPPC)
Ministerial Decision 48963	Government Gazette 2703/B/05-10-2012	On the Specifications for the Contents of Environmental Permitting

Law/Decision and relevant European (EU)/International documents	Reference Number	Subject
Ministerial Decision 170225	Government Gazette 135/B/17-01-2014	On the specification of indicators for environmental permitting studies
Joint Ministerial Decision 30651	Government Gazette 1817/B/02-06-2014	On the specification of the Electronic Environmental Registry requirements
Law 3422	Government Gazette 303/A/13-12-2005	Ratification of the Aarhus Convention
Ministerial Decision 21697	Government Gazette 224/YODD/03-05-2012	Composition of the Central Council for Environmental Permitting
Law 4042	Government Gazette 24/A/13-02-2012	Environmental liability - framework for waste generation and management
Law 4819	Government Gazette 129/A/23-07-2021	Integrated framework for waste management
Commission Decision	2000/479/EC of 17 July 2000	On the implementation of the European Pollutant Emission Register (EPER) under Article 15 of Council Directive 96/61/EC on integrated pollution prevention and control (IPPC)
Joint Ministerial Decision 172058	Government Gazette 354/B/17-02-2016	Establishment of rules, measures and terms for the prevention of major accident hazards in installations or units due to the presence of dangerous substances, in compliance with Directive 2012/18/EU
Joint Ministerial Decision 1915	Government Gazette 304/B/02-02-2018	Environmental risk assessment
Regulation (EC)	Regulation (EC) No 166/2006 of the European Parliament and of the Council of 18 January 2006	On the establishment of a European Pollutant Release and Transfer Register and amending Council Directives 91/689/EEC and 96/61/EC
Guidance Document	European Commission, 31.05.2006	On the implementation of the European PRTR
Law 743	Government Gazette 137/A/17-10-1977	On the protection of the marine environment
Law 743	Government Gazette 2970/B/19-12-2001	On shoreline and beach and other provisions
Ministerial Decision 55/1998	Government Gazette 58/A/20-04-1998	On the protection of the marine environment (codification of Law 743)
Ministerial Decision 11/2002	Government Gazette 6/A/21-01-2002	National Emergency Response Plan for dealing with pollution incidents from oil and other harmful substances
Ministerial Decision ΥΠΕΝ/ΔΔΦΠΒ/50146/1786	Government Gazette 3118/B/10-05-2023	Establishment and approval of conservation objectives for bird species under paragraphs 1 and 2 of Article 4 of Directive 2009/147/EC in Special Protection Areas (SPAs) of the national Natura 2000 ecological network
Ministerial Decision ΥΠΕΝ/ΔΔΦΠΒ/24776/985	Government Gazette 1807/B/22-03-2023	Establishment of conservation objectives for natural habitat types of Annex I and species of Annex II of Directive 92/43/EEC in Special Areas of Conservation and Sites of Community

Law/Decision and relevant European (EU)/International documents	Reference Number	Subject
		Importance of the national Natura 2000 ecological network
Joint Ministerial Decision 174505/607	Government Gazette 1311/B/2017	On ambient air quality (Amendment of JMD 22306/1075/2007 and JMD 14122/549/E103/2011 in compliance with Directive 2015/1480/EU)
Barcelona Convention of 1976, including pollution from the exploration and exploitation of hydrocarbons – Ratified by the Hellenic Parliament by Laws 855/1978 and 3022/2002	Government Gazette 235/A/23-12-1978 & Government Gazette 144/A/19-06-2002 2013/5/EC	Ratification of the International Convention for the Protection of the Mediterranean Sea against Pollution and its amendments
International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC), 1990 – Ratified by the Hellenic Parliament by Laws 2252/1994 and 3100/2003	Government Gazette 192/A/18-11-1994 & Government Gazette 20/A/29-01-2003	Ratification of the OPRC Convention and its amendments
International Convention for the Prevention of Pollution from Ships, 1973, as amended by the 1978 Protocol (MARPOL 73/78) – Ratified by the Hellenic Parliament by Law 1269, as amended and in force	Government Gazette 89/A/21-07-1982	Ratification of the International Convention for the Prevention of Pollution from Ships and its amendments
ACCOBAMS	-	Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and contiguous Atlantic area
Ministerial Decision 148/2009	Government Gazette 190/A/29-09-2009	On environmental liability regarding the prevention and remediation of environmental damage

As documented in the relevant preceding and following Sections, <u>the methodology applied for the preparation of the present ESIA is fully aligned with the requirements, specifications and guidelines of the national Legislative Framework, the European Directives, and the international Conventions and agreements on Environmental Impact Assessment and the achievement of the objective of environmental protection (with an emphasis on the marine environment).</u>

5.2.4 Legislative Framework for the Prevention of Marine Pollution

5.2.4.1 Directive on the Safety of Offshore Oil and Gas Operations (2013/30/EU)

Following the Deepwater Horizon incident in the Gulf of Mexico in April 2010, the European Commission expressed its initial views on the safety of offshore oil and gas operations in its communication entitled **"Facing the Challenge of the Safety of Offshore Oil and Gas Activities"** (published on 13 October 2010).

The European Commission's communication concluded that the existing divergent and fragmented regulatory framework governing the safety of offshore oil and gas operations in Europe, as well as the recent safety practices within the industry, did not sufficiently ensure the minimization of risks from offshore accidents across the Union.

On 28 June 2013, the European Commission published the Offshore Safety Directive. The purpose of this Directive is to reduce as much as possible the occurrence of major accidents related to offshore oil and gas operations and to limit their consequences.

According to Directive 2013/30/EU, the EU has established a set of rules, as summarized below, to help prevent accidents as well as to ensure a prompt and effective response in the event of an incident.

- Before commencing exploration or production, companies must prepare a **Report on Major Hazards (RoMH)** for their offshore installation. This report must include a risk assessment and an emergency response plan.
- Companies must ensure the availability of the necessary resources so that they can be deployed if needed.
- When granting licenses, EU countries must ensure that companies are financially sound and possess the necessary technical expertise.
- Operators' drilling programs and designs must be independently verified to ensure the required safety levels. This verification must take place before drilling operations commence.
- National Authorities must verify compliance with safety regulations, environmental protection measures and the preparedness of both production and non-production facilities for emergency situations. If companies fail to meet the minimum standards, EU countries may impose sanctions, including the suspension of operations.
- Information regarding how companies and EU countries maintain the safety of installations should be made available to the public.
- Companies will bear full responsibility for any environmental damage caused to protected marine species and natural habitats.

To further promote offshore safety, the European Commission collaborates with its international partners on implementing the highest safety standards worldwide. Inspectors of offshore installations from EU countries also cooperate with the European Union Offshore Oil & Gas Authorities Group (EUOAG) to exchange best practices and improve standards.

The proposed project is not directly related to this Directive, as it does not involve the exploration, extraction, or exploitation of hydrocarbons. However, the project is indirectly related to the Directive, since part of the offshore section is installed on Offshore Oil and Gas Installations (Prinos offshore platforms), where all commitments and specifications arising from Directive 2013/30/EU are fully complied with.

5.2.4.2 Marine Strategy Framework Directive (MSFD), 2008/56/EC

The Marine Strategy Framework Directive (Directive 2008/56/EC) was adopted on 17 June 2008 after many years of preparation and extensive consultation with all stakeholders and the public, and it came into force on 15 June 2008. The Directive aims to achieve **Good Environmental Status (GES)** of the EU's marine waters by 2020 and to protect the resources on which marine economic and social activities depend. It is the EU's first legal instrument related to the protection of marine biodiversity, as it includes the specific regulatory objective of "maintaining biodiversity by 2020" as a cornerstone for achieving Good Environmental Status in marine waters. The Directive establishes within a legislative framework the ecosystem-based approach to managing human activities that impact the marine environment, integrating the concepts of environmental protection and sustainable use. To achieve its objective, the Directive establishes European marine regions and subregions based on geographic and environmental criteria. Specifically, the Directive distinguishes four European marine regions — the Baltic Sea, the Northeast Atlantic Ocean, **the Mediterranean Sea**, and the Black Sea — all located within the geographic boundaries of existing regional sea conventions. Cooperation among Member States within a marine region, as well as with neighboring countries sharing the same marine waters, already takes place through these Regional Sea Conventions.

In order to achieve Good Environmental Status (GES) by 2020, each Member State (MS) is required to develop a strategy for its marine waters (Marine Strategy). Furthermore, since the Directive follows an adaptive management approach, Marine Strategies must be updated and revised every 6 years. In this context, the Commission developed a set of detailed criteria and methodological standards to assist Member States in implementing the MSFD. These criteria and methodological standards were revised in 2017, leading to the new Commission Decision on Good Environmental Status. Annex III of the Directive was also amended in 2017 (Directive 2017/845/EU) to better link the components of ecosystems, anthropogenic pressures, and impacts on the marine environment with the 11 qualitative descriptors of the MSFD and the new decision on Good Environmental Status.

The MSFD was incorporated into national legislation through Law 3983/2011, as amended by Joint Ministerial Decision YPEN/DNEP/50529/2779/2018 (amending Annex III in accordance with Directive 2017/845/EU), which established the following qualitative descriptors for determining Good Environmental Status (GES) in the waters of the marine sub-region of the Aegean Sea – Eastern Mediterranean (Levantine Sea):

1 Biodiversity is maintained. The quality and extent of habitats, as well as the distribution and abundance of species, are consistent with prevailing physiographic, geographic, and climatic conditions.

2 The introduction of non-indigenous species due to human activities occurs at levels that do not adversely alter ecosystems.

3 Populations of all commercially exploited fish, mollusks, and crustaceans are within biologically safe limits.

4 All elements of the marine food webs, to the extent that they are known, exist in conditions of normal abundance and diversity, and at levels capable of ensuring the long-term abundance of species and the maintenance of their full reproductive capacity.

5 Anthropogenic eutrophication is minimized.

6 The integrity of the seabed is such that the structure and functions of ecosystems are ensured, with benthic ecosystems, in particular, not being negatively affected.

7 Permanent alteration of hydrographic conditions does not adversely affect marine ecosystems.

8 Pollutant concentrations are at levels that do not cause impacts.

9 Pollutants in fish and other seafood intended for human consumption do not exceed the limits set by Community legislation or other equivalent standards.

10 The properties and quantities of waste in the sea do not cause harm to the coastal and marine environment.

11 The import of energy, including underwater noise, is at levels that do not adversely affect the marine environment.

The corresponding Environmental Objectives and Indicators for each qualitative descriptor parameter were established through Joint Ministerial Decision 1175/2012 (see the following **table**), while Joint Ministerial Decision oik. 142569/2017 established the Programme of Measures for achieving or maintaining Good Environmental Status (GES) in accordance with Article 12 of Law 3983/2011.

Table 5-1: National Environmental Objectives for achieving Good Environmental Status (GES) in the marine sub-region of the Aegean Sea – Eastern Mediterranean (Levantine Sea) within the framework of the MSFD (Joint Ministerial Decision 1175/2012)

Qualitative Descriptor Parameter	Environmental Objectives
1	1 Conservation of the population of the Mediterranean monk seal (Monachus monachus) in Greek waters. 2 Census of the population of the loggerhead sea turtle (Caretta caretta) breeding on Greek coasts and conservation of nesting areas. 3 Conservation and mapping of Posidonia oceanica seagrass meadows. 4 Census of the extent occupied by biogenic sediments of the Maerl type. 5 Conservation of benthic macrofauna communities and the structure of planktonic communities.
2	Census of invasive alien species and their environmental impacts on marine ecosystems.
3	6 Monitoring of the indicators “Fishing Mortality” (F/Fmsy) and “Spawning Biomass” (B/Bmsy) for representative benthopelagic species. 7 Monitoring of the “Fishing Exploitation” indicator for representative pelagic species. 8 Correlation of fishing activities with the established indicators.
4	Monitoring and assessment of the biomass balance at higher trophic levels relative to the total catch of benthopelagic fish.

Qualitative Descriptor Parameter	Environmental Objectives
5	9 Reduction of organic load and nutrients entering the marine environment from point and non-point sources. 10 Reduction of nitrate pollution from agricultural activities.
6	11 Mapping of sensitive benthic habitats. 12 Maintenance of the balance of benthic macrofauna.
7	Prevention of environmental impacts from locally occurring, anthropogenic permanent alterations of hydrographic conditions.
8	Specification of the impacts of pollutants and determination of prevailing concentration trends of these substances in the water column, sediments, marine organisms, and ecosystems.
9	Maintenance of pollutant levels in fish and other seafood intended for human consumption within permissible limits.
10	Reduction of anthropogenic waste on the coasts and in the marine environment.
11	Control of energy levels to prevent adverse effects on the marine environment.

According to Article 11 of the MSFD, Greece is obliged to present a set of monitoring activities (monitoring programmes) in its marine territorial waters in order to meet the requirements of the aforementioned 11 parameters of Good Environmental Status (GES).

Monitoring programs under the MSFD framework are a combination of new and existing monitoring activities derived from other legal obligations of Member States (MS), such as monitoring of marine areas within the Natura 2000 network for the implementation of the Habitats and Birds Directives (HD and BD), monitoring of coastal water bodies under the Water Framework Directive (WFD), and the Data Collection Framework for Fisheries (DCF - COM 199/2008) for the implementation of the EU Common Fisheries Policy regulations (COM 1380/2013).

Taking into account the proposed measures and the environmental monitoring program outlined in **Chapters 12** and **13** respectively, the project does not conflict with the objectives and provisions of the above Directive.

5.2.4.3 Water Framework Directive (WFD) 2000/60/EC

The Water Framework Directive (Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000) was adopted to establish a framework for Community action in the field of water policy. The Directive commits Member States to achieving good qualitative and quantitative status of their waters (including marine waters up to 1 nautical mile from the coast). It is considered a framework directive because it outlines the necessary steps to reach a common objective, rather than adopting the more traditional approach of fixed limit values. The Directive aims to achieve "Good" overall status for all groundwater and surface waters (rivers, lakes, transitional and coastal waters) within the EU. The WFD integrates qualitative, ecological, and quantitative objectives for the protection of aquatic ecosystems and the good status of all water resources, introducing the concept of integrated management at the scale of River Basin Districts (RBDs).

Furthermore, it redefines the concept of the RBD to include inland surface waters (rivers, lakes), groundwater, transitional (deltas, river estuaries), and coastal ecosystems. The ecological and chemical status of surface water bodies is assessed based on the following criteria:

- Biological quality elements (such as fish fauna, benthic invertebrates, and aquatic flora).
- Hydromorphological quality elements, including features like riverbank structure or the substrate of the riverbed.
- Physicochemical quality elements, such as temperature conditions, dissolved oxygen levels, and nutrients.
- Chemical quality, referring to Environmental Quality Standards (EQS) for specific pollutants within a river basin. These standards define maximum allowable concentrations for certain substances. If even one of these limits is exceeded, the water body cannot be classified as having "good ecological status."

The standards and threshold values define the applicable classes for each quality characteristic and are set out in the WFD Guidelines (2016). In addition, Article 6 of the WFD requires the establishment of a register or registers of all areas within River Basin Districts (RBDs) that are designated as areas of special protection under specific Union legislation, either for the protection of surface and groundwater or for the conservation of habitats and species directly dependent on water. The WFD was amended by Directive 2008/105/EC concerning environmental quality standards in the field of water policy.

The harmonization of national legislation with the Water Framework Directive (WFD) was achieved through Law 3199/2003, Presidential Decree 51/2007, and Joint Ministerial Decision Η.Π. 51354/2641/E103/2010. The provisions of this legislation incorporate the core principles of the WFD, defining the administrative structure and responsibilities of the involved parties at both national and regional levels. Within this framework, the competent authority (General Directorate for Water of the Ministry of Environment and Energy) is preparing the 2nd Revision of the River Basin Management Plans (RBMPs) for the 14 River Basin Districts of the country, in accordance with the WFD and national legislation.

The study area falls within Water Districts EL11 "Eastern Macedonia" and EL12 "Thrace," where the 1st Revisions of the River Basin Management Plans (RBMPs) for these districts were approved by Government Gazettes No. B 4679/29.12.2017 and No. B 4680/29.12.2017, respectively. Currently, the 2nd Revisions of the Management Plans for these districts are in the final drafting stage, following the completion of the public consultation process.

Taking into account the proposed measures and the environmental monitoring program outlined in **Chapters 12 and 13** respectively, the project does not conflict with the objectives and provisions of the Water Framework Directive (WFD).

5.2.4.4 Directive 2014/89/EU on Maritime Spatial Planning (MSP)

Maritime Spatial Planning (MSP) is developed at both cross-border and cross-sectoral levels to ensure that human activities at sea are carried out in an efficient, safe, and sustainable manner. MSP contributes to the effective management of marine activities and the sustainable use of marine and coastal resources by creating a framework for consistent, transparent, sustainable, and evidence-based decision-making. In this context, the European Parliament and the Council adopted Directive 2014/89/EU establishing a framework for maritime spatial planning, with the aim of creating a common approach to MSP across Europe. The MSP Directive came into force in September 2014 and constitutes the world's first legal requirement for countries to create transparent marine spatial planning systems and cooperate with their neighbors for their implementation. The application of MSP in the territorial waters of member states must be achieved by March 2021. The Directive focuses on four goals related to legal bases: environment, fisheries, maritime transport, and energy. Member states can add additional sectors to ensure that all activities are equally covered and that the interests of all stakeholders are taken into account. The Directive does not impose specific planning details or management targets, as these should be decided by the member states. However, it requires MSP implementation across all EU waters and facilitates cross-border cooperation through common minimum requirements and a specific timeline.

Directive 2014/89/EU on Marine Spatial Planning (hereinafter MSP) was incorporated into Greek legislation through Law 4546/2018 (Government Gazette 101/A/2018), as amended by Law 4759/2020 and is currently in force. According to Article 3 of Law 4546/2018, as amended by Article 19 of Law 4759/2020, MSP is the process by which the competent authority analyzes and organizes human activities in marine areas to achieve the integration of ecological, environmental, economic, social, and cultural parameters, with the aim of promoting the sustainable development of marine economies and marine areas, as well as the sustainable use of marine resources.

According to Article 4 of Law 4546/2018, as amended by Article 20 of Law 4759/2020, the main objectives of Marine Spatial Planning (MSP) at the national and regional levels are:

- Support and promotion of sustainable development and spatial cohesion between the marine and coastal areas, through the integration of ecological, environmental, economic, social, and cultural parameters, taking into account land-sea interactions, the ecosystem-based approach, and generally the principles of sustainable management.
- Sustainable, rational, and integrated spatial development of activities in the marine space, such as, among others, the energy sector, maritime transport and shipping in general, fishing and aquaculture, sustainable tourism, sustainable extraction of raw materials, as well as the conservation, protection, and enhancement of the natural, anthropogenic, and cultural environment, taking into account, in general, the underwater cultural heritage as defined by the provisions of Law 3028/2002 (A' 153). Within this framework, the harmonious coexistence of all related activities and uses is pursued, and the conservation of marine biodiversity and resilience to the impacts of climate change are ensured.

According to Article 5 of Law 4546/2018, as amended by Article 21 of Law 4759/2020, Marine Spatial Planning (MSP) includes:

A. **The National Spatial Strategy (NSS)** for the Marine area as defined in Article 6, and

B. **The Marine Spatial Frameworks (MSF)** of Article 6 of the aforementioned law.

During the development of the National Spatial Strategy (NSS) for the maritime space and the Marine Spatial Frameworks (MSF), existing national policies—especially island policy—may be included and utilized, as well as regulations and mechanisms, provided they contribute to achieving the objectives of the Integrated Maritime Policy and comply with the requirements of Article 7 of Law 4546/2018 as in force.

However, the corresponding Marine Spatial Plans have not yet been developed, and marine spatial planning issues are currently covered by the existing Special and Regional Spatial Planning Frameworks, which pertain to specific economic sectors (renewable energy sources, industry, aquaculture, etc.) and include spatial planning guidelines for the development of each sector in the terrestrial, coastal, and to a lesser extent, the marine area.

To achieve the objectives of Marine Spatial Planning as defined in Article 4 of Law 4546/2018, and to ensure coherence between Marine Spatial Planning and terrestrial spatial planning, the competent authority, when drafting the National Spatial Strategy for the Marine Space and the Marine Spatial Plans, must take into account (Article 7 of Law 4546/2018):

- The relevant activities and uses in the marine waters and coastal zones,
- The land-sea interactions,
- The environmental, economic, social, and cultural parameters, as well as issues related to climate change and security,
- The secure energy supply of the island regions and the mainland part of the country.

Additionally, it should:

- Ensure the participation of interested stakeholders, in accordance with Article 9
- Organize the use of the best available data, according to Article 10.
- Ensure cross-border cooperation with other Member States, as per Article 11.
- Promote cooperation with third countries, according to Article 12.

At the national level, maritime uses have not been formally established, with the exception of the Special Framework for Spatial Planning and Sustainable Development (SFPSSD) for Aquaculture, which was enacted in November 2011 (Government Gazette 2505/B/2011).

The main competent authority for the development, implementation, and evaluation of the Marine Spatial Planning (MSP) is the Ministry of Environment and Energy (Article 14, paragraph 1 of Law 4546/2018). The implementation duties are hierarchically delegated to the General Secretariat of Spatial Planning and Urban Environment – General Directorate of Spatial Planning – Directorate of Spatial Planning.

Given the absence of an established National Spatial Strategy (NSS) for the marine area and the corresponding Marine Spatial Plans (MSPs), the compatibility of the proposed project with the existing marine spatial planning framework—namely the applicable Special and Regional Spatial Planning Frameworks, which concern specific economic sectors (RES, industry, aquaculture, etc.) and include spatial planning guidelines for the development of each sector in the terrestrial, coastal, and to a lesser extent, marine areas—is assessed. The compatibility of the proposed project with the existing Special and Regional

Spatial Planning Frameworks is examined in the relevant sections, the conclusions of which indicate that the project is fully compatible with the established spatial planning constraints.

5.2.4.5 The Bathing Water Directive (2006/7/EC)

The Bathing Water Directive was initially enacted in 1975 and its main objective is to ensure public health and protect the aquatic environment of coastal and inland areas from pollution. Bathing waters can be coastal or inland (rivers, lakes). For waters to fall under the Directive, comply with its mandatory quality standards, and be subject to monitoring and information obligations, swimming in these waters must either be explicitly permitted or not prohibited and traditionally practiced by a large number of people. The bathing season in the EU generally extends from late May to late September. The original Directive was replaced by the new Bathing Water Directive 2006/7/EC, which updates the measures of the 1975 legislation and simplifies management and monitoring methods. The new directive also provides a more proactive approach to informing the public about water quality by using four quality categories for bathing waters: "poor," "sufficient," "good," and "excellent".

The new Bathing Water Directive was incorporated into national legislation through Ministerial Decision H.P. 8600/416/E103/2009 for the management of bathing waters, in compliance with the provisions of Directive 2006/7/EC. Within this framework, the competent Special Secretariat for Waters (SSW/MEECC) created the Register of Bathing Beaches to describe and present the main characteristics of bathing beaches, identify sources of pollution that may affect the quality of bathing waters, and assess the extent of these impacts. The Register also serves as a guide for selecting appropriate measures to minimize pressures on bathing waters and to manage resources more effectively.

The Project is consistent with the restrictions and guidelines of the aforementioned Directive, as the provisions of the above legislation concerning the protection of bathing waters are duly taken into account.

5.2.4.6 Environmental Liability Directive (ELD) (2004/35/EC)

The Environmental Liability Directive (ELD) 2004/35/EC came into force in 2009. Unlike Directive 96/82/EC (Seveso II Directive), which applies to large high-risk installations, the Environmental Liability Directive applies to all enterprises regardless of size, including those active in the energy sector, as defined in Annex III of the Directive.

The ELD defines environmental damage as:

- Damage that significantly affects the environmental (ecological, chemical, or quantitative) status of water resources, as defined in the EU Water Framework Directive and the Marine Strategy Framework Directive
- Damage to soil, which creates a serious risk to human health.
- Damage to protected species and natural habitats, which negatively impacts their conservation status, as defined in the Birds Directive and the Habitats Directive.

The above definition of environmental damage, as outlined in the Environmental Liability Directive (ELD)

2004/35/EC, includes the emission of pollutants into the atmosphere, as these can affect the condition of soil or water bodies. It also encompasses discharges into inland surface waters, groundwater, and any deliberate release of genetically modified organisms (GMOs) into the environment, in accordance with Directive 2001/18/EC.

The ELD applies to waters governed by the Water Framework Directive 2000/60/EC, which defines "surface waters" to include territorial waters. Consequently, environmental liability may be assigned for any damage occurring within 12 nautical miles from the coastline.

However, there are specific exceptions to the scope of this directive. These include environmental damage caused by armed conflicts or natural disasters, as well as types of damage already covered by international conventions (such as marine pollution). Furthermore, nuclear risks fall outside the ELD's remit, as they are regulated under the Euratom Treaty.

Regarding preventive and remedial actions, the Environmental Liability Directive (ELD) establishes the following obligations:

- If there is an imminent threat of environmental damage, the operator must immediately take the necessary preventive measures.
- If damage has already occurred, the operator is required to promptly notify the competent authorities and take appropriate actions to manage the situation. This includes preventing further environmental harm and risks to human health, as well as implementing suitable remediation measures to restore the affected environment.

The Environmental Liability Directive (ELD) was amended by Directives 2006/21/EC, 2009/31/EC, and 2013/30/EU. It was transposed into national legislation through Presidential Decree 148/2009.

The Project is in line with the restrictions and guidelines of the aforementioned Directive.

5.2.4.7 Directive 2009/123/EC, which amends Directive 2005/35/EC on ship-source pollution and the introduction of penalties, including criminal penalties for infringements, aims to strengthen the legal framework addressing illegal discharges of polluting substances

The purpose of the Directive was to incorporate international standards on ship-source pollution into EU law and to ensure that those responsible for the discharge of polluting substances are subject to appropriate penalties, including criminal sanctions. The aim is to improve maritime safety and to strengthen the protection of the marine environment from ship-generated pollution. The Directive does not prevent Member States from adopting stricter measures against ship-source pollution, provided they are consistent with international law. According to Article 3 of the Directive, it applies—in accordance with international law—to the discharge of polluting substances in:

- Internal waters of a Member State, including ports, to the extent that the MARPOL regime applies,
- Territorial waters of a Member State

- Straits used for international navigation and subject to the regime of transit passage, as defined in Part III, Section 2 of the 1982 United Nations Convention on the Law of the Sea, provided that these straits fall under the jurisdiction of a Member State,
- the exclusive economic zone or equivalent zone of a Member State, established in accordance with international law and
- the high seas.

The Directive applies to discharges of polluting substances from any ship, regardless of flag, except for warships, auxiliary warships, or other government-owned or operated ships used temporarily only for governmental, non-commercial purposes. Member States must ensure that discharges of polluting substances from ships, including minor cases of such discharges, in any of the aforementioned areas, are considered violations when committed intentionally, through conscious negligence, or gross negligence. Each Member State shall take the necessary measures to ensure that any natural or legal person who has committed an infringement as defined in paragraph 1 can be held responsible. The discharge of polluting substances in any of the aforementioned areas shall not be considered an infringement if it meets the conditions specified in Annex I, Regulations 15, 34, 4.1 or 4.3, or in Annex II, Regulations 13, 3.1.1 or 3.1.3 of Marpol 73/78. The discharge of polluting substances in areas (c), (d), and (e) shall not be considered an infringement for the shipowner, the master, or the crew, provided that it meets the conditions of Annex I, Regulation 4.2 or Annex II, Regulation 3.1.2 of Marpol 73/78.

The Directive was incorporated into national legislation through Law 4037/2012.

<u>The Project complies with the restrictions and guidelines of the aforementioned Directive, as the provisions of the above legislation concerning pollution from ships are taken into account.</u>

5.2.4.8 The Barcelona Convention

The Convention for the Protection of the Mediterranean Sea against Pollution (Barcelona Convention) was adopted on February 16, 1976, during a conference of Mediterranean coastal states held in Barcelona. During this conference, two Protocols were adopted aimed at preventing pollution from ships and aircraft (dumping) and at cooperation to combat pollution in emergency situations. These legal instruments came into effect on February 12, 1978. The Convention also provided for the establishment of additional legal tools and was soon supplemented by the Protocol on Pollution from Land-Based Sources (1980), the Protocol on Specially Protected Areas (1982), and the Offshore Protocol (1994).

The main objectives of the Convention are:

- The assessment and control of marine pollution.
- The assurance of sustainable management of natural marine and coastal resources
- The integration of the environment into economic and social development.
- The protection of the marine environment and coastal zones through the prevention and reduction of pollution, and, as far as possible, the elimination of pollution, whether of marine or land-based origin.
- The protection of natural and cultural heritage.
- The strengthening of solidarity among the coastal States of the Mediterranean.

- The contribution to the improvement of quality of life.

In 1995, the Contracting Parties adopted significant amendments to the 1976 Convention, which was renamed the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean and came into force in 2004. Additionally, in 1995, the Contracting Parties adopted the Action Plan for the Protection of the Marine Environment and the Coastal Region of the Mediterranean (Mediterranean Action Plan – MAP, Phase II), replacing the original MAP adopted in 1975. The Barcelona Convention activated a total of seven Protocols concerning specific aspects of Mediterranean environmental conservation, complementing the legal framework of the MAP. These are:

1 <u>Dumping Protocol:</u> Protocol for the prevention of pollution of the Mediterranean from the dumping of waste and other materials from ships and aircraft (approved in 1976, amended in 1995, and its amendments have not yet entered into force).

2 <u>Protocol for Land-Based Sources (LBS Protocol):</u> (including Regional Plans under Article 15 of the LBS), which entered into force in 2011:Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources and Activities, which entered into force in 1980 and was amended in 1996, with the amendment entering into force in 2008. Regional Plans were also adopted under the LBS Protocol for the reduction or elimination of substances or their loads, as well as marine litter.

3 <u>SPA Protocol:</u> Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean (SPA Protocol), adopted in 1995, replacing the corresponding protocol of 1982, along with its Annexes (as adopted in 1996 and amended in 2009, 2012, and 2013).

4 <u>Prevention and Emergency Protocol:</u> Protocol on Cooperation in Preventing Pollution from Ships and, in Cases of Emergency, Combating Pollution of the Mediterranean Sea (Prevention and Emergency Protocol), adopted in 2002, replacing the corresponding 1976 Protocol, and entered into force in 2004.

5 <u>Offshore Protocol:</u> Protocol for the Protection of the Mediterranean Sea against Pollution Resulting from Exploration and Exploitation of the Continental Shelf, the Seabed, and its Subsoil (Offshore Protocol), adopted in 1994 and entered into force in 2011.

6 <u>Hazardous Waste Protocol:</u> Protocol on the Prevention of Pollution of the Mediterranean Sea by Transboundary Movements of Hazardous Wastes and their Disposal (Hazardous Waste Protocol), adopted in 1996 and entered into force in 2011.

7 <u>ICZM Protocol:</u> Protocol on Integrated Coastal Zone Management in the Mediterranean (ICZM Protocol), adopted in 2008.

On 17 December 2012, the Council approved the EU's accession to the Offshore Protocol, thereby underlining the EU's commitment to reducing the environmental impacts of offshore activities in the Mediterranean through effective regional cooperation. The institutional outcome of the above was the incorporation of the Offshore Protocol into EU legislation.

The Barcelona Convention, its amendments, and protocols were ratified by Greece through Laws 855/1978, 3022/2002, and 1634/1986 (SPA Protocol).

The Project complies with the restrictions and guidelines of the aforementioned Convention, as the provisions of the above legislation are taken into account.

5.2.4.9 Directive 96/82/EC of the Council on the Control of Major-Accident Hazards Involving Dangerous Substances (SEVESO II Directive)

The Seveso II Directive requires the identification by EU Member States of high-risk industrial sites, the adoption of appropriate measures to prevent major accidents involving dangerous substances, and the limitation of their consequences for humans and the environment.

The proposed project is not directly related to this Directive. However, the project is indirectly related to the Directive, as its onshore part is installed within the Sigma unit, where all obligations and specifications arising from the Seveso II Directive are fully complied with.

5.2.4.10 IPPC Directive (2008/1/EC)

The Directive (commonly known as the "IPPC Directive") establishes the issuance of permits for industrial and agricultural activities with a high pollution potential. The issuance of this permit requires compliance with certain environmental requirements so that businesses themselves undertake the prevention and reduction of pollution they may cause.

Integrated prevention and control of pollution apply to industrial and agricultural activities, whether new or existing, with a high pollution potential, as defined in Annex I of the Directive (energy industries, metal production and processing, mining industry, chemical industry, waste management).

In order for an industrial or agricultural facility to obtain an operating permit, it must comply with certain fundamental obligations mainly concerning:

- the use of all necessary pollution control measures, primarily the application of the best available techniques (to minimize waste generation, use the least hazardous substances, enable the recovery and recycling of emitted substances, etc.)
- the prevention of any major pollution incidents
- the prevention, recycling, or disposal of waste with the least polluting impact
- the efficient use of energy
- the prevention of accidents and the limitation of their consequences
- the restoration of the site after the completion of activities.

The proposed project is not directly related to this Directive. However, the project is indirectly related to the **Directive**, as its onshore part is installed within the Sigma unit, where all obligations and specifications arising from the IPPC Directive are fully complied with.

5.2.4.11 International Convention for the Prevention of Pollution from Ships (MARPOL)

The International Convention for the Prevention of Pollution from Ships (MARPOL) is the main international convention addressing the prevention of pollution of the marine environment from ships, whether caused by operational or accidental reasons.

The MARPOL Convention was adopted on November 2, 1973, under the framework of the International Maritime Organization (IMO). The 1978 Protocol was adopted in response to a surge of tanker accidents during 1976–1977. Since the 1973 MARPOL Convention had not yet entered into force, the 1978 MARPOL Protocol absorbed the parent Convention. The combined instrument came into effect on December 2, 1983. In 1997, a Protocol amending the Convention was adopted, and a new Annex VI was added, which entered into force on May 19, 2005. MARPOL has been updated periodically through amendments.

The Convention includes regulations aimed at preventing and minimizing pollution from ships—both accidental pollution and pollution from routine operations—and currently comprises six technical Annexes. Most Annexes include Special Areas with strict controls on operational discharges.

- Annex I: Regulations for the Prevention of Pollution by Oil (entered into force on October 2, 1983)
  - It covers the prevention of pollution by oil from operational measures as well as from accidental discharges. The 1992 amendments to Annex I made double hulls mandatory for new oil tankers and established a phased timetable for the retrofit of double hulls on existing tankers, which was subsequently revised in 2001 and 2003.
- Annex II: Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk (entered into force on October 2, 1983)
  - It describes in detail the discharge criteria and measures for controlling pollution from noxious liquid substances carried in bulk. Approximately 250 substances have been evaluated and are included in the list attached to the Convention. The discharge of their residues is permitted only at reception facilities up to certain concentrations and under conditions (which vary depending on the category of substances) that must be observed.
  - In any case, the discharge of residues containing noxious substances is prohibited within 12 miles from the nearest shore.
- Annex III: Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form (entered into force on July 1, 1992)
  - It contains general requirements for the issuance of detailed standards on packaging, labeling, documentation, quantity limitations, exemptions, and notifications.
  - For the purposes of this Annex, “harmful substances” are substances classified as marine pollutants in the International Maritime Dangerous Goods Code (IMDG Code) or that meet the criteria of the Appendix to Annex III.
- Annex IV: Prevention of Pollution by Sewage from Ships (entered into force on September 27, 2003)

- It includes the requirements for controlling pollution of the sea by sewage. The discharge of sewage into the sea is prohibited unless the ship operates an approved sewage treatment plant or discharges comminuted and disinfected sewage using an approved system at a distance greater than three nautical miles from the nearest shore. Sewage that is neither comminuted nor disinfected must be discharged at a distance greater than 12 nautical miles from the nearest shore.

- Annex V: Prevention of Pollution by Garbage from Ships (entered into force on December 31, 1998)
  - It deals with various types of garbage and defines the distances from the shore and the manner in which they can be disposed of. The most important feature of the Annex is the complete ban it imposes on the discharge of any form of plastic into the sea.
- Annex VI: Prevention of Air Pollution from Ships (entered into force on May 19, 2005)
  - It sets limits on sulfur oxide (SOx) and nitrogen oxide (NOx) emissions from ship exhaust gases and prohibits deliberate emissions of ozone-depleting substances. In designated emission control areas, stricter standards apply for SOx, NOx, and particulate matter. A chapter approved in 2011 covers mandatory technical and operational energy efficiency measures aimed at reducing greenhouse gas emissions from ships.

The MARPOL Convention, its amendments, and protocols were ratified by Greece through the following laws, Presidential Decrees, and Ministerial Decisions:

- Presidential Decree 404/1986 (Government Gazette 182/A/26-11-1986)
- Presidential Decree 254/1989 (Government Gazette 120/A/11-05-1989)
- Presidential Decree 288/1992 (Government Gazette 147/A/02-09-1992)
- Presidential Decree 103/1992 (Government Gazette 47/A/31-03-1992)
- Presidential Decree 46/1993 (Government Gazette 17/A/17-02-1993)
- Presidential Decree 361/1996 (Government Gazette 233/A/20-09-1996)
- Presidential Decree 54/1999 (Government Gazette 53/A/22-03-1999)
- Presidential Decree 128/2000 (Government Gazette 112/A/06-04-2000)
- Presidential Decree 206/2000 (Government Gazette 186/A/25-08-2000)
- Presidential Decree 312/2002 (Government Gazette 273/A/13-11-2002)
- Presidential Decree 114/2006 (Government Gazette 112/A/08-06-2006)
- Ministerial Decision 2431.02/02/05 (Government Gazette 331/B/15-03-2005)
- Presidential Decree 27/2007 (Government Gazette 19/A/30-01-2007)
- Ministerial Decision 2431.02.1/02/07 (Government Gazette 197/A/23-08-2007)
- Law 3104/2003 (Government Gazette 28/A/10-02-2003)

<u>The Project complies with the restrictions and guidelines of the said Convention, which aim at the prevention and minimization of pollution from ships.</u>

5.2.4.12 Convention for the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention)

The Convention for the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention) is one of the first global conventions for the protection of the marine environment from human activities and has been in force since 1975. Its aim is to promote effective control of all sources of marine pollution and to take all practical measures to prevent marine pollution caused by the dumping of wastes and other matter. Currently, 87 countries are contracting parties to the Convention, including Greece. In 1996, the "London Protocol" was agreed upon for the further modernization and eventual replacement of the Convention. According to the Protocol, all dumping practices are prohibited except for wastes accepted on the so-called “reverse list,” which includes the following:

- Dredged material
- Sewage sludge
- Fish waste
- Vessels and platforms
- Inert, inorganic geological materials (e.g. mining wastes)
- Organic materials of natural origin
- OBulky items primarily comprising iron, steel, concrete
- Wastes from carbon dioxide capture processes

The Protocol entered into force on March 24, 2006, with 51 contracting parties. Greece ratified the London Convention through Law 1147/1981 but has not yet ratified the corresponding London Protocol.

<u>The Project complies with the restrictions and guidelines of the said Convention, which aim at preventing marine pollution from the dumping of wastes and other matter.</u>

5.2.4.13 Regulation (EC) No. 1907/2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)

The REACH Regulation, which entered into force on June 1, 2007, requires manufacturers and importers of chemical products to assess the risks arising from the use of chemical substances and to manage those risks. REACH applies to the manufacture, placing on the market, or use of substances in their pure form, in mixtures, or in articles, as well as the placing of mixtures on the market. A “substance” is defined as a chemical element and its compounds in the natural state or as obtained by any manufacturing process.

Key elements of REACH include the registration requirements, under which the production or import of chemical substances in quantities of one tonne or more per year must be registered. Substances of very high concern are also subject to an authorisation process. Additionally, the REACH Regulation implements a restriction procedure, which sets limitations on the manufacturing conditions, use(s), and/or placing on the market of a substance—or may even lead to a complete ban on its manufacture, use, or placing on the market.

Although the draft EU Regulation does not specifically refer to REACH, it is considered relevant, as the Offshore Protocol requires that the use of chemical substances for the exploration and/or exploitation of resources be regulated, restricted, or prohibited.

The Project complies with the restrictions and guidelines of the said Regulation, as its design has incorporated all specifications related to the use of chemical substances.

5.2.4.14 Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC), 1990

In July 1989, a summit of leading industrialized nations in Paris called on the International Maritime Organization (IMO) to further develop measures for the prevention of pollution from ships. This request was approved by the IMO Assembly in November of the same year, and work began on drafting a convention aimed at providing a global framework for international cooperation in responding to major incidents or threats of marine pollution.

The contracting parties to the International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC) are required to establish measures for responding to pollution incidents, either at the national level or in cooperation with other countries.

Ships are required to have an emergency plan for responding to oil pollution, and operators of offshore units under the jurisdiction of the Contracting Parties are also obliged to have oil pollution emergency plans or similar arrangements. These must be coordinated with national systems to ensure a prompt and effective response to oil pollution incidents.

In addition, ships are obligated to report pollution incidents to coastal authorities, and the Convention outlines in detail the actions that must be taken in response. The Convention calls for the establishment of oil spill response equipment stockpiles, the conduct of oil spill response exercises, and the development of detailed contingency plans for dealing with pollution incidents.

The Contracting Parties to the Convention are obliged to provide assistance to others in the event of an emergency pollution situation, and any assistance provided is expected to be reimbursed.

In 2000, a Protocol related to hazardous and harmful substances (OPRC-HNS Protocol) was also adopted.

The Project complies with the restrictions and guidelines of the said Convention, as its design has incorporated all specifications for oil pollution response.

5.2.4.15 United Nations Convention on the Law of the Sea (UNCLOS)

The United Nations Convention on the Law of the Sea (UNCLOS), also known as the Law of the Sea Convention or the Law of the Sea Treaty, is the international agreement that resulted from the Third United Nations Conference on the Law of the Sea (UNCLOS III), held between 1973 and 1982. The Convention defines the rights and responsibilities of nations regarding their use of the world's oceans, establishing guidelines for operations, environmental protection, and the management of marine natural resources. Concluded in 1982, the Convention replaced four treaties from 1958. UNCLOS came into force in 1994.

As of January 2015, 166 countries and the European Union have acceded to the Convention. However, it remains uncertain whether the Convention codifies customary international law.

5.2.4.16 Stockholm Convention on Persistent Organic Pollutants (POPs)

The Stockholm Convention on Persistent Organic Pollutants (POPs) is an international environmental treaty, signed in 2001 and entered into force in May 2004, aiming to eliminate or restrict the production and use of persistent organic pollutants.

Key elements of the Convention include the obligation of developed countries to provide new and additional financial resources and measures to eliminate the production and use of intentionally produced persistent organic pollutants, to eliminate unintentional production of pollutants where feasible, and to manage and dispose of persistent organic pollutant waste in an environmentally sound manner. Attention is given throughout the Stockholm Convention, with specific references to the preamble, the objective, and the provision concerning the identification of new persistent organic pollutants.

5.2.4.17 International Convention for the Safety of Life at Sea (SOLAS) regarding Noise Emissions on Ships

The main objective of the SOLAS Convention, adopted in 1974, is to establish the minimum standards for the construction, equipment, and operation of ships to ensure their safety. Flag states are responsible for ensuring that ships flying their flag comply with the Convention's requirements, which is evidenced by a series of certificates required under the Convention. The prescribed inspection procedures also allow contracting states to inspect ships of other contracting states if there are serious indications of non-compliance with the Convention's requirements—this process is known as port State control. The current SOLAS Convention includes articles defining general obligations, procedures for amending the Convention, etc., as well as an Annex divided into 14 chapters.

In 2012, IMO adopted a regulation under the SOLAS Convention requiring ship construction to aim at reducing onboard noise and protecting personnel from noise exposure, in accordance with the Code on Noise Levels on Board Ships. The Code sets maximum noise level limits in engine rooms, control rooms, workshops, accommodations, and other ship areas. The International Labour Organization's Maritime Labour Convention (MLC 2006) also establishes requirements for preventing the risk of exposure to hazardous noise levels on ships.

The SOLAS Convention was ratified by Law No. 1045/1980, and a series of Presidential Decrees have been issued adopting the Convention's amendments (http://www.elinyae.gr/etiketes/solas).

The Project complies with the restrictions and guidelines of this Convention.

5.2.4.18 International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage (FUND)

Although the 1969 Civil Liability Convention (CLC) was a useful mechanism to ensure compensation payments for oil pollution damage, it did not adequately address all the legal, financial, and other issues raised during the Conference that approved the CLC. The 1969 Brussels Conference is considered a compromise proposal to create an international fund, where cargo insurance interests would be registered, with the dual purpose of, on one hand, relieving the shipowner from the burden of claims under the new convention, and on the other hand, providing additional compensation to victims of pollution damage in cases where the compensation foreseen by the 1969 Civil Liability Convention was either insufficient or unattainable.

The Conference recommended that the International Maritime Organization establish this system, and the International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage was adopted at a conference held in Brussels in 1971. It is complementary to the Civil Liability Convention.

The purposes of the Fund Convention are:

- To provide compensation for pollution damage to the extent that the protection provided by the 1969 Civil Liability Convention is inadequate.
- To provide relief to shipowners regarding the additional financial burden imposed on them by the 1969 Civil Liability Convention. This relief is subject to conditions designed to ensure compliance with maritime safety and other conventions.
- To implement the relevant objectives set out in the Convention.

According to the first purpose, the Fund is obligated to pay compensation to States and individuals who suffer damage from pollution if these parties are unable to obtain compensation from the owner of the ship from which the oil escaped, or if the compensation owed by the shipowner is insufficient to cover the damage suffered.

Under the Fund Convention, victims of oil pollution damage may be compensated beyond the liability limit of the shipowner. However, the Fund's obligations are limited. When there is no liable shipowner or the responsible shipowner is unable to meet their liability, the Fund must pay the full amount of the compensation owed. Under certain conditions, the Fund's maximum liability can be increased.

With the exception of a few cases, the Fund is obliged to pay compensation to victims of oil pollution damage who are unable to obtain sufficient or any compensation from the shipowner or their guarantor under the Civil Liability Convention.

The Fund's obligation to pay compensation is limited to pollution damage occurring within the territory, including the territorial waters, of the Contracting States. The Fund is also obliged to pay compensation related to measures taken by a Contracting State outside its territory.

The Fund may also provide assistance to Contracting States threatened or affected by pollution and wishing to take measures to combat it. This assistance may take the form of personnel, equipment, credit facilities, or other support.

Regarding its second main function, the Fund is obliged to compensate the shipowner or their insurer for part of the shipowner's liability under the Civil Liability Convention.

The Fund is not required to compensate the shipowner if the damage was caused by their own willful misconduct or if the accident was caused, even partly, because the ship did not comply with certain international conventions. Additionally, the Convention includes provisions concerning the claims procedure, rights and obligations, as well as jurisdiction.

Contributions to the Fund must be made by all persons receiving oil by sea in Contracting States.

Greece ratified the Convention, its Protocols, and amendments through Law 1638/1986, Presidential Decrees 270/1995, 270/1995, 286/2002, 291/2003, and Law 3482/2006.

The Project complies with the restrictions and guidelines of the said Convention.

5.2.5 Legal Framework for Human Rights and Social Welfare

5.2.5.1 International Legal Framework for Human Rights

International law on human rights is based on the Universal Declaration of Human Rights and consists of 9 core international instruments with additional optional protocols. The relevant international instruments on human rights are listed below:

- International Covenant on Civil and Political Rights (ICCPR): The ICCPR recognizes the dignity of every individual and promotes the protection of individuals' freedom from state interference, ensuring that everyone can participate in civil society. Freedom of speech and freedom of assembly are part of these rights.
- International Covenant on Economic, Social and Cultural Rights (ICESCR): The parties to the ICESCR agree to protect the enjoyment of these rights from violations by third parties.

5.2.5.2 International Regulations on Workers' Rights

The International Labour Organization (ILO) is a UN agency that sets labor standards, develops policies, and designs programs that promote decent work for all women and men.

The eight fundamental conventions of the ILO are as follows:

1. Convention on Freedom of Association and Protection of the Right to Organise, 1948 (No. 87)
2. Convention concerning the Application of the Principles of the Right to Organise and to Bargain Collectively, 1949 (No. 98)
3. Convention concerning Forced or Compulsory Labour, 1930 (No. 29) (and the 2014 Protocol)
4. Convention concerning the Abolition of Forced Labour, 1957 (No. 105)
5. Convention concerning the Minimum Age, 1973 (No. 138)
6. Convention concerning the Worst Forms of Child Labour, 1999 (No. 182)
7. Convention concerning Equal Remuneration, 1951 (No. 100)
8. Convention concerning Discrimination (Employment and Occupation), 1958 (No. 111)

Greece has ratified the following ILO conventions:

- Greece has ratified 71 Conventions and 1 Protocol, of which 51 are currently in force. Seventeen Conventions have been denounced, and 3 instruments have been abrogated. Of the 71 Conventions and 1 Protocol ratified by Greece, none have been ratified in the last 12 months.
- Fundamental Conventions: 8 out of 8.
- ΣGovernance (Priority) Conventions: Greece has not ratified Convention C129 – Labour Inspection (Agriculture), 1969.
- Technical Conventions: 60 out of 177.

5.2.5.3 International Institutional Framework for Access to Information and Public and Stakeholder Participation in Decision-Making

5.2.5.3.1 Aarhus Convention

The United Nations Economic Commission for Europe (UNECE) Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters was adopted on 25 June 1998 in the city of Aarhus, Denmark, during the Fourth Ministerial Conference in the framework of the "Environment for Europe" process.

The Convention:

- Links environmental and human rights
- Recognizes that we have an obligation towards future generations
- States that sustainable development can only be achieved with the participation of all interested parties
- Connects governmental accountability and environmental protection
- Focuses on the interactions between citizens and public authorities within a democratic framework.

The subject matter of the Convention concerns the core of the relationship between citizens and governments and addresses governmental accountability, transparency, and responsiveness.

The Aarhus Convention grants rights to citizens and imposes obligations on the Parties and public authorities regarding access to information, public participation, and access to justice.

The Aarhus Convention also establishes a new process for public participation in the negotiation and implementation of international agreements.

Its three main pillars are as follows:

- **Access to information:** Every citizen must have the right to broad and easy access to environmental information. Public authorities are obliged to provide all the required information, and to collect and disseminate it in a timely and transparent manner. This includes information about the state of the environment, the policies and measures being taken, or the state of human health and safety in cases where it may be affected by the condition of the environment. Certain information is exempt from disclosure, such as in cases where disclosure would negatively affect international relations, national defense, public security, the functioning of justice, trade secrets, or the confidentiality of personal data. Information may also be withheld if its release could harm the environment, such as the locations of breeding grounds of rare species.

- **Public participation in decision-making:** Citizens have the right to participate in decision-making on environmental matters. Public authorities must ensure that mechanisms are in place to allow the public to be informed and, if they wish, to comment on proposals for projects that affect the environment, or on plans and programmes relating to the environment. Any comments made must be taken into account in the decision-making process. Decision-makers can benefit from the knowledge and experience of citizens. This contribution is a significant opportunity to improve the quality of environmental decisions and outcomes, and it guarantees procedural legitimacy.
- **Access to justice:** Citizens have the right to judicial or administrative appeal procedures in cases where a Party violates or fails to comply with the principles of the Convention. In other words, they have the right to seek redress when environmental law is violated and to access review procedures to challenge public decisions made without consideration of the Convention's other two pillars.

<u>The design, development, and permitting process of the project fully comply with the requirements of the Aarhus Convention.</u>

5.2.5.3.2 European Legislation

The EU legislation concerning public consultation, public participation, and stakeholder involvement in environmental information includes the following Directives:

- Directive 2003/35/EC of the European Parliament and of the Council, dated 26 May 2003, on public participation in the preparation of certain plans and programs relating to the environment, and amending, with regard to public participation and access to justice, Council Directives 85/337/EEC and 96/61/EC. Directive 2003/35/EC refers to the second pillar of the "Aarhus Convention."
- Directive 2003/4/EC of the European Parliament and of the Council, dated 28 January 2003, on public access to environmental information and repealing Council Directive 90/313/EEC. Directive 2003/4/EC refers to the first pillar of the "Aarhus Convention."

5.2.5.3.3 National Legislation

Greece has ratified and incorporated the European legislation concerning the requirements for consultation and public and stakeholder participation in environmental information through the following laws:

- The Joint Ministerial Decision (JMD) 1649/45/2014, as amended by JMD oik. 5688/2018, includes provisions and specifications regarding: a) the means of consultation between various authorities, and b) the ways of informing the public as well as their participation in public consultation during the environmental permitting process.
- JMD 21398/2012 concerns the creation and operation of a dedicated website for publishing decisions related to the approval, renewal, or modification of environmental permits.

- JMD 9269/470/2007 relates to judicial procedures for protecting the public from administrative acts or omissions regarding the disclosure of information and participation during the environmental permitting process.
- JMD 11764/653/2006 incorporates Directive 2003/4/EC regarding public access to environmental information.
- Law 3422/2005 ratifies the Aarhus Convention (Directive 2003/35/EC).
- JMD 3711/2021/2003 concerns media tools and citizen participation during the approval of environmental terms.

5.2.5.4 National Institutional Framework for Human Rights

The Greek authorities make every possible effort to ensure that the level of protection of fundamental rights is upheld by all state bodies and institutions, so as to guarantee the rules of a free, non-discriminatory democratic society. In the hierarchy of legal rules that guarantee the protection of fundamental rights, the Greek Constitution, as the supreme law, includes a special chapter on individual and social rights (Part B - Articles 4-25) (Greek Council for Refugees, 2019).

The Hellenic National Commission for Human Rights (HNCHR), as an independent advisory body of the State on matters of Human Rights protection, constitutes the National Human Rights Institution (NHRI). According to UN principles, within the scope of its powers granted by its founding law, it is tasked with monitoring developments in its areas of activity, addressing the competent state services, and undertaking initiatives to raise public awareness (Greek Council for Refugees, 2019). The HNCHR places special importance on the status of international protection and has issued a series of related decisions (reports, statements, announcements), such as the recent reference report on refugees (September 2019), which outlines the HNCHR's positions on the reception and housing of applicants for international protection, the detention of applicants for international protection, international protection procedures at the first and second instance, unaccompanied minors, the pushback of third-country nationals at the Greek-Turkish borders, and the integration of refugees in Greece (Greek Council for Refugees, 2019).

Additionally, the National Action Plan for Human Rights was established by the Greek State for the period 2014-2016 in order to strengthen, implement, and protect fundamental rights in Greece.

5.2.5.5 National Institutional Framework for Social Welfare

National legislation on social welfare includes:

- Articles 29 and 30 of Presidential Decree 141/2013.
- Establishment of the Asylum Service by Law 3907/2011, which began operating in June 2013. It is the first independent structure in Greece responsible for examining international protection applications. The same law established the Appeals Authority, which reviews appeals against decisions of the Asylum Service rejecting international protection applications at first instance, as well as the Reception and Identification Service, through which a system of first reception and registration of the data and needs

of those entering Greece without legal formalities was launched, including individuals wishing to seek asylum. Currently, the operation of all three services is regulated by Law 4375/2016.

- Article 1 (IA) (2) of Law 4093/2012, as amended by Article 6 of Law 4472/2017.
- Article 10 of Law 3220/2004.
- Joint Ministerial Decision (KYA) G4a/F.225/161 (Government Gazette 108/B/15.2.1989).
- Article 235 of Law 4389/2016.
- Article 93 of Law 4387/2016.

5.3 INTERNATIONAL – EU – NATIONAL ENVIRONMENTAL PROTECTION GOALS RELATED TO THE PROJECT

5.3.1 International – EU Environmental Protection Goals Related to the Project

5.3.1.1 United Nations 2030 Agenda

The 2030 Agenda for Sustainable Development, along with the 17 Sustainable Development Goals and 169 targets, was adopted within the framework of the United Nations General Assembly on September 25, 2015, through the resolution "Transforming Our World: The 2030 Agenda for Sustainable Development."

The 2030 Agenda is the most ambitious global agreement ever achieved by the UN, as it is an action plan for People, Planet, and Prosperity. The 2030 Agenda promotes the integration of all three dimensions of sustainable development — social, environmental, and economic — across all sectoral policies, while also fostering the interconnection and coherence of policies and legislative frameworks related to the **Sustainable Development Goals (SDGs)**. Sustainable development can be understood through addressing challenges related to the following five pillars (5 P):

- People,
- Planet,
- Prosperity,
- Peace,
- Partnership.

The 17 SDGs (as shown in the following diagram) were adopted by the 193 UN member states, including Greece, and are universal with a target implementation timeline until 2030. They serve as a roadmap for achieving a better and more sustainable future for all. The goals are interconnected and indivisible, meaning that achieving one goal impacts the achievement of others.

Source: United Nations Regional Information Centre, https://unric.org/

Figure 5‒1: Sustainable Development Goals of the United Nations 2030 Agenda

The 2030 Agenda is the international community's roadmap for achieving sustainable development for all — that is, economic development that guarantees social well-being without exclusion and the protection of the environment and natural resources for the benefit not only of current but also future generations — by 2030.

For the implementation of the SDGs, all UN member states have made commitments, and the EU, together with its member states, has committed to taking a leading role in the implementation of the United Nations 2030 Agenda.

In November 2016, the European Commission presented its strategic approach for implementing the Sustainable Development Goals of the 2030 Agenda.

Key actions for the implementation of the 2030 Agenda include the following:

- Integration of the SDGs into all EU policies and initiatives, so that sustainable development becomes a fundamental guiding principle in all European Commission policies.
- Regular reporting on the EU's progress, starting in 2017.
- Promotion of the implementation of the 2030 Agenda jointly with the governments of EU member states, the European Parliament, other European institutions, international organizations, civil society organizations, citizens, and other stakeholders.
- Creation of a high-level platform involving multiple stakeholders to promote the exchange of best practices across all sectors at both national and European levels.
- Formulation of a long-term vision extending beyond 2020.

The SDGs are interconnected and therefore require a much more integrated approach across all policy sectors — from addressing poverty and social exclusion (SDG 1), ensuring universal access to quality health (SDG 3) and education services (SDG 4), securing full employment and decent work for all (SDG 8), promoting development in the fields of industry, innovation, and infrastructure (SDG 9), and reducing social and regional inequalities (SDG 10), to ensuring integrated water resource management (SDG 6), promoting renewable energy and energy efficiency (SDG 7), and protecting and sustainably managing the oceans (SDG 14). Finally, the SDGs also include cross-cutting goals, such as building efficient, reliable, and transparent institutions (SDG 16) and strengthening and promoting open, participatory, and democratic processes as means of implementation (SDG 17). It is worth noting that approximately 7 out of the total 17 Goals are directly related to environmental issues (see SDG 6 – water, SDG 7 – sustainable energy, SDG 11 – sustainable cities, SDG 12 – sustainable production and consumption patterns, SDG 13 – climate change, SDG 14 – marine environment, SDG 15 – biodiversity), with environmental SDGs acting as a "catalyst" for achieving all other goals.

<u>The project concerns the storage of carbon dioxide (CO_2), and therefore fully aligns with the directions of the Sustainable Development Goals, as it aims to mitigate climate change. Specifically, it is consistent with the following SDGs:</u>

The sub-goals of **SDG 11**, which refers to “Sustainable Cities and Communities,” are aligned with the Project:

- 11.6 By 2030, reduce the adverse per capita environmental impact of cities, with particular attention to air quality and municipal and other waste management.
- 11.b By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and the development and implementation of holistic disaster risk management at all levels, in line with the Sendai Framework for Disaster Risk Reduction 2015–2030.

The sub-targets of SDG 13, which concerns “Climate Action”, that align with the Project are:

- 13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries.
- 13.2 Integrate climate change measures into national policies, strategies and planning.

5.3.1.2 8th Environment Action Programme (EAP)

Environmental action programmes have guided the shaping of EU environmental policy since the early 1970s.

In March 2021, the ambassadors of the EU Member States approved a mandate for the Council to negotiate with the European Parliament to reach an agreement on the 8th Environment Action Programme (8th EAP). The 8th EAP will serve as a guide for the development and implementation of environmental and climate policy until 2030.

The Commission's proposal for the 8th Environment Action Programme (8th EAP) exceptionally does not include a list of actions but is based on the European Green Deal and the list of actions it contains.

The 8th EAP aims to accelerate the green transition in a fair and inclusive manner, with the long-term goal for 2050 of "Well-being within the limits of our planet," as established by the 7th EAP.

The six thematic priority objectives of the 8th EAP concern:

- the reduction of greenhouse gas emissions.
- adaptation to climate change.
- a development model that gives back to the planet more than it takes.
- the ambition of zero pollution
- the protection and restoration of biodiversity.
- the reduction of key environmental and climate pressures related to production and consumption.

<u>The proposed Project fully aligns with and promotes the above goals as it concerns CO2 storage and constitutes an environmentally friendly technology. Furthermore, it should be emphasized that the project design will include measures to reduce potential environmental impacts, such as waste management and measures to avoid, address, and remediate accidental pollution incidents, as described in **Chapter 12** of this document.</u>

5.3.1.3 European Green Deal

Climate change and environmental degradation threaten the very existence of Europe and the world. To address these challenges, the European Green Deal aims to transform the EU into a modern, resource-efficient, and competitive economy, ensuring the following:

- Net zero greenhouse gas emissions by 2050.
- Economic growth decoupled from resource use.
- No person and no region left behind.

One third of the €1.8 trillion investments from the Next Generation EU recovery plan, as well as the EU's seven-year budget, will finance the European Green Deal.

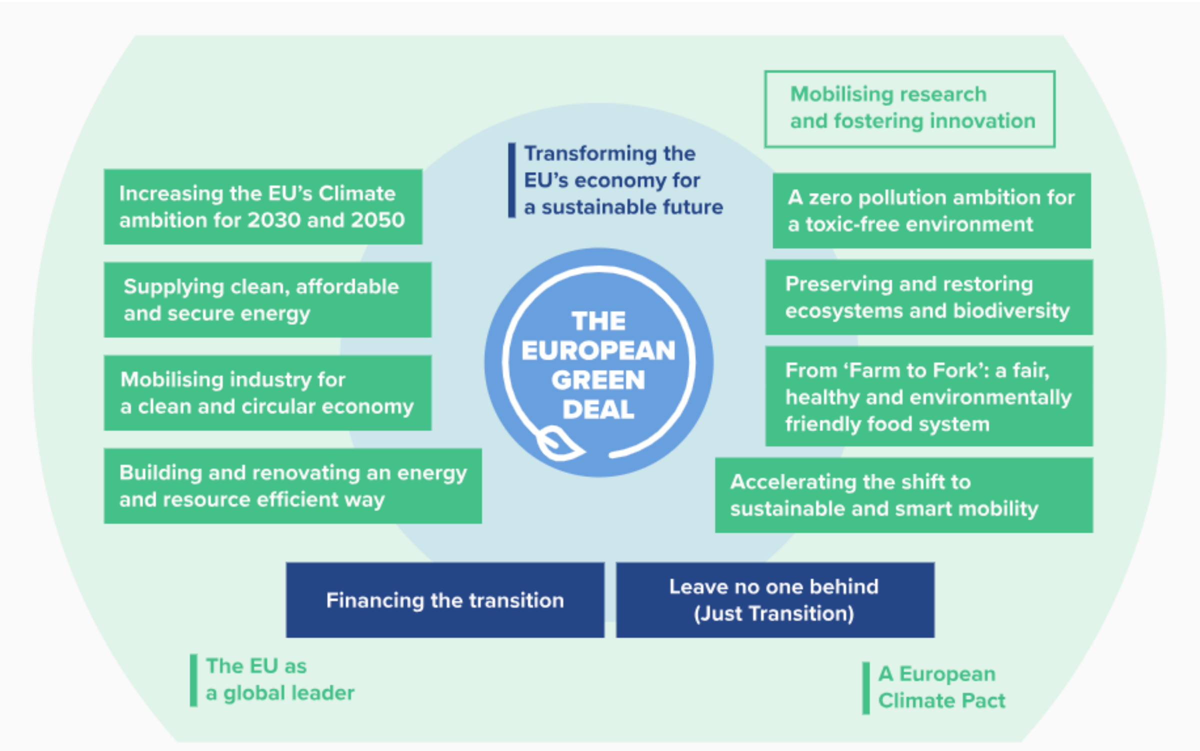
The European Green Deal provides an action plan to enhance resource efficiency by transitioning to a clean, circular economy, restoring biodiversity, and reducing pollution.

The plan outlines the necessary investments and available financing instruments. It explains how a fair and inclusive transition can be ensured.

The EU has set an emblematic goal to become the first climate-neutral continent by 2050. Achieving this goal requires action across all sectors of the economy, such as:

- Investments in environmental technologies.
- Support for innovation in the industrial sector.
- Development of cleaner, more economical, and healthier forms of private and public transportation.
- Decarbonization of the energy sector.
- Ensuring the energy efficiency of buildings.
- Collaboration with international partners to improve global environmental standards.

The following **Diagram** depicts the various elements of the Green Deal as presented in the European Commission Communication, COM (2019) 640.



Source: European Commission, https://commission.europa.eu/

Figure 5–2: Elements of the European Green Deal

The proposed Project aligns with the above goals as, by its nature, it promotes sustainable development and the reduction of the climate footprint. Additionally, it should be emphasized that the project design will incorporate measures to reduce potential environmental impacts, such as waste management measures and prevention/response/restoration of accidental pollution incidents, as described in **Chapter 12** of this document.

5.3.1.4 Framework for Climate and Energy for 2030

The framework for climate and energy for 2030 includes targets and policy goals at the EU level for the period from 2021 to 2030.

Within the framework of the European Green Deal, the European Commission proposed in September 2020 to increase the greenhouse gas emissions reduction target for 2030 to at least 55% compared to 1990. It examined the actions required across all sectors, including increasing energy efficiency and renewable energy sources, and initiated the process of submitting detailed legislative proposals to implement and achieve this target. This will enable the EU to move towards a climate-neutral economy and fulfill its commitments under the Paris Agreement by updating the Member States' targets.

The Commission proposes that the climate and energy framework for 2030 should be based on the full implementation of the 2020 targets and the following:

- A 40% reduction in greenhouse gas emissions by 2030 compared to 1990 levels, to be achieved through domestic measures only. These measures include a combination of a 43% emissions reduction compared to 2005 under the Emissions Trading System (ETS) as well as national actions by Member States to reduce emissions by 2030 in sectors outside the ETS.
- An increase in the share of energy from renewable sources consumed in the EU to at least 27%, which is binding at the EU level but not at the national level, allowing Member States flexibility to meet their targets in the most cost-effective way.
- Revision of the Emissions Trading System (ETS) through the creation of a new Market Stability Reserve, as well as the limitation of the annual emissions cap after 2020. Alongside this announcement, a legislative proposal was published aiming to establish the reserve.
- Further improvement of energy efficiency, which is essential for competitiveness, energy supply security, and sustainability. A revision of the 2012 Energy Efficiency Directive — later in 2014 — will help define future energy-saving policies.
- New European governance system for achieving climate and energy targets. Member States must develop national plans for competitive, secure, and sustainable energy. These plans will be reviewed and assessed by the Commission.
- Key indicators will be used to monitor progress across all aspects of competitiveness, security, and sustainable energy.

The 40% greenhouse gas reduction target is implemented through the EU Emissions Trading System, the Effort Sharing Regulation, targets for Member States' emission reductions, and regulations on land use, land-use change, and forestry. These climate-related legislative measures must be updated to implement the proposed greenhouse gas reduction target of at least 55%. This process is ongoing, and the targets have not yet been officially revised.

The aforementioned Project aligns with the above targets. Additionally, it should be emphasized that the project's design will include measures to reduce potential environmental impacts, such as waste management and prevention/response/restoration of accidental pollution incidents, as described in Chapter 12 of this document.

5.3.1.5 28th United Nations Climate Change Conference (COP28)

Every year, the COP meets to set ambitions and responsibilities for climate action, as well as to identify and evaluate climate measures. The 2023 conference was hosted by the United Arab Emirates, which held the presidency of COP28..

The 28th United Nations Climate Change Conference (COP28) took place from November 30 to December 13, 2023, in Dubai, United Arab Emirates. The EU and its 27 member states attended the event as parties to the United Nations Framework Convention on Climate Change (UNFCCC).

The main topics of COP28 were as follows:

- Global stocktake of efforts for climate change mitigation.
- Work program for climate change mitigation.
- Global goal on adaptation
- Climate finance, including financial arrangements for loss and damage.

More specifically, during his speech at the COP28 plenary session, President Charles Michel called for strengthening and accelerating global action to keep the planet's temperature increase within 1.5°C. President Charles Michel emphasized the EU's commitment to climate neutrality. He pointed out that the EU has already reduced greenhouse gas emissions by 30% compared to 1990 levels and has decided to triple energy from renewable sources and double energy efficiency. He also stressed the need to end our dependence on fossil fuels as soon as possible.

The EU is the largest provider of public climate finance worldwide. In Dubai, President Charles Michel emphasized that the EU is fulfilling its commitment to contribute to achieving the US$100 billion target set by the Paris Agreement. This year, €23 billion has been pledged by the EU for disbursement. The EU and its member states announced a contribution of €220 million to the loss and damage fund to help the poorest and most vulnerable countries.

5.3.1.6 "Fit for 55" Adaptation to the 55% Target

The European climate legislation makes it a legal obligation to achieve the EU's climate target of r**educing greenhouse gas emissions by at least 55% by 2030**. EU countries are developing new legislation to meet this target and to make the EU climate neutral by 2050.

The "Fit for 55" package is a set of proposals for the revision and update of EU legislation and the establishment of new initiatives, aiming to ensure that EU policies are aligned with the climate targets agreed upon by the Council and the European Parliament.

The package of proposals aims to create a coherent and balanced framework for achieving the EU's climate targets, which:

- Ensures a fair and socially equitable transition.
- Maintains and strengthens innovation and competitiveness of the EU industry, while ensuring a level playing field with economic operators from third countries.

- Establishes the EU's position as a global leader in combating climate change.

5.3.2 International Conventions – EU Environmental Protection Directives

5.3.2.1 Habitats Directive (92/43/EEC)

The Habitats Directive (officially known as Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora) was adopted in 1992 in response to the Bern Convention. The Directive aims to protect approximately 200 habitat types and 1,000 species listed in its Annexes, which are considered to be of European interest based on the Directive's criteria, as follows:

- Annex I includes the protected habitat types.
- Annex II includes approximately 900 species whose habitats have been designated as Special Areas of Conservation (SACs) and are part of the Natura 2000 network. These areas must be managed according to the ecological requirements of the species.
- Annex IV includes more than 400 species that must be subject to strict protection across their natural range within the EU, both inside and outside the Natura 2000 network sites.
- Annex V includes more than 90 species for which Member States must ensure that their exploitation and removal from the wild do not adversely affect their favorable conservation status.

Directive 92/43/EEC forms the basis of European nature conservation policy, together with the Wild Birds Directive. It established the extensive European ecological network of protected areas known as Natura 2000 (Special Areas of Conservation – SACs, and Special Protection Areas – SPAs). Certain articles of the Habitats Directive (Articles 6, 12, 16, and 17) require Member States to submit reports on the status and conservation status of habitats and species, the compensatory measures taken for projects that have negative impacts on Natura 2000 sites, or any derogations from the strict protection measures of these areas.

The Habitats Directive was transposed into national legislation through Joint Ministerial Decision (JMD) 33318/3028/1998, establishing the measures and procedures for the conservation of natural habitats and wild fauna and flora, as amended by JMD 14849/853/E103/4-4-2008. Additionally, Law 3937/2011 on Biodiversity Conservation established the National System of Protected Areas (including Natura 2000 sites), as amended by JMD 50743/2017 (which revised the national list of Natura 2000 sites), along with general guidelines and regulations for their conservation.

The project under consideration is located within the protected Natura 2000 site SCI & SPA GR1150014 "Marine Area of Kavala – Thasos." In the wider area, the SAC GR1150010 "Nestos Delta and Keramoti lagoons – Wider Area" is also identified.

<u>The project complies with the guidelines and objectives of the current Directive as it does not cause significant adverse effects on the **Conservation Features** and corresponding Conservation **Objectives** of the aforementioned SACs (as thoroughly documented in the Environmental Impact Assessment attached in the relevant Annex of this document). Moreover, the design of the proposed project has taken into account all</u>

relevant obligations and best technical practices arising from the inclusion of the study area within a Special Area of Conservation (SAC).

The following Figure presents the Natura 2000 protected areas located in the wider study area of the site, along with their distances from the project.

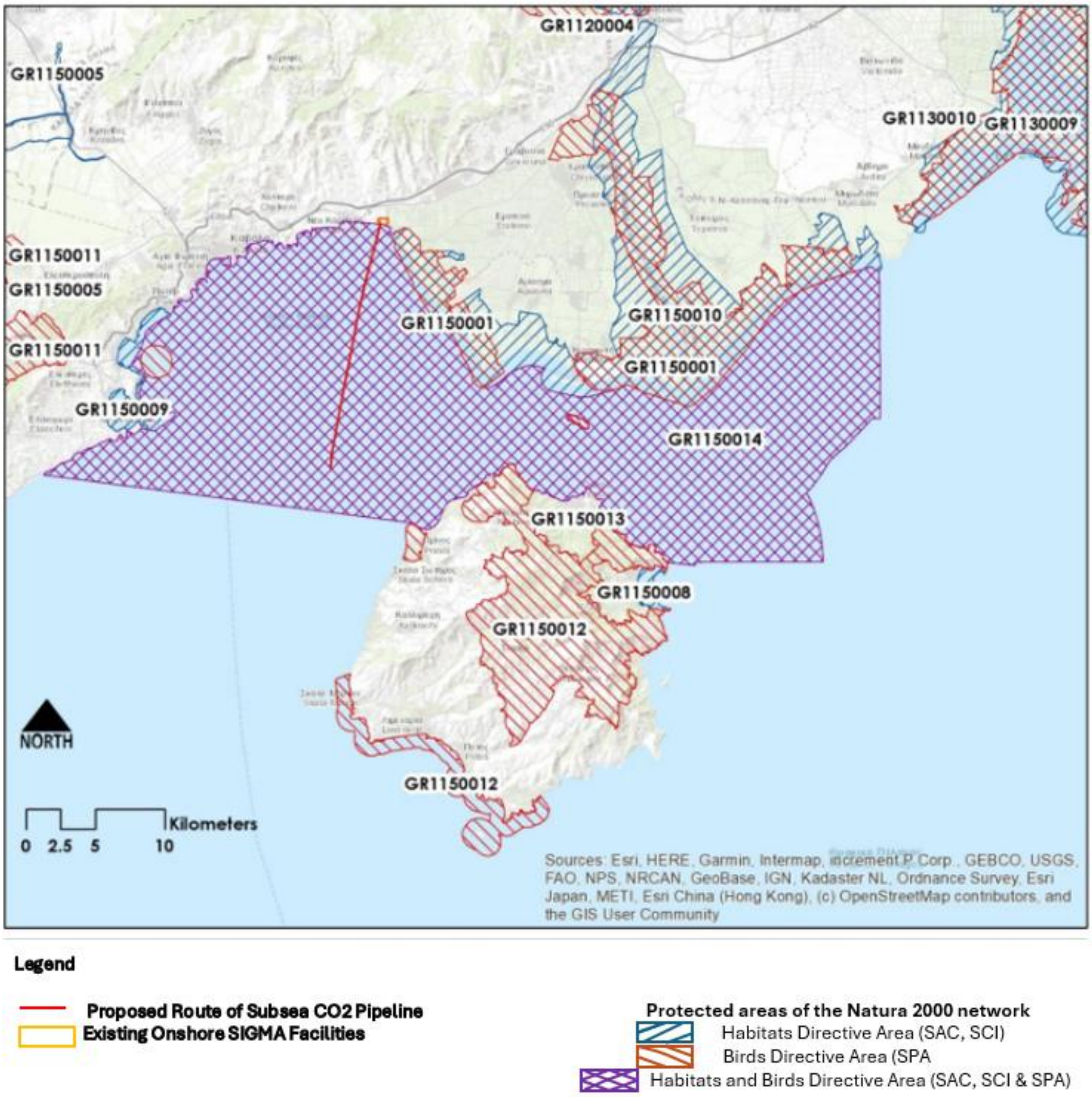


Figure 5–3: Protected Natura 2000 Network Areas

As observed from the above Figure, the new subsea pipeline falls within the Natura 2000 site coded GR1150014, named “Marine Area of Kavala – Thasos” (SPA & SCI), with a total area of 75,686.03 ha.

The project’s study area, as shown in the following Figure, is also located within the SAC area GR1150010 “Nestos Delta and Keramoti Lagoons – Wider Area,” covering a total area of 23,028.11 ha, as well as the SPA area GR1150001 “Nestos Delta and Keramoti Lagoons and Thasopoula Island,” with a total area of 14,773.69 ha.

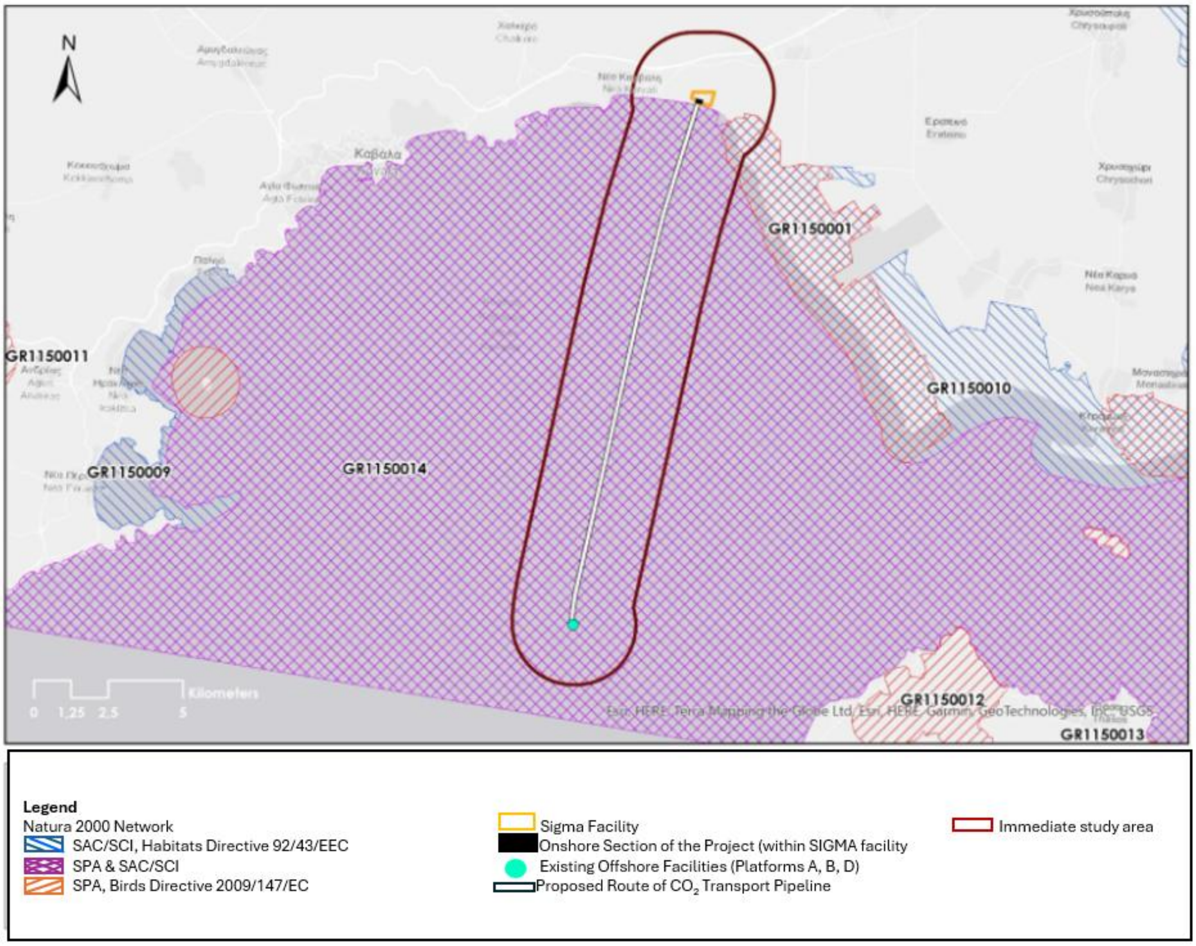


Figure 5-4: Protected Natura 2000 Network Areas Within the Study Area

A more detailed description of the Natura 2000 network areas is provided within the framework of the Project's Special Ecological Assessment Study (SEAS).

5.3.2.2 Directive on the Conservation of Wild Birds (2009/409/EC)

The Birds Directive, officially known as Directive 2009/147/EC on the Conservation of Wild Birds, was adopted in 2009 and replaced Directive 79/409/EEC of April 2, 1979, on the conservation of wild birds, which had been amended several times and had become unclear. The Directive aims to protect approximately 500 bird species found in the EU and their critical habitats by designating **Special Protection Areas (SPAs)** within the Natura 2000 network, regulating activities that directly threaten bird populations, and promoting scientific research.

- Annex I: Contains 194 species and subspecies that are particularly threatened, for which Member States must designate Special Protection Areas (SPAs) to ensure their survival. All species listed are migratory.
- Annex II: Lists 82 bird species that may be hunted. However, hunting periods are restricted, and hunting is prohibited when the birds are most vulnerable — during their return to breeding areas, breeding, and chick development.

- **Annex III:** Includes activities that directly threaten bird populations and are completely prohibited, such as intentional killing, capture, trade, or destruction of nests. Under specific restrictions, Member States may permit certain activities for the 26 species listed in this annex.
- **Annex IV:** The Directive provides for sustainable hunting management, but Member States must eliminate all forms of non-selective and mass killing of birds, especially the methods listed in this annex.
- **Annex V:** The Directive promotes research to support the protection, management, and exploitation of all bird species covered by the Directive and listed in this annex.

The Birds Directive was transposed into national legislation through Ministerial Decision 414985/1985 on the management measures for wild bird populations, Joint Ministerial Decision 37338/1807/E.103/2010 establishing measures and procedures for the conservation of wild birds and their habitats in compliance with Directive 79/409/EEC (as codified by Directive 2009/147/EC), and Joint Ministerial Decision 8353/276/E103/2012 amending Decision 37338/1807/2010. Furthermore, Law 3937/2011 on biodiversity conservation established the National System of Protected Areas (including Natura 2000 sites), as amended by Joint Ministerial Decision 50743/2017 (which revised the national list of Natura 2000 sites), along with general guidelines and regulations for their conservation

The Birds Directive was incorporated into national legislation through Ministerial Decision 414985/1985 on the management measures of wild bird species, Joint Ministerial Decision (JMD) 37338/1807/E.103/2010 establishing measures and procedures for the conservation of wild bird species and their habitats in compliance with Directive 79/409/EEC, as codified by Directive 2009/147/EC, and JMD 8353/276/E103/2012 amending JMD 37338/1807/2010. Furthermore, Law 3937/2011 on biodiversity conservation established the National System of Protected Areas (including Natura 2000 sites), as amended by JMD 50743/2017 (revision of the national Natura 2000 sites list), along with general guidelines and regulations for their conservation.

The examined Project is located within the protected Natura 2000 area SAC & SPA GR1150014 "Marine Area of Kavala and Thasos," while in the broader area are also located SPA GR1150001 "Nestos Delta and Keramoti Lagoons and Thasopoula Island" and SPA GR1150012 "Thasos (Mount Ypsario and coastal zone)."

The Project is aligned with the guidelines and objectives of the present Directive as it neither causes significant adverse impacts on the **Protected Features** nor on the corresponding **Conservation Objectives of the relevant SPA areas** (as thoroughly documented in the SEA attached in the relevant Annex of this document), while all related obligations and best technical practices resulting from the inclusion of the study area in a Special Protection Area have been taken into account in the design of the proposed project.

5.3.2.3 Convention on Migratory Species (CMS or Bonn Convention)

The Convention on the Conservation of Migratory Species of Wild Animals—commonly known simply as the Convention on Migratory Species (CMS) or the Bonn Convention—aims to conserve terrestrial, marine, and avian migratory species throughout their migratory range. It is an intergovernmental treaty concluded under the auspices of the United Nations Environment Programme (UNEP) and concerns the conservation of wildlife and habitats on a global scale. The Convention was signed in 1979 in Bonn and entered into force in 1983. The Convention on Migratory Species is the only global intergovernmental organization, established under the United Nations, dedicated exclusively to the conservation and management of terrestrial, aquatic, and avian migratory species throughout their migratory range. The Convention on Migratory Species and its related agreements set policies and provide further guidance on specific issues through Strategic Plans, Action Plans, resolutions, decisions, and guidelines. All Parties maintain on their websites a list of all adopted decisions, guideline issues, and Action Plans approved by the Member States.

The Convention on Migratory Species and its subsidiary agreements (see the table below) establish policy and provide additional guidance on specific issues through Strategic Plans, Action Plans, resolutions, decisions, and guidelines. The subsidiary agreements of the Convention maintain on their respective websites lists of all decisions taken, guidelines, and Action Plans approved by the Member States. Greece ratified the Convention on Migratory Species in 1999 through Law 2719/1999. It should be noted that among the subsidiary agreements of the Convention on Migratory Species, Greece is a Member State of the ACCOBAMS Agreement, which is the main tool for the conservation of cetaceans in the Mediterranean. Additionally, Greece has signed but not yet ratified the AEWA Agreement on the Conservation of Migratory Waterbirds.

Table 5-2: Subsidiary agreements arising from the Bonn Convention

Acronym	Agreement
ACAP	Agreement on the Conservation of Albatrosses and Petrels (http://acap.aq/)
ACCOBAMS	Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area (http://accobams.org/)
AEWA	Agreement on the Conservation of African-Eurasian Migratory Waterbirds (http://www.unep-aewa.org)
ASCOBANS	Agreement on the Conservation of Small Cetaceans of the Baltic, North-East Atlantic, Irish and North Seas (http://www.ascobans.org)
EUROBATS	Agreement on the Conservation of Populations of European Bats (http://www.eurobats.org)
Gorilla Agreement	Agreement on the Conservation of Gorillas and Their Habitats (http://www.cms.int/gorilla)
Wadden Sea Seals	Agreement on the Conservation of Seals in the Wadden Sea (http://www.waddensea-secretariat.org/management/seal-management)

The Project is compatible with and does not contradict the guidelines and objectives of the present Convention.

5.3.2.4 Agreement on the Conservation of Cetaceans in the Black Sea, Mediterranean Sea, and Contiguous Atlantic Area (ACCOBAMS)

The Agreement on the Conservation of Cetaceans in the Black Sea, the Mediterranean, and the Contiguous Atlantic Area (ACCOBAMS) is a cooperation tool for the conservation of marine biodiversity in the Mediterranean and Black Seas. The purpose of the Agreement is to reduce threats to cetaceans in the waters of the Mediterranean and Black Seas, as well as to improve the existing knowledge. According to the ACCOBAMS Conservation Plan (Annex 2 of the Agreement), the contracting Parties are called upon to designate and manage areas that serve as habitats for cetaceans as specially protected areas. Within this framework, the study area of the Northeastern Aegean Sea has been designated as a Critical Cetacean Habitat (CCH).

ACCOBAMS emerged from consultations among the following four conventions:

- The Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean and its Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean,
- The Bonn Convention for the Conservation of Migratory Species of Wild Animals,
- The Bern Convention for the Conservation of European Wildlife and Natural Habitats.
- Due to the migratory nature of these species, the agreement was established under the auspices of the Bonn Convention (UNEP/CMS).

The Agreement area consists of all marine waters of the Black Sea, the Mediterranean Sea, and the adjoining area of the Atlantic Ocean west of the Strait of Gibraltar. The area includes the Pelagos Sanctuary, which is dedicated to marine mammals in the northwestern Mediterranean and was established by France, Italy, and Monaco. ACCOBAMS is the first agreement to bind the countries of these regions to cooperate in the conservation of cetaceans. An innovative aspect of this agreement is the inclusion of non-coastal countries whose maritime activities may endanger the conservation of cetaceans.

In 2010, the Parties to ACCOBAMS adopted a resolution to extend the geographic scope of the Agreement area to include the Exclusive Economic Zones of Spain and Portugal. As of 2022, the Agreement has 24 Parties: Albania, Algeria, Bulgaria, Croatia, Cyprus, Egypt, France, Georgia, Greece, Italy, Lebanon, Libya, Malta, Monaco, Montenegro, Morocco, Portugal, Romania, Slovenia, Spain, Syria, Tunisia, Turkey, and Ukraine.

In 2023, pursuant to Government Gazette 9/A/17.01.2023, Greece ratified the Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area, along with the related Final Act of the Agreement, signed in Monaco on 24 November 1996, as well as the amendments adopted by the Meeting of the Parties to the Agreement on 12 November 2010 in Monaco through Resolution A/4.1.

According to Article 4 of Annex II of the present Government Gazette, the Contracting Parties undertake coordinated, joint research on cetaceans and facilitate the development of new techniques to enhance their conservation. In particular, the Contracting Parties:

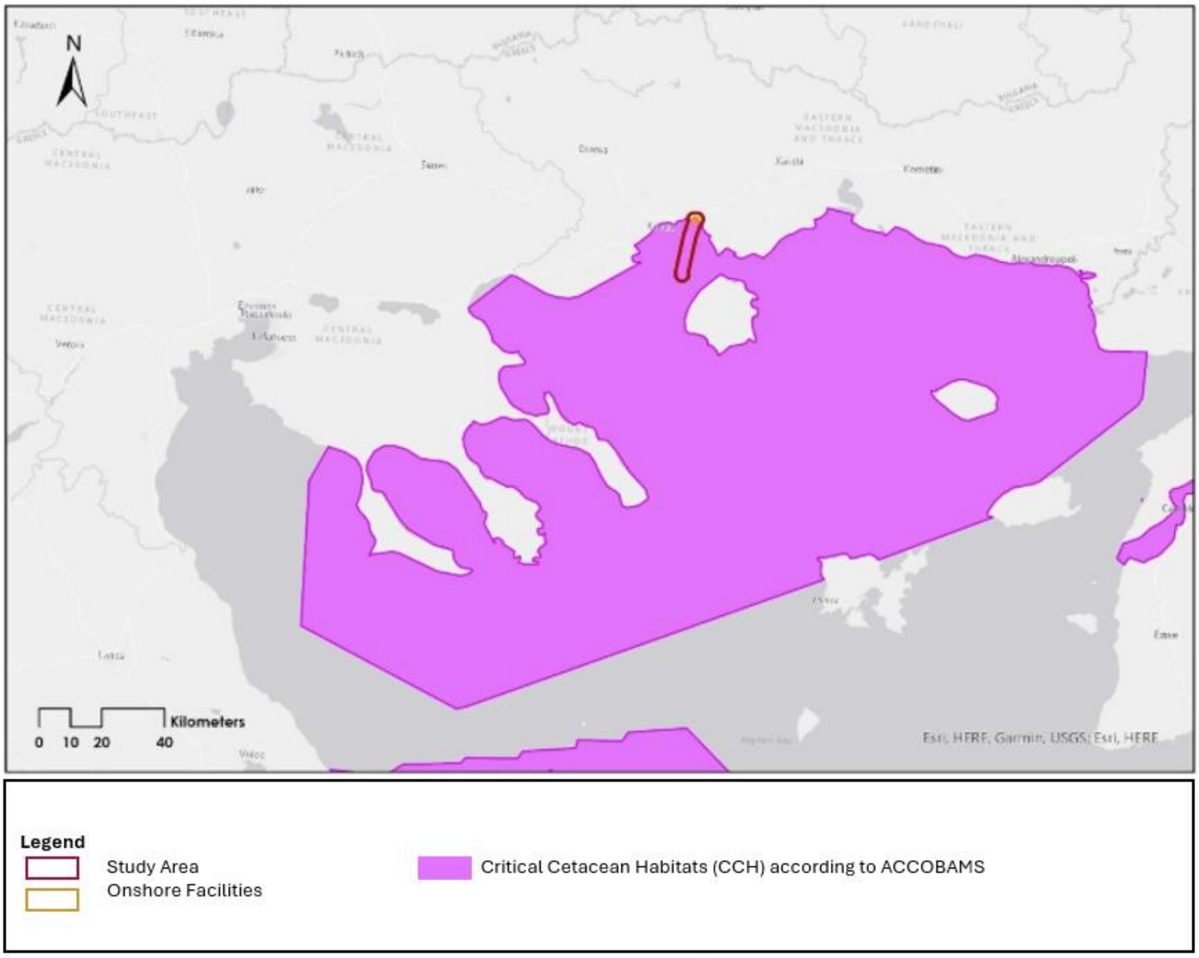
- monitor the status and trends of the species covered by this Agreement, particularly those in poorly known areas or species for which data is limited, in order to facilitate the development of conservation measures,
- cooperate to identify migratory routes as well as breeding and feeding areas of the species covered by the Agreement, in order to determine areas where human activities may need to be regulated as a result,
- assess the dietary needs of the species covered by the Agreement and accordingly adjust fishing regulations and techniques,
- develop systematic research programs for dead, stranded, injured, or sick animals, in order to determine the main interactions with human activities and to identify existing and potential threats and

- facilitate the development of passive acoustic techniques for monitoring cetacean populations.

According to the ACCOBAMS Methodological Guide on "Underwater Noise Mitigation Measures" published in 2022 (ACCOBAMS-MOP8/2022/Inf44), recommended measures are defined for mitigating the impacts of underwater noise from human activities.

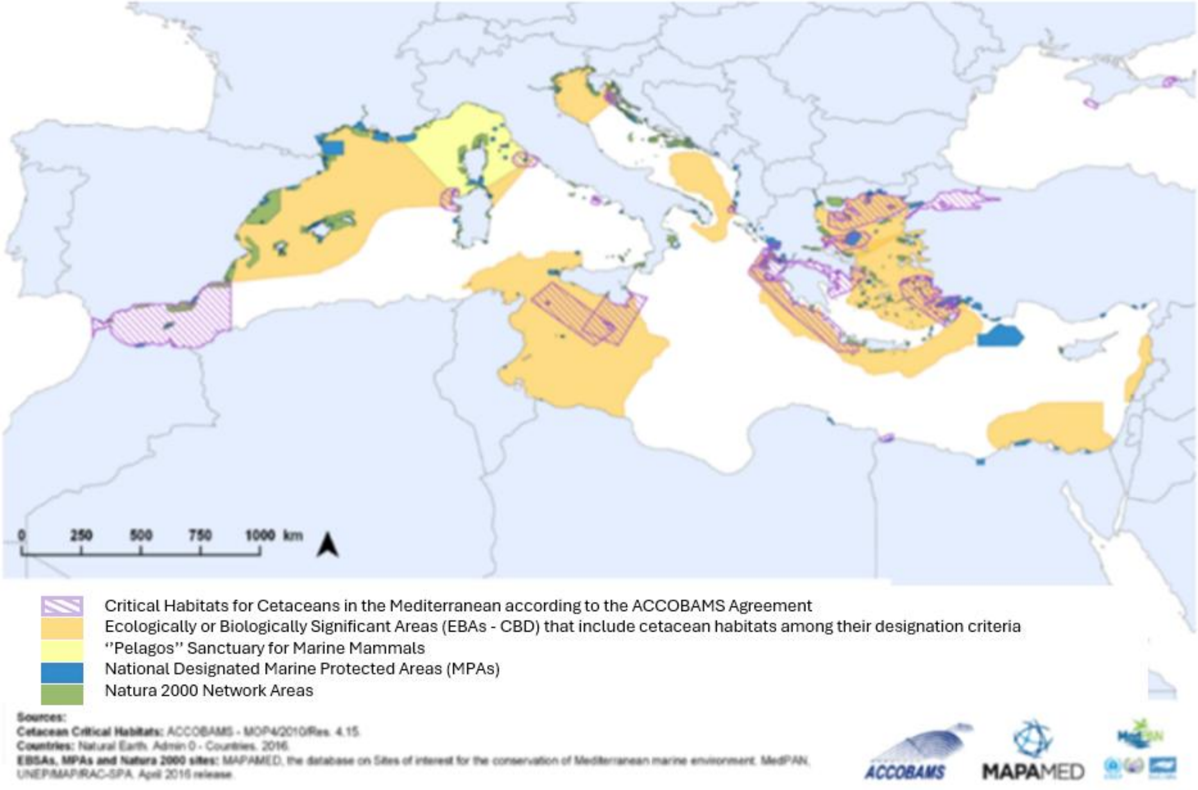
According to this Guide, as well as the EU Marine Strategy Framework Directive, underwater noise generated by human activities is categorized as impulsive noise (e.g., noise from drilling operations) and continuous noise (e.g., from vessel movement). The Guide describes practices and technologies that should be used during, instead of, or in addition to conventional techniques that produce underwater noise, with the aim of reducing the acoustic impacts of human activities at sea.

Overall, the study area, as shown in the following figure, falls within ACCOBAMS Zone 9 in the Northeastern Mediterranean (Thracian Sea).



(Source: Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area, https://accobams.org/)

Figure 5–5: Critical Cetacean Habitats in the Northeastern Mediterranean according to the ACCOBAMS Agreement



(Source: http://www.accobams.org/, 2019)

Figure 5–6: Critical Habitats for Cetaceans in the Mediterranean according to the ACCOBAMS Agreement

The characteristic species of the Northern Aegean study area found in ACCOBAMS Zone 9 are marine mammals. The project area includes only shallow (<50m) marine waters. Based on the types of marine habitats typically used by the species present in the wider project area, the cetacean species recorded during fieldwork are: the bottlenose dolphin (Tursiops truncatus), the common dolphin (Delphinus delphis), and the harbor porpoise (Phocoena phocoena).

This is also indicated by an initial review of the available literature regarding the presence of cetaceans in the specific area. As for the presence of the Mediterranean monk seal (Monachus monachus), this is also confirmed by the available scientific literature on the species. The presence of these species highlights the ecological value of the area and the need for continuous efforts for protection and conservation within the framework of international agreements such as ACCOBAMS.

Additionally, a complementary Special Ecological Assessment Study of the Project is being conducted, as various cetacean species, which constitute an important part of the marine biodiversity of the area, were recorded.

The Project is in compliance with the directions and objectives of the present Agreement as, on the one hand, it does not cause significant adverse effects on the species characterizing the study area found in Zone 9 of ACCOBAMS (as thoroughly documented in the Special Ecological Assessment Study attached in the relevant

Appendix of this document and in the corresponding sections of this Environmental Impact Assessment), and on the other hand, all relevant obligations and best technical practices arising from the inclusion of the study area in Zone 9 of ACCOBAMS have been taken into account in the design of the proposed project.

5.3.2.5 Ramsar Convntion

The Convention on Wetlands of International Importance, especially as Waterfowl Habitat, known as the "Ramsar Convention" — named after the Persian city where it was signed in 1971 — provides for the protection of wetland ecosystems.

According to Article 1 of the Convention, wetlands are defined as: "...natural or artificial areas consisting of marshes with herbaceous vegetation, non-exclusively rain-fed marshes with peat substrate, peatlands, or water. These areas are permanently or temporarily flooded with water which may be stagnant or flowing, fresh, brackish, or salty, and also include those covered by seawater with a depth at low tide not exceeding six meters. Wetlands may also include riparian or coastal zones adjoining wetlands or islands or marine water bodies that are deeper than six meters at low tide...".

The Convention was ratified by Greece through Legislative Decree 191/1974 (Government Gazette 350/A/20.11.1974), which was later amended by Law 1751/1988 (Government Gazette 26/A/02.09.1988) and Law 1950/1991 (Government Gazette 84/A/31.05.1991) "On the Ratification of the Amendments to the Ramsar Convention. "The Greek wetlands designated as wetlands of international importance (Ramsar wetlands) since August 21, 1975, are 10 and cover an area of 1,635,010 square meters. It should be noted that by signing and ratifying the Ramsar Convention, Greece has committed to the conservation and sustainable use of all its wetlands through local, regional, and international activities and collaborations.

Within the project development area, inside the boundaries of the Nestos Municipality, there is one (1) Ramsar Wetland. This wetland, named the "Nestos Delta and adjacent lagoons," covers a total area of 21,930 hectares and was designated as a Ramsar site in 1975.

The project aligns with the guidelines and objectives of the present Convention, as it neither causes significant adverse effects on the characteristic species of the internationally important wetland "Nestos Delta and adjacent lagoons" (as thoroughly documented in the Environmental Impact Assessment Study (EIAS) attached in the relevant Annex and in the related sections of the current Environmental Impact Report (EIR)), nor disregards any obligations. Moreover, the design of the proposed project has taken into account all relevant obligations and best technical practices arising from the presence of this internationally significant wetland.

5.3.2.6 Bern Convention

The Bern Convention for the Conservation of Wildlife and Natural Habitats of Europe, also known simply as the Bern Convention, is an international legal instrument in the field of Nature Conservation, aimed at protecting the natural heritage of Europe and certain countries in Africa. The Convention was signed on

September 19, 1979, and came into force on June 1, 1982. It specifically concerns the protection of natural habitats and endangered species, including migratory species.

The convention primarily aims at the following:

- The conservation of wild flora and fauna and their natural habitats,
- The promotion of cooperation between states,
- Focusing attention on endangered and vulnerable species, including threatened and vulnerable migratory species.

The Convention also takes into account the impacts that other policies may have on the natural heritage and recognizes the intrinsic value of wild flora and fauna, which must be preserved and passed on to future generations. Fifty countries and the EU have already signed the Convention and are committed to promoting national conservation policies, assessing the environmental impacts of planning and development, promoting education and awareness for conservation, and coordinating related research activities. Greece signed the Convention in 1979 and ratified it with Law 1335/1983.

<u>The Project is compatible with and does not conflict with the guidelines and objectives of this Convention.</u>

5.3.2.7 Convention on Biological Diversity (CBD)

The Convention on Biological Diversity (CBD), informally known as the Biodiversity Convention, is a multilateral treaty. The Convention has three main objectives:

- Conservation of biodiversity,
- Sustainable use of its components, and
- Fair and equitable sharing of the benefits arising from genetic resources.

The goal of the Convention is the development of national strategies for the conservation and sustainable use of biological diversity. The Convention is often considered the key document for sustainable development. It was signed at the Earth Summit in Rio de Janeiro in June 1992 and entered into force on December 29, 1993. For the first time in international law, the Convention recognized that the conservation of biodiversity is “a common concern of humanity” as well as an integral part of development. The Convention covers all ecosystems, species, and genetic resources. It links conservation efforts with the economic goal of using biological resources in a sustainable way. It establishes principles for the fair and equitable sharing of benefits arising from the use of genetic resources, especially those intended for commercial use. It should be noted that the Convention is legally binding, and the countries that ratify it (“Contracting Parties”) are obligated to implement its provisions.

Greece signed the Convention in June 1992 and ratified it with Law 2204/1994. According to the requirements of the CBD, Greece approved its first National Biodiversity Strategy in 2014 (Ministerial Decision 40332/2014) aiming to halt biodiversity loss and the degradation of ecosystem services by 2026. The strategy’s implementation period is 15 years (2014–2029) and consists of 13 general national objectives, based on which 39 specific targets have been formulated concerning the following: (i) enhancement of scientific knowledge, (ii) conservation of national natural capital, (iii) national system of protected areas, (iv) conservation of genetic resources, (v) synergistic policies for biodiversity conservation, (vi) conservation of landscape diversity, (vii) biodiversity and climate change, (viii) biodiversity and invasive alien species, (ix) international and transboundary conservation, (x) public administration and biodiversity protection, (xi) integration of biodiversity conservation into societal value systems, (xii) public participation in biodiversity conservation, and (xiii) assessment of ecosystem services and promotion of the importance of Greek biodiversity. The 13 general national objectives of Greece correspond both to the Aichi Biodiversity Targets and to the EU Biodiversity Goals. The strategy is expected to be revised and amended every five years, with action plans developed on a five-year basis. Actions have been set to achieve the 39 specific targets during the first five-year period (2014–2019), along with some indicative implementation indicators. The Ministry of Environment and Energy is the competent authority responsible for the implementation of the National Biodiversity Strategy.

<u>The Project is compatible with and does not conflict with the guidelines and objectives of the present Convention.</u>

5.3.3 National Environmental Protection Objectives Relevant to the Project

5.3.3.1 National Strategy for Climate Change Adaptation

The European Commission approved the EU strategy for climate change adaptation in April 2013 (COM (2013) 216). The EU strategy aims to encourage action by Member States, ensure policymaking and decision-making are based on more comprehensive data and information, and integrate climate change adaptation considerations into all relevant policy areas.

In December 2014, the Ministry of Environment, Energy and Climate Change (now the Ministry of Environment and Energy / YPEN), the Biomedical Research Foundation of the Academy of Athens, and the Bank of Greece (BoG) signed a memorandum of cooperation, which, among other things, concerned the drafting of the National Strategy for Adaptation to Climate Change (NSACC).

The primary goal of the NSACC is to contribute to strengthening the country's resilience to the impacts of climate change and to create the conditions for informed, long-term decision-making by addressing the risks and capitalizing on the opportunities arising from climate change. The NSACC outlines an initial five-year horizon for developing adaptive capacity and for prioritizing and implementing a first set of actions.

The **key objectives** of the NSACC are:

- Improving the decision-making process through the acquisition of more comprehensive information and scientific data related to adaptation,
- Promoting the development and implementation of regional/local action plans in alignment with the NSACC,
- Advancing adaptation actions and policies across all sectors, with an emphasis on the most vulnerable ones,
- Establishing a mechanism for monitoring and evaluating adaptation actions and policies, and

- Informing and raising awareness among the public.

The Regional Plans for Adaptation to Climate Change (RPACC), based on the climatic conditions and vulnerability of each region, precisely define the priority policy sectors and geographical areas for the implementation of measures. They also specify the adaptation measures in detail, as well as the financial instruments for their implementation, the implementing bodies, the involved stakeholders, and so on.

The Regional Plan for Adaptation to Climate Change (RPACC) of Eastern Macedonia and Thrace was prepared in December 2018 and revised in September 2023.

The main objective of the Regional Strategy for Adaptation to Climate Change of the Region of Eastern Macedonia and Thrace is to strengthen resilience across all priority sectors and to achieve sustainable development goals. The Pillars – Priority Axes of the Regional Strategy of Eastern Macedonia and Thrace for Climate Change are as follows:

- Priority Pillar – Axis 1 (PA1): Leadership and enhancement of administrative capacity
- Priority Pillar – Axis 2 (PA2): Promotion and dissemination of knowledge and skills
- Priority Pillar – Axis 3 (PA3): Strengthening resilience in priority sectors

<u>The proposed Project is fully aligned with the directions and objectives of both the National Strategy for Adaptation to Climate Change (NSACC) and the Regional Plan for Adaptation to Climate Change (RPACC) of Eastern Macedonia and Thrace, and it advances their goals.</u>

5.3.3.2 National Energy and Climate Plan (NECP)

With Decision No. 4/23.12.2019 of the Government Council for Economic Policy (Government Gazette B' 4893), the National Energy and Climate Plan (NECP)[4] was ratified. The National Energy and Climate Plan is a strategic plan addressing climate and energy issues and presents a roadmap for achieving specific energy and climate targets by 2030. The NECP outlines and analyzes priorities and policy measures across a wide range of developmental and economic activities, making it a key reference document for the coming decade.

The **key targets** of the NECP for the year 2030 are as follows:

- Share of Renewable Energy Sources (RES) >35% of Gross Final Energy Consumption
- Share of RES 61-64% of Gross Final Electricity Consumption
- Final Energy Consumption of 16.1-16.5 Mtoe (>38% reduction compared to 2007 projections)
- Zero participation of lignite in electricity generation.
- >42% reduction in greenhouse gas emissions compared to 1990, >56% reduction compared to 2005.

A priority of the NECP, at the level of planned policies and implementation of specific measures, is the achievement of concrete targets regarding energy supply security, the functioning of energy markets and the

[4] Revised Edition of the NECP, August 2024
ΥΠΕΝ_ΤΕΛΙΚΟ ΣΧΕΔΙΟ ΕΣΕΚ_231219

role of consumers, the enhancement of the economy's competitiveness, as well as the promotion of research and innovation activities.

Specifically, the NECP sets for the year 2030 a significantly higher central target for greenhouse gas emissions reduction, aiming for a reduction of more than 42% compared to the emissions of 1990 and more than 56% compared to the emissions of 2005, thereby surpassing even the central European targets. It is worth noting that in the initial NECP draft, these targets were significantly lower, aiming at reductions of 33% and 49%, respectively. These new greenhouse gas emission reduction targets are also necessary to enable the transition to a climate-neutral economy by 2050, as the Greek Government aims to participate proportionally in the commitment to a climate-neutral economy at the EU level. At the same time, regarding climate change and adaptation policies, the NECP presents the initiatives to be undertaken within the framework of the National Strategy for Adaptation to Climate Change (NSACC), which defines the general objectives, guiding principles, and implementation tools for necessary climate adaptation measures at the national, regional, and local levels.

To achieve the above targets, the NECP text presents and analyzes the specific Policy Priorities for the upcoming period, as well as the corresponding Policy Measures designed to implement these priorities and achieve the NECP goals, across seven different thematic areas: 1 Climate Change, Greenhouse Gas Emissions and Removals, 2 Renewable Energy Sources, 3 Improvement of Energy Efficiency, 4 Energy Supply Security, 5 Energy Market, 6 Agriculture, Shipping, Tourism (new thematic area), 7Research, Innovation, and Competitiveness

Regarding the **Project under study**, it is stated in the "Research, Innovation, and Competitiveness" sector that innovative applications will be supported which contribute to mitigating the environmental footprint of businesses and the impact of climate change on the urban environment, as well as promoting the circular economy. Emphasis is placed on material recovery and the recovery and reuse of discarded energy, along with **innovative techniques for CO_2 capture and reuse.**

According to the update of the draft revised NECP (Revised Edition, August 2024), Greece is fully aligned with the policies and commitments of the European Union to mitigate climate change. Within this framework, it sets a target of reducing greenhouse gas emissions by 55% by 2030 compared to 1990 emission levels. The draft revised NECP foresees that this 2030 target will be achieved at approximately a 52% reduction, excluding CO_2 absorption from the LULUCF sector, and that the reduction could reach up to 59% if a greater contribution from LULUCF[5] is achieved by then. This target is significantly higher than that of the existing NECP. The NECP's target for greenhouse gas emissions reduction by 2040 is set at -72% without LULUCF and can reach -80% including LULUCF. The corresponding target for 2050, according to the simulated scenario, is -88% without LULUCF and -98% with LULUCF, a performance that closely approaches the climate neutrality goal for 2050. By 2050, only small-scale emissions remain in certain sectors where complete elimination is challenging. These emissions require compensation through negative emissions (i.e., **through the storage of greenhouse gases that reduce carbon dioxide concentration in the atmosphere**) and absorption.

[5] Land Use, Land-Use Change and Forestry. The land use, land-use change and forestry sector is a net source of carbon emissions in all years.

Carbon dioxide capture from industrial flue gases/exhaust gases is the only way to reduce the carbon footprint of certain industrial sectors, at least until alternative technologies based on redesigning production processes or products are developed. The captured CO_2 can be used for the synthesis of synthetic fuels until 2040, in accordance with EU policy (to reduce the use of new fossil fuels in transportation). It can also be stored in sealed geological formations, as provided for within the framework of the present project.

Within this framework, and given that industry is subject to international competition, investment incentives are provided for CO_2 capture emitted from these industrial facilities (in Greece, refineries and cement industries). Three projects have already been approved for co-financing by the Innovation Fund: i) The IRIS project for capturing approximately 0.5 Mt of CO_2 annually at the hydrogen production unit using natural gas reforming at a refinery in Corinth, ii) The IFESTOS project for capturing 1.9 Mt of CO_2 annually at a cement production plant in Kamari, Boeotia, and iii) The OLYMPUS project for capturing 1.0 Mt of CO_2 annually at a cement production plant in Milaki, Evia. At the same time, the first CO_2 storage unit in Prinos, Kavala—which is the subject of this study—has already been included for co-financing under the Recovery and Resilience Facility and is advancing through the licensing process. The initial phase involves storage of 1 Mt of CO_2, with full operation targeting 3 to 4 Mt of CO_2. The total storage capacity is estimated at 60–70 Mt of CO_2. The first phase (with a capacity of approximately 1 Mt per year) is scheduled for completion by the end of 2025, and the second phase (full capacity) by the end of 2027. Progress is also being made in finalizing the relevant licensing and regulatory framework for the capture, transport, use, and storage of CO_2. The responsibility for supervising the construction and operation of storage projects has been assigned to a specialized public company (EDEYEP). Additionally, through the RePower pillar of the Recovery and Resilience Facility (RRF), funding has been secured for the pipeline network to transport captured CO_2 from industrial facilities. This network is intended to transfer the carbon dioxide for liquefaction at a central unit in Revythoussa. It is worth noting that the storage unit in Prinos, combined with the pipeline transport network and the liquefaction and temporary storage unit for CO_2, constitutes a project on the first list of Projects of Common Interest (PCI).

Finally, it is worth noting that small-scale Carbon Dioxide Capture technologies involving the incorporation of captured CO_2 into solid or liquid chemical compounds are also expected to be used in the shipping sector. Recent decisions by the International Maritime Organization (IMO/MEPC 80, July 2023) set binding absolute greenhouse gas (GHG) reduction targets, including, among others, the goal of decarbonizing shipping (net zero) by 2050 and indicative, yet ambitious, interim absolute reduction targets for 2030 and 2040. These developments make carbon capture and storage (CCS) technology an important solution for shipping, at least until synthetic fuels mature. CCS technology has already been included in the IMO's sustainable pathways and is expected to become one of the compliance options for shipowners to meet the decarbonization goals of the shipping industry.

Complementing the NECP, the **Long-Term Strategy for 2050** is being developed. This strategy serves as a roadmap for climate and energy issues within the framework of the country's participation in the collective European goal of a successful and sustainable transition to a climate-neutral economy by 2050 at the European Union level.

The long-term strategy toward climate neutrality by 2050 includes key policies classified into the following **pillars:**

1 Improvement of energy efficiency

2 Electrification of transport and heating

3 Renewable energy sources

4 Clean mobility in the transport sector

5 Industrial competitiveness and climate neutrality

6 Network infrastructure and market integration policies

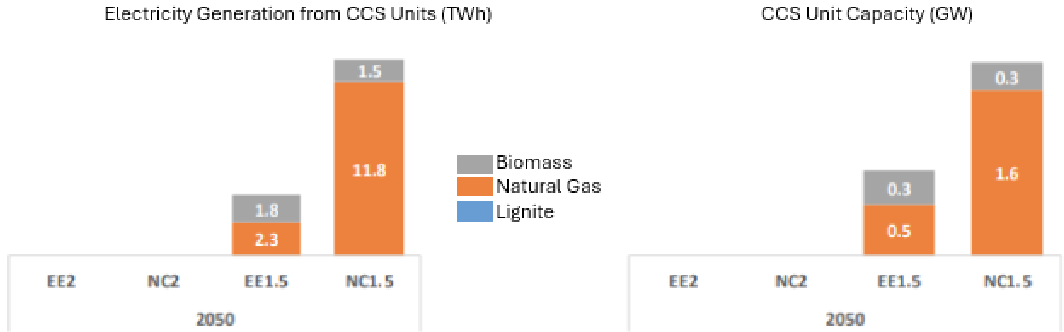
7 Bio-economy

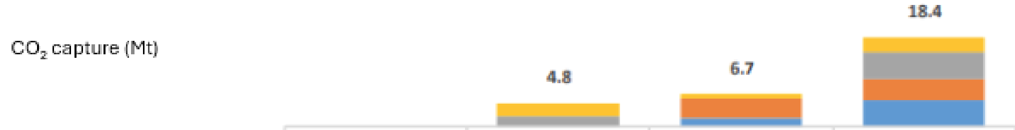
The Long-Term Strategy for 2050 (LTS50) analyzes scenarios for the evolution of the energy system and the consumption patterns in the end-use sectors, with the ultimate goal of transitioning to a climate-neutral economy by the year 2050. However, it does not present specific detailed measures.

The **scenarios** of the Long-Term Strategy are defined as follows:

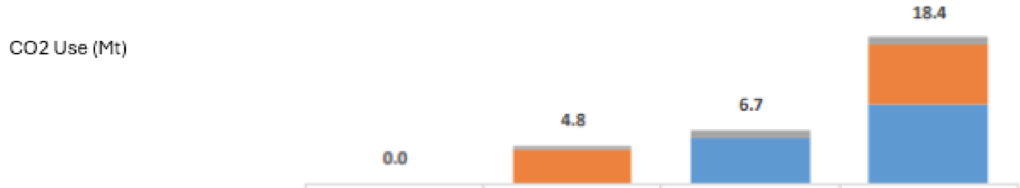
- NECP-2030 Scenario: Discontinuation/no further strengthening of NECP policies after 2030.
- NECP-2050 Scenario: Basic policies. Continuation of NECP-2030 implementation through to 2050.
- EE2 Scenario: Electrification and improvement of energy efficiency aligned with the 2°C target.
- NC2 Scenario: New energy carriers aligned with the 2°C target
- EE1.5 Scenario: Electrification and improvement of energy efficiency aligned with the 1.5°C target.
- NC1.5 Scenario: New energy carriers aligned with the 1.5°C target

The following **diagram** provides a summary of carbon dioxide capture in power generation units and industrial processes, capture from air and biomass, and its use and storage both underground and in materials.





	EE2	NC2	EE1.5	NC1.5
	2050			
CO2 capture from biomass	0.0	2.7	0.9	2.9
CO2 capture from air	0.0	2.1	0.0	5.6
CO2 capture from industrial processes	0.0	0.0	4.0	4.6
CO2 capture from fossil fuel combustion	0.0	0.0	1.7	5.4
Total CO2 capture	0.0	4.8	6.7	18.4



	EE2	NC2	EE1.5	NC1.5
	2050			
CO2 capture in materials	0.0	0.4	0.9	1.0
Use of CO2 for synthetic hydrocarbons production	0.0	4.4	0.0	7.4
CO2 storage in underground formations	0.0	0.0	5.8	10.0
Total CO2 utilization	0.0	4.8	6.7	18.4

(Source: Long-Term Strategy M50)

Figure 5–7: Carbon Dioxide Capture, Storage, and Utilization (CCUS)

According to the Long-Term Strategy for 2050 by the Ministry of Environment and Energy (ΥΠΕΝ), "**climate neutrality**" (Net Zero) is equivalent to achieving zero total greenhouse gas emissions, where zero emissions mean the sum of positive and any negative emissions. "**Carbon neutrality**" is a similar concept but refers only to CO_2 emissions. The neutrality of an energy form with respect to the climate requires zero greenhouse gas emissions at all stages of production, conversion, transport, and use. The permanent storage of greenhouse gases, whether in underground formations or in materials, is considered to ensure climate neutrality, while the storage of carbon dioxide captured from the air or biomass is regarded as a negative emission.

<u>The proposed Project fully aligns with the objectives of the aforementioned National Energy and Climate Plan, as well as with the goals of the corresponding revised draft and the Long-Term Strategy 2050, since it is an</u>

activity that contributes to reducing the climate footprint. The operation of the proposed Project also entails significant storage of CO_2 quantities, as the related CO_2 emissions have a negative balance (see Section 4.4.1). As is obvious, the operation of the Project supports both the achievement of overall greenhouse gas emission reduction targets and the attainment of climate neutrality by 2050, as well as the offsetting of any emissions that remain after 2050.

5.3.3.3 Greek Action Plan for Combating Desertification

The United Nations Convention to Combat Desertification was ratified by Greece with Law 2468/1997, as our country is among those affected by the phenomenon of desertification, resulting from a combination of its biogeoclimatic characteristics and the overexploitation of its natural resources.

Within the framework of this law, the "National Committee for Combating Desertification" was first established in 1996, reconstituted by Ministerial Decision No. 291203/2005 of the Ministry of Rural Development and Food, and supplemented by Ministerial Decision YA 305116/2005 (Government Gazette 1472/B).

Among the activities and accomplishments of the National Committee for Combating Desertification is the preparation of the "Greek National Action Plan to Combat Desertification (GNAPCD)," which was approved by Joint Ministerial Decision 99605/3719/2001 (Government Gazette 974/B).

The Action Plan serves as a framework of measures aimed at preventing and mitigating desertification, to be followed at the national level according to the ecological and socio-economic context of each threatened area. These measures take the form of integrated programs and are intended to cover all sectors of activity (actions for agriculture, forests, livestock farming, water resources, fauna, special socio-economic actions). They are incorporated into the development programs of each area and are implemented within a temporal and spatial planning framework tailored to each threatened region.

The National Action Plan states that the implementation of measures to combat desertification will initially begin in pilot areas, from which conclusions will be drawn regarding the suitability and effectiveness of the proposed measures. The areas initially selected as pilot sites were the region of Crete east of the Heraklion-Tymbaki line, Attica, Western Lesbos, the islands of the Central Aegean, the Kilkis area in Macedonia, and the hilly region of Central Thessaly.

In June 2021, the interim Report of the National Committee for Combating Desertification (ΕΘΕΚΕ) was presented. This report is a summary of the positions and preliminary policy measure proposals of ΕΘΕΚΕ to be taken into account in shaping the Strategic Plan for the new Common Agricultural Policy (CAP).

For the preparation of the Strategic Plan for the new CAP, it is proposed to add soil protection to the strategic objectives of the Strategic Plan, as well as to provide for the integration of the National Action Plan for Combating Desertification (NADC) into national, regional, and local development plans, as well as into the National Spatial Plan, Special Spatial Plans, and Regional Spatial Plans.

As the Report states, CAP policy measures for the period 2023-2027 should aim at the protection of non-degraded lands (low/very low risk of desertification), the restoration of degraded lands (moderate risk of desertification), and the recovery of desertified lands (high risk of desertification), as indicated by the United

Nations Convention to Combat Desertification, in order to prevent further deterioration of the current situation and increase the chances of achieving the zero land degradation target after 2030.

To achieve the objectives of the Strategic Plan, it is proposed:

- Adoption of a holistic, multi-sectoral, spatial approach to rural development,
- Ensuring the socio-ecological resilience of rural areas,
- Management of land resources aimed at maintaining and improving the ecosystem services of the soil to maximize the added value of produced goods and offered services, while simultaneously preserving and protecting high-productivity agricultural land.

According to the relevant announcement by the Ministry of Rural Development, the Committee continues its work on submitting specific proposals.

<u>The proposed project does not contradict the goals and directions of the aforementioned National Plan.</u>

5.3.3.4 National Strategy for Biodiversity

The National Strategy for Biodiversity for the years 2014−2029 and the corresponding five-year Action Plan were approved in September 2014 by Ministerial Decision 40332 (Government Gazette 2383/B/8.9.2014).

The vision for 2050, based on the National Strategy for Biodiversity, is as follows: Greece's biodiversity — and the ecosystem functions it supports, i.e., the country's natural capital considered as a national asset — is valued, subject to rational management, effectively protected, and restored both as an inherent value and due to its essential contribution to prosperity and economic well-being. By 2050, the primary goal is considered to be the prevention of destructive changes caused by biodiversity loss.

The **General Objective** of the Strategy includes:

- Halting the loss of biodiversity.
- Highlighting biodiversity as a national asset.
- Intensifying Greece's contribution to the global prevention of biodiversity loss.

There are **13 Strategic Goals for Biodiversity:**

1. Increase scientific knowledge
2. Preserve the national natural capital
3. National System of Protected Areas
4. Conservation of genetic resources
5. Policy synergy with biodiversity conservation.
6. Preservation of landscape diversity
7. Biodiversity and climate change
8. Biodiversity and invasive alien species

9 International and transnational cooperation.

10 Public administration and biodiversity protection

11 Integration of biodiversity conservation into society's value system

12 Public participation in biodiversity conservation

13 Assessment of ecosystem services and promotion of the value of Greek biodiversity

The duration of the National Biodiversity Strategy is 15 years. However, at the same time, foundations are laid and conditions created for actions beyond this timeframe. Successful implementation of the National Strategy requires continuous monitoring and evaluation of its progress. The responsible authority, both for the National Strategy and for coordinating the involved ministries, is the Ministry of Environment and Energy.

By taking measures to prevent and address environmental impacts, as foreseen in the project's planning, there will be no adverse effects that conflict with the strategy for biodiversity conservation.

5.3.3.5 National Marine Strategy

The MSFD (Marine Strategy Framework Directive) was incorporated into national legislation through Law 3983/2011 "National Strategy for the Protection and Management of the Marine Environment," as amended by the Joint Ministerial Decision YPEN/DNEP/50529/2779/2018 (amendment of Annex III in accordance with Directive 2017/845/EU) and Law 4759/2020. The competent authority for the implementation of the Directive in Greece was designated as the Special Secretariat for Water (ESY) of the Ministry of Environment and Energy (YPEN).

With Law 3983/2011 as in force, the following Descriptors were established for defining **Good Environmental Status** (hereinafter **GES**) in the waters of the marine subregions of the Aegean and Ionian Seas, as updated by Ministerial Decision YPEN/DPDYΠ/661/5/2022:

- **DESCRIPTOR D1** "Biodiversity": Biodiversity is maintained. The quality and frequency of habitats, as well as the distribution and abundance of species, are consistent with prevailing physiographic, geographic, and climatic conditions.
- **DESCRIPTOR D2** "Non-indigenous species": The introduction of non-indigenous species from human activities occurs at levels that do not adversely alter ecosystems.
- **DESCRIPTOR D3** "Commercially exploited fish and shellfish populations": Populations of fish and shellfish species subject to commercial exploitation remain within safe biological limits, with characteristics in terms of age and size distribution indicative of a healthy state for each stock.
- **DESCRIPTOR D4** "Elements of marine food webs": All elements of marine food webs, to the extent known, exist in conditions of natural abundance and diversity, and at levels capable of ensuring the long-term abundance of species and the maintenance of their full reproductive capacity.
- **DESCRIPTOR D5** "Eutrophication": Human-induced eutrophication is minimized, particularly its adverse effects such as biodiversity loss, ecosystem degradation, harmful algal blooms, and oxygen depletion in sea bottom waters.

- **DESCRIPTOR D6** “Sea-floor integrity”: The integrity of the seabed is at a level that ensures the structure and functioning of ecosystems are safeguarded, and that no adverse impacts are observed, especially on benthic ecosystems.
- **DESCRIPTOR D7** “Hydrographical conditions”: Permanent alteration of hydrographical conditions does not negatively affect marine ecosystems.
- **DESCRIPTOR D8** “Contaminants”: Concentrations of pollutants remain at levels that do not cause pollution-related adverse effects.
- **DESCRIPTOR D9** “Contaminants in seafood”: Contaminant levels in fish and other seafood intended for human consumption do not exceed standards set by EU legislation or other equivalent benchmarks.
- **DESCRIPTOR D10** "Marine Litter":The properties and quantities of marine litter do not cause harm to the marine and coastal environment.
- **DESCRIPTOR D11** "Underwater Noise": The introduction of energy, including underwater noise, is at levels that do not adversely affect the marine environment.

he specific Environmental Targets for each Descriptor, as shown in the following Table, were established through Ministerial Decision 1175/2012, based on the initial assessment of marine waters conducted by the Special Secretariat for Water (EGY) in 2012, and their revision is still pending. In 2016, the Monitoring Programs were approved for the continuous assessment of the environmental status of marine waters in accordance with Law 3983/2011 (Ministerial Decision 126635/2016), which were subsequently updated by Ministerial Decision ΥΠΕΝ/ΔΠΔΥΠ/661/5/2022 (replacing MD 126635/2016). The Monitoring Programs include the criteria, methodologies, and monitoring targets for each Descriptor (current status and pressures).

Table 5-3: Environmental Targets for Achieving Good Environmental Status (GES) of Marine Waters in the Aegean and Ionian Seas

Descriptor	Envrionmental Targets
D1	Conservation of the population of the Mediterranean monk seal (Monachus monachus) in Greek waters. Census of the population of the sea turtle (Caretta caretta) that nests on Greek coasts and preservation of nesting areas. Conservation and mapping of Posidonia oceanica seagrass meadows. Census of the area covered by Maerl-type biogenic sediments. Conservation of benthic macrofaunal communities and the structure of planktonic communities.
D2	Census of invasive alien species and their environmental impacts on marine ecosystems.
D3	Monitoring of the indicators "Fishing mortality" (F/Fmsy) and "Spawning biomass" (B/Bmsy) of characteristic demersal species. Monitoring of the "Fishing exploitation" indicator of characteristic pelagic species. Correlation of fishing activities with the established indicators.
D4	Monitoring and assessment of the biomass balance at higher trophic levels in relation to the total catch of demersal-pelagic fish.
D5	Reduction of organic load and nutrients entering the marine environment from point and non-point sources. Reduction of nitrate pollution from agricultural activities

Descriptor	Envrionmental Targets
D6	Mapping of sensitive benthic habitats. Maintenance of the balance of benthic macrofauna.
D7	Prevention of environmental impacts from locally occurring permanent anthropogenic changes in hydrographic conditions.
D8	Specification of the impacts of pollutants and identification of prevailing trends in the concentration of these substances in the water column, sediments, marine organisms, and ecosystems.
D9	Maintaining pollutant levels in fish and other seafood intended for human consumption within permissible limits.
D10	Reduction of anthropogenic waste on coasts and in the marine environment.
D11	Control of energy levels to prevent adverse impacts on the marine environment.

(Source: Ministerial Decision 1175/2012)

Finally, the corresponding Programmes of Measures for achieving or maintaining Good Environmental Status in the marine waters, according to Article 12 of Law 3983/2011, were approved by Ministerial Decision oik. 142569/2017.

According to Ministerial Decision 142569/2017 and its Chapter 11, measures to limit Underwater Noise are proposed. The marine environment is considered to achieve Good Environmental Status (GES) when the impulsive sounds of high, medium, and low frequency produced within the marine environment by human activities (e.g., shipping, underwater hydrocarbon exploration) do not have negative effects on vulnerable groups of marine organisms (key functional groups), such as cetaceans, so that their life is not threatened or their reproduction is not hindered. Additionally, continuous low-frequency sounds produced by human activities within the marine environment must not put vulnerable groups of marine organisms at risk.

The 2012 Report (Initial Assessment) recorded a lack of information for assessing the current state of underwater noise. The monitoring program for the Marine Strategy Framework Directive (MSFD) will highlight the lack of quantitative data on underwater noise in marine waters and may provide sufficient information to determine Good Environmental Status (GES) and appropriate targets. The proposed measures are as follows:

- Establishment of regulations to reduce underwater noise during hydrocarbon exploration.
- Establishment of regulations to reduce underwater noise from shipping in cooperation with the International Maritime Organization (IMO).

<u>The proposed Project is compatible with the goals and directions set by the National Marine Strategy. Furthermore, as mentioned in **Chapter 12** of the current study, measures are planned to limit underwater noise.</u>

5.4 STANDARDS OF INTERNATIONAL INDUSTRY AND INTERNATIONAL FINANCIAL INSTITUTIONS

5.4.1 Good Oilfield Practice (GOP) and Good International Industry Practice (GIIP)

The term "Good Oilfield Practice" is used by certain national oil and gas regulatory authorities to describe the approach expected from operators working in their jurisdictions. Unfortunately, it is not a clearly defined concept, and as such, its meaning can be interpreted in different ways.

A commonly accepted definition of **"Good Oilfield Practice"** is the following:

"The practices and procedures used in the oil industry worldwide by prudent and diligent operators under conditions and circumstances related to Hydrocarbon Activities, primarily aiming to ensure:

- Sustainable viability achieved through resource preservation of oil and natural gas, implying the use of appropriate methods and procedures to maximize hydrocarbon recovery in a technically and economically viable way, with corresponding control of reserve decline and minimization of surface losses,
- Operational safety, involving the use of methods and procedures that promote occupational safety and accident prevention,
- Environmental protection, which requires the adoption of methods and procedures that minimize the impact of Hydrocarbon Activities on the environment."

"Good International Industry Practice (GIIP)" is defined as follows:

"The exercise of professional skill, diligence, prudence, and foresight that would reasonably be expected from skilled and experienced professionals engaged in the same type of undertaking under the same or similar circumstances globally. Circumstances that skilled and experienced professionals may consider when assessing the range of available pollution prevention and control techniques may include, but are not limited to, varying levels of environmental degradation and assimilative capacity, as well as differing levels of economic and technical feasibility." The World Bank Group's Health, Safety & Environmental (HSE) Guidelines, established in 2007, are technical reference documents that provide examples of approaches based on Good International Industry Practice. The Equator Principles and the Performance Standards of the International Finance Corporation (IFC) refer to these guidelines when defining acceptable performance levels.

In contrast, there are no strict guidelines or established rules that define how "good oilfield practice" is achieved or how performance against such a standard can be measured. Good Oilfield Practice does not concern the adherence to a specific procedure, but rather the approach an operating company takes in carrying out its duties to the government that granted its license. By definition, adherence to the principles of Good International Industry Practice would constitute Good Oilfield Practice.

It is clearly a concept related to how a facility is designed, the methods of construction, operation, and maintenance, as well as how it is managed overall, and is thus equally applicable at every stage of the asset lifecycle.

Good Oilfield Practice is by definition an evolving concept. It requires operators to monitor successes and failures in the industry and adapt their internal practices accordingly. Regulators wish to avoid failures observed elsewhere in the world while ensuring that new, more effective approaches are implemented as soon as possible. Good Oilfield Practice equally promotes the use of recognized and well-proven Standards at the design stage, internal management/control procedures during project execution, and risk-based inspection systems during operations as a means of managing cost.

Energean is committed to adhering to Good Oilfield Practice throughout its day-to-day activities, whether drilling new wells, installing new facilities, or managing existing facilities. This commitment is demonstrated in the way the Existing Development Project in the Prinos Area has been formulated and implemented. This project has included:

- The hiring of international staff with proven experience in developing similar fields.
- The use of internationally recognized contractors for specialized technical and non-technical tasks.
- The identification of appropriate international and industry standards based on which new facilities will be designed and old ones assessed.
- The design of internal controls that allow project reviews and approvals as they pass through each decision-making stage. The upgrade of the newly acquired rig according to international standards, using OEM (Original Equipment Manufacturer) equipment and personnel.
- The early integration of risk reduction techniques in the design process.
- A desire to maximize the project's positive impact on the Greek economy by adapting the design to local industrial capabilities.

Energean's senior management and owners have committed to leveraging the operational excellence established by the previous owners of the Prinos Basin assets, which Energean acquired with the purchase of Kavala Oil in 2007. The Prinos assets are technically complex, mainly due to the highly sour nature of the crude oil and associated gas produced. Kavala Oil and subsequently Energean had to establish and maintain world-class operational standards to ensure the safe operation of these facilities over a 30-year period. This is evidenced by the company's excellent safety performance and the absence of any hydrocarbon accidental release incidents into the environment. The Prinos assets coexist harmoniously with a vibrant tourism industry and fishing operations, both onshore and offshore.

<u>**The proposed Project is not directly related to Good Oilfield Practice (GOP), as it does not concern hydrocarbon exploration, extraction, and exploitation.** However, the Project is indirectly related to GOP, as part of its offshore component is installed on Offshore Oil and Gas Facilities (Prinos Offshore Platforms), where all commitments and specifications arising from Good Oilfield Practice (GOP) and Good International Industry Practice (GIIP) are observed.</u>

5.4.2 EBRD Standards

For the design of the Project and the planning of its construction, operation and decommissioning phases, as well as for the preparation of the related Studies and Plans (including the present ESIA), Energean has taken into account the Performance Requirements (PRs) of the European Bank for Reconstruction and Development (hereinafter EBRD).

The EBRD is committed to promoting "environmentally sound and sustainable development." To this end, it has established a comprehensive set of Performance Requirements covering key areas of environmental and social sustainability that must be met by projects (EBRD Environmental and Social Policy, 2019).

The present ESIA, and the environmental and social assessment process in general, has taken into consideration the EBRD Performance Requirements (PRs), in accordance with the EBRD's Environmental and Social Policy (2019), which include the following 10 core requirements:

- PR1 – Assessment and Management of Environmental and Social Impacts and Issues
- PR2 – Labour and Working Conditions
- PR3 – Resource Efficiency and Pollution Prevention and Control
- PR4 – Health, Safety, and Security
- PR5 – Land Acquisition, Involuntary Resettlement, and Economic Displacement
- PR6 – Biodiversity Conservation and Sustainable Management of Living Natural Resources
- PR7 – Indigenous Peoples
- PR8 – Cultural Heritage
- PR9 – Financial Intermediaries
- PR10 – Information Disclosure and Stakeholder Engagement

Key elements of these Performance Requirements are summarized in the following tables.

Table 5-6: Key Elements of Performance Requirements 1 & 2

Performance Requirement 1	Performance Requirement 2
Identification and assessment of adverse and beneficial environmental and social impacts and issues associated with the Project.	Adoption and maintenance of written human resources policies and management systems or procedures appropriate to the size and workforce to be employed, which describe the approach to managing labour in accordance with the requirements of this and national legislation.
Adoption of measures to avoid or, where avoidance is not possible, minimize, mitigate or offset adverse impacts on workers, affected communities and the environment.	Provision of a written contract to workers at the start of the employment relationship outlining their rights under national labour and employment law and any applicable collective agreements. Ensuring rights related to workers' associations. Implementation of an effective grievance mechanism related to the workplace.
Identification of, and whenever possible, realization of opportunities to improve environmental and social performance.	Compliance with relevant non-discrimination requirements based on individual characteristics such as gender, ethnicity, age, political beliefs, or sexual orientation with regard to employment. Compliance with principles of equal opportunity and fair treatment in the context of employment relations. Taking measures to prevent and address all forms of violence and harassment.
Promotion of improved environmental and social performance through a dynamic process of performance monitoring and evaluation.	Prohibition of child labour and forced labour, which consists of work or service not undertaken voluntarily and demanded of a person under threat of penalty, including through abusive and fraudulent recruitment practices.

Table 5-7: Key Elements of Performance Requirements 3 & 4

Performance Requirement 3	Performance Requirement 4
Promotion of practices for resource efficiency, prevention and control of pollution in accordance with good international practices and best available techniques in the sector (saving raw materials, energy and water and avoiding and reducing waste generation).	Avoidance or limitation of adverse impacts on health and safety and issues related to the Project's activities. Provision of safe and healthy conditions for workers and the community. Identification and assessment of risks related to occupational health and safety, community health and safety, gender-based violence and implementation of appropriate measures to avoid or mitigate such risks.
Minimization of waste generation and reduction of its harmfulness to the extent possible. Where waste generation cannot be avoided but has been minimized, reuse or recycling or recovery of waste and use as an energy source is proposed in a manner safe for human health and the environment. Safe use and management of hazardous substances and materials.	Reduction or elimination of potential exposure of workers and the community to hazardous materials. Where exposure is possible, demonstration of due diligence in managing such exposure by eliminating, substituting or isolating the hazardous condition or substance.
Promotion of environmental and social assessment processes of the Project. Selection of alternative solutions and implementation of efficient techno-economic options to avoid or minimize greenhouse gas emissions related to the Project.	Identification and assessment of security threats of the Project to workers and communities affected by the Project. Where risks are identified, appropriate safety management arrangements should be implemented according to GIP.
Identification of risks and potential impacts of climate change and implementation of appropriate measures to mitigate such risks and impacts in accordance with GIP (Good International Practice).	Identification and assessment of potential risks to traffic and road safety for workers and communities affected by the project throughout its lifecycle.

Table 5-8: Key Elements of Performance Requirements 5 & 6

Performance Requirement 5	Performance Requirement 6
Addressing impacts of land acquisition related to projects, including restrictions on land use and access to assets and natural resources, which may cause physical and/or economic displacement. Promotion of universal respect and observance of human rights and freedoms, particularly the right to private property, adequate housing and continuous improvement of living conditions.	The objective of the Requirement is: • Protection and conservation of biodiversity by applying a precautionary approach. • Adoption of the mitigation hierarchy in project design and implementation to avoid biodiversity loss and, where appropriate, achieve biodiversity gain. • Ecosystem conservation. And • Promotion of good international practices regarding the sustainable management and use of living natural resources.
Implementation of measures to avoid or minimize displacement. Where displacement impacts exist, a resettlement action plan (or Livelihood Restoration Framework if relocation is not expected) must be prepared. The plan includes a census and detailed initial socio-economic study. Affected people must be informed and consulted during the planning process. Special provisions should be made for consultation with vulnerable groups and gender issues should be considered. When land acquisition or restrictions on the use of land, other assets, and natural resources (permanent or temporary) cannot be avoided, the Project Proponent shall provide compensation to the affected individuals at full replacement cost, as well as any other assistance that may be necessary to help improve or at least restore their standard of living and livelihoods.	In cases where the project is located within or has the potential to adversely affect a legally protected area and/or one internationally recognized or proposed for such status by national governments, the Project Proponent should identify and assess the potential impacts and apply the mitigation hierarchy to ensure that the project does not jeopardize the integrity, conservation objectives and/or biodiversity significance of such an area.
Promotion of consultation with affected persons and host communities so that relevant information on the alternative project options under consideration is disclosed.	Implementation of necessary actions to mitigate environmental and social impacts on sustainability-related matters. The implementation of actions necessary to meet this Requirement shall be managed through the Company's Environmental and Social Management System (ESMS).
Establishment of procedures for monitoring and evaluating implementation of the possible resettlement plan and taking corrective action, if necessary, during implementation. Monitoring of the land acquisition, resettlement and livelihood restoration process will be conducted in accordance with Requirement PR1 and will include participation of key stakeholders, including affected communities.	Management of natural resources through application of national regulatory requirements, GIP standards and relevant EU environmental standards, as applicable to each Project.

Table 5-9: Key Elements of Performance Requirements 7 & 8

Performance Requirement 7	Performance Requirement 8
• Full respect for the dignity, rights, culture, customary laws and livelihoods of indigenous peoples. • Anticipation and avoidance of risks and adverse impacts of projects on the lives and livelihoods of indigenous peoples' communities or, where avoidance is not possible, minimization, mitigation or compensation. • Promotion of opportunities for indigenous peoples to participate in and benefit from project-related activities in an accessible, culturally appropriate and inclusive manner. • Establishment and maintenance of an ongoing relationship with indigenous peoples affected by a project throughout its lifecycle. • Ensuring effective participation in the design of project activities or mitigation measures that may affect them positively or negatively.	Protection of cultural heritage and development of the Project in a way that avoids or mitigates adverse impacts on cultural heritage. Compliance with the provisions of governmental plans for areas legally protected for their cultural heritage or internationally recognized, and adherence to national and local requirements related to cultural heritage.
Establishment of continuous relationships with affected communities and indigenous peoples. Understanding and respect of relevant national law.	Assessment of risks and impacts related to cultural heritage. Identification of potential adverse impacts of the Project on cultural heritage at an early stage of the environmental and social assessment.
Provision of sufficient time for indigenous peoples for collective decision-making processes.	The Project Proponent must consult with affected persons, communities and other relevant stakeholders as appropriate.
Taking measures and promoting a consultation process regarding potential impacts on indigenous peoples.	Implementation of a chance finds procedure. In case of such finds, activities will be suspended and the chance finds procedure will be applied.

Table 5-10: Key Elements of Performance Requirements 9 & 10

Performance Requirement 9	Performance Requirement 10
Implementation of a clearly defined Environmental and Social Management System (ESMS) including an environmental and social policy for each subproject of the main Project.	Identification of the Project's stakeholders who are or may be affected by the Project, including disadvantaged or vulnerable groups who may be affected differently or disproportionately by the Project.
	Ensuring information disclosure and meaningful consultation throughout the Project's life so that stakeholders can appropriately participate in consultation on environmental and social issues that may potentially affect them. Provision of relevant information, guidance and training to workers and communities affected by the Project on health and safety risks, protective and preventive measures.
Ensuring that subprojects are structured to meet national regulatory requirements related to environmental and social matters, including, where required, national regulatory requirements concerning public consultation and disclosure.	Establishment of a Grievance Mechanism to receive and facilitate resolution of stakeholder concerns and grievances related to the Project.

Performance Requirement 9	Performance Requirement 10
Categorization of environmental and social risk of proposed subprojects (low/medium/high) in accordance with the EBRD's environmental and social risk categorization list for financial institutions.	Provision to stakeholders, on an ongoing basis, of appropriate information on the Project's environmental and social performance, risks, impacts and grievances raised, to inform stakeholders. Monitoring of project changes and appropriate update of the SEP.

5.4.3 Green Economy Transition (GET) Assessment

In 2015, the EBRD introduced the "Green Economy Transition" (hereinafter GET) approach, with the aim of ensuring that the investments it finances deliver environmental benefits. The EBRD has developed a set of principles and criteria that must be met so that all new projects align with the strategic objectives of GET, namely to be consistent with the transition towards a green economy.

In 2020, the Board of Directors approved the new GET approach for the period 2021–25 (GET 2.1) as part of the EBRD's Strategic and Capital Framework (SCF) 2021–25. The new approach aims to enhance the Bank's contribution to addressing the climate and environmental crisis.

Building on a solid track record of green finance and policy implementation, GET 2.1 is a comprehensive and realistically grounded approach to the climate and environmental challenges facing the economies where the EBRD invests. Through this new approach, the Bank will work to accelerate the transition to a green, low-carbon and resilient economy by:

- Aligning its operations with the principles of international climate agreements, primarily the Paris Agreement.
- Strengthening policy engagement in support of long-term low-carbon development strategies and the greening of financial systems.
- Promoting innovation in investments across a range of values aligned with climate change mitigation, such as green digital solutions, just transition, circular economy, natural capital, and green value chain finance.

The following table summarises the principles and eligibility criteria that projects must meet in accordance with the requirements of the GET approach.

Table 5-11: Principles and Eligibility Criteria for Projects under the GET Approach

Principle	Criteria
Level of Detail	Only clearly defined environmental activities or project components that can be separated from non-environmental ones are eligible under GET.
Environmental Benefits	Measurable net overall environmental benefits compared to the baseline scenario.
Minimum Environmental Performance and Standards	Application of Best Available Techniques (BAT) per sector, in line with EU environmental performance and social standards.

Principle	Criteria
Multiple Environmental Benefits	No double-counting of financing for multiple environmental benefits. The GET assessment is based on the main (primary) environmental benefit, while other types of benefits are also acknowledged.

(Source: Implementing the Green Economy Transition. Technical Guide, July 2023)

An activity (other than climate change mitigation or climate change adaptation activities) is considered to have environmental benefits in the context of the green economy transition if it results in a materially positive environmental outcome that is not primarily climate change mitigation or adaptation. Other environmental activities are divided into four main categories, according to the EU Taxonomy Regulation:

- Sustainable use and protection of water and marine resources.
- Resource efficiency and transition to a circular economy.
- Αποδοτικότητα των πόρων και μετάβαση σε μια κυκλική οικονομία
- Pollution prevention and control.
- Protection and restoration of biodiversity and ecosystems.

In accordance with the GET requirements, there are 11 tables covering the various categories of Projects, as shown in the following Table. Each activity is required to meet all the specified criteria.

Table 5-12: List of 11 GET Activity Tables by Project Category

Table Number	Description
Table 1	Energy
Table 2	Mining and production of metals for climate action
Table 3	Manufacturing activities
Table 4	Agriculture, forestry, land use and fisheries
Table 5	Water supply and sanitation
Table 6	Solid waste management
Table 7	Transport
Table 8	Buildings, public facilities and end-use energy efficiency
Table 9	Information and Communication Technology (ICT) and digital technologies
Table 10	Research, development and innovation
Table 11	Cross-cutting activities

(Source: Implementing the Green Economy Transition. Technical Guide, July 2023)

According to the above categorization of activities, the Project under consideration can be classified under the following subcategory of Table 11 of the GET.

Table 5-13: Correlation of the Project with the List of Activities in the 11 GET Approach Tables

Category	Activity	Screening Criteria and Guidance
Reduction of greenhouse gas emissions	Transport, use or permanent storage of CO_2	• When the activity involves only transport, the project must demonstrate that the transported CO_2 will be used productively or stored permanently. • When the activity involves the construction of new transport infrastructure, it must be intended for the transport of captured CO_2. • When the project involves utilization, the output of the project must replace primary raw materials. Furthermore, the project must demonstrate a significant reduction in net greenhouse gas emissions or carbon intensity (e.g., tCO_2e/unit of output), taking into account lifecycle sources of materials, such as when Scope 3 emissions or Scope 1 emissions during construction are expected to be significant. • Productive utilization does not include the production of fossil fuels, such as enhanced oil recovery.

(Source: Implementing the Green Economy Transition. Technical Guide, July 2023)

5.5 STANDARDS AND EMISSION LIMITS ACCORDING TO NATIONAL LEGISLATION

5.5.1 Air Quality Standards

To maintain air quality, the provisions and guideline values for air quality set forth in the following must be followed:

- Joint Ministerial Decision 14122/549/E103/24-03-2011 (Government Gazette B’ 488), which establishes measures for improving air quality in compliance with Directive 2008/50/EC.
- Joint Ministerial Decision 22306/1075/E103/29-05-2007 (B’ 920), which sets target values and assessment limits for concentrations of arsenic, cadmium, mercury, nickel, and polycyclic aromatic hydrocarbons in the air, in accordance with Directive 2004/107/EC.
- PYS (Presidential Decree) 25/18.3.88 (Government Gazette 52/A/22.3.88) and PYS 34/30.5.02 (Government Gazette 125/A/5.6.02), “Limit and guideline values for air quality regarding sulfur dioxide, nitrogen dioxide and nitrogen oxides, particulate matter, and lead.”
- PD 1180/81 (Government Gazette 293/A/1981) regarding point emissions of solids (suspended particles) from construction sites and project facilities sets a limit of 100 mg/m^3 (Article 2, paragraph d).

The **table** below presents the legally established concentration limits for air pollutants according to Joint Ministerial Decision 14122/549/E103/2011 (Government Gazette 488/B/2011).

Table 5-4: Limit values for concentrations of gaseous pollutants in the environment according to Joint Ministerial Decision (KYA) H.P. 14122/549/E.103/2011

Pollutant substance	Limit value	Date of limit value achievement	Tolerance Margin
Carbon Monoxide (CO) (mg/m³) (Directive 2008/50/EC)	10 Maximum daily 8-hour value	1/1/2005	60%
Benzene (C_6H_6) (μg/m³) (Directive 2008/50/EC)	5 Annual average value	1/1/2010	
Sulfur Dioxide (SO_2) (μg/m³) (Directive 2008/50/EC)	350 Hourly average value, must not be exceeded more than 24 times per year	1/1/2005	150 μg/m³ (43%)
	125 Daily average value, must not be exceeded more than 3 times per year	1/1/2005	
	500 Warning threshold, for 3 consecutive hours		
Nitrogen Dioxide (NO_2) (μg/m³) (Directive 2008/50/EC)	200 Hourly average value, must not be exceeded more than 18 times per year	1/1/2010	
	40 Annual average value	1/1/2010	
PM10 Particles (μg/m³) (Directive 2008/50/EC)	50 Daily average value, should not be exceeded more than 35 times per year	1/1/2005	50%
	40 Annual average value	1/1/2005	20%
Lead (Pb) (μg/m³) (Directive 2008/50/EC)	0.5 Annual average value	1/1/2005	100%
Ozone (O_3) (μg/ m³) (Directive 2008/50/EC)	120 Maximum daily 8-hour average value, should not be exceeded more than 25 times within 3 years	1/1/2010	
	180 Alert threshold, hourly average value		

5.5.2 Acoustic Environment Quality Standards

For the assessment and management of environmental noise, the provisions of Joint Ministerial Decision (JMD) 13586/724/28.3.2006 (Government Gazette B' 384) apply, which established measures, conditions, and methods for evaluating and managing noise in the environment in compliance with the provisions of Directive 2002/49/EC.

Rules and procedures for setting operational restrictions related to the noise generated are defined in Presidential Decree 80/2004 (Government Gazette A' 63), which aligned Greek legislation with the provisions of Directive 2002/30/EC.

For the noise emitted by construction equipment of the project, the provisions of Joint Ministerial Decision (JMD) 37393/2028/29.3.2003 apply, which establish measures and conditions for noise emissions into the environment from equipment intended for outdoor use (Government Gazette B' 1418), as amended by JMD 9272/471/2.3.2007 (B' 286). For construction works, the limit for the Leq index at a distance of 100 meters from the boundaries of the construction site is Leq = 65 dB(A), based on the limits set by Presidential Decree 1180/81 (Government Gazette 293/A/06.10.1981) as the maximum permissible noise level from industrial and all types of mechanical installations. Additionally, the following apply regarding noise from construction activities:

- Presidential Decree 57/2010 (Government Gazette 97/A/25.6.2010) — Adaptation of Greek Legislation to Directive 2006/42/EC of the European Parliament and of the Council "on machinery and amending Directive 95/16/EC," repealing PDs 18/96 and 377/93, as amended by PD 81/2011 (Government Gazette 197/A/9.9.2011) "Amendment of PD 57/2010 (97/A) in compliance with Directive 2009/127/EC of the European Parliament and of the Council 'amending Directive 2006/42/EC.'"
- Ministerial Decision 56206/1613/1986 (Government Gazette 570B/9.9.1986) — "Specification of noise emission from machinery and construction site devices in compliance with Directives 79/113/EEC, 81/1051/EEC, 85/405/EEC."
- Ministerial Decision 69001/1921/1988 (Government Gazette 751/B/18.10.1988) on the "EEC type approval for the limit noise level of machinery and construction site devices, specifically motor-driven air compressors, tower cranes, welding generator sets, power generator sets, and portable concrete breakers and pneumatic hammers," as amended by Ministerial Decision 10399Φ5.3/361/91 (Government Gazette 359B/28.5.1991) on the "Determination of the noise limit level for tower cranes as a supplement to Ministerial Decision 69001/1921/1988."
- Ministerial Decision 765/1991 (Government Gazette 81B/21.2.1991) on the "Determination of noise limit levels for hydraulic shovels, cable shovels of earth movers, loaders, and loader-excavators," as amended by Ministerial Decision 11481/523/97 (Government Gazette 295B/11.4.1997).

The maximum permissible limits of environmental traffic noise are defined in the Joint Ministerial Decision (JMD) 211773/27.4.2012 (Government Gazette B' 1367) for the establishment of evaluation indicators and maximum permissible limits of environmental noise indicators originating from the operation of transportation projects.

Thus, **the maximum permissible limits** for traffic noise indicators are specified as follows:

- For the Lden indicator (24-hour): 70 dB(A),
- For the Lnight indicator (8-hour nighttime): 60 dB(A),

measured at a height of 4.0 ± 0.2 m (3.8 to 4.2 m) above the ground and at a minimum distance of 2 m from the most exposed façade (towards the respective linear source of traffic noise) — either an external wall or window frame — of residential buildings and other sensitive uses requiring protection.

Lden is an indicator of the overall noise level during the day, evening, and night, used to quantify the annoyance associated with noise exposure. Lnight is an indicator of the noise level during the night. The values of the Lden and Lnight indicators are determined using a standardized common methodology set out in Annex II of the Directive, employing specific estimation methods as well as measurements.

5.5.3 Water and Wastewater Quality Standards

5.5.3.1 Water Quality Standards

5.5.3.1.1 Surface Waters

The project's study area falls within the Water Districts (WD) EL11 "Eastern Macedonia" and EL12 "Thrace", for which River Basin Management Plans (RBMPs) have been developed and approved in accordance with the specifications of Directive 2000/60/EC, as implemented through Law 3199/2003 and Presidential Decree 51/2007.

The Water District of Eastern Macedonia (EL11) consists of one (1) river basin, that of the Strymonas River (EL1106), while the Water District of Thrace (EL12) consists of five (5) river basins: the Nestos River (EL1207), the Streams of Xanthi – Dry Stream (EL1208), the Streams of Komotini – Loutrou Evros (EL1209), the Evros River (EL1210), and the basins of Thasos – Samothraki (EL1242).

Specifically, the land-based installations fall within the river basin of the Nestos River (EL1207).

According to Measure **M12B11023**[6] of the 1st Revision of the River Basin Management Plan (RBMP) for the Water District (WD) of Thrace (Government Gazette 2290/B/2013), which has been replaced by Measure **M12B0702** of the 2nd Revision of the RBMP of the WD of Thrace, a study is foreseen to be conducted by the competent Decentralized Administration (Water Directorates, Ministry of Environment and Energy – Special Secretariat for Water) for determining emission limits for priority substances and other pollutants affecting surface waters, as established by Joint Ministerial Decision (JMD) 51354/2641/E103/2010, as currently in force, as well as for physico-chemical parameters. In defining the emission limit values, the following will be taken into account:

[6] It is not included as a standalone measure in the 2nd Revision of the River Basin Management Plan (RBMP) of the Thrace Water District (EL12).
Aspects of the measure will be incorporated into the program in combination with measure M12B0702.

1 The Environmental Quality Standards established by Joint Ministerial Decision (JMD) 51354/2641/E103/2010 (Government Gazette 1909/B/2010), as amended by Ministerial Decision 182314/1241/2016 (Government Gazette 2888/B/2016).

2 The provisions set forth in Directive 91/271/EEC.

3 The dilution achieved during the summer period from the river's minimum flow and the maximum discharges of wastewater from various industrial and other activities.

4 The sensitivity character of the area.

5 The estimated daily and annual pollutant load of the facility.

6 The concentration of the main pollutant load parameters.

7 The correlation with protection areas for drinking water.

The Emission Limit Values will represent maximum values that must be met in every case by the wastewater of industrial and other activities operating within the river basin.

5.5.3.2 Groundwater

For groundwater, the established quality standards set out in Ministerial Decision (YA) 1811/2011 (Government Gazette 3322/B/2011) apply. These were enacted in accordance with paragraph 2 of Article 3 of Joint Ministerial Decision (KYA) 39626/2208/E130/2009 (Government Gazette 2075/B/2009) (see following table).

Table 5-5: Quality Standards of Ministerial Decision 1811/2011 for Groundwater

Parameter	Quality Standards
Nitrates	50 mg/lt
Active substances of plant protection products (including metabolites, degradation and reaction products)	0,1 mg/lt 0,5 μg/lt (total*)
pH	6,5 - 9,5
Conductivity	2.500 μScm
Arsenic	10 μg/lt
Cadmium	5 μg/lt
Lead	25 μg/lt
Mercury	1 μg/lt
Nickel	20 μg/lt
Total Chromium	50 μg/lt
Aluminium	200 μg/lt
Ammonium	0,5 mg/lt
Nitrites	0,5 mg/lt
Chloride ions	250 mg/lt

Parameter	Quality Standards
Sulfate ions	250 mg/lt
Sum of trichloroethylene and tetrachloroethylene	10 μg/lt

* It means the sum of all individual pesticides that are detected and quantitatively determined during the monitoring.

5.5.3.3 Wastewater Standards

5.5.3.3.1 Wastewater Discharge Limit Standards

The wastewater discharge limit standards are defined in the Health Regulation E1β/221/65 concerning the "Disposal of liquid waste." Specifically, the quality standards and discharge limits for wastewater discharged into waters intended for swimming and any other use except for water consumption are as follows:

- pH 6,5 - 8,5.
- Dissolved oxygen 5 mg/l.
- Coliform bacteria 0 – 50 / 100ml.
- Absence of settling solids or sludge deposits originating from liquid or industrial waste
- Non-toxic, non-harmful, or non-thermal wastewater

Additionally, wastewater must be effectively treated before its discharge into the final recipient. Specific limits for wastewater disposal into the Kavala Gulf are detailed by the Kavala Prefecture in a Prefectural Decision (see attached **table**).

Table 5-6: Limit values for liquid wastewater discharge

Parameter	Limit
pH	6,6 – 8,5
Temperature	35oC
Floating solids	>0,5 cm. none
Suspended solids	70mg/l
BOD_5	40 mg/l
COD	120 mg/l
Fats and oils (animal-vegetable)	20 mg/l
Mineral oils – hydrocarbons	10 mg/l
Aluminum (Al)	5 mg/l
Arsenic (As)	0,5 mg/l
Barium (Ba)	2 mg/l
Boron (B)	2 mg/l
Cadmium (Cd)	0,5 mg/l
Chromium (III) (Cr^{3+})	2 mg/l
Chromium (VI) (Cr^{6+})	0,2 mg/l
Total Iron (Fe)	20 mg/l

Parameter	Limit
Dissolved Iron	4 mg/l
Manganese (Mn^{2+})	2 mg/l
Mercury	0,01 mg/l
Nickel	2 mg/l
Lead	0,1 mg/l
Copper	2 mg/l
Selenium	0,1 mg/l
Tin	10 mg/l
Zinc	1 mg/l
Cyanide Compounds	0,5 mg/l
Chlorine (free)	2 mg/l
Sulfites	2 mg/l
Sulfides	2 mg/l
Fluorides	10 mg/l
Phosphorus	30 mg/l
Total Ammonia	30 mg/l
Nitrite Nitrogen	3 mg/l
Nitrate Nitrogen	30 mg/l
Total Phenols	0,5 mg/l
Aldehydes	1 mg/l
Aromatic Solvents	0,4 mg/l
Nitrogenous Solvents	0,2 mg/l
Chlorinated Solvents	
Total Toxic Substances	3 mg/l
Total Coliforms	500 K/100ml
Κοπρανώδη κολοβακτηρίδια	100 K/100ml

5.5.3.3.2 Sewage from ships, International Convention for the Prevention of Pollution from Ships, MARPOL 73/78, Annex I, IV, V

Annex I: Regulations for the Prevention of Pollution by Oil (Entered into force on October 2, 1983)

It covers the prevention of pollution from oil through operational measures, as well as accidental discharges. The 1992 amendments to Annex I made double hulls mandatory for new oil tankers and set a phased timetable for the adaptation of double hulls on existing tankers, which was later revised in 2001 and 2003.

Annex IV: Prevention of Pollution from Ship Sewage (entered into force on September 27, 2003)

It includes requirements for controlling marine pollution from sewage. Discharge of sewage into the sea is prohibited unless the ship is equipped with and operating an approved sewage treatment plant, or if the ship discharges comminuted and disinfected sewage using an approved system at a distance greater than three nautical miles from the nearest shore. Sewage that is neither comminuted nor disinfected must be discharged at a distance of more than 12 nautical miles from the nearest shore.

Annex V: Prevention of Pollution by Garbage from Ships (entered into force on December 31, 1998)

It includes various types of garbage and specifies the distances from the shore and the manner in which they can be disposed of. The most important feature of the Annex is the complete prohibition it imposes on the discharge of any form of plastic into the sea.

5.5.4 Alarm Limits for Short-Term Response Measures

5.5.4.1 Air Pollutants

The Joint Ministerial Decision (KYA) 14122/549/E103/2011 has established alert thresholds for limiting pollution in cases where, mainly due to extremely unfavorable meteorological conditions, a significant increase in pollution levels is expected. The alert limits for urgent measures set by this KYA relate to the pollutants NO_2, SO_2, and O_3. No alert threshold is provided for particulate matter (PM10) by either European or Greek legislation. The following **table** presents the alert thresholds for triggering short-term response measures to address air pollution.

Table 5-7: Alert thresholds for gaseous pollutants to trigger short-term response measures

Pollutant substance	Averaging Period	Limits
SO_2	1 hour	500 μg/m^3 (*)
NO_2	1 hour	400 μg/m^3 (*)
O_3	1 hour	240 μg/m^3 (*)

(*) Exceedance of this value for 3 consecutive hours

Since the EU legislation does not provide alert and alarm thresholds for PM10 or for addressing air pollution from particulate matter, Joint Ministerial Decision 70601 (Government Gazette 3272/B/2013) was issued. This decision establishes PM_{10} concentration levels, defines measures for informing and protecting the population, as well as measures to reduce particulate emissions from combustion sources, industry-crafts, and vehicle traffic depending on the concentration levels.

Table 5-8: ☐PM10 Concentration Alert Thresholds

Pollutant	Time Basis	Limit
PM_{10}	24h	51-75 μg/ m^3 Recommendations for Vulnerable Population Groups
		76-100 μg/ m^3 Recommendations for Vulnerable Population Groups and the General Population
		101-150 μg/m^3 Recommendations for vulnerable population groups and the general public, measures to reduce particulate matter emissions from combustion sources, industrial-craft activities, and traffic.
		>150 μg/ m^3 Recommendations for vulnerable population groups and the general public, measures to reduce particulate matter emissions from combustion sources, industrial-craft activities, and traffic.

5.5.4.2 Noise

The limits set by Presidential Decree 1180/81 (Government Gazette 293A/1981) for mechanical noise and Joint Ministerial Decision No. οικ. 211773/2012 for noise from the operation of road transport projects apply.

5.5.4.3 Wastewater

The limits specified in the Health Regulation E1b/221/65, as described in **Section 5.5.3.3,** apply.

5.5.4.4 Waters

The limits described in **Section 5.5.3** apply.

5.6 LOCATION OF THE PROJECT IN RELATION TO THE AREAS OF THE NATURAL AND ANTHROPOGENIC ENVIRONMENT OF THE REGION

5.6.1 Established Boundaries of Settlements and Approved Urban Plans

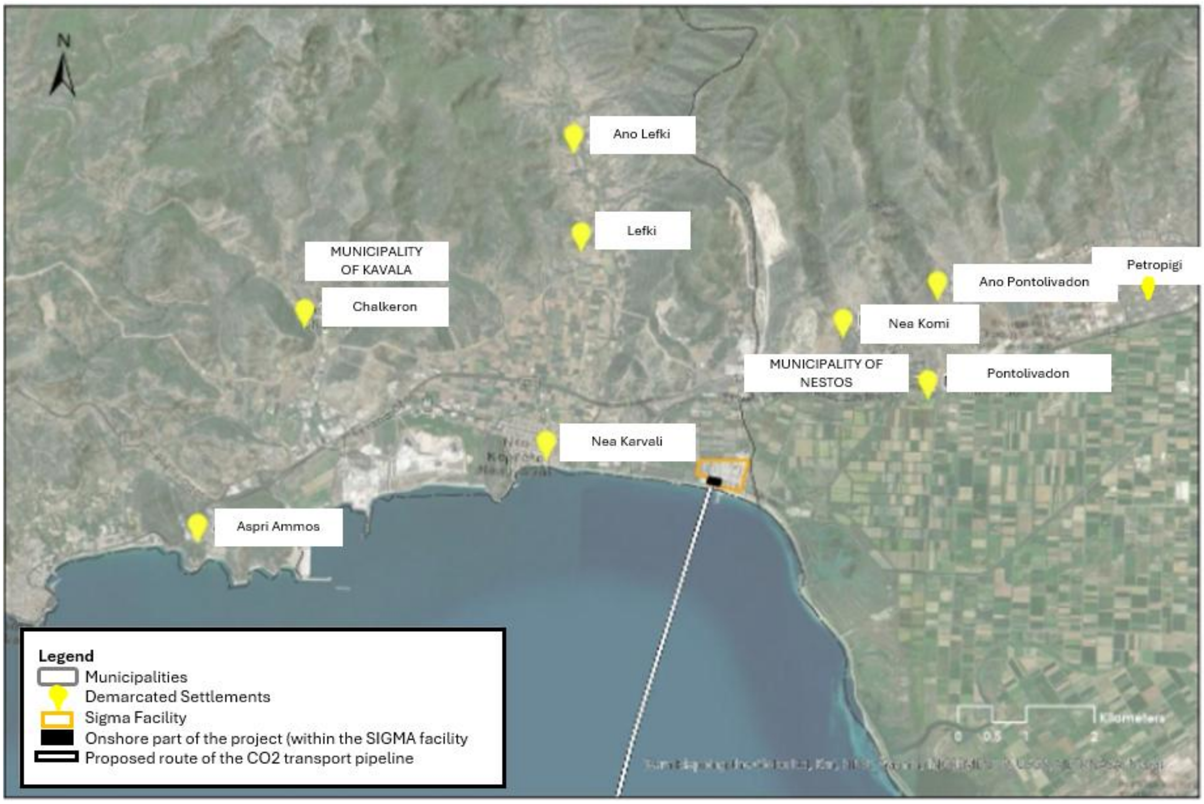
The existing facilities and the total area of the planned and potential future development of the Prinos CO2 Storage Unit are located in the Gulf of Kavala, 8 km west of Thasos and 18 km south of the Kavala coastline. The Gulf of Kavala is part of the Thracian Sea and belongs to the Northeastern Aegean.

The onshore facilities of the Project are situated on the border between the Municipality of Kavala and the Municipality of Nestos. The proposed (planned and potential future) and existing offshore facilities are located in the region of Eastern Macedonia and Thrace, in the southern coastal part of the Kavala Regional Unit, near the borders of the Municipalities of Kavala (to the north), Pangaio (to the north-northwest), Nestos (to the north-northeast), and Thasos (to the east-southeast).

The Kavala Regional Unit consists of 3 Municipalities and 11 Municipal Units (MUs)

- Municipality of Pangaio
  - MU of Eleftheroupoli
  - MU of Eleftheres
  - MU of Orfano
  - MU of Pangaio
  - MU of Pieria
- Municipality of Kavala
  - MU of Kavala
  - MU of Filippoi
- Municipality of Nestos
  - MU of Keramoti
  - MU of Oreino
  - MU of Chrysoupoli

The following **figure** presents the closest settlements to the onshore facilities of the Project. As observed, the nearest settlement is Nea Karvali, which is approximately 2.6 km away from the onshore facilities.



(Source: HSA, 2021)

Figure 5–8: Settlements near the onshore facilities

City Plans: For the Municipality of Kavala in the Regional Unit of Kavala, where the onshore facilities are located, a General Urban Plan (hereinafter referred to as GUP) has been drafted and approved (Decision No. 5248π.ε./04-02-2013), and was published in Government Gazette FEK 69/ΑΑΠ/11-03-2013. The boundaries of the GUP coincide with the administrative boundaries of the Municipal Unit of Kavala, and it includes the city of Kavala and the settlements of Aspri Ammos, Palio, Nea Karvali, Chalero, Lefki, and Ano Lefki.

For the community of Nea Karvali in the Regional Unit of Kavala, a Local Urban Plan has been approved and published in Government Gazette FEK 487/Δ/07-08-1989, titled: "Approval of a Local Urban Plan in the community of Nea Karvali, Regional Unit of Kavala, for the designation of an area for the construction of a regional market."

For the settlement of Chrysoupoli, a General Urban Plan (GUP) has been drafted and approved, in accordance with Government Gazette FEK 814/Δ/26-08-1987.

A Residential Control Zone (ZOE) has been designated for areas outside city plans and beyond the boundaries of settlements pre-existing before 1923, within the Municipality of Kavala (Regional Unit of Kavala) and the communities of Amisiana, Amygdaleonas, Nea Karvali, Chalkero, and Kokkinoxoma (Regional Unit of Kavala), in accordance with Government Gazette FEK 326/Δ/1995.

Defined Settlements: In the broader area surrounding the onshore facilities, the defined settlements are those listed in the following table (not included here). According to data from the Hellenic Statistical Authority (ELSTAT, 2021): The total population of the Municipal Unit of Kavala in 2021 was estimated at 54,065 residents, the Municipal Unit of Nea Karvali had 2,003 residents, the Municipality of Nestos had 20,311 residents. The closest settlement to the facilities is the settlement of Nea Karvali.

Table 5-9: Nearest Settlements within the Kavala Regional Unit

Settlement	Distance from onshore facilities (km)	2021 Population Census
Nea Karvali	2,6	2.003
Ponolivadon	3,2	250
Nea Komi	2,7	55
Chalkeron	6,6	175
Lefki	4	57
Aspri Ammos	7,8	51
Kavala	11,5	54.065

5.6.2 Boundaries of Areas of the National System of Protected Areas according to Law 3937/2011

The project under consideration is located within the protected Natura 2000 site SAC & SPA GR1150014 "Marine Area of Kavala – Thasos", as shown in the following figure. In the wider area, the following Natura 2000 sites are identified: SCI GR1150010 "Nestos Delta and Keramoti lagoons – Wider area", SPA GR1150001 "Nestos Delta and Keramoti lagoons and Thasopoula Island" and SPA GR1150012 "Thasos (Ypsario Mountain and coastal zone)"

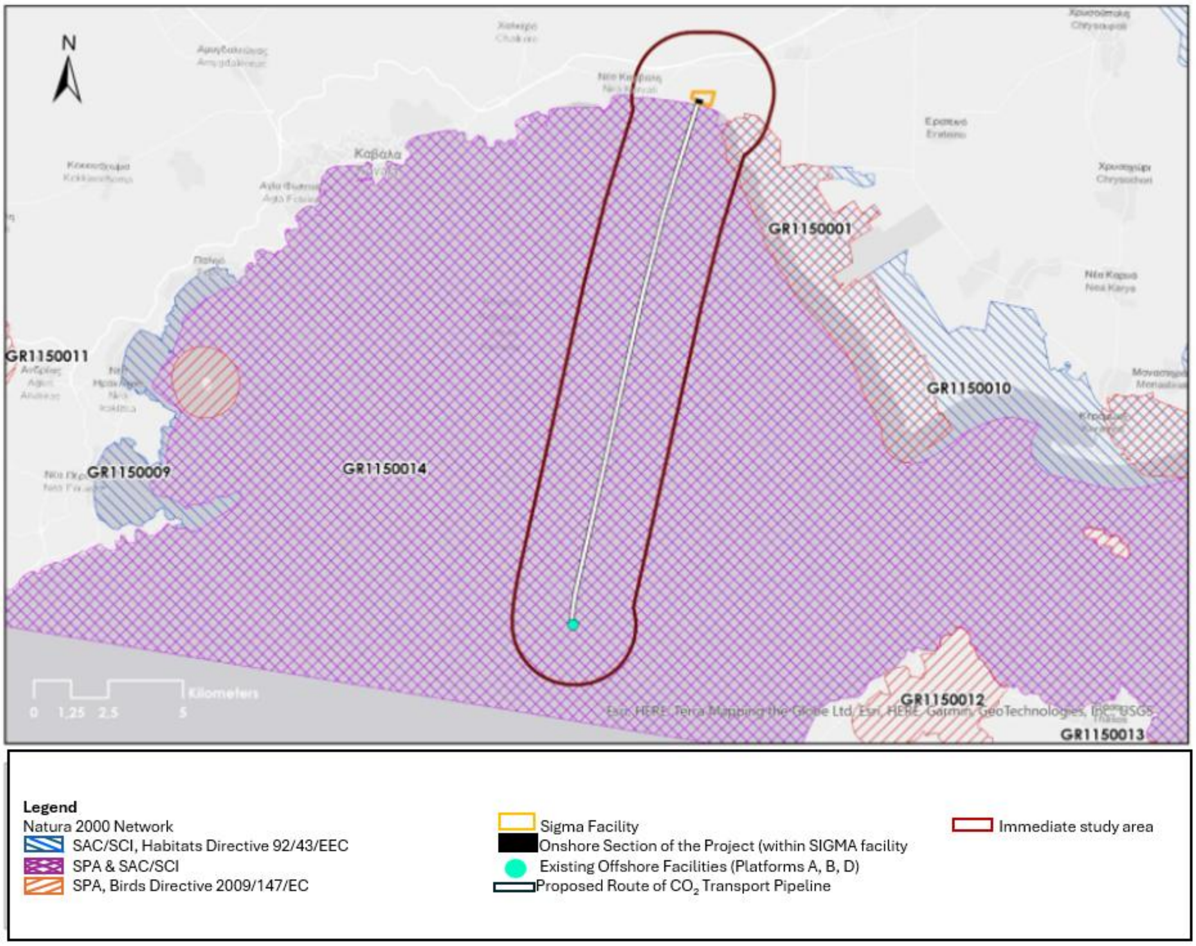
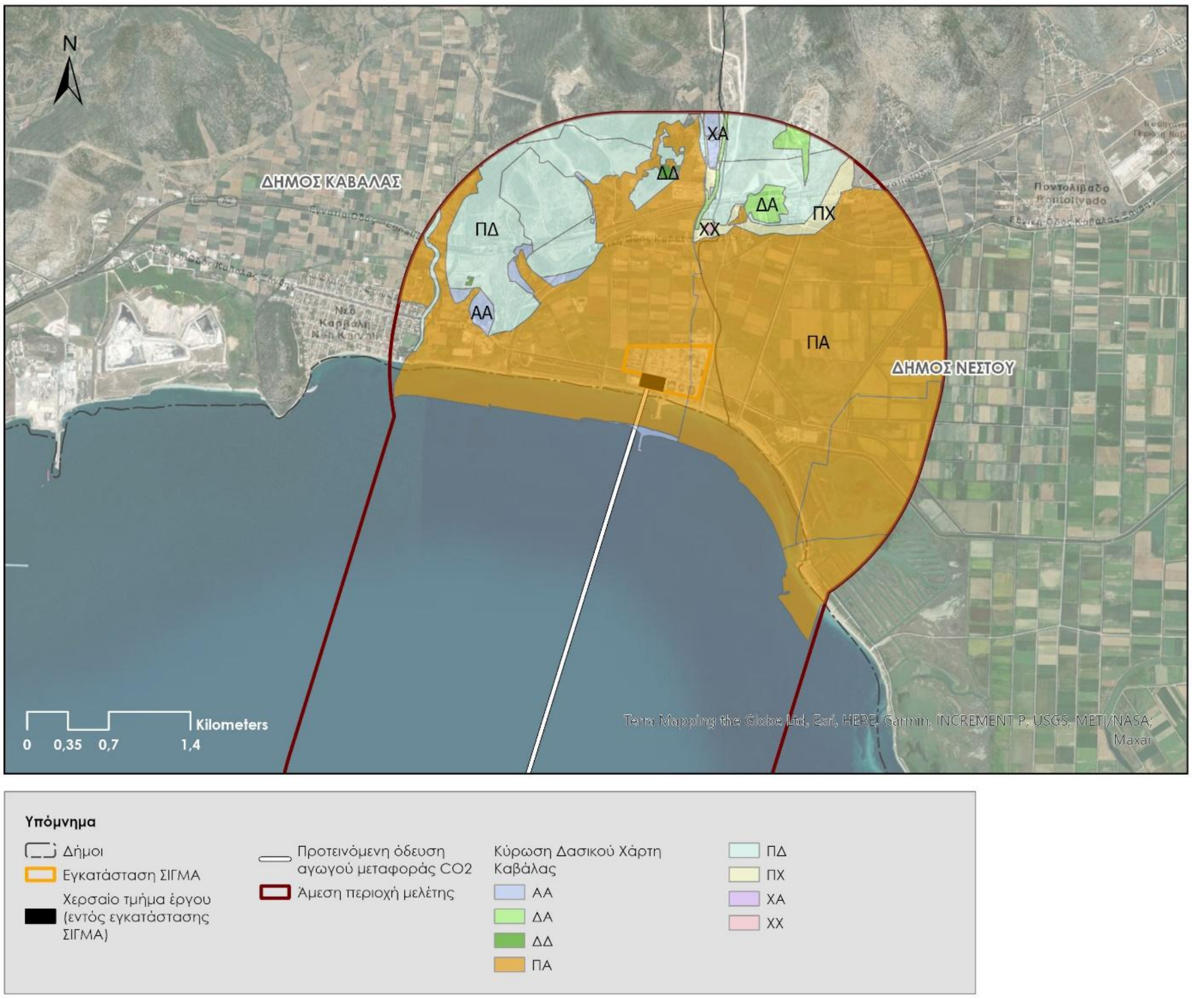


Figure 5–9: Natura 2000 protected areas within the study area

A more detailed description of the Natura 2000 Network areas is provided within the framework of the Project's Special Ecological Assessment Study (SEAS).

5.6.3 Forests, Forested Areas and Reforestation Areas

By Decision No. 385085/31-10-2022 of the Secretary General of Forests of the Ministry of Environment and Energy (Government Gazette FEK 777/Δ΄ /07-11-2022), the Forest Maps of the Regional Units of Kavala and Thasos were ratified. Based on the provisions of the above decision and according to publicly available data from the website of the Hellenic Cadastre, the following excerpt is derived using geospatial data from the Hellenic Cadastre, depicting the onshore facilities of the Project.



(Source: Ratification of the Kavala Forest Map 2022)

Figure 5–10: Forested and non-forested areas within the wider area

The onshore facilities are located within areas coded as AA: Other types of coverage in older aerial photographs and PA: Finalized acts and decisions of classification – non-forested (as shown in the above **figure**), which are not subject to the restrictions of forest legislation.

The following tables present the percentages and coverage of the immediate study area by forested, reforestation, or other types of land.

Table 5-10: Percentage and area of forested lands within the immediate study area by category

Character code	Character Description	Area within the immediate study area (km²)	Occupancy percentage within the immediate study area (%)
ΠΑ	Finalized acts & classification decisions – Non-forested	9,495	74,01
ΠΧ	Finalized acts & classification decisions – Grassland	0,207	1,61
ΧΧ	Grassland areas in older aerial photographs / Grassland areas in recent aerial photographs and in field inspections or in cadastral maps of Law 248/1976	0,006	0,05
ΔΑ	Forests and forested areas in older aerial photographs or pre-existing data / Other types of coverage in aerial photographs and field inspections or in cadastral maps of Law 248/1976.	0,184	1,44
ΧΑ	Grassland areas in older aerial photographs / Other types of coverage in aerial photographs and field inspections or in cadastral maps of Law 248/1976.	0,012	0,09
ΠΔ	Finalized acts and classification decisions – forested	2,703	21,07
ΑΑ	Other types of coverage in older aerial photographs / Other types of coverage in recent aerial photographs.	0,177	1,38
ΔΔ	Forests and forested areas in older aerial photographs or pre-existing data / Forests and forested areas in recent aerial photographs and in field inspections or in cadastral maps of Law 248/1976.	0,044	0,34

Table 5-11: Total percentage and area of forested lands within the immediate study area

Character Description	Character Code	Area within the immediate study area (km²)	Occupancy percentage within the immediate study area (%)
Forests and forested areas	ΑΔ, ΔΑ, ΔΔ, ΠΔ	2,9322	22,85
Other types of land	ΑΑ, ΠΑ	9,673363	75,39
Grassland areas	ΠΧ, ΧΑ, ΧΧ	0,225	1,75
Forested reforestation areas	ΑΝ-ΑΔ, ΔΑ-ΑΝ, ΔΔ-ΑΝ, ΠΔ-ΑΝ	0	0
Other types of land	ΑΑ-ΑΝ, ΠΑ-ΑΝ	0	0

5.6.4 Social Infrastructure and Public Utility Facilities

5.6.4.1 Road Network

The road network of the Region of Eastern Macedonia and Thrace (REMT), which includes national and provincial roads, has a total length of 3,191 km (828 km of National Network and 2,363 km of Provincial Network).

The national and provincial road network has achieved satisfactory connectivity with the Egnatia Odos through the 20 constructed Interchanges (ICs). The most important road infrastructure in the Kavala area is the Egnatia Odos. This highway and its vertical axes form a modern motorway that connects Kavala with Igoumenitsa to the west and Kipoi to the east. It is part of the Trans-European Transport Networks, linking four ports, six airports, and nine vertical axes that ensure access to countries in southeastern Europe. A complementary project to alleviate traffic congestion in the city is the completion of the Kavala Ring Road.

The network is sufficiently dense, in good condition, and allows smooth access. The coastal areas are connected to each other via the peripheral roads.

Apart from the Egnatia Odos, access to the project area is ensured by the National Road Kavala – Xanthi.

The following **table** presents the length of the road network passing through the Municipality of Kavala.

Table 5-12: Length of the road network of the Municipality of Kavala

Name	km
National Roads	
National Road 2 (E.O.2) Kavala – Nestos Bridge	**40**
National Road 12 (E.O. 12) Stavros Amygdaleonas – Marmara Skari (Lydia Exit)	**18**
Kavala Ring Road	**3**
Strimona Bridge – Eleftheroupoli – Kavala	**40**
Peripheral / Local Roads	
Amygdaleonas – Platamonas – Dipotamos – Skopos – Kechrokampos - Stavroupoli	60
Amygdaleonas – Zygos – Kryoneri – Limnia – Vounochori – Lykostomo	21
Nea Karvali – Lefki – Elafochori – Makrychori – Skopos	30
Platamonas – Lykostomo towards Adrianí	6
Kavala – Palio – Nea Iraklitsa – Nea Peramos – Elaiochori – Foliá - Towards Egnatia – Loutra Eleftheron – Karyani – Orfani	69
Eleftheroupoli – Antifilippi – Georgiani – Nikisiani	18

(Source: Operational Plan of the Municipality of Kavala 2021-2023, Phase A)

5.6.4.2 Ports – Ferry Connections

In the Region of Eastern Macedonia and Thrace (REMT), the main ports are those of Alexandroupoli and Kavala. Other ports in the region include Porto Lagos, Thasos, Kamariotissa (on Samothrace), Keramoti, Prinos, and the Eleftheres-Peramos port.

The majority of domestic ferry traffic in REMT in 2022 was recorded in the Kavala (48%) and Thasos (44%) regional units.

The Port of Kavala is classified as a Port of International Interest according to the national port classification under Joint Ministerial Decision No. 8315.2/02/07/02.02.2007 (Government Gazette 202/B/16.02.2007). The Central Port of Kavala, "Apostolos Pavlos," is a distinct part of the Port of Kavala that serves its passenger and tourist traffic.

The port of Nea Karvali, called "Philippos B," is used for commercial purposes. The ports of Keramoti (Keramoti – Thasos Ferry) and the central port of Thasos are also considered important for passenger and fishing fleet use. The port of Prinos and Limenaria in the Regional Unit of Thasos, as well as the port of Nea Peramos, mainly serve local passenger transport. The latter also supports the transportation of workers to the oil extraction facilities.

Four ferry routes depart from the port of Kavala: "Kavala – Lemnos," "Kavala – Samothrace," "Alexandroupoli – Kavala," and "Kavala – Ormos Prinos – Thasos."

<u>The nearest port to Nea Karvali, "Philippos B," is located approximately 6.2 km southwest of the project's onshore facilities.</u>

5.6.4.3 Air Connections

In the Region of Eastern Macedonia and Thrace, two airports operate: those of Kavala and Alexandroupoli. Of the two, only Kavala Airport serves international freight traffic.

In the Regional Unit of Kavala, there is one national civil airport serving air transport in the area. The "Megas Alexandros" Airport is located in Chrysoupoli and essentially serves as the main entry point for foreign tourists to the area, especially to Thasos. It was built in the late 1970s and initially handled only charter flights.

<u>No airports are located within the study area. The nearest airport to the study area is the Kavala State Airport, which is approximately 7.5 km from the project's onshore facilities.</u>

5.6.4.4 Railway connection

Rail transport is underperforming, especially regarding passenger traffic. The railway infrastructure connects all the cities of the Region of Eastern Macedonia and Thrace (PA.M.TH.), except for Kavala, but it has outdated infrastructure and lacks intermodality. The existing railway line connects Thessaloniki with Ormenio Evrou, then continues to the Greek-Bulgarian border, passing through all urban centers except Kavala.

There is no railway network within the study area. However, it is noted that in 2022, the Ministry of Environment and Energy (YPEN) approved the environmental terms for the section of the new railway line from Thessaloniki to Nea Karvali. The new Thessaloniki-Kavala-Xanthi railway line is part of the so-called Eastern Railway Egnatia. It starts at the exit of the Nea Filadelfeia Railway Station and ends in the area of Toxotes in Xanthi, where it is planned to connect with the existing Thessaloniki-Alexandroupoli line.

5.6.4.5 Water Supply Networks

The Municipality of Kavala is served for its water supply needs by the Public Water Supply and Sewerage Company of Kavala (hereinafter DEYAK), which has been operating since 1984. According to data from the Municipality of Kavala's Operational Program 2021-2023 (Phase A), the average annual water consumption for the year 2015 was estimated at 4,265,454 m^3, while the length of the municipality's water supply network is approximately 300,000 km. Additionally, the settlements of the Municipality of Kavala are supplied with water from springs and boreholes (a total of 19 boreholes recorded in the Operational Program).

In the immediate area of the Project's land facilities, three (3) active water abstraction points are identified, as shown in the following Figure and Table from the National Registry of Water Abstraction Points (EMSY).

Table 5-13: Water abstraction points near the land facilities

Serial number	EMSY Code	Distance from land-based facilities	Coordinates (EGSA 87)
1	1200011770795	< 0,5 km	X: 545495 Y: 4533809
2	1200012050924	1 km	X: 545725 Y: 4534829
3	1200003076622	1,15 km	X: 545480 Y: 4534941

(Source: National Registry of Water Abstraction Points (EMSY))

Figure 5–11: Water abstraction points near the onshore facilities (Source: National Registry of Water Abstraction Points (EMSY))

5.6.4.6 Sewerage Networks

In the wider study area, both within the Regional Unit of Kavala and Thasos, the following wastewater treatment plants are located and operational (see the following **table**), which comply with the limits of Directive 91/271/EEC.

According to the Special Secretariat for Water, the closest wastewater treatment plant is located approximately 7.5 km southwest of the project's onshore facilities.

Table 5-14: Wastewater Treatment Plants (WWTP) near the study area

Name of WWTP	WWTP Code	Type of Treatment	Total incoming flow to the Wastewater Treatment Plant (WWTP) (m^3/day)	Receiver
CHRYSOUPOLI	EL115011018	Secondary treatment with nitrogen removal and disinfection	1.951	EL1150110180
KAVALA	EL115001016	Secondary treatment with nitrogen and phosphorus removal	13.500	EL1150010160
PALAIO TSIFLIKI	EL11500101117	Secondary treatment with nitrogen and phosphorus removal	1.200	EL115001011170
NEA PERAMOS, KAVALA	EL1150030115	Secondary treatment with nitrogen and phosphorus removal and disinfection	1.834	EL11500301150

Name of WWTP	WWTP Code	Type of Treatment	Total incoming flow to the Wastewater Treatment Plant (WWTP) (m³/day)	Receiver
THASOS	EL1150040116	Secondary treatment with nitrogen and phosphorus removal and disinfection	1.123	EL11500401160
PHILIPPOI	EL1150100118	Secondary treatment with nitrogen and phosphorus removal and disinfection	2.430	EL11501001180
ELEFTHEROUPOLI	EL1150020114	No data available	2.400	EL11500201140

(Source: Special Secretariat for Water, Wastewater Treatment Plants Operation Monitoring Database, June 19, 2024)

Figure 5–12: Wastewater Treatment Plants (WWTP) in the wider study area

5.6.5 Sites of Archaeological Interest

The main archaeological sites in the Prefecture of Kavala are briefly described in the following **Table**.

Table 5-15: Main archaeological sites in the Prefecture of Kavala

Archaeological site	Type of protection	Protection status
Archaeological site of Philippi		
It is located along the provincial road Kavala – Drama. The archaeological site includes the remains of the ancient city of Philippi, which comprise the acropolis, the city walls, the theater, the agora, and the cemeteries — both Eastern and Western — as well as the hills and the battlefield of the Battle of Philippi. It also includes the Byzantine cemetery and the funerary chapel, the basilicas outside the city walls, the funerary monument of C. Vibius Quartus, the prehistoric settlement of Dikili Tash, the Arch of the Via Egnatia, and the River Zygaktis.	Type of protection by the Ministry of Culture: Designation Competent Authority: Ephorate of Antiquities of Kavala World Heritage Site: YES European Cultural Heritage: YES	Ministerial Decision 15794, Government Gazette (FEK): 35/B/1962-02-02 Ministerial Decision 15813, Government Gazette (FEK): 36/B/1962-02-03 Ministerial Decision 15813, Government Gazette (FEK): 179/B/1962-05-26 Ministry of Culture and Sports / General Directorate of Antiquities and Cultural Heritage / Directorate of Prehistoric and Classical Antiquities / Division of Protection and Documentation / File No. Φ18/171892/91557/11622/5399, Government Gazette (FEK): 357/AAP/2013-10-09
Ancient city and port of Thasos (Underwater site). The commercial and military harbors of Thasos are located at the site of the modern port of the city, and the first fortification of the harbor dates back to the late 6th / early 5th century BC. More generally, this monument is cited as an example of the understanding of "closed" military harbors, which were an integral part of ancient cities and were constructed throughout antiquity, from the Archaic period to the Late Hellenistic era.	Type of protection by the Ministry of Culture: Designation Competent Authority: Ephorate of Underwater Antiquities	Ministry of Culture / Directorate of Antiquities / A1 Department / File No. Φ18/52652/2146, Government Gazette (FEK): 74/B/1987-02-05 Ministerial Decision YPAITHPAGGP / General Directorate of Antiquities and Cultural Heritage / Directorate of Prehistoric and Classical Antiquities / Department of Architecture and Planning / File No. Φ43/69887/33898/4701/2361, Government Gazette (FEK): 166/AAP/2013-05-15
The Alyki Peninsula is located in the southeast of Thasos and is, after the city of Thasos, one of the most important archaeological sites on the island, featuring significant visible monuments and a period of continuous occupation from the 7th century BC to the 7th century AD.	Type of protection by the Ministry of Culture: Designation Competent Authority: Ephorate of Antiquities of Kavala	Ministerial Decision 9763, Government Gazette (FEK): 415/B/1962-11-19 Ministerial Decision Φ31/28167/2649/74, Government Gazette (FEK): 166/B/1977-03-03 Ministerial Decision Ministry of Culture (ΥΠΠΕ) / A1 Department / File No. Φ18/14306/532, Government Gazette (FEK): 244/B/1985-05-02

The marine area of the Gulf of Kavala, where all offshore facilities (existing and new) are located, has been thoroughly investigated, and there is <u>no evidence of significant underwater archaeological findings</u>. Over time, the shallow waters and the type of seabed do not allow for the preservation of any possible ruins.

At a short distance from the study area, the following archaeological sites and monuments are also identified (the relevant distances are presented in the following table):

Table 5-16: Archaeological sites and monuments within or near the study area

Serial Number	Monument – Temple	Distance from onshore facilities (km)	Study Area
1	Chalkero, Kavala	6	Outside
2	Eskitepe Lefki, Kavala	3.6	Outside
3	Nea Karvali, Kavala	1.15	Outside
4	Remains of the ancient city Akontisma, Nea Karvali, Kavala	0.98	Outside
5	Church of Saint Gregory, Nea Karvali, Kavala	2.26	Outside
6	Pontolivado, Kavala	3.3	Outside
7	Nea Komi, Kavala	2.4	Outside

Traditional settlements are residential complexes of particular historical, urban planning, architectural, folkloric, social, and aesthetic character, developed from the 16th to the 19th century. The following **table** presents the settlements that have been designated as Traditional in the Prefecture of Kavala, pursuant to Presidential Decree 19-10-1978 (Government Gazette 594/D/13.11.1978).

Table 5-17: Traditional settlements in the Regional Units of Kavala and Thasos

Local Government Authority	Traditional Settlement	Proposed notable (sites) 1975 / Protection Level[7]
ELEFTHEROUPOLI	Kipia (Bostanli) Chrysokastron	Settlement / Protection Level 3 Settlement / Protection Level 3 – Surrounding Area / Protection Level 3
THASOS	Alyki Theologos Kastro Mariai Palaiochoriôn Panagia (Anastasion) Potamia Prinos	Settlement / Protection Level 2 – Surrounding Area / Protection Level 1 Settlement / Protection Level 2 – Part of Settlement / Protection Level 1 – Surrounding Area / Protection Level 2 - Settlement / Protection Level 2 – Surrounding Area / Protection Level 2 - Settlement / Protection Level 3 – Part of Settlement / Protection Level 2 – Surrounding Area / Protection Level 1 Settlement / Protection Level 3 Settlement / Protection Level 1 – Surrounding Area / Protection Level 1
KAVALA	PALIA KAVALA	Part of Settlement / Protection Level 2

7 https://portal.tee.gr/portal/page/portal/teetkm/GRAFEIO_TYPOY/TEXNOGRAFIMA_2007/%D4%C5%D7%CD%CF%C3%D1%C1%D6%C7%CC%C1%20336/12-13_0.pdf

Local Government Authority	Traditional Settlement	Proposed notable (sites) 1975 / Protection Level7
ORINOS	KECHROKAMPOS KRYONERION (KARGA) MAKRICHORION PLATAMON	Settlement / Protection Level 3 – Part of Settlement / Protection Level 2 Settlement / Protection Level 3 – Surrounding Area / Protection Level 2 Settlement / Protection Level 3 – Part of Settlement / Protection Level 2 • -
ORFANI	PODOCHORIO	Settlement / Protection Level 2 – Surrounding Area / Protection Level 3
PANGAIO	PALAIOCHORION	• -
PIERIS	MOUSTHENI DOMATIA (SAMAKOVO) MELISSOKOMEION MESOROPI PYRGOCHORION	Settlement / Protection Level 3 – Part of Settlement / Protection Level 2 Settlement / Protection Level 3 – Part of Settlement / Protection Level 2 – Surrounding Area / Protection Level 2 - Settlement / Protection Level 3 – Surrounding Area / Protection Level 2 Settlement / Protection Level 3 – Surrounding Area / Protection Level 3
FILIPPOI	ZIGOS KORYFAI	- Settlement / Protection Level 3 – Part of Settlement / Protection Level 2

(Source: http://estia.minenv.gr/)

The project under study will not cause any damage to the protected monuments of the archaeological site, as they are located at a significant distance from the proposed intervention areas. Furthermore, it should be noted that the proposed interventions of the project will be of short duration and will concern a limited area (see **Section 8.11.5**).

In any case, to ensure the protection of the cultural environment of the study area in accordance with the requirements of Law 3028/2002, as amended and currently in force, as detailed in **Chapter 12**, the proposed interventions will be carried out under the supervision of the competent archaeological authorities following timely and written notification prior to the commencement of works, which is the responsibility of the project operator.

5.7 APPLICABLE SPATIAL AND URBAN PLANNING REGULATIONS IN THE PROJECT AREA

This **section** presents the key spatial planning policies that have been established at the level of Strategic Spatial Planning for the study area in accordance with Law 4447/2016, and examines the compatibility of the proposed project with these policies.

5.7.1 Provisions and Guidelines of the General, Special, and Regional Frameworks for Spatial Planning and Sustainable Development

5.7.1.1 General Framework for Spatial Planning and Sustainable Development (GFSPSD)

The applicable General Framework for Spatial Planning and Sustainable Development (GFSPSD), approved by Decision No. 6876/4871/2008 of the Parliament (Government Gazette 128/A/03-07-2008), in accordance with Article 12(3) of Law 4447/2016, as in force, serves as the National Spatial Strategy. It includes a set of texts and plans that record and assess the factors affecting the long-term spatial development and structure of the national territory, evaluate the spatial impacts of international, European, and national policies, and determine, with a 15-year outlook, the key priorities and strategic directions for integrated spatial development and sustainable organization of national space.

More specifically, in view of the acute problems caused by rapidly progressing climate change, the following goals are set:

- Ongoing efforts for energy conservation
- Promotion of environmentally friendly alternative energy sources, especially renewable energy sources
- Enhancement of natural feedback mechanisms (forests, wetlands, etc.)
- Adaptation of the country to the new conditions brought about by climate change and addressing their consequences (wildfires, floods and erosion, drought, salinization, desertification, and other natural phenomena), through the creation of appropriate preventive mechanisms, infrastructure, and action plans.

Regarding the spatial organization and development of the industrial sector (mining – manufacturing), according to Article 7, Section C of the GFSPSD, the following key goals and objectives are set:

- Promotion of a polycentric spatial organization model for industry in order to enhance its contribution to regional development and the exploitation of the comparative advantages of various areas.
- Resolution of land-use conflicts and ensuring conditions for the coexistence of activities, taking into account the uniqueness and availability of resources for the development of each productive activity and weighing social-economic and environmental costs/benefits.
- Enhancement of competitiveness and entrepreneurship in the industrial sector through appropriate spatial regulations, focusing on activities that meet local needs and have a comparative advantage in international markets.
- Improvement and coordination of the institutional provisions of individual spatial policies, to more effectively promote entrepreneurship and ensure transparency and legal certainty in the siting of industrial activities.
- Integration of the environmental dimension into industrial activities through the application of modern exploitation and production techniques, as well as anti-pollution and environmental restoration technologies

According to Article 10 of the GFSPSD, in relation to climate change mitigation, in addition to measures for the protection of water, soil, and air, the following are also promoted:

- Plans for the use of renewable energy sources.
- Promotion of less energy-intensive transport modes.
- Infrastructure for the widespread use of natural gas (especially in electricity production).
- Obligatory reduction of pollutant gas emissions contributing to the greenhouse effect by industries.
- Application of best available techniques in industries.
- Energy saving measures.
- Forest fire prevention measures and reforestation.
- Applications of bioclimatic architecture, etc.
- Strengthening of natural feedback mechanisms (forests, wetlands, etc.) and their biodiversity.

The project under consideration aims to mitigate the effects of climate change through the storage of carbon dioxide and is not in conflict with the objectives set by the GFSPSD for the same purpose.

5.7.1.2 Regional Framework for Spatial Planning and Sustainable Development (RFSPSD)

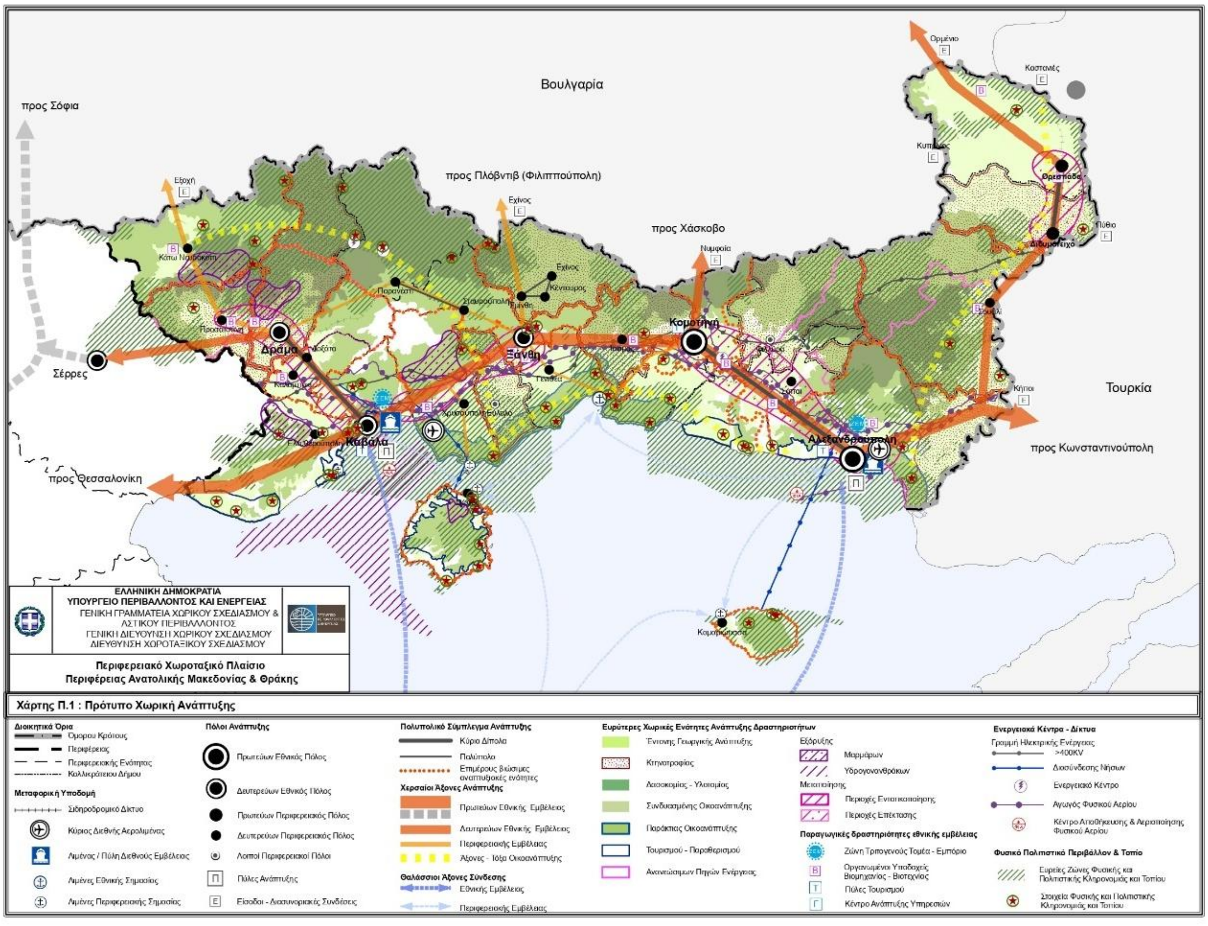
In the Region of Eastern Macedonia and Thrace, within the framework set by Law 4447/2016, the Regional Spatial Framework (RSF) of Eastern Macedonia and Thrace was approved by Ministerial Decision YPEN/DCHORS/68605/1092 (Government Gazette 248/AAP/25-10-2018). The RSF of Eastern Macedonia and Thrace aims to formulate an integrated strategic program of spatial policies for the region, which will serve as the main framework for spatial, urban, and development decisions throughout its period of validity. At the same time, the RSF is also approved environmentally by the Region itself, as it revises and replaces the previous Regional Framework for Spatial Planning and Sustainable Development.

The Region of Eastern Macedonia and Thrace is divided into six regional units (Drama, Kavala, Thasos, Xanthi, Rodopi, and Evros). Its administrative center is Komotini, and its largest city is Alexandroupolis.

The spatial development model of the Region of Eastern Macedonia and Thrace presents a strong urban center structure along the axis of the Egnatia Motorway, as illustrated in the following figure. The concentration of the majority of employment and, consequently, the Regional GDP in the main urban centers has reinforced the dependency on these centers, while failing to create viable functional units in areas outside the development axis. As for the main urban centers, the specific roles anticipated for each of them in the previous Regional Framework were not successfully undertaken.

Kavala is designated as a Secondary National Pole and a gateway of international and interregional significance for the Region, in relation both to Bulgaria and the Eastern Balkans and to Central Europe. Contributing to this prospect are its strategic position within the development axis network, the airport of Chrysoupoli, its ports (urban port and commercial port “Philippos B”), and its university departments, technical institutions, and research institutes. Its strengthening as a gateway is linked to the connection between the “Philippos B” port and the railway network, the improvement of the port’s infrastructure and facilities, and the city's connection with the Kavala – Drama – Serres road axis. It is also related to the improvement of infrastructure and facilities of the urban port for its operation as a cruise and marina port.

Regarding infrastructure, it is worth noting that the Region has strategically invested to a large extent in its integration into international transport networks. However, the delay in the development of the vertical axes of the Egnatia Motorway and in combined transport systems significantly reduces the expected positive outcomes, also due to the underutilization—caused by lack of appropriate infrastructure—of the ports of Kavala and Alexandroupolis. The Region of Eastern Macedonia and Thrace aims to reverse this situation and enhance its infrastructure in the future.



(Source: Map P.1 of the Regional Spatial Framework, 2018)

Figure 5–15: Spatial Development Model of the Region of Eastern Macedonia and Thrace

According to Article 1, the following general objectives of the RSF are defined:

- Strengthening the position and role of the region at international, EU, and national levels, within the framework of territorial cohesion policies for integrated, balanced, and sustainable development, with controlled competitiveness of spatial systems and the interregional area.
- Halting recession, reinforcing social cohesion, and ensuring the region's sustainable economic prosperity.

- Enhancing territorial cohesion at an intra-regional level by forming viable development units and ensuring a balanced and complementary distribution of productive activities across the territory.
- Prudent and effective resource management, including land resources, by promoting synergies among them and encouraging reuse both in the production process and in urban development.
- Addressing climate change challenges and limiting the environmental impacts of the energy and transport sectors, giving priority to the development of RES and the redesign of the transport system within the framework of regional planning.
- Protection, integrated promotion, and exploitation of the region's rich natural and cultural environment, which is recognized as an important development asset and a comparative advantage of the region.
- Recognition of landscape as an important factor of well-being and quality of life, and promotion of its protection and enhancement as an equal component of spatial planning and development programming policies. Sustainable land management and provision of guidelines for land organization, development of productive activities, and protection of the natural and cultural environment and landscape in subordinate planning, by setting prioritized goals and utilizing the available tools of spatial and environmental planning.

According to Article 15 of the RSF, to address the impacts of climate change, the development of a Regional Adaptation Plan is promoted. For areas of agricultural and livestock activities, the primary objective is the sustainable management of soil, water resources, and biodiversity in agricultural ecosystems and grazing lands, through appropriate adaptation of cultivation techniques. The development of a Sustainable Agricultural Development Program at the regional level is promoted for climate change adaptation and risk management from natural disasters. For forest areas, measures are foreseen for the protection of forest ecosystem biodiversity and the reduction of wildfires. For coastal zones, hazard zones are to be defined according to the characteristics and vulnerability of each area. For urban areas, adaptation of urban planning to potential changes in the microclimate of the built environment is foreseen, as well as the reduction of thermal and energy needs of buildings through energy-saving measures.

Finally, it is noted that according to Article 19 of the RSF, it is stipulated that: the design and implementation of projects and actions under the Plan must take into account the guidelines for addressing and adapting to climate change. At a minimum, projects must be compatible with national and local greenhouse gas emission reduction plans, the national energy planning framework, the National Adaptation Strategy to climate change (Articles 42 and 45 of Law 4414/2016), and the corresponding regional adaptation plans (Article 43 of Law 4414/2016).

<u>As such, the Project under assessment aims to mitigate the impacts of climate change through the storage of carbon dioxide and does not contradict the objectives set by the RFSPSD for the same purpose.</u>

5.7.2 Special Spatial Planning and Sustainable Development Frameworks

This **section** examines the compatibility of the project with the provisions and guidelines of the following **Special Spatial Planning and Sustainable Development Frameworks (SSPSDFs)** that have been institutionalized to date and may be related to the activities and facilities of the project under assessment:

- SSPSDF for Industry (Joint Ministerial Decision 11508/2009, Government Gazette 151/AAP/2009).
- SSPSDF for Renewable Energy Sources (Joint Ministerial Decision 49828/2008, Government Gazette 2464/B/2008), (currently under revision).
- SSPSDF for Aquaculture (Joint Ministerial Decision 31722/2011, Government Gazette 2505/B/2011).

It is important to note that the Ministry of Environment and Energy has initiated the process of drafting the **SSPSDF** for Mineral Raw Materials. The purpose of this framework is to formulate policy guidelines for the spatial organization of the sector in conjunction with existing land uses, based on sustainable development, highlighting the country's comparative advantages, preserving and protecting cultural and natural heritage. It also aims to develop a spatial organization model that promotes and strengthens the competitiveness and strategic resource enrichment, while aligning with the national strategic plan for the exploitation of mineral wealth, offering legal certainty—a prerequisite for attracting investment.

5.7.2.1 Special Spatial Planning and Sustainable Development Framework for Renewable Energy Sources (RES)

The Special Spatial Planning and Sustainable Development Framework for Renewable Energy Sources (SSPSDF–RES), approved by Joint Ministerial Decision 49828/2008 (Government Gazette 2464/B/2008), concerns the comprehensive spatial planning of all categories of RES projects throughout Greece. According to Article 1, the minimum goal of the SSPSDF–RES is to achieve Greece's contractual targets for addressing climate change and promoting RES, as derived from its European and international obligations.
It is noted that the SSPSDF–RES is currently under revision, with no definitive approval date available at this time.
<u>The project under assessment is not directly related to this framework, as it does not concern a RES project. However, it is worth noting that it indirectly contributes to the achievement of the framework's objectives (e.g., addressing climate change) and does not negatively impact its provisions or planning in any way.</u>

5.7.2.2 Special Spatial Planning and Sustainable Development Framework for Aquaculture

The SSPSDF for Aquaculture (SSPSDF–Aqua), issued by Government Gazette 2505/B/2011, addresses the categorization of four specific aquaculture sectors:

1 Marine aquaculture (excluding shellfish farming).

2 Shellfish farming.

3 Freshwater aquaculture.

4 Aquaculture of aquatic organisms in natural brackish ecosystems.

The SSPSDF–Aqua defines the spatial planning framework at two levels:

- Spatial allocation and planning of aquaculture units in the marine area.
- Spatial allocation and planning of the main production activities, associated, and supporting facilities in the terrestrial area.

The framework identifies and categorizes suitable areas for aquaculture development (referred to as Areas of Aquaculture Development – AAD), based on their characteristics and the current level of aquaculture activity. These areas reflect the suitability for aquaculture development. From a spatial planning perspective, they represent broader search zones for hosting areas (Organized Aquaculture Development Areas – OADA or Informal Unit Clusters – IUC) and individual units.

These areas are classified into five (5) categories:

1 Highly developed areas requiring improvements, infrastructure modernization, and environmental protection and enhancement.

2 Areas with significant potential for further development of marine aquaculture.

3 Remote areas with high potential for marine aquaculture development.

4 Environmentally sensitive areas where installation and operation conditions must be adapted to the specific environmental characteristics.

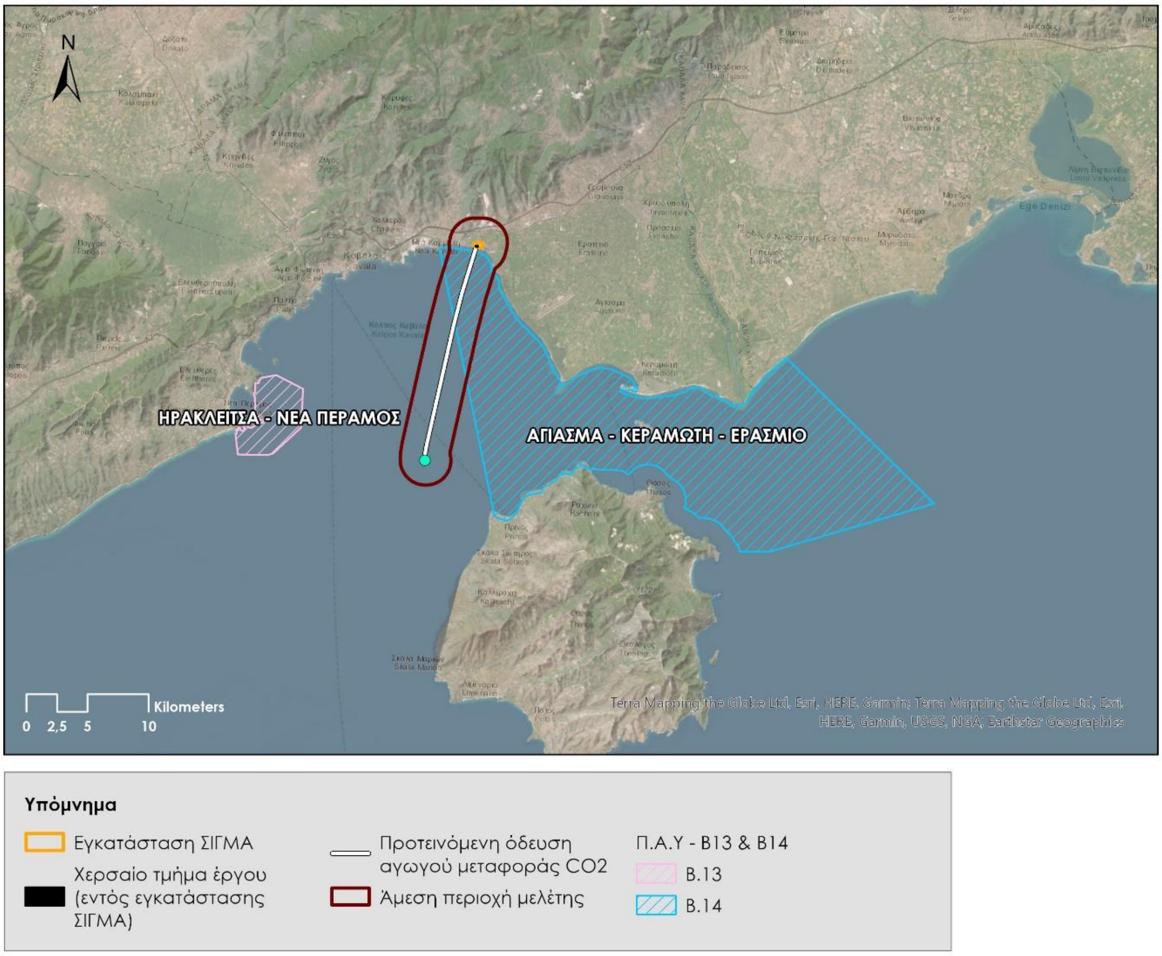
5 Spot-location areas.

The standard model for marine aquaculture unit placement includes the installation of units within **Areas of Aquaculture Development (AAD)** and the establishment of individual units.

Specifically, units may be installed:

- Within AADs:
  - i. In Organized Aquaculture Development Areas (OADA), as defined in Article 10 of Law 2742/1999 (as currently in force).
  - ii. In Informal Unit Clusters (IUC), which represent a transitional phase toward organized OADAs.
  - iii. Individually.
- At individual sites, within or outside AADs, subject to specific criteria

According to the Aquaculture Spatial Planning Framework (Government Gazette 2505/B/04.11.2011), part of the project falls within AAD B14 "Agiasma–Keramoti–Erasmio" (covering fish farming, shellfish farming, and other aquatic organisms), and is located approximately 10.6 km from Area B13 "Iraklitsa–Nea Peramos", as shown in the following figure. These AADs are classified as Category B areas, meaning they have significant potential for further aquaculture development.

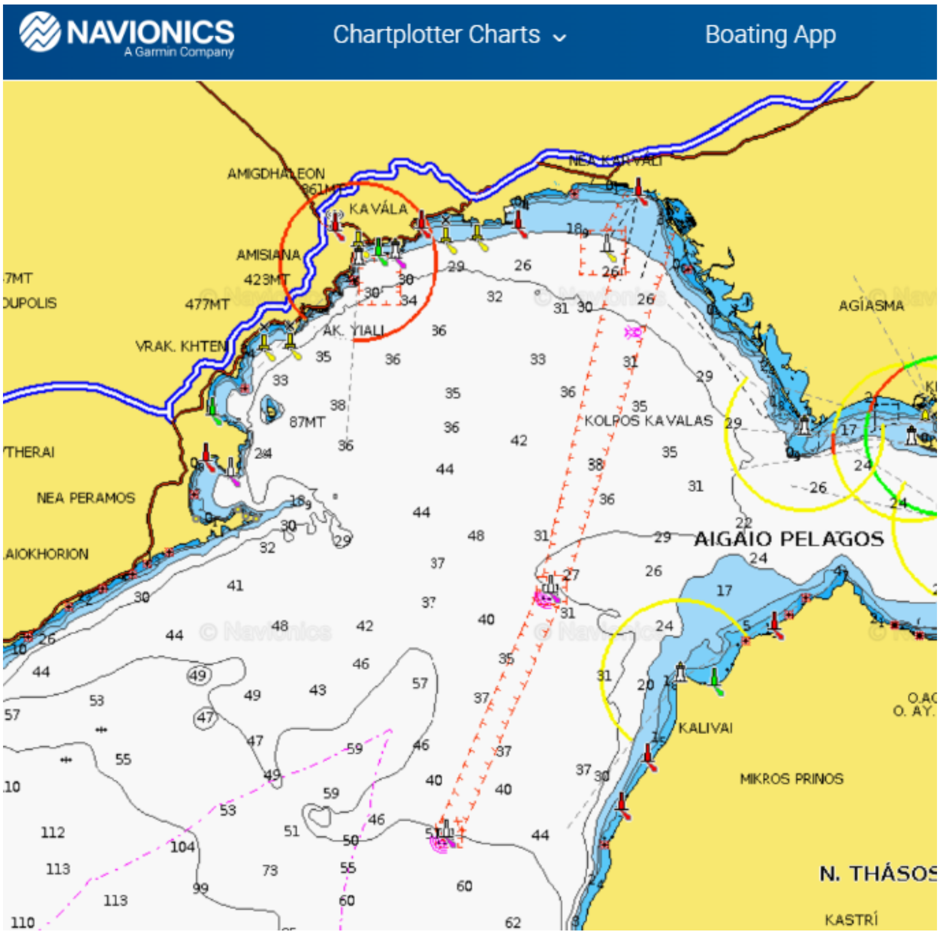


(Souce: Government Gazette (ΦΕΚ) 2505 B / November 4, 2011, own processing)

Figure 5–13: Aquaculture Development Areas (ADAs)

According to the following figure (https://webapp.navionics.com/#boating@8&key=qjywF%7BlquC), for the already operational and environmentally licensed project (Environmental Approval No. οικ8413 / 24-04-2018, ADA: ΨΓΛ14653Π8-Ζ79 titled *"Environmental terms approval for the Prinos Offshore Development Project"*), a zone within the Aquaculture Development Area (AAD) is defined (between the red lines) through which pipelines pass, and within which anchoring and any form of fishing is strictly prohibited.

Given that the pipeline under consideration will pass through this already designated zone, it is not expected to further affect the uses of the AAD. Therefore, the project is considered compatible with the SSPSDF for Aquaculture.



(Source: Navionics)

Figure 5–17: Prohibited anchoring and fishing zone in the project area

Within the framework of the 1st River Basin Management Plan (RBMP), regarding marine waters, coastal water bodies associated with the AADs listed in Table 1 of the Annex of JMD 31722/4.11.2011 were included in the Monitoring Program as protected areas under Directive 2006/113/EC.

According to the Detailed Justification Document of the Updated River Basin Management Plan (RBMP[8]) – 2nd Revision, in the Thrace River Basin District (EL12), there are currently twenty-nine (29) aquaculture units in operation, of which twenty-four (24) are registered in the Registry of Aquaculture Product Production Enterprises Holding a Veterinary Registration Number for Fish. Of the 29 units, nine (9) are fish farms (six freshwater and three marine), and twenty (20) are coastal mussel farms. All marine aquaculture units are located within the Aquaculture Development Zones (ADZs) B.14 and D.2, as defined in Joint Ministerial Decision 31722/4.11.2011.

[8] It is noted that the Detailed Justification Document for the "Update of the Register of Protected Areas" of the 2nd Revision of the River Basin Management Plan (RBMP) for the Thrace Water District (EL12) has not yet been published. However, it is available in the relevant documents that have been submitted for public consultation on the official website of the Ministry of Environment and Energy (YPEN): (https://wfdver.ypeka.gr/el/project/consultation-el12-45-2revision-protected-areas-gr/)

Additionally, within the boundaries of the Thrace RBD (EL12), there are twenty-five (25) potentially exploitable lagoons. Of these, eighteen (18) lagoons and two (2) lakes — Ismarida and Vistonida — are currently under exploitation. These exploited lakes and lagoons cover a total area of approximately 77,200 stremmas (7,720 hectares). The most significant of these areas is Lake Vistonida, covering 45,000 stremmas. Also considered important exploitable fishing grounds are the lagoons of Agiasma, Erateino, Vassova in the broader Keramoti area, as well as the lagoons of Rodopi (Porto Lagos, Lagos, Ismarida, etc.).

According to the 2nd Revision of the RBMP (EL11), in the Eastern Macedonia River Basin District (EL11), a total of sixteen (16) aquaculture units are in operation, of which three (3) are fish farms, seven (7) mussel farms, and six (6) spirulina cultivation units. Furthermore, within the coastal water body "Strymonikos Gulf" (EL1106C0001N), there is one (1) marine Mediterranean fish farm and five (5) mussel farms. The plan also includes all four (4) coastal water systems of the Eastern Macedonia RBD (EL11).

5.7.2.3 Special Spatial Planning and Sustainable Development Framework for Industry

The Special Spatial Planning and Sustainable Development Framework for Industry (SSPSDF-I) was approved by Joint Ministerial Decision 11508/2009 (Government Gazette 151/AAP/13-4-2009) and includes guidelines related to the macro-spatial organization of industry, as well as its siting at the local level in connection with land uses, with a planning horizon up to 2021. Among other provisions, the SSPSDF-I notes that the sectors of petroleum and coal products are stagnant (section B.9), while in section B.17, it states: “The adequacy of energy supply — both conventional and renewable — to industrial and other professional installations and storage facilities is of fundamental importance.”

According to this Special Spatial Framework, the Region of Eastern Macedonia and Thrace is characterized by a developmental deficit, and the strategy will focus on increasing GDP and achieving convergence. Priority will be given to the completion of transport infrastructure, including vertical road axes and multimodal transport systems, along with the adjustment of planning for the Egnatia Odos (Egnatia Highway) connections to areas of economic activity.

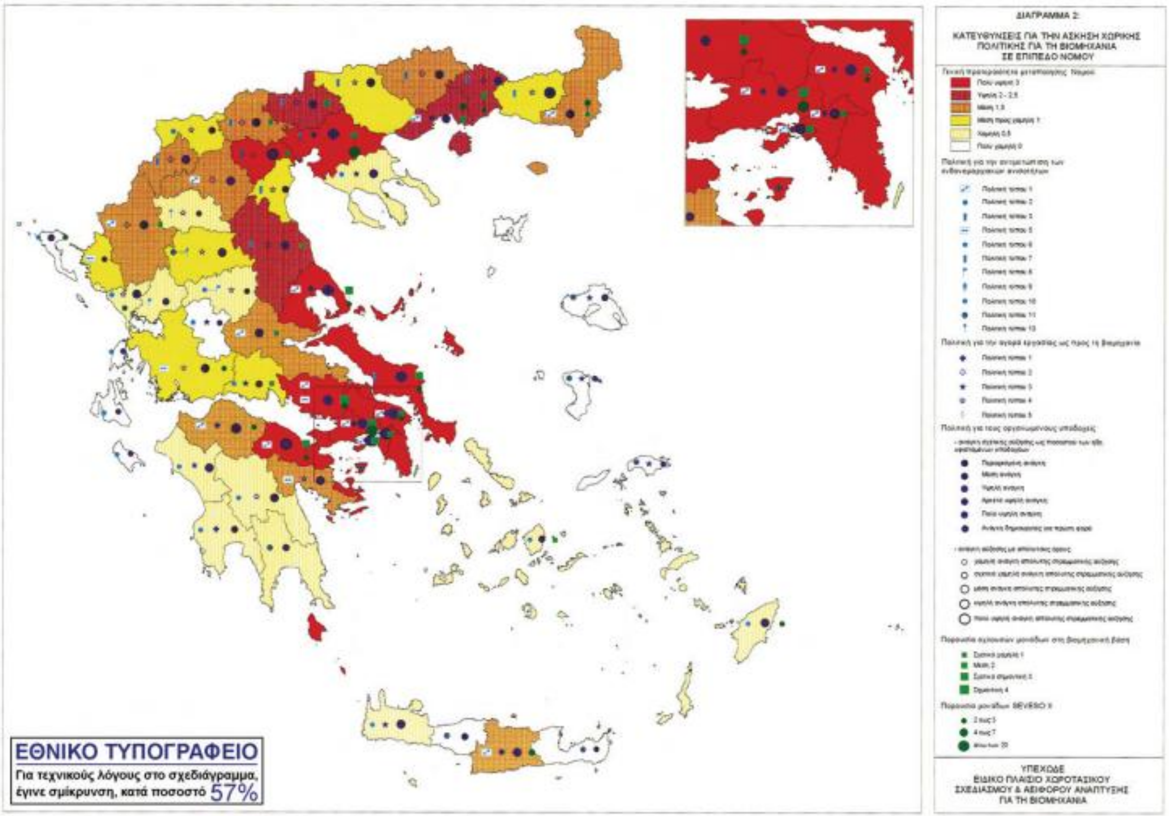
Land use policy includes the following **directions:**

- Preventing roadside development of processing units along non-enclosed motorways and the rest of the main road network, which are considered strong elements of the spatial organization of industry.
- The siting of new units based on the general provisions of off-plan construction legislation is considered unacceptable in the peri-urban area of Kavala and in the suburban zones of major urban centers.
- The scale of the existing processing base necessitates facilitating on-site transformation of scattered existing units.

In general, spatial inequalities in relation to medium-intensity industry are primarily intra-regional and should be addressed at the respective level.

Specifically, the Prefecture of Kavala, where the project's onshore installations are administratively located, is characterized as a high-priority area for spatial policy for manufacturing. The spatial organization of manufacturing is focused on a broad zone centered in Kavala, which covers the entire southern part of the prefecture, oriented along the Egnatia Highway and continuing beyond the prefecture westward — forming part of a wider inter-prefectural industrial axis. The completion of this axis creates further conditions for strengthening this industrial zone.

It is also noted that **industrial activity in the Prefecture of Kavala** has been institutionalized since 1977 with the establishment of the Kavala Industrial Area (VI.PE Kavala), which demonstrates significant need for properly planned reception areas — both for new units and for relocations.



(Source: Map 2 of the Special Spatial Framework for Industry, 2009)

Figure 5–18: Guidelines for spatial policy implementation for industry at the prefectural level

Specifically for the Prefecture of Kavala, Annex I of the Special Spatial Framework for Industry provides the following guidelines:

- **Sectoral priorities:** Although the industrial base is relatively small in absolute terms, it is characterized by existing integration, with the presence of clusters 2, 3, and 4. However, the absence of cluster 1 activities, as well as economies of scale, are limiting factors regarding the long-term sustainability of the prefecture's traditional industrial specialization. In this context, the sectoral priorities include support for clusters 2 (primarily) and 3, as well as intra-sectoral modernization. Finally, the prefecture is strongly specialized in two extraction sectors: sector 11 (oil extraction, etc.)—being the only one in the country—and sector 14 (other mining and quarrying activities), which have led to the strong development of the associated manufacturing sectors: sector 23 (production of petroleum refining products), sector 24 (chemical manufacturing), and sector 26 (non-metallic mineral products). These dependencies reflect spatial commitments and should be supported through spatial policies.

- **Land uses and relation to other activities:** Tourism has a relatively strong presence, with potential for tourist exploitation of mountainous resources and the interior in general, as well as for expanding tourist activity towards the coastal zone. The industrial sector's environmental and spatial characteristics render land use conflicts between the two activities likely. Detailed spatial planning in the southern part of the prefecture is therefore necessary.
- **Environmental impacts of industry:** High. There is a need for specific anti-pollution measures. Additionally, the presence of a significant number of SEVESO-type facilities requires the effective preparation of a Major Technological Accident Response Plan (MTARP).
- Policy for areas with particularly low industrial presence (intra-prefectural disparities): Type 1 policy.
- Industry and labor market: Type 3 policy.

The Industrial Area of Kavala (Government Gazette 152D/1981, FEK 1465D/2003) is located within the Regional Unit of Kavala. It has been developed over an area of 2.08 km² in the settlement of “Pontolivado”, northeast of the city of Kavala, along the (old) Kavala–Xanthi National Road.

The aquaculture area is included in the plan of the Special Spatial Planning Framework for Aquaculture (Government Gazette 2505B/04.11.2011), and more specifically in areas B13 and B14. The offshore development zone lies outside the designated aquaculture activity zone.

The Kavala Industrial Park was established by Joint Ministerial Decision (JMD) 22773/1887/24-10-2005 (Government Gazette B-1466), which defines its location, area, boundaries, the type of Industrial Area, the environmental terms, and the agencies responsible for establishing and implementing the Industrial Park.

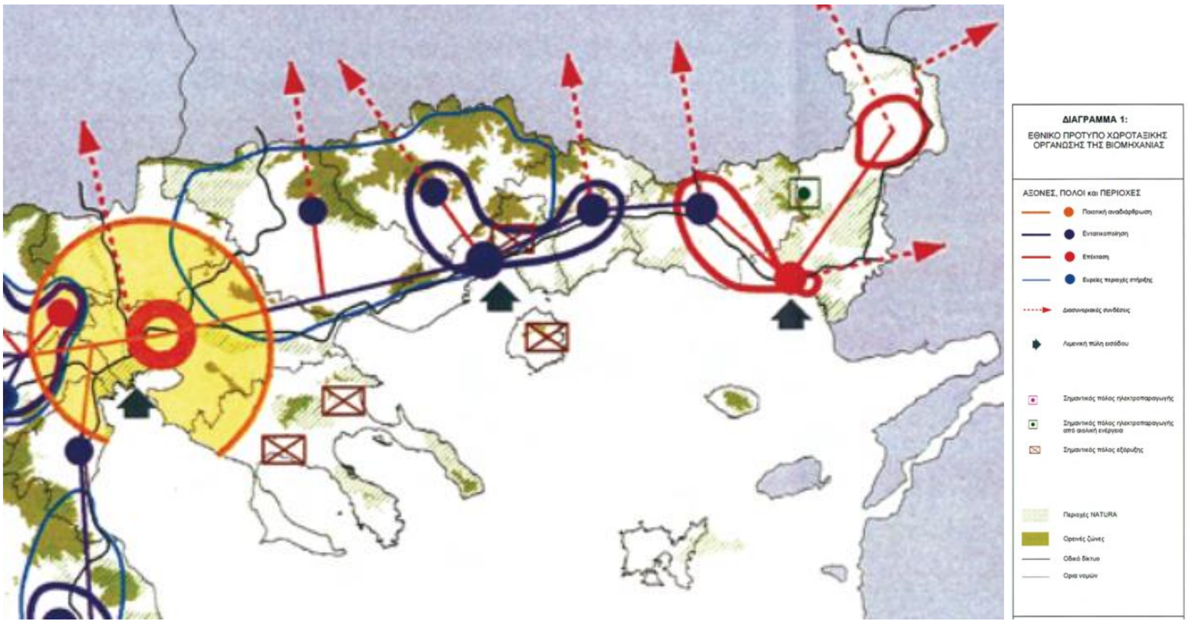
The above Special Spatial Framework for Industry complements the already approved:

- General Spatial Planning and Sustainable Development Framework (Government Gazette 128/3.7.2008),
- Special Spatial Framework for Aquaculture (Government Gazette 2505/B/4.11.2011),
- Special Spatial Frameworks for Tourism (Government Gazette 1138B/11.6.2009, FEK 3155B/12.12.2013),
- Special Spatial Framework for Renewable Energy Sources (RES) (Government Gazette 2464B/3.12.2008).

Finally, existing and planned future activities related to the oil and natural gas industry located in the wider Kavala region and Eastern Macedonia include:

- Underground storage facilities,
- DESFA pipelines,
- The Trans Adriatic Pipeline (TAP),
- The Greece–Bulgaria Interconnector (IGB).

Lastly, it is noted that both the Burgas–Alexandroupolis oil pipeline and the South Stream pipeline have already been approved.



Source: National Spatial Planning and Sustainable Development Framework for the Industrial Sector

Figure 5–19: National Spatial Organization of Industry

Regarding the onshore facilities of the Project, these are located in an area designated as "Industrial Park" land use, according to the Land Use Map of the General Urban Plan (GUP) of the Municipality of Kavala. They comply with the directions and requirements of both this Plan and the National Spatial Planning Framework for Industry (SPPF-I). Overall, the project under study fully aligns with the specifications, requirements, and guidelines of the aforementioned SPPF-I.

5.7.3 Legal Framework of Land Uses in the Study Area

The onshore SIGMA facilities of the Project are located within the Land Use Control Zone (ZOE) of the Municipality of Kavala, as defined by Government Gazette 437D/1989, as shown in the following Figure:

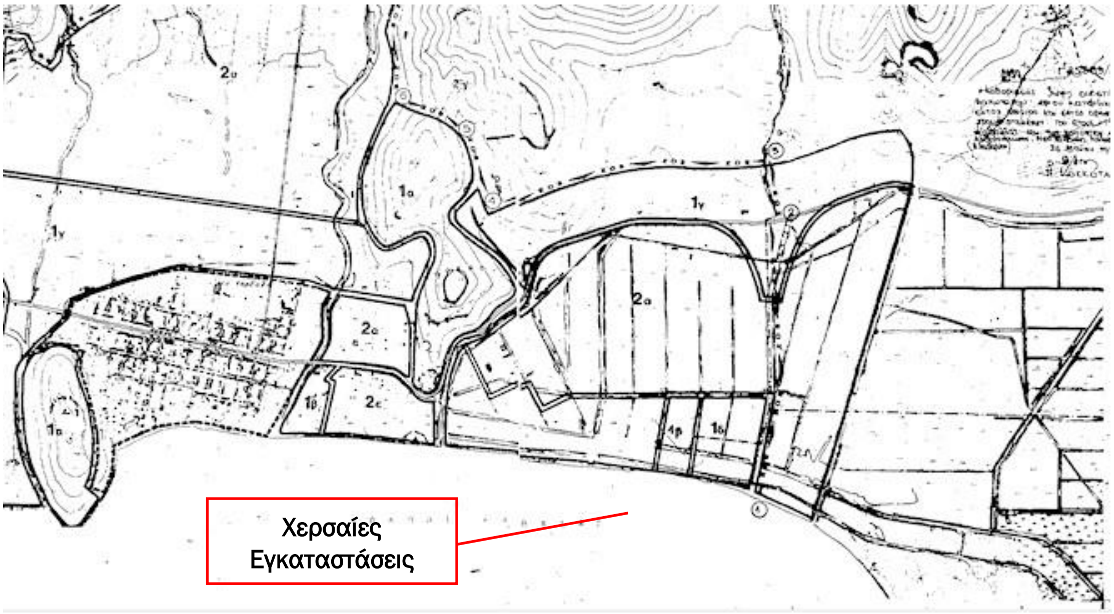


Figure 5–20: ZOE Zones of the Municipality of Kavala within the study area (Source: Map P11-A of the ZOE of the Municipality of Kavala, Gov. Gazette 437D/1989)

As shown in the above Figure, the onshore facilities of the Project fall under Zone 1d of the ZOE of the Municipality of Kavala, with the designated use as "existing nuisance-causing uses".

In the broader **onshore area of the Project**, the following have been defined:

- The General Urban Plan (GUP) of the Municipality of Kavala (decision no. 5248π.ε./04-02-2013), published in Gov. Gazette 69/AAP/11-03-2013.
- A Local Urban Plan for the community of Nea Karvali, Kavala Prefecture, published in Gov. Gazette 487D/1989-08-07, titled: "Approval of Local Urban Plan for the community of Nea Karvali, Kavala Prefecture, for the designation of a site for a regional Market".
- A Land Use Control Zone (ZOE) for the out-of-plan and out-of-settlement-limit areas predating 1923 in the Municipality of Kavala (Kavala Prefecture) and the communities of Amisiana, Amygdaleonas, Nea Karvali, Chalkero, and Kokkinoxoma (Kavala Prefecture), according to Gov. Gazette 326D/1995.
- The General Urban Plan (GUP) for the settlement of Chrysoupoli, published in Gov. Gazette 814D/26-08-1987.

It is also noted that the **Local Spatial Plan (LSP)** of the Municipality of Kavala is currently under development, based on Law 4447/2016 "Spatial Planning – Sustainable Development and other provisions", which includes the municipal unit of Philippi.

The GUP aims to define the guiding principles of urban planning for sustainable residential development. Specifically, it aims to:

1. Gradually enhance and organize space,
2. Ensure the structured organization of settlements by aligning residential parameters, protecting the environment, and halting unregulated development, through development criteria that contribute to optimal use of land extensions,

3 Upgrade the environment, especially degraded areas, by ensuring necessary social infrastructure, technical facilities, and land use control in accordance with urban planning standards and suitability criteria, and

4 Protect, enhance, and environmentally upgrade the centers, cultural hubs, traditional cores of settlements, green spaces, and other elements of the natural, archaeological, historical, and cultural environment of cities, settlements, and the rural space.

According to the aforementioned GUP of the Municipality of Kavala, the designated land uses are presented in the following **Table.**

Table 5-28: Land Uses According to the GUP of the Municipality of Kavala

Land Use	Total Area (m²)	Area Distribution
Unknown	12.661,6	0,1%
Sports	156.039,5	1,7%
Other Use (Proposed Parking Area)	1.054,4	0,01%
Grove	69.861,3	0,8%
Pure Residential	431.103,3	4,7%
Recreation	5.701,5	0,06%
Urban Green Space	1.150.955,8	12,6%
General Residential	5.118.925,5	56,2%
Reservoir	1.616,0	0,02%
Administration	32.217,4	0,4%
Special Urban Planning Area	57.071,1	0,6%
Education	524.266,0	5,6%
City Center	301.060,7	3,3%
Social Services	119.777,2	1,3%
Port	6.258,1	0,07%
Other Uses (Proposed Parking Area)	688,3	0,01%
Healthcare	62.039,6	0,7%
Master Plan Area of Kavala Port Authority	57.579,2	0,6%
Cultural Activities	80.653,1	0,9%
Proposed Beach Expansion	38.818,3	0,4%
Proposed Bus Station	4.667,9	0,05%
Welfare	45.455,9	0,5%
Fire Station	2.846,6	0,03%
Watercourses	27.849,0	0,3%
Settlement Section Under Transitional Provisions	13.517,5	0,1%
Local Neighborhood Center	484.766,7	5,3%
Tourism – Recreation	282.521,5	3,1%
Parking Area	18.215,4	0,2%

In the majority of the total area covered by the GUP of the Municipality of Kavala, the prevailing land uses are General Residential (56.2%) and Pure Residential (4.7%). Additionally, significant areas are occupied by Urban Green Space (12.6%), Education (5.6%), and Local Neighborhood Center (5.3%). The aforementioned uses account for approximately 84.4% of the total area covered by the GUP of the Municipality of Kavala.

The main land uses near and within the onshore facilities of the Project, according to the Land Use Map of the aforementioned GUP, are presented in the following **Figure.**

The onshore facilities of the Project, according to the said map, fall within a Secondary Sector Activity Development Area (non-nuisance industries).

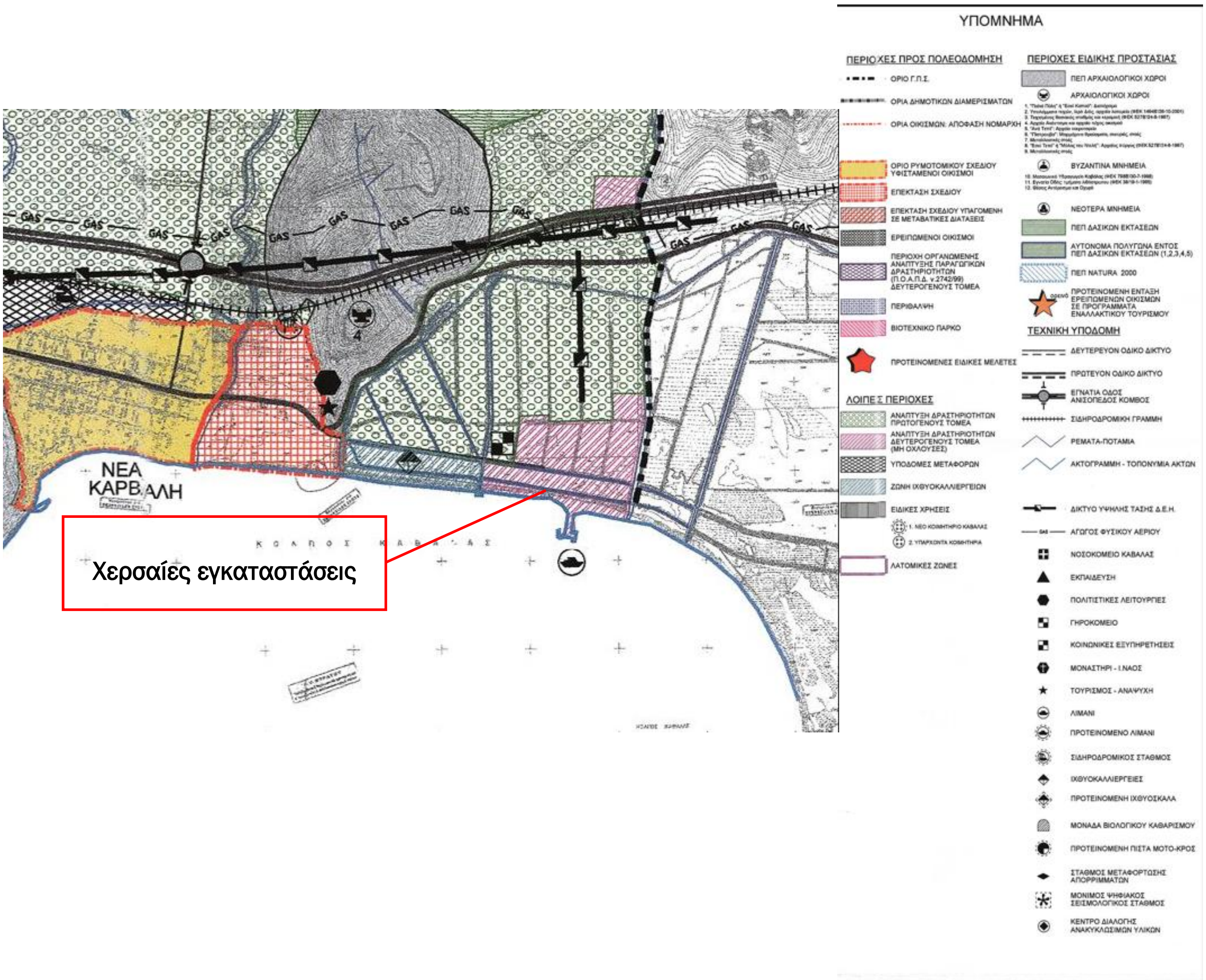


Figure 5–21: Designated Land Uses Near the Onshore Facilities of the Project
(Source: Land Use Map, General Urban Plan of the Municipality of Kavala – Official Gazette (FEK) 69/AAP/11-03-2013)

<u>The spatial planning applicable in the broader project area is </u>defined by:

- The Special Framework for Spatial Planning and Sustainable Development for Industry, which considers the Prefecture of Kavala as an important oil extraction area.
- The Special Framework for the Spatial Organization of Aquaculture Activities (FEK B 2505/2011), according to which the offshore development area lies outside the aquaculture activity zone.
- The Regional Framework for Spatial Planning and Sustainable Development (RFSP&SD) of the Region of Eastern Macedonia and Thrace (FEK B 1471/2003), the guidelines and standards of which align with the existing offshore and onshore hydrocarbon facilities in the Gulf of Kavala.

According to the General Urban Plan (GUP) of the Municipality of Kavala (FEK 69/AAP/11-03-2013), the area of the onshore facilities of the Project falls within an Organized Area for the Development of Productive Activities (OADPA) of the Secondary Sector. This zone is designated for urban development according to Law

2742/1999 and the provisions of the Special Spatial Framework for Industry (Joint Ministerial Decision 11508/2009 – FEK 151/AAP/13-4-2009), and includes the area west of Nea Karvali, between the Egnatia Highway and the transport zone of the new port, being designated as a "General Purpose Receptor".

Within this area, the "Hellenic Fertilizers ELFE" industrial unit is already present, as well as the currently established Industrial and Business Park (BIO.PA.), which is part of the broader area. During urban planning, the exact boundaries of the pre-existing lake and neighboring properties will be defined. Furthermore, within the area under urban development, the establishment of a "Freight Center" is foreseen, in accordance with Law 3333/2005. The new receptor will be subject to the building terms of the BIO.PA. For the siting of low and medium nuisance units in the area, and until its urban development, the provisions of the current legislation for out-of-plan construction apply.

Finally, new activities falling under the SEVESO II directive are excluded. Permitted project and activity categories include Category B and Category A2 (Joint Ministerial Decision 15393/2332, FEK 1022/5–8–2002). For these categories, and according to JMD 13727/724/2003 (FEK B 1087/2003), units of low and medium nuisance levels are applicable.

At the national level, no maritime uses have been formally designated, except for the Special Spatial Planning Framework for Aquaculture, which was enacted in November 2011 (FEK 2505/B/2011).

The main uses that may be developed in **marine areas** include:

- Fishing
- Aquaculture
- Shipping and maritime transport
- Military uses and activities
- Research and protection of the marine ecosystem & underwater antiquities
- Renewable energy production
- Hydrocarbon and mineral extraction
- Tourism / Recreation

Given the absence of an established Maritime Spatial Framework and corresponding Marine Spatial Plans (MSPs), spatial planning in the maritime area of the proposed project is defined by the existing maritime spatial planning – i.e., the applicable Special and Regional Spatial Frameworks, which relate to specific economic sectors (e.g., RES, industry, aquaculture) and include spatial planning guidelines for the development of each sector in terrestrial, coastal, and marine areas (to a lesser extent).

At the national level, no marine uses have been designated, with the exception of the Special Spatial Planning Framework for Aquaculture, which was enacted in November 2011 (FEK 2505/B/2011). According to this Framework (FEK 2505 B/04.11.2011), part of the project falls within the PAZ B14 "Agiasma–Keramoti–Erasmio" (fish farming, shellfish farming, other aquatic organisms), while it lies 10.6 km from PAZ B13 "Nea Iraklitsa–Nea Peramos." These PAZs are classified as Category B, i.e., aquaculture development areas with potential for further expansion.

However, it is important to note that all coastal and offshore facilities of the proposed project will be developed in locations with existing infrastructure or in areas where restrictions are already in place due to the presence of the Prinos offshore hydrocarbon extraction project (e.g., the CO_2 transport pipelines will be installed within an already designated zone).

5.7.4 Special Management Plans

5.7.4.1 National Waste Management Plan (NWMP)

The National Waste Management Plan (NWMP) was approved by Cabinet Act No. 39/31-08-2020 (Government Gazette 185/A/2020) and amended by Cabinet Act No. 5 of 18.4.2023 (Government Gazette 94/A/18.4.2023). It was drafted in accordance with Articles 22 and 35 of Law 4042/2012 (Government Gazette 24/A/2012) for the implementation of Article 28 of Directive 2008/98/EC, with a time horizon of 2020–2030. The NWMP sets out the strategic directions for reducing the negative impacts of waste generation and management, decreasing the overall impact of natural resource use, and improving resource efficiency in order to achieve the desired high level of protection of the environment and human health.

In this context, the new National Waste Management Plan (NWMP) sets as its primary goal the reduction of municipal solid waste (MSW) landfilling to less than 10% by 2030. Achieving this target will be pursued through a series of measures, including waste prevention, the introduction of new and the strengthening of existing separate waste streams, the promotion of reuse, the increase of recycling rates, the development of the secondary materials market, public information and awareness campaigns, the rapid development of bio-waste and recyclable material collection networks, the creation of modern waste and bio-waste management facilities (WMFs and BWMFs), the significant upgrade of Material Recovery Facilities (MRFs), and, within this framework, the utilization of Waste Treatment Units (WTUs) and Recycling Recovery Units (RRUs) for the sorting of recyclable materials. It also includes the calculation, per municipality, of the quantity of recyclable materials and corresponding impurities, as well as the energy recovery of alternative (secondary/refuse-derived) fuels and processing residues.

Particular emphasis is also placed on recycling and Source Separation (SS), with the separate collection of bio-waste implemented nationwide by the end of 2022. At the same time, the plan calls for intensified efforts for the separate collection of four recyclable waste streams, giving priority to strengthening the collection of recyclable materials.

Within the framework of the new NWMP, waste is grouped into the following streams, as shown in the table below.

Table 5-18: Categories and quantities of waste generated at the national level according to the new NWMP

Waste category	Production in reference year 2018 (tons)	Percentage of the total
Municipal-type waste		
Municipal solid waste	**5.523.809**	**17,9%**
Municipal-type sludge	**11.021**	**0,4%**
Industrial waste (excluding those included in alternative management or other categories)		
Industrial non-hazardous waste	**7.469.790**	**24%**

Waste category	Production in reference year 2018 (tons)	Percentage of the total
Industrial hazardous waste	**99.655**	**0,3%**
Agricultural and livestock waste		
Agricultural and livestock waste	12.469.086	40,3%
Other hazardous waste		
Waste containing asbestos, waste from packaging of hazardous substances, waste containing polychlorinated biphenyls (PCBs) / triphenyls	2.994	~0%
Excavation, construction, and demolition waste		
Construction and Demolition Waste & Excavation Waste	4.943.092	16%
Other waste streams subject to alternative management		
Waste (of lubricating) oils, end-of-life vehicles, waste from vehicle and industrial batteries, waste electrical and electronic equipment, used vehicle tires	303.602	1%
Hazardous waste from healthcare units (HWU)		
Purely infectious hazardous waste, mixed hazardous waste, and other hazardous waste	17.770	0,1%
Total Production	**30.943.819**	**100%**

(Source: ΦΕΚ 185/Α/2020)

The main waste streams that may be generated during the construction of the Project, which fall under the categorization of the approved NWMP, are as follows:

- I. Municipal-Type Waste
- II. Excavation, Construction, and Demolition Waste (ECDW).
- III. Other waste streams subject to alternative management.

<u>The proposed Project meets the specifications for prevention, minimization, and proper management of the above waste streams as recommended by the NWMP. Each waste stream generated will be managed in accordance with the provisions of the applicable legislation, as detailed in the Waste Management Plan (WMP) of the project, which accompanies this document.</u>

The WMP includes practices for the prevention and minimization of generated waste and the management methodology for each waste stream. The final disposal of each waste stream will be carried out by appropriately licensed entities and alternative management systems in accordance with the current applicable legislation.

5.7.4.2 National Hazardous Waste Management Plan (NHWMP)

The National Hazardous Waste Management Plan (NHWMP) was approved by Ministerial Decision 62952/5384/2016 (Government Gazette 4326/B/2016) and was drafted in accordance with Article 31 of Law 4342/2015 for the implementation of Articles 22 and 23 of Law 4042/2012 as currently in force. The objective of the NHWMP is to promote, through integrated and rational management of hazardous waste, the waste hierarchy set out in Directive 2008/98/EC in order to reduce impacts on the environment and public health. At the same time, waste management is intended to contribute positively to economic and social development. Within the framework of the NHWMP, hazardous waste is grouped into the following streams:

- Industrial hazardous waste (IHW)..
- Hazardous waste from healthcare units (HWU).
- Hazardous waste from public utility, public service, etc. installations (PUW).
- Hazardous waste subject to alternative management:
    - Waste oils (WO).
    - Waste from vehicle and industrial batteries (WVIB).
    - Waste from portable electric batteries and accumulators (WPEBA).
    - Waste subject to alternative management that are hazardous or generate hazardous waste during their decontamination: Hazardous waste from end-of-life vehicle decontamination (ELV), waste lamps containing hazardous substances, hazardous waste from decontamination of electrical and electronic equipment (WEEE).
- Waste containing asbestos (hazardous C&D waste).
- Small quantities of hazardous waste in Municipal Solid Waste (SQHW).
- Packaging waste containing hazardous substances.
- Waste containing polychlorinated biphenyls/triphenyls (PCB/TP).

The main streams of hazardous waste expected to be generated during the construction of the project, which fall under the above NHWMP categorization, are as follows:

- Packaging waste containing hazardous substances.
- Drilling waste containing hydrocarbons.
- Hazardous waste subject to alternative management (waste oils, WEEE, lamps, etc.).

<u>The project complies with the prevention, minimization, and proper management specifications recommended by the NHWMP for the above waste streams, as each hazardous waste stream generated will be managed in accordance with the provisions of the applicable legislation, as detailed in the Waste Management Plan (WMP) of the project accompanying this document.</u>

5.7.4.3 Regional Waste Management Plan (RWMP) of the Region of Eastern Macedonia and Thrace

By Joint Ministerial Decision No. 61076/5267 (Government Gazette B'/4123/21-12-2016), the Update of the Regional Waste Management Plan (RWMP) of the Region of Eastern Macedonia and Thrace was approved.

The current RWMP sets out appropriate measures that promote, in a hierarchical and combined manner: a) prevention, b) reuse, c) recycling, d) other types of recovery, such as energy recovery and e) the safe final disposal at the regional level.

The **general objectives** of the RWMP for the Region of Eastern Macedonia and Thrace are:

- Sustainable waste management throughout the Region.
- Prevention and reduction of municipal waste generation, with priority given to the prevention and continuous reduction of packaging waste, (biowaste) food waste, paper, and WEEE, with special emphasis on public awareness and guidance of target groups, supported by the implementation of specialized actions.
- Expansion and modernization of the municipal waste collection and transportation network.
- Strengthening actions that promote the reuse of unwanted products that do not need to be discarded as waste.
- Enhancing recycling by encouraging alternative management systems for packaging and other products.
- Utilization of the various materials contained in municipal waste (recycling) and energy recovery from them, in order to conserve resources and energy and reduce the rate of final disposal.
- Safe final disposal: environmentally acceptable final disposal in sanitary landfill sites (SLS) of that portion of municipal waste which is not subject to further treatment.
- Remediation of environmental damage: cessation of operation, gradual restoration, and environmental upgrading of sites polluted by uncontrolled disposal of municipal waste.
- Application of the proximity principle.
- Public information and awareness-raising to ensure active participation and responsibility of citizens in the management of solid waste.
- Full alignment with Joint Ministerial Decision 29407/3508/2002, which requires significant upgrading and transformation of management bodies, changes in the project planning and permitting processes, immediate introduction of waste treatment technologies, changes in the costing of provided services, and imposes stricter operating rules for sanitary landfills (SLS). The ultimate goal is to construct as few sanitary landfills as possible, operate them according to higher standards, and gradually convert them into engineered sanitary landfills with material recovery (SLSMR).

According to the aforementioned RWMP, the total production of municipal solid waste (MSW) for the Regional Unit of Kavala in 2015, as well as the projections for MSW production for the years 2015–2020, are presented in the following tables.

Table 5-19: Categories and quantities of municipal solid waste (MSW) generated at the regional level according to the RWMP

Waste category	Production for the reference year 2015 (tons)
Regional Unit of Kavala	
Total MSW (Municipal Solid Waste)	52.118
Participation in % of total production in EMTH (EMTH = Eastern Macedonia and Thrace)	21,2%
Waste from industries/private individuals/companies	970
Recyclables	797
Glass	125
WEEE (Waste Electrical and Electronic Equipment)	490
Green Waste / Household Composting	2.049

(Source: Government Gazette 4123/B/2016)

Table 5-20: Estimated quantity of MSW generated up to 2020 according to the RWMP

	2015	2016	2017	2018	2019	2020
Regional Unit of Kavala	52.118	52.879	53.651	54.434	55.229	56.035
Regional Unit of Thasos	10.855	11.013	11.174	11.337	11.503	11.671
Eastern Macedonia and Thrace (EMTH)	**245.960**	**249.551**	**253.194**	**256.891**	**260.642**	**264.447**

(Source: Government Gazette 4123/B/2016)

In addition to the current RWMP, in June 2021 the Regional Association of Solid Waste Management Bodies (FoDSA) of Eastern Macedonia & Thrace issued the RWMP Guide, to establish comparable targets between the existing situation in 2025 and further projections for 2030. The main findings of the Guide are summarized below:

- In the Region of Eastern Macedonia and Thrace, none of the MRF/MBT facilities planned in the 2016 RWMP have been completed. The MRF/MBT projects for the Eastern Sector, as well as the MBTs of Prosotsani and Paranesti, have been contracted. The MRF/MBT of the Western Sector and the MBT of Drama are at an advanced stage of readiness, while the remaining projects have very low (MRF of Northern Evros and MRF of Samothraki) or zero readiness (MRF of Thasos, MRF of Xanthi, MBTs of Northern Evros, MBTs of Xanthi and Komotini, MBTs of Thasos and MBT of Pangaio). For the purpose of estimating the achievement of the 2030 targets, it is assumed that all projects planned in the 2016 RWMP will be completed and operational by 2030.
- The total capacity of the planned MBT facilities, as well as the capacity at the project level, is sufficient to achieve the biowaste recycling target for 2030.
- The achievement of the residue target can be realized through energy recovery.

The waste management system of the Project aligns with the above directions of the updated RWMP, as mentioned earlier, since during construction and operation, practices for prevention and minimization of waste generation are foreseen, along with appropriate management of each waste stream according to the applicable legislation, as detailed in the Project's Waste Management Plan (WMP) accompanying this document.

5.7.4.4 Local Waste Management Plan (TOPSDA) of the Municipality of Kavala

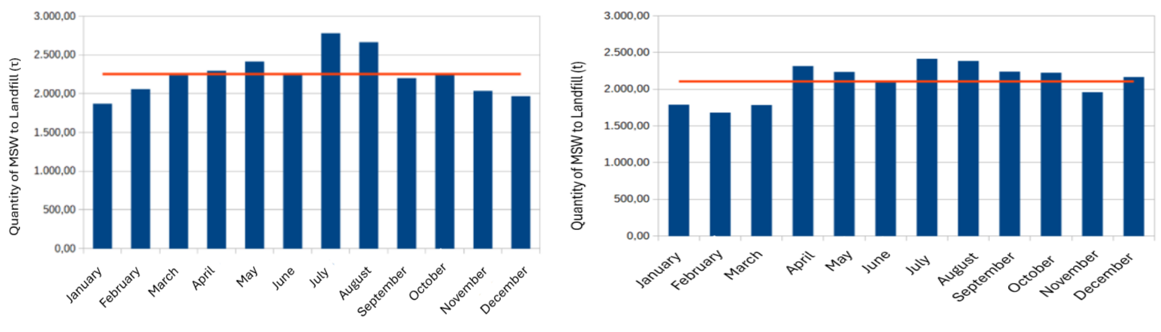
The main national targets for the management of Municipal Solid Waste (MSW) in the Local Waste Management Plan (TOPSDA) of the Municipality of Kavala (2021) are summarized as follows:

- Practical implementation of the waste management hierarchy, where sanitary landfill — always and only after appropriate pre-treatment of waste — will be the last option. The maximum percentage of municipal waste sent to sanitary landfill by 2030 should not exceed 10%.
- Mandatory universal separate collection of organic waste by December 31, 2022.
- Recycling of packaging waste must reach 65% by weight by 2025 and 70% by weight by 2030, while specific targets are set for individual packaging waste types.
- Increase preparation for reuse and recycling of MSW to at least 55% by weight by 2025 and 60% by weight by 2030.
- Energy recovery from MSW residues and secondary (refuse-derived) fuels.
- Safe final disposal in Sanitary Landfill Sites (XYTA/XYTY) for the entire country.
- Definitive closure and rehabilitation of all existing Illegal Dumping Sites (ΧΑΔΑ) by 2022.

The main focus of the Local Plan, beyond the obvious compliance with the requirements of Law 4819/2021 (Government Gazette 129 A'), consists of:

- Source Separation (SS) of organic biodegradable waste.
- Source Separation (SS) of recyclable materials (paper, glass, plastic, and metals), beyond packaging waste, through an extensive network of Recycling Corners and Green Points.

The monthly variation of the Municipal Solid Waste (MSW) generated in the Municipality of Kavala and entering the facilities of the Kavala Landfill (XYTA), during the period 2019–2020, is summarized in the following diagrams. In the same diagrams, the average annual MSW input to the Kavala Landfill facilities is also shown (with a red line).



Source: The Local Waste Management Plan of the Municipality of Kavala, 2021

Figure 5–14: Monthly variation of Municipal Solid Waste (MSW) loads to the Kavala Landfill (XYTA) for the years 2019 (left) and 2020 (right)

t is noted that, based on the projections of the Waste Management Plan (WMP) of the Project accompanying this document, the quantities of municipal waste generated both during the construction and operation phases cause a negligible burden on the municipal waste management system of the municipality and on the final disposal – landfill facilities.

According to the relevant data, the monthly distribution of MSW (Municipal Solid Waste) production in the Municipality of Kavala entering the Kavala Landfill (XYTA) facilities during the period 2017–2020 is summarized in the **table** below.

As shown in the **table**, approximately 46% of the total annual MSW (Municipal Solid Waste) production is expected during the tourist season from May to September, while around 19.8% of the total annual MSW production in the Municipality of Kavala is anticipated during the July–August period. In contrast, MSW production appears to be at its lowest during the January–February period (approximately 6.8% and 6.6% of the total annual MSW production, respectively).

Table 5-21: Monthly distribution of Municipal Solid Waste entering the facilities of the Kavala Landfill Site (2017–2020)

Month	Distribution of MSW production (% of total annual production)
January	6,80%
February	6,59%
March	7,66%
April	8,37%
May	9,15%
June	8,42%
July	10,02%
August	9,75%
September	8,66%

Month	Distribution of MSW production (% of total annual production)
October	8,77%
November	8,17%
December	7,65%
TOTAL	100%

The project's waste management system is in line with the directions of the Local Waste Management Plan, as it has already been mentioned that during both the construction and operational phases, practices for the prevention and minimization of generated waste are foreseen, along with the appropriate management of each waste stream in accordance with the applicable legislation, as specified in the Waste Management Plan (WMP) accompanying this document.

5.7.4.5 River Basin Management Plans of the Water Districts (RBMP)

The project study area falls within the Water Districts (WD) of Eastern Macedonia (EL11) and Thrace (EL12), for which River Basin Management Plans (RBMP) have been developed in accordance with the specifications of Directive 2000/60/EC, pursuant to Law 3199/2003 and Presidential Decree 51/2007, and approved by Decision 1005/12-09-2013 of the National Water Committee.

The 2nd Revision of the River Basin Management Plan for the Eastern Macedonia Water District (EL11) was approved and published in Government Gazette A 82/12.06.2024, while the 2nd Revision of the River Basin Management Plan for the Thrace Water District (EL12) was approved and published in Government Gazette A 81/12.06.2024.

The Eastern Macedonia WD (EL11) consists of one (1) river basin, that of **Strymonas (EL1106),** whereas the Thrace WD (EL12) consists of five (5) river basins: **Nestos (EL1207)**, Remnants of Xanthi – Xerorema (EL1208), Remnants of Komotini – Loutrou Evrou (EL1209), Evros (EL1210), and Thasos – Samothraki (EL1242).

The terrestrial facilities of the proposed project fall entirely within the Nestos River Basin while the proposed pipeline route passes through both the Nestos and Strymonas River Basins. Within the project study area, **the river water body Asprochoma R. (EL1106R0009010092N)** is recorded, with a total length of 17.21 km. It is located west of the project’s terrestrial facilities at a **distance of approximately 1.7 km.**

Within the study area, the transitional water body LTH (Λεκάνη Υδρολογικής Τάξης) of the Wider Keramoti Area (EL1207T0001N) is found, covering a total area of 7.7 km².

The study area, specifically part of the proposed pipeline route, lies within two coastal water bodies of the Nestos and Strymonas River Basins. Specifically, it is located **within the coastal water bodies Western Gulf of Kavala (EL1106C0004N) and Eastern Gulf of Kavala (EL1207C0001N).**

The study area falls within three (3) groundwater bodies: the Nestos Delta GWB (EL1200060), the Mountain Basin GWB (EL1200070), and the Symbolos-Kavala GWB (EL1100130). **The terrestrial facilities fall entirely within the Nestos Delta GWB.**

More detailed information is provided in Chapter 8 of the present study.

The Groundwater Body of the Mountain Basin (EL1200070) is designated for human consumption and is therefore protected by the following Basic Measures:

- **M12B0401:** Definition and delimitation of zones and/or protection measures for water abstraction points intended for human consumption from groundwater bodies.
- **M12B0402:** Protection of groundwater bodies included in the register of protected drinking water areas and establishment of a regulatory protection framework.
- **M12B0403:** Protection of water abstraction works from surface waters for water supply purposes.
- **M12B0404:** Implementation of Water Safety Plans.

Additionally, the Groundwater Body Delta of Nestos (ΥΥΣ Δέλτα Νέστου - EL1200060) is protected by the following Basic Measures:

- **M12B0501** : Restrictions, terms, and conditions for the construction of water abstraction works for groundwater extraction (wells, boreholes, etc.) for new uses, as well as for the extension of existing water use permits in groundwater bodies with poor quantitative status.
- **M12S0801** : Prohibitions, restrictions, and conditions for the construction of new water abstraction works.
- **M12S0802** : Special regulations for the protection of groundwater bodies with good quantitative statusbut facing increased quantitative pressures.

<u>The project does not conflict with the provisions and measures of the 2nd Revision of the River Basin Management Plan</u>

5.7.4.6 Flood Risk Management Plan (FRMP) of the River Basin District (RBD)

Part of the study area of the Project (onshore facilities) falls within RBD12 "Thrace", for which a Flood Risk Management Plan (FRMP) has been prepared and approved in accordance with Government Gazette 2688/B/2018.

The onshore facilities are located within the boundaries of the Potentially High Flood Risk Zone (PHFRZ), named: "Xanthi – Komotini Plain (Lowland Zones of the rivers Nestos, Kosynthos, Kompsatos, Aspropotamos, Bosbozis, Filiouris and riparian areas of Lake Vistonida)" with code GR12RAK0001, as also shown in the following **Figure**. It is also noted that the onshore facilities fall within the flood-prone areas for a return period of T=100 years (flooding due to Mean Sea Level rise).

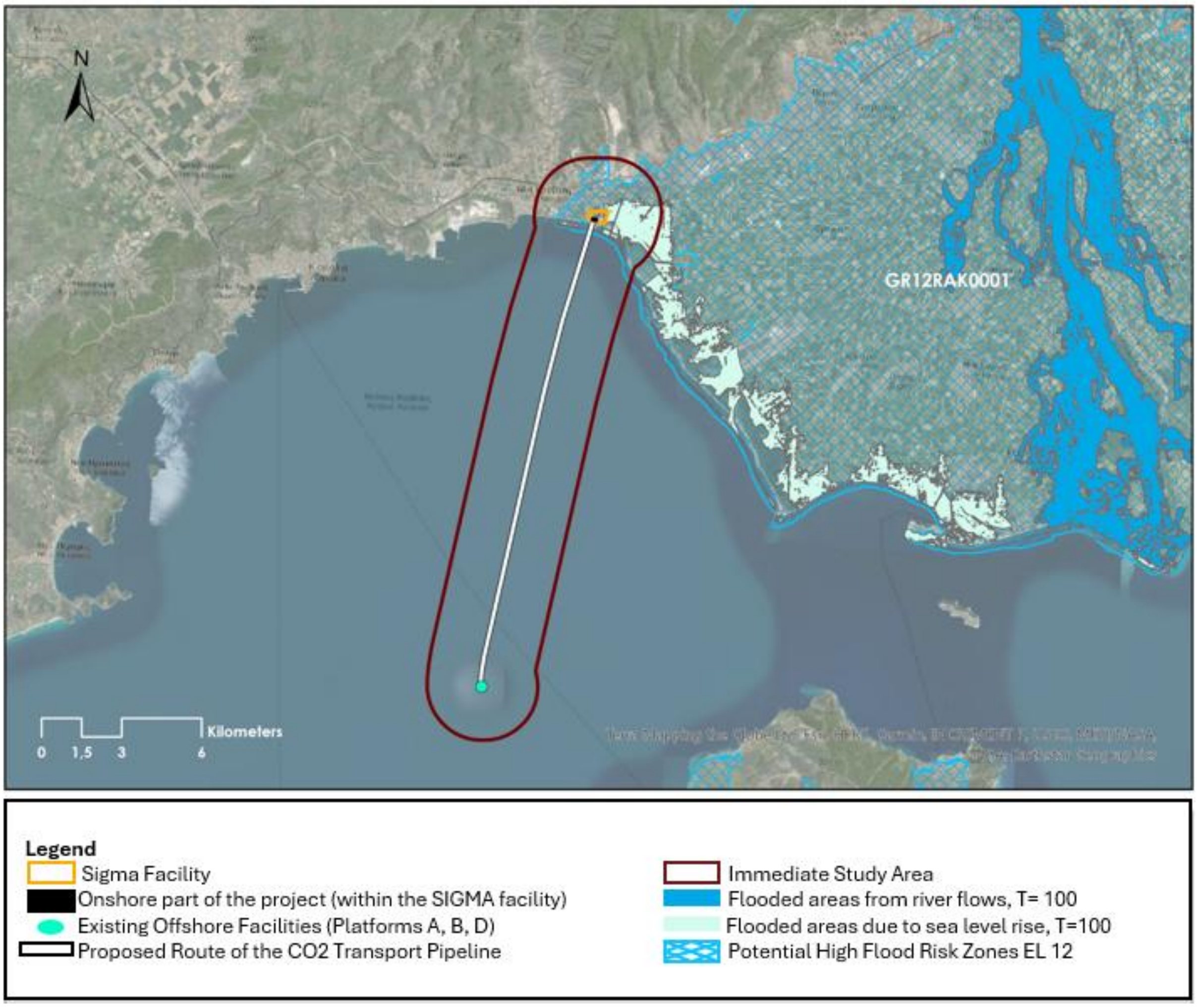


Figure 5–15: Excerpt from the Flood Hazard Map of the Nestos River Basin District (Source: Flood Risk Management Plans (FRMP) RBD EL12)

The following are the measures proposed in the Flood Risk Management Plan (FRMP) that are related to the operation of the project and its protection against potential flood risk.

Table 5-22: Flood Risk Management Plan (FRMP) Measures Related to the Project

Measure Code	Measure name	Observations
EL_12_35_28	Monitoring of the Coastal Zone	Development and maintenance of a shared database for monitoring the coastline and the coastal zone of the Potentially High Flood Risk Areas (PHFRAs). Monitoring of the coastal zone will also contribute to climate change adaptation (sea level rise and protection against coastal flooding).
EL_12_42_20	Integration into Internal Emergency Plans and SEVESO Safety Reports (SATAME) of Impact Assessments and Protective Measures Against Pollution Spills Following Flood Events Based on Flood Risk Maps	The internal Emergency Plans are a mandatory requirement for SEVESO facilities. More detailed information is provided in Chapter 8.

Measure Code	Measure name	Observations
EL_12_43_21	Public awareness campaigns targeting the general public, local authorities, and communities regarding flood risk.	-
EL_12_44_24	Strengthening the technical, organizational, and administrative capacity of involved agencies in flood protection matters.	-
EL_12_53_26	Upgrading/Creating a damage assessment and compensation mechanism for buildings due to flooding.	-

The project complies with the prescribed measures of the relevant Flood Risk Management Plan (FRMP), as its design incorporates all the recommended measures of the FRMP, with particular emphasis on the impacts from the rise of the mean sea level (MSL). Additionally, it is noted that within the framework of this study, the risk from inland water floods as well as the corresponding risk from the rise of the MSL are examined and evaluated (**Chapter 11**). Specialized measures for prevention, minimization, response, and restoration of impacts are also proposed (**Chapter 12**), through which the project is safeguarded against potential flood risks.

5.7.5 Organized Activity Receptors

According to the guidelines of the revised Regional Spatial Planning Framework (RSPF) of Eastern Macedonia, published in Government Gazette 248/AAP/2018, the following are proposed for the spatial organization of productive activities:

- **Primary sector:** Restructuring of the primary sector by reducing dependence on subsidies, increasing competitiveness and outward orientation, and linking with the secondary sector to produce and market higher value-added products. Promotion of multi-cropping in agriculture, increasing employment and productivity in livestock farming, and further utilization of comparative advantages in fisheries.
- **Secondary sector:** Restructuring of the secondary sector—transforming it into an important industrial hub, recognizing branches connected with the primary sector, regional specialization, and export orientation. Promotion of strengthened organized spatial planning, environmental remediation, and functional upgrading of existing industrial clusters with optimal use of existing facilities and creation of necessary infrastructure.
- **Mining activities:** Sustainable exploitation of mineral resources, focusing on restructuring and optimizing extraction methods in the region's main sector—marble mining—while improving effectiveness in environmental and landscape protection and restoration. Specifically for marble quarries, sustainable further development of mining activities is encouraged (notably marble quarries in the regional units of Kavala, Thasos, and Drama) through the establishment of organized zones.

For the organized activity receptors, the following are proposed:

- Actions to improve the attractiveness of the organized receptors.

- Strengthening and, where necessary, cleansing and upgrading of existing receptors according to the use of Law 3982/2011.
- Integration of informal "clusters" into organized receptors and linking activities with other sectors in which the Region holds—or can acquire—a comparative advantage.
- Promotion of the siting of large industrial units within organized receptors to avoid scattered siting of such units.

The Prefecture of Kavala as a whole constitutes an important area for oil extraction and other mining and quarrying activities, which have consequently developed industrial activities for the production of chemical products and exploitation of mineral resources.

The Industrial Area of Kavala (Government Gazette 152D/1981, 1465D/2003) is located within the Regional Unit of Kavala, as shown in the following Figure. It has been developed over an area of 2.08 km² in the region of the settlement "Pontolivado," northeast of the city of Kavala, along the (old) National Road Kavala – Xanthi. The Industrial Area of Kavala is one of the 29 organized industrial zones managed by ETBA (Business & Industrial Parks), with defined building regulations according to Government Gazettes 152D/23-3-1981 and 1465D/31-12-2003.

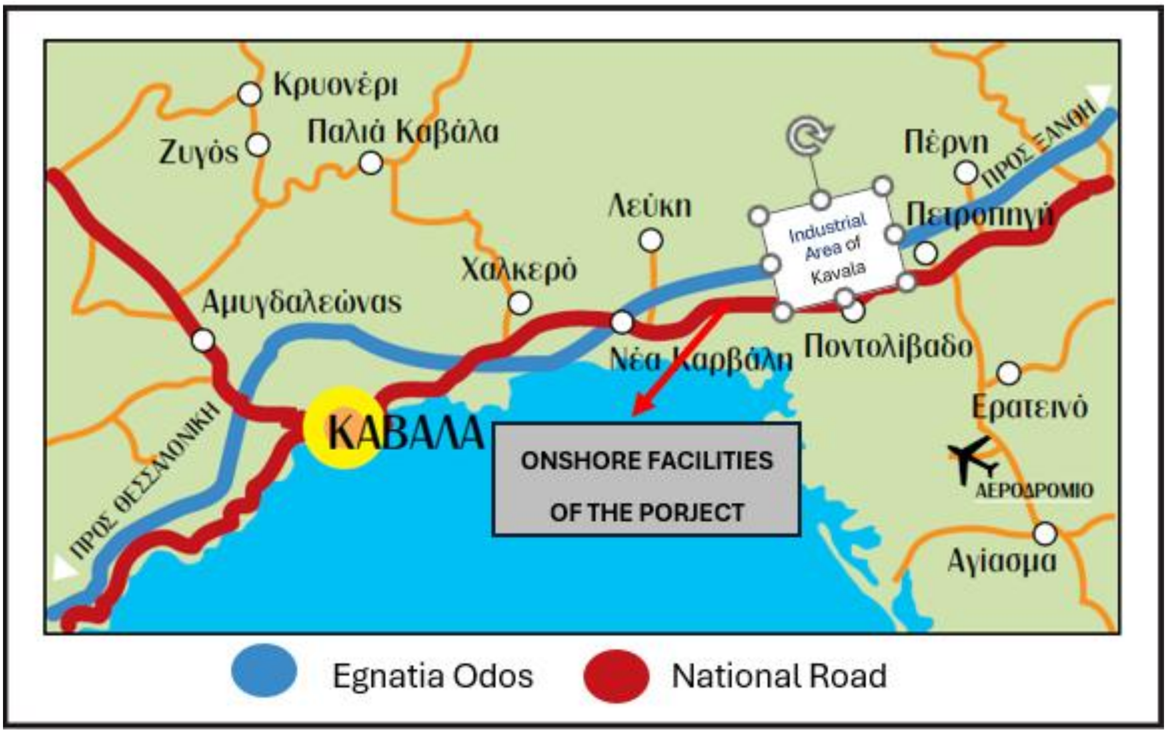


Figure 5–16: (Industrial Area of Kavala
(Source: Business & Industrial Parks ETBA VI.PE) https://www.etvavipe.gr/, 05/06/2024)

The Industrial Park of Kavala was established by the Joint Ministerial Decision (JMD) 22773/1887/24-10-2005 (Government Gazette B-1466), which defines its location, area, boundaries, type of Industrial Area, environmental terms, and the authorities responsible for the establishment and implementation of the Industrial Park.

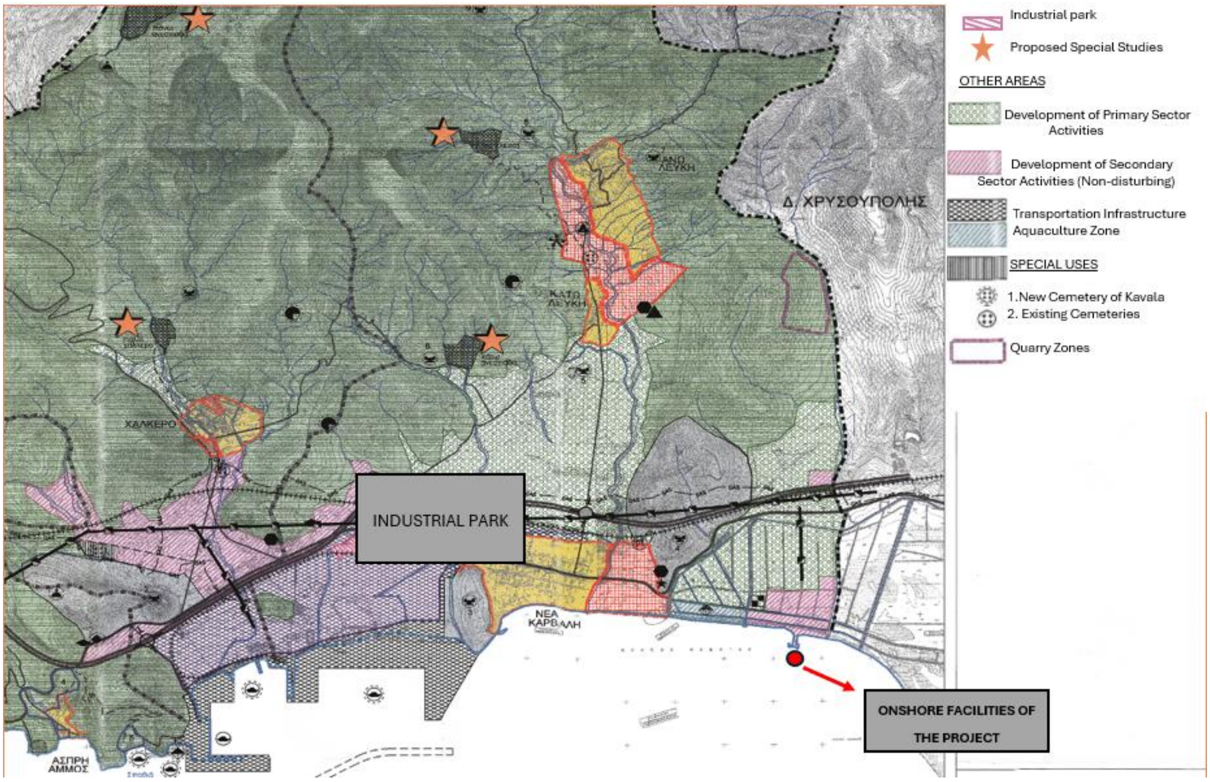


Figure 5–17: Location of the Industrial Park of Kavala
(Source: Land Use Map, General Urban Plan (GUP) of the Municipality of Kavala (Government Gazette 69/AAP/11-03-2013))

Finally, it is noted that the nearest licensed aggregate quarry, according to the Ministry of Environment and Energy's (YPEN) "latomet" portal, is located at Pikro Nero[9], approximately 2 km from the onshore facilities, as well as the quarry at Nea Komi[10], also about 2 km away. Additionally, the quarrying area at Lygaries Neas Komis[11] is situated approximately 3.5 km from the site.

[9] Quarries of N. KORAKAS S.A. (area of 138,000 m²)
[10] Quarries of VOUGIOUKLIS S.A. (area of 25,000 m²)
[11] Quarry Area of N. KORAKAS S.A.

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6 DETAILED DESCRIPTION OF THE PROJECT DESIGN

6.1 PROJECT DETAILS

The project under study is a full-scale CO_2 storage facility in Prinos. The operation of the facility is planned to be developed in two distinct phases (Phase 1 and Phase 2), for reasons of scalability and adaptation to market conditions.

- During **Phase 1**, an initial nominal capacity of up to 1 MTPA (million tonnes per annum) is planned for a period of 20 years (starting at the end of 2025 or early 2026). The CO_2 will primarily be supplied in bulk via a pipeline reaching the boundary of the onshore facility**,** under suitable conditions for injection.Small quantities of CO_2 will also be received at the Sigma onshore facilities from trucks**,** through pilot CO_2 capture projects**.**
- During **Phase 2**, an expansion is planned to reach a final nominal capacity of up to 3 MTPA. The facility will be modified to accept liquefied CO_2**,** which will be delivered by marine carriers at a newly constructed jetty.

The present study focuses on **Phase 1** of the Project. The CO_2 sources and the main reception processes during Phase 1 of operation will be as follows:

- **Bulk CO_2 supply via pipeline**: An onshore station located within the Sigma facilities, consisting of the reception manifold for the onshore CO_2 pipeline, will receive up to 1 MTPA of compressed CO_2. The CO_2 stream will then be transported through a new dedicated pipeline to an existing offshore platform, where the CO_2 will be injected through specialized injection wells.
  The CO_2 stream will originate from remote producers and is assumed to be delivered under pressure and temperature conditions suitable for injection into the wells. The CO_2 reception manifold will route the CO_2 stream to the Prinos offshore facilities complex via a 12–16" pipeline, 20 km in length. The CO_2 pipeline will initially handle up to 1 MTPA of compressed CO_2, but it is designed to also accommodate the project's future planned capacity of 3 MTPA. The riser (vertical inter-platform connection pipe) for the CO_2 pipeline will be equipped with Emergency Shutdown Valves (ESDVs) for isolation. In addition, to prevent low temperatures in the piping and the formation of hydrates/salts near the well area, the installation of an electric start-up heater and a methanol injection system is planned.
- **Reception of CO_2 shipments:** The shipments will arrive by trucks at the Sigma onshore facilities and will be delivered in ISO containers. The containers will be loaded onto supply vessels or a barge using cranes, then transported and unloaded at the existing Beta platform of the Prinos offshore facilities via a flexible hose system.This unloading process involves connecting the vessel and supplying the CO_2 to the platform's piping, where, after appropriate processing, the CO_2 stream will be conditioned to meet the requirements for injection into the well. At the platform, the appropriate conditions for injection will be achieved (pressure of 101 barg, temperature of 20°C), according to the preliminary design study (pre-FEED). The main processing equipment, including a pump/compressor station, will be located on the open deck of the Beta platform. Additionally, the vessel may be equipped with built-in pumps/compressors to increase the pressure of the CO_2 stream, facilitating its flow through the flexible

hose from the ship to the platform. It is noted that provision will also be made for direct injection of CO_2 shipments into the onshore reception manifold, via a compression station during truck unloading.

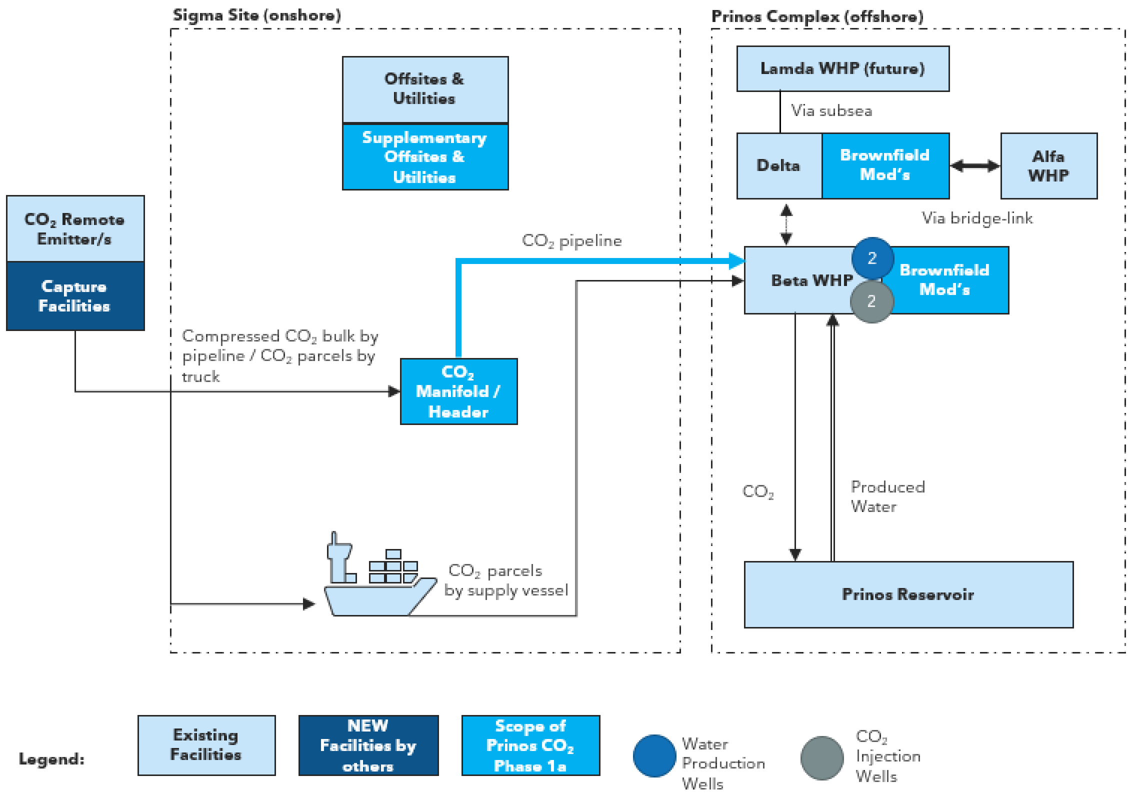


Figure 6-1: Schematic Diagram for Phase 1 of the CO_2 Storage Project in Prinos

The new facilities and wells planned for the operation of the CO_2 storage Project include:

- Onshore facilities: modification of a specific area within the existing site at the Sigma plant for the construction of the reception manifold and an unloading and compression area.
- Offshore pipeline: a subsea pipeline connecting the Sigma plant area with the offshore Beta platform, approximately 20 km in length.
- Offshore platform: modification of the existing Prinos offshore facilities to receive CO_2 from the new subsea pipeline and CO_2 shipments in containers and to inject CO_2 into the new wells.
- Wells: 2 CO_2 injection wells and 2 water production wells on the existing Beta platform of the Prinos offshore complex.

6.2 EXISTING ENERGEAN FACILITIES RELATED TO THE OPERATIONS OF THE PROJECT

6.2.1 Sigma Facilities (Onshore)

Activity Description

The onshore industrial Sigma unit (**Figure 6-2**) includes facilities for the desalination and stabilization of the produced crude oil (from the offshore installations), the separation of sweet gas from the produced sour gas (from the offshore installations), the production of liquid sulfur, as well as the necessary facilities for the safe storage and handling of the produced crude oil, natural gas, and sulfur.

The Sigma unit also includes the necessary auxiliary facilities (typical examples: steam generation and distribution, air compression & dehydration, nitrogen storage, deionized water production, flare system), as well as facilities for the collection, temporary storage, and treatment of the waste generated at each stage of the production process and the personnel's domestic sewage.

Figure 6-2: View of the Sigma plant from south to north

According to Joint Ministerial Decision (JMD) 1958/2012, as amended by Ministerial Decision DIPA/No. 37674/10-8-2016 and Ministerial Decision No. 2307/14-02-2018, the project belongs to Group 9: Industrial activities and related installations, and is overall classified under Subcategory A1. According to the classification table of industrial activities by nuisance levels in JMD No. 3137/191/F.15/2012 as currently in force (Government Gazette 1048/B/2012), the project includes activities of **High** and **Medium** nuisance levels.

Additionally, the project is classified as a top-tier establishment according to Joint Ministerial Decision 172058/2016, complying with Directive 2012/18/EU (Seveso III), as it includes onshore facilities for the storage of stabilized crude oil and liquid fuel gas.

Finally, the project includes the following activities according to NACE Rev.2 / STAKOD 2008:

- 20.13 Production of basic inorganic chemicals by chemical transformation
- 20.13 Production of inorganic chemicals only by simple mixing or hydration of components
- 52.10 Onshore storage facilities for petroleum, liquid fuels, and chemical products
- 52.10 Storage of fuel gases
- 52.24 Cargo handling

The unit has been in operation since July 1981, with brief interruptions during the periods 1998–1999 and 2021–2023. Every 3 years, operations are halted for approximately 15 days as part of the scheduled preventive maintenance of the facilities. The plant is supplied with crude oil and sour gas (raw materials for the production process) produced by the offshore production facilities via subsea pipelines, in accordance with the related Environmental Terms Approval No. oik. 8413/24-04-2018.

The project operator, within the framework of Environmental Terms Approval No. 213450/05-12-2013 (ADA: BLGX0-BF7) and the company's implemented Health, Safety & Environment policy, has established an Environmental Unit within the facilities, with a Responsible Environmental Engineer. At the facilities, a Waste Management Plan (WMP), a Ship Waste Management & Reception Plan, an Emergency Pollution Response Plan, and a Safety and Health Plan and File (SHP-SHF) are implemented. The project operator complies with the specifications and requirements of Joint Ministerial Decision 172058/2016 (Directive 2012/18/EU - Seveso III), as well as the specifications of the International Ship and Port Facility Security Code (ISPS Code) of the International Maritime Organization (IMO).

The area of the Sigma facilities site is 204,059 m^2, and the total building coverage is 3,874 m^2.

A total of 184 people are employed at the project facilities on a permanent basis (daily and in shifts). The technical staff consists of production operators, electricians, equipment technicians, welders, lifting equipment operators, and mechanical equipment maintenance technicians.

The main characteristics of the Sigma unit are presented in the following table.

Table 6-1: Type and size of the Project under study

Type of Activity	Processing – stabilization – storage – transportation of crude oil Processing of acidic gas Production – storage – transportation of liquid natural gas liquids (NGL) Production – transportation of sulfur in solid or liquid form Electricity generation Preparation of drilling mud
Production Capacity	Crude Oil: 27,000 barrels per day (bbl/d) Fuel Gas Mixture: 333,000 normal cubic meters per day (Nm^3/d), with methane content by volume 67.78% and other components 32.2% Sulfur: 478 metric tons per day (MT/d) Electric Power: 17.67 megawatts (MW)

	Liquid Fuel Gas - NGL: 264 cubic meters per day (m^3/d) Drilling Mud: 135 cubic meters (m^3)

The Sigma industrial unit, as environmentally licensed under approval no. 213450/05-12-2013, includes the following processing and production lines, as diagrammatically presented in Figure 6-3:

- Line 1: Crude Oil Processing / Stabilization (Production capacity of stabilized crude oil: 27,000 bbls/day).
- Line 2: Processing of the Produced Acid Gas from the offshore facilities (Production capacity of sweetened gas: 333,000 Nm^3/day).
- Line 3: Production of sulfur in liquid or solid form (Production capacity: 478 MT/day).
- Line 4: Electricity generation for internal consumption using a combined cycle of 2 gas turbines and 1 steam turbine (Production capacity: 17.67 MWe).
- Line 5: Production of liquid natural gas liquids - NGL (Production capacity: 264 m^3/day).

The raw materials feeding the production process of the plant are crude oil and acid gas produced at Energean's offshore facilities and transported to the onshore Sigma facilities via subsea pipelines of the offshore project. According to the most recent data (2023) and the aforementioned licensed capacity, the final products per processing and production line of the Sigma plant are presented in the following Table.

Table 6-2: Products produced in 2023 by the existing Sigma facilities (production data for 2023)

Production line	Product	Production quantity
Line 1	Stabilized Crude Oil	58.405 Mt
Line 2	Fuel gas mixture with volumetric methane content of 67.78% and other components 32.2%	2.120.472 Nm^3
Line 3	Sulfur (liquid)	4.601 Mt
Line 4	Electric power	25 GWh
Line 5	Liquefied Natural Gas liquids (NGL)	1.100 Nm^3

For safety and economic reasons, the produced liquefied natural gas liquids (NGL) are not stored but are entirely blended into the stabilized crude oil. Additionally, the section of Line 3 related to the production of solid sulfur is not operational.

The produced natural gas (i.e., the gas remaining after the treatment of the sour gas) is used as fuel for the operational needs of the onshore and offshore facilities. Approximately 200,000 Nm^3/day of natural gas recirculate from the onshore to the offshore installations, are injected into the well pipelines to support crude oil extraction at the offshore facilities, and return to the onshore facilities mixed with the produced sour gas. In the future, with the planned expansion of the offshore extraction facilities as licensed under the decision no. οικ. 8413/24-04-2018 Environmental Permit, the produced natural gas from the unit will supply the natural gas network of DEPA S.A.

The produced crude oil is supplied to BP Oil International according to the relevant contract between the project operator and the company. The produced liquid sulfur is transported to the fertilizer and chemical industry ELFE S.A. under a related agreement.

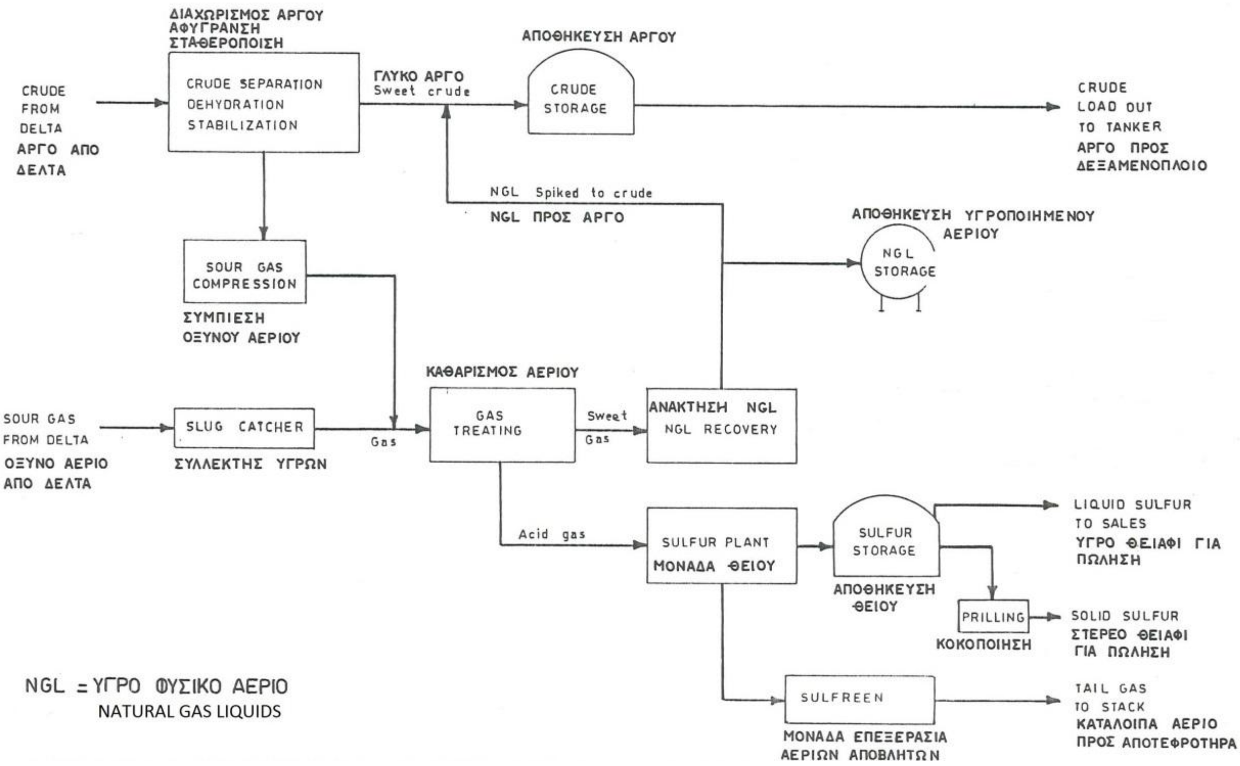


Figure 6-3: Flow diagram of the production process of the Sigma Plant

The main and supporting facilities of the industrial unit, as licensed under permit no. 213450/05-12-2013, include:

- **Main facilities:**
  - Crude oil processing and stabilization unit, with a capacity of 27,000 bbl/d.
  - Acid gas treatment unit, with a capacity of 333,000 Nm^3/d.
  - Liquid sulfur production units, with a capacity of 478 MT/d.
  - Solid sulfur production unit, with a capacity of 10 t/h, which is currently not in operation.
  - Natural Gas Liquids (NGL) recovery unit, with a capacity of 264 m^3/d.
  - Three above-ground floating roof storage tanks for crude oil, with a total capacity of 59,622 m^3, and one backup spherical tank of 1,590 m^3 used for temporary storage of crude oil that does not meet transport specifications.
  - One spherical storage tank for NGL, with a capacity of 556 m^3.
  - Three sulfur storage tanks (1 above-ground and 2 underground), with a total capacity of 3,008 m^3.
  - Tanks and containers for chemical storage.
  - Open storage pits for drill cuttings and oil-based mud, with a total capacity of approximately 3,700 m^3.

    - Outdoor asphalt-paved storage area for solid sulfur, covering an area of 4 stremmas (4,000 m²).
    - Combined Heat and Power (CHP) unit, with a nominal electrical output of 17.67 MWe and steam boiler thermal capacity of 49.04 MW.
- 150 kV High Voltage (HV) substation located within the site, used for connecting the project facilities to the HEDNO (Hellenic Electricity Distribution Network Operator) grid, currently being expanded with an additional transformer bay.
- **Support facilities:**
    - Depressurization network – Flare system.
    - Water softening unit with a capacity of 30 m³/h.
    - Acidic water treatment unit with a capacity of 43.2 m³/h.
    - Spherical acidic water storage tank with a capacity of 858 m³.
    - System of 4 parallel oil-water separators (gravity and coalescence type), each with a treatment capacity of 68.1 m³/h.
    - Drilling mud preparation system with a capacity of 135 m³ to support the company's offshore installations.
    - Ballast and oily water storage tank with a capacity of 11,924 m³.
    - Closed-loop cooling water system with seawater heat exchangers.
    - Jetty, with a total length of 240 meters and surface area of 1,024 m², located south of the facility, used for loading and unloading materials for the offshore extraction installations.
    - Offshore crude oil loading station with a mooring point in an open sea area at a depth of 24 meters, located 3 km from the shore, used for loading/unloading crude oil onto tankers via a 24" subsea pipeline, 3 km in length.
    - 16" subsea pipeline for the transfer of ballast water from tankers at the offshore crude oil loading station to the oily water collection and storage tank TK-661, 3 km in length, operating at a pressure of 6–8 barg.
    - 8" subsea pipeline for the transport of dehydrated sour crude oil from the "Delta" platform to the onshore crude oil loading facilities, 18 km in length, operating at a pressure of 25–30 barg.
    - Secondary municipal wastewater treatment facility with a capacity of 11 m³/day, located within the site, with treated effluent discharged into a nearby channel/ditch and ultimately into the sea.
    - External underground 6" pipeline connecting to the DEPA natural gas network, with a total length of 7.5 km and operating pressure of 30–40 bar.
    - Internal infrastructure networks, including roadways, water supply, sewerage, stormwater drainage, electricity supply, and parking areas.

The facilities are accompanied by the necessary systems and equipment for the prevention and management of accident risks, in accordance with the applicable legislation, such as safety bunds for crude oil storage tanks, corrosion protection systems, a pressure relief and flare network, fire detection systems, hydrogen sulfide and explosive gas detection systems, emergency shutdown systems, a firefighting network, storage areas for personal protective equipment, rescue and first aid equipment, emergency escape gates and an entrance guardhouse, as well as monitoring and data collection networks.

Figure 6.4 presents the existing facilities of the Sigma plant.

Figure 6.5 shows the loading/unloading mooring and the subsea crude oil pipelines.

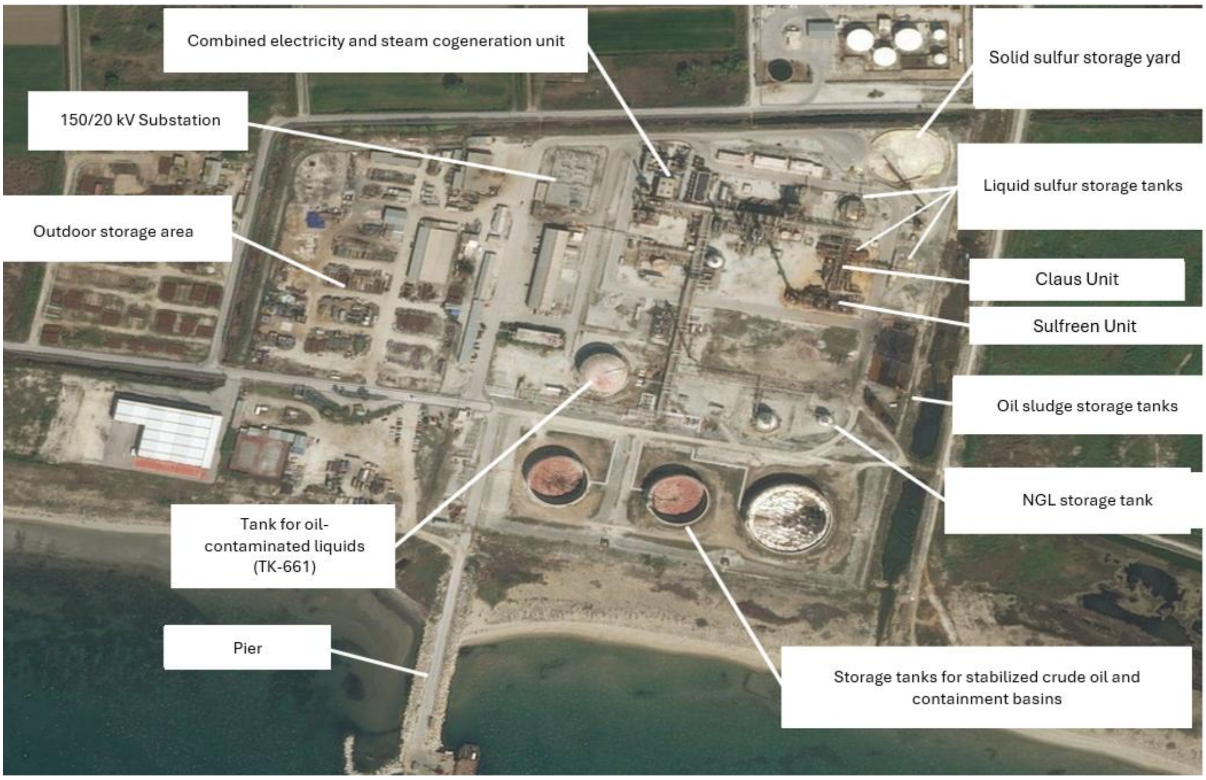


Figure 6-4 Satellite view of the existing project facilities (Bing Maps base layer, 2019)

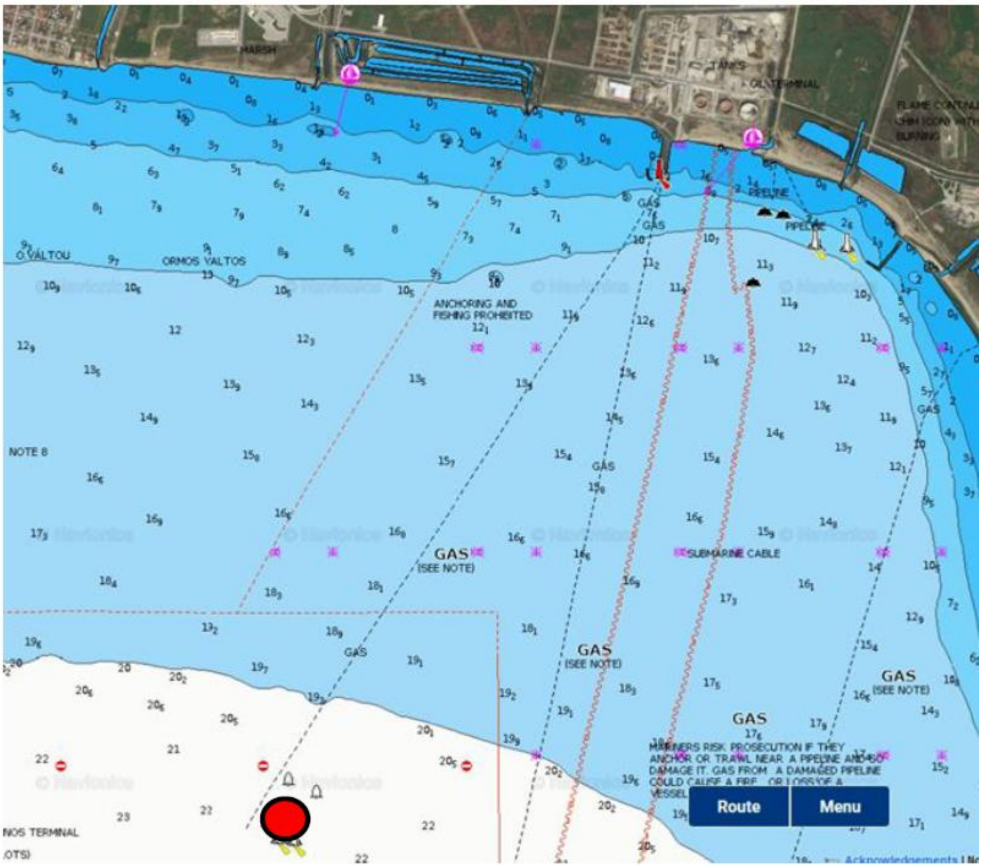


Figure 6-5: Location of the existing crude oil loading anchorage for tankers (marked in red) and the project's 24" and 16" subsea pipelines (background Navionics, 2020, Copernicus, 2020)

6.2.2 Prinos Facilities (Offshore)

According to the valid Environmental Terms Approval Decision DIPA/8413/24.04.2018 (ADA: ΨΓΛ14653Π8-Ζ79), the Prinos Offshore Development project concerns the existing offshore oil and natural gas extraction facilities located in the Gulf of Kavala, in the Northeastern Aegean, as well as their expansion with two new platforms, one of which is planned for the long term. The total production capacity is 27,000 barrels per day of stabilized crude oil.

Figure 6-6: Prinos Offshore Facilities

The key details of the Prinos Offshore Development project are summarized as follows:

- The existing offshore project consists of the following individual facilities (which remain essentially unchanged during the project, with only minor modifications to the Prinos Delta platform for the connection of planned and potential future platforms):
    - The **Kappa** platform is located at the sweet gas reservoir, which is not associated with an oil field, in Southern Kavala.
    - A 12 km, 6-inch pipeline (operating pressure 8–12 barg) transports the sweet gas and condensate from Southern Kavala (Kappa platform) to the Prinos Delta platform.
    - The **Alpha** and **Beta** production platforms each have twelve wellheads; they are part of the Prinos complex and are connected by bridges to the Delta platform. They are designed to accommodate suitable drilling rigs.
    - The Delta processing platform contains all the offshore initial processing facilities and, to date, receives oil, natural gas, water, and condensate produced from the Prinos, North Prinos, Epsilon, and Southern Kavala fields. The Delta platform is connected by bridges to the Alpha and Beta platforms as well as to its own flare stack. New vertical connection risers are being added on the Delta platform to allow the reception of produced fluids from the Lambda platform (and potentially the Omicron platform), as well as to send gas lift and injection water to the Lambda platform. Additionally, a vertical protective conduit is added for the installation of a multiplexer cable that will transmit power, data, communications, and auxiliary fluids to the Lambda platform.
    - The **flare stack** of the Prinos platform complex.
    - An 18 km, 12-inch pipeline (operating pressure 8 barg) for transporting sour natural gas from the Delta platform to the onshore facilities.
    - An 18 km, 8-inch pipeline (operating pressure 20–40 barg) for transporting crude oil from the Delta platform to the onshore facilities.

   - An 18 km, 5.3-inch pipeline for transporting sweet natural gas (gas lift) from the onshore facilities to the Delta platform.
   - Two submarine power cables, each with a capacity of 10 kVA, running from the onshore facilities to the Prinos platform complex.
- The direct expansion project, which includes the installation of a new satellite platform Lambda (currently under construction) as well as drilling from this installation of 5 to 9 new production wells. The key elements of the planned expansion project are summarized as follows:
   - The new **Lambda platform (currently under construction)** is located approximately 3.5 km northwest of the existing Prinos platforms. On the Lambda platform, 5 to 9 wells will be installed to produce from the Epsilon reservoir. The platform is designed to operate without personnel. All produced fluids are transferred to the Prinos Delta platform, where initial separation of oil, produced water, and natural gas takes place using the existing equipment and processes.
   - Three subsea pipelines, currently under construction, connect the Lambda platform with the Delta platform. The first pipeline is 10" and transports all produced fluids from the Lambda platform to the Delta platform. The other two pipelines are 6" each and transport injection water into the reservoir and natural gas for production string unloading (gas lift), respectively, from the Delta platform of Prinos to Lambda.
   - Five to nine wells will be drilled from the Lambda platform at the Epsilon field, which will initially be completed as producers, while subsequently, two to four of them will be converted for water injection. The final number of wells will be determined after the confirmation of recoverable reserves. The new platform is equipped with 15 well slots. The initial wells will be drilled using a contracted suitable drilling rig, and later the Energean Force drilling rig will be installed on the platform, with its barge moored at eight anchoring points.
- Future expansion project for the further development of the fields in North Prinos and Kazaviti, involving the installation of a second new drilling platform, similar to Lambda, which will be called Omicron and will be located between the North Prinos and Prinos fields. Kazaviti will be drilled with the third sidetrack from the Alpha platform of Prinos in order to establish the decision regarding the feasibility of its development.

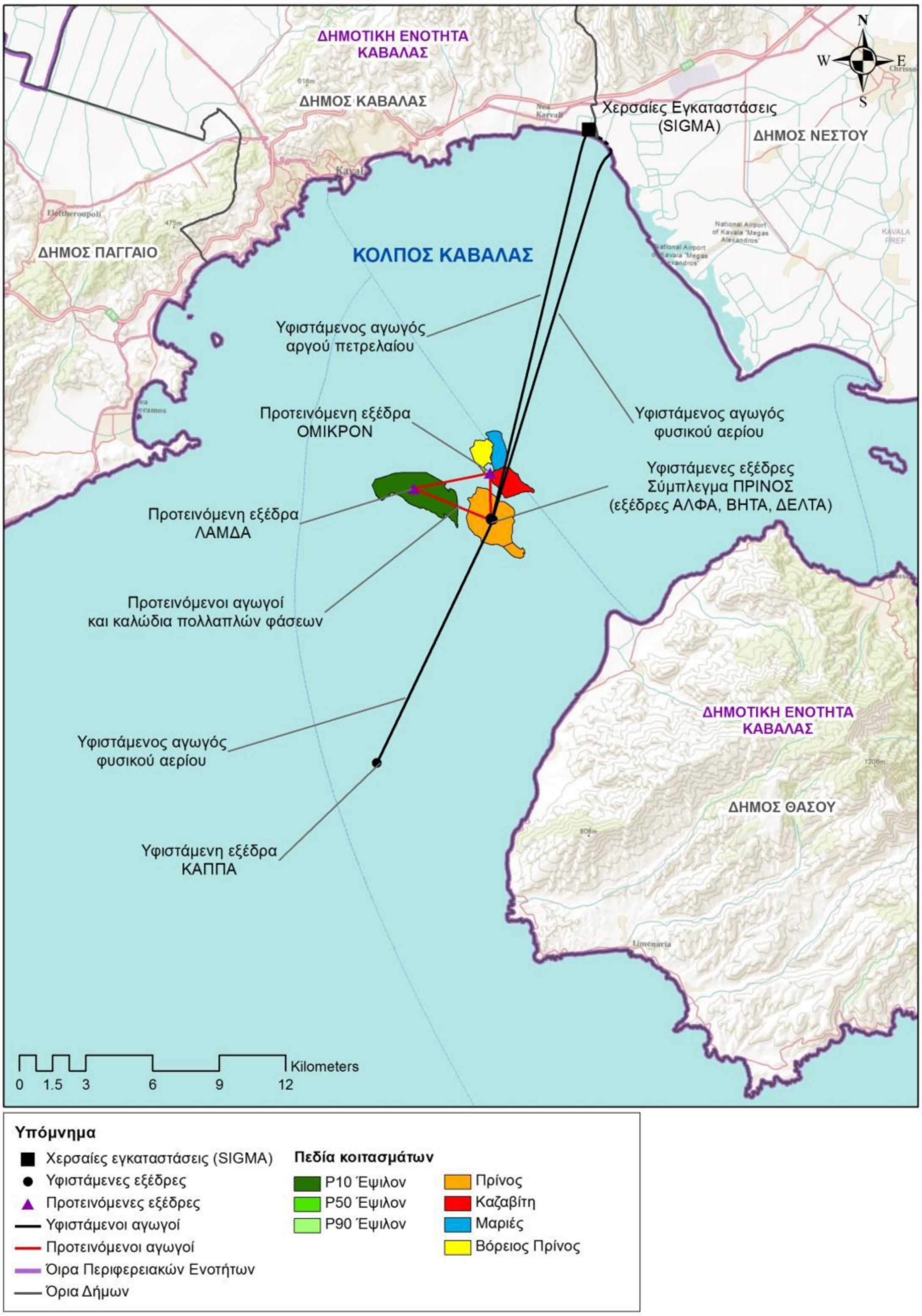


Figure 6-7: Location of the Prinos offshore facilities (existing, planned, and potential future).

The coordinates of the central points of the platforms of the Prinos Offshore Development project in WGS 84 are as follows:

Table 6-3: Coordinates of the Central Points of the Prinos Platforms

Platform	Coordinates (Lat, Lon)	
Delta	24°29′ 50.40′′ E	40°47′ 54.92′′ N
Alpha	24°29′ 49.62′′ E	40°47′ 57.62′′ N
Beta	24°29′ 54.41′′ E	40°47′ 55.36′′ N
Kappa	24°26′ 34.95′′ E	40°42′ 03.74′′ N
Lambda	24°27′ 12.97′′ E	40°48′ 33.55′′ N
Omicron	24°29′ 45.17′′ E	40°47′ 06.71′′ N

Figure 6-8: Alpha Platform

Figure 6-9: Beta Platform

Figure 6-10: Delta Paltform

Water treatment on the Delta platform

A special reference is made below to the water treatment carried out on the Delta platform, as these facilities will also be used for treating the water from the new water wells of the CO_2 storage project currently under study at the Beta platform.

The produced water from separators V-101 A/B and V-107 is transferred to the oil-water separator M-111. This is a horizontal vessel (with a diameter of 1,850 mm and a length of 7,625 mm) that performs the following functions:

- Separation and removal of small quantities of gas and hydrogen sulfide, which are released as the water depressurizes from the high pressure of the separators to the atmospheric pressure of the oil-water separator.
- Separation of oil droplets from the water by gravity, aided by special plastic coalescing media.
- Collection of the separated oil and transfer to the oil collector M-166.
- Discharge of the treated water and transfer to the second oil-water separator in series, M-111 B.

The section of the oil-water separator where coalescence occurs provides a large contact surface, where oil droplets merge together, rise to the surface, and form an oily layer. The oil is collected and transferred to the oil collector M-166 and subsequently to the oily water and oil collection vessel V-133.

Once a sufficient amount of liquid is collected, the automatic monitoring system, depending on the level, activates one or both pumps P-133 A/B, which return the fluids from V-133 back to the inlet of the separators V-101 A/B.

The water from the coalescence section of the oil-water separator is transferred to the settling zone at the rear of the vessel, where any remaining oil droplets separate by gravity, and is then sent to the hydrogen sulfide stripper V-111.

Although the first oil-water separator M-111 usually achieves complete oil retention, a second separator M-111 B (with a diameter of 2,700 mm and a length of 6,650 mm) operates in series at zero pressure. It is of similar design but with significantly greater capacity. The second separator ensures the quality of the discharged water in the event of malfunction in the upstream equipment. Under normal operation, no oil is removed from this vessel.

The capacity of the two oil-water separators operating in series is 164 m^3/hour (3,936 m^3/day). The two separators can also operate in parallel with a combined capacity of 238 m^3/hour (5,712 m^3/day).

The hydrogen sulfide stripper V-111 is a 30-meter-high tower with 35 trays, operating at nearly zero pressure and at a temperature of 77 °C. This tower removes the remaining hydrogen sulfide from the produced water.

The removal of hydrogen sulfide is achieved by the flow of sweet natural gas. The addition of hydrochloric and citric acid at the inlet of the stripper aids in the removal of hydrogen sulfide and prevents salt formation inside the tower.

The stripper is designed for a maximum water processing capacity of 100 m^3/hour (2,400 m^3/day). In the event that the flow exceeds 100 m^3/hour (which has not occurred so far), the excess is directed to the tubular oil separator M-164, after passing through oil-water separators M-111 and M-111 B.

The high capacity and good oil separation efficiency at the Delta platform (M-111, M-111 B) means that the water exiting the oil-water separators — which then enters the stripper V-111 — contains minimal hydrogen sulfide residue. This residue can in turn be removed by the tubular oil separator (skim pile) M-164 and the subsea settling tank TK-164, where the treated water is discharged. This arrangement allows the stripper V-111 to be bypassed when the water flow is low.

The produced water treatment system is designed to reduce the oil concentration in the water to 10 ppm. Regular sampling is carried out to ensure this water quality. The actual concentration of oil in the discharged water is slightly below this level, thanks to the residence time in the tubular oil separator and the subsea settling tank. Additionally, oil droplets aggregate and the separated oil in the settling tank is pumped back to the platform.

Figure 6-11: Oil-water separator M-111

Figure 6-12: Oil-water separator M-111B

Figure 6-13: Stripper V-111

Figure 6-14: Oil-water separator M-164

6.3 NEW FACILITIES

6.3.1 Storage Area

6.3.1.1 Activation of CO_2 Storage Right

Energean holds, among other rights, the research and exploitation rights of hydrocarbons in the offshore area of the Prinos oil fields based on the contract dated 23.11.1999 with the Greek State, ratified by Law 2779/1999 (Government Gazette A 296/30.12.1999) and as currently in force. Therefore, within the scope of its activities in the area, Energean proceeded with the design and licensing preparation of a CO2 Storage Unit in Prinos, making use of Article 173 of Law 4964/2022. More specifically, according to Law 4964/2022 (Government Gazette A 150/30.07.2022) titled "Provisions for simplifying environmental permitting, establishing a framework for the development of Offshore Wind Farms, addressing the energy crisis, protecting the environment, and other provisions," and more specifically based on its Article 173, entities to which the Greek State has granted (under Law 2289/1995 (A' 27)) the right or license for hydrocarbon exploration and exploitation in a specific area, and who possess sufficient data (especially geological, geophysical, and drilling data) to substantiate the preliminary eligibility of a geological formation or formations located in the subsurface of the granted area (onshore or offshore) as a site for carbon dioxide (CO_2) storage, acquire (under the conditions of the said article) the right to continue and complete the investigation process of the specific area in order to determine its suitability for CO_2 storage.

Based on the above, Energean submitted a request to EDEYEP on August 31, 2022, for the activation of the right to continue and complete the investigation of the structures of the Prinos and Epsilon fields and the underlying aquifer (the "Area") in order to determine their suitability as CO_2 storage sites. This request was accepted by the Activation Decision of the Right to Investigate for CO_2 Storage (as approved by EDEYEP Decision No. 14577/29.09.2022 (Government Gazette 5247/B/11.10.2022)), which approved the preliminary eligibility of the storage site located within the boundaries of the Prinos concession and includes the structures of the Prinos and Epsilon fields and the underlying aquifer. It also approved the continuation and completion of the investigation of the Area as a storage site for a period of twenty-two (22) months starting from October 1, 2022, by Energean.

The Area is defined by the following coordinates (geographic system WGS84 UTM Zone 35N):

Table 6-4: Coordinates of the Prinos CO_2 Storage Site

X	Y
282179	4521234
282460	4520425
289570	4514682
290106	4515480
291607	4517969
291708	4519568
289462	4522144
286651	4522616
284123	4521177

The area extends from a depth of 1,900 meters to a depth of 4,200 meters, with the delineated volume of the storage space defined at 93.4 km^3.

According to paragraph 5 of article 173 of Law 4964/2022, after the completion of the suitability investigation and before the expiration of the investigation completion right, the interested party submits an application to EDEYEP (Hellenic Hydrocarbon Resources Management) to confirm the suitability of the geological formation as a CO_2 storage site and to activate the party's storage right. Based on this law, the interested party may be either the holder of the investigation continuation and completion right (in this case Energean) or an affiliated company whose exclusive purpose is CO_2 storage activities (in this case EnEarth).

With the progress and completion of the investigation procedures of the Area as a CO2 storage site, EnEarth, as an affiliated company of Energean, submitted an application on 30.06.2024 to confirm the suitability of the geological formation as a CO2 storage site and to activate the storage right of the entity, in accordance with paragraph 5 of article 173 of Law 4964/2022. Energean, as the holder of the right to continue and complete the investigation, has co-signed the above application.

6.3.1.2 Characteristics of the CO_2 Storage Site

The CO_2 storage site under study is located within the Prinos basin, in the Gulf of Kavala, in the Northern Aegean Sea. The deposits in this area have been explored since the 1970s, followed by the development of oil production from three deposits within the Prinos License area, as well as natural gas production from the South Kavala License (Figure 6-15), since the 1980s.

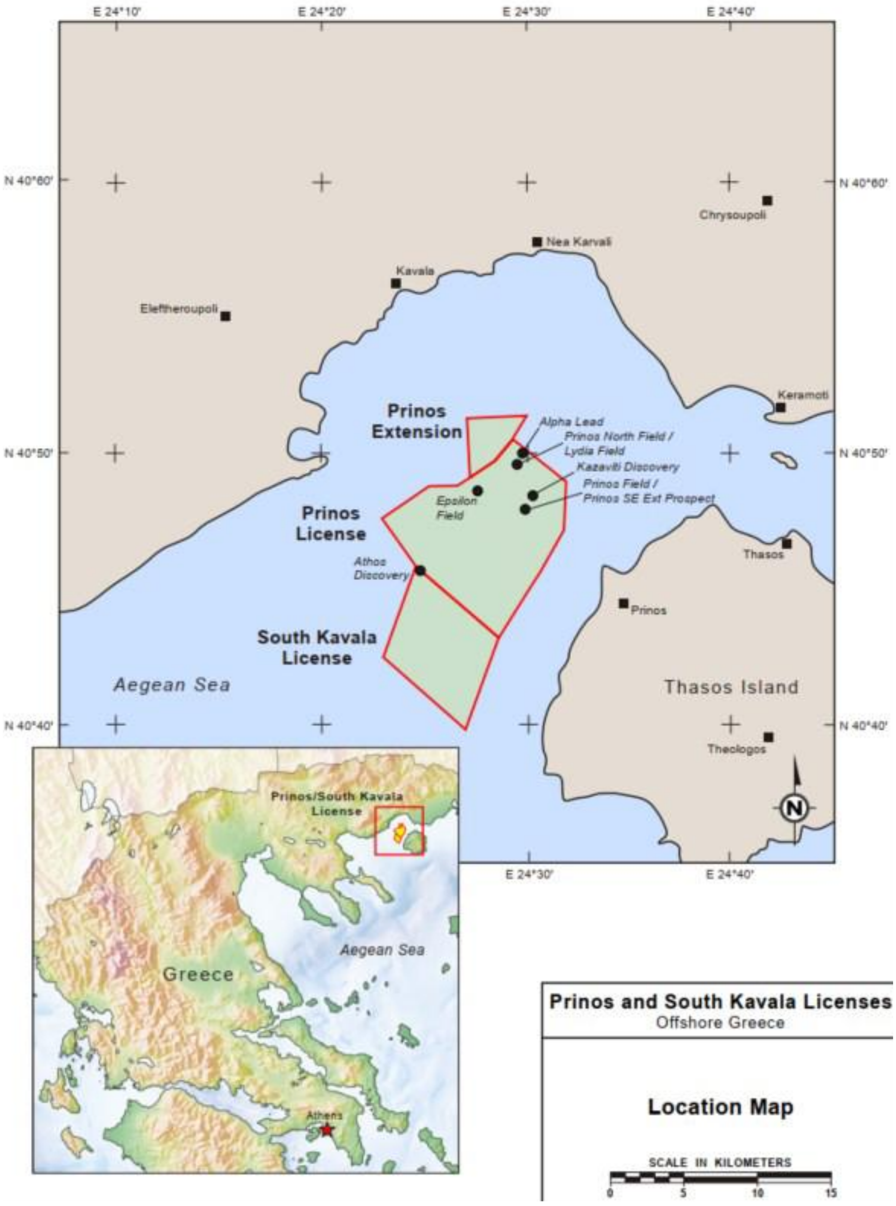


Figure 6-15: Map of the Prinos Basin with Active Licenses

The area of interest for the CO_2 storage exploration site is located within the Prinos License, where Energean holds 100% ownership and management for oil and gas exploration and development activities since 2007.

With the maturation of the studies conducted for the Project, it was determined that it is more effective to limit the CO_2 storage to the Prinos structure.

The potential CO_2 storage location lies within the Prinos structure, as shown in **Figure 6-16.**

In order for this area to be characterized as suitable for CO_2 storage (at reservoir scale), the wider surrounding area is evaluated as a storage complex (at basin scale), covering a broader area with the requested minimum radius of 1 km around the storage site (**Figure 6-17**).

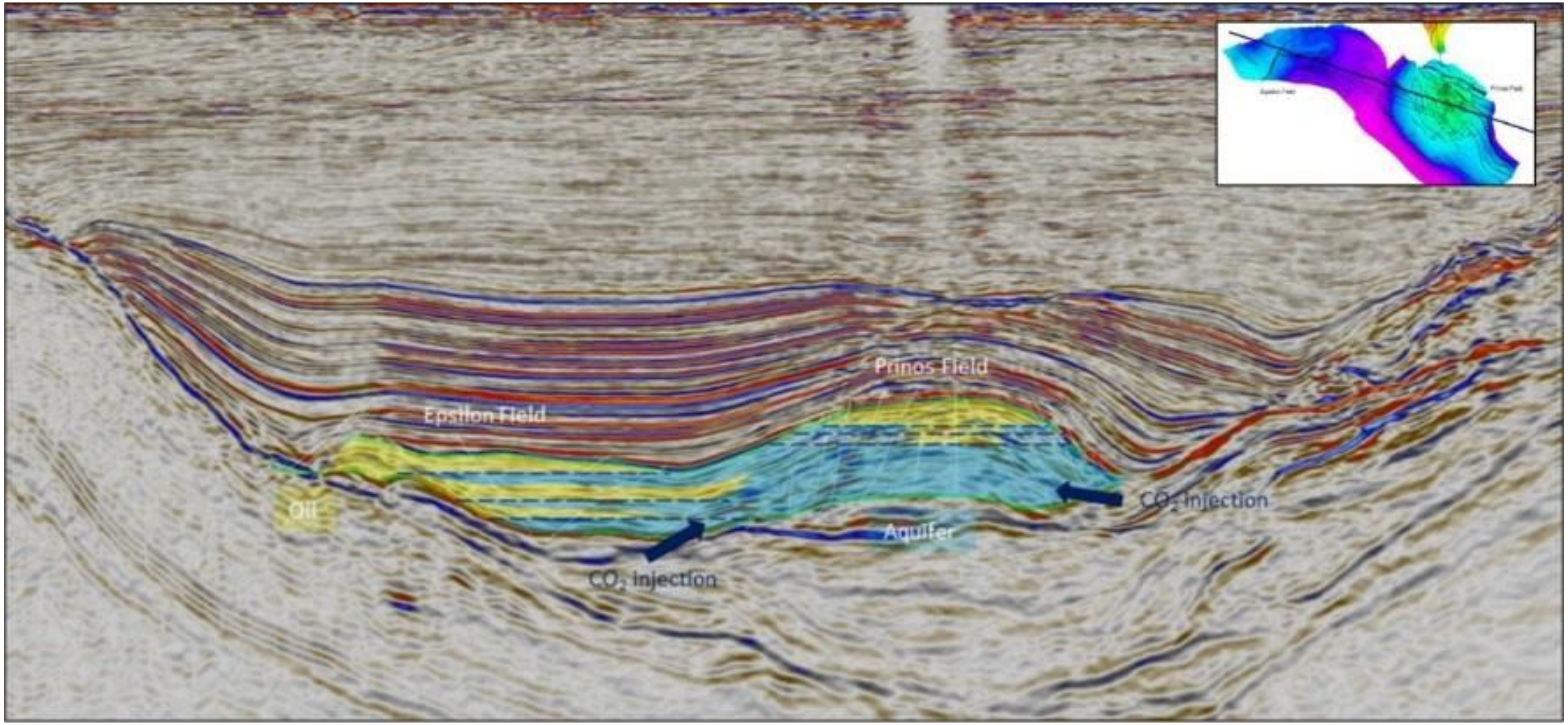


Figure 6-16: Cross-section of the potential CO2 storage site in the Prinos structure (the oil layer is highlighted in yellow, the aquifer in light blue, and the CO2 plume in white). CO2 injection wells are shown in green, and water production wells in blue.

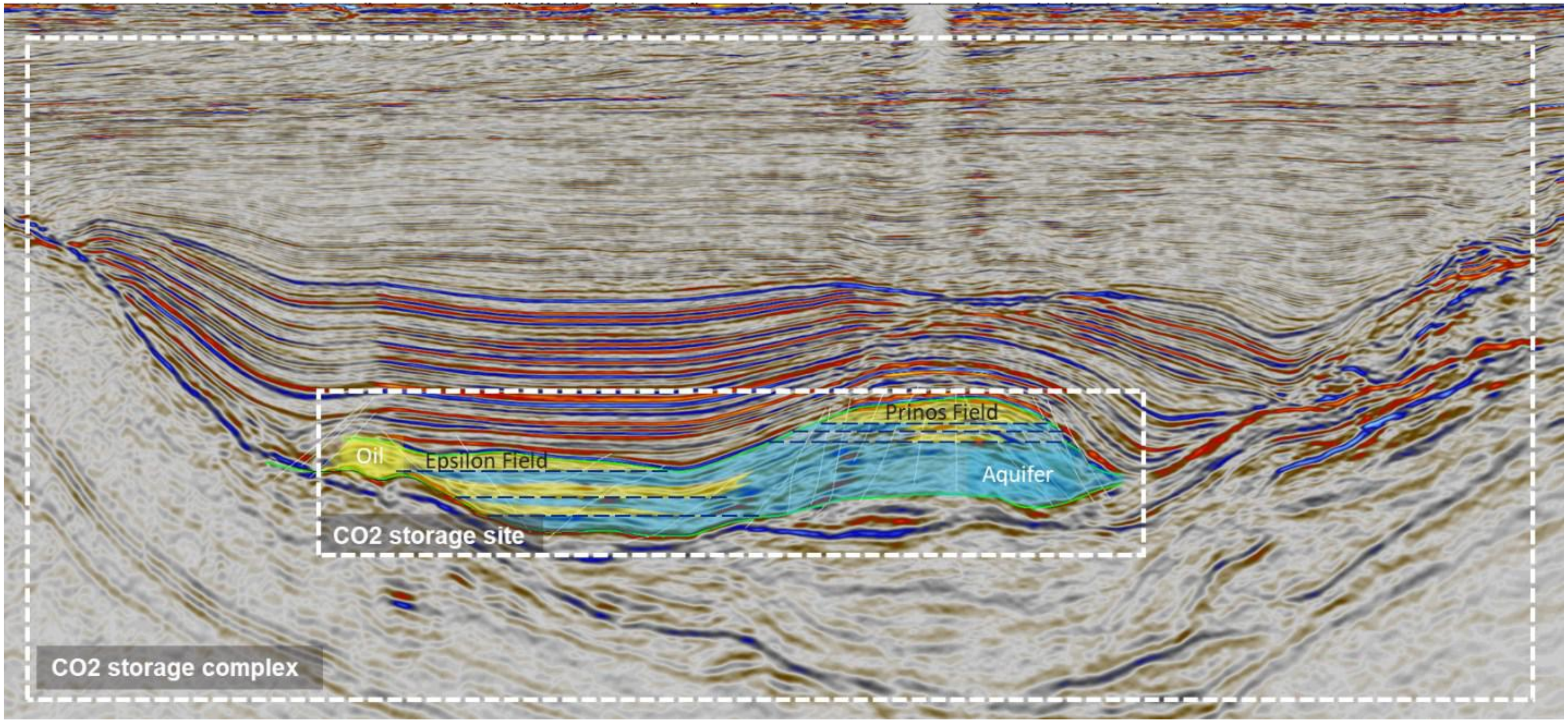


Figure 6-17: Cross-section of a potential CO2 storage site and storage complex as included in the exploration license. After evaluation of the area, the Epsilon field was excluded from the CO2 injection and storage area.

<u>CO_2 Storage Site and CO_2 Storage Complex</u>

The concept of the storage complex is broader than that of the storage site, as shown in **Figure 6-18**. It includes the storage site as well as the surrounding geological formations, the nature of which is crucial for the effectiveness and safety of CO_2 storage. These formations contribute to the overall storage capacity and the integrity of the CO_2 storage project.

The storage site refers to a specific volume within a geological formation that is selected and configured for the purpose of CO_2 storage. It is designed to receive the injected CO_2 and to ensure its long-term storage. The site is supported by infrastructure for injecting CO_2 into the geological formation, as well as surface facilities, which include the necessary equipment and installations for monitoring, controlling, and maintaining the storage.

The continuous presence of impermeable rocks (caprocks) throughout the storage complex is essential for its integrity and safety. These sealing formations provide a secure containment mechanism, reducing the risk of CO_2 leakage or migration to the surface or other subsurface areas. Their continuity is a critical factor in the identification and characterization of a storage complex.

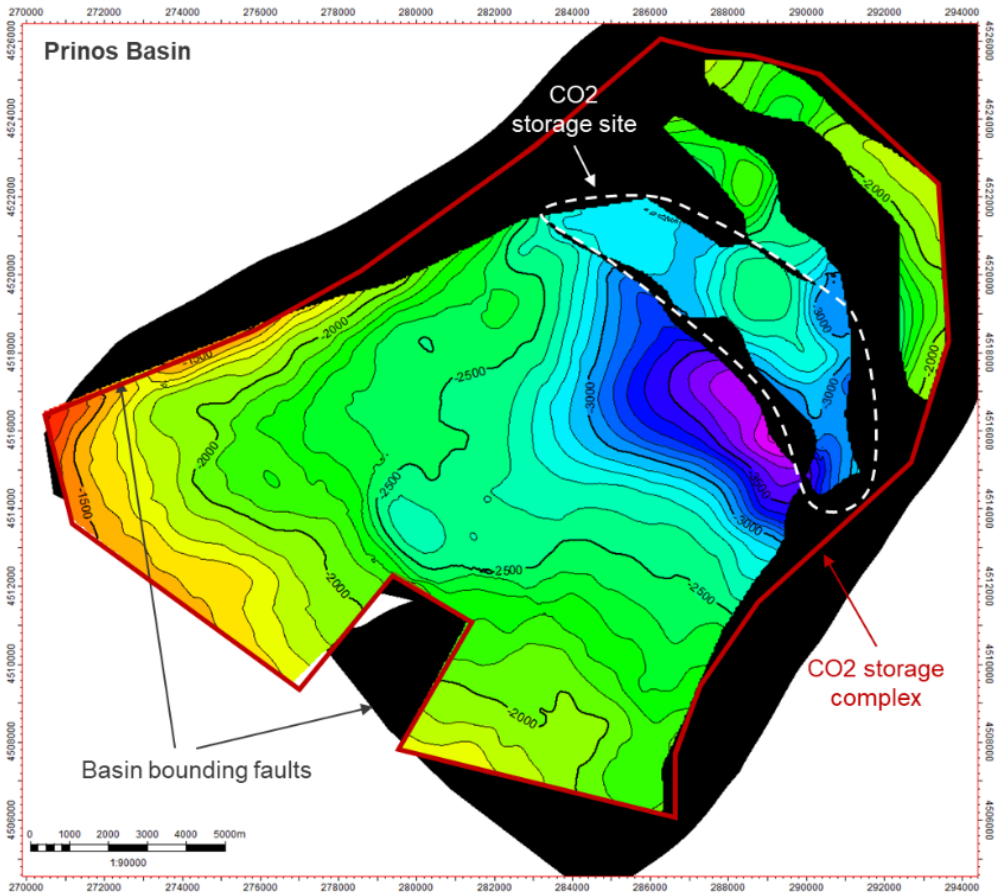


Figure 6-18: Plan view of the polygons of the CO_2 storage complex and storage site of Prinos, with the reservoir formations as a background

The area of the storage complex has therefore been selected due to the continuity of the geological formations within the basin, as well as the boundaries of the Prinos basin in all directions (delineated by faults to the NE, SW, NW, and SE). It is also noted that the adequacy of data from oil and gas exploration and development activities carried out over the past 40 years enhances the reliability of the assessment of the storage site and complex.

Figure 6-19 illustrates the storage complex (**Table 6-5**) and the extent of the storage site, as well as the polygon of the Exploration License (see **Section 6.3.1.1**) for CO_2 Storage, within the Prinos basin.

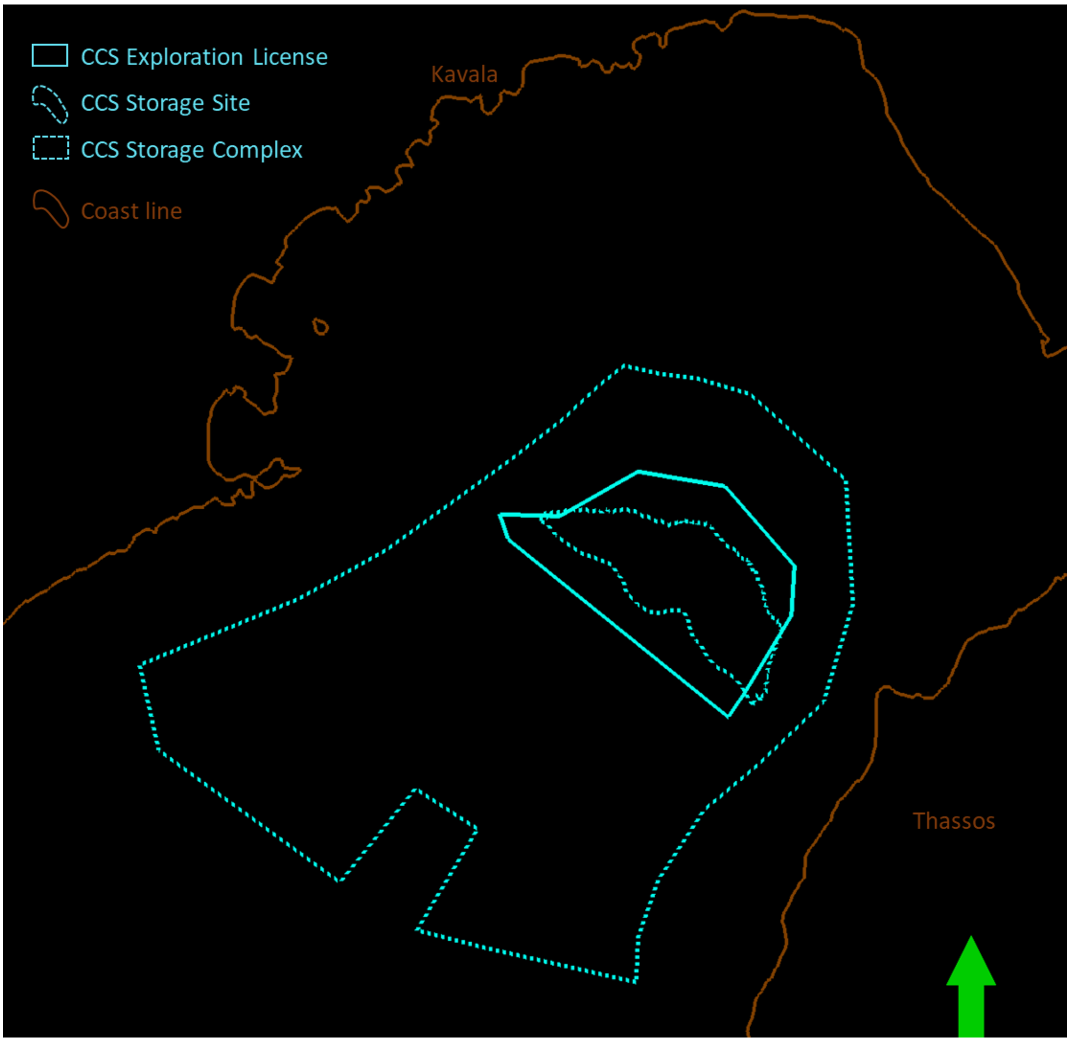


Figure 6-19: Plan view of the surface extent of the storage complex (large dashed-line polygon), the extent of the storage site (small dashed-line polygon), and the exploration license polygon (solid line). The coastline is shown in brown.

The storage complex covers an area of approximately 256.86 km², with a perimeter of about 72.99 km. The storage site covers an area of approximately 20.16 km² with a perimeter of 26.77 km.

The coordinates of the CO_2 storage complex are listed in the table below.

Table 6-5: Coordinates of the CO_2 storage complex are listed in the table below

X	Y
279453	4512372
277020	4509345
271165	4513610
270546	4516366
275694	4518510
278502	4520077
282475	4522958
284177	4524272
285451	4525453
286197	4526041
287328	4525784
288558	4525629
290269	4525124
293368	4522358
293598	4518334
292650	4515169
290556	4513167
288786	4511682
287305	4509419
286657	4507571
286593	4506115
281658	4507241
279506	4507795
281466	4511071
279453	4512372

The main reservoir units of the Prinos field selected for CO_2 storage consist of saline aquifers in the equivalent zones A1, A2, B, and C. These aquifers exhibit favorable rock properties, with a clean to mixed ratio exceeding 66%, an average porosity of 14%, and an average permeability of 250 mD (with a maximum of approximately 6 Darcy). The top of the structure lies at a subsea depth (TVDSS) of -2,475 m, the deepest parts of the structure reach approximately -3,615 m TVDSS, and the formations of the storage site have an average thickness of about 285 m.

To ensure the sealing integrity of the storage site, multiple seals are examined. The primary seal consists of the shale layer that covers the storage formations, which is defined by the seismic horizon of the lower salt basement, extending throughout the area and having an average thickness of 20 m. Additionally, the evaporitic sequence overlying this sealing shale contains various salt layers alternating with clastic layers, further contributing to the containment capabilities. The effectiveness of the sealing impermeable formations is also supported by the fact that they have effectively contained hydrocarbons over geological time scales. The shales present in each of the four distinct reservoir units can be considered as secondary seals (as evidenced by the oil production history of more than 40 years) or at least as potential barriers to vertical flow, thereby enabling and enhancing CO_2 containment.

Oil production from zones B and C of the Prinos field will be completed before the start of CO_2 storage. Production from zone A, as well as the development program of the Epsilon field (FDP), will continue until 2035. CO_2 injection will target zones B and C of the reservoir, with two injection wells planned for the period 2025–2035 along with two water injection wells, and will subsequently be extended to the entire reservoir until the end of the project.

The following figures highlight the location of the injection wells and water production wells (**Figure 6-20**, **Figure 6-21**).

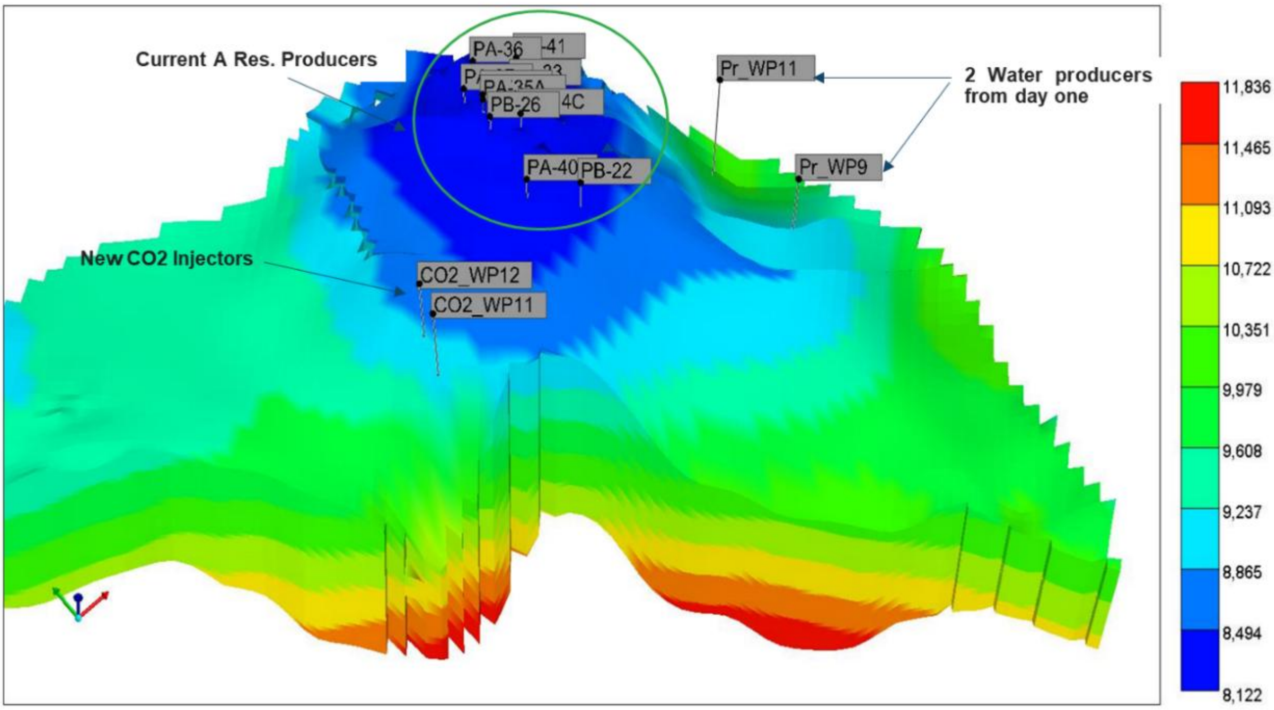


Figure 6-20: Location of wells in the storage site (3D view)

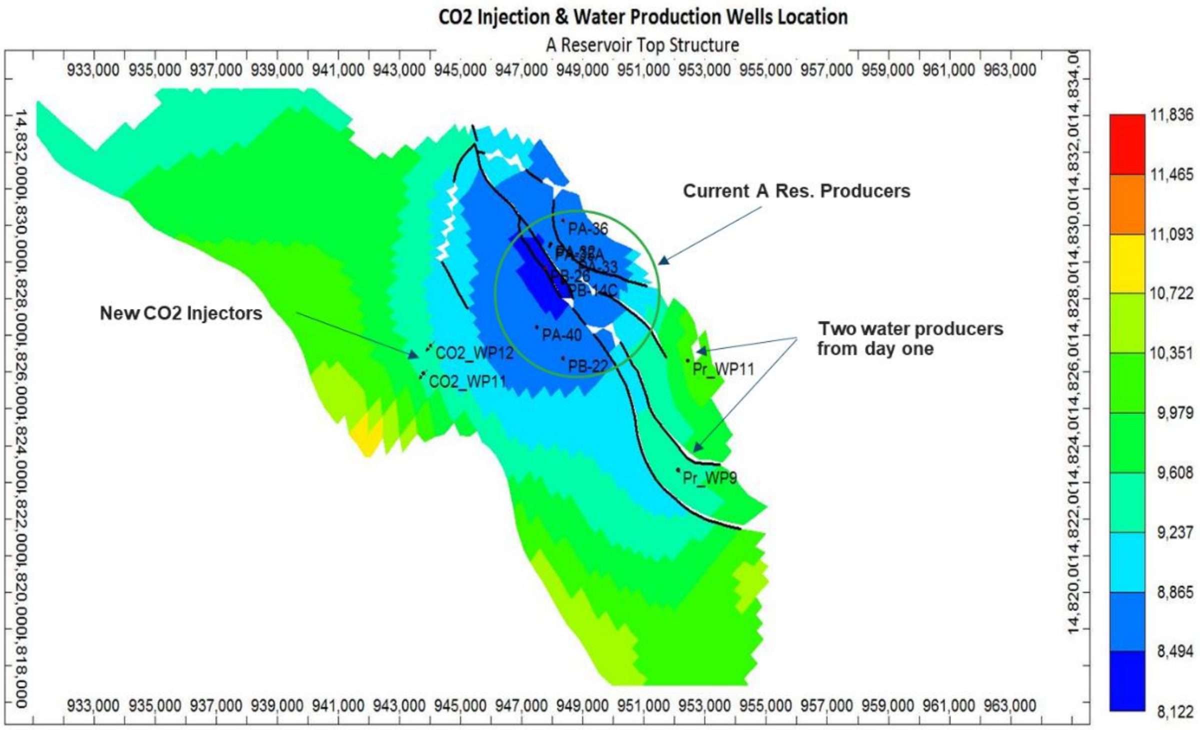


Figure 6-21: Location of wells in the storage site (plan view)

6.3.1.3 Estimated Capacity of the CO_2 Storage Site

The operational scenario of the CO_2 storage site includes a stepped increase in the injection rate through the two wells in reservoirs B and C, starting from late 2025 to early 2026. The CO_2 injection rate begins at 0.25 MTPA and gradually increases to **1 MTPA within the first three years** (**Figure 6-22**). The maximum injection rate for the two wells is 0.5 MTPA per well. According to the results of the geomechanical study of the formation, a maximum bottomhole flowing pressure (max FBHP) of 7,000 psi has been set. To manage reservoir pressure, the two water wells produce water from the aquifer layers of reservoirs B and C at an initial maximum rate of 7.5 kbwpd, increasing to 9 kbwpd by 2035. The total CO_2 storage capacity under this base scenario is estimated to reach 18 MT by the end of 2045 (20 years) and 22.8 MT by the end of 2050 (**Figure 6-23**).

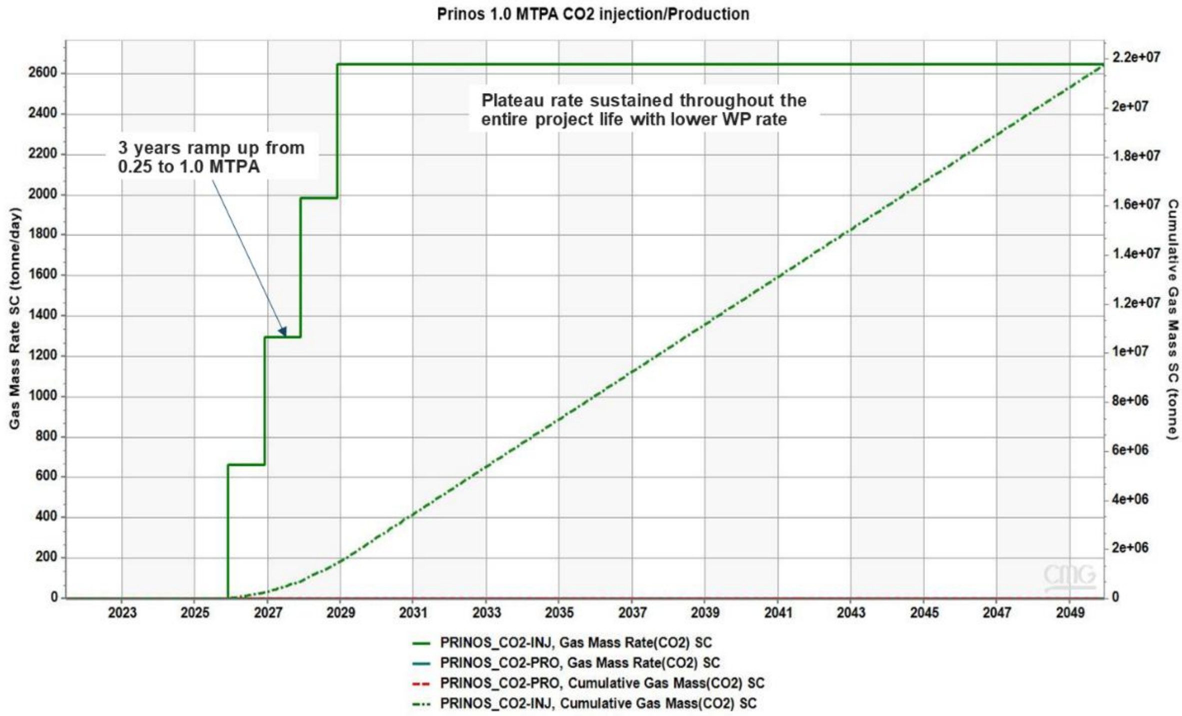


Figure 6-22: Forecasts of CO_2 injection rate (mass) and cumulative injection/production volumes for the 1 MTPA scenario

The distribution of CO_2 storage capacity per reservoir zone A, B, and C is shown in Figure 6-23. Specifically, the CO_2 storage capacity of reservoir A is estimated to reach 7.7 MT by the end of 2045 (starting from 2035 for 10 years) and 11.1 MT by 2050. Similarly, the CO_2 storage capacity of reservoir B is estimated to reach 1.9 MT by the end of 2045 (20 years) and 2.2 MT by 2050, while the CO_2 storage capacity of reservoir C is estimated to reach 8.3 MT by the end of 2045 (20 years) and 9.4 MT by 2050. The lower storage capacity of reservoir B is related to the poorer quality rocks in zone B compared to the underlying reservoir C.

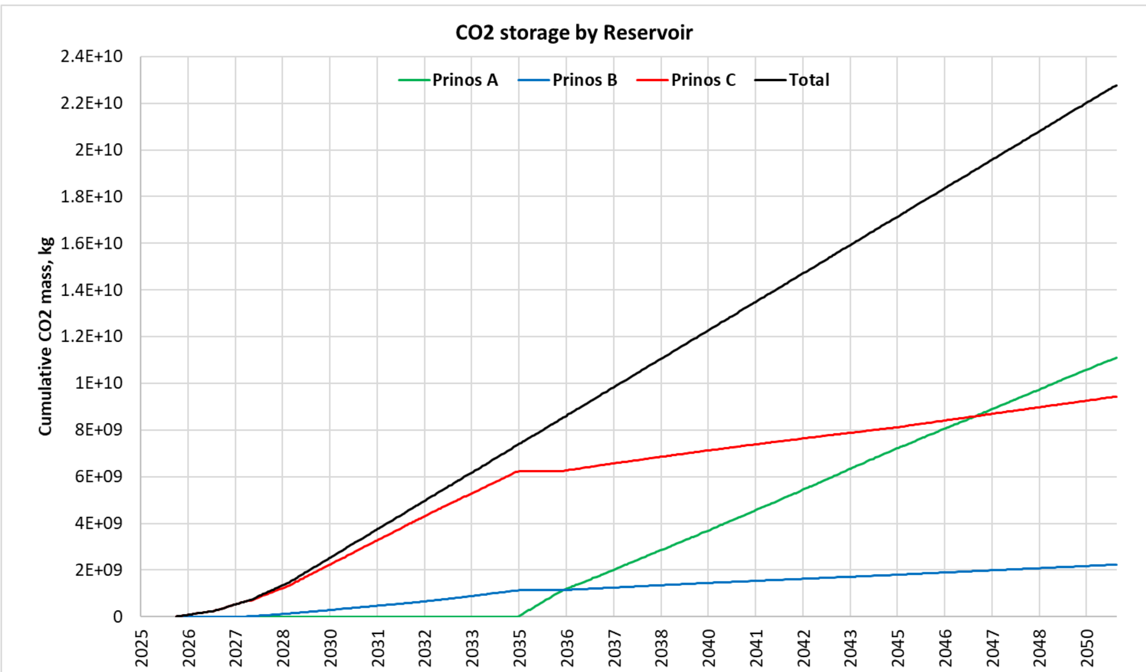


Figure 6-23: Distribution of CO_2 storage capacity per reservoir zone A, B, and C for the 1 MTPA scenario

As part of the assessment of the suitability of the Storage Site under study, the total resource volume in the Prinos reservoir was calculated at 460 million m³, which corresponds to 313 MT of final CO_2 storage capacity (assuming an in situ CO_2 density of 680 kg/m³). Taking into account the simulation modeling of injectivity, the final theoretical CO_2 storage capacity is estimated to be up to 100 MT, with the plume remaining within the storage site over the long term.

6.3.1.4 Suitability and Long-Term Safety of the CO_2 Storage Site

The following presents the modeling results for investigating the suitability of the Prinos geological formation for use as a storage site, after characterization and evaluation of the potential CO_2 storage complex and the surrounding area, according to the criteria defined in Annex I of Ministerial Decision 48416/2037/E.103 (Government Gazette 2516/B/4.11.2011) 'Measures and conditions for the storage of carbon dioxide in geological formations — Amendment of Ministerial Decision 29457/1511/2005 (B' 992), Presidential Decree 51/2007 (A' 54), and Presidential Decree 148/2009 (A' 190), in compliance with the provisions of Directive 2009/31/EC'.

6.3.1.4.1 Spatial and Temporal Evolution of CO_2 Storage

Based on the Project design, CO_2 injection will target zones B and C of the reservoir with two injection wells during the period 2025–2035 and will then be extended to the entire reservoir until the end of the Project. As shown in the following Figures (**Figures 6-24, 6-25, 6-26**), there is no migration of the CO_2 plume from zones B and C to zone A, therefore, the entire stored CO_2 remains in zones B and C until 2035, while oil production from zone A of the reservoir continues until then.

After 2035, the plume migrates smoothly through all the reservoirs as expected, moving from the top and eventually towards the water production wells that create the pressure differential.

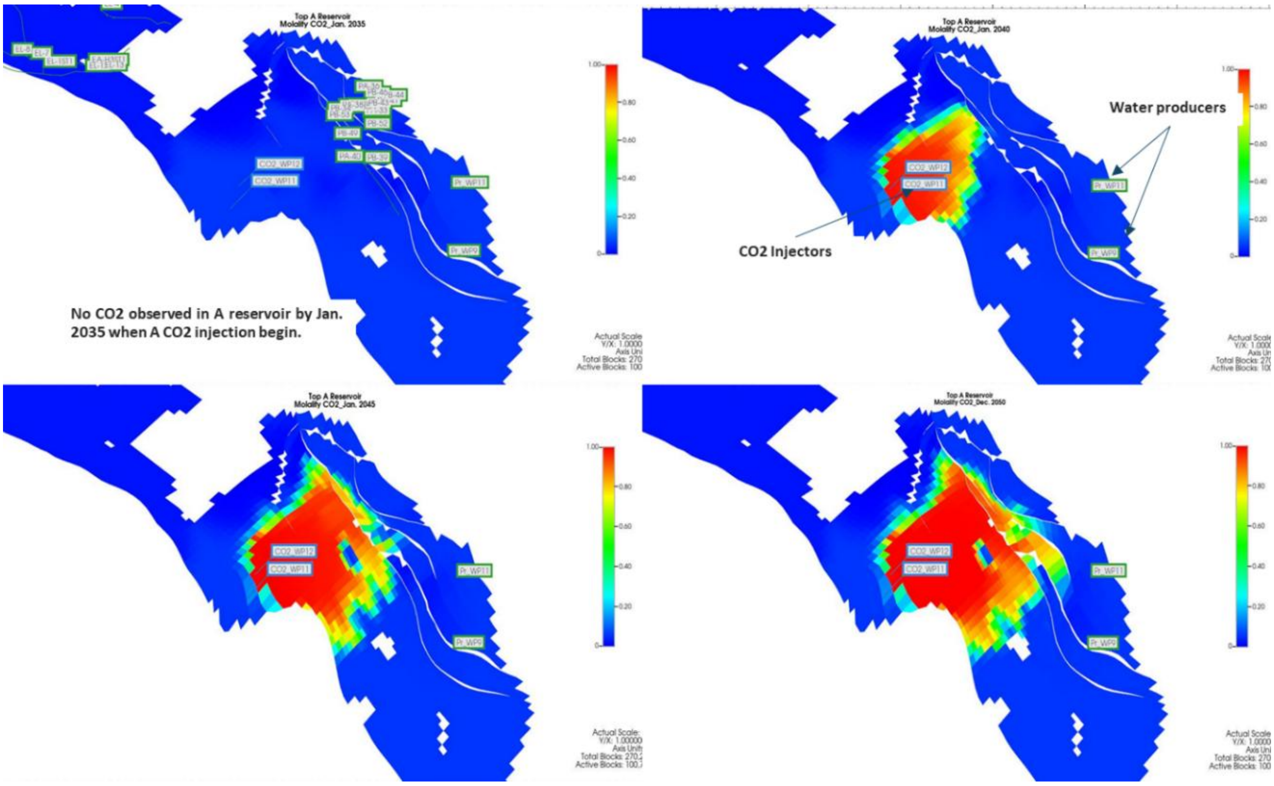


Figure 6-24: Migration of the CO_2 plume in reservoir A (2035, 2040, 2045, 2050)

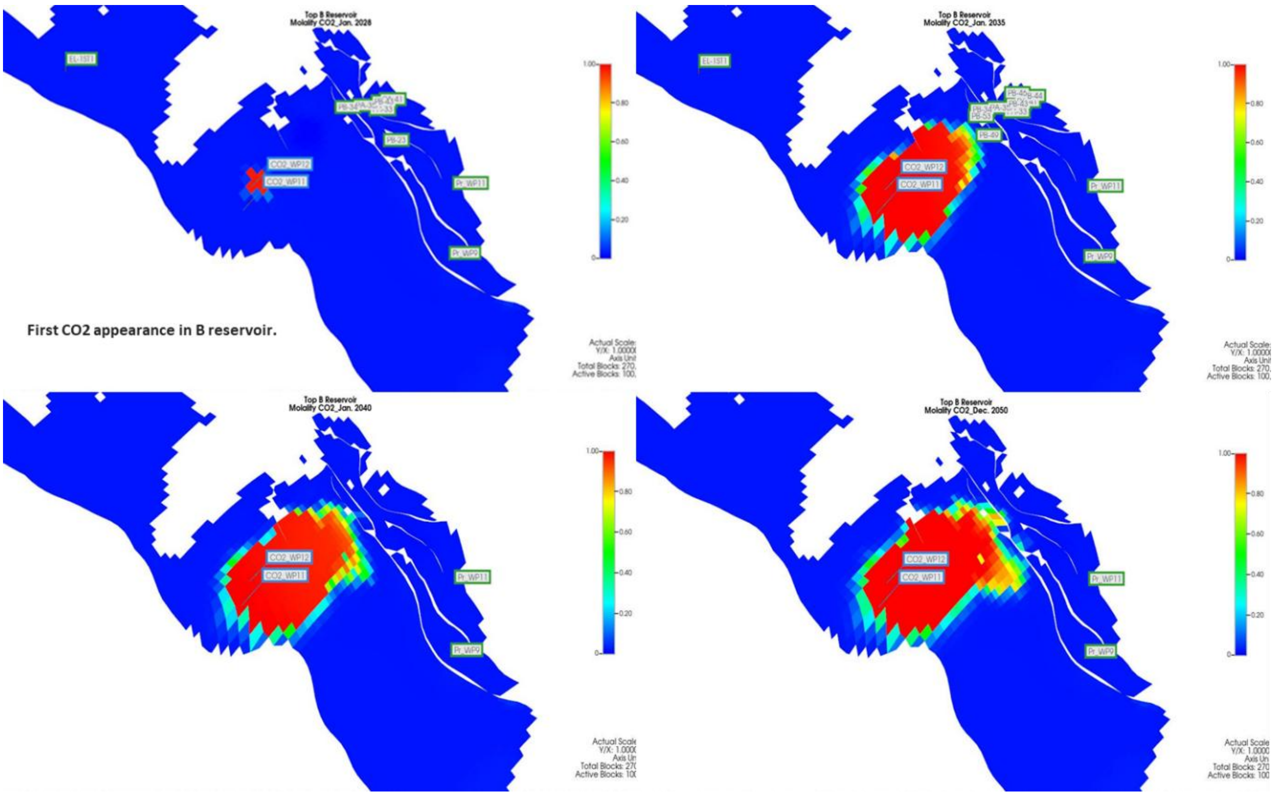


Figure 6-25: Migration of the CO_2 plume in reservoir B (2035, 2040, 2045, 2050)

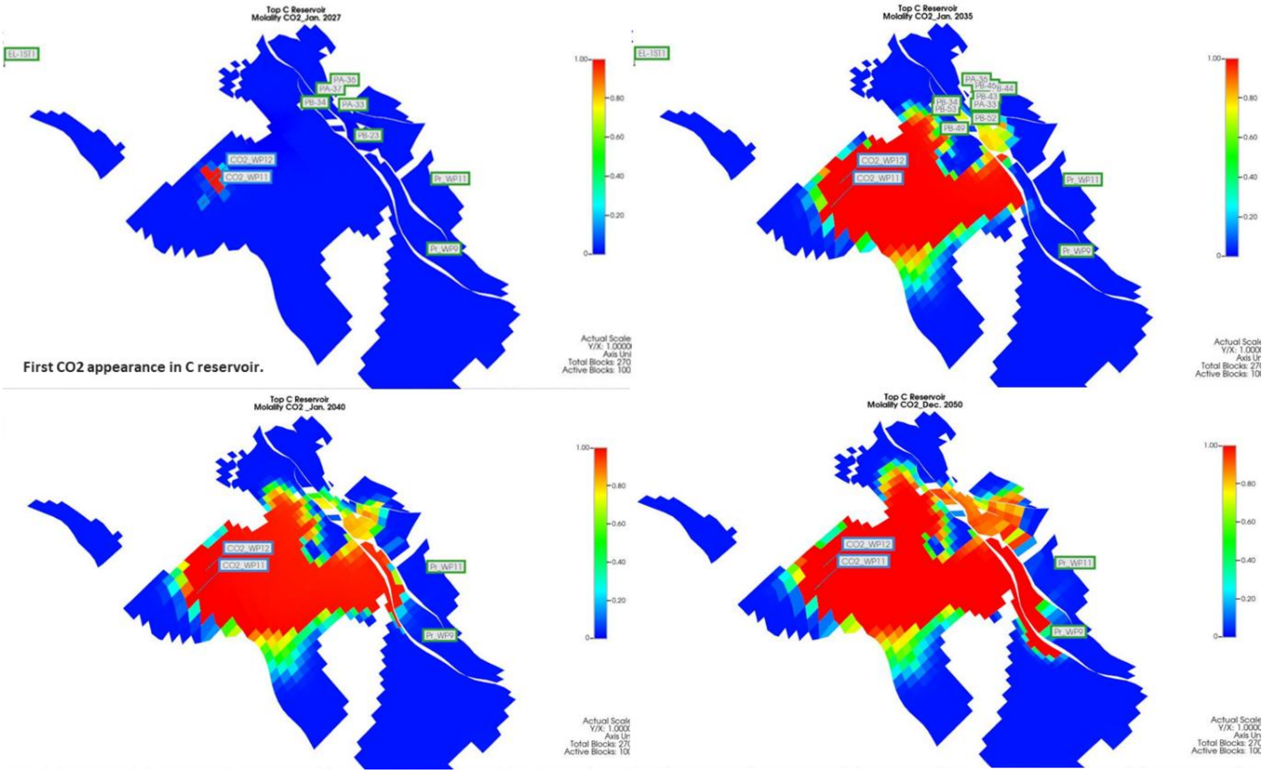


Figure 6-26: Migration of the CO_2 plume in reservoir A (2035, 2040, 2045, 2050)

The pressure in the reservoirs reaches acceptable levels and in any case remains below the threshold values derived from the geomechanical study (<7000 psi) and the well integrity study (<6200 psi). CO_2 is confined only to reservoirs B and C until 2035, **without interacting with oil production** from reservoir A, which is also confirmed by the different pressure profiles in each reservoir, as shown in **Figure 6-27**.

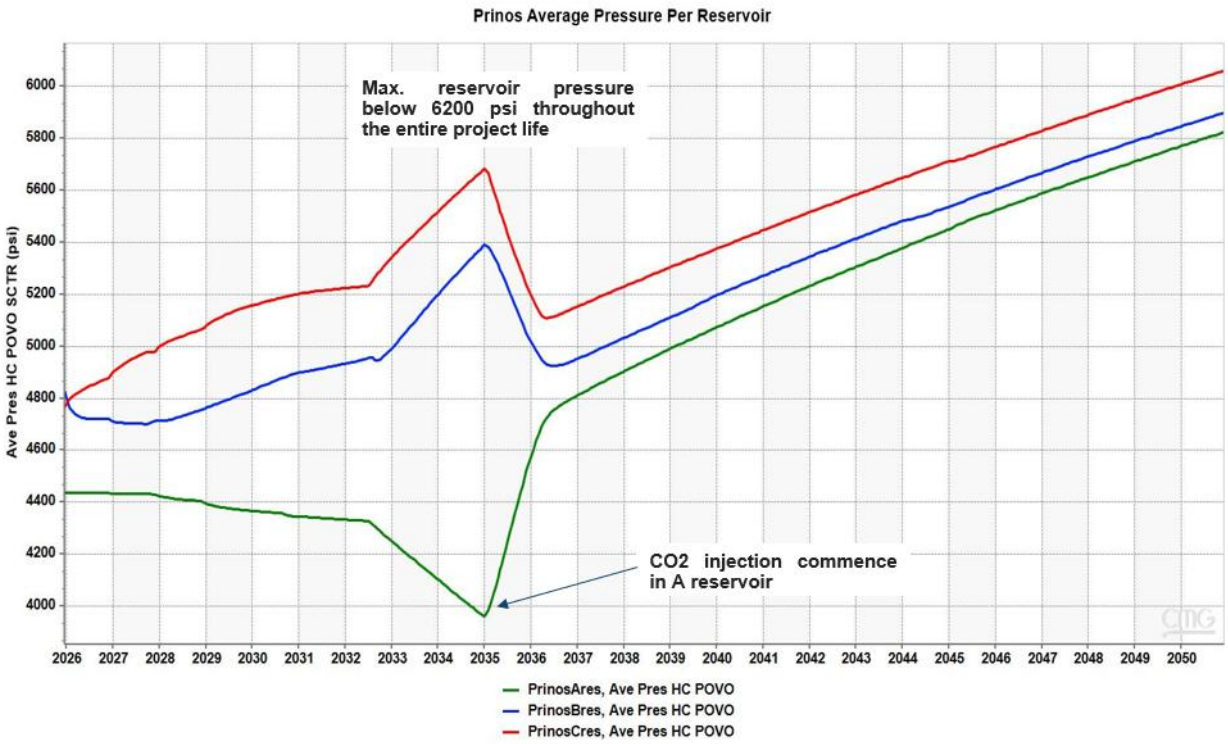


Figure 6-27: Average pressure in reservoirs A (green), B (blue), C (red)

6.3.1.4.2 Trapping through Mineralization (Long-Term)

Mineralization immobilizes the CO_2. It is enhanced by CO_2 trapping in the formation's pores and by dissolution trapping. The mineralization trapping mechanism is evaluated in a dedicated simulation lasting 1,000 years. The results of this mechanism are expected to contribute a small percentage to the total stored CO_2 compared to the other trapping mechanisms.

CO_2 will react with specific minerals that make up the reservoir rocks, forming new minerals. Specifically, in the Prinos structure, CO_2 will react with the existing chlorite minerals, as described by the following equation:

Chlorite Fe-Mg (ripidolite) + CO_2 → siderite + magnesite + smectite (beidellite)

CO_2 will also react with the existing water and strontium minerals with kaolinite, as described by the following equations:

$CO_2 + H_2O \rightarrow HCO_3^- + H^+$
K-feldspar + kaolinite + H^+ → illite + quartz + K^+
Albite + kaolinite + H^+ + K^+ → illite + quartz + Na^+

Due to the lack of minerals that react with CO_2 within the Prinos reservoir, the effect of mineralization trapping is expected to be negligible. This process, even after a significant period, results in an increase in reservoir rock porosity of up to 0.19% over a 30-year period, reaching up to 1.29% over a 1,000-year period.

6.3.1.4.3 Characterization of Dynamic Behavior During Storage

Through three-dimensional modeling of various scenarios for the Prinos CO_2 storage project, the nature of CO_2 flow in the reservoir, its phase behavior and its trapping mechanisms were investigated, among other aspects.

In the short to medium term, the movement of the CO_2 plume is governed by structural and stratigraphic trapping, and therefore depends on the location of the CO_2 injection wells and the injection rate. In general, the CO_2 plume rises toward the crest of the reservoir's anticline and accumulates there, remaining under supercritical conditions. Residual trapping in the formation's pore space and solubility trapping, which immobilize the CO_2, account for approximately 5.5% and 7.1% respectively of the total CO_2 stored during this period, as indicated by the dynamic simulation of the 3D model. The high temperature and salinity of the water in the geological formation reduce CO_2 solubility. The miscibility of CO_2 with hydrocarbons (oil phase) constitutes an additional trapping mechanism.

By directing the wells toward the aquifer and distributing the injection rates across various locations, localized high-pressure phenomena are avoided, while at the same time the CO_2 plume is given broader contact with the hypersaline aquifer water, leading to increased dissolution and trapping of CO_2.

In the long term, especially after the cessation of injection, the aforementioned trapping and solubility mechanisms increase to approximately 22% and 10%, respectively. Over a period of 500 years following injection, CO_2 continues to dissolve in the water, increasing its density and **settling at the bottom** of the reservoir as a heavier 'fluid.' This phenomenon enhances the safety of CO_2 storage by **shifting from 'storage' to long-term 'trapping,'** ensuring that CO_2 is immobilized as stationary-phase molecules rather than mobile ones (which pose a risk of leakage depending on available migration pathways). An additional trapping mechanism is also evident—CO_2 **mineralization**—which likewise immobilizes the CO_2, making it permanently bound within the rock (see Section 6.3.1.4.2).

To assess the CO_2 plume trapping mechanisms, a simulation scenario with an injection rate of 1 MTPA was used.

The results from the simulation for the **period 2025–2050 (Figure 6-28)** show that the majority of the stored CO_2 remains under supercritical conditions within the reservoir, mainly structurally/stratigraphically trapped, while the CO_2 trapped in the formation's pore space is approximately 1/15 of the structurally/stratigraphically trapped CO_2. The CO_2 miscible in the oil phase is about 1/4 of the mass of free CO_2, although it is continuously increasing. A small portion of the CO_2 is dissolved in water, with a steadily increasing volume, while the amount of CO_2 in liquid phase is almost negligible.

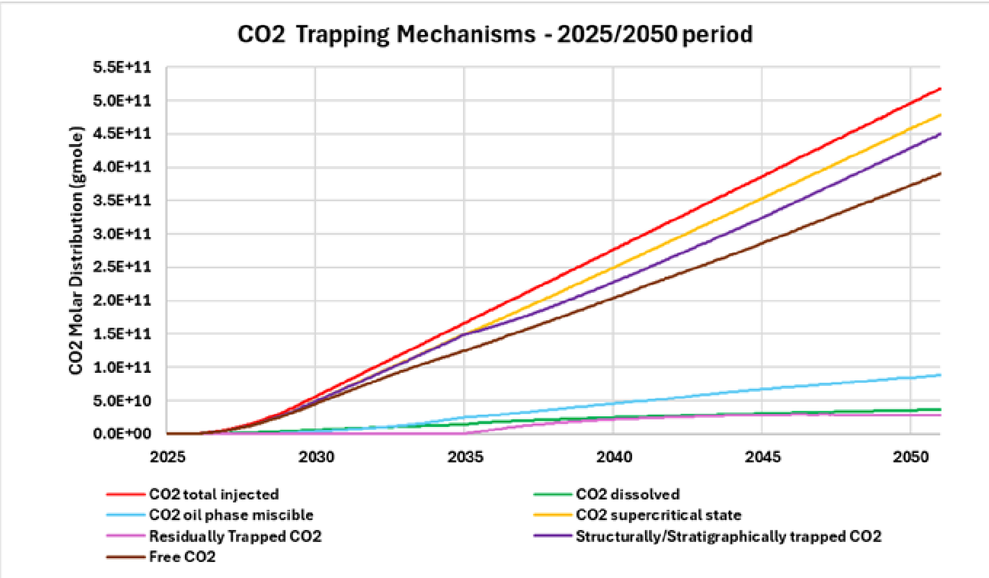


Figure 6-28: CO_2 Trapping Mechanisms – Short-Term Results

The main relationships between these forms of CO_2 are listed below for clarity and reference, using the same colors as those in the above chart:

- Supercritical CO_2 = Residually trapped CO_2 + Structurally / Stratigraphically trapped CO_2
- **Stored CO_2** = Dissolved CO_2 + Residually trapped CO_2 + Structurally / Stratigraphically trapped CO_2
- Supercritical CO_2 = Free CO_2 + CO_2 dissolved in oil phase

As shown in **Figure 6-29**, there is a steady slow decline of the mobile supercritical CO_2 phase over a 100-year period (yellow line), while at the same time, the immobile phases of stored CO_2, namely the trapped and dissolved phases (magenta and green lines respectively), continuously increase.

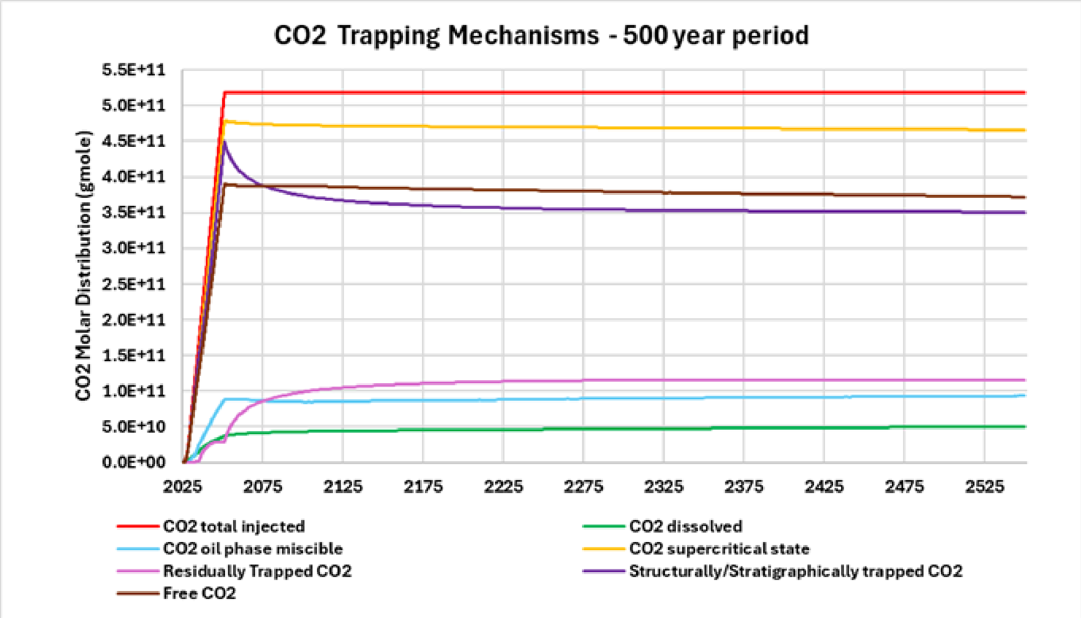


Figure 6-29: CO_2 Trapping Mechanisms – Long-term Results: 500 Years After Injection

6.3.1.4.4 Potential CO_2 Leakage Points

The CO_2 storage site under study in Prinos is a closed system, as it is surrounded by faults or layer pinch-outs, as shown in Figure 6-30.

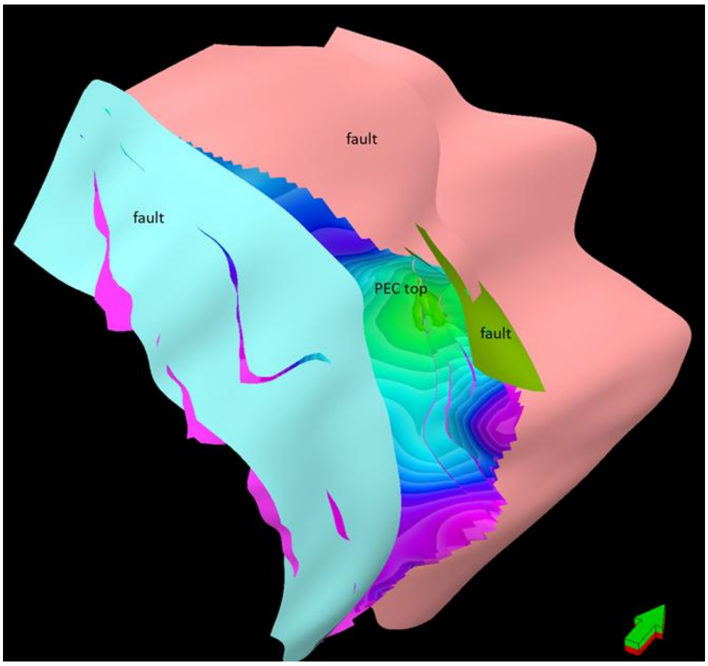


Figure 6-30: 3D visualization of the top and bottom surfaces of the storage site and the surrounding faults

Since the Prinos field is part of an extensive closed structure that includes the Epsilon field, there is no significant risk of CO_2 leakage. The only (low probability) risk is the migration of CO_2 from the Prinos field to the Epsilon field through the spill point separating the two (**Figure 6-31**), which has been identified as a potential lateral leakage pathway (L1).

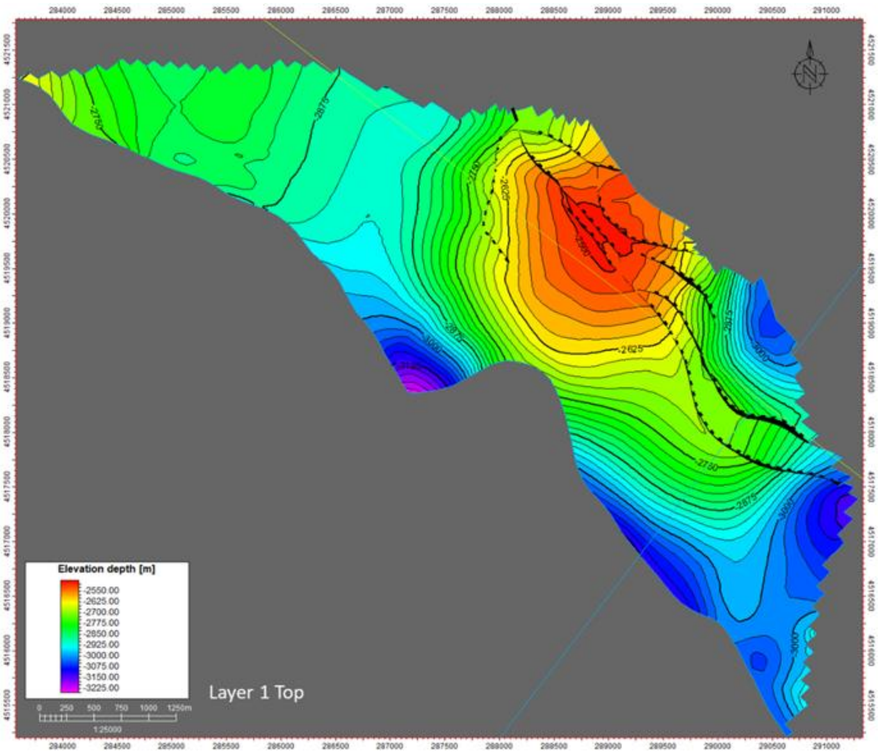


Figure 6-31: Plan view of the storage site model – map of the top of zone A. The deeper area (potential leakage point) between the Prinos and Epsilon structures is depicted on the map.

However, for the given CO_2 injection rate of 1 MTPA, all simulations conducted during the sensitivity analysis phase indicate that 100% of the injected CO_2 remains within the Prinos anticline. Consequently, there is no realistic likelihood of CO_2 migrating after injection to the leakage point and subsequently leaking into the Epsilon reservoir. **Figure 6-32** shows a representative cross-section along the Prinos and Epsilon structures, highlighting the area of the potential leakage point. Based on the baseline scenario of 1 MTPA, the CO_2 plume migrates over time toward the top of the Prinos anticline, moving away from the Epsilon area and the leakage point, and appears to remain at the top even 100 years after injection.

During the injection period, the density of the supercritical CO_2 remains lower than that of the hypersaline formation water as well as the oil. Given that the injection points are located in the lower areas of the structure, which favor the movement of the CO_2 plume towards the top of the Prinos anticline, most of the injected CO_2 will eventually be retained beneath the crest of the structure, except for quantities trapped by various other mechanisms. The only possibility for downward migration of CO_2 is through diffusion into the hypersaline formation water, during which the density of the CO_2-saturated hypersaline water increases by a small percentage (approximately 2–3%). If this occurs, the denser CO_2-saturated hypersaline water will settle downward rather than migrate laterally.

An analysis of the potential CO_2 leakage pathways is presented in **Section 10.4.1** of this Environmental Impact Assessment (EIA), along with the corresponding risk assessment.

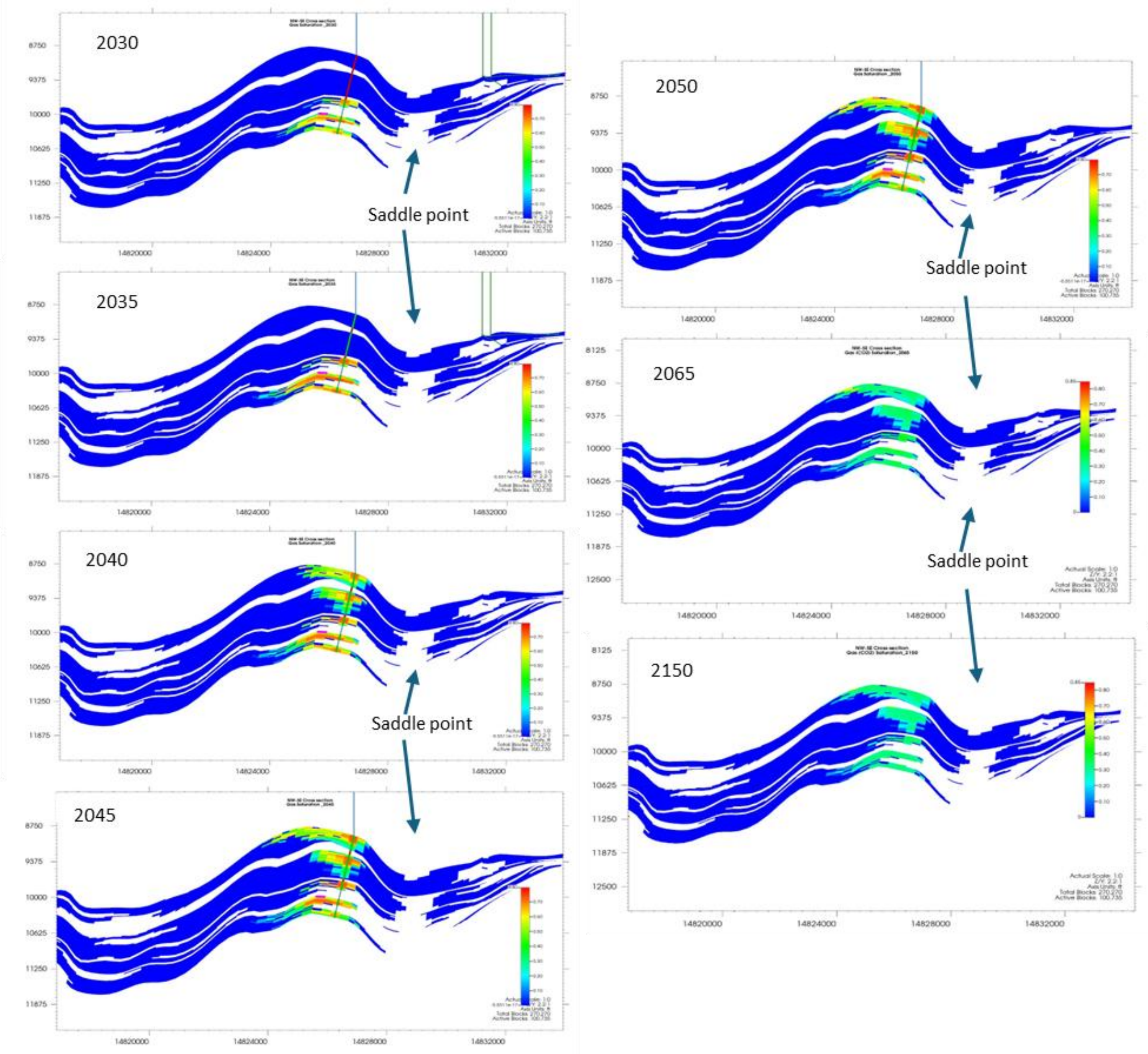


Figure 6-32: Cross-section along the Prinos and Epsilon structures. The deepest area (outflow point) is indicated on the sections. Over time, the CO_2 plume migrates toward the crest of the Prinos anticline, moving away from the Epsilon area and the potential outflow point. The CO_2 plume remains at the top of the structure even 100 years after injection.

6.3.2 Modifications to Existing Facilities

6.3.2.1 Modification of the Beta Platform

The existing Beta platform has slots for 12 wells and is connected to the Delta processing platform (**Figure 6-33**).

Modifications will be made to the Beta platform to include the necessary CO_2 injection facilities. It will be equipped with a riser, a gathering pipeline, and equipment for processing CO_2 loads, while auxiliary facilities may be upgraded to support the new activities. Two CO_2 injection wells and two water production wells will be drilled by repurposing existing wells on the Beta platform. Prior to repurposing, the existing wells will be sealed and abandoned. The two water wells will operate with Electric Submersible Pumps (ESPs) to produce the required water, which will then be managed at the existing processing facility on the Delta platform.

Four of the 12 slots will be used for the two new CO2 injection wells (see **Section 6.3.3.4.1**) and the two new water production wells (see **Section 6.3.3.4.2**).

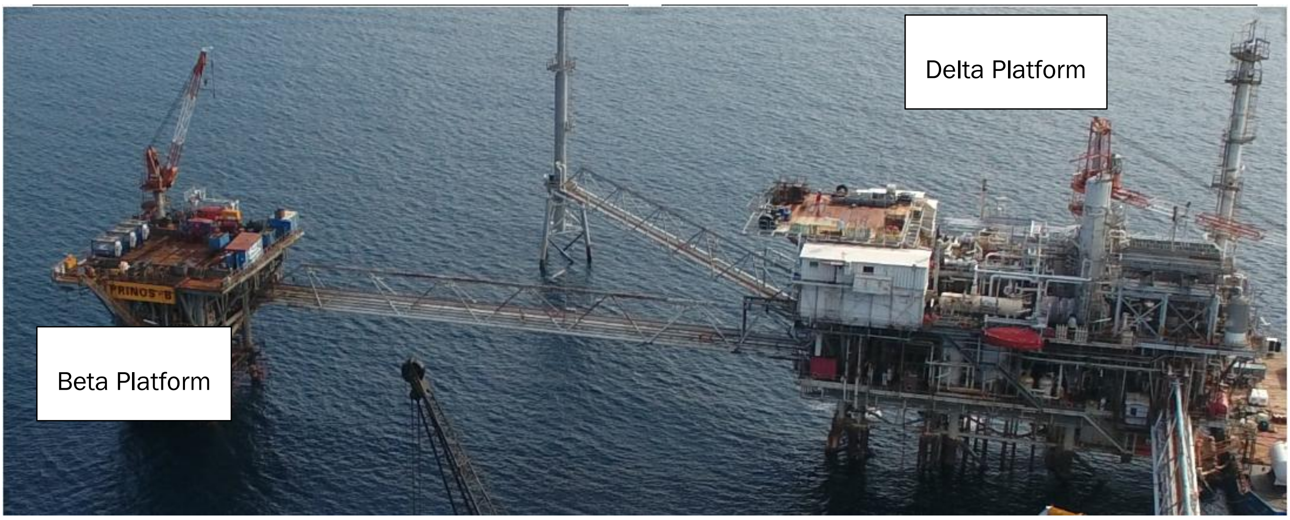


Figure 6-33: Beta and Delta Paltforms

The works will be carried out under safe conditions and with SIMOPS work permits, which are currently implemented as part of the Prinos operational procedures.

The following process flow diagram illustrates the equipment required from the top of the lift pipeline to the injection well (**Figure 6-34**):

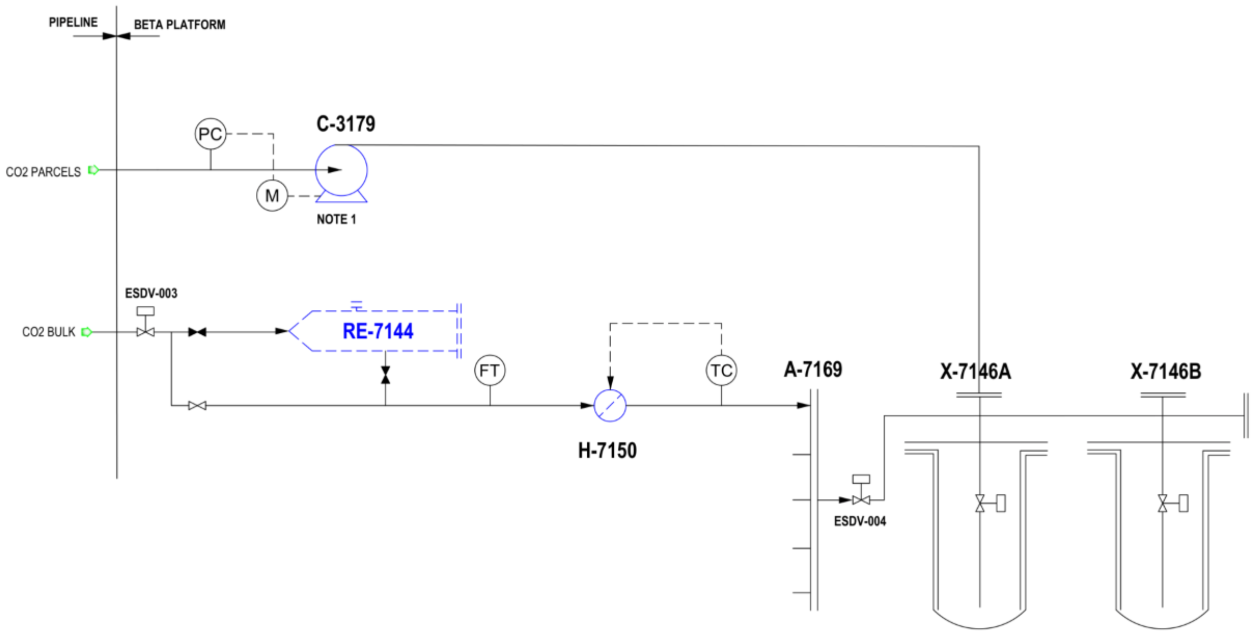


Figure 6-34: Flow Diagram from the CO_2 Pipeline to the CO_2 Injection Wells

The additions/modifications of equipment on the Beta platform will include, in summary, the following:

- Piping for connecting the new CO_2 pipeline to a temporary tie-in point leading to the well.
- Piping related to the required startup heater and compressor
- Pipe connections to the "Christmas tree" and the injection wellhead.
- Safety valves and shutdown systems.
- Electrical interconnection and equipment for monitoring and communication with onshore control stations.
- Piping from the water production wells and connecting pipelines to the existing water treatment facility on Delta platform via the existing bridge.

6.3.2.2 Modification of Delta Platform

The modification of the Delta platform will involve a comprehensive upgrade of auxiliary facilities, the produced water treatment and disposal unit, and the control and safety systems. This upgrade aims to ensure that the water produced for reservoir pressure management will be treated using the existing facilities. This integrated approach optimizes resource use while enhancing the platform's operational performance, environmental management, and the protection of the marine environment.

It is expected that the water produced from the storage project will undergo the same treatment process currently in place. However, this will be further evaluated at the beginning of the project's operation, by sampling aquifer water from the storage complex.

6.3.3 CO_2 Management Facilities (Reception – Transport – Injection)

6.3.3.1 Onshore Facilities – Site Layout

The key infrastructure for receiving CO_2 at the Sigma plant activity site during Phase 1 of the Project operation will include a reception station, consisting of the reception manifold of the onshore CO_2 pipeline and a compression/pumping station for the CO_2 loads.

The area where the bases of the onshore equipment will be installed is estimated at approximately 50 m^2. The estimated excavation area for the onshore section of the pipeline is 200 m^2.

Road access for the needs of the new Project—mainly for the delivery of CO_2 loads by truck—will be through the Main Gate of the Sigma plant (Figure 6-35).

Figure 6-35: Road access for servicing the new facilities (onshore installations)

The layout of the Sigma plant and the area designated for the reception and the starting point of the pipeline are shown below in red. The area will be approximately 30 m x 30 m and will also serve as the starting point of the subsea pipeline at the shore.

Figure 6-36: Area of onshore infrastructure for CO2 reception and transportation

The main service roads will serve all units for operation, maintenance, construction, and emergency access, ensuring vehicle circulation both inside and outside the facility and in both directions. The internal service roads will allow flexible movement around the facilities for operational and maintenance purposes.

The access road to the plant from the existing western road to Kavala will be paved and will have vehicle speed limit signage approaching the plant. The main vehicle and personnel entrance gate to the plant is centrally located on the western perimeter fence.

6.3.3.2 Reception and CO_2 Management Equipment

The onshore CO_2 management facilities (reception, processing, and pumping to the storage site) are located within the Sigma facility.

The type and nature of these facilities will be based on standard industry practices for gas transfer from onshore to offshore installations.

The main equipment, whose technical specifications are presented according to the results of the preliminary design study (pre-FEED), includes:

- Collection pipeline with appropriate flanged outlets. Design pressure: 240 barg, design temperature: -46°C (operating conditions 90 to 220 barg).
- Portable pig launcher/receiver for the subsea pipeline. Design pressure: 240 barg.
- Onshore pipeline 12-16" with welded connection to the subsea pipeline. Design pressure: 240 barg, design temperature: -46°C (operating conditions 90 to 220 barg).
- Monitoring equipment, safety valves, control room.

The manifold connection and all necessary equipment for the supply of liquid CO_2 through pipelines will be installed in a way that minimizes interaction with the existing facility.

The piping will be designed to minimize flange connections. All valves will be positioned to allow access for their operation and maintenance, taking into account the duration and frequency of their use.

CO_2 loads will be transported to the Sigma quay and loaded onto supply vessels or barges that will transfer them to the offshore facilities of Prinos.

6.3.3.3 CO_2 Transport Pipelines to Storage

A large-diameter pipeline of 12-16" will be installed for the maximum capacity of Phase 1, which will also be sufficient for Phase 2 (1500#, material: CS, WT: 0.5", coating: 3mm LPP, design pressure: 240 barg, design temperature: -46 °C).

The pipeline will be routed from the onshore area of the Sigma plant to a receiving point at the Beta platform (**Figure 6-37**).

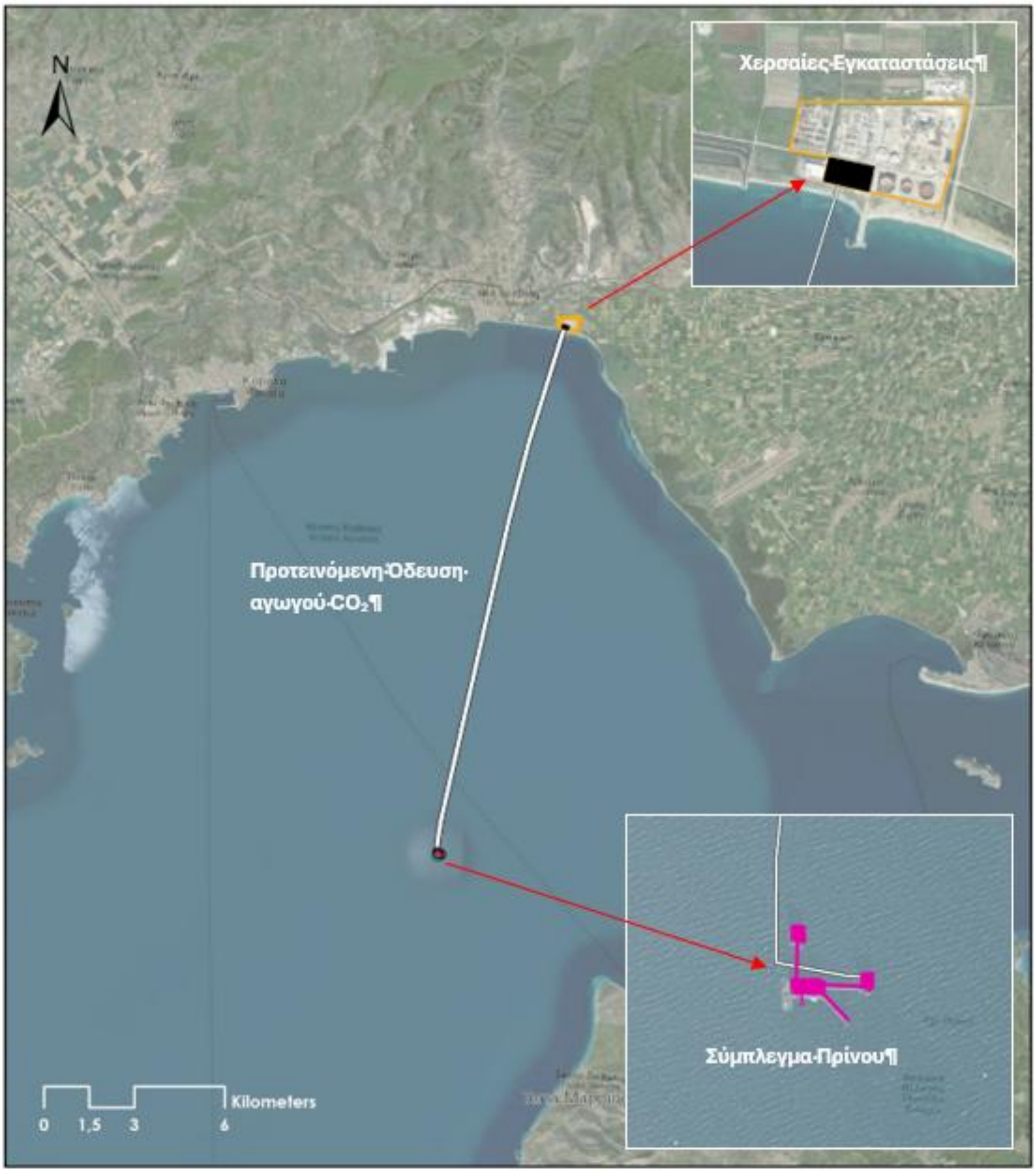


Figure 6-37: CO_2 pipeline routing

The main characteristics of the pipeline, according to the preliminary design study (pre-FEED) completed in 2022, are as follows:

- Length: 20 km, within the existing corridor of the Prinos pipelines.
- Size: 12-16" OD, 3 mm anti-corrosion coating, concrete coverage thickness of 30 to 50 mm.
- Anti-corrosion protection: Anodes at suitable intervals to provide a 30-year lifespan.
- Installation: The pipeline will be buried along its entire length to protect it from trawling fishing activities in the area. In the coastal section, for the first 500 m, the burial depth from the top of the pipeline will be 2 m, and in the offshore section, the burial depth will be 1 to 1.5 m.
- Maximum water depth: 32 m at the platform location.

6.3.3.4 CO_2 Injection and Water Production Wells

Two CO_2 injection wells and two water production wells are planned to be drilled in the Prinos reservoir. All wells must be drilled within zones B and C of the Prinos reservoir, in order to inject CO_2 and simultaneously produce water from the aquifers located below zone A of the reservoir. The targets of each well have been determined based on the Geomechanical model mapping the reservoir boundaries.

Table 6-6: Final Drilling Depth Criteria (UTM zone 35N)

Type of drilling	Name	Starting well	Starting depth of new well (m)	Target	Surface location
CO_2 Injection	PBC-1	PB-17A	1.000	X:287725.69 y:4518803.72 Z:-2779.95	X:288963.21 y:4519413.86
CO_2 Injection	PBC-2	PB-24	1.000	X:287778.73 y:4519015.54 Z:-2718.38	X:288963.21 y:4519411.57
Water Production	PBW-1	PB-22	1.000	X:290192.01 y:4517931.73 Z:-2741.54	X:288967.79 y:4519416.15
Water Production	PBW-2	PB-23A	1.000	X:290060 y:4518995 Z:-2840	X:288965.50 y:4519413.86

The drilling stages for each section up to the final measured depth of 3,700 m include, in summary:

- Drilling with a 16" diameter up to a measured depth of approximately 2,200 m (vertical depth 1,850 m).
- Drilling with a 12-1/4" diameter up to a measured depth of approximately 3,150 m (vertical depth 2,667 m).
- Drilling with an 8-1/2" diameter up to a measured depth of approximately 3,700 m (vertical depth 2,800 m).

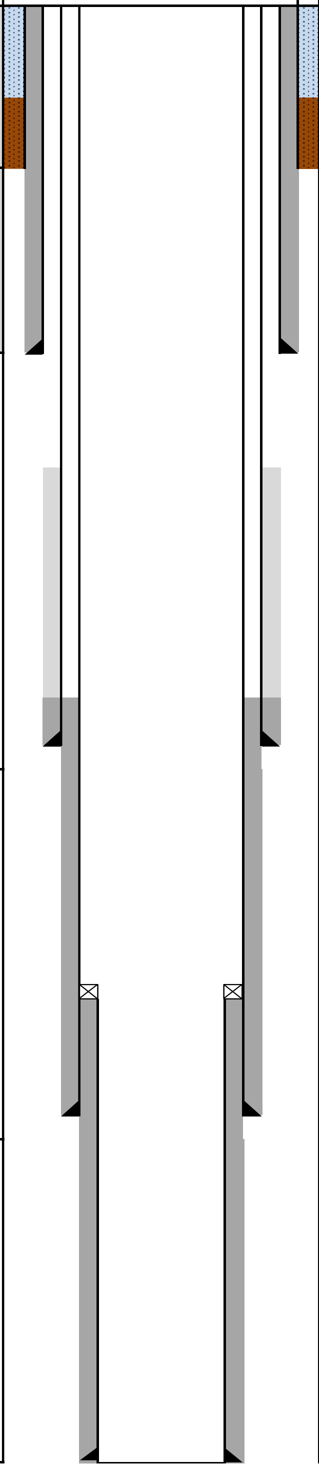
6.3.3.4.1 CO_2 Injection Wells

During the first 3 years of operation of the storage site, the CO2 injection rate will gradually increase from 0.25 to 0.5, then to 0.75, and finally to 1.0 MTPA.

CO2 injection will target zones B and C of the reservoir with two injection wells during the period 2025-2035, and then it will expand to the entire reservoir by the end of the Project.

Figure 6-38 presents a schematic diagram of the injection wells in the expected configuration based on the preliminary design. The final depth and exact operating parameters will be finalized at a later design stage.

CCS injector Well Status Diagram: Rev A



HOLE SIZE	DEPTH MDBRT	DEPTH TVD RT	INC	Conn OD	Min ID / Drift	CASING DESIGN MDBRT	CASING DESIGN Description
						30.5 m	MSL
						62.0 m	Sea bed
Drive	91	91	0	24.000	22.500	91 m	24" Conductor
22"	349	349	3°	18.625	17.755" (Casing ID) 17.568" (Drift ID) 17.568	349 m	18 5/8" Surface Casing
16"	2,200	1,850	45°	14.252	12.415" (Casing ID) 12.259" (Drift ID) 12.259	2,209 m	13 3/8" Intermediate Casing
12 1/4" x 13 1/2"					8.535" (9 5/8" ID) 8.500" (9 5/8" Drift ID)		9 5/8" casing from surface to above 13 3/8" shoe, 9 7/8" across open hole
					8.539" (9 7/8" ID) 8.500" (9 7/8" Drift ID)	3,950 m	Top of 7 5/8" Production Liner & 9 5/8" x 9 7/8" XO
	3,150	2,667	68°	10.984	8.500	4,003 m	9 7/8" x 9 5/8" Production Casing
8 1/2" x 9 1/2"					6.375" (Casing ID) 6.25" (Drift ID)	0 m	Top of 4 1/2'' slotted liner
Well TD	3,700	2,837	83°	7.811	6.250	4,984 m	7 5/8" Production Liner

Figure 6-38: Schematic diagram of CO_2 injection wells

6.3.3.4.2 Water Production Wells

The water production wells will be equipped with Electrical Submersible Pumps (ESPs) and will extract water from the reservoir, providing a means of active pressure management of the reservoir. The produced water will be directed to the water treatment facilities on the existing Delta platform, from where the treated water will eventually be discharged into the sea.

The operation development of the water production wells is expected as follows, according to simulation studies:

- The two water production wells will operate with a production rate of up to 7,500 bwpd each during the period 2025-2030 (6 years).
- Water production will increase to 9,000 bwpd per well in 2031 and continue at this rate until the end of the Project.
- The capacity of 7,500 bwpd per well corresponds to the operation of the Electrical Submersible Pump (ESP) at 83% of its capacity, while the capacity of 9,000 bwpd per well corresponds to operation of the ESP at 100% of its capacity.

The configuration of the water production wells will be similar to that of the CO2 injection wells.

6.3.4 Auxiliary Facilities

The existing auxiliary facilities at Prinos include steam and electricity generation, seawater desalination, air network, fuel systems, closed-loop cooling system, open-loop cooling system using seawater, nitrogen supply, fire-fighting network, and flare system.

The table below presents the surplus capacities of the available auxiliary (onshore) facilities:

Table 6-7: Available Capacity of Auxiliary Systems in Onshore Facilities

Auxiliary system	Unit	Available capacity
Steam @ 20.6 barg	t/h	40
Steam @ 4.8 barg	t/h	40
Power	MW	1 (estimate)
Cooling water @ 4.8 barg	M^3/h	1700
Air @ 6.9 barg	Nm^3/h	400

The air network of the facilities provides up to 1,575 m^3/h of dry air at 6.9 bar.

The available auxiliary systems of the offshore facilities of Prinos are:

- Chemicals – demulsifier and corrosion inhibitor, biocides, etc.
- Acid gas dehydration with triethylene glycol (TEG)
- 3 air compressors (total capacity: 1,000 Nm^3/h)
- 4 seawater pumps (135 m^3/h each)
- Diesel
- Potable water

- Communication network

6.3.4.1 Electrical Power Network

The connection of the Sigma facilities to the 150 kV DESMIE network is achieved via a ring connection from the Kavala and Iasmos branches. The two high-voltage power lines from Kavala and Iasmos connect at the outdoor substation to the 150 kV busbar located in the northwestern area of the Sigma facilities site.

The facilities include a combined heat and power (CHP) plant consisting of two gas turbines and one steam turbine for electricity generation, with a total capacity of 17.67 MWel. The power units comprise one steam turbine-generator set with a capacity of 5.5 MW, with steam extraction at 20.7 bar and 4.8 bar, and two gas turbines with a capacity of 5.5 MW each, paired with two generators of 7,150 MVA.

There is also a backup diesel generator of 1,200 kVA for starting the gas turbines in the event of a complete power outage from the DEDDIE grid. For powering the emergency lighting system and the battery chargers (UPS system), there is a backup generator G-625 with a capacity of 250 kW.

The current energy demand in the present situation is approximately 6 MW (based on the maximum average monthly energy consumption during the period 2016-2022), of which the energy consumption at the offshore facilities is about 4 MW.

The location of the main electrical installations and control facilities at the Sigma onshore installations is shown in Figure 6-39, while Figure 6-40 shows the open-type electrical substation.

Figure 6-39: Location of the main electrical installations and control facilities at the Sigma facilities

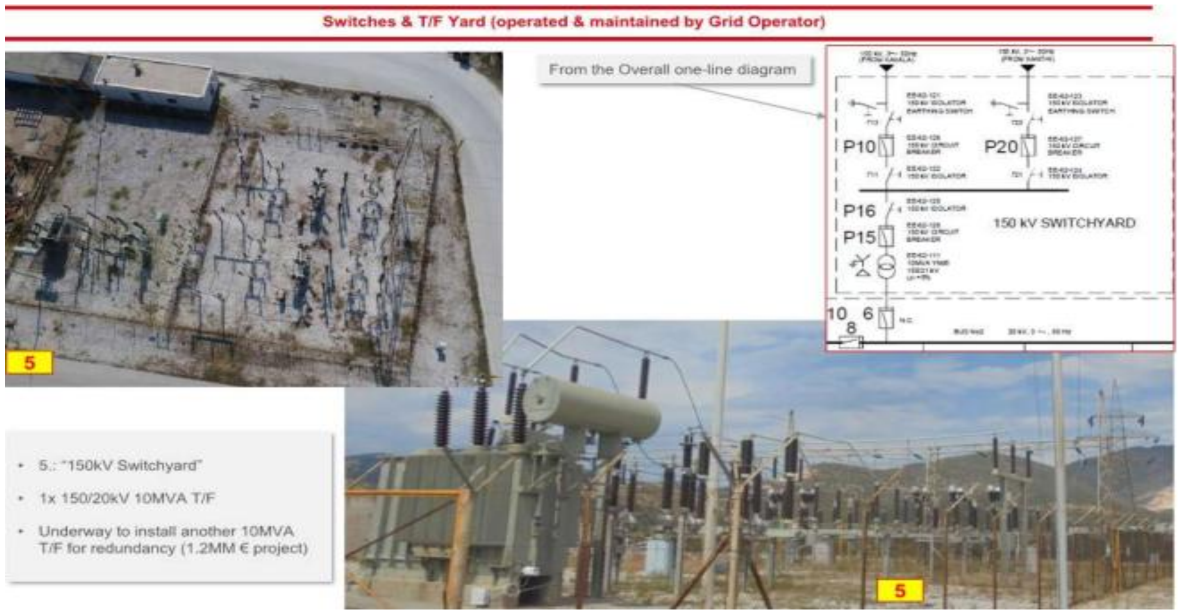


Figure 6-40: Connection of the Sigma facilities to the electrical grid

Electrical power is supplied from the onshore facilities to the Delta platform via 20 km long subsea cables (2 x 3C-120 mm^2, 20 kV), which currently provide power up to approximately 4 MW.

Regarding the **needs of the new facilities**, no increase in energy demand is expected for the **onshore facilities**, as no processing is planned there either for the CO2 loads or for the quantities delivered via pipelines.

The following main electrical installations are planned for the **offshore facilities** during Phase 1:

- For the pumping of the produced water from the water wells at the Beta platform, two Electrical Submersible Pumps (ESPs) with a capacity of approximately 0.5 to 1 MW each are planned. Power supply to the pumps will be provided via power cables fed from Variable Speed Drive (VSD) systems within the electrical room of the Beta platform. Subsequent development phases will require the installation of additional water wells and corresponding submersible pumps and transmission systems, with a corresponding increase in required power.
- Heating and pumping/compression equipment will operate on the upper deck of the Beta platform for the processing of CO2 under the required conditions for its injection.
- The surface "Christmas tree" valves will be equipped with the necessary control systems, power supply, and hydraulic system from the hydraulic power unit and the Control Panel of the wellhead.

6.3.4.2 Natural Gas Network

The natural gas fuel used in the Prinos installations and at the Sigma plant is a blend of three types of sweet natural gas, originating from the Prinos fields, the South Kavala field, and from the DEPA S.A. network via the PFIC Ltd fertilizer plant (formerly VFL).

The natural gas consumption points are the glycol heater (Delta platform), the acid water stripper (Delta platform), and at the onshore facilities, the steam boilers B-611/B-612, the gas turbines GT-1/GT-2, the steam superheater H-611, the sulfur unit incinerator, the flare pilots ME-649, and the regeneration furnace of the Sulfreen unit H-504.

6.3.4.3 Steam Production

Steam for the operational needs of the Sigma facilities is produced as follows:

- Two combustion boilers with a capacity of 36.6 t/h and two waste heat boilers with a capacity of 22.7 t/h (sulfur installation) produce 79.9 t/h saturated steam at 41.4 bar.
- superheater with a capacity of 79.4 t/h produces steam at 41.4 bar and 420°C.

Part of the superheated steam at 41.4 bar (420°C) is used in the steam turbine of the power generator G-624, from where it is routed to the 20.7 bar and 4.8 bar steam systems. The remaining steam is desuperheated to 371°C using boiler feedwater in two desuperheaters DSV-603 A/B. This steam is subsequently used in steam turbines driving motors, pumps, compressors, and blowers necessary for the operation of the facilities.

6.3.4.4 Cooling Systems

The open seawater cooling system (one-through) consists of two pumps with a capacity of 2,497 m^3/h at 4.8 bar (one standby), supplying water to the heat exchangers.

The closed-loop cooling system (freshwater) consists of a heat exchanger cooled by seawater and two pumps of 79.5 m^3/h (one standby) that supply water at 3.45 bar to compressors, turbine bearings, pumps, and other equipment where freshwater cooling is required.

6.3.4.5 Nitrogen Supply

A dedicated liquid nitrogen storage tank exists at the Sigma plant's onshore facilities, equipped with special vaporizers to supply gaseous nitrogen to the plant's distribution network. Additionally, portable nitrogen supply systems (clusters) are available for nitrogen use in the onshore facilities as needed.

6.3.4.6 Fire, Hydrogen Sulfide and Explosive Gas Detection System

The onshore facilities of the Sigma plant are covered by a dense network of detectors of various types, depending on the requirements of the areas they protect. In the plant's central control room, there is a special panel that visually (indicator lights with coded colors) and audibly (buzzers) displays signals indicating the location and cause of detector activation. The installation includes:

- Smoke detectors (ionization type), thermal detectors, explosive gas detectors, hydrogen sulfide detectors, hydrochloric gas detectors, chlorine gas detectors,
- Building pressure loss detectors,
- Manual fire alarm switches, hydrogen sulfide/gas leak alarms,

- Light repeaters,
- Local fire/hazard alarm buzzers,
- Portable gas and hydrogen sulfide detectors.

The existing offshore facilities operate systems for detecting flammable gases, H_2S, and fire, which are connected to the fire and gas control panel in the control room of the Delta platform.

For the needs of the new CO_2 storage Project, systems will be installed to prevent CO_2 leakage, in accordance with the specific Monitoring Plan (**Appendix 17.2**).

6.3.4.7 Emergency Shutdown Systems

In case of an emergency, the operation of the units at the onshore facilities of the Sigma plant can be stopped manually or automatically. Specifically, there are:

- Manual emergency shutdown switches that stop the flow in the subsea crude oil and sour gas pipelines (located in the control room and at the gate).
- Manual emergency hold switches for the sulfur production unit U-500 as well as for the equipment.
- Automatic emergency shutdown system with fire and flammable gas detectors in the gas turbine unit.
- Emergency shutdown system for the facilities due to operational abnormalities (high/low pressures or levels).
- The main equipment is also equipped with local manual emergency shutdown switches for selective unit stoppage.

In the **new** bulk CO2 receiving **facilities** under study, the import riser for the CO2 pipeline to the offshore installations will be equipped with Emergency Shutdown Valves (ESDV) for isolation.

6.3.4.8 Firefighting Network

The fire protection network of the Sigma plant's onshore facilities utilizes seawater. The required water volume is provided by two pumps, each with a capacity of 681 m^3/h at a pressure of 8.6 bar. One of these pumps is electrically powered (main), and the other is diesel-powered (backup). The network pressure is maintained by a jockey pump with a flow rate of 28.4 m^3/h at a pressure of 7.9 bar. All three pumps draw seawater from the seawater intake basin located within the plant's premises. In the same area as the firefighting pumps, there are also seawater pumps installed to meet the operational needs of the plant (e.g., equipment cooling). These consist of two pumps, each with a flow rate of 2,497 m^3/h (one of which is a backup) at a pressure of 4.8 bar. A permanent 8" connection is in place from the cooling water pumps to the discharge line of the firefighting pumps, providing a contingency in the unlikely event that both firefighting pumps fail. The firefighting water distribution network consists of an underground pipeline loop with a 12" diameter and is divided into sections with 25 valves. This allows for water flow from two different directions and enables the isolation of any part of the network in case of failure.

At Delta platform, four seawater pumps are installed (135 m^3/h each). The firefighting system provides the necessary firefighting water (seawater) to all Prinos platforms, either manually or automatically, based on the activation of two fire detectors. Firefighting water (at a flow rate of 455 m³/h) is supplied by one diesel pump and one electric firefighting pump.

No modifications to these systems are expected to be required for the needs of the new Project.

6.3.4.9 Potable Water Supply and Distribution Network, Water Softening Unit

The potable water system of the Sigma plant's onshore facilities includes:

- A 6" water supply pipeline from Paradisos, 1 km in length, connected to the main 16" Paradisos–BFL water pipeline.
- A feed pump P-631A with a capacity of 5.7 m^3/h at 4.8 bar (used only when the pressure in the main Paradisos pipeline is low).
- A pressurized vessel V-630 with a capacity of 1.9 m^3, from which the distribution network is fed (offices, workshops, laboratory, control room, locker rooms, guard post), as well as the automatic supply valve LV-601A. The pressure in vessel V-630 is maintained by compressed air. An increase in pressure (3.5 barg) indicates a rising water level in the vessel, which automatically closes the supply valve, stopping the water flow. Conversely, a pressure drop (2.0 barg) indicates a falling water level, which automatically opens the valve to resume water supply.
- A chlorination system CH-630 for the periodic chlorination of the water.

The Water Demineralization Unit (WDU), with a capacity of 30 m^3/h, operates with a Paradisos feed of 5–8 m^3/h to compensate for losses in the boiler feedwater network. The unit consists of a sand filter, a cation exchanger, a carbon dioxide degasser, an anion exchanger, and a mixed-bed ion exchange unit.

6.3.4.10 Communication, Monitoring and Control Systems

The new onshore facilities will be monitored and controlled from the existing Central Control Room (CCR) and the Local Equipment Room (LER) at the Sigma plant.

VHF and telecommunications network infrastructure is available at the existing offshore facilities, which are connected to the onshore facilities via high-frequency links. The operations of the new Prinos CO_2 storage Project will utilize the existing communication network.

6.4 CONSTRUCTION PHASE

6.4.1 Construction Process

6.4.1.1 Onshore Facilities – Structural Works and Configurations, CO_2 Reception and Management Equipment

The designated equipment will be prefabricated off-site and delivered by trucks to the construction site, where it will be unloaded using a crane. Construction works for the onshore facilities will include the following:

- Geotechnical sampling and data collection.
- Ground preparation for equipment foundations.
- Concrete works (0.5 m thick) for base slab foundations. Excavation areas will be limited to the points where the onshore equipment foundations will be placed, estimated at approximately 50 m^2. The estimated excavation area for the onshore section of the pipeline is 200 m^2, with a depth of 3 m.
- Once the pipeline trench is excavated, it will be backfilled with the same material.
- Installation of piping assemblies and welding. The pipes will be installed on the ground on the new foundations, without requiring protective casing, as is standard for onshore plant piping.
- Connection and testing of the electrical network and instrumentation.

6.4.1.2 CO_2 Transport Pipelines to Storage Site

The subsea pipeline will be buried along its entire length to protect it from fishing activities (trawlers) in the area. In the onshore section, the burial depth for the first 500 m will be 2 m from the top of the pipe (Top Of Pipe – TOP), and in the offshore section the burial depth will range between 1 and 1.5 m (TOP).

The pipeline construction works will be carried out in five phases:

- **Phase 1:** Geophysical and geotechnical surveys along the pipeline route (1 month).
- **Phase 2:** Shoreline approach works for the pipeline, including dredging of a 500 m section from the shoreline at the pipeline head area at the Sigma plant. The trench will be approximately 3 m deep along its entire length, ending level with the seabed at the end of the 500 m zone (6 months).
- **Phase 3:** Installation of the subsea pipeline and hydraulic testing using a specialized pipe-laying vessel (2–3 weeks).
- **Phase 4:** Installation of the riser pipeline at the existing Beta platform and diving works to connect the riser to the end of the subsea pipeline (1 week).
- **Phase 5:** Final testing and commissioning (1 month).

6.4.1.2.1 Phase 1: Geophysical and Geotechnical Surveys

Before construction begins, and in order to determine the final pipeline routing, a series of geophysical and geotechnical investigations will be carried out, in accordance with standard industry practices.

- Geophysical Survey: A small vessel, approximately 15 m in length, equipped with seabed scanning equipment, will be used to provide essential data within the pipeline corridor. This includes bathymetry, detection of any objects, existing pipelines or cables, and seabed profiles up to 5 m below the seabed. Following processing of the results, the final routing will be determined.
- Geotechnical Survey: After the geophysical survey results have been processed, soil samples will be collected using grab samplers and box corers. These samples will be sent to laboratories for soil data analysis, including strength, friction coefficients, and grain size distribution.

6.4.1.2.2 2: Shoreline Approach Works for the Pipeline

Before the pipeline is installed along the nearshore section of the route, an open trench of 500 m must be excavated. Equipment used for trench excavation will be standard dredging equipment employed in port works, including grab dredgers mounted on barges and bucket-type equipment for the deeper sections of the trench (see Figure 6-41 for a typical example).

Figure 6-41: Trench Excavation Equipment

The dredged materials will be stockpiled alongside the trench for later backfilling after the pipeline is installed, so that the pipeline is fully buried in its final position. The estimated volume of seabed excavation material is approximately **7,500 m³**.

Excavators will complete the trench in the nearshore section of the route, up to the connection point with the onshore facilities' pipeline.

Before pipeline installation begins, a **300 Te winch** will be installed at the designated pipeline landfall location. The winch wire will be laid in the trench up to a water depth of **12 m**, at the trench's seaward end, and will be marked. The end of this cable will subsequently be retrieved and used by the pipelaying vessel for installation.

6.4.1.2.3 Phase 3: Installation of the Subsea Pipeline

The 20 km subsea pipeline will be installed by a specialized pipelaying and trenching vessel, supported by two supply/tugboats. The pipeline will be manufactured at a steel pipe fabrication plant, transported by ship to the nearby Filippos B commercial port, and stored securely in an area accessible from the port quay. The pipeline will then be loaded by crane onto the support vessels and delivered to the pipelaying vessel for installation.

Figure 6-42: Typical Pipelay Vessel (S-Lay Method)

The S-lay method for pipeline installation is the oldest and most commonly used method for offshore pipeline laying. It is named so because the pipeline takes on an S-shape during installation (**Figure 6-43**).

Figure 6-43: S-Lay Method

During pipeline installation using the S-lay method, the pipeline is laid loosely from the stern of the pipelay vessel as it moves forward. The pipe descends into the sea until it reaches the seabed (known as the Touch Down Point, see Figure 6-44). Each pipeline joint is welded on board the vessel and gradually deployed into the sea. A supporting stinger at the stern, which may be up to 300 ft (~91 m) in length, assists in guiding and supporting the pipeline as it transitions into the water. Some pipelay barges are equipped with an adjustable stinger.

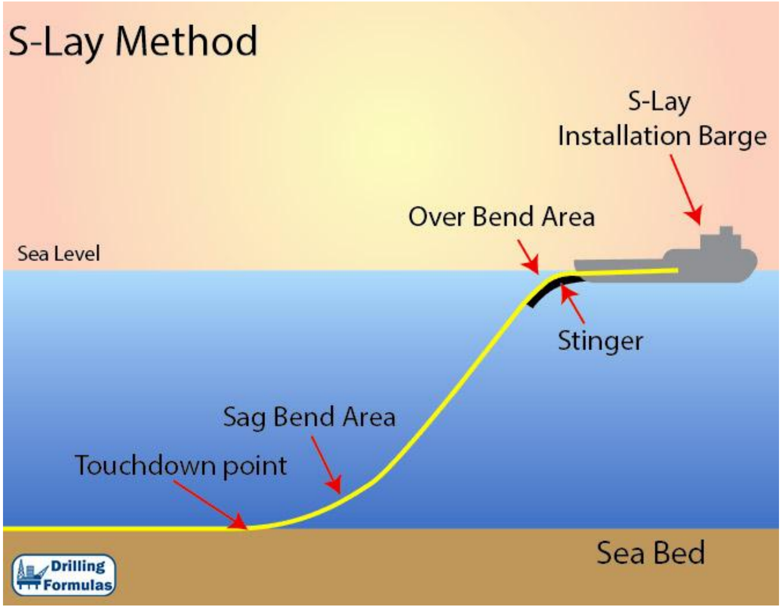


Figure 6-44: Schematic Representation of the S-Lay Method

The S-lay method allows the installation of any pipe size, making it ideal for water depths up to 600 meters. The pipe is welded in a horizontal position. Depending on the vessel's capacity, the laying speed can reach 2–4 km per day, and the pipeline diameter can be up to 60 inches.

Figure 6-45: Pipe Welding on the S-Lay Barge

This method requires high axial tension to prevent excessive bending at both the sag-bend (touch-down point on the seabed) and the over-bend (departure point from the vessel).

The pipeline installation works are expected to last approximately 2–3 weeks, during which marine mammal observers will be present on board. Emissions from this type of vessel are comparable to those of conventional ships. Due to the short duration of operations, waste will be stored on board and properly disposed of once the installation is completed.

After installation, the pipeline will be filled with chemically treated water and subjected to a hydrostatic test. The test will be conducted at a pressure determined by best industry practices, typically ranging from 1.2 to 1.5 times the maximum design pressure of the pipeline.

6.4.1.2.4 Phase 4 – Installation of Riser on Beta Platform, Tie-In Works

Following installation, the pipeline will be connected to the riser on the existing Beta Platform. The tie-in may be executed either from the pipelay vessel or from a specialized diving support vessel. Divers will prepare the platform by attaching clamps to the platform's support structures, enabling the new riser to be mounted. Before installation, the new riser will be hydrostatically tested.

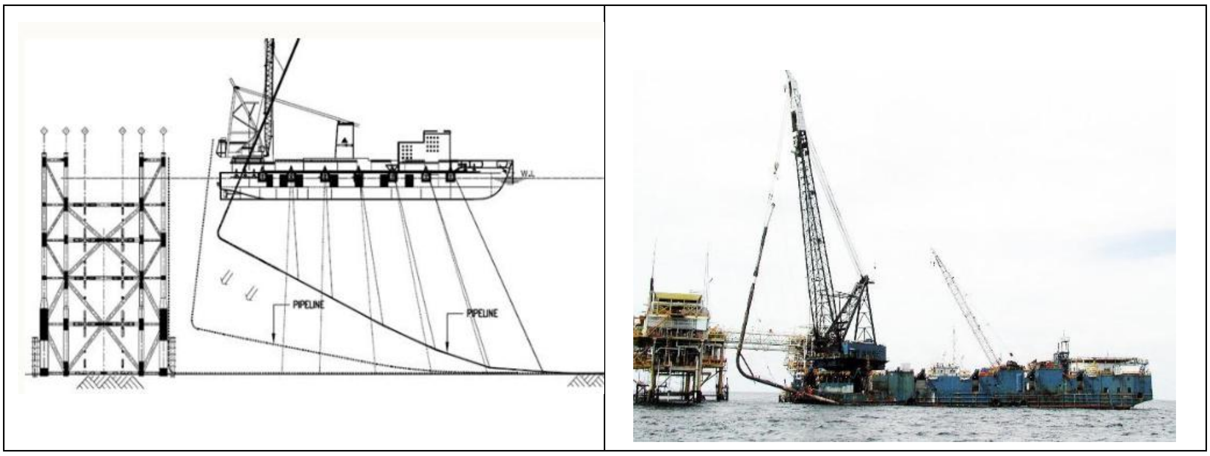


Figure 6-46: Installation of Riser on Beta Platform, Tie-In Works

6.4.1.2.5 Phase 5 – Trenching and Pipeline Protection, Commissioning

Once the pipeline and tie-ins are installed, the entire length of the pipeline must be buried. This process will be supported by appropriate equipment and a dedicated work boat.

Possible trenching tools include:

- A pipeline burial plow, towed by a support vessel, which passes over the pipeline axis and creates the trench.
- A jet sled, supported by a specialized vessel, using high-pressure water jets to form the trench as it is dragged along the pipeline.
- A hydro-trencher, supported by a specialized vessel, which uses an underwater fan to displace soil beneath the pipeline, forming the trench.

Multiple passes may be required to reach the desired trench depth (typically 1.5 to 2 m TOP), depending on seabed conditions. Due to the nature of the soil and the strong bottom currents in the area, natural backfilling of the trench is expected, so no additional backfilling work is planned.

Pre-lay trenching for the full 20 km pipeline route is not economically feasible, and thus this option is excluded. In locations where post-lay trenching is not possible (due to accessibility, proximity to structures, or the platform), exposed pipeline segments will be protected with a concrete mattress for added protection.

After completion of the offshore construction works, the pipeline will be emptied of water using a series of onshore pumps, and remaining moisture will be removed using chemicals such as Monoethylene Glycol (MEG) to ensure it is completely dry and suitable for commissioning. MEG is a recyclable substance listed under the PLONOR[1] list, and will be recovered and disposed of by a certified company. A dedicated study will be conducted prior to construction to confirm the exact quantities of MEG to be used.

6.4.1.3 Injection Wells and Water Wells

The existing wells on the Alpha and Beta platforms of the Prinos field will remain operational during the CO_2 storage project under study, with the exception of four (4) wells that have been selected as starting points (donor wells).

The following describes the activities related to the drilling of four new wells from sidetracks of the donor wells. The wells will be drilled using a jack-up drilling rig. All four new wells will be constructed using conventional methods, employing telescopic casing with decreasing diameters as depth increases. The casings will be cemented in place, with cement filling the annular space between the casing and the rock wall.

Two of the wells will be used as CO_2 injection wells, and two will be used as water production wells, in order to maintain reservoir pressure balance. However, all will be drilled using a Top Drive System (TDS) rig and guided using a combination of mud motors and rotary steerable drilling assemblies, depending on the required angle and inclination. Drill cuttings will be circulated out of the borehole by pumping drilling mud through the drill string, out of nozzles at the drill bit, and then back up through the annulus of the borehole. The drilling mud will be water-based when drilling through the section down to the Brown Marker[2] formation, and oil-based in the evaporite caprock and reservoir section. The mud weight will vary depending on the formation pressure encountered during drilling. Chemicals such as barite are used to increase the weight of the drilling mud as needed.

[1] OSPAR List of Substances Used and Discharged Offshore which Are Considered to Pose Little or No Risk to the Environment (PLONOR) – Update 2024 (https://www.ospar.org/work-areas/oic/chemicals)

[2] At the base of the post-evaporitic sequence and at the top of the evaporites, there is a marker bed known as the "Brown Marker." It is a marl, light to medium gray in color, fine-grained, with high moisture content, calcareous to highly calcareous, and at times firm to very hard, featuring a series of dark clayey layers.

6.4.1.3.1 Drilling rig

To ensure safe drilling operations, a jack-up rig with a capacity of approximately 2,500 hp, equipped with a Top Drive System and three high-pressure mud pumps, will be used. The rig must have adequate tank capacity to support the drilling mud system.

An example of a suitable rig is the CROSCO Labin unit (**Figure 6-47**), designed and manufactured according to API 4F and the latest European regulations, including low emissions standards, and is fully ATEX certified.

Figure 6-47: Jack-Up Rig Labin – Proposed Rig Type for the Project

6.4.1.3.2 Drilling Methodology

Drilling operations may begin once the jack-up drilling unit is connected to the Beta platform. The following sections describe the main elements of the drilling process:

- Drilling mud
- Casing execution
- Blowout Prevention Mechanism (BOP)
- Drilling, Cementing, and Completion
- Loss Management

For the drilling of the wells, the **Rotary Steerable System (RSS)** method will be applied. The decision to use the RSS technique for drilling the 16", 12¼", and 8½" sections is justified by the following:

- Achieves increased drilling performance due to higher Rate of Penetration (ROP) during verticality correction, if needed.

- It is the optimal method for confirming the position of the casing shoe, by enabling the use of near-bit gamma ray tools.
- Provides better control over the wellbore direction.
- Allows for smoother verticality correction, which facilitates casing installation and wireline logging operations to total depth.
- Results in reduced overall wellbore tortuosity.
- Minimizes the risk of **differential sticking**, as the entire drill string is rotated during drilling.

Before drilling begins, a Blowout Preventer (BOP) will be installed. The BOP is one of the primary safety barriers, ensuring that any influx of fluids into the wellbore during drilling cannot reach the surface level of the rig. For each new well, the BOP is installed once the surface casing has been run to the required depth. Initially, the existing well is killed, the Christmas Tree is removed, and the BOP is mounted onto the wellhead. Generally, BOP valves are inspected and tested every 14 days. Any extension of the BOP valve testing period beyond 14 days will require approval from Energean's drilling supervisor.

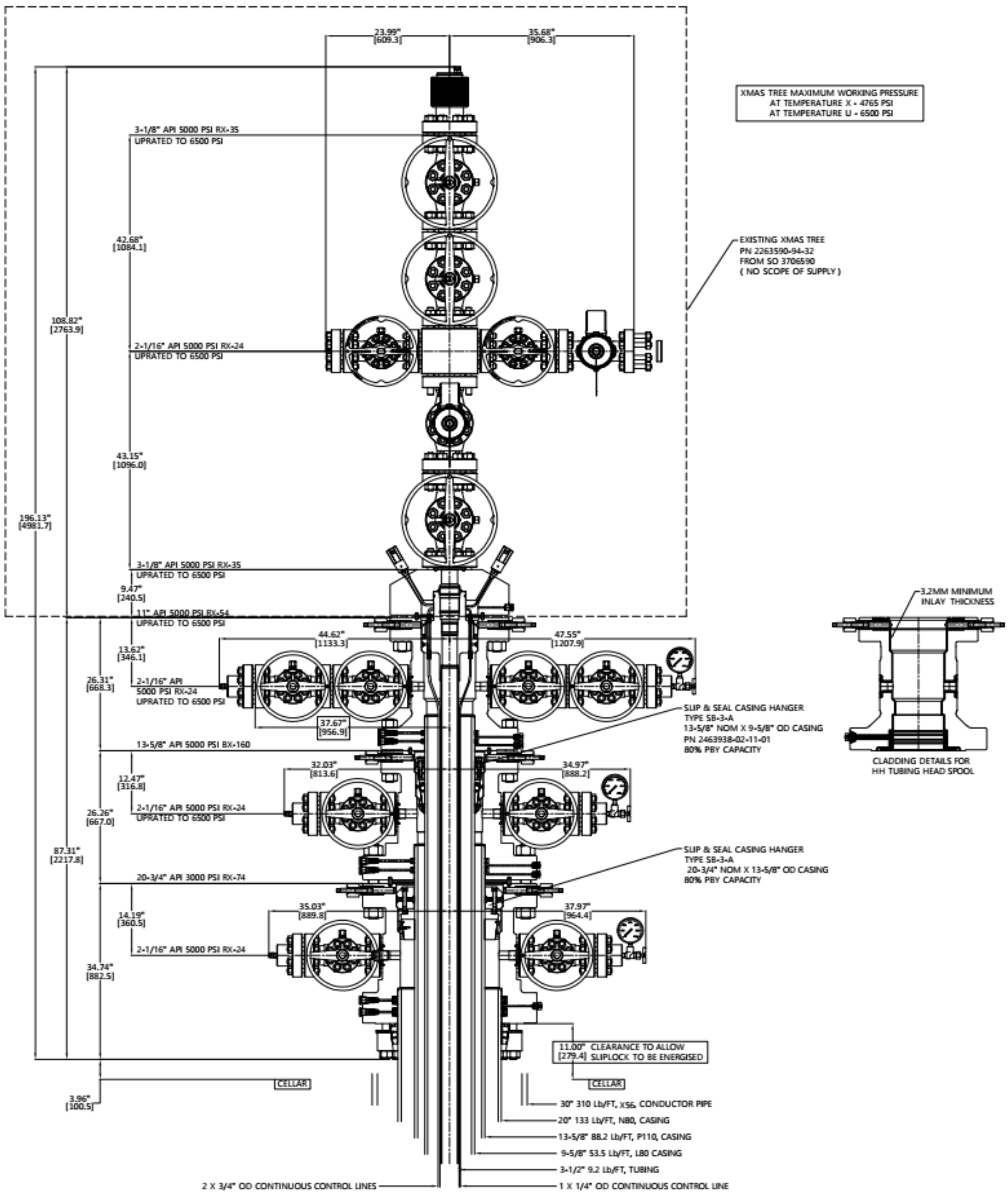


Figure 6-48: 6,500 psi Wellhead System

6.4.1.3.2.1 Drilling Mud

The use of drilling mud (or fluid) throughout the drilling process is essential for the following reasons:

- It removes rock cuttings from the bottom of the well and transports them to the surface, where they are examined to provide information about the geology of the formation being drilled.
- It protects the wellbore walls from collapse by forming a filter cake on their surface, preventing the loss and infiltration of drilling fluids during operations.
- It cools and lubricates the drill bit and the drill string.
- It exerts hydrostatic pressure (equal to or greater than formation pressure), thus controlling the influx of fluids from geological layers into the wellbore.

The drilling mud enters the wellbore through the drill pipe and then returns to the rig floor via the annular space formed between the walls of the wellbore and the drill string. At the rig floor, the drilling mud undergoes a series of processes to allow it to be recirculated into the well. Any gases are then safely removed and vented to the atmosphere. Rock cuttings are separated using a series of vibrating screens (shale shakers). After the shakers, the mud passes through centrifuges where fine solids are removed. Sand remaining in the mud is removed in settling tanks. If gas bubbles are present, they are removed in a separate degassing tank with a vacuum system. The processed mud returns via gravity-fed pipelines to the storage tanks on the drilling unit and is then pumped back to the rig floor using high-pressure mud pumps.

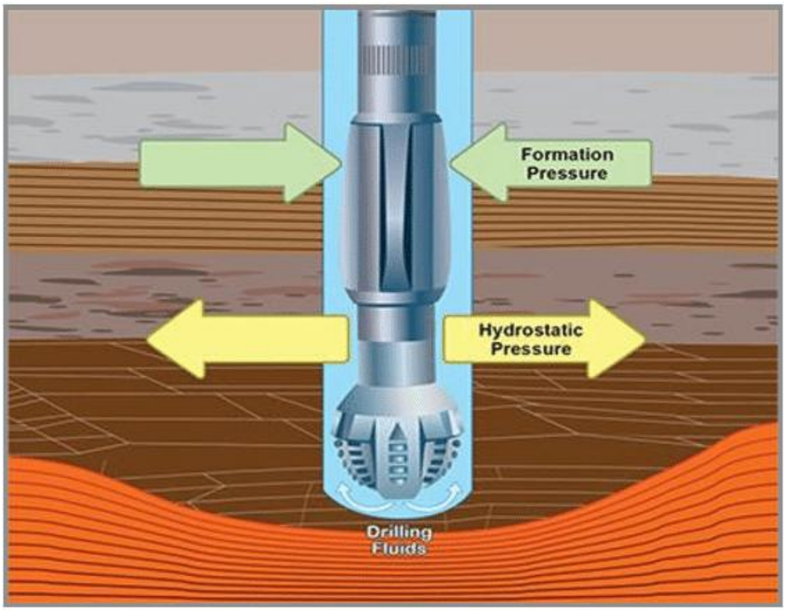


Figure 6-49: Schematic representation of drilling mud circulation

6.4.1.3.2.2 Casing Operations

Once a section of a predetermined diameter is drilled, a casing pipe of slightly smaller diameter is inserted into it. This casing reaches the bottom of the drilled section and serves to stabilize the walls of the wellbore. Once the casing is in place, cement is pumped down the well through a special tool and pushed upward into the annulus, where it hardens. The cement must completely fill the annular space between the casing and the geological formation. After the cement sets, a smaller-diameter hole is drilled to the bottom of the next section, and the process is repeated. In this way, a telescoping and stable wellbore is constructed. The length of each section is defined in the drilling program and depends on the pressure of formation fluids.

In the new wells of platform Beta no surface casing is required as all four wells will be sidetracks and therefore will share the same casing with the existing wells starting points.

The steps for performing the sidetrack include the placement of a packer to be used as a base for the sidetracking equipment whipstock the determination of the sidetrack orientation and the creation of the opening using drilling equipment (**Figure 6-50**).

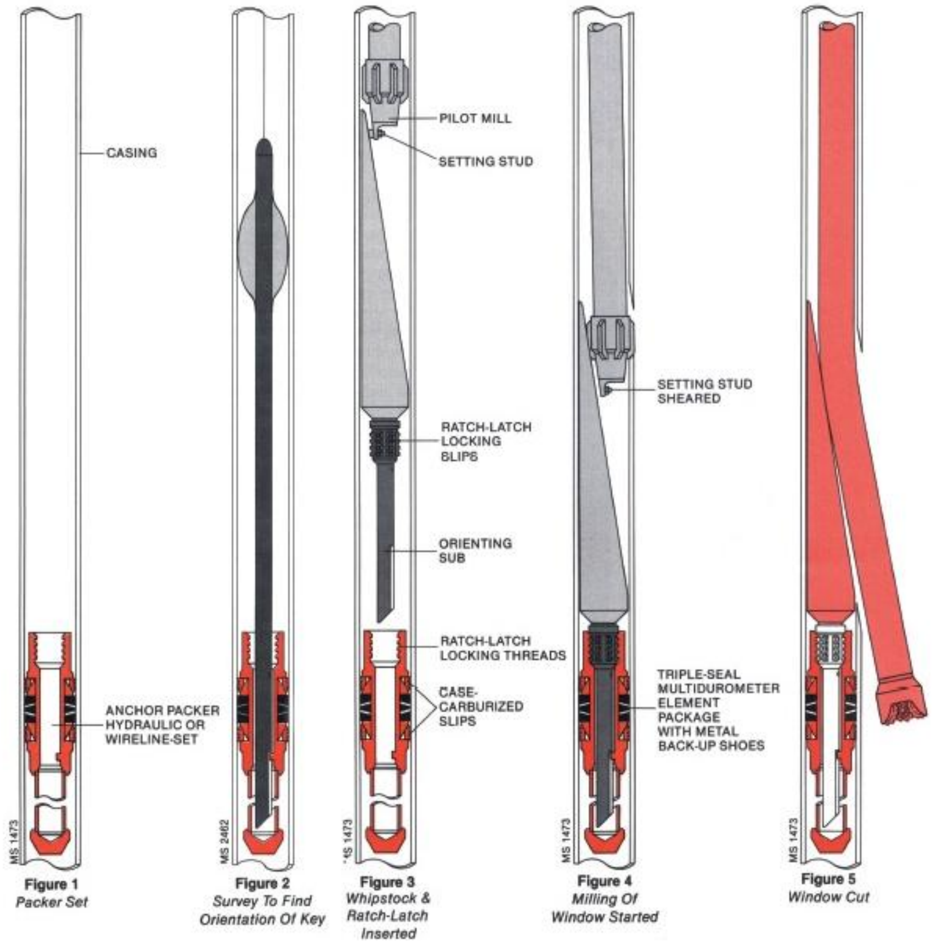


Figure 6-50: Sidetrack drilling equipment

During the drilling operations no coring from the reservoir is planned A complete mud logging unit with suitable operators will be present on the rig during drilling operations.

Formation samples will be collected as described in the following Table.

Table 6-8: Formation samples per drilling phase

Hole Size	Cutting Sample		Frequency
	Number of Sample	Type	
16"	1	Wet	20 m
	1	Washed/Dry	20 m
12 1/4"	1	Wet	20 m
	1	Washed/Dry	20 m
8 1/2"	1	Wet	20 m
	1	Washed/Dry	20 m

6.4.1.3.2.3 Blowout Prevention Mechanism (BOP)

Before drilling begins a Blowout Prevention mechanism BOP will be installed The BOP is one of the main barriers that ensures any fluid influx during drilling will not reach the rig level For each new well the BOP is installed when the surface casing has been guided to the required depth In the case of an existing well the well is initially killed the Christmas Tree is removed and the blowout prevention mechanism is attached to the wellhead.

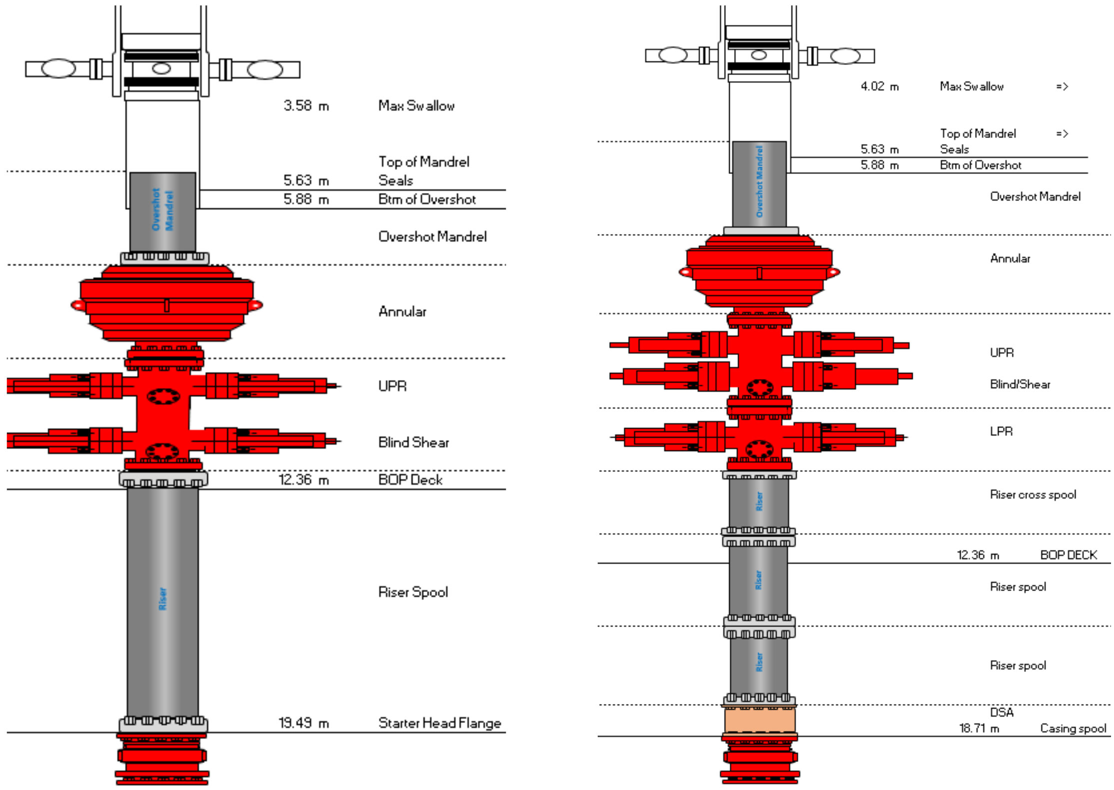


Figure 6-51: BOP Assemblies to Be Used in the Wells Under Study

Fluids from the geological formation may enter the wellbore during drilling if the formation pressure exceeds the pressure exerted on the formation by the drilling mud. The BOP (Blowout Preventer) consists of a series of valves. When required, these valves can be closed using a hydraulic fluid reservoir stored on the drilling floor, in cylinders or accumulators. These cylinders are kept fully charged at all times. A pressure loss automatically triggers the closure of the BOP. When the valves are closed, the well is sealed, preventing fluids from the formation from reaching the surface. The sudden influx of reservoir fluids into a wellbore is called a kick. These fluids may be water or hydrocarbons.

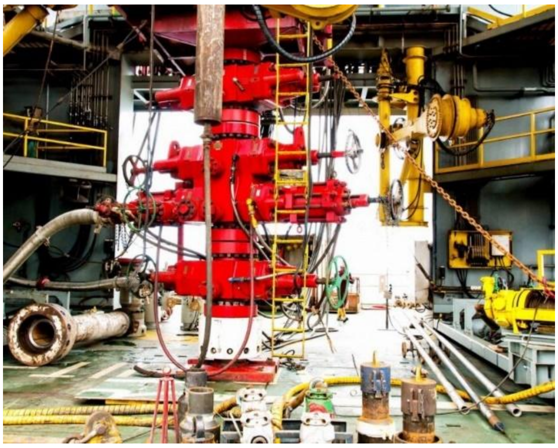


Figure 6-52: Typical BOP Mechanism on a Jack-Up Rig

Before the BOP is reopened, the fluids in the wellbore are removed and the mud weight is increased to prevent further influx. Increasing the mud weight raises the hydrostatic pressure and eventually balances the pressure of the geological formation.

To ensure the proper functioning of this process, special outlet pipes are installed on the BOP. These pipes are placed on the exterior side of the vertical riser and are connected to a remotely operated valve system (choke manifold).

6.4.1.3.3 CO_2 Injection Well and Water Production Well Drilling Procedure

The following describes the program for a CO_2 injection well (including the preparation of the existing starting well) for each section down to the final depth of approximately 3,700 m. The paragraphs below provide a brief description of the drilling stages..

6.4.1.3.3.1 Preparation of Existing Starting Well

For the injection drilling phase, planned to be drilled to a total measured depth of 3,700 m, a permanent mechanical barrier (bridge plug) will be set at a predetermined depth inside the production casing after killing the well. The well is planned to be "killed" (hydrostatic pressure will be significantly higher than that of the reservoir) using specially weighted drilling mud that will provide a hydrostatic pressure at least 200 psi greater than the reservoir pressure. Then, the production tubing will be retrieved from the mechanical barrier up to the surface, and a double cement plug will be placed.

Placing the cement plug will achieve complete isolation between geological formations (rock-to-rock), since at this depth the formation outside the well is impermeable. The next step is to retrieve the 9 5/8" production casing down to approximately 1,200 m, in order to create sufficient space for sidetracking with a planned hole size of 12 ¼". Above the cut 9 5/8" casing, a mechanical barrier will be installed so that it can be used as a base for the whipstock (Figure 6 53).

During the above steps, the Christmas Tree and associated head components will be removed from the 9 5/8" protective casing.

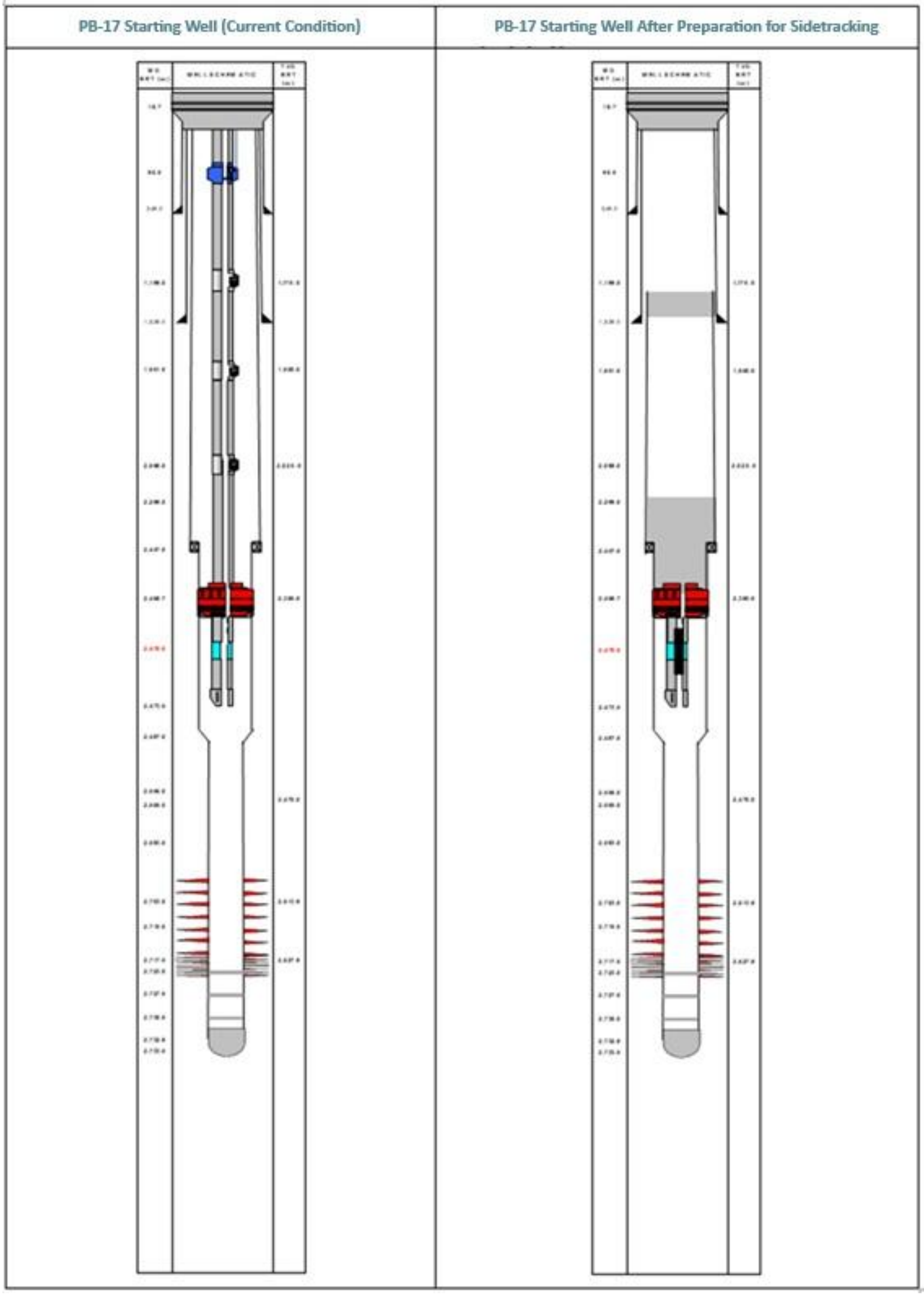


Figure 6-53: Starting well and preparation for sidetrack drilling of CO_2 injection well

6.4.1.3.3.2 16” diameter drilling to a depth of approximately 2,200 m

The drilling will extend to about 2,200 m, using a 16" diameter cutting bit. A high-viscosity mud with specific gravity from 1.05 to 1.25 SG will be used. For this section, cementing mud and water-based mud will be utilized. The drilling will be cleaned with a high-viscosity fresh mud prior to the circulation and installation of the protective casing 13-3/8”. The protective casing will be cemented 200 m above the base of the previous casing.

6.4.1.3.3.3 12-1/4” x 13 ½” diameter drilling down to approximately 3,150 m

A 12-1/4" x 13 ½" bit will be used to drill down to approximately 3,150 m. A low-toxicity oil-based mud with a specific gravity between 1.35 and 1.75 SG will be used for this section. The final depth of this phase will be at the base of the evaporite, just above the reservoir section. The protective casing will be cemented with a 200 m column of cement above the base of the previous 13-3/8" casing, and full cementing will be carried out along the entire length of the open-hole geological formation.

6.4.1.3.3.4 8-1/2” diameter drilling down to approximately 3,700 m

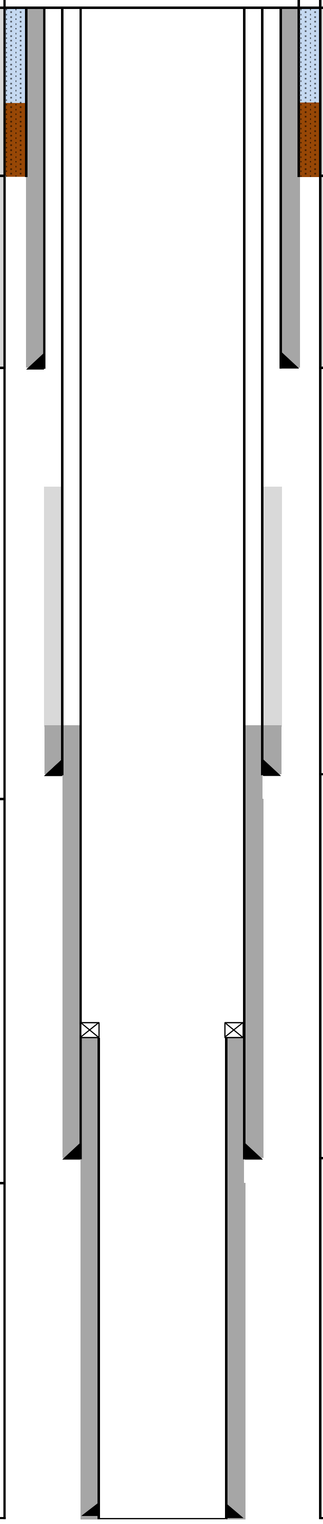
Drilling will reach approximately 3,700 m using an 8-1/2" bit. The same drilling mud as in the previous phase will be used. The final target of the CO_2 injection wells is within zones B and C of the reservoir. This will allow CO_2 injection into these specific reservoir zones without disturbing the productive formations of zone A. In general, the reservoirs in the Prinos field consist of compact sandstones, and sand production is not expected to be an issue. A 7” diameter protective casing will be cemented along the reservoir section and subsequently perforated at the preferred depth where CO_2 injection is required.

Table 6-9: Drilling sections and casing plan for the CO_2 injection well

Section	Final Depth (MD m)	Section Length (m)	Hole Diameter (inches)	Casing Diameter (inches)
I	2250	1850	16	13 5/8
II	3150	900	12 ¼	9 5/8
III	3700	550	8 ½	7

A similar approach will be applied for the two water production wells.

CCS injector Well Status Diagram: Rev A



HOLE SIZE	DEPTH MDBRT	DEPTH TVD RT	INC	Conn OD	Min ID / Drift	CASING DESIGN MDBRT	CASING DESIGN Description
Drive	91	91	0	24.000	22.500	30.5 m 62.0 m 91 m	MSL Sea bed 24" Conductor
22"	349	349	3°	18.625	17.755" (Casing ID) 17.568" (Drift ID) 17.568	349 m	18 5/8" Surface Casing
16"	2,200	1,850	45°	14.252	12.415" (Casing ID) 12.259" (Drift ID) 12.259	2,209 m	13 3/8" Intermediate Casing
12 1/4" x 13 1/2"	3,150	2,667	68°	10.984	8.535" (9 5/8" ID) 8.500" (9 5/8" Drift ID) 8.539" (9 7/8" ID) 8.500" (9 7/8" Drift ID) 8.500	 3,950 m 4,003 m	9 5/8" casing from surface to above 13 3/8" shoe, 9 7/8" across open hole Top of 7 5/8" Production Liner & 9 5/8" x 9 7/8" XO 9 7/8" x 9 5/8" Production Casing
8 1/2" x 9 1/2" Well TD	3,700	2,837	83°	7.811	6.375" (Casing ID) 6.25" (Drift ID) 6.250	0 m 4,984 m	Top of 4 1/2'' slotted liner 7 5/8" Production Liner

Figure 6-54: Proposed Drilling Diagram. The final depth will be confirmed during the final stage of well design.

6.4.1.3.4 Total Drilling Depth Criteria

All wells must be drilled within zones B and C of the Prinos reservoir in order to allow for CO_2 injection and concurrent water production from the aquifers located below reservoir zone A. The target depths for each well have been determined based on the geomechanical model mapping the reservoir boundaries (see Table 6.6).

The operational specifications of the wells are defined both by platform constraints and by experience gained from the Epsilon and Prinos drilling programs.

Table 6-10: Operational Specifications for Wells

Maximum CO_2 injection rate	102,7 tons/hour
Minimum injection well pump pressure (BHP)	3.500 psi
Maximum THP for injection and water production wells	2.830 psi
Maximum water production rate	9.000 bpd
Maximum CO_2 injection pump pressure (BHP)	6.500 psi

Electric Submersible Pumps (ESP) will be installed in the water production wells to assist in extracting water from the reservoir aquifer. The estimated maximum water production volume per well is approximately 9,000 barrels per day. Two different completion scenarios are being evaluated for the installation of the ESP pump: in a 7" production casing or a 9 5/8" production casing. In both cases, the selected completion tubing is either 4 ½" or 3 ½", with end size 2 7/8" or 3 ½", featuring high-quality connections and materials suitable for water production and CO_2 handling.

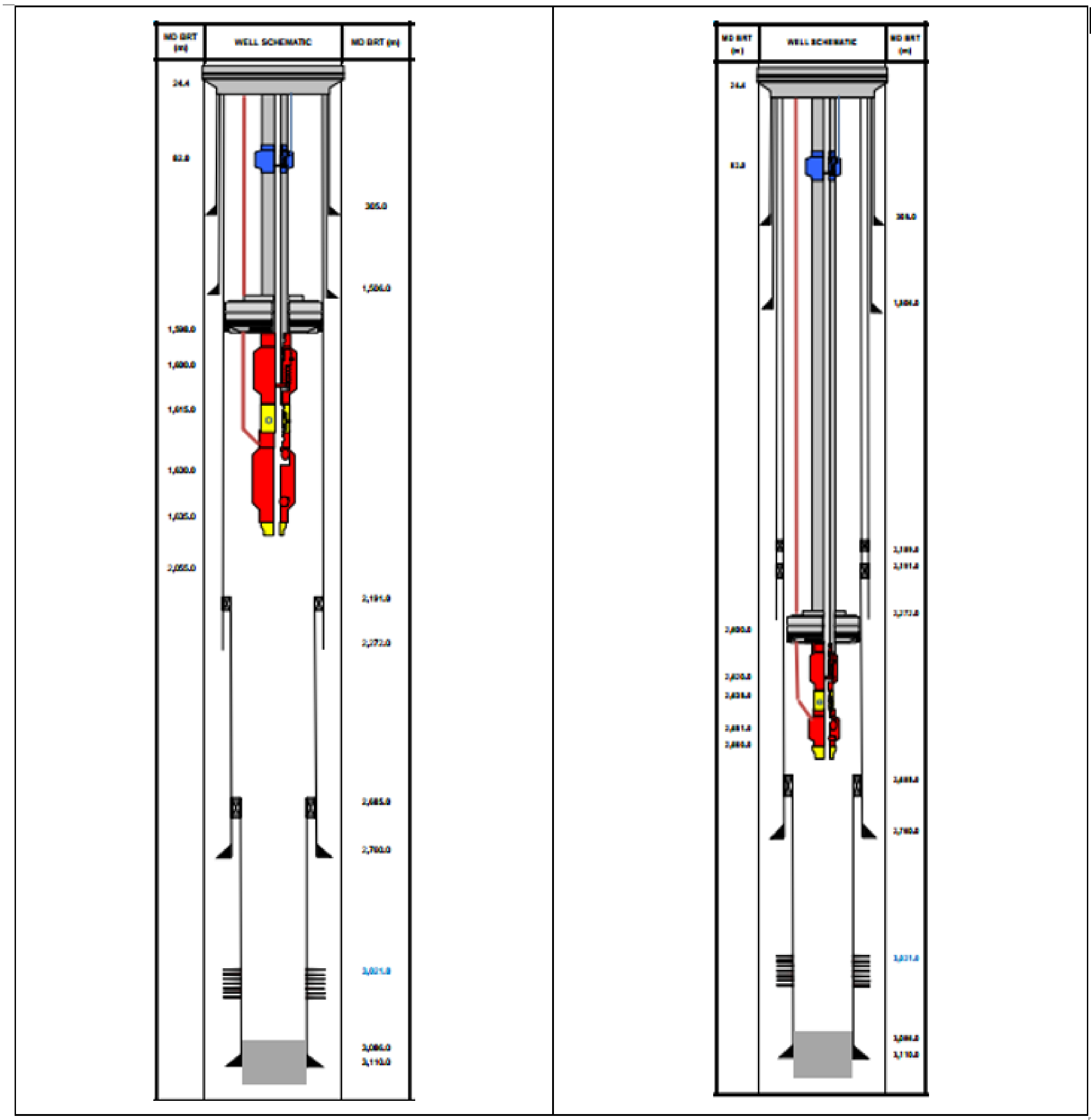


Figure 6.55: Water Wells with Pumps at Different Depths

The selection of materials and quality of protective casing for the four wells is presented below (Table 6.11). The specific materials for each section will be determined at a later stage, once the design of each well is finalized. However, the table below provides an indicative list of materials that have been used in casing for similar projects.

Table 6.11: Protective Casing Selection for CO_2 Injection and Water Production Wells

Casing Type	Size (in)	Weight (lbs/ft)	Type	Connection	ID (in)	OD (in)	Burst (psi)	Compression/ Collapse (psi)	Tensile Strength (Lbs)
Intermediate	13 5/8”	68	L-80	TSH B or similar	12,250	13.886	8,830	4,570	1556k

Casing Type	Size (in)	Weight (lbs/ft)	Type	Connection	ID (in)	OD (in)	Burst (psi)	Compression/ Collapse (psi)	Tensile Strength (Lbs)
Production casing	9 ⅝"	53.5	L80 or 13Cr	TSH B or similar	8,535	9.878	12,390	8,440	1244k
Production liner	7'' ή 75/8"	32	L80 or 13Cr	TSH B or similar	6.094 / 6.625	7.732/76.25	1246 /9180	10780 / 8820	1025k/895k
Completion tubing	3 1/2" και/ή 2 7/8"	9.2/6.4	L80 or 13Cr 25Cr	TSH B or similar	2.9/2.4	3.9/3.3	10160 / 10570	10540 / 11170	207k/145k

In any case, regardless of the materials, quality, and weight of the casing selected, the well design criteria will be met in accordance with the drilling delivery procedure documents. The casing design will comply with the following minimum design factors for casing and production tubing:

Compression Collapse:	1.0
Burst:	1.1
Tensile:	1,4
Triaxial stress:	1,25

The following available data from relevant nearby wells will be considered in the well design:

- Casing design and setting depth,
- Pore pressure and fracture pressure profiles,
- Lithological column,
- Drilling constraints,
- Drilling problems,
- Mud and cementing data,
- Sequence of operations and schedule.

The well design will aim to minimize risks. Identified risks will be listed and mitigation methods will be defined. The final well design will reflect the expected operational window of the well throughout its entire construction and production life cycle.

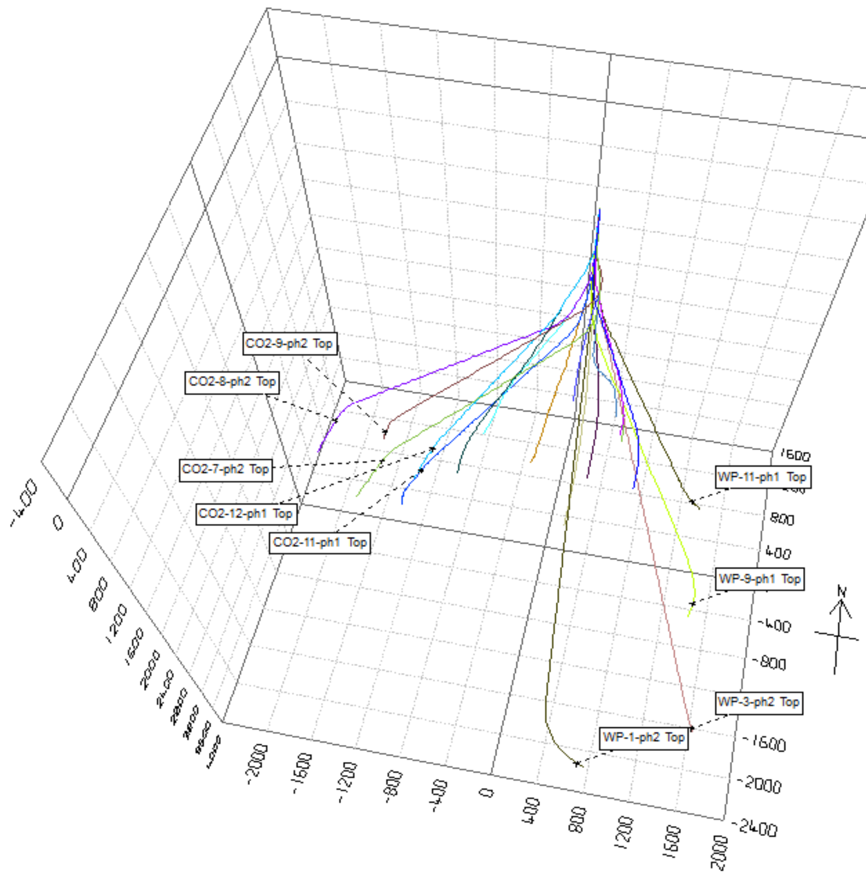


Figure 6-56: Targets and well trajectories for the Project, including the starter wells from the Beta platform

6.4.1.3.5 Typical drilling mud program

The primary section of the well will be 16 inches in diameter and will be drilled from approximately 350 m down to a depth of 2,200 m. In this section, a seawater- and lime-based drilling mud will be used, which will be biodegradable and have no adverse environmental impacts. The geological formation in this section is uniform and consists of sandstone and clay layers, and from all the wells drilled in the area, no traces of hydrocarbons have ever been observed at these depths.

The cuttings from this section will be deposited on the seabed, while below the depth of approximately 2,200 m, the drilling fluids will return to the surface, where the cuttings will be removed, and the mud will be treated.

The total volume of drilling mud and the additives are presented in the table below.

Table 6-12: Drilling mud program per section and additives used

Section	Diameter (inches)	Estimated drilling mud volume per well (m^3)	Drilling mud system – Main additives
I	16	+/- 700	Gel / Polymer / Lime Additives: Bentonite, Potassium Chloride, Polypac, CMC, Lime, Calcium Carbonate, Sodium Chloride, Flo-Vis.

Section	Diameter (inches)	Estimated drilling mud volume per well (m^3)	Drilling mud system – Main additives
II	12 1/4	+/- 490	Versavert LTOBM Additives: EDC 95/11, Safe-Scav, Safe Carb, Bentonite, Calcium Chloride, Barite, Versatrol
III	8 1/2	+/- 350	FLO-PRO WBM or Versavert LTOBM Additives: Flo-Trol, Soda Ash, Safe-Scav, Sodium Chloride, Zinc Oxide, Conqor

6.4.1.3.6 Mitigation of Drilling Fluid/Mud Losses

Loss of circulation occurs when drilling mud is lost from the wellbore into surrounding geological formations during drilling. In cases of loss, the affected section of the well does not remain filled with drilling mud once the pumps are shut down, which leads to a reduction in hydrostatic pressure in the wellbore and thus a decrease in the pressure exerted on the reservoir formation. This situation creates a risk of losing control over drilling operations. To regain control of the well, specifically the control of the reservoir formation pressure, losses must be stopped. Various techniques are applied depending on the extent of the losses. The additives used seal fractures and pores in permeable formations to prevent drilling mud losses during both drilling and casing operations. These products react with the drilling mud at the bottom of the wellbore, creating a mass that allows re-drilling and therefore recovery of well control.

6.4.1.3.7 Well Control

The design of a well aims, among other things, to maintain the density of the drilling mud so that it exerts hydrostatic pressure on the formations greater than the formation pressure, but not so high as to cause losses. After investigation, suitable depths are selected for the placement of protective casing to isolate loose formations, thus allowing an increase in the drilling fluid pressure, as required, to exceed formation pressure.

In the event of a well kick, the Blowout Preventer (BOP) system is activated. In formations above the evaporites, it is unlikely that formation pressures will exceed hydrostatic pressure. Since water-based drilling mud has a higher density than water, there is very little chance of sudden influx of formation fluids into the wellbore under normal conditions. Nevertheless, a Well Control Plan will be applied, specifying all necessary preventive measures as well as mitigation means, in accordance with Best Practices for the drilling program, once the evaporitic section is drilled and pressure is expected to be above normal hydrostatic levels. Managing mud weight is critical in these deeper intervals. In the Prinos wells, the reservoirs beneath the evaporites have been significantly depleted over the last 35 years, and pressures are now lower than hydrostatic. Therefore, mud weights are reduced once the reservoir cap rock is penetrated and the evaporitic section is isolated with production casing. A low-toxicity oil-based mud is used when drilling evaporites to prevent swelling of interbedded clay formations and thus avoid stuck pipe incidents. The reservoir may also be drilled with low-toxicity oil-based mud, but with a lower density fluid system.

6.4.2 Construction Schedule

The schedule of works for the new onshore and offshore facilities and the drilling of wells serving the CO_2 storage project is as follows:

Works	Duration
Onshore facilities: modification of a designated area within the existing Sigma plant site for the construction of the manifold and an unloading/compression area.	3 months
Offshore pipeline: subsea pipeline connecting the Sigma plant area to the Beta offshore platform, approximately 20 km long. Pipeline works will be executed in several phases:	9 months
Phase 1 – Geophysical and geotechnical surveys along the pipeline route	1 months
Phase 2 – Shore approach works for the pipeline, involving dredging of a 500 m section from the shoreline at the pipeline head area at Sigma plant. The trench will be about 3 m deep along its entire length and will level out with the seabed at the end of the 500 m zone.	6 months
Phase 3 – Installation of subsea pipeline and hydrotesting using a specialized lay vessel	2 – 3 weeks
Phase 4 – Installation of a riser on the existing Beta platform and diver operations to connect the riser to the subsea pipeline end	1 week
Phase 5 – Final commissioning and testing	1 month
Offshore platform: modification of existing Prinos offshore facilities to receive CO_2 from the new subsea pipeline and inject it into the new wells.	4 months
Wells: 2 CO_2 injection wells and 2 water production wells on the existing Beta platform of the Prinos offshore complex.	8 months

6.4.3 Personnel Requirements

The typical crew of a **jack-up** drilling unit is approximately **90 people**, divided into two 12-hour shifts. Personnel are accommodated at the offshore facility, in a structure that typically houses 110 people, and are transported to and from the rig by vessel from Kavala. The number of additional contractor personnel depends on the activities undertaken. Typical contractor staff include drill operators, drilling fluid management engineers, geologists, cementing engineers, solids control crews, etc. The rig is supported by one vessel and one support ship, owned respectively by a third party and by Energean.

The crew working during drilling operations is described below:

- Drilling crew: 15-20 people
- Maintenance crew: 15-18 people
- Vessel crew: 10-15 people
- Catering crew: 10-15 people
- Rig deck crew: 10-15 people
- Drilling supervision: 3-5 people
- General works crew: 10 – 20 people

Energean already employs a number of technical and administrative staff to carry out daily operations. The construction works (drilling, jack-up unit) will also be supported by contractor personnel.

During the CO_2 **pipeline construction** phase, it is estimated that an average of **200 workers** per day will be accommodated on the construction vessel.

During the project's **onshore construction phase, it is estimated that 10 workers per day** will be employed on-site at peak activity.

6.4.4 Equipment Requirements

6.4.4.1 Equipment for Construction of Onshore Facilities

The planned equipment for the onshore facilities will be prefabricated off-site and delivered by truck to the construction yard, where it will be unloaded using a crane with a lifting capacity of 50 tons. At the construction yard within the Sigma factory, the following machinery and vehicles will also be used: (**Table 6-13**):

Construction Yard Equipment	Number
Excavator Machine	1
Loader	1
Dump Truck	2
Concrete Mixer	1
Bulldozer	1
Road Roller	1
Generator	1

Figure 6-13. Composition of the project construction yard

This composition is indicative and results from the detailed technical parameters of the proposed projects. It constitutes a maximalist approach aimed at investigating the worst-case environmental scenario to ensure maximum environmental protection.

6.4.4.2 Equipment for construction of the submarine CO_2 pipeline

During the construction of the 20 km long submarine CO_2 pipeline, a specialized vessel (**pipelay and trenching vessel)** will be used for the excavation works on the seabed and the placement of the pipeline(**Figure 6-57**).

The main characteristics of a typical vessel of this type are:

- Total length: 164.62 m
- Length between perpendiculars (Bow - Stern): 112.82 m
- Total beam: 36.57 m
- Mean draft: 2.84 m
- Displacement: 10,875 t
- Maximum deck area: 1,000 m^2
- Maximum deck load: 3.6 t/m^2

The equipment for pipeline construction includes:

- Fully closed production line for a maximum pipeline diameter of 60".
- Two 90 t type crawlers
- Winch ≥ 200 t 30 m/min
- Fully automated welding system
- Alignment system: 2 multiple direction cylinders
- Cutting equipment: 2 stations 44 kW
- 2 X-ray welding testing stations
- Pipeline joint stations with injections of marine mastic or foam.

For pipeline construction, **2 support supply / tugboats** will also be used.

Figure 6-41: Typical pipeline construction vessel (pipelay and trenching vessel)

6.4.4.3 Drilling Construction Equipment

For the construction of the new installations at the Vitha and Delta offshore sites (injection wells, water production wells, and accompanying works), specialized equipment based on best practices will be used. To minimize the environmental footprint of the drilling operation, a 2,500 hp hydraulic drilling rig will be used, with a drilling unit of type TDS (Top Drive System) and 3 high-pressure mud pumps. The drilling rig includes the necessary equipment for temporary storage of produced waste and fuels. The rig, indicative model CROSO Labin or similar, will be designed and constructed according to API 4F standards and the latest European regulations, including low emissions specifications, and will be fully ATEX certified.

The transport of the drilling rig to the drilling location will be carried out by tugboats.

6.4.5 Raw Materials, Water, and Energy

6.4.5.1 Raw Material Requirements

6.4.5.1.1 Onshore Installations

For the onshore installations, the following will be required during the construction phase:

- Pipes made of carbon steel and protective steel coatings: 50 tn
- Concrete for pipe coatings, foundations, pipe supports, temporary access: 350 tn
- Copper cables for electrical installations and instruments, various sizes: 2 tn

6.4.5.1.2 Pipeline Construction

Estimation of material quantities for the subsea CO2 pipeline:

- Carbon steel pipes for the offshore pipeline: 2480 Mte
- Concrete for pipe coatings: 3800 Mte
- Anti-corrosion coating with epoxy polyethylene/polypropylene (3LPE/PP): 102 Mt
- Anodes for cathodic protection of pipelines (Magnesium, Zinc, Aluminum): 75 te

After the completion of the construction works, monoethylene glycol (MEG) will be used to remove the residual moisture, ensuring that the pipeline is completely dry and suitable for the commencement of its operation. MEG is a recyclable substance listed in the PLONOR inventory and will be recovered for disposal by a certified company. A dedicated study will be conducted prior to the construction phase to confirm the exact quantities of MEG to be used.

6.4.5.1.3 Well Construction

For the interventions at the existing Beta and Delta wells, the following will be required:

- Pipes made of carbon steel and protective steel coatings: 30 Mte
- Valves, pipe fittings, flanges: 25 Mte
- Copper cables for electrical installations and instruments, various sizes: 3t

Below are the basic materials used for the preparation of drilling fluids.

- Bentonite is a clayey mineral used to increase the specific gravity of the drilling mud/slurry and to counteract formation pressure. It is used with prehydration at initial concentrations of 40 - 70 kg/m^3. Bentonite at the recommended concentrations is a mineral and is not considered harmful to the environment.
- POLYPAC consists of polyanionic cellulose and is a high-quality water-soluble polymer designed to control fluid loss. It is an additive in very small quantities (additive "Ultra Low"), thus causing negligible to minimal reduction of fluidity. The usual concentration is 5 - 15 kg/m^3. POLYPAC at the recommended concentration is not considered harmful to the environment.
- Lime is used as a source of calcium (Ca2+) and alkalinity (OH-), in water-based drilling fluids. Lime at the recommended concentration is not considered harmful to the environment.
- CMC HV is carboxymethylcellulose sodium of high viscosity, designed to control losses of drilling mud/slurry to the walls of the borehole and the fluidity of the aqueous base mud. It is resistant to bacteria and has high tolerance to chemical reactions of the mud. CMC HV is biodegradable.
- POLYDRILL is a polymer for aqueous base mud, which controls fluid loss and the rheology of the mud and is particularly effective at high temperatures, as well as in fluids with high electrolyte content. Polydrill reduces fluid loss by decreasing or plugging the pore diameter. This polymer has significant water-binding capacity, minimizing fluid loss.
- KLA-CURE is a hydration suppressant agent and consists of a water-soluble, environmentally acceptable organic blend designed to reduce swelling and dispersion of reactive clay formations. KLA-CURE can be used in fresh or seawater systems with low or high solids content. Typical concentrations range from 11.4 to 22.8 kg/m^3, depending on hole diameter and drilling length.
- Barite is used to increase the specific gravity of drilling mud/slurry and to balance formation pressure. Barite is a mineral and is not considered hazardous to the environment.
- FLO-VIS is a biopolymer (clarified xanthan gum biopolymer) of high quality that can improve the rheological properties of drilling mud/slurry. It is not considered hazardous to the environment.
- FLO-TROL is a highly modified starch derivative used to control fluid loss and viscosity. It is not considered hazardous to the environment.
- SAFE-SCAN HS reacts with hydrogen sulfide and remains soluble even after chemical reaction with it. It is based on an organic chemical substance, as an alternative to zinc or iron compound mixtures.
- SAFE-CARB is a high-purity, acid-soluble calcium carbonate used as a binder in drilling, treatment, and completion fluids. Compared to limestone, it has higher hardness and purity, providing better solubility in acids.
- Calcium carbonate is produced in various grain sizes and can be used as a weighting agent to increase the specific gravity of drilling mud/slurry and to reduce formation fluid influx in drilling fluids. It is a mineral and is not considered hazardous to the environment.

- The natural resin VESATROL is used for controlling high-pressure high-temperature (HPHT) filtration in all VERSA oil-based systems. It is often used to seal depleted or low-pressure formations. High temperature conditions and special applications require higher concentrations, up to 29 kg/m³.
- EDC 95-11 is the main component of LTOBM and is also referred to as base oil. It has a high purity level and very low aromatic hydrocarbon content.
- CONQOR is a phosphate-based corrosion inhibitor used in water-based drilling fluids, saline water systems, and fluids in gas, aerosol, and foam form. It is suitable for preventing calcium salt deposits and is particularly effective in highly aerated fluids such as drilling operations. If the corrosion rate is high, the concentration should be increased to at least 1.7 L/m³.
- Sodium carbonate, as an alkalinity agent in granular form, is mainly used to increase the pH of drilling fluids. It can also maximize the performance of bentonite and other polymers. Typical concentrations range from 1.2 to 2.4 kg/m³.

Table 6-14: Concentration of Substances in Drilling Mud by Well Section

Substances / Additives		Concentration per section (hole size)		
		I	II	III
Bentonite	kg/m³	86		
Potassium Chloride	kg/m³	100		100
Polypac	kg/m³	6		6
CMC	kg/m³	6		
Lime	kg/m³	11	7	
Calcium Carbonate	kg/m³	100		
Sodium Chloride	kg/m³	40		314
Flo-Vis	kg/m³	4		4
EDC 95-11	kg/m³		428	
Safe Scav NA	kg/m³	1		1
Safe Carb	kg/m³	100	42	100
Spercene	kg/m³	9		
Calcium Chloride	kg/m³		60	
Barite	kg/m³	30	565	
Versatrol	kg/m³		14	
Flo-trol	kg/m³	9		9
Soda Ash	kg/m³	1		1
Safe Scav	kg/m³	1		1
Zinc Oxide	kg/m³	1		1
Conqor	kg/m³	1		1

Table 6-15: Estimated Quantities of Materials for Drilling Mud Preparation by Well Section

Substances / Additives		Concentration per section (hole size)		
		I	II	III
Bentonite	kg	45.000		
Potassium Chloride	kg	53.000		23.000
Polypac	kg	3.000		1.400
CMC	kg	3.000		
Lime	kg	6.000	3.000	
Calcium Carbonate	kg	53.000		
Sodium Chloride	kg	21.000		72.000
Flo-Vis	kg	2.500		1.000
EDC 95-11	kg		165.000	
Safe Scav NA	kg	15		7
Safe Carb	kg	53.000	27.000	23.000
Spercene	kg	4.500		
Calcium Chloride	kg		23.000	
Barite	kg	16.000	225.000	
Versatrol	kg		5.400	
Flo-trol	kg	4.500		2.000
Soda Ash	kg	745		350
Safe Scav	kg	300		150
Zinc Oxide	kg	375		180
Conqor	kg			100

6.4.5.2 Water Requirements

6.4.5.2.1 Onshore Facilities

Worker Accommodation

During the construction phase of the project, it is estimated that 10 workers will be on-site per day at peak times. The daily water consumption per worker is estimated at 20 liters, consisting of 5 liters for drinking water and 15 liters for personal hygiene. Therefore, during construction, approximately 200 liters/day of potable water will be required for worker accommodation at peak periods, totaling 12 m^3 over the construction phase (3 months, 60 working days). These needs will be met by the water supply network of the Sigma facilities and by the supply of bottled water.

Material Wetting

During the construction phase, water will be required for wetting materials within the project footprint and at the temporary storage site in order to control dust emissions from soil surfaces and materials. Additionally, water will be required for wetting concrete surfaces. The needs for concrete wetting and tool washing are estimated at approximately **100 m³,** which will be supplied from the Sigma facilities water network. The required water for wetting materials and soil surfaces, about **200 m³,** may be provided using seawater via a mobile pump or water trucks under the responsibility of the project owner.

Concrete Production

The demand for potable water for concreting is expected to be low given the nature of the works and will be met by the water supply network of the Sigma facilities.

6.4.5.2.2 Pipeline Construction

During the construction phase of the CO_2 pipeline, it is estimated that an average of 200 workers will stay aboard the construction vessel daily. The daily water consumption per worker is estimated at 150 liters, covering both drinking water and personal hygiene. Therefore, during pipeline construction, approximately 30 m³/day of potable water will be required for worker accommodation, totaling 900 m³ over the construction phase (based on about 30 working days during which 200 workers will stay aboard daily).

The needs for potable and service water will be met by a seawater treatment system (Vacuum Vapour Compression) with an estimated capacity of 50 m³/day, installed on the vessel, along with the supply of bottled water.

6.4.5.2.3 Well Construction

Significant water demand is expected at the offshore facilities during the construction period of the new wells. Water consumption for a single well is estimated at approximately 3,200 m³ and can reach up to 3,700 m³, as shown in the calculations below (Table 6-16).

Table 6-16: Estimated water requirements per well and per section

Well Section (diameter – in)	MD (m)	Fluid Type	SG	Water Use per Well (m³)	Water Use for 4 Wells (m³)
16	1850	WBM/Lime	1.05-1.15	1.700	6.800
12.25	950	OBM	1.45-1.70	600	2.400
8.5	1033	OBM/WBM	1.10-1.30	200	800
Total				2.500	10.000

The water needs of personnel during the construction phase are estimated at approximately 4,000 m³ (of which about 200 m³ will be potable water). Bottled commercial water will be used as drinking water for the workers.

6.4.5.3 Energy Requirements

6.4.5.3.1 Energy Consumption

Table 6-17 presents the average consumption for a drilling unit similar in type to the *Labin Jack-up* rig.

Table 6-17: Installed power of drilling rig

Equipment	Installed Power (kW)	Comments
Mud pumps (MP)	1760	2 x 3200 lpm @ 300bar
Top drive system (TDS)	770	34K Nm @ 200 rpm
Drill string hoisting unit (DW)	740	1 x Motor
Motor control center (MCC)	600	440 V / 220 V, 60 Hz

The average power during drilling operations is as follows:

- Maximum average power: 3,870 kW.
- Minimum average power: 1,500 kW.

The total energy consumption for drilling the wells is indicatively estimated at 1,006,200 kWh.

These needs will be met by the rig's generator, which will operate on diesel..

6.4.5.3.2 Fuel Consumption

During the construction of the onshore facilities, liquid fuel consumption concerns the operation of heavy vehicles and construction site machinery. More specifically, during the construction phase, it is estimated that approximately **16 t of diesel** (see **Table 6-31**) and approximately **0.5 t of gasoline** will be required.

For the construction of the CO_2 pipeline, the construction vessel and the auxiliary vessels will use marine fuel (*Marine Gasoil DMA ISO 8217:2012 / Max. Sulphur Cont. 0.1% (M/M)*) in the following quantities:

- Moored, idle: 3.5 Mt/day,
- Moored, loading phase: 4.5 – 5.6 Mt/day,
- During relocation: 3.5 – 4.5 Mt/day,
- During pipeline construction: 11 – 12 Mt/day.

Liquid fuel (diesel) consumption during well drilling refers to the drilling rig and one support vessel, as presented below per well:

Table 6-18: Total fuel consumption per indicative drilling phase

Drilling Phase	Total Fuel Consumption (t)
Positioning the rig in final location	13,50
Well preparation and "killing"	15,50
Recovery of production casing	15,50

Drilling Phase	Total Fuel Consumption (t)
Abandonment of starter (donor) well	40,00
18 5/8" window milling	10,00
Drilling 16" section	72,00
Installation and cementing of 13 3/8" casing	15,00
Drilling 12-1/4" section	45,00
Installation and cementing of 9 5/8" casing	15,00
Drilling 8 1/2" section	22,50
Installation and cementing of 7" casing	15,00
Formation logging	0,00
Completion operations	82,00
Moving the rig to the next location	9,50
Total	370,50

From the above table, the total fuel consumption during the well drilling phase for the four wells is **1,482 t**, while the average fuel consumption is estimated at **5.5 t/day**.

The consumption for the supply vessel is estimated at **1,300 t** for the entire duration of the Project.

6.4.6 Waste Generation

6.4.6.1 Municipal-Type Waste

6.4.6.1.1 Municipal Waste

It is estimated that the Project will generate both non-hazardous and hazardous municipal waste (MW), as well as certain other waste streams subject to alternative management (management via Collective Systems of Alternative Management – CSAM).

The categories of waste expected to be generated during the implementation of the Project, based on the European Waste Catalogue (EWC) (Decision 2001/118/EC, as amended and in force), are presented in the table below. It is noted that codes marked with an asterisk (*) indicate waste considered hazardous.

Table 6-19: Classification of municipal-type waste according to the EWC

EWC Code	EWC Description
15	WASTE PACKAGING; ABSORBENTS, WIPING CLOTHS, FILTER MATERIALS AND PROTECTIVE CLOTHING NOT OTHERWISE SPECIFIED
15 01	packaging (including separately collected municipal packaging waste)
15 01 01	paper and cardboard packaging
15 01 02	plastic packaging
15 01 04	metal packaging

EWC Code	EWC Description
15 01 05	composite packaging[3]
15 01 06	mixed packaging
15 01 07	glass packaging
15 01 10*	packaging containing residues of or contaminated by hazardous substances
19	**19 WASTES FROM WASTE MANAGEMENT FACILITIES, OFF-SITE WASTEWATER TREATMENT PLANTS AND THE PREPARATION OF WATER INTENDED FOR HUMAN CONSUMPTION AND INDUSTRIAL USE**
19 08	wastes from wastewater treatment plants not otherwise specified
19 08 05	sludges from urban wastewater treatment
20	**MUNICIPAL WASTES (HOUSEHOLD WASTE AND SIMILAR WASTES FROM COMMERCIAL ACTIVITIES, INDUSTRIES AND INSTITUTIONS), INCLUDING SEPARATELY COLLECTED FRACTIONS**
20 01	separately collected fractions (except those mentioned in 15 01)
20 01 01	paper and cardboard
20 01 02	glass
20 01 13*	solvents
20 01 14*	acids
20 01 15*	alkaline waste
20 01 19*	pesticides
20 01 21*	fluorescent tubes and other mercury-containing waste
20 01 23*	discarded equipment containing chlorofluorocarbons
20 01 25	edible oils and fats
20 01 27*	paints, inks, adhesives and resins containing hazardous substances
20 01 29*	detergents containing hazardous substances
20 01 33	μπαταρίες και συσσωρευτές που αναφέρονται στα 16 06 01, 16 06 02 ή 16 06 03 και μεικτές μπαταρίες και συσσωρευτές που περιέχουν τις εν λόγω μπαταρίες
20 01 34	batteries and accumulators other than those mentioned in 20 01 33
20 01 35*	discarded electrical and electronic equipment, other than those mentioned in 20 01 21 and 20 01 23, containing hazardous components
20 01 36	discarded electrical and electronic equipment other than those mentioned in 20 01 21, 20 01 23 and 20 01 35
20 01 37*	wood containing hazardous substances
20 01 39	plastics
20 01 40	metals
20 03	other municipal waste
20 03 01	mixed municipal waste
20 03 04	septic tank sludge

It should be noted that waste classification – i.e., the identification of hazardous properties through assessment of the waste's hazardousness and, ultimately, its classification as hazardous or non-hazardous – will be carried out in accordance with the provisions set out in the **Commission Notice on Technical Guidance on the Classification of Waste** (2018/C 124/01), based on the **Waste Framework Directive 2008/98/EC**, which has been transposed into Greek legislation through **Law 4819/2021** (Government Gazette 129/A/23.07.2021), and the **CLP Regulation**[4] ("Regulation (EC) No 1272/2008 on classification,

[3] Beverage packaging (Tetra Pak type), snack packaging (e.g., potato chips, corn puffs), blister packs.

[4] Current consolidated version: 01/12/2023: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02008R1272-20231201

labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006”).

The estimates made for the Project’s municipal waste generation are based on a series of assumptions:

- Duration of construction works:
  - Onshore facilities: 3 months (60 working days)
  - CO_2 pipeline: 9 months (180 working days)
  - Modification of existing offshore Prinos facilities to receive CO_2 from the new subsea CO_2 pipeline and inject it into new wells: 4 months (80 working days)
  - Drilling of wells: 8 months (160 working days)
  - Total construction duration: 14 months (worst-case scenario for MW generation estimate)
- Average daily number of workers:
  - Onshore facilities: 10
  - CO_2 pipeline: 200
  - Modification of existing offshore facilities: 20
  - Drilling of wells: 90
- Daily municipal waste generation rate: 0.4 kg/person
- Qualitative composition of MW based on National Waste Management Plan (NWMP)[5] estimates
- Separate collection of recyclable materials (paper and cardboard, metals, plastics, glass)
- Specific weight by MW type:
  - Paper/cardboard: 0.20 t/m^3
  - Plastics: 0.22 t/m^3
  - Metals: 0.23 t/m^3
  - Glass: 0.33 t/m^3
  - Other – mixed: 0.26 t/m^3
- Recyclable fraction per MW stream:
  - Paper/cardboard: 85%
  - Plastics: 50%
  - Metals: 70%
  - Glass: 60%

Based on the above, **Table 6-20** presents the estimated total quantity of MW during the construction phase of the Project, as well as the average daily MW generated. In addition, the table shows the maximum expected MW generation, corresponding to a simultaneous daily presence of 188 workers.

[5] National Waste Management Plan (ESDA) Ministerial Decision Act 39 dated 31.8.2020 (Government Gazette 185/A/29.9.2020), as amended by the Legislative Act (P.Y.S.) 5 dated 18.4.2023 (Government Gazette 94/A/18.4.2023).

Table 6-20: Estimate of municipal waste quantities generated.

Municipal Waste Generation		Mixed	Recyclable	Total	Unit
Total Generation (14 months)	MW Generation (tn)	14,19	6,85	**21,04**	**tn**
	MW Generation (m^3)	54,57	32,22	**86,79**	**m^3**
Average Daily Generation	Average Daily MW Generation (tn/d)	0,05	0,02	**0,08**	**tn/d**
	Average Daily MW Generation (m3/d)	0,19	0,12	**0,31**	**m^3/d**
Maximum Daily Generation	Maximum Daily MW Generation (tn/d)	0,08	0,04	**0,12**	**tn/d**
	Maximum Daily MW Generation (m3/d)	0,30	0,18	**0,48**	**m^3/d**

Regarding the remaining municipal-type waste streams (waste streams subject to Alternative Management, Small Quantities of Hazardous Waste – SQHW, etc.), for which no permanent generation is expected during the operation of the Project based on the current phase data, it is not possible to estimate the generated quantities.

Table 6-21 presents the method of managing municipal waste streams in accordance with the requirements of the applicable legislation. It is noted that the overall Waste Management Plan of the Project is presented in **Annex 17.3.**

Table 6-21: Record of Integrated Waste Management System – Municipal Waste

EWC Code	EWC Description	Waste Type Description	Waste Stream Management		
			Collection/Temporary Storage within Project	Temporary Storage Equipment within Project	Removal (Transport) / Processing[6]
20 03 01	mixed municipal waste	mixed municipal waste	Separate collection of mixed municipal waste / Temporary storage within Project	Mixed Waste Bin (plastic bin EN 840-2/5/6, capacity 80 to 1100 L)	Competent Municipality (OTA) or collection/transport entity – if not feasible, provision for the Project's operator to dispose of waste in the existing municipal collection system / Kavala Landfill
19 08 05	sludges from urban wastewater treatment	Sigma WWTP sludges from treatment of the Project's municipal wastewater	-	-	Licensed collection, transport and management entity
15 01 01	paper and cardboard packaging	Mixed recyclable materials of paper/cardboard,	Separate collection of recyclables /	Recyclables Bin (plastic bin EN 840-2/5/6,	Competent Municipality (OTA) or

[6] "Treatment": Recovery or disposal operations, including preparation prior to recovery or disposal (Law 4819/2021).

EWC Code	EWC Description	Waste Type Description	Waste Stream Management		
			Collection/Temporary Storage within Project	Temporary Storage Equipment within Project	Removal (Transport) / Processing[6]
15 01 02	plastic packaging	plastic, metal, and glass[7]	Temporary storage within Project	capacity 80 to 1100 L)	collection/transport entity – if not feasible, provision for the Project's operator to dispose of waste in the existing municipal collection system / Xanthi Materials Recovery Facility (MRF)
15 01 04	metallic packaging				
15 01 05	composite packaging[8]				
15 01 06	mixed-material packaging[9]				
15 01 07	glass packaging				
20 01 01	paper and cardboard				
20 01 02	glass				
20 01 39	plastics				
20 01 40	metals				
20 01 25	edible oils and fats	Edible oils and fats. Permanent generation during Project implementation is not expected. If necessary, generated quantities must be temporarily stored in the Project's waste storage area.	Separate collection of edible oils and fats / Temporary storage within Project *if required*	Edible Oils and Fats Collection Container (IBC or UN HDPE drum, capacity 30 to 220 L) *if required*	Licensed collection, transport and management entity *if required*
20 01 23*	discarded equipment containing chlorofluorocarbons	Waste Electrical and Electronic Equipment (WEEE). Permanent generation of WEEE during Project implementation is not expected. If necessary, generated quantities must be temporarily stored in the Project's waste storage area.	Separate collection of WEEE / Temporary storage within Project *if required*	WEEE Bin (plastic bin EN 840-2/5/6, capacity 80 to 1100 L, or WEEE Bin from contracted EPR scheme) *if required*	Collection and transport entity / WEEE EPR scheme – if not feasible, provision for the Project's operator to dispose of waste in designated WEEE recycling points of EPR schemes *if required*
20 01 35*	discarded electrical and electronic equipment, other than those in 20 01 21 and 20 01 23, containing hazardous components				
20 01 36	discarded electrical and electronic equipment other than those in 20 01 21, 20 01 23 and 20 01 35				

[7] https://www.eoan.gr/%ce%b5%ce%bd%ce%b7%ce%bc%ce%ad%cf%81%cf%89%cf%83%ce%b7/%cf%84%ce%b9-%cf%85%ce%bb%ce%b9%ce%ba%ce%ac-%ce%b1%ce%bd%ce%b1%ce%ba%cf%85%ce%ba%ce%bb%cf%8e%ce%bd%ce%bf%cf%85%ce%bc%ce%b5/

[8] Beverage packaging (Tetra Pak type), snack packaging (e.g. potato chips, cheese puffs), tablet packaging.

[9] Composite packaging: packaging consisting of two or more layers of different materials that cannot be separated by hand and constitute a single, integrated unit consisting of an inner receptacle and an outer covering, which is filled, stored, transported, and emptied as a single unit — Directive (EU) 2018/852.

EWC Code	EWC Description	Waste Type Description	Waste Stream Management		
			Collection/Temporary Storage within Project	Temporary Storage Equipment within Project	Removal (Transport) / Processing[6]
20 01 33	batteries and accumulators listed in 16 06 01, 16 06 02, or 16 06 03, and mixed batteries and accumulators containing such batteries	Waste Batteries & Accumulators	Separate collection of Batteries & Accumulators / Temporary storage within Project	Battery Bin (from contracted EPR scheme)	Collection and transport entity / Battery EPR scheme
20 01 34	batteries and accumulators other than those mentioned in 20 01 33				
20 01 21*	Fluorescent tubes and other mercury-containing waste	Waste Lighting Equipment, Lamps, and Small Devices (WEEE). Permanent generation during Project implementation is not expected. If necessary, generated quantities must be temporarily stored in the Project's waste storage area.	Separate collection of lighting equipment, lamps, and small devices / Temporary storage within Project *if required*	Lighting-Lamp Bin (WEEE Bin from contracted EPR scheme) *if required*	Collection and transport entity / WEEE EPR scheme – if not feasible, provision for the Project's operator to dispose of waste in designated WEEE recycling points of EPR schemes *if required*
20 01 13*	solvents	Small Quantities of Hazardous Waste in Municipal Waste (SQHW). Permanent generation during … separately stored for each type in the Project's waste storage area.		Suitable separate bin for each type … *required*	Αδειοδοτημένος licensed collection, transport, and hazardous waste management entity *if required*
20 01 14*	acids				
20 01 15*	alkaline waste				
20 01 19*	pesticides				
20 01 27*	paints, inks, adhesives, and resins containing hazardous substances				
20 01 29*	detergents containing hazardous substances				
20 01 37*	wood containing hazardous substances				
15 01 10*	packaging containing residues of or contaminated by hazardous substances	Empty paint, solvent, etc. containers. Permanent generation during Project implementation is not expected. If necessary, generated quantities must be temporarily and separately stored for	Separate collection / Temporary storage within Project *if required*	UN HDPE drum, UN metal drum *if required*	Licensed collection, transport, and hazardous waste management entity *if required*

EWC Code	EWC Description	Waste Type Description	Waste Stream Management		
			Collection/Temporary Storage within Project	Temporary Storage Equipment within Project	Removal (Transport) / Processing[6]
		each type in the Project's waste storage area and managed as hazardous waste.			
20 03 04	septic tank sludge	Waste from site chemical toilets	-	-	Collection and transport entity

It is noted that, through the electronic services of the **Electronic Waste Registry (EWR)**, it is possible to search, based on the EWC code(s), for the corresponding licensed waste collection and transport entities per regional unit.

6.4.6.1.2 Wastewater and other liquid waste during construction

During the construction phase at the **onshore works site**, domestic wastewater will be generated from workers' habitation. It is estimated that the flow of domestic wastewater will be equal to the potable water consumption of workers, as calculated in Section 6.4.5.2.1, i.e. 0.2 m^3/day at peak. For staff service, the infrastructure of the existing Sigma facilities will be used, while alternatively, chemical toilets may be used within the site, which will be emptied and maintained regularly by a licensed company under the responsibility of the project's contractor. In total, the liquid waste generated by workers during the construction phase (3 months, 60 working days) amounts to approximately **12 m^3.**

During the **construction phase of the CO_2 pipeline**, domestic wastewater will be generated on the vessel from workers' habitation. It is estimated that the flow of domestic wastewater will be equal to the water consumption for workers' habitation, as calculated in Section 6.4.5.2.2, i.e. approximately 30 m^3/day. The wastewater will be treated in a biological treatment system onboard the vessel.

Other liquid waste expected to be generated on the vessel during the construction of the CO_2 pipeline includes **bilge water** and **ballast water**:

- Water from the ship's engine room may contain grease and/or oils (bilge water). The management of bilge water will be carried out in accordance with Annex I of MARPOL 73/78 (Regulations for the Prevention of Pollution by Oil) and its relevant amendments. The treatment equipment (bilge water separator) will comply with the specifications of the IMO Guidelines (Guidelines and Specifications for Pollution Prevention Equipment for Machinery Space Bilges of Ships, IMO Resolution MEPC.107(49)).
- The discharge of ballast water, used for ship stabilization at sea, is subject to the requirements of Annex I of MARPOL 73/78 and the International Convention for the Control and Management of Ships' Ballast Water and Sediments (Ballast Water Management – BWM). The ballast water treatment system onboard the vessel will comply with the D-2 standard concerning ballast water treatment.

During the **drilling phase**, domestic wastewater will be generated from workers' habitation. It is estimated that the flow of domestic wastewater will be equal to the water consumption for workers' habitation, as calculated in Section 6.4.5.2.3. Domestic-type wastewater from the platform complexes is collected and stored in dedicated tanks located on each platform. These tanks are periodically emptied into the barge or the support vessel's tank. The tank contents are transported via barge to onshore facilities for biological treatment.

6.4.6.2 Construction Works Waste

The integrated management of Construction and Demolition Waste (CDW) related to the construction works and excavation activities of the Project will be carried out in accordance with Joint Ministerial Decision 36259/1757/E103/2010 (Government Gazette 1312/B/24.08.2010) "Measures, terms and program for the alternative management of waste from excavations, constructions, and demolitions (CDW)" and the relevant provisions of Law 4819/2021, as amended and in force.

It is estimated that the Project will generate CDW subject to alternative management (Extended Producer Responsibility - EPR) as well as other waste, hazardous and non-hazardous, such as construction residues (e.g., concrete, metals, packaging materials, etc.) and surplus materials, from site preparation and construction activities.

The wastes resulting from construction works and estimated to be generated during the construction of the Project are presented in the following Table, based on the European Waste Catalogue (Decision 2001/118/EC, as amended and in force). It should be noted that codes with an asterisk (*) after the number represent wastes considered hazardous.

Table 6-8: Classification of construction waste according to the European Waste Catalogue (EWC)

EWC Code	Description
08	**WASTE FROM THE PRODUCTION, FORMULATION, SUPPLY, AND USE (PFSU) OF COATINGS (PAINTS, VARNISHES, AND GLASS ENAMELS), ADHESIVES, SEALANTS, AND PRINTING INKS**
08 01	Waste from PFSU as well as from the removal of paints and varnishes
08 01 11*	Waste from paints and varnishes containing organic solvents or other hazardous substances
08 04	Waste from the PFSU of adhesives and sealants (including water-proofing products)
08 04 09*	Waste from adhesives and sealants containing organic solvents or other hazardous substances
10	**WASTE FROM THERMAL PROCESSES**
10 13	Waste from the production of cement, quicklime, and hydrated lime, as well as from objects and products made from these materials
10 13 14	Waste concrete and concrete sludge
13	**WASTE OILS AND WASTE LIQUID FUELS (excluding edible oils and those included in chapters 05, 12, and 19)**
13 01	Waste hydraulic oils
13 01 11*	Synthetic hydraulic oils
13 02	Waste engine, gearbox, and lubricating oils
13 02 06*	Synthetic engine, gearbox, and lubricating oils
13 05	Contents of oil/water separators
13 05 07*	Oily water from oil/water separators
15	**WASTE FROM PACKAGING; ABSORBENT MATERIALS, WIPING CLOTHS, FILTER MATERIALS AND PROTECTIVE CLOTHING NOT OTHERWISE SPECIFIED**

EWC Code	Description
15 02	Absorbent materials, filter materials, wiping cloths, and protective clothing
15 02 02*	Absorbent materials, filter materials (including oil filters not otherwise specified), wiping cloths, and protective clothing contaminated by hazardous substances
17	WASTE FROM CONSTRUCTION AND DEMOLITION (INCLUDING EXCAVATED SOIL FROM CONTAMINATED SITES)
17 01	Concrete, bricks, tiles, and ceramics
17 01 01	Concrete
17 02	Wood, glass, and plastic
17 02 01	Wood
17 02 04*	Glass, plastic, and wood containing or contaminated by hazardous substances
17 04	Metals (including their alloys)
17 04 05	Iron and steel
17 04 09*	Metal waste contaminated with hazardous substances
17 05	Soil (including excavated soil from contaminated sites), stones, and dredging spoil
17 05 04	Soil and stones other than those mentioned in 17 05 03
17 05 06	Dredging spoil other than those mentioned in 17 05 05

It is noted that the classification of waste—meaning the determination of hazardous properties through the assessment of waste hazardousness and, ultimately, its classification as hazardous or non-hazardous—will be carried out in accordance with the provisions set out in the "Commission Notice on technical guidance on the classification of waste" (2018/C 124/01), based on the Waste Framework Directive 2008/98/EC (WFD), which has been transposed into Greek legislation by Law 4819/2021 (Government Gazette 129/A/23.07.2021) and the CLP[10] Regulation "Regulation (EC) No. 1272/2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No. 1907/2006."

According to initial estimates, the surplus excavation materials from the site preparation works of the Project amount to approximately **200 m³.** Excavations will be limited to those strictly necessary, while priority will be given to their reuse for backfilling needs within the framework of the Project's construction.

Beyond the surplus from excavations, the other generated C&DW (Construction and Demolition Waste) from construction works is difficult to estimate at this stage, as no corresponding calculation model is available.

The presentation of the waste stream management method, based on the requirements of the applicable legislation, is provided in the following table. It should be noted that the overall **Waste Management Plan** of the Project is presented in **Annex 17.3.**

[10] Τρέχουσα ενοποιημένη έκδοση: 01/12/2023: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02008R1272-20231201

Table 6-9: Representation of an Integrated Waste Management System from Construction Works

EWC Code	EWC Description	Description of Waste Type	Waste Steam Management		
			Collection / Temporary Storage within the Project	Temporary Storage Equipment within the Project	Removal (Transport)/ Processing[11]
17 01 01	Concrete	Concrete from demolitions. No production is anticipated during the implementation of the Project. In any case, and if the need arises, the quantities produced shall be temporarily stored in the Project's waste temporary storage area.	Separate collection of demolition concrete / Temporary storage within the Project *if the need arises	Concrete skip container (Skip Lift Container) *if the need arises	Reuse – recycling on site or licensed collection and transport contractor / Collective Waste Management System (CWMS) *if the need arises
17 02 01	Wood	Wood. No production is anticipated during the implementation of the Project. In any case, and if the need arises, the quantities produced shall be temporarily stored in the Project's waste temporary storage area.	Separate collection of wood / Temporary storage within the Project *if the need arises	Wood skip container (Skip Lift Container) *if the need arises	Reuse on site or licensed collection and transport contractor / Collective Waste Management System (CWMS) *if the need arises
17 02 04*	Glass, plastic, and wood containing hazardous substances or contaminated with them	Wood containing hazardous substances or contaminated with them. No production is anticipated during the implementation of the Project. In any case, and if the need arises, the quantities produced shall be temporarily stored in the Project's waste temporary storage area and managed as hazardous waste.	Separate collection of hazardous wood / Temporary storage within the Project *if the need arises	Hazardous wood skip container (Skip Lift Container) *if the need arises	Licensed hazardous waste collection, transport, and management contractor *if the need arises
17 04 05	Iron and steel	Iron and steel (metal waste)	Separate collection of iron/steel / Temporary storage within the Project	Iron/steel container (Skip Lift Container or metal container EN 840-2/5/6)	Reuse within the Project or licensed collection and transport contractor / Extended Producer Responsibility Scheme (EPRS)
17 04 09*	Waste of metals contaminated by hazardous substances	Metals contaminated by hazardous substances. Production during Project implementation is not expected. In any case, if necessary, the generated quantities must be temporarily stored in the Project's waste temporary	Separate collection of hazardous metals / Temporary storage within the Project *if needed*	Hazardous metals container (Skip Lift Container or metal container EN 840-2/5/6) **if needed*	Licensed contractor for collection, transport, and management of Hazardous Waste **if needed*

[11] «Επεξεργασία»: Οι εργασίες ανάκτησης ή διάθεσης, στις οποίες συμπεριλαμβάνεται η προετοιμασία πριν από την ανάκτηση ή τη διάθεση (N. 4819/2021)

EWC Code	EWC Description	Description of Waste Type	Waste Steam Management: Collection / Temporary Storage within the Project	Waste Steam Management: Temporary Storage Equipment within the Project	Waste Steam Management: Removal (Transport)/ Processing[11]
		storage area and managed as hazardous waste.			
17 05 04	Soils and stones other than those mentioned in point 17 05 03	Earthy excavation waste	Separate collection of excavation waste / Temporary storage within the Project	Bulk storage – Temporary disposal site near the Project site area	Reuse within the Project or collection and transport contractor / Disposal in approved suitable sites (e.g., quarries, landfills) according to the Project's Environmental Terms Approval or the Alternative Management System
08 01 11*	Waste from paints and varnishes containing organic solvents or other hazardous substances	*No permanent production is expected during the Project implementation. In any case, if necessary, the generated quantities should be temporarily and separately stored for each waste type in the Project's temporary waste storage area.*	Separate collection / Temporary storage within the Project	Suitable separate container for each type (plastic container EN 840-2/5/6, capacity from 80 up to 1100 liters or UN HDPE drum or UN metal drum, etc.) **if necessary*	Licensed entity for collection, transport, and management of Hazardous Waste **if necessary*
08 04 09*	Waste from adhesives and sealants containing organic solvents or other hazardous substances				
10 13 14	Concrete and concrete sludge waste	Waste from concrete production. No production is expected during the Project implementation. In any case, if necessary, the generated quantities should be temporarily stored in the Project's temporary waste storage area and managed as hazardous waste.	Separate waste collection / without temporary storage **if necessary*	-	Collection and management by the contractor-supplier or Licensed collection and transport entity / Extended Producer Responsibility Scheme (EPR)
13 01 11*	Synthetic hydraulic oils	Waste Lubricating Oils (WLO)	Separate collection of lubricating oils / Temporary storage within the Project	Lubricating oils container (Metal barrel UN)	Collection and transport entity / WLO EPR system
13 02 06*	Synthetic oils for engine, gearbox, and lubrication				
13 05 07*	Oily waters from oil/water separators				
15 02 02*	Absorbent materials, filter materials (including oil filters not	Oil sludge, oil filters. No permanent production during Project implementation is expected. In any case, if	Separate collection / Temporary storage on site **if necessary*	UN HDPE barrel, UN metal barrel, portable spill response unit containing	Licensed entity for collection, transport, and management of

EWC Code	EWC Description	Description of Waste Type	Waste Steam Management		
			Collection / Temporary Storage within the Project	Temporary Storage Equipment within the Project	Removal (Transport)/ Processing[11]
	otherwise specified), wiping cloths, protective clothing contaminated by hazardous substances	necessary, the generated quantities must be temporarily and separately stored by type at the Project's temporary waste storage area and managed as hazardous waste.		megabags for waste containment *if necessary*	Hazardous Waste *if necessary*
-	-	Other construction waste not included in this plan that may contain small quantities of hazardous or toxic materials (e.g., solvent-based concrete additives, adhesives, pitch-based emulsions, paints and coating layers, packaging, etc.). If such waste is generated during Project implementation, it must be categorized according to the European Waste Catalogue (EWC), temporarily stored at the Project's temporary waste storage area, and managed as hazardous waste.	Separate collection of each type / Temporary storage within the Project *if needed*	Appropriate equipment for temporary storage of hazardous waste (Intermediate Bulk Container (IBC) or UN HDPE drum, etc.) *if needed*	Licensed entity for the collection, transport, and management of hazardous waste *if needed*

It is noted that, through the electronic services of the Electronic Waste Registry (EWR)[12] it is possible to search by the code or codes of the European Waste Catalogue (EWC) for the corresponding licensed waste collection and transport operators by regional unit.

The management of Construction and Demolition Waste (CDW) in the Region of Eastern Macedonia and Thrace is carried out in accordance with the provisions of Joint Ministerial Decision (JMD) 36259/1757/E103/2010 through the following Alternative Management Systems (based on data from the Hellenic Recycling Organization (HRO)[13]):

- Alternative Management System (AMS) "Recycling of Inert Materials of Northern Greece S.A.," with the trade name "AN.A.V.E. S.A."
- AMS "Recycling of Construction and Demolition Waste of Central Macedonia S.A.," with the trade name "ANA.K.E.M."
- AMS "Central Greece Recycling System Ltd.," with the trade name "S.AN.K.E. Ltd."
- AMS "PEDMEDE ECO Limited Liability Company," with the trade name "PEDMEDE ECO LLC."

[12] https://wrm.ypeka.gr/eka-search-form
[13] https://www.eoan.gr

6.4.6.3 Drilling Waste

Drilling operations generate mining waste, both hazardous and non-hazardous, which primarily consist of drilling cuttings and drilling mud.

Drilling muds are categorized based on their main component, which can be oil-based derivatives, water, or synthetic substances. A combination of materials and chemicals is used to produce drilling muds in order to achieve the desired properties (such as specific gravity, viscosity, etc.). For the implementation of the Project, water-based/lime mud, oil-based mud, and oil-based/water-based mud will be used. Cuttings consist of fragments of the geological formations penetrated by the drill string. They are separated during the removal of solids from the recirculation of the drilling mud flow through a series of physical processes and are temporarily stored in special closed containers. Subsequently, the drilling muds are temporarily stored in special mud tanks and reused in the further drilling process until they are no longer needed or have been exhausted.

Noted that the primary section of the drilling will be 16 inches and will be drilled from approximately 350 m to a depth of 2,200 m. In this section, a drilling fluid based on seawater and lime will be used, which will be biodegradable and without negative environmental impacts. The geological formation in this section is uniform and consists of sandstone and clay layers, and from all the wells drilled in the area, no traces of hydrocarbons have ever been observed at these depths. The cuttings from this section will be deposited on the seabed, while below the depth of approximately 2,200 m, the drilling fluids will return to the surface, where the cuttings will be removed and the mud will be processed. It will be ensured that the components of the water-based muds are not harmful to the environment, and records of these components along with their safety data sheets (MSDS) will be maintained. Provided these conditions are met, the cuttings generated using these water-based muds will be allowed to be disposed of on the seabed.

Regarding the cuttings that contain hydrocarbons, due to the use of oil-based mud, they will be separated at the drilling unit and transferred to a management system located at the drilling facility. The cuttings undergo centrifugation to remove most of the mud and are then dried. The dry cuttings are placed in containers and transported onshore for further management through a certified waste management contractor. The drilling muds are temporarily stored in special mud tanks and reused in the drilling process until they are no longer needed or have been "depleted." The depleted mud is transported to onshore facilities, and final management is carried out by a licensed waste collection, transport, and management entity.

During the cementing process for the drilling of wells, since drilling mud and cement slurry are sequentially displaced, an intermediate separating fluid ($CaCl_2$ brine), known as a spacer, is inserted to ensure effective displacement and to prevent contamination between the two fluids (drilling fluid and slurry). The spacer displaces the drilling fluid, and then the cement slurry displaces the spacer without leaving any passage between them.

The categories of mining waste estimated to be produced during the construction of the Project, based on the European Waste Catalogue (EWC), are presented in the following table. It should be noted that codes marked with an asterisk (*) represent waste considered hazardous.

Table 6-10: Classification of drilling waste according to the European Waste Catalogue (EWC)

EWC Code	EWC Description
01	WASTE FROM EXPLORATION, MINING, QUARRYING, AND PHYSICAL AND CHEMICAL PROCESSING OF MINERALS
01 05	Drilling muds and other drilling wastes
01 05 04	*Fresh water drilling muds and wastes applies to water-based mud/fluids*
01 05 05*	*Oil-containing drilling muds and wastes*
01 05 06*	*drilling muds and other drilling wastes containing hazardous substances*
01 05 07	*barite-containing drilling muds and wastes other than those mentioned in 01 05 05 and 01 05 06*
01 05 08	*chloride-containing drilling muds and wastes other than those mentioned in 01 05 05 and 01 05 06*
17	WASTE FROM CONSTRUCTION AND DEMOLITION (INCLUDES EXCAVATED SOIL FROM CONTAMINATED SITES)
17 01	Concrete, bricks, tiles, and ceramics
17 01 01	Concrete

It is noted that the classification of waste, i.e., the determination of hazardous properties through the assessment of waste hazard and ultimately their classification as hazardous or non-hazardous, will be carried out in accordance with the provisions of the "Commission Communication on technical guidance for the classification of waste" (2018/C 124/01), based on the Waste Framework Directive 2008/98/EC (WFD), which has been incorporated into Greek legislation through Law 4819/2021 (Government Gazette 129/A/23.07.2021), and the CLP[14] Regulation:

"Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labeling, and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006."

It is estimated that the drilling muds produced during the construction of the Project will amount to 1,540 m^3 per well.

In a typical well for the CO_2 storage project, approximately 650 m^3 of cuttings are produced; therefore, in the program of four (4) wells, about 2,700 m^3 of solid waste will be generated. The drilling activities in the Project produce small volumes of residues, as all planned wells are of small diameter and lateral drilling.

[14] Current consolidated version: 01/12/2023: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02008R1272-20231201

Table 6-11: Estimated quantities of cuttings per drilling section

Drill section diameter (in)	MD (m)	Mud type	Specific Gravity (SG)	Mud volume per well (m³)	Cuttings volume per well (m³)	Total cuttings volume (4 wells) (m³)
16	1850	Water-based / Lime	1.05-1.15	+/- 700	360	1.140
12 1/4	950	Oil-based	1.45-1.70	+/- 490	210	844
8 1/2	1033	Oil-based / Water-based	1.10-1.30	+/- 350	100	406
			Total:	1.540	670	2.691

The spacer fluid (the hypersaline water of the $CaCl_2$ aquifer) that may be used during the cementing phase is estimated at approximately 20-30 m³ per well, while the excess cement is about 20 m³ per well.

Table 6-26 presents the waste stream management methods that may be generated according to the applicable legislation. It should be noted that the overall **Waste Management Plan** of the Project is presented in **Annex 17.3.**

Table 6-12: Mapping of an integrated waste management system for drilling operations

EWC Code	EWC Description	Description of waste type	Waste Stream Management		
			Collection/Temporary Storage within the Project	Temporary Storage Equipment within the Project	Removal (Transport) / Processing[15]
01 05 04	Muds and wastes from water drilling	Muds (water-based drilling fluids)	Separate mud collection / Temporary storage on-site	Mud tanks	Licensed entity for collection, transport, and management
		Drilling cuttings from water-based drilling fluids	Separate cuttings collection / Temporary storage on-site	-	Disposal on the seabed
		Separation fluid - spacer	Separate liquid collection / Temporary storage on-site *if needed	Metal storage tanks 5-25 m³	Licensed collection, transport, and management operator
01 05 05*	Muds and drilling wastes containing oil	Oil-based muds (drilling fluids)	Separate mud collection / Temporary storage on-site	Mud tanks	Licensed waste collection, transport, and management entity
		Drill cuttings from oil-based drilling fluids	Separate cuttings collection / Temporary storage on-site	Cutting tanks	Licensed waste collection, transport, and management entity

[15] "Processing": The activities of recovery or disposal, including preparation before recovery or disposal (Law 4819/2021).

EWC Code	EWC Description	Description of waste type	Waste Stream Management		
			Collection/Temporary Storage within the Project	Temporary Storage Equipment within the Project	Removal (Transport) / Processing[15]
		Separation fluid - spacer	Separate liquid collection / Temporary storage on-site *if needed	Metal storage tanks 5-25 m³	Licensed waste collection, transport, and management entity
01 05 06*	Drilling muds and other drilling wastes containing hazardous substances	Muds (drilling fluids containing hazardous substances)	Separate mud collection / Temporary on-site storage	Mud tanks	Licensed waste collection, transport, and management entity
		Drill cuttings containing hazardous substances	Separate collection of cuttings / Temporary on-site storage	Cutting tanks	Licensed waste collection, transport, and management entity
		Separation fluid - spacer	Separate collection of liquid / Temporary on-site storage *if necessary	Metal storage tanks 5-25 m³	Licensed waste collection, transport, and management entity
01 05 07	Muds and drilling wastes containing barite, excluding those referred to in points 01 05 05 and 01 05 06.	Muds containing barite (water-based drilling fluids)	Separate sludge collection / Temporary storage on-site	Mud tanks	Licensed waste collection, transport, and management entity
		Drill cuttings containing barite from water-based drilling fluids	Separate collection of cuttings / Temporary storage on-site	Cutting tanks	Collection and transportation entity or disposal to approved suitable recipients in accordance with the Project's Environmental Terms of Approval.
01 05 08	Muds and drilling wastes containing chlorides, excluding those referred to in points 01 05 05 and 01 05 06.	Muds containing chlorides (water-based drilling fluids)	Separate mud collection / Temporary storage on-site	Mud tanks	Licensed waste collection, transport, and management entity
		Drilling cuttings containing chlorides from water-based drilling fluids	Separate cuttings collection / Temporary storage on-site	Cutting tanks	Collection and transport entity or disposal at approved suitable recipients in accordance with the Project's Environmental Terms of Approval
		Separation fluid – spacer	Separate collection of liquid / Temporary storage within the Project *if necessary	Metal storage tanks 5-25 m³	Licensed waste collection, transport, and management entity

EWC Code	EWC Description	Description of waste type	Waste Stream Management		
			Collection/Temporary Storage within the Project	Temporary Storage Equipment within the Project	Removal (Transport) / Processing[15]
17 01 01	Concrete	Excess cement slurry	Separate collection of solidified cement / Temporary storage within the Project *if necessary	Metal storage container	Reuse on-site or collection and transport by licensed operator / Waste Management System (WMS)

t is noted that, through the electronic services of the Electronic Waste Registry (EWR)[16] it is possible to search for the corresponding licensed waste collection and transport operators by the EWC code(s) according to each regional unit.

6.4.7 Atmospheric Emissions

Atmospheric emissions from the construction activities of the proposed Project arise as follows:

- Exhaust gases from the operation of the drilling rig during drilling activities.
- Atmospheric pollutants from the construction of the CO2 pipeline.
- Atmospheric pollutants from the construction of the onshore facilities:
    - Exhaust gases from employee commuting to and from the project site.
    - Exhaust gases from truck transportation to the project and construction machinery within the project area.
    - Dust emissions from truck transportation to the project and construction machinery within the project area.

6.4.7.1 Atmospheric emissions from Drilling Operations

Emissions to the atmosphere will be produced by the jack-up rig and the support vessels during the drilling operations. Given the limited emissions and the distance from receptors, these emissions are not considered to significantly contribute to the degradation of air quality in the area of the proposed Project.

The estimation of pollutant emissions from the drilling activities is based on the expected fuel consumption as calculated in **Section 6.4.5.3.2.** The pollutant emissions (CO and NOx) from the individual components of the drilling equipment are presented in the following Table, according to data provided by the drilling equipment supplier:

[16] https://wrm.ypeka.gr/eka-search-form

Table 6-13: Pollutant emissions during drilling operations

Equipment	Total daily emission	
	CO (mg/m³)	NOx (mg/m³)
Main engine #1, Caterpillar 3516, Ser. No. 73Z00834	3058,80	8678,76
Main engine #2, Caterpillar 3516, Ser. No. 73Z00835	2594,76	9100,80
Main engine #3, Caterpillar 3516, Ser. No. 73Z00836	2523,96	9534,72
Main engine #4, Caterpillar 3516, Ser. No. 73Z00837	2360,04	8031,12
Deck crane #1, Caterpillar 3406, Ser. No. 90U17565	3623,60	1826,80
Deck crane #2, Caterpillar 3406, Ser. No. 90U17584	1311,60	2760,40
Deck crane #3, Caterpillar 3408, Ser. No. 67U3279	1080,80	2231,20
Cement unit engine #1, Detroit Diesel 12VA, Ser. No. 48993-7123-7000	636,20	2661,20
Cement unit engine #2, Detroit Diesel 12VA, Ser. No. 28335-7123-7000	545,00	2811,20
Auxiliary engine, Caterpillar 3508, Ser. No. 70Z01072	32,49	118,34

6.4.7.2 Atmospheric emissions from the construction of the CO2 pipeline

The main sources of gaseous pollutant emissions during the construction of the pipeline will be diesel engines and generators of the vessels. The emissions concern greenhouse gases (GHGs): carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O), as well as contaminants of primary concern (COPC): carbon monoxide (CO), nitrogen oxides (NOx), sulfur oxides (SOx), and particulate matter (PM).

The vessels to be used will fully comply with the international standards of the MARPOL 73/78 Convention, Annex VI "Regulations for the Prevention of Air Pollution from Ships." Annex VI regulates the emissions of ozone-depleting substances, nitrogen oxides (NOx), sulfur oxides (SOx), and volatile organic compounds (VOCs).

For the construction of the CO_2 pipeline, the construction vessel and the auxiliary vessels will use marine fuel (Marine Gasoil DMA ISO 8217:2012), with a maximum sulfur content of 0.1% (m/m), in the following quantities:

- Moored, stationary: 3.5 Mt/day
- Moored, during loading phase: 4.5 – 5.6 Mt/day
- While moving: 3.5 – 4.5 Mt/day
- During pipeline construction: 11 – 12 Mt/day

The total emissions of Contaminants of Primary Concern (COPC) based on the estimated fuel consumption during the works, according to the indicative construction schedule (**Section 6.4.2**), are calculated in the following tables. For the calculation of emissions, standard emission factors for Marine Gas Oil fuel from the European Environment Agency's emission inventory guidebook (EMEP/EEA 2023, EMEP/EEA air pollutant emission inventory guidebook, Technical guidance to prepare national emission inventories, https://www.eea.europa.eu/publications/emep-eea-guidebook-2023) were used.

Table 6-14: Fuel consumption during the construction of the CO2 pipeline

Phase of subsea pipeline construction	Duration	Pipelay vessel		Tugboats		Total fuel consumption (t)
		Mt/day	Days	Mt/day	Days	
Phase 2: Works for approaching the shore, dredging 500 m from the coastline	6 months	4,5	100	4,5	120	1530,0
Phase 3: Installation and hydrotesting	2 – 3 weeks	12	20	4,5	20	420,0
Phase 4: Installation of lifting pipeline on the Beta platform	1 week	4,5	2	4,5	5	54,0
					Total	2004,0

Table 6-15 Estimated air pollutant emissions during the construction of the CO_2 pipeline

	CO	HC	NOX	SO2	TSP	Unit
Emission factors	72,2	3,84	1,75	1,82	1,07	kg/t fuel
Total per day, installation and hydrotesting phase	1.191,3	63,4	28,9	30,0	17,7	kg/d
Total for the construction phase of the submarine pipeline (tons)	144,7	7,7	3,5	3,6	2,1	t

Source: Tier 1 Emission Factors for Ships using Marine Diesel/Marine Gas Oil (EMEP/EEA, 2023)

6.4.7.3 Atmospheric Emissions from the Construction of the Onshore Facilities

The main sources of air pollutant emissions during the construction phase of the onshore facilities within the Sigma activity area include:

- Air pollutant emissions from the movements of trucks to and from the project site and construction machinery.
- Air pollutant emissions from the movements of employees' passenger vehicles.

The following sections calculate the emissions of major air pollutants (CO, HC, NOx, SO_2, TSP) and greenhouse gases (CO_2) from the above activities during the construction phase of the proposed projects.

<u>Air pollutant emissions from the movements of trucks to and from the projects and construction machinery</u>

Emissions of major air pollutants (CO, HC, NO_X, SO_2, TSP) from the construction activities of the proposed projects are examined. The calculation of emissions is based on a Gaussian Model and concerns exhaust emissions from trucks and construction machinery, taking into account assumptions regarding traffic data and a representative construction site composition, as presented in the following table. This composition is indicative and derived from the specific technical parameters of the proposed projects.

Table 6-16: Construction Site Composition of the Project

Construction Site Equipment	Number
Mechanical Excavator	1

Construction Site Equipment	Number
Loader	1
Dump Truck	2
Concrete Mixer	1
Bulldozer	1
Road Roller	1
Generator	1

The above indicative composition represents a maximalist approach aimed at exploring the most environmentally adverse scenario to ensure maximum environmental protection.

Below are presented the estimated fuel consumption of the construction machinery during the project construction phase (**Table 6-31**), as well as the emission factors per type of fuel consumed (**Table 6-32**). It is noted that the daily fuel consumption of the construction machinery will be significantly lower, as the machinery will not operate continuously (daily operating hours range from 4 to 6 hours). However, for safety reasons and based on the precautionary principle, calculations are made assuming an 8-hour daily operation of the machinery.

Table 6-17: Estimated fuel consumption of construction machinery and heavy vehicles during the project construction phase

Machinery type	Fuel type	Fuel consumption		
		lt/day	tn/day	Total project (tn)
Mechanical Excavator	Diesel	80	0,06	2,0
Loader	Diesel	40	0,03	1,0
Dump Truck	Diesel	160	0,11	4,0
Concrete Mixer	Diesel	170	0,12	1,4
Bulldozer	Diesel	160	0,11	4,0
Road Roller	Diesel	160	0,11	2,7
Generator	Diesel	40	0,03	0,7
Total		*810*	0,6	15,9

Table 6-18: Air pollutant emission factors

	CO	HC	NO_X	SO_2	TSP
Machinery, kg/tn diesel	0,049	0,017	0,025	0,006	0,014
Diesel trucks, gr/km	19,2	5,2	9,5	2,7	2,3

The following table presents the total estimated emissions of CO, HC, NOx, SO2, and TSP from the operation of construction machinery within the worksite area and from the movements of heavy vehicles to and from the Sigma facilities during the construction phase, both overall and for the peak day, based on the assumptions outlined above.

Table 6-19: General total emissions of air pollutants (CO, HC, NOx, SO_2, TSP) from construction machinery and heavy vehicles during the Project construction phase

	CO	HC	NOx	SO_2	TSP	Μονάδα
Machinery	745,0	258,5	380,1	91,2	212,9	kg
Heavy vehicles	9,98	2,70	4,94	1,40	1,20	kg
Total	755,0	261,2	385,0	92,6	214,1	kg
Daily emissions	12,6	4,4	6,4	1,5	3,6	kg/d

Air pollutant emissions from employee commuting

The traffic load from employee commuting to and from the construction site is estimated at approximately 5 passenger vehicles per day. The following table presents the estimated emissions of main air pollutants from the staff's passenger vehicles over the entire construction phase of the onshore facilities (60 working days), based on the current EU emission factors for passenger vehicles, assuming an average road distance of 15 km from the city of Kavala and two trips per day.

Table 6-20: Emissions of main air pollutants from employee commuting to and from the project

Type of passenger vehicle	Technology	CO (g/km)	NMVOC (g/km)	NOx (g/km)	N_2O	NH_3	Pb
Petrol Medium	Euro 5-EC 715/2007	0,62	0,065	0,061	0,0013	0,0123	0,0000182
Total emissions (kg)		5,58	0,585	0,549	0,0117	0,1107	0,0001638

6.4.7.4 Greenhouse Gas Emissions

Greenhouse gas emissions during the construction phase of the projects mainly concern direct emissions **from the transportation of employees, construction machinery, and heavy vehicles** to and from the site, as well as indirect emissions from the production of construction materials and the electromechanical equipment of the projects. Emissions from the transportation of employees and heavy vehicles to and from the site, and from the operation of construction machinery, are estimated at approximately **61 tons of CO_2**, as shown in the following tables. Emissions from the production of construction materials cannot be estimated at this stage.

Table 6-21: Estimated CO_2 emissions from employee transportation during the construction of the projects

Employee transportation	
Total vehicle kilometers (km) / day	150
Total duration of construction phase (days)	60
Estimated number of employee passenger cars	5
CO_2 emission factor for passenger cars (EU Regulation 2019/631) (kg CO_2/km)	0,095
Total emissions CO_2 emissions (t)	0,855

Table 6-22: Estimated CO_2 emissions from heavy vehicle traffic and operation of construction machinery during the construction phase of the projects

Machinery/Vehicle	CO_2 emissions (t)
Mechanical excavator	7,60
Loader	3,80
Dump truck	15,2
Concrete mixer	5,39
Bulldozer	15,21
Road roller	10,14
Generator	2,53
Total CO_2 emissions (t)	**59,88**

Greenhouse gas emissions from the **operation of the drilling equipment** are calculated based on the equipment specifications, as follows:

Equipment	Average fuel consumption (l/h)	Operating hours / day	Daily emissions (kg/GJ)*			Daily emissions (kg/ημέρα)		
			CO_2	CH_4	N_2O	CO_2	CH_4	N_2O
Main engine #1, Caterpillar 3516, Ser. No. 73Z00834	82,00	12	2820	0,0072	0,0156	107.110,4	0,27	0,59
Main engine #2, Caterpillar 3516, Ser. No. 73Z00835	82,00	12	2820	0,0072	0,0156	107.110,4	0,27	0,59
Main engine #3, Caterpillar 3516, Ser. No. 73Z00836	82,00	12	2820	0,0072	0,0156	107.110,4	0,27	0,59
Main engine #4, Caterpillar 3516, Ser. No. 73Z00837	82,00	12	2820	0,0072	0,0156	107.110,4	0,27	0,59
Deck crane #1, Caterpillar 3406, Ser. No. 90U17565	33,00	4	376	0,0012	0,0024	1.915,8	0,01	0,01
Deck crane #2, Caterpillar 3406, Ser. No. 90U17584	33,00	4	376	0,0012	0,0024	1.915,8	0,01	0,01
Deck crane #3, Caterpillar 3408, Ser. No. 67U3279	34,00	4	388	0,0012	0,002	2.036,8	0,01	0,01
Cement unit engine #1, Detroit Diesel 12VA, Ser. No. 48993-7123-7000	31,00	2	178	0,0004	0,001	426,0	0,00	0,00
Cement unit engine #2, Detroit Diesel 12VA, Ser. No. 28335-7123-7000	31,00	2	178	0,0004	0,001	426,0	0,00	0,00
Auxiliary engine, Caterpillar 3508, Ser. No. 70Z01072	35,00	0,1	10	0,00003	0,00005	1,4	0,00	0,00

Total						435.163,2	1,11	2,41

** Emission factor: 74,1 kg CO_2 /GJ of fuel, 0,0002 kg CH4/GJ of fuel, 0,0004 kg N_2O/GJ of fuel*

Greenhouse gas emissions from the construction of the CO_2 pipeline using the construction vessel and auxiliary ships, which consume marine fuel (Marine Gasoil DMA ISO 8217:2012 / Max. Sulphur Content 0.1% (m/m)), are calculated using the UNFCCC Greenhouse Gas (GHG) Emissions Calculator, Document version: 01.3, Publication date: May 2021 (https://unfccc.int/documents/271269). Based on the fuel consumption calculated in Section 6.4.5.3.2, the total CO_2 emissions for the entire pipeline construction period are estimated at 6,467.33 tonnes.

Based on the above analysis, **Table 6-37** summarizes the calculation of CO_2 emissions from the construction activities of the Project.

Table 6-23: Calculation of CO_2 Emissions from the Construction Activities of the Project

Construction activities	CO_2 emissions (tn)
Transportation of workers and heavy vehicles to and from the project site, operation of construction machinery	61,0
Operation of drilling equipment[17]	69.626,1
Construction of the CO_2 pipeline with the construction vessel and auxiliary vessels	6.467,3
Total CO_2 emisions during construction phase	**76.154,4**

6.4.8 Noise and Vibration Emissions

6.4.8.1 Noise Emissions from Drilling Operations

Natural noise levels in the sea caused by wind and wave action can range from 90 dBA at 1 μPa under very calm conditions with low wind, up to 110 dB at 1 μPa under windy conditions. Certain phases of drilling operations could generate noise exceeding these natural background levels. Shell Australia conducted a detailed study in 1998, where noise levels for a rig under static conditions were compared to those of a rig during drilling operations. Noise levels from a supply vessel servicing the drilling rig were also measured and compared with the noise from the drilling rig (R. McCauley, 1998, Underwater noise emissions measured from the drilling rig Ocean General, tugboats, fishing vessels, and natural sources in the Timor Sea, Australia). The noise levels during drilling and non-drilling periods (generator operation, human activity) were similar. At a distance of 125 meters from the drilling rig, a noise level of 117 dB was recorded. During unloading activities from support vessels, noise levels reached up to 134 dB.

[17] The operation of the drilling equipment is considered to be 20 days per month over a period of 8 months, according to the Project's construction schedule.

Therefore, although the Jack-up type drilling rig will introduce an increased noise level above the natural background, this level is not expected to be higher than the noise levels produced by other marine vessels in the area, including those servicing the existing platforms.

6.4.8.2 Noise emissions from the construction activities of the CO2 pipeline

The pipeline construction vessel and the escort/support vessels will generate underwater noise during the operations. The main sources of underwater noise are categorized as follows:

- Propellers and thrusters: Noise from propellers and thrusters is mainly caused by cavitation around the propellers during vessel movement or during the operation of thrusters used to maintain/stabilize the position of the support vessel while refueling the research vessel (OSPAR 2009, Richardson et al., 1995). The resulting underwater noise from propellers and thrusters includes:
  - Broadband acoustic signals with free-field source levels approximately 160–175 dB (re 1 μPa), produced by small vessels and ships (up to 50 m in length), although these emissions heavily depend on vessel speed and other operational characteristics.
  - Typical broadband source levels ranging between 165–180 dB (re 1 μPa) from more complex propulsion systems, which usually include submerged thrusters on tugboats, crew boats, supply vessels, and many research vessels (length 50 to 100 m).
  - Relatively strong and mainly low-frequency noise (the strongest energy is usually concentrated at frequencies below several hundred Hz), with broadband source levels around 180–190 dB (re 1 μPa) from large vessels (length > 100 m).
- Engines and Electromechanical Equipment: Noise from engines often dominates when vessels are stationary or moving at low speeds. The main sources of mechanical noise include large mechanical equipment such as major power generation units (diesel engines or gas turbines), compressors, and pumps. Mechanical noise is typically low-frequency and tonal in nature.

6.4.8.3 Noise emissions from the construction of the onshore facilities

The noise emissions from the construction activities at the onshore installations are examined. The calculation of noise emissions from trucks and construction machinery is based on the indicative site equipment composition presented in section 6.4.4.1 (Table 6-13).

Noise from mobile and stationary construction machinery

As part of the noise calculation from the mobile and stationary machinery used in the construction of the proposed projects, the LAeq (T) noise level was investigated for a combined total operation time T = 12 hours of a construction site (indicative composition), considering the worst-case operating scenario and thus at the nearest receptor, and for the maximum possible number of machines. This was done in accordance with the standard BS5228-1: 2009: Code of practice for noise and vibration control on construction and open sites Part 1: Noise.

For the estimation of the noise level emitted by the simultaneous operation of the machinery, typical values based on data from international literature for machines of similar power were used, along with the applicable regulatory limits for machinery operating outdoors.

Additionally, different actual operating times t_c were taken into account, as shown in the following table, which presents the assumptions and the results of the noise emission assessment from the construction site during the construction phase of the projects.

Table 6-24: Calculation of Noise Levels from Construction Activities

Machinery	Lwa dB(A)	Res. LAeq dB(A)	Total Dist. Ratio	Equiv. On-time	Duration Corr. On-time	PNI	dB(A)
Mechanical excavator	110	68,02	20,00	0,0756	5,0%	0,03195	55
Loader	118	76,02	20,00	0,0756	5,0%	0,20162	63
Dump truck	108	66,02	20,00	0,0756	5,0%	0,02016	53
Concrete mixer	107	65,02	20,00	0,0756	5,0%	0,01601	52
Bulldozer	117	75,02	20,00	0,0756	5,0%	0,16015	62
Road roller	110	68,02	20,00	0,0756	5,0%	0,03195	55
Generator	103	61,02	2,00	0,3789	25,3%	0,03195	55

According to the calculations, the combined noise level index LAeq (12-hour) for this specific construction site scenario, assuming 100% operating time, is estimated to be **67 dB(A)** at an average distance of 50 meters from the construction activities and **60 dB(A)** at an average distance of 100 meters.

Noise from heavy vehicle traffic

To estimate the emitted noise levels from heavy vehicle traffic, typical values are used based on international literature data and the applicable regulatory limits for road traffic in transport projects. The following table presents the results of the noise estimation from heavy vehicle traffic during the construction phase.

Table 6-25: Calculation of Noise Levels from Heavy Vehicle Traffic during the Construction Phase

Heavy vehicles	Lwa dB(A)	Μήκος εργασίας (m)	Res. LAeq dB(A)	Total Dist. Ratio	Equiv. On-time	Active dur. (h)	Duration Corr. On-time	PNI	dB(A)
Mechanical excavator	110	20.00	68,02	400,00	0,0093	8	0,6%	0,003925	46
Loader	118	20.00	76,02	400,00	0,0093	8	0,6%	0,024763	54
Dump truck	108	20.00	66,02	400,00	0,0093	8	0,6%	0,002476	44
Concrete mixer	107	20.00	65,02	400,00	0,0093	8	0,6%	0,001967	43
Bulldozer	117	20.00	75,02	400,00	0,0093	8	0,6%	0,01967	53
Road roller	110	20,00	68,02	400,00	0,0093	8	0,6%	0,003925	46

According to the above calculations, the combined LAeq (12-hour) noise level for the specific scenario, assuming 100% operating time, is estimated to be 58 dB(A) at an average distance of 50 meters from the vehicle.

During the construction phase, vibrations may occur due to excavation activities and the movement of heavy vehicles. However, for the Project's onshore facilities, given the absence of extensive earthworks (in depth and area), the levels and duration of vibrations are not expected to be significant.

6.4.9 Electromagnetic Radiation and Radioactivity Emissions

During the construction of the projects, no electromagnetic radiation emissions are expected, as no fixed installations or machinery that continuously emit radiation will be used.

Regarding the Naturally Occurring Radioactive Material (NORM) associated with the Prinos formations, most drilling cuttings historically produced from the Prinos wells have radiation levels comparable to background levels.

6.5 OPERATION PHASE

6.5.1 Total Description of Processes

EnEarth plans to construct a full-scale carbon dioxide storage facility in Prinos, capable of storing significant amounts of CO_2. The operation of the facility is expected to develop in two distinct phases (Phase 1 & Phase 2), for reasons of scalability and adaptation to market conditions, each with synergistic prospects that can achieve significant CO_2 reductions.

- **Phase 1:** initial nominal capacity up to 1 MTPA (start end of 2025 to early 2026).
- **Phase 2:** expansion to a final nominal capacity of up to 3 MTPA.

<u>This study focuses on **Phase 1** of the Project, which is described in the following sections. In summary, Phase 1 includes the following sources of CO2:</u>

- Bulk CO_2 supply via pipeline reaching the boundaries of the onshore facility under suitable conditions for injection.
- Reception of CO_2 loads at the Sigma onshore facilities from trucks through pilot CO_2 capture projects.

6.5.1.1 Onshore CO_2 Receiving Facilities and Unloading Operations

At the onshore CO_2 receiving facilities, the main reception processes during Phase 1 operation of the Project will include (see **Figure 6-58**):

- **Bulk CO_2 supply via pipeline:** An onshore station within the Sigma facilities, consisting of the manifold of the onshore CO2 pipeline, will receive up to 1 MTPA of compressed CO_2. The CO_2 stream will then be transferred via a new dedicated pipeline to an existing platform of the offshore facilities, where CO_2 injection will take place through special injection wells.
- **Reception of CO_2 shipments:** Shipments will arrive by trucks at the Sigma onshore facilities and will be delivered in ISO containers. These containers will be loaded onto supply vessels by cranes, transported,

and unloaded at the existing Beta platform of the offshore Prinos facilities via a flexible hose system (loading arm).

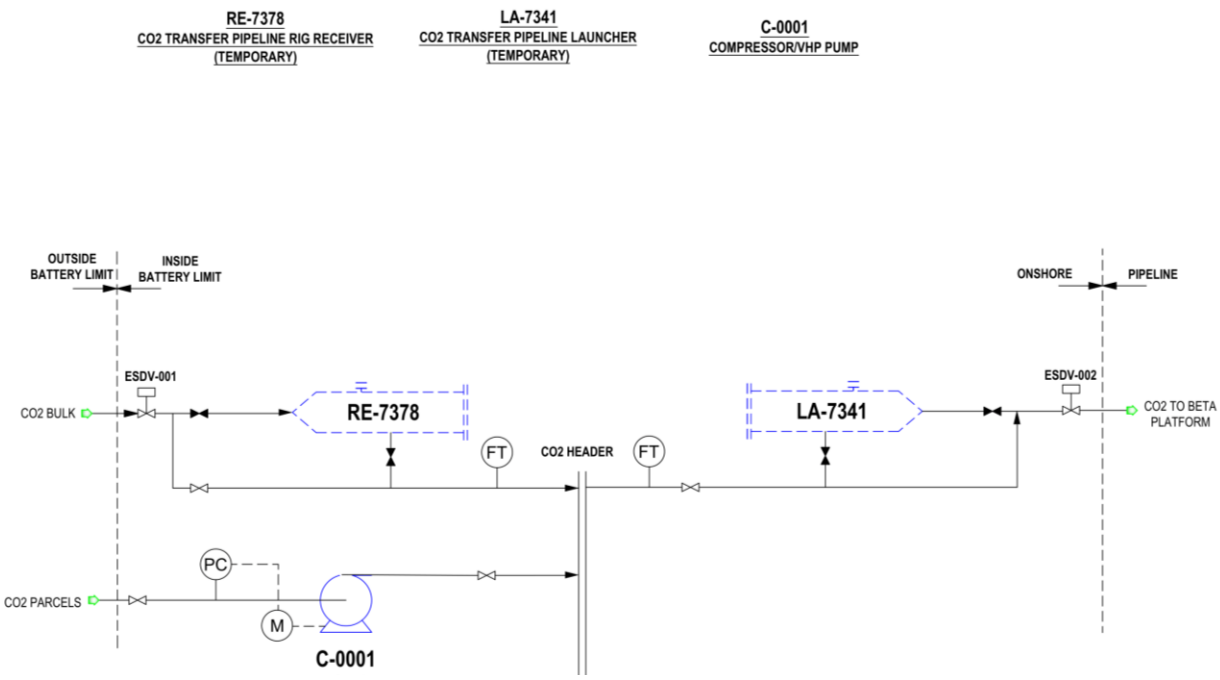


Figure 6-42: Flow diagram of processes at the onshore CO2 reception facilities (Phase 1)

There is also a provision for the direct injection of CO_2 shipments from the containers into the pipeline reception manifold at the onshore facilities. This configuration necessitates a compression station during unloading from the trucks, located next to the manifold area. In this case, the trucks will unload the ISO containers adjacent to the manifold area. A flexible hose will be used to unload the contents of the ISO containers into the compressor, from where the CO_2 will be directed to the manifold, ensuring that all safety measures are followed for safe operation.

The CO_2 reception processes are described in detail below.

6.5.1.1.1 Bulk CO_2 Reception via Pipeline

The CO_2 entering the facility via the onshore pipeline during Phase 1 is expected to be at pressure and temperature suitable for injection at the storage site, without requiring further processing.

Table 6-26: Specifications of bulk CO_2

Parameter	Value/Description
Source	Underground pipeline
Nominal flow	126 tons/hour
Pressure	102 barg

Temperature	29°C
Composition	See Table 6-41

The CO_2 is supplied under suitable conditions for injection and is directed to the wellhead, from where it is transported to the Prinos complex via the CO_2 transport pipeline (1500#). The injection lift for the CO_2 pipeline will have Emergency Shutdown Valves (ESDVs) for isolation. The injection pressure for Phase 1 is 101 barg, and the injection temperature is 20°C.

EnEarth, as part of its technical studies, is examining similar operational projects to understand the challenges related to the composition of the CO_2 stream and compliance with the requirements of Article 12 of the relevant European Directive (2009/31/EC), which explicitly states that the CO_2 stream should mainly consist of carbon dioxide with possible small amounts of impurities of other substances. **Table 6-41** presents the likely specifications of the CO_2 stream expected to be received in bulk via the pipeline and CO_2 shipments. These values are indicative and are based on the maturity of the Pilot Programs. They also take into account the specifications of similar more advanced projects in Europe (Northern Lights[18], Porthos[19]).

Table 6-27: Possible composition of bulk CO2 stream and CO_2 shipments

Component	Value	Unit
CO_2	>99	mol%
N_2	-	mol%
H_2	50	ppm mol
Ar	-	ppm mol
CO	0,1	mol%
Methane	< 100	ppm mol
Ethane	< 75	ppm mol
Permissibile mixture (N_2+H_2+Ar+CO+CH_4+C2)	0,4 (H_2+N_2+O_2+Ar+CH_4+CO)	mol%
Hydrocarbons C3+	0,12 (hydrocarbons C2 - C10)	mol%
H_2O	30	ppm mol
O_2	10	ppm mol
NOx	10	ppm mol
SOx	10	ppm mol
H_2S	9	ppm mol
NH_3	10	ppm mol
Aromatic hydrocarbons (C6-C10, incl BTEX)	15	ppm mol
Methanol	40	ppm mol
Solids	1	mg/Nm^3
Mercury	3	ppb mol
Cadmium	0,03	ppm mol

[18] https://norlights.com/news-media-and-technical-reports/
[19] https://www.porthosco2.nl/en/

Component	Value	Unit
Thallium		
VOCs (Formaldehyde, Acetaldehyde, Dimethyl sulfide, Ethanol)	10 (except MeOH, EtOH and aldehyde)	ppm mol
Formaldehyde	20	ppm mol
Acetaldehyde	20	ppm mol
Amines	10	ppm mol
Glycols	Not allowed (MEG, TEG)	ppm mol

6.5.1.1.2 Reception of CO_2 Loads via Containers (CO_2 Parcels)

The CO_2 loads from pilot projects will be transported to the Sigma plant dock using ISO container trucks. The containers will be received by a 50-ton crane, loaded onto the deck of a supply vessel or transport barge, and transferred to the offshore facilities at the Beta platform. The high-pressure containers can store CO_2 at ambient temperatures without energy losses associated with liquefaction and maintaining cryogenic conditions. Regarding the quantities of CO_2 expected to be received in loads and the frequency of deliveries, the following assumptions are made:

- Considering a quantity of 400 tons from Pilot Program 1[20] under the framework of the EU's Horizon Europe program, 19 trips will be required by a truck with a capacity of 21,375 kg (indicatively, 18 trips at 100% load capacity, 1 trip at 71% load capacity) to deliver the total quantity of CO_2 shipments. A frequency of 1 truck per week is assumed for a duration of almost 5 months (19 weeks).
- Considering a quantity of 40 tons from Pilot Program 2[21] under the framework of the EU's Horizon Europe program, 2 trips will be required by a truck with a capacity of 21,375 kg (indicatively, 1 trip at 100% load capacity, 1 trip at 87% load capacity) to deliver the total quantity of CO_2 shipments. A frequency of 1 truck every 3 months is assumed.

The distance that the trucks will travel per trip to deliver the CO_2 shipments to the Sigma facilities can be considered as 150 km (Pilot Program 1) and 700 km (Pilot Program 2), respectively.

There is also a provision for the direct injection of CO_2 shipments from the containers into the pipeline manifold at the onshore facilities. This configuration creates the need for a compression station during unloading from the trucks next to the manifold area. In this case, the trucks will unload the ISO containers next to the manifold area. A flexible hose will be used to unload the contents of the ISO containers into the compressor, from where the CO_2 will be directed to the manifold, ensuring that all safety measures for safe operation are met.

[20] HERCCULES/HORIZON-CL5-2022-D3-01 Call (Project no. 101096691)
[21] COREU/ HORIZON-CL5-2023-D3-01 (Project No. 101136217)

6.5.1.2 Transport of CO_2 to the Prinos Offshore Storage Facilities

During Phase 1, according to the preliminary design study (pre-FEED), the CO_2 supplied via pipeline will be delivered in suitable conditions for injection. It will connect to the new facilities through a flange connection on the receiving manifold and will be exported to the offshore facilities complex of Prinos via the new subsea CO_2 transport pipeline, which is 18-20 km long, with a diameter of 12-16 inches, and class 1500#.

The CO_2 pipeline will initially handle a capacity of up to 1 MTPA of compressed CO_2 but is designed to accommodate the project's future planned capacity (3 MTPA CO_2). The jacket's riser pipe connecting the platform to the CO_2 pipeline will be equipped with emergency shutdown valves (ESDV) for isolation.

Regarding the CO_2 shipments, the supply vessel / barge transporting the containers is expected to connect to the piping on the platform via a system of flexible hoses. From there, the CO_2 shipments will undergo further processing (as described below) to meet the correct specifications and conditions for injection into the well.

6.5.1.3 CO_2 injection

The main processing equipment for the CO_2 shipments on the Beta platform will include a compression station to achieve the required injection conditions, installed on the open deck of the platform. At startup, to avoid low temperatures in the piping and the formation of hydrates/slugs near the well, the installation of an electric startup heater and a methanol injection system is planned (see **Figure 6-59**).

The CO_2 injection will target zones B and C of the reservoir, using two injection wells during the period 2025-2035, and will later expand to the entire reservoir by the end of the Project.

During the first 3 years of operation at the storage site, the CO_2 injection rate will gradually increase from 0.25 to 0.5, then to 0.75 and finally to 1.0 MTPA.

For Phase 1, the required injection conditions at the well are a pressure of 101 barg and a temperature of 20°C.

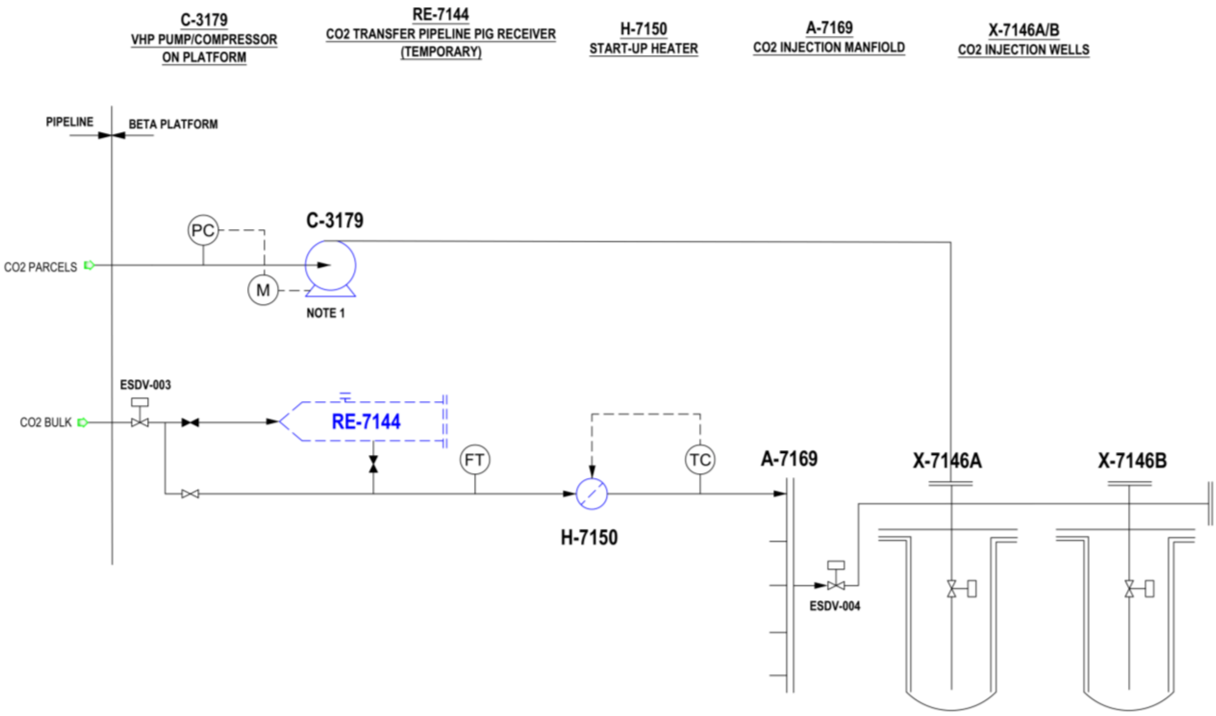


Figure 6-43: Process flow diagram of CO2 injection operations on the Beta platform

6.5.1.4 Water Pumping

The water wells on the Beta platform will be equipped with Electrical Submersible Pumps (ESPs) and will extract water from the reservoir in order to provide a means of active management of reservoir pressure.

According to simulation studies, the two water production wells will operate with a production rate of up to 7,500 barrels of water per day (bwpd) each during the period 2025–2030 (6 years). Water production will gradually increase to 9,000 bwpd per well in 2031 and until the end of the Project.

The capacity of 7,500 bwpd per well corresponds to the operation of the ESP at 83% of its capacity, whereas the capacity of 9,000 bwpd per well corresponds to the ESP operating at 100% of its capacity.

The water extracted from the reservoir to provide a method of active management of reservoir pressure will undergo treatment on the Delta platform and will be discharged into the sea via a disposal caisson. All extracted water is expected to be treated at the existing facilities on the Delta platform, similarly to the produced water treatment of the operating Prinos facilities, without the need for construction of new installations on the platform. It is important to note that this consideration is subject to further evaluation once samples of the aquifer water are obtained.

Figure 6-60 describes the water production process from the water wells on the Beta platform.

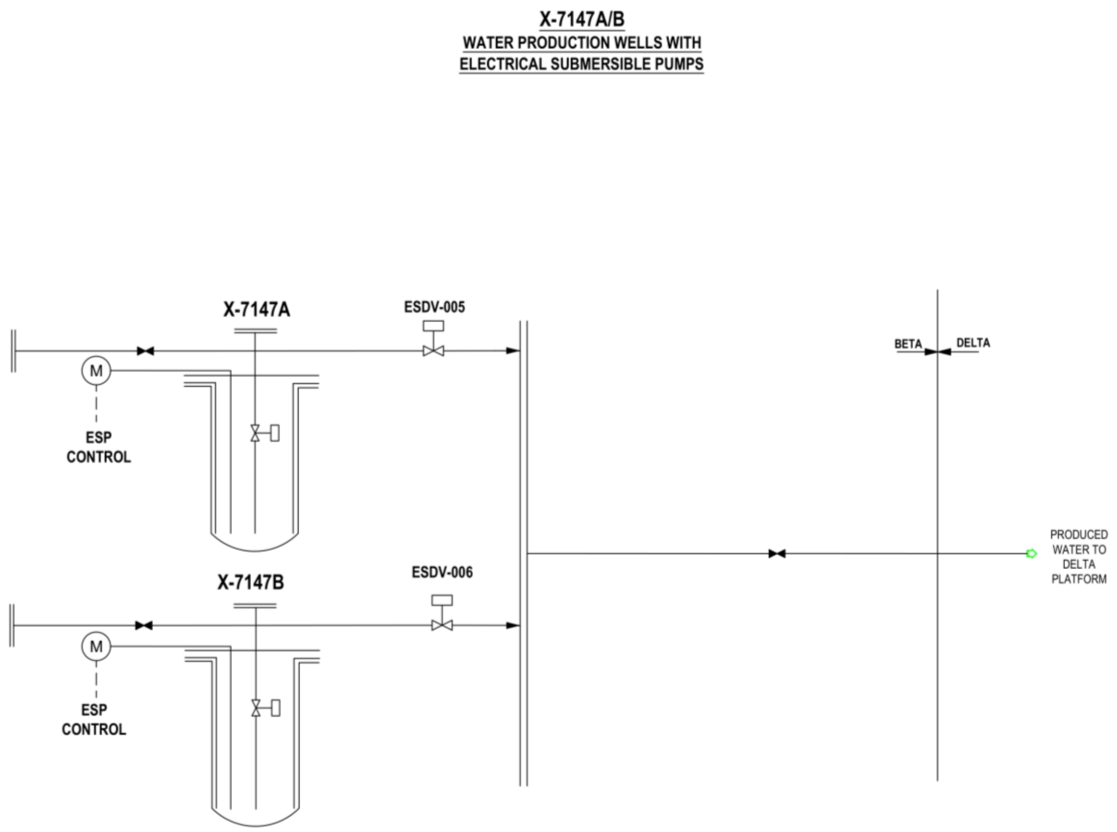


Figure 6-44: Process flow diagram of water production at the new water wells on the Beta platform

6.5.2 Personnel Requirements

As part of the development of the Project, EnEarth will employ specialized technical and administrative personnel both during the construction phase and the operational phase.

Additionally, Energean will provide technical support to EnEarth through its human resources, who will continue to be employed at the existing facilities.

In summary, the following operational team is planned for the duration of the Project's operation:

- Safety, offices, warehouse, logistics, marine control: 20 personnel
- Monitoring team for Environment, Health, and Safety (HSE): 20 personnel.
- Maintenance team: 6 personnel

6.5.3 Equipment List

The following tables include the equipment lists, according to the preliminary design study, that will operate in the onshore section of the Project (bulk CO_2 reception via pipeline and CO_2 loads via trucks) and in the offshore section (CO_2 injection and water production).

Table 6-28: Indicative equipment list for bulk CO_2 reception via pipeline (according to the preliminary design study)

Equipment		Number	Size/Capacity	Design Pressure (barg)	Operating Pressure (barg)	Design Temperature (°C)
RE-7378	CO_2 Transfer Pipeline Pig Receiver	1	8''	90-104	240	-46
LA-7341	CO_2 Transfer Pipeline Pig Launcher	1	12-16"	90-220	240	-46
RE-7144	CO_2 Transfer Pipeline Pig Receiver	1	12-16"	101-194	240	-46
H-7150A	Start-up heater	1	1,5 MW			T εισόδου ~ 10

Table 6-29: Indicative equipment list for CO_2 load reception (according to the preliminary design study)

Equipment		Number	Size/Capacity	Design Pressure (barg)	Operating pressure (barg)	Design Temperature (°C)
C-001	Compressor	1	~ 5-10 kW	60-80	84	52
P-3179	Compressor on Platform	1	~ 5-10 kW	60-80	84	52

Table 6-30: Indicative equipment list for the CO_2 injection and water production processes (according to the preliminary design study)

Equipment		Number	Size/Capacity	Design Pressure (barg)	Operating Pressure (barg)	Design Temperature (°C)
ESP-001	Electric Submersible Pump	1	9 5/8''	25-165	200	150
ESP-002	Electric Submersible Pump	1	9 5/8''	25-165	200	150
XMT –001	Xmas tree water producers and CO_2 injectors	2	13 5/8''	240-345	450	-29 - 121
XMT –002	Xmas tree water producers and CO_2 injectors	2	13 5/8''	240-345	450	-29 - 121
X-7146A	CO_2 injection well	1	8''	101-194	240	-46
X-7146B	CO_2 injection well	1	8''	101-194	240	-46
X-7147A	Water production well	1	8''	101-194	240	-46
X-7147B	Water production well	1	8''	101-194	240	-46
A-7169	1-5 flowline CO_2 injection manifold	1	16" (1 off) x 8" (5 off)	101-194	240	-46

6.5.4 Raw Materials, Water, and Energy

6.5.4.1 Material Requirements

During the operational phase of the CO_2 storage facilities, the required materials and consumables will be used as needed, mainly for the routine maintenance of the facilities.

6.5.4.2 Water Requirements

During the operational phase of the CO_2 storage facilities, no demand for fresh water is expected, except for personnel needs, similar to the current operation of the facilities.

The daily consumption per employee is estimated at 20 liters, which includes drinking water consumption (5 liters) and water use for personal hygiene (15 liters). Therefore, during the operation of the Project, approximately 800 liters per peak day of drinking water will be required to support the personnel's living needs.

6.5.4.3 Energy Requirements

6.5.4.3.1 Energy Consumption

In the new offshore facilities during the operational phase, power will be required for the processing of CO_2 on the Beta platform to achieve the appropriate injection conditions (pressure, temperature). Based on the initial estimate regarding the anticipated energy consumption for compressing CO_2 loads, as well as heating bulk CO_2 during startup, the power demand is expected to be around **1.6 MW**. Approximately 99% of this power demand is attributed to the operation of the electric heater required during startup as a means to prevent low temperatures in the piping and the formation of hydrates/ices near the well area. The required daily energy for 16 hours of operation (2 shifts) amounts to 1.6 MW x 16 h/day = 25.6 MWh, while the annual energy consumption is **9,344 MWh/year**.

For the pumping of produced water from the water wells on the Beta platform, two Electrical Submersible Pumps (ESPs) with a power of approximately **0.5** to **1 MW** each are planned. Power supply to the pumps will be provided via power cables fed from Variable Speed Drive (VSD) systems located within the electrical room of the Beta platform. Assuming 24-hour operation of the pumps and considering an average power value of 0.75 MW, the annual energy required for each pump is calculated as 0.75 MW × 24 hr/day × 365 days = 6,570 MWh. Therefore, the total energy required for the operation of both pumps amounts to **13,140 MWh/year**. The subsequent development phases will require the installation of additional water wells and corresponding submersible pumps and transmission systems, with a proportional increase in the required power.

The required control systems, power supply, and hydraulic system from the hydraulic power unit and the wellhead control panel will be installed on the surface "Christmas tree" valves on the Beta platform.

Electrical power is supplied from the onshore facilities to the Delta platform via 20 km long subsea cables (2 x 3C-120 mm², 20 kV), which currently provide power of up to approximately 4 MW.

Table 6-31: Electricity Consumption During Operation

Installed Power	8.000 kW
Maximum Power Demand	4.000 kW
Average Energy Consumption	96.000 kWh/day 2.900 MWh/month
Grid Voltage (Low/Medium)	0,4 / 6,3 and 20 kV

Regarding the needs of the onshore facilities, it is noted that no treatment is planned for CO_2 loads or for the quantities delivered via pipelines. However, since the majority of the CO_2 quantity will in the future be transported to the reservoir via a pipeline system originating from industries in the wider region of Northern Greece (from Volos, Larisa to Alexandroupoli), indicative energy requirements are estimated, although these **fall outside the physical scope of the Project under study.**

The energy requirements for receiving bulk CO_2 via pipeline (outside the Project) during its operation will consist of consumption for compression (on the order of 100 kWh/t CO_2), cooling (approximately 144 Mcal/t CO_2), and transportation of CO_2 from producers to the storage site. According to the above, the total energy consumption in the pipeline is expected to be approximately 267.4 kWh/t CO_2, that is, **267,360.0 MWh/year** for a capacity of 1 MTPA (million tonnes per annum).

6.5.4.3.2 Fuel Consumption

Fuel consumption during operation will concern the movement of trucks and vessels for the reception of CO_2 loads, as well as the usual transportation of personnel and supplies, which will be similar to those of the existing activity at the Sigma onshore facilities and the offshore facilities of Prinos.

- The reception of CO_2 loads is estimated to be carried out through 21 truck trips with a capacity of 21,375 kg each (indicative calculation, Section 6.5.1.1.2). The distance traveled by the trucks per trip for delivering the CO_2 loads to the Sigma facilities can be considered 150 km (Pilot Program 1) and 700 km (Pilot Program 2), respectively. Based on the above, the fuel consumption is expected to be in the range of **2.5 – 3 tons.**
- The frequency of mobilization of the supply vessel/barge for transporting CO_2 loads will correspond to that of the trucks delivering the loads (Section 6.5.1.1.2). Fuel consumption for the supply vessel is estimated to be 1,300 tons over the total duration of the Project.

6.5.5 Waste Generation

6.5.5.1 Municipal-type of waste

6.5.5.1.1 Municipal Waste

It is estimated that the Project will generate non-hazardous and hazardous Municipal Waste (MW) as well as certain other waste streams that fall under alternative management (Extended Producer Responsibility - EPR).

The categories of waste expected to be generated during the operation of the Project, based on the European Waste Catalogue (EWC) (Decision 2001/118/EC, as amended and in force), are presented in the following table. It should be noted that codes which, in addition to the number, include an asterisk (*), represent wastes classified as hazardous.

Table 6-32: Classification of Municipal-type Waste according to the EWC (European Waste Catalogue)

EWC Code	EWC Description
15	**WASTE FROM PACKAGING: ABSORBENTS, WIPING CLOTHS, FILTER MATERIALS AND PROTECTIVE CLOTHING NOT OTHERWISE SPECIFIED**
15 01	Packaging (including separately collected municipal packaging waste)
15 01 01	Paper and cardboard packaging
15 01 02	Plastic packaging
15 01 04	Metal packaging
15 01 05	Composite packaging[22]
15 01 06	Mixed packaging
15 01 07	Glass packaging
15 01 10*	Packaging containing residues of hazardous substances or contaminated by such substances
19	**19 WASTE FROM WASTE MANAGEMENT FACILITIES, OFF-SITE WASTEWATER TREATMENT PLANTS, AND THE PREPARATION OF WATER INTENDED FOR HUMAN CONSUMPTION AND WATER FOR INDUSTRIAL USE**
19 08	Waste from wastewater treatment plants not otherwise specified
19 08 05	Sludges from the treatment of urban wastewater
20	**MUNICIPAL WASTE (HOUSEHOLD WASTE AND SIMILAR WASTE FROM COMMERCIAL ACTIVITIES, INDUSTRIES, AND INSTITUTIONS), INCLUDING SEPARATELY COLLECTED FRACTIONS**
20 01	Separately collected fractions (excluding those mentioned in 15 01)
20 01 01	Paper and cardboard
20 01 02	Glass
20 01 13*	Solvents
20 01 14*	Acids
20 01 15*	Alkaline waste
20 01 19*	Pesticides
20 01 21*	Fluorescent tubes and other waste containing mercury
20 01 23*	Discarded equipment containing chlorofluorocarbons (CFCs)

[22] Beverage cartons (e.g. Tetra Pak), Snack packaging (e.g. chips, cheese puffs), Blister packs (tablet packaging)

EWC Code	EWC Description
20 01 25	Edible oils and fats
20 01 27*	Paints, inks, adhesives, and resins containing hazardous substances
20 01 29*	Detergents containing hazardous substances
20 01 33	Batteries and accumulators referred to in 16 06 01, 16 06 02, or 16 06 03 and mixed batteries and accumulators containing those batteries
20 01 34	Batteries and accumulators other than those mentioned in 20 01 33
20 01 35*	Discarded electrical and electronic equipment, excluding those mentioned in 20 01 21 and 20 01 23, containing hazardous components
20 01 36	Discarded electrical and electronic equipment, excluding that mentioned in 20 01 21, 20 01 23, and 20 01 35
20 01 37*	Wood containing hazardous substances
20 01 39	Plastics
20 01 40	Metals
20 03	Other municipal waste
20 03 01	Mixed municipal waste

The estimates for the production of municipal waste from the Project are based on the following assumptions:

- Average number of employees per day: 46
- Daily municipal waste generation rate: 0.4 kg/person
- Qualitative composition of the municipal waste based on NSR[23] estimates
- Separate collection of recyclable materials (paper and cardboard, metals, plastics, glass)
- Specific weight per type of municipal waste: (to be determined)
  - Paper/cardboard: 0,20 tn/m^3
  - Plastics: 0,22 tn/m^3
  - Metals: 0,23 tn/m^3
  - Glass: 0,33 tn/m^3
  - Other – mixed: 0,26 tn/m^3
- Percentage of waste that can be recycled per municipal waste stream:
  a. Paper/cardboard: 85%
  b. Plastics: 50%
  c. Metals: 70%
  d. Glass: 60%

Based on the above, the following table presents the estimated annual quantity of municipal waste during the operation phase of the Project, as well as the average daily generated quantities of municipal waste.

Table 6-33: Estimated Municipal Waste Quantities – Operational Phase

Municipal Waste Generation		Mixed Waste	Recyclables	Total	Unit
Annual Generation	Waste generation (tn)	14,19	6,85	**21,04**	**tn**

[23] ESDA Ministerial Decision Act 39 dated 31.8.2020 (Government Gazette 185/A/29.9.2020), as amended by the P.Y.S. 5 dated 18.4.2023 (Government Gazette 94/A/18.4.2023).

Municipal Waste Generation		Mixed Waste	Recyclables	Total	Unit
	Waste generation (m³)	54,57	32,22	**86,79**	**m³**
Average daily generation	Average daily wate generation (tn/d)	0,012	0,006	**0,02**	**tn/d**
	Average daily waste generation (m³/d)	0,048	0,028	**0,08**	**m³/d**

Regarding other urban-type waste streams (waste streams falling under Alternative Management, Small Quantities of Hazardous Waste (SQHW), etc.), for which no permanent production is expected during the operation phase of the Project based on the current phase data, it is not possible to estimate the produced quantities.

The following table presents the management approach for the urban waste streams according to the requirements of the applicable legislation.

It is noted that the overall **Waste Management Plan** of the Project is presented in **Appendix 17.3.**

Table 6-34: Mapping of the integrated waste management system – Municipal Waste

EWC Code	EWC Description	Description of waste type	Waste Stream Management		
			Collection/Temporary Storage within the Project	Temporary Storage Equipment within the Project	Collection (Transport) / Treatment[24]
20 03 01	Mixed municipal waste	Mixed municipal waste	Separate collection of mixed municipal waste / Temporary storage within the Project	Mixed Waste Bin (plastic bin EN 840-2/5/6, capacity from 80 to 1100 liters)	Responsible Local Authority (Municipality) or authorized collection and transport entity – if this is not feasible, provision should be made for the Project's operator to deposit the waste into the existing municipal collection system / Kavala Landfill (XYTA).
19 08 05	Sewage sludge from municipal wastewater treatment	Sludge from the Sigma Wastewater Treatment Plant (WWTP) resulting from the treatment of the Project's municipal wastewater	-	-	Licensed entity for collection, transport, and management.
15 01 01	Paper and cardboard packaging	Mixed recyclable materials from paper/cardboard,	Separate collection of recyclable materials / Temporary	Recyclable Materials Bin (plastic bin EN 840-2/5/6,	Responsible Local Authority (Municipality) or authorized collection and
15 01 02	Plastic packaging				

[24] "Treatment": Recovery or disposal operations, including preparation prior to recovery or disposal (Law 4819/2021).

EWC Code	EWC Description	Description of waste type	Waste Stream Management		
			Collection/Temporary Storage within the Project	Temporary Storage Equipment within the Project	Collection (Transport) / Treatment[24]
15 01 04	Metal packaging	plastic, metal, and glass [25]	storage within the Project	capacity from 80 to 1100 liters)	transport entity – if this is not feasible, provision should be made for the Project's operator to deposit the waste into the existing municipal collection system / Xanthi Recyclable Materials Sorting Center (ΚΔΑΥ).
15 01 05	Composite packaging[26]				
15 01 06	Mixed packaging[27]				
15 01 07	Glass packaging				
20 01 01	Paper and cardboard				
20 01 02	Glass				
20 01 39	Plastics				
20 01 40	Metals				
20 01 25	Edible oils and fats	Edible oils and fats. Permanent production during the implementation of the Project is not anticipated. In any case, and if the need arises, the quantities generated must be temporarily stored in the Project's waste temporary storage area.	Separate collection of edible oils and fats / Temporary storage within the Project *if needed*	Edible Oils and Fats Collection Container (Intermediate Bulk Container (IBC) or UN HDPE drum, capacity from 30 to 220 liters) *if needed*	Licensed entity for collection, transport, and management *if needed*.
20 01 23*	Discarded equipment containing chlorofluorocarbons (CFCs)	Waste Electrical and Electronic Equipment (WEEE). Permanent generation of WEEE during the implementation of the Project is not anticipated. In any case, and if the need arises, the quantities generated must be temporarily stored in the Project's waste temporary storage area.	Separate collection of WEEE / Temporary storage within the Project *if needed*	WEEE Bin (plastic bin EN 840-2/5/6, capacity from 80 to 1100 liters, or WEEE Bin provided by a contracted Producer Responsibility Organization - PRO) *if needed*	Collection and transport entity / WEEE PRO – if this is not feasible, provision should be made for the Project's operator to deposit the waste at appropriate WEEE recycling points of the PROs *if needed*.
20 01 35*	iscarded electrical and electronic equipment, other than those referred to in 20 01 21 and 20 01 23, containing hazardous components				
20 01 36	Discarded electrical and electronic equipment, other than that referred to in 20 01 21, 20				

[25] https://www.eoan.gr/%ce%b5%ce%bd%ce%b7%ce%bc%ce%ad%cf%81%cf%89%cf%83%ce%b7/%cf%84%ce%b9-%cf%85%ce%bb%ce%b9%ce%ba%ce%ac-%ce%b1%ce%bd%ce%b1%ce%ba%cf%85%ce%ba%ce%bb%cf%8e%ce%bd%ce%bf%cf%85%ce%bc%ce%b5/

[26] Beverage cartons (Tetra Pak type), snack packaging (e.g., potato chips, crisps), tablet/blister packaging.

[27] Mixed packaging: packaging consisting of two or more layers of different materials that cannot be separated by hand and constitute a single integrated unit composed of an inner receptacle and an outer casing, which is filled, stored, transported, and emptied as a single unit, DIRECTIVE (EU) 2018/852.

EWC Code	EWC Description	Description of waste type	Waste Stream Management		
			Collection/Temporary Storage within the Project	Temporary Storage Equipment within the Project	Collection (Transport) / Treatment[24]
	01 23, and 20 01 35				
20 01 33	Batteries and accumulators referred to in 16 06 01, 16 06 02, or 16 06 03, and mixed batteries and accumulators containing these batteries	Waste Electrical Batteries & Accumulators (WBA)	Separate collection of WBA / Temporary storage within the Project	WBA Bin (WBA Bin provided by a contracted Producer Responsibility Organization - PRO)	Collection and transport entity / WBA PRO
20 01 34	Batteries and accumulators other than those referred to in 20 01 33				
20 01 21*	Fluorescent tubes and other mercury-containing waste	Waste from Lighting Equipment, Lamps, and Small WEEE Devices. Permanent generation of WEEE during the implementation of the Project is not anticipated. In any case, and if the need arises, the quantities generated must be temporarily stored in the Project's waste temporary storage area.	Separate collection of lighting equipment, lamps, and small WEEE devices / Temporary storage within the Project **if needed*	Lighting and Lamp Bin (WEEE Bin provided by a contracted Producer Responsibility Organization - PRO) **if needed*	Collection and transport entity / WEEE PRO – if this is not feasible, provision should be made for the Project's operator to deposit the waste at appropriate WEEE recycling points of the PROs **if needed*.
20 01 13*	Solvents	SHPHW (Small Quantities of Hazardous Waste at the Project Site). Permanent generation during the implementation of the Project is not anticipated. In any case, and if the need arises, the quantities generated must be temporarily and separately stored by waste type in the Project's temporary waste storage area.	Separate collection / Temporary storage within the Project **if needed*	Suitable separate container for each waste type (plastic bin EN 840-2/5/6, capacity from 80 to 1100 liters, or UN HDPE drum, UN metal drum, etc.) **if needed*	Licensed entity for the collection, transport, and management of Hazardous Waste **if needed*.
20 01 14*	Acids				
20 01 15*	Alkaline wastes				
20 01 19*	Pesticides				
20 01 27*	Paints, inks, adhesives, and resins containing hazardous substances				
20 01 29*	Detergents containing hazardous substances				
20 01 37*	Wood containing hazardous substances				
15 01 10*	Packaging containing residues of hazardous substances or contaminated by them	Empty containers of paints, solvents, etc. Permanent generation during the implementation of the Project is not anticipated. In any case, and if the need arises, the quantities	Separate collection / Temporary storage within the Project **if needed*	UN HDPE drum, UN metal drum **if needed*	Licensed entity for the collection, transport, and management of Hazardous Waste **if needed*.

EWC Code	EWC Description	Description of waste type	Waste Stream Management		
			Collection/Temporary Storage within the Project	Temporary Storage Equipment within the Project	Collection (Transport) / Treatment[24]
		generated must be temporarily and separately stored by waste type in the Project's temporary waste storage area and managed as hazardous waste.			

t should be noted that, through the electronic services of the Electronic Waste Registry (EWR)[28] it is possible to search for the licensed waste collection and transport entities by the corresponding EWC code(s) within each regional unit.

6.5.5.1.2 Wastewater and other aqueous wastes

The water produced from the planned wells will be sent to the Delta platform of Prinos, where it will be separated and treated in the existing systems and then discharged into the sea.

Rainwater on the platforms, which may potentially contain hydrocarbons, enters the closed drainage system through the bunded areas. To minimize these quantities, the size of the bunded areas has been minimized and protected from rain wherever possible.

6.5.5.2 Operational / maintenance waste of the facility

It is estimated that during the operation and maintenance of the underground CO_2 storage facility, both non-hazardous and hazardous waste will be generated.

Given the early stage of the Project's study, it is not possible to precisely estimate the types and quantities of hazardous and non-hazardous waste that may be produced. However, it can be noted that hazardous waste from the existing facilities is generated on the Delta platform. These wastes are produced during the general maintenance of the facilities, which lasts 15 days every 30 months. The hazardous waste generated from the cleaning of vessels V-101 A/B, V-107, and V-102 from the water treatment on the Delta platform consists of oily sludge (mixtures of heavy hydrocarbons mainly containing asphaltenes), rags, absorbent materials, etc. Both hazardous and non-hazardous waste may arise from the processing of CO_2.

Indicatively, the categories of waste estimated to be generated from the operation and maintenance of the underground storage facility, based on the European Waste Catalogue (EWC), are presented in the following table. It should be noted that codes which, in addition to the number, have an asterisk (*), represent wastes considered hazardous.

[28] https://wrm.ypeka.gr/eka-search-form

Table 6-35: Indicative types of waste from the operation and maintenance of the underground facility according to the EWC

EWC Code	Description
13	**OIL WASTES AND WASTES OF LIQUID FUELS (excluding edible oils and those included in chapters 05, 12, and 19)**
13 02	Waste oils from engines, gearboxes, and lubricants
13 02 05*	Non-chlorinated mineral-based waste oils from engines, gearboxes and lubricants
14	**WASTE FROM ORGANIC SUBSTANCES USED AS SOLVENTS, REFRIGERANTS, AND PROPELLANTS (excluding chapters 07 and 08)**
14 06	Waste from organic substances used as solvents, refrigerants, and foam/aerosol propellants
14 06 01*	Chlorofluorocarbons (CFCs), HCFCs, HFCs
14 06 03*	Other solvents and solvent mixtures
15	**WASTE FROM PACKAGING; ABSORBENT MATERIALS, WIPING CLOTHS, FILTER MATERIALS AND PROTECTIVE CLOTHING NOT OTHERWISE SPECIFIED**
15 02	Absorbent materials, filter materials, wiping cloths and protective clothing
15 02 02*	Absorbent materials, filter materials (including oil filters not otherwise specified), wiping cloths, and protective clothing contaminated by hazardous substances
16	**WASTES NOT OTHERWISE SPECIFIED IN THE CATALOGUE**
16 05	Gases in pressure containers and discarded chemicals
16 05 06*	Laboratory chemical substances consisting of or containing hazardous substances, including mixtures of laboratory chemical substances
16 10	Aqueous liquid wastes intended for treatment off-site
16 10 01*	Aqueous liquid wastes containing hazardous substances
16 10 02	Aqueous liquid wastes other than those mentioned in entry 16 10 01Aqueous liquid wastes other than those mentioned in entry 16 10 01
17	**WASTE FROM CONSTRUCTION AND DEMOLITION**
17 04	Metals (including their alloys)
17 04 05	Iron and steel
17 04 09*	Metal waste contaminated by hazardous substances

The management of the above-mentioned hazardous and non-hazardous wastes, as well as any other potential wastes generated during the operation and maintenance phase of the facility, will be carried out in accordance with the applicable legislation. The generated wastes will be collected separately by type in containers suitable for their safe temporary storage on-site, in compliance with safety and environmental protection regulations. Their management will be conducted by licensed waste collection, transport, and disposal entities.

Hazardous wastes such as rags, absorbent materials, etc., related to this project and originating from the shared use of the water separation system of the Delta platform, e.g., water separator V-102, are already included in the existing operation of the Delta platform.

6.5.6 Atmospheric Emissions

The atmospheric emissions during the operation of the Project will mainly originate from the operation of trucks transporting the CO_2 loads, the operation of cranes, the operation of supply vessels, as well as the processing of the loads and the bulk flow of CO_2 (heating and pumping).

6.5.6.1 Atmospheric emissions during CO2 receipt

The receipt of the CO_2 loads is estimated to take place via 21 truck trips with a capacity of 21,375 kg each (indicative calculation, **Section 6.5.1.1.2**). The distance traveled by the trucks per trip for delivering the CO_2 loads to the Sigma facilities can be considered 150 km (Pilot Program 1) and 700 km (Pilot Program 2), respectively.

The typical air pollutant emissions from the transport trucks include pollutants such as carbon dioxide (CO_2), nitrogen oxides (NOx), particulate matter (PM), volatile organic compounds (VOCs), sulfur dioxide (SO_2), and carbon monoxide (CO). These emissions result from the fuel use in the truck engines.

Air pollutant emissions from the operation of cranes result from the fuel use in their engines, similar to trucks.

Below are presented the estimated fuel consumption during CO_2 receipt (**Table 6-50**), as well as the emission factors per type of fuel consumed (**Table 6-51**). It is noted that the daily fuel consumption will be significantly lower since the operation of cranes and vehicles will not be continuous but will last only for the duration of the receipt process. Nevertheless, for safety reasons and based on the precautionary principle, the calculations are made assuming an 8-hour daily operation of the machinery.

Table 6-36: Estimated fuel consumption of machinery and heavy vehicles during CO_2 receipt

Machinery Type	Fuel Type	Fuel Consumption		
		lt/day	tn/day	Total project (tn)
Crane	Diesel	40	0,03	3,0
Truck	Diesel	80	0,06	2,0
Total		120	0,08	5,0

Table 6-37: Air pollutant emission factors

	CO	HC	NO_x	SO_2	TSP
Machinery, kg/tn diesel	0,049	0,017	0,025	0,006	0,014
Diesel trucks, gr/km	19,2	5,2	9,5	2,7	2,3

The following table presents the total estimated emissions of CO, HC, NOx, SO_2, and TSP from the operation of cranes and trucks, as well as from the movements of heavy vehicles to and from the Sigma facilities, based on the assumptions outlined above.

Table 6-38: Overall total emissions of air pollutants (CO, HC, NOx, SO2, TSP) during CO_2 reception

	CO	HC	NO_X	SO_2	TSP	Unit
Machinery	247,0	85,7	126,0	30,2	70,6	kg
Heavy vehicles	116,0	31,4	57,4	16,3	13,9	kg
Total	362,9	117,1	183,4	46,5	84,5	kg
Daily emissions	1,0	0,3	0,5	0,1	0,2	kg/d

6.5.6.2 Atmospheric emissions during transport and processing for CO_2 injection

Emissions from the operation of vessels transporting CO_2 cargo and personnel include exhaust gases from the ship's propulsion and engine operation, as well as emissions from internal combustion engines of other equipment.

The total emissions of key air pollutants (COPC), based on the estimated fuel consumption, are calculated in the following tables. For the emission calculations, standard emission factors for Marine Gas Oil fuel from the European Environment Agency's emission inventory guidebook were used (*EMEP/EEA 2023, EMEP/EEA air pollutant emission inventory guidebook, Technical guidance to prepare national emission inventories, https://www.eea.europa.eu/publications/emep-eea-guidebook-2023*).

Table 6-39: Fuel consumption from CO_2 cargo transport vessels and supply boats

Use of vessels during the operation of the Project	Tugboats		Total fuel consumption (t)
	Mt/day	Days	
Transport of CO_2 loads to the Beta platform	4,5	20	90,0
Refueling / Personnel transport	4,5	300	1.350,0
Total			1.440,0

Table 6-40 Estimated air pollutant emissions from CO_2 cargo transport vessels and refueling operations

	NOx	CO	NMVOC	SO_2	PM10	Unit
Emission factors	72,2	3,84	1,75	1,82	1,07	kg/t fuel
Total per day	324,9	17,3	7,9	8,2	4,8	kg/d
Total for Phase A	104,0	5,5	2,5	2,6	1,5	t

Source: Tier 1 Emission Factors for Ships using Marine Diesel/Marine Gas Oil (EMEP/EEA, 2023)

No direct atmospheric emissions will occur during the preparation for CO_2 injection and water production at the Beta platform, as the equipment (heater, compressors/pumps) will be electric and no fuel will be used.

6.5.6.3 Greenhouse Gas Emissions

Greenhouse gas emissions during the operational phase concern the transportation of CO_2 by tanker trucks from pilot projects during the first year of the Project's operation, the transport of CO_2 loads to the Beta platform, employee movements by ships, as well as the operation of the Project's equipment.

Emissions from the tanker trucks transporting CO_2 from pilot projects are expected during the first year of the Project's operation (related analysis in **Section 6.5.1.1.2**). For a traveled distance of 4,250.0 km, the emissions produced from diesel use are estimated at **3,678.0 tons of CO_2**[29].

The main portion of the carbon dioxide quantity will, in the future, be transported to the reservoir via a pipeline system, originating from industries in the broader region of Northern Greece (from Volos, Larissa to Alexandroupoli). Accordingly, the energy requirements for receiving bulk CO_2 via pipeline (outside the Project) during the Project's operation will consist of consumption for compression (approximately 100 kWh/t CO_2), cooling (around 144 Mcal/t-CO_2), and the transportation of CO_2 from the producers to the storage site. Based on the above, the total energy consumption in the pipeline is expected to be approximately 267.4 kWh/t CO_2, i.e., 267,360.0 MWh/year for a capacity of 1 MTPA.

The fuel consumption for the supply vessel is estimated to be 1,300 tons for the entire duration of the Project. Emissions from the consumption of marine fuel (Marine Gasoil DMA ISO 8217:2012 / Max. Sulphur Content 0.1% (M/M)) are calculated using the UNFCCC Greenhouse Gas (GHG) Emissions Calculator, Document version: 01.3, Publication date: May 2021 (https://unfccc.int/documents/271269). For the above fuel consumption, total CO_2 emissions for the entire duration of the Project are estimated at 4,195.37 tons.

A power of approximately 1.6 MW is required in the CO_2 processing to achieve the appropriate injection conditions (pressure and temperature). This power demand includes the requirements for compressing/pumping CO_2 loads, as well as heating the bulk CO_2 during startup. This power demand is mainly due to the operation of the electric heater needed at startup, which serves to prevent low temperatures in the piping and the formation of hydrates/solids near the well area. The required daily energy for 16 hours of operation (2 shifts) amounts to 1.6 MW × 16 h/day = 25.6 MWh, while the annual energy demand is 9,344 MWh/year.

Additionally, for pumping the produced water from the water wells at the Beta platform, two Electric Submersible Pumps (ESPs) with a power rating of approximately 0.5 to 1 MW each are planned. Power supply to the pumps will be provided via feed cables powered by Variable Speed Drive (VSD) systems within the Beta platform's electrical station. Assuming 24-hour operation of the pumps, with an average power value of 0.75 MW, the annual energy required for each pump is 0.75 MW × 24 hr/day × 365 days = 6,570 MWh. Therefore, for the operation of both pumps, a total energy of 13,140 MWh/year is required.

According to the emission factor of the residual energy mix, as published by DAPEEP (Hellenic Energy Exchange Operator), the **indirect annual emissions due to electricity consumption** are:

[29] The calculations are performed using the UNFCCC Greenhouse Gas (GHG) Emissions Calculator, Document version: 01.3, Publication date: May 2021 (https://unfccc.int/documents/271269)

CO_2 emissions = energy production x emission factor = (9,344 + 13,140 + 267,360) MWh x 436.889 kg/MWh = 126,629.6 tons CO_2/year.

Based on the above analysis, **Table 6-55** summarizes the calculation of CO_2 emissions for an average operating year of the Project.

Table 6-41: Calculation of CO_2 emissions for an average operating year of the Project

		Units
A. Direct CO_2 emissions		
Trucks transporting CO_2 from Pilot Projects[30]	3.678,0	tnCO_2/year
Supply vessel	4.195,4	tnCO_2/year
B. Indirect CO_2 emissions		
Compression / pumping and heating (within the Project)	9.344,0	MWh/year
Pumping of produced water	13.140,0	MWh/year
Energy consumption in pipeline (outside the Project)	267.360,0	MWh/year
Total indirect emissions	126.629,6	tnCO_2/year
Γ. CO_2 emissions (A + B)	130.825,0	tnCO_2/year

6.5.7 Noise and Vibration Emissions

During the operational phase, vibrations or noise may occur. Vibrations can result from the operation of rotating machinery such as pumps. While operational vibrations are generally less intense than those caused by construction activities, they may still pose risks to surrounding infrastructure or sensitive equipment. Noise emissions during operation mainly arise from the continuous operation of machinery and equipment on the platforms (pumps, electric heaters).

Although noise emissions from operation are continuous, their prevention and mitigation are achievable through equipment design modifications, installation of soundproofing in noisy parts of the facilities, and regular maintenance practices.

Limited-intensity noise emissions will also occur during the receipt of loads and their loading onto vessels for transport to the offshore facilities, mainly due to the movement of heavy vehicles and transport trucks.

6.5.8 Electromagnetic Radiation and Radioactivity Emissions

No emissions of electromagnetic radiation or radioactivity are expected during the operation phase of the Project.

[30] The land transport of CO_2 by trucks within the framework of the Pilot Projects will take place only during the first year of the Project's operation; therefore, it is not considered in the calculation of CO_2 emissions for an average year of the Project's operation.

6.5.9 Support Functions

6.5.9.1 Technical Works / Maintenance

Regular inspections of the facilities will be conducted in accordance with the existing maintenance procedures followed by Energean.

The most important inspection planned is the inspection of the offshore pipeline. Typically, every 5 years or in other cases of system shutdown, the offshore CO_2 pipeline will be inspected using a smart pigging tool, which measures the wall thickness of the pipeline to ensure the integrity of the pipeline is maintained. This tool can detect any defects, wall thickness loss due to corrosion, or other impacts, so that corrective actions can be taken if repairs are needed. The tool is inserted into the pipeline from the onshore end using a launcher and operates by applying water pressure until it reaches the end of the pipeline at the Beta platform.

The following **Figure** shows a typical example of a pipeline inspection tool.

Figure 6-45: Pipeline inspection equipment (intelligent pig)

6.5.9.2 Waste management

The waste generated during the operation of the new CO_2 storage facilities will be managed in accordance with the **Project's Waste Management Plan**, as presented in **Appendix 17.3.**

6.5.9.3 Monitoring and Control

The operation of the new CO_2 storage facilities will be monitored in accordance with the Environmental Terms of the Project, combined with the existing Monitoring Plans implemented by Energean at the onshore Sigma plant facilities and the offshore Prinos installations.

The proposed Monitoring Plan for the Project's CO_2 storage facilities is presented in **Section 12.** The specific CO_2 Monitoring Plan referred to in Paragraph 2 of Article 14 of Joint Ministerial Decision 48416/2037/E.103/2011 is included in **Appendix 16.2.**

6.6 CEASATION OF OPERATION – RESTORATION

6.6.1 Decommissioning Philosophy

The guidelines of the trade association "Offshore Energies United Kingdom (OEUK)," which represents the industrial sector for offshore oil drilling, natural gas, hydrogen, and wind energy production, have been taken as a reference point for assessing the suitability of the Prinos wells for conversion into a CO_2 storage complex. OEUK has also developed guidelines for the decommissioning process of CO_2 storage wells (OEUK, November 2022).

According to the OEUK guidelines, each well within the storage site must be individually assessed for its suitability for CO_2 storage, including existing wells that are still accessible as well as older wells that have already been abandoned or decommissioned. Furthermore, based on OEUK guidelines, decommissioned or abandoned wells with zones that have flow potential must have two barriers between them and the surface. For zones where flow could occur if filled with CO_2, these must be isolated from the reservoir with two barriers, acknowledging that (a) the final CO_2 injection pressure is likely to be unknown, and (b) if the zone is shallow, the formation at the plug placement depth must have sufficient fracture strength to withstand pressure.

For the purposes of decommissioning the CO_2 storage site, the lithology at Prinos can be simplified into three main sections:

- Section 1 – Post-evaporitic sequence from the Pliocene and Pleistocene epochs: Its extent is from the seabed to the Brown Marker formation. These formations mainly consist of sandstones with layers of clay/mud in parts.
- Section 2 – Evaporitic sequence: Its extent is from the Brown Marker formation down to the cap rock. This is a large sequence of overpressured evaporite salts interbedded with clastic, clayey, and muddy formations. There are also overpressured clay formations (OPC).
- Section 3 – Prinos Reservoir: a basaltic sequence of hydrates, anhydrites, and clay formations, followed by a pile of reservoir sandstone layers. For decommissioning purposes, and according to OEUK guidelines, abandonment plugs must be placed in a solid formation with fracture strength greater than the maximum expected pressure that the reservoir could impose at the base depth of the plug. The minimum possible depth for this depends on the formation's strength. This minimum plug depth is referred to as the minimum safe abandonment depth. Ideally, a double abandonment plug is placed in one of the salt sections within the Evaporitic sequence to "restore the cap rock" and create two barriers between the reservoir and the surface/shallow permeable zones.

6.6.2 Sealing and Decommissioning of Wells

For the permanent abandonment/decommissioning of wells, cement is considered the most suitable material, although other materials may also be used. To be considered a permanent barrier, the long-term integrity of the material must be ensured, and it must not significantly degrade during the design life of the barrier, while still meeting the design criteria.

Sealing formations such as evaporites, which are known to close an annular space where cement is absent or incomplete, can be considered barriers, provided that the formation is impermeable and has sufficient strength. If it can be verified that the length of the resulting seal from the geological formation against the casing is sufficient to prevent fluid flow, then such a seal is accepted as an alternative to the cement annulus.

If cement is used as a barrier, a cement column of at least 30 meters is required to form a permanent barrier. Where possible, 152 meters of plugs are placed to provide these 30 meters of cement. A combined plug of at least 60 meters of cement is required to form a dual barrier. Where possible, 244 meters of cement are placed to provide these 60 meters of cement.

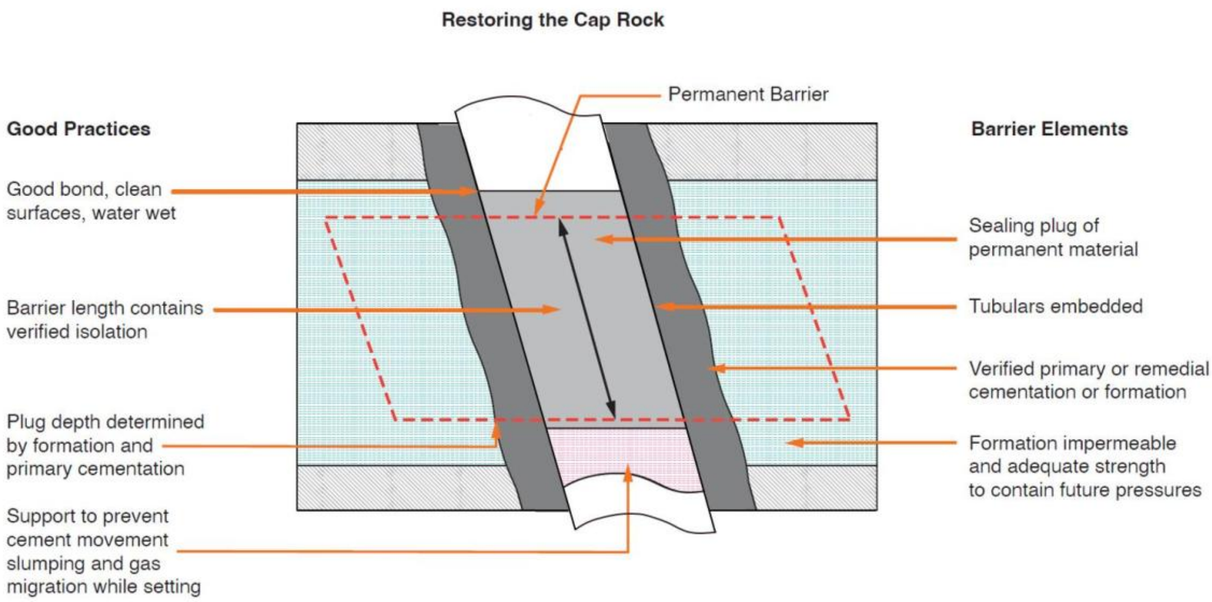


Figure 6-46: Schematic illustration of permanent abandonment barriers (OEUK, 2022)

6.6.3 Cleaning, Securing, and Decommissioning of Pipelines

The pipelines within the onshore section of the CO2 pipeline transport system will be depressurized, cleaned, and purged with nitrogen to be secured in accordance with international guidelines and best practices[31]. The onshore section will be isolated from the offshore pipeline with a sealed flange, dismantled, and the area will be restored to its original condition.

[31] *UK Offshore Petroleum Regulator for Environment and Decommissioning, 2022. Decommissioning of Offshore Oil and Gas Installation and Pipelines Guidelines, OEUK Decommissioning Pipeline's Guidelines*

The offshore pipeline and the riser will be depressurized, cleaned using standard pigging operations, and then deactivated by introducing nitrogen. Subsequently, the pipeline will be isolated from the offshore platform, sealed with welded end caps or flanges, and will remain in place in accordance with international standards. The piping from the top of the riser to the wellheads will be depressurized and filled with nitrogen to inert the system. The pipelines will be disconnected from the wellheads, capped, and left in place.

6.6.4 Subsequent Monitoring of the Reservoir and the CO_2 Storage Site

The subsequent monitoring of the Project will focus on detecting potential leaks to minimize environmental impacts and ensure compliance with regulations. Geological surveys of the reservoir formations will be conducted to identify possible leakage pathways or geological hazards and to minimize the risk of CO_2 leakage into the marine environment. Monitoring parameters of the wells, such as pressure, temperature, and composition, will be overseen to ensure safety against leaks.

Post-closure monitoring will be based on information collected and modeled during the implementation and updating of the monitoring plan. It will specifically serve to provide the necessary information to ensure the safety requirements of the closed storage site, in accordance with paragraph 1 of article 19 of Joint Ministerial Decision 48416/2037/E.103/2011.

Special provisions for post-closure monitoring are included in the specific CO_2 Monitoring Plan of Paragraph 2, Article 14 of Joint Ministerial Decision 48416/2037/E.103/2011, which is provided in **Appendix 17.2.**

6.6.5 Waste discharges

Waste management during the decommissioning and dismantling phase will be carried out in accordance with current legislation. The generated waste will be collected separately by type in containers suitable for their safe temporary storage on-site, following safety and environmental protection regulations. Their management will be performed by licensed waste collection, transport, and disposal entities.

The most significant source of waste during the decommissioning and dismantling phase is the equipment to be removed. Priority in its management will be given to reuse, followed by recycling, and finally the safe disposal of materials that cannot be reused or recycled. Specifically, the volume of metallic waste (expected to be the largest by volume) requiring management will largely depend on the chosen dismantling method (i.e., disposal in deep waters or towing ashore for disassembly).

A specific type of waste stream during decommissioning arises from the growth of marine organic matter inside the support pipelines. It is preferable that this organic matter be removed using a water jet in the marine environment rather than on land during the cleaning phase. Its disposal into the marine environment (either on the seabed or at the surface) will cause a short-term increase in suspended solids in the water column, which is expected to disperse quickly under the prevailing hydrodynamic conditions. Subsequently, this organic matter will naturally biodegrade without adverse environmental impacts.

In addition to the above, the usual special categories of waste are also expected, such as metallic scrap, batteries, electrical and electronic equipment (WEEE), though the quantities of these cannot be determined at this stage.

6.6.6 Atmospheric Emissions

Atmospheric emissions during the decommissioning phase will mainly originate from the operation of supply vessels and equipment/waste transport vessels. These emissions will include exhaust gases from ship propulsion and engine operation, as well as emissions from internal combustion engines of other equipment.

6.6.7 Noise and Vibration Emissions

During the decommissioning phase, noise levels largely depend on the size of the fleet used for the dismantling and removal of structures. The abandonment of the new installations will have much smaller impacts, as they will either be lifted and moved to a new location or dismantled onshore. Noise levels are not expected to exceed those of typical marine activities in the area, but temporary noise episodes may occur that could disturb the marine fauna in the vicinity.

6.6.8 Electromagnetic Radiation and Radioactivity Emissions

No emissions of electromagnetic radiation or radioactivity are expected during the project's decommissioning phase.

6.7 EMERGENCY CONDITIONS AND ENVIRONMENTAL RISKS

The Project under study, due to its nature, is associated with potential hazards and emergency conditions throughout its lifecycle, which require thorough identification and risk assessment.

During construction, potential hazards include structural failures, equipment malfunctions, and accidents during pipeline installation and facility construction. During operation, risks arise from CO_2 leaks, pipeline ruptures, and equipment failures, which could lead to environmental damage and pose risks to personnel. Unpredictable events such as natural disasters and extreme weather conditions further exacerbate these risks.

Even during the decommissioning phase, careful planning is essential to mitigate residual risks, including the possibility of CO_2 migration after closure. Additionally, the interaction between the injection process and existing hydrocarbon facilities introduces complexities, including potential interference with well integrity and operational disruptions. Throughout the project's lifecycle, diligent monitoring and mitigation strategies are imperative to prevent adverse impacts. Comprehensive risk assessment methodologies are necessary to ensure the safety and sustainability of the Project, while complying with regulatory requirements and environmental standards.

The critical risks associated with the Project development are described in detail in **Chapter 10: Risk Assessment of this Environmental Impact Assessment (EIA).**

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7 ALTERNATIVE SOLUTIONS

EnEarth implements a structured process to advance the Prinos CO_2 storage project, which began with the feasibility stage, including the exploration of possible approaches and alternatives. The investigation of alternatives focuses on the development options of the Project under study, which were examined during the design stages, guided by international best practices.

This chapter analyzes the alternative solutions for the implementation of the CO_2 storage Project at the Prinos reservoir in relation to the wells, the offshore handling of CO_2 loads at the storage site, as well as the alternative routing options for the CO_2 pipeline to the injection wells. The no-action alternative is examined in a separate section.

Each alternative solution is subjected to a comparative evaluation based on economic criteria such as capital expenditure (CAPEX), operational expenditure (OPEX) as well as qualitative criteria including operational flexibility, risk level and environmental impacts. The ultimate goal of the evaluation process is to identify the option that best aligns with key priorities such as minimizing environmental impacts, ensuring (technically and reasonably) as low as reasonably practicable (ALARP) risk levels, maximizing the utilization of available facilities, resources and personnel, and minimizing investment and operational costs.

7.1 NO-ACTION ALTERNATIVE

The no-action alternative A0 refers to the existing situation, meaning that the new CO_2 storage project is not introduced in the study area.

Under this alternative, no actions are planned for CO_2 storage in the Prinos reservoir, resulting in the absence of the four (4) new wells and other facilities of the CO_2 storage project. Therefore, the objective and the feasibility described in Chapter 4 of this study are not achieved.

This option would have the following consequences:

- Environmental:
  - The absence of CO_2 storage infrastructure means that large quantities of CO_2 produced by industrial facilities will continue to be released into the atmosphere, which could hinder progress toward carbon dioxide emission reduction targets, thereby exacerbating the long-term impacts of climate change.
  - CO_2 storage is increasingly recognized as a key means to reduce carbon emissions from energy-intensive sectors of the economy, such as power generation. The absence of CO_2 storage facilities would hinder efforts to reduce greenhouse gas emissions, while simultaneously obstructing the development of the CO_2 storage infrastructure sector.
  - The absence of CO_2 storage infrastructure negatively impacts the achievement of the country's European and International obligations, which have been incorporated into the National Strategy for Adaptation to Climate Change (NSACC) (Article 45 of Law 4414/2016 (Government Gazette A' 149)). The NSACC sets the general objectives, guiding principles, and implementation means of a modern, effective and developmental strategy for climate change

adaptation within the framework defined by the United Nations Framework Convention on Climate Change, European policies and international experience..

- The absence of CO_2 storage infrastructure negatively affects the achievement of overall greenhouse gas (GHG) emission reduction targets and the attainment of climate neutrality by 2050, as well as the offsetting of any remaining emissions beyond 2050, in accordance with the revised National Energy and Climate Plan (NECP) and the Long-Term Strategy for 2050 of the Ministry of Environment and Energy. The permanent storage of greenhouse gases in underground formations or materials is considered to ensure climate neutrality, while the storage of carbon dioxide captured from the air or biomass is regarded as a negative emission.
- Furthermore, from an environmental perspective, the failure to implement CO_2 storage facilities would be detrimental to the sustainability goals of the Energean group, particularly regarding efforts to reduce carbon emissions. In an era where the transition to renewable energy sources and adherence to the Paris Agreement are of critical importance, opportunities for sustainable development and carbon emission reduction should not be missed. The no-action alternative would not deliver the specific environmental benefits arising from (a) the Company's corporate social responsibility policy, (b) social investment programs, and (c) investment programs for biodiversity protection.

- Socioeconomic:
  - The formations in the Prinos area contain significant CO_2 storage potential. Therefore, failing to utilize these resources would mean a loss of opportunities for economic development (hiring personnel, investment in new expertise). From an economic perspective, it would result in the (direct/indirect) loss of income associated with employment in the local market and collaboration with industries related to CO_2 storage (producers).
  - The local market would lose the opportunity to gain direct and indirect revenues related to the CO_2 storage activity under study
  - There would be no hiring of personnel and no investments in new expertise.
  - There would be socioeconomic impacts due to the loss of employment opportunities for a significant number of people, primarily employed within the local market.
  - The Project will offer technological, research, and educational opportunities at both local and national levels. The no-action alternative would eliminate these opportunities.
  - The CO_2 storage Project in Prinos is expected to contribute positively to reshaping the country's development orientation, adding an important alternative pillar of environmental development. The implementation of environmentally friendly programs (within which the proposed Project is included) is an attractive and realistic option that will positively support the country's "green" developmental restructuring. The no-action alternative would eliminate this possibility
  - Furthermore, avoiding further investments in the Prinos area may have broader impacts on global energy markets and the transition to sustainable energy. As the world progressively shifts towards renewable energy sources and low-carbon technologies, decisions made within the framework of projects like the CO_2 storage project under study send signals to investors, policymakers and other stakeholders regarding the feasibility and direction of future energy investments. In a rapidly evolving energy landscape, the failure to capitalize on opportunities

for innovation and sustainable development will reduce prospects for improving competitiveness and securing a leading position in emerging markets.

In conclusion, the no-action scenario regarding the CO_2 storage project in Prinos carries significant consequences in economic, environmental, and geopolitical sectors.

Based on the above, the no-action alternative was not considered a viable option for sustainable future development, as the implementation of the Project is significantly positive from an environmental perspective, favorable from a socioeconomic standpoint, and does not entail undesirable or additional environmental threats or health risks.

7.2 ALTERNATIVE SOLUTIONS

7.2.1 Drilling

The alternatives examined in relation to the wells concern the selection of initial wells (donors and slots), as well as the methodology and technology used. The wells included in Phase 1 of the Project (CO_2 storage up to 1 MTPA) are part of a larger Project that encompasses all offshore facilities as well as specialized reservoir studies. Therefore, the alternatives considered take into account the future development and the full scope of the CO_2 storage Project. Accordingly, the following paragraphs present the alternative solutions related to the overall interventions of the CO_2 storage program

The targets for the CO_2 injection wells, as well as for water production wells, are determined based on data collected during neighboring drilling operations in the Prinos reservoir and from other available geological, geochemical, and geophysical (primarily seismic) data. The processed seismic data are interpreted and converted into geological information, which is then used to develop the necessary subsurface maps through which potential targets are identified to meet the needs of the project.

Once the candidate drilling target has been selected, the well location must then be determined based on the potential drilling trajectory. This represents a "bottom-up" approach to define the initial position or slot of the well. In the case of Prinos, two alternative scenarios for the initial well location are being investigated: a) the platform from which the drilling rig will operate (Alpha or Beta), and b) the specific slot on the platform from which the drilling will commence..

Platform Alpha was initially considered as a potential location for the new wells of the CO_2 storage Project. However, Platform Alpha hosts a significantly larger number of wells—44 in total—compared to the 24 wells on Platform Beta. This total includes both wells that have been abandoned in previous years and those that remain accessible. The denser well layout on Platform Alpha significantly increases the risk of collision during the drilling of new wells. Additionally, this dense configuration contributes to uncertainty in well monitoring due to magnetic interference affecting the drilling equipment that provides positional data during the drilling process. In contrast, Platform Beta, with fewer wells, presents a lower risk of such incidents, as demonstrated by the results of previous related anti-collision studies.

Furthermore, Platform Alpha has more recent seabed footprints from jack-up drilling rigs. This relatively recent activity introduces additional complexities in achieving a safe and stable positioning of the rig for new operations

Platforms Alpha and Beta each have 12 slots, all of which are currently occupied by existing wells. For this reason, the new wells required for the Project will follow the practice of subsurface deviation from donor wells. The drilling rig and auxiliary equipment will be positioned at the top of these donor wells in order to carry out the drilling, as described in detail in Chapter 6.

In general, the criteria for selecting the well location are as follows::

- The primary criterion is that the drilling rig must be able to reach the subsurface target, either vertically or with a deviated trajectory (if a vertical path is not feasible)
- Next is the accessibility of the location for the drilling rig, drilling equipment, and all necessary operations for the well on the offshore platform.
- Equally important is the geotechnical and technical adequacy and safety of the location for conducting drilling operations. This includes stable seabed soils, avoidance of previous drill rig footprints in the area, and the exclusion of seabed installations such as pipelines, electrical cables and similar infrastructure.
- The drilling location should be as close as possible to the target to ensure the safest execution of the drilling operations.
- The azimuth of the drilling trajectory of the donor well should be in the desired direction..
- Finally, the cost of access and preparation of the donor well to facilitate the underground deviation should be considered..

For the proposed Project, the design phase was a complex and detailed process during which all the above criteria were jointly evaluated. Potential targets were identified at depths within the B and C layers of the reservoir and prioritized based on the assessment of technical data, environmental conditions, sustainability parameters, etc.

For the needs of the CO2 storage Project, four new wells will need to be drilled: two CO2 injection wells and two water production wells. The wells will be drilled using the method of underground deviation, requiring meticulous planning in the selection of the starting slots (donors). The selection process is critical, as it affects both the technical feasibility and the economic performance of the drilling operations.

On the Beta platform, there are 12 available slots/positions for potential use in sidetrack drilling. Of these, slots/positions 1, 5, 6, 7, 8, 9, 10, and 11 (a total of 8) were considered the most viable for transitioning to new wells, based on ease of access and simplicity of operations.

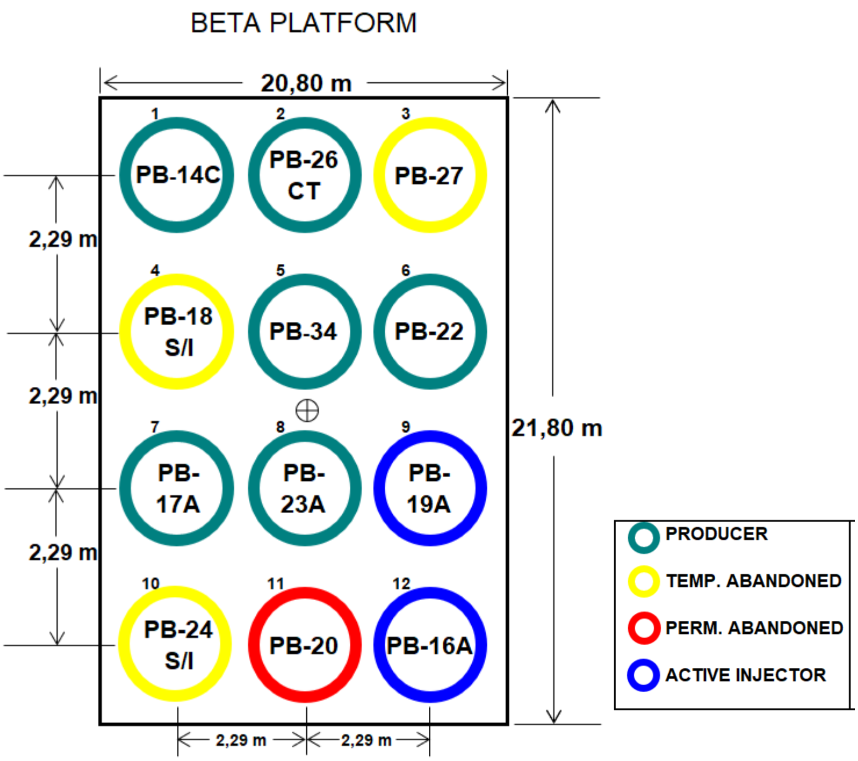

Figure 7-1: Well slots/openings on the beta platform

The analysis focused on selecting the optimal positions for sidetrack drilling operations, taking into account factors such as the current use of the slot/position, the azimuth of the existing well, and the complexity of recovering the donor well (slot recovery). The assumptions are listed below:

- Injection well PBC-1: Initially, position #1, which hosts well PB-14C, was considered. However, the northeast azimuth and the cementing of the intermediate casing at shallow depths posed significant risks and challenges. Therefore, position #7, occupied by well PB-17A, was selected due to its favorable westward azimuth and the less demanding slot recovery process.
- Injection well PBC-2: Position #9, currently hosting well PB-19A, was also considered but rejected due to unfavorable azimuth and difficult slot recovery conditions. Position #10, which hosts well PB-24, was deemed suitable because of its alignment with the corresponding target and the easier slot recovery process.
- Water production well PBW-1: The analysis for the water production wells followed a similar logic. Slot #5, with well PB-34 as the donor, was rejected due to an unfavorable azimuth direction and difficult slot recovery conditions. Conversely, slot #6 (donor well PB-22) was selected due to its more advantageous position
- Water production well PBW-2: For this well, slot #11 (donor well PB-20) was initially considered but ultimately excluded for the same reasons as above. Slot #8, occupied by well PB-23A, was selected due to better alignment and feasibility.

Slot recovery is inherently complex and time-consuming. The slots that were rejected presented significant operational challenges, such as the potential need for future retrieval of unusable materials from the well ("fishing") and the requirement for high-tech equipment and a drilling rig with a power output exceeding 2,500 horsepower, which would significantly increase costs.

The selected slots minimize these risks by providing a simpler drilling path for the sidetrack drilling operation.

7.2.2 Routing of the CO_2 pipeline to the injection wells

During the initial design stage of the Project (pre-FEED), alternative routing options for the CO_2 pipeline from the onshore facilities to the offshore installations and injection wells were examined. These alternatives are presented in Figure 7-2.

The aforementioned alternatives are briefly described as follows:

- **Alternative 1**: A 31 km route that crosses three existing pipelines and two cables, located north of the Prinos complex..
- **Alternative 2**: A 29 km route that is routed around the (under-construction) Lambda platform and crosses one pipeline to the south of the Prinos complex, originating from the Kappa platform.
- **Alternative 3**: A direct 20 km route that ends at the Prinos complex (Beta platform)

Alternative 3 represents the shortest route, is located within the existing pipeline corridor of the Prinos complex, and avoids crossings with existing pipelines. In contrast, Alternatives 1 and 2 require a longer route (due to the need for a curvature radius of approximately 2.5 km) and involve crossing existing pipelines either to the north or south of the Prinos complex.

It is also noted that all alternative CO_2 pipeline routes from the onshore facilities to the offshore installations of Prinos are located within the Natura 2000 area “Marine Area of Kavala – Thasos” (GR1150014). Therefore, it is essential to minimize intervention and to avoid any form of pollution, disturbance, or accidental leakage, both during the construction phase and during the operation of the Project. The impacts—primarily during the construction phase but also during the operation of the pipeline—will largely correspond to the scale (length) of the Project. Therefore, the shortest route is the most favorable in terms of impacts on the biotic environment. Additionally, the occupation of new areas is avoided, as Alternative 3 is routed within the existing corridor where fishing and other activities are already restricted.

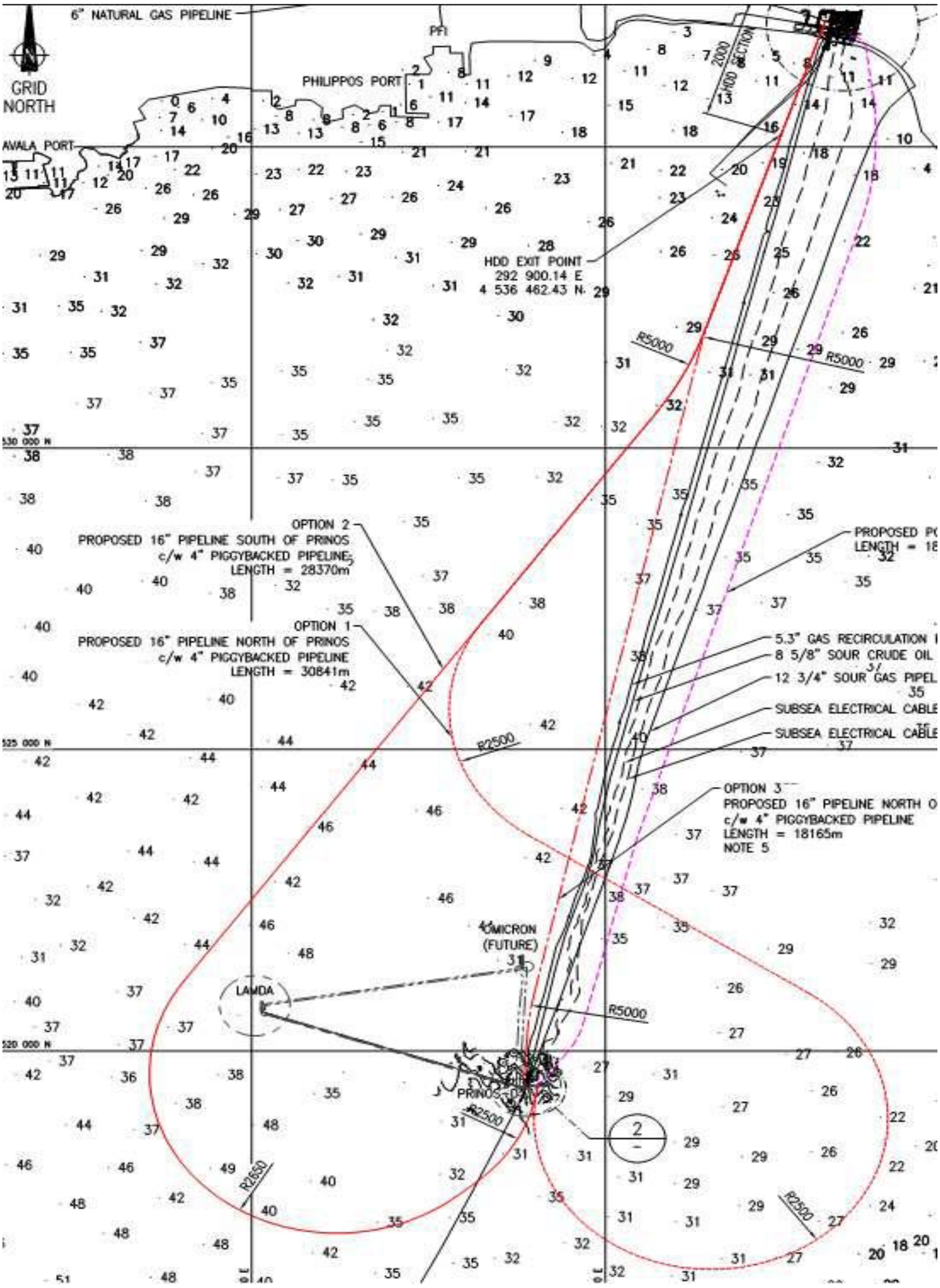

Figure 7-2: Alternative routing options for the CO_2 pipeline to the injection wells

7.2.3 Management of CO_2 loads

In its search for effective CO_2 storage solutions, EnEarth has examined alternative approaches regarding the proposed method for handling CO_2 loads on Platform Beta for injection. These alternatives are as follows:

- Alternative 1: Direct injection from the shuttle carrier into the injection well. In this design, CO_2 conditioning is performed entirely on the vessel.
- Alternative 2: The vessel unloads into a temporary storage unit moored near the platform. In this configuration, CO_2 conditioning takes place on the platform

7.2.3.1 Alternative 1 – Direct Injection from the Shuttle Carrier Vessel

In Alternative 1, the specialized shuttle carrier vessel arrives at the designated location for CO_2 injection, carrying its cargo (ISO containers), where it injects the CO_2 directly into the injection well. The CO_2 processing for injection is carried out on the vessel itself, through processes such as compression and pumping. The CO_2 passes through a series of compressors and pumps until it reaches the required conditions for injection. Subsequently, the pressurized CO_2 is transferred directly to the well via a pipeline system.

7.2.3.2 Alternative 2 – Temporary Storage Near the Platform

In Alternative 2, the process begins as the transport vessel approaches the designated CO_2 injection point, carrying its cargo (ISO containers). Instead of offloading directly into the injection well, the CO_2 is offloaded from the vessel to a temporary storage facility near the platform. This temporary storage solution consists of anchored containers or tanks positioned close to the platform for operational efficiency. The CO_2 processing for injection takes place on the platform. The main advantage of Alternative 2 is the faster offloading of CO_2, which reduces transportation time and thus allows for more efficient use of the transport vessels.

7.2.3.3 Proposed Design – Direct Injection from the Platform

The containers will be unloaded onto the Beta platform via a flexible hose system. On the platform, the appropriate conditions for injection will be achieved (according to the pre-FEED study: pressure of 101 barg, temperature of 20°C). This process involves connecting the ship and supplying the CO_2 to the platform's piping, where with proper processing, the CO_2 stream will reach the suitable conditions for injection into the well. The main processing equipment, including a pumping station, will be located on the open deck of the Beta platform. Additionally, the ship will have built-in pumps to increase the pressure of the CO_2 stream, facilitating the flow through the flexible hose from the ship to the platform.

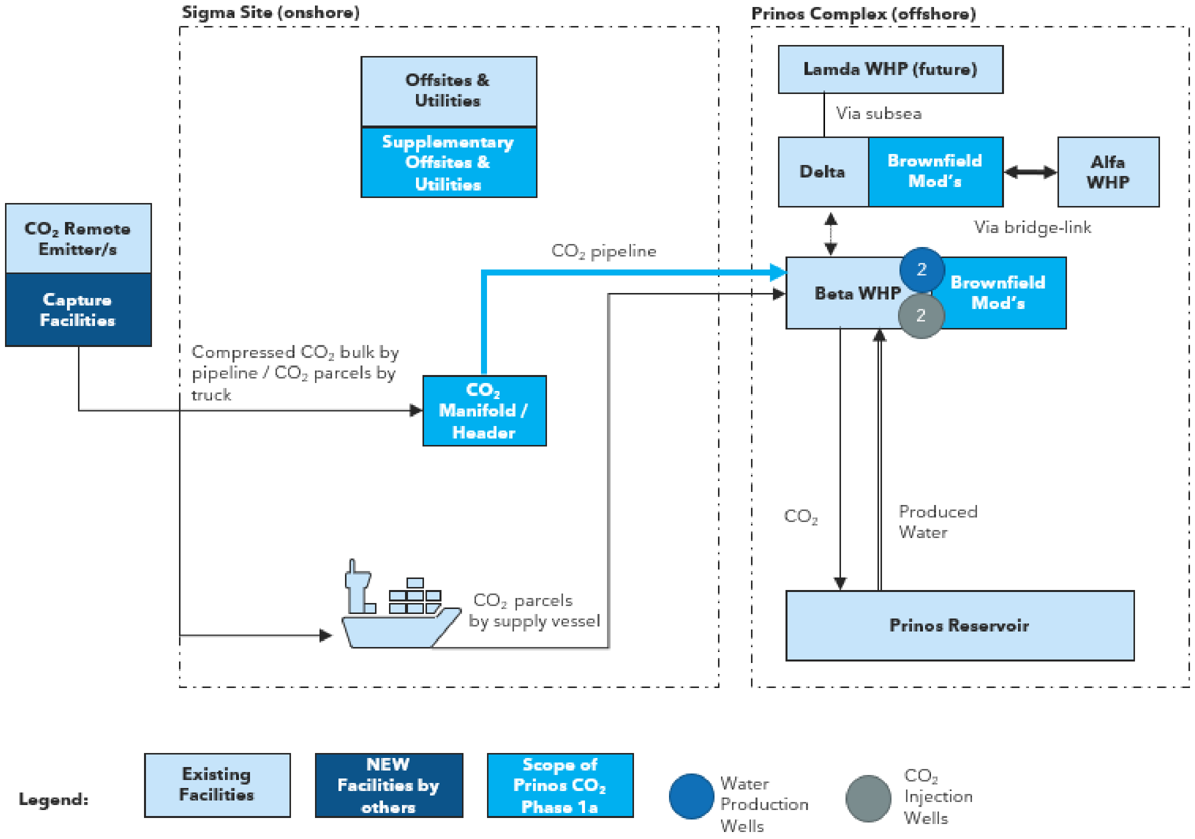

Figure 7-3: Flow diagram – Proposed Design – Direct injection

7.3 COMPARATIVE EVALUATION AND DOCUMENTATION OF OPTIONS

For the evaluation of alternative scenarios for the implementation of the CO_2 storage Project at the Prinos field — in terms of the drilling operations, the offshore approach for delivering CO_2 loads to the storage site, and the routing of the CO_2 pipeline to the injection wells — environmental criteria are defined within the framework of this EIA, in order to assess the impacts of each scenario and select the optimal solution for development. The technical feasibility and operational functionality of the alternatives are also examined, as well as the factor of economic viability (capital expenditure – CAPEX, and operational expenditure – OPEX).

The above criteria are described in the following Table:

Table 7-1: Environmental Criteria for the Evaluation of Alternative Scenarios

Criterion		Criterion Description
1	Biodiversity – Flora – Fauna	• Avoid alteration of protected natural areas. • Avoid disturbances to local flora and fauna.
2	Atmosphere and Climatic Factors	• Minimize pollutant emissions into the atmosphere • Prevent greenhouse gas emissions
3	Energy – Natural Resources	• Conserve energy

Criterion		Criterion Description
4	Acoustic Environment – Noise	• Limit noise pollution.
5	Water Resources	• Promote rational use of water. • Protect water resources – avoid uncontrolled wastewater discharge.

This paragraph presents the comparison of the above alternative scenarios. The comparison is carried out using an Evaluation Table and a corresponding scoring system for their performance.

The qualitative comparison of the Scenarios provides an objective approach to assessing their environmental impacts, based on widely accepted scientific principles. The environmental performance scoring of the examined scenarios is indicative and is provided to offer an overall, illustrative view for evaluating the Scenarios based on specific environmental objectives and criteria.

To better illustrate the overall comparison of the examined Scenarios, an indicative scoring will be provided below, in order to present a quantified analytical comparison. For this purpose, a color-coded scale is used, corresponding to the intensity levels of environmental impact, as shown below. The most favorable Scenario is the one that achieves the highest total score.

Explanation of the Color Coding in the Evaluation Table

This particular solution is considered highly suitable under the proposed design and is not expected to cause negative impacts.	This particular solution is considered suitable (with minor improvements to the proposed design) and minimizes negative impacts.	This particular solution is considered to cause neutral or uncertain impacts.	This particular solution is considered that, with minor improvements to the proposed design, it would cause minor negative impacts.	This particular solution is considered to cause significant negative impacts.
5	4	3	2	1

7.3.1 Drillings

Table 7-2 presents a comparative analysis of the alternative solutions examined regarding the selection of well locations for the CO_2 storage Project, based on environmental impacts, technical feasibility, and economic assessments.

Table 7-2: Main solution and alternative scenarios for well drilling

Criteris	Main Solution A1 Drilling of wells from the Beta platform and selection of specific slots	Alternative Solution A2 Drilling of wells from the Alpha platform and alternative slot selections
Biodiversity – Flora – Fauna	The drilling of wells from the Beta platform constitutes a safe and conventional solution with a lower environmental risk and smaller environmental footprint compared to drilling from the Alpha platform, due to the fact that: • The drilling and completion time of the wells will be shorter. • There will be no need to use additional specialized equipment for fishing the donor well.. • There will be no need for a high-performance drilling rig (>2,500 hp).	A high-power drilling rig (>2,500 hp) will be required. The drilling risks due to a higher likelihood of collision with other wells during drilling increase the potential impacts on the environment and the safety of workers.
Atmosphere and climatic factors	The drilling and completion time of the wells will be shorter, requiring less energy (fuel) consumption. Therefore, emissions of atmospheric pollutants (CO, NOx, TSP) and greenhouse gases will be reduced.	The drilling and completion time of the wells will be longer, requiring higher energy consumption. Therefore, increased emissions of atmospheric pollutants (CO, NOx, TSP) and greenhouse gases are expected.
Energy – Natural resources	The drilling and completion time of the wells will be shorter, thus requiring less energy consumption. There will be no need for a high-performance drilling rig (>2,000 hp)	The drilling and completion time of the wells will be lengthy, thus requiring greater energy consumption and a high-capacity drilling rig (>2,000 hp) will also be needed.
Acoustic environment – Noise	The drilling and completion time of the wells will be shorter, resulting in reduced disturbance. There will be no need for a high-performance drilling rig (>2,500 hp).	The drilling and completion time of the wells will be lengthy, thus causing significant disturbance and a high-capacity drilling rig (>2,500 hp) will also be required.
Waters	The drilling will be safer and involve relatively simple procedures, therefore there are fewer risks of accidental pollution.	The increased drilling risks create a higher likelihood of water contamination.
Technical feasibility	Basic well equipment and relatively simple procedures are required for the drilling of the wells compared to the Alpha platform.	Technical risks arise from a higher likelihood of collision with other wells during drilling, as the denser configuration contributes to uncertainty in well monitoring due to magnetic interference from the drilling equipment that provides positioning during drilling. Although this solution also requires 4 wells, its completion will involve specialized equipment and specific procedures, consequently requiring additional workforce and maintenance.

Criteris	Main Solution A1 Drilling of wells from the Beta platform and selection of specific slots	Alternative Solution A2 Drilling of wells from the Alpha platform and alternative slot selections
Economic viability	It has lower construction costs compared to option A2, which is extremely important for the project's viability and the achievement of its feasibility.	This solution requires significantly higher construction and operational costs. At the same time, it poses a greater risk during the drilling process
Overall Rating	28	13

The combination of a higher risk of well collisions and the complexities associated with more recent drilling activities in the area makes the Alpha platform less suitable for the new wells, further validating the decision to proceed with the Beta platform (Main solution A1) for the CO_2 storage project.

The selection of slot locations for the deviation of the new wells on the Beta platform has been carefully considered to optimize both technical outcomes and cost efficiency. The chosen slots for wells PBC-1, PBC-2, PBW-1, and PBW-2 offer the best prospects for successful drilling operations with minimized risks and operational challenges.

7.3.2 Routing of the CO_2 Pipeline to the Injection Wells

Table 7-3 presents a comparative analysis of the alternative solutions examined regarding the routing of the CO2 pipeline to the injection wells, based on environmental impacts, technical feasibility, and economic assessments.

Table 7-3: Evaluation of alternative routing options for the CO_2 pipeline

Criteria	Alternative 1 – Routing east of the Prinos complex (31 km)	Alternative 2 – Routing west of the Prinos complex (29 km)	Alternative 3 (Proposed Solution) – Direct routing (20 km)
Biodiversity – Flora – Fauna	Increased environmental impacts and larger environmental footprint due to the longer pipeline length.	Significant environmental impacts and environmental footprint due to the long pipeline length compared to the proposed solution.	Smaller environmental footprint due to the shorter pipeline length and the installation of the pipeline within the existing corridor. The occupation of new areas is avoided as Alternative 3 is located within the existing corridor.
Atmosphere and Climatic Factors	The construction works will be of long duration and will require greater energy consumption. Therefore, increased emissions of air pollutants (CO, NOx, TSP) and greenhouse gases are expected.	The construction works will be of long duration and will require greater energy consumption. Therefore, increased emissions of air pollutants (CO, NOx, TSP) and greenhouse gases are expected.	The construction works will be of shorter duration and will require less energy consumption (fuels). Therefore, fewer emissions of air pollutants (CO, NOx, TSP) and greenhouse gases are expected.

Criteria	Alternative 1 – Routing east of the Prinos complex (31 km)	Alternative 2 – Routing west of the Prinos complex (29 km)	Alternative 3 (Proposed Solution) – Direct routing (20 km)
Energy – Natural Resources	Construction works will be of long duration and will require higher energy consumption..	Construction works will be of long duration and will require higher energy consumption	Construction works will be of shorter duration and will require less energy consumption
Acoustic Environment – Noise	The construction period will be longer. Therefore, significant disturbance is expected.	The construction period will be longer. Therefore, significant disturbance is expected.	The pipeline construction will be of shorter duration. Therefore, less disturbance is expected.
Waters	The greater pipeline length and location outside the existing corridor create a higher risk of water pollution.	The greater pipeline length and location outside the existing corridor create a higher risk of water pollution.	The pipeline construction will be safer and within the existing corridor. Therefore, there is a lower risk of accidental pollution.
Technical feasibility	The pipeline installation will be outside the existing corridor, and there will be crossings with 3 existing pipelines and 2 cables north of the Prinos complex.	The pipeline installation will be outside the existing corridor. The routing will go around the (under construction) Lambda platform and will intersect with one pipeline south of the Prinos complex, starting from the Kappa platform.	Avoids crossings with existing pipelines and cables of the offshore facilities; located within the existing corridor.
Economic viability	Higher CAPEX compared to the other alternatives due to the longer pipeline length (radius ~2.5 km from the Prinos complex).	Higher CAPEX compared to the proposed solution due to the longer pipeline length (radius ~2.5 km from the Prinos complex).	Lower CAPEX due to the shorter pipeline length.
Overall Rating	13	14	28

7.3.3 Management of CO_2 loads

Table 7-4 presents a comparative analysis of the alternative solutions examined for the management of CO_2 loads, based on environmental impacts, technical feasibility, and economic assessments.

Table 7-4: Evaluation of alternative options for the management of CO_2 loads

Criteria	Alternative 1 – Direct injection from the transport ship (processing on the ship)	Alternative 2 – Temporary storage near the platform (processing on the platform)	Proposed Design – Direct injection from the platform
Biodiversity – Flora – Fauna	Equivalent environmental footprint to the proposed design due to the absence of the need for storage tanks, construction and installation of cranes.	Increased environmental impacts and larger environmental footprint due to the need for developing storage infrastructure in offshore areas.	Smaller environmental footprint due to the absence of new storage tanks and construction and installation of cranes.

Criteria	Alternative 1 – Direct injection from the transport ship (processing on the ship)	Alternative 2 – Temporary storage near the platform (processing on the platform)	Proposed Design – Direct injection from the platform
Atmosphere and Climate Factors	The exclusive onboard processing equipment increases the required ship capacity, which may increase fuel consumption. For continuous operation, a backup transport vessel will be needed, further increasing fuel consumption and emissions of atmospheric pollutants (CO, NOx, TSP) and greenhouse gases.	Fast CO_2 unloading reduces transport time, therefore emissions of atmospheric pollutants (CO, NOx, TSP) and greenhouse gases will be lower.	Fast CO_2 unloading reduces transport time, therefore emissions of atmospheric pollutants (CO, NOx, TSP) and greenhouse gases will be lower.
Energy – Natural Resources	The exclusive onboard processing equipment increases the required ship capacity, which may increase energy consumption. For continuous operation, a backup transport vehicle will be needed, further increasing energy consumption (fuel).	Fast CO2 unloading reduces transport time, so the transport vessels are used more efficiently.	Fast CO2 unloading reduces transport time, therefore energy consumption will be lower.
Acoustic Environment – Noise	Construction work disturbance is avoided.	Longer duration of construction work. The shorter unloading time will help limit the disturbance.	Construction work disturbance is avoided. The shorter unloading time will help limit the disturbance..
Waters	No construction and installation of storage tanks is required.	The need for storage equipment, as well as the multiple unloading stages, create a greater risk of water pollution.	No construction and installation of storage tanks is required.
Technical Feasibility	The CO_2 processing takes place on the ship through processes such as pumping until the required injection conditions are met. The ship is positioned next to the injection well, and the pressurized CO_2 is transferred directly to the well via a pipeline system. Installation of CO_2 processing equipment on the ship is required, leading to a need for greater ship capacity.	CO_2 is unloaded from the ship into a temporary storage system near the platform (anchored containers or tanks). The CO_2 processing for injection occurs on the platform. This requires storage equipment and involves multiple unloading stages.	Containers will be unloaded at platform Beta via a flexible hose system. Appropriate conditions for injection (pressure 101 barg, temperature 20°C) will be achieved on the platform.
Economic Viability	The exclusive equipment for processing on the ship increases the required capacity of the ship, which impacts the OPEX. For continuous operation, a backup transport vehicle will be needed, further increasing the OPEX.	Higher CAPEX due to storage tanks for CO2 loads, which increases the cost related to CO2 load processing. Lower OPEX due to shorter unloading times of ships compared to Alternative 1.	Lower CAPEX because of the absence of new storage tanks. Lower OPEX compared to Alternative 1 because of the shorter unloading time.
Overall Rating	19	19	28

From an environmental perspective, the proposed configuration presents a significant advantage regarding environmental impacts. By eliminating the need to develop storage infrastructure in offshore areas, the related environmental impacts are dramatically reduced. This results in a smaller environmental footprint compared to Alternative 2, which includes temporary storage near the platform.

From a technical perspective, all alternatives, including the proposed design, are feasible. However, the proposed design ensures technical viability while minimizing the installation and modifications of additional equipment, thereby reducing complexity and logistics.

Finally, the proposed design achieves a balance between capital expenditures (CAPEX) and operational expenditures (OPEX). While Alternative 2 may offer lower OPEX due to shorter ship unloading times, it is accompanied by higher CAPEX related to storage tanks, which add to the CO_2 load processing equipment costs. In contrast, the proposed design benefits from lower CAPEX due to the absence of new storage tanks. Additionally, it offers reduced OPEX compared to Alternative 1, thanks to shorter unloading times.

In summary, the proposed design offers a balance between environmental impacts, technical feasibility, and economic factors. By utilizing existing infrastructure and minimizing additional construction, it presents a cost-effective and environmentally sustainable solution for CO_2 load unloading design.

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8 CURRENT ENVIRONMENTAL STATUS

8.1 STUDY AREA

The existing environmental and social conditions in the Project area constitute the reference point, based on which the potential environmental and social impacts caused by the installation and operation of the proposed Project are examined. The data collection was based on both secondary data (bibliography, corresponding Environmental Impact Studies of existing projects in the study area, research results, etc.), and primary data, which resulted from the field work in the context of this, as well as from the Environmental Monitoring Program of the Prinos offshore project. More specifically, the following were used as primary data sources:

- Primary data originating from the Environmental Monitoring Program (EMP) of the Prinos offshore project (which is implemented in accordance with the requirements of the environmental licensing of the said project and also concerns the implementation area of this proposed project). The activities implemented within the framework of the work of the PPP of the offshore project of Prinos (marine ecology, physicochemical analyses of sediment and seawater, surveys in the Natura 2000 network area, bird fauna observation, etc.), as well as their results, are presented in detail in the Sections corresponding to each environmental parameter under consideration.
- Primary data collected within the framework of the field work of this project (including the field work of the MEOA of the project) with the aim of specifying and updating the existing conditions/baseline values of the area under consideration and to be used both for the assessment of the environmental impacts of the proposed project, and for the monitoring of the evolution of its potential impacts on environmental parameters. The fieldwork, during which data were collected that were used to determine the baseline values and reference conditions for the study area, included field observation activities, sampling and laboratory analyses. The activities implemented in the context of the fieldwork, as well as their results, will be presented in detail in the sections corresponding to each environmental parameter under consideration, as well as in the MEOA of the project attached to the relevant Annex hereto.

Prior to the collection of the reference data, specific areas to be studied were defined. The determination of the coverage of the main study area is mainly based on the following factors: the physical characteristics of the project location, the biological characteristics, the nature of the receptors and their sensitivity, the prevailing meteorological conditions and the area of potential impacts.

Regarding the determination of the Study Area, based on Annex II to the "Basic EIA Specifications for Category A projects and activities" of the Decision of the Ministry of Environment, Energy & Climate Change with A.P. ec. 170225/2014 (Government Gazette 135 B' /20.01.2014) "Specification of the contents of the environmental licensing files for Category A projects and activities of the decision of the Minister of Environment, Energy & Climate Change with no. 1958/2012 (B' 21) as in force, in accordance with article 11 of law 4014/2011 (A' 209) as well as any other relevant details", the minimum radius of influence for point and area projects or activities of Subcategory A1 for areas outside the boundaries of settlements or urban plans are defined at 2 km from the boundaries of the site, while for linear projects or activities at 1 km around their axis respectively.

Therefore, within the framework of this Study, the Direct Study Area (or zone of direct influence) was defined as the total area enclosed by the 2 km zone around each element of the project under consideration (offshore platform, pipeline or onshore installation), as shown in the following Figure.

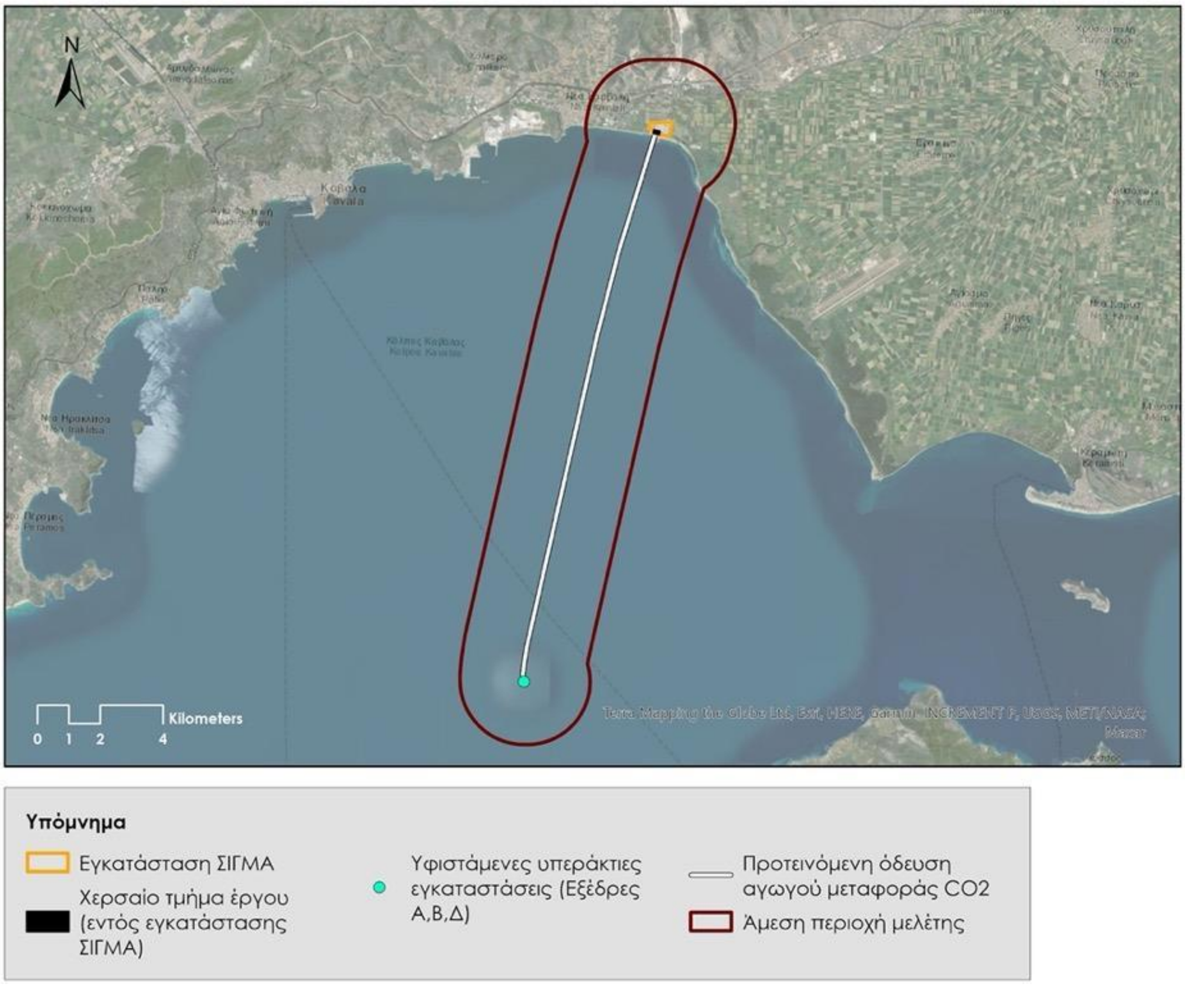


Figure 8–1: Project Study Area

However, the description of the current state of the environment discussed in this Chapter was chosen not to be narrowly limited to the study area, but to present available data and characteristics of the wider project implementation area, so as to obtain the most complete possible picture of its impact on all the parameters that shape the natural and anthropogenic environment of the wider area. Therefore, for reasons of completeness of this chapter, an expanded Wider Study Area is also described based on bibliographic data.

The definition of the immediate and wider study area for each environmental and social parameter is summarized in the Table below

Table 8–1: **Definition of main and wider study area**

Environmental Parameter	Wider study area	Main study area
Climatic and bioclimatic characteristics	Coastal Zone of Land Installations, Gulf of Kavala	Existing platforms (Prinou Complex) and along the new pipeline

Morphological and topological characteristics	Coastal Zone of Land Installations, Gulf of Kavala	Approximately 2 km around the existing platforms and along the new pipeline
Geological and tectonic characteristics	Coastal Zone of Land Installations, Gulf of Kavala	Approximately 2 km around the existing platforms
Aquatic environment	Gulf of Kavala	Approximately 2 km around the existing platforms
Atmospheric environment	Coastal Zone of Land Installations and Gulf of Kavala	Onshore facilities and Existing platform locations
Acoustic environment	Coastal Zone of Land Installations and Gulf of Kavala	Existing platform locations
Biotic environment	Thracian Sea and Gulf of Kavala	Approximately 2 km around the existing platforms (Prinou Complex)
Anthropogenic environment	Regional Unit of Kavala	Municipalities of Kavala and Thassos
Socioeconomic environment	Regional Unit of Kavala	Municipalities of Kavala and Thassos
Technical infrastructure	Coastal Zone and Gulf of Kavala	Municipalities of Kavala and Thassos
Existing pressures on the human and natural environment	Coastal Zone of Land Installations, Gulf of Kavala	Coastal Zone and Gulf of Kavala

It is noted that within the framework of the new project, an access exclusion zone will be established in line with the other offshore installations in the area. This zone will be determined in cooperation with the Maritime Authorities (Port Authority and Coast Guard, under the supervision of the competent Ministries), prior to the start of the project implementation works.

8.2 CLIMATE AND BIOCLIMATIC CHARACTERISTICS

8.2.1 Climatic Characteristics

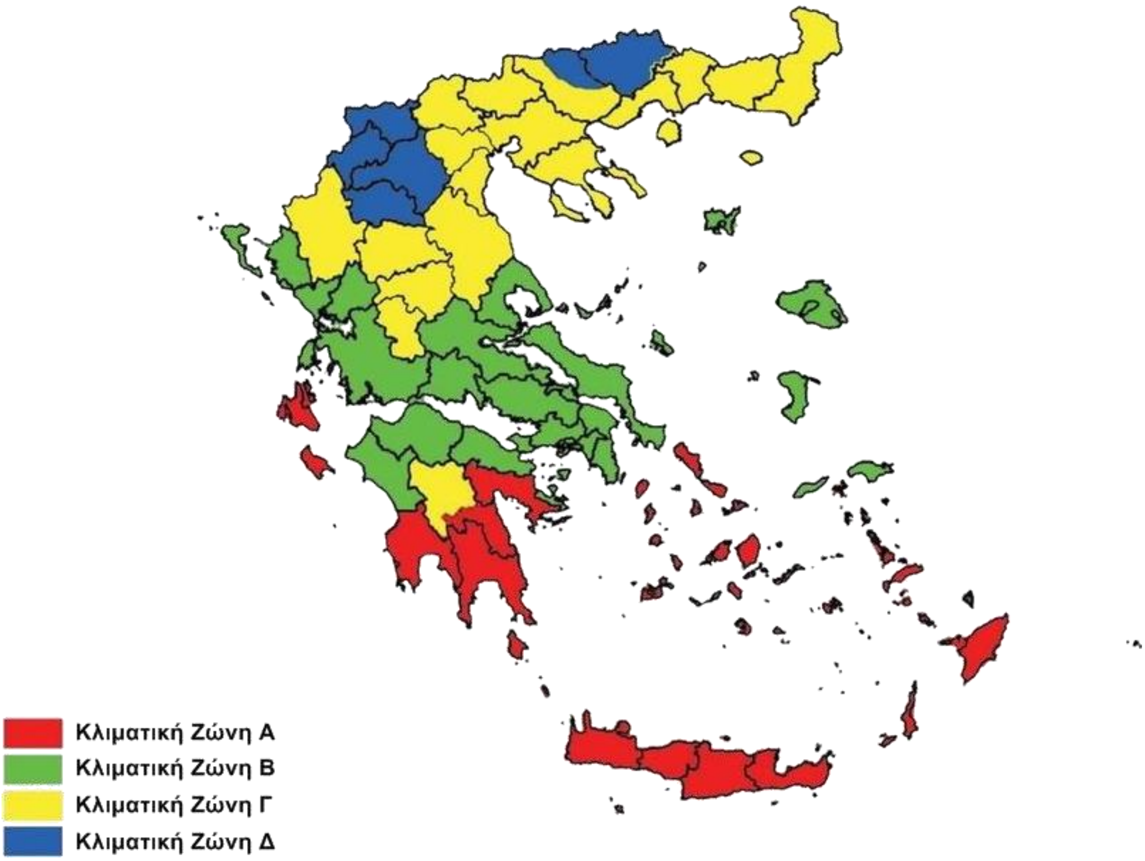
8.2.1.1 General information

The climate of the coastal zone of the Regional Unit of Kavala, in which the Project under study is located, is classified as Mediterranean type, with hot, dry summers (circulation of subtropical and warm dry air), cold and wet winters (circulation of relatively cool air from the temperate zone) with rainfall of approximately 300-400 mm. The corresponding continental part of the Regional Unit tends to be different, presenting a continental climate, characterized by cool wet winters, dry summers and rainfall at approximately twice the value of that of the coastal zone.

To investigate the climatic conditions of the area, data obtained from the Meteorological Station (MS) of Kavala (operates under the responsibility of the National Meteorological Service), which is located at λ: 24.62 and φ: 40.92 (in the WGS84 projection system) and is located at an altitude of 4 m, were examined.

8.2.1.2 Climate Zone

According to the “Regulation on Energy Performance of Buildings KENAK” (approval: Government Gazette 2367/B/12-7-2017), the Greek territory is divided into four (4) climatic zones based on heating degree days. The Kavala Regional Administrative Region is located in the C’ climatic zone, as shown in the following Figure.



(Source: KENAK, 2017)

Figure 8–2: Schematic illustration of climatic zones of Greek territory

8.2.1.3 Temperature

According to statistical data from the Hellenic Meteorological Service (from the Kavala MS, data for a period of 52 years), for the Project area it is estimated that January is the coldest month, with an average minimum temperature of 1.8°C and an average monthly temperature of 5.6°C, while the warmest month is July, with an average maximum temperature of 30.1°C and an average monthly temperature of 26.1°C. In absolute values, for the same period, the maximum recorded temperature is 39°C during July and the corresponding minimum is -8°C in January and -8.8°C in December.

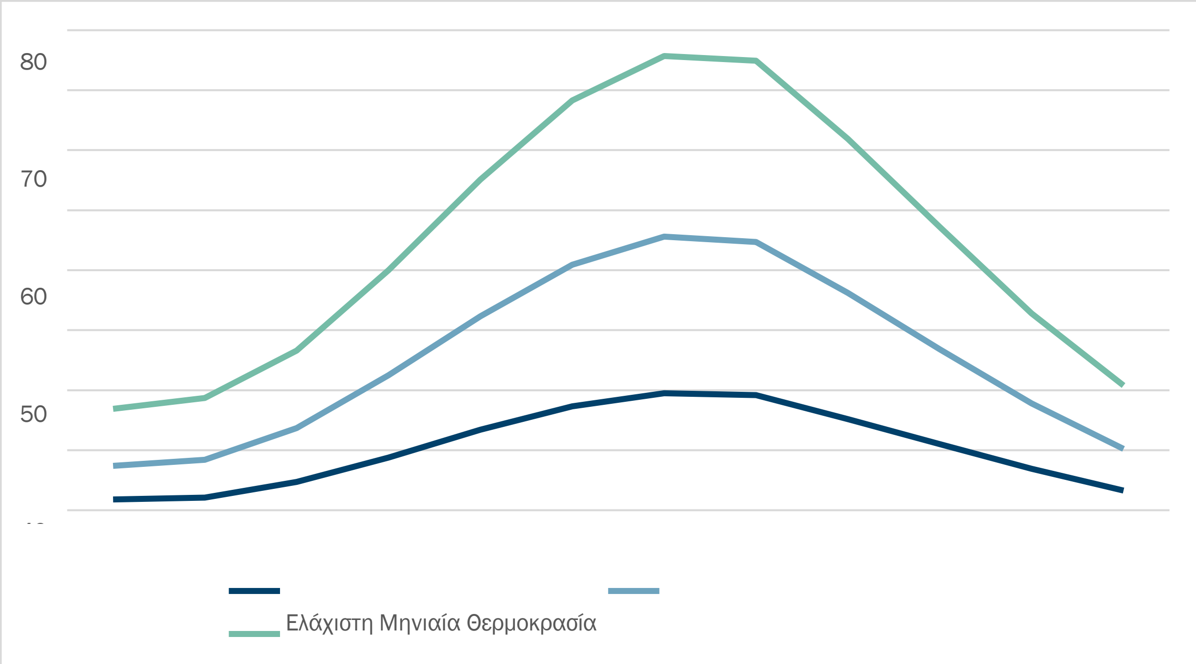
It is noted that although the coldest months are located temporally during the winter (December, January and February), the minimum temperature can drop below zero in March and April, due to the incoming cold winds.

The following Table and Figure present the meteorological temperature data of the Kavala Metropolitan Area for a period of 52 years (from 1958 to 2010).

Table 8–2: Temperature data from the Kavala Meteorological Station for the period 1958-2010

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Minimum Monthly Temperature	1,8	2,1	4,7	8,8	13,4	17,3	19,5	19,2	15,2	11,0	6,9	3,3
Average Monthly Temperature	5,6	6,3	9,0	13,7	18,9	23,6	26,1	25,5	21	15,8	10,9	6,9
Maximum Monthly Temperature	9,5	10,3	12,9	17,5	22,8	27,4	30,1	30,2	25,7	20,4	15,0	10,6

(Source: Kavala Meteorological Station, Hellenic National Meteorological Service (HNMS))



(Source: Kavala Meteorological Station, Hellenic National Meteorological Service (HNMS))

Figure 8–3: Schematic illustration of climatic zones of Greek territory

8.2.1.4 Wind

According to the anemological data of the Kavala MS, it appears that in the study area the winds have a prevailing easterly direction for most months. The range of the average monthly intensity ranges from 3.9 km/h to 4.8 km/h, while the average annual intensity corresponds to 4.4 km/h. The Figure below presents the annual diagram of the average wind value of the Kavala MS, while the following Table presents the average and highest wind value, as well as the prevailing direction per month.

Table 8–3: Average monthly values of meteorological data from Kavala station

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Prevailing Wind Direction	A	A	A	A	A	ΝΔ	A	A	A	A	A	A
Average Monthly Wind Speed	4,5	4,8	5,3	4,9	4,6	4,0	3,9	3,9	4,1	4,1	4,1	4,4

(Source: Kavala Meteorological Station, Hellenic National Meteorological Service (HNMS))

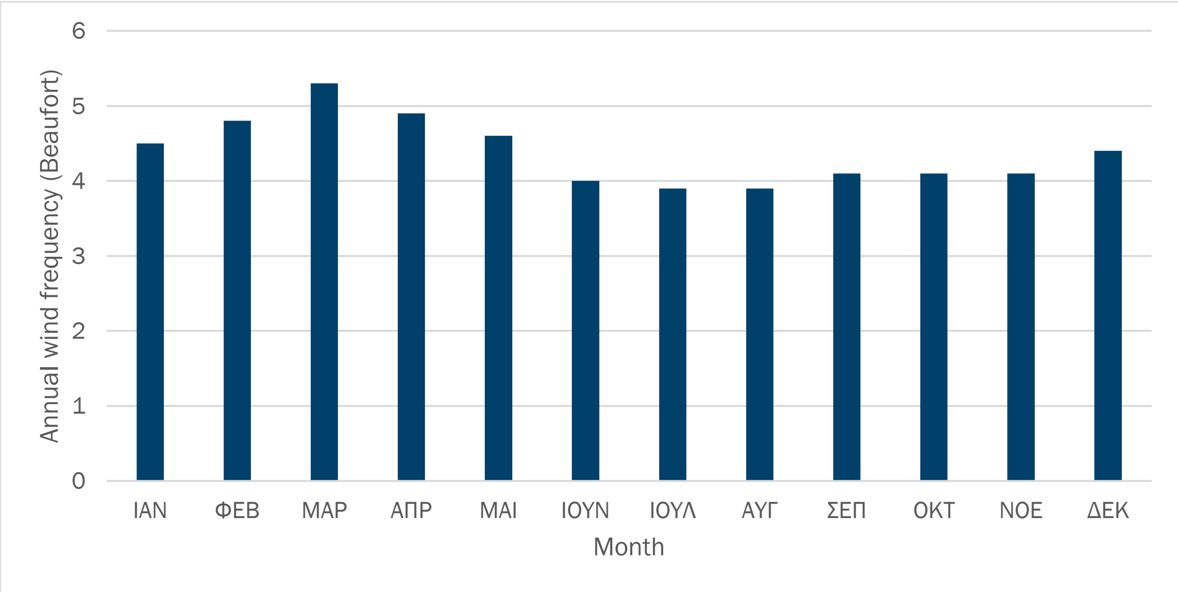
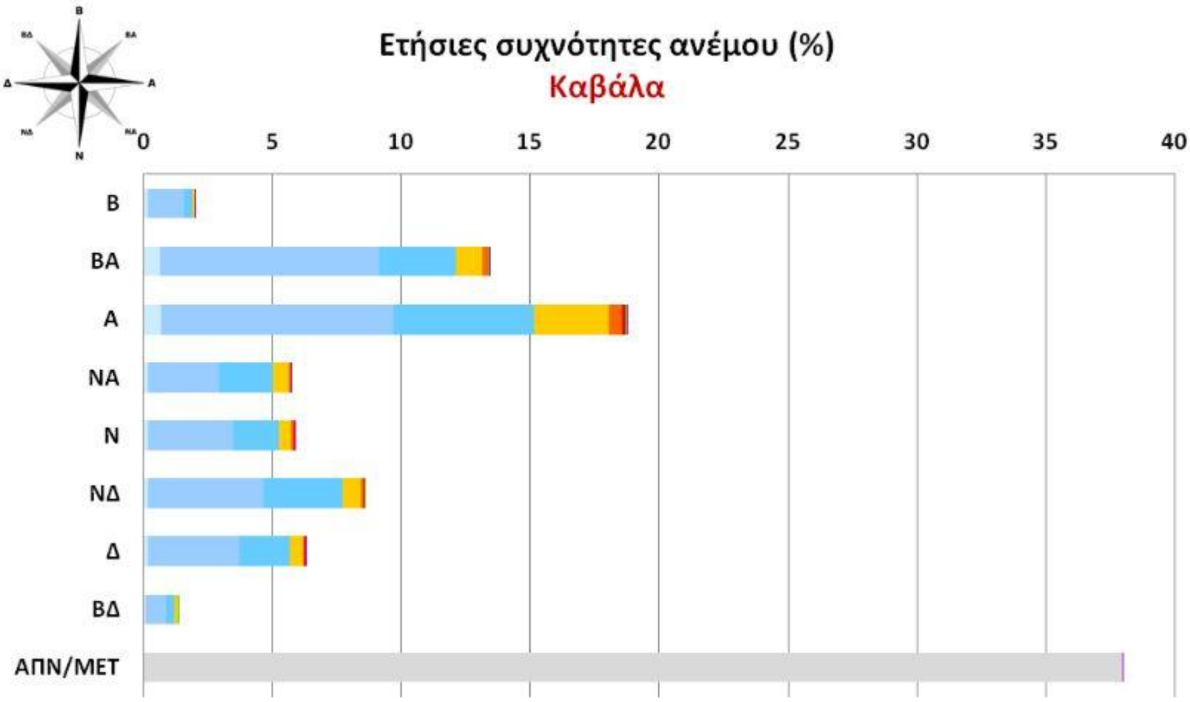


Figure 8–4: Distribution of wind data 1958-2010

The following Figure presents the annual wind frequencies in Beaufort in relation to wind direction, as recorded in the Kavala MS.



	ΑΠΝ/ΜΕΤ	ΒΔ	Δ	ΝΔ	Ν	ΝΑ	Α	ΒΑ	Β
Απνοια	37.96								
1b	0.01	0.07	0.18	0.20	0.18	0.16	0.71	0.65	0.18
2b	0.00	0.79	3.54	4.47	3.33	2.76	9.00	8.49	1.41
3b	0.00	0.32	1.99	3.05	1.78	2.09	5.45	2.98	0.32
4b	0.00	0.15	0.48	0.74	0.46	0.65	2.87	1.04	0.08
5b	0.00	0.01	0.08	0.09	0.08	0.06	0.54	0.20	0.01
6b	0	0.01	0.01	0.02	0.03	0.01	0.14	0.03	0.00
7b	0	0.00	0	0.01	0.00	0.00	0.02	0.01	0
8b	0	0	0	0	0.00	0.00	0.01	0.00	0
>=9b	0.00	0	0.00	0	0.00	0.00	0.01	0.00	0.00

(Source: Kavala Meteorological Station, Hellenic National Meteorological Service (HNMS))

Figure 8–5: Annual wind frequencies

8.2.1.5 Humidity and Precipitation

According to the measurements of the Kavala Meteorological Service, the average relative humidity in the study area is estimated at 69.3%. The maximum values are observed in the winter months. In addition, the annual amount of precipitation, according to the measurements of the Kavala Meteorological Service, corresponds to 466.2 mm and the average number of days with rain in the area is 92.5 days. The following Table presents the average monthly humidity values, height and number of days of precipitation per month of measurements, as they have been recorded per day at the Kavala Meteorological Service.

Table 8‑4: Average monthly humidity values, height and number of precipitation days

Month	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Relative Humidity (%)	75,4	73,4	72,2	71,2	67,0	63,3	58,4	60,4	65,7	71,6	76,2	76,3
Average Monthly Precipitation (mm)	41,3	49,3	36,6	33,2	30,2	26,2	22,4	17,0	24,8	44,5	62,3	78,4
Average Monthly Number of Rainy Days (d)	8,8	8,9	9,2	9,3	8,9	7,0	4,6	3,4	5,0	7,6	9,7	10,1

(Source: Kavala Meteorological Station, Hellenic National Meteorological Service (HNMS))

The following Figure shows the distribution of average monthly humidity, which ranges from 63.3% to 76.3%.

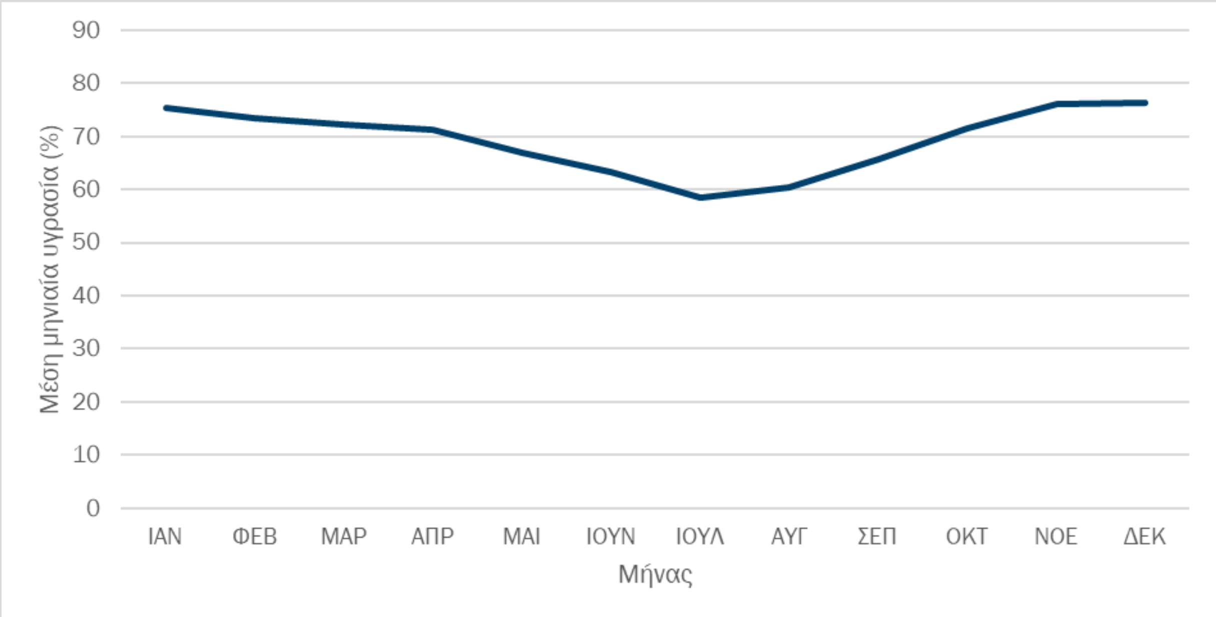
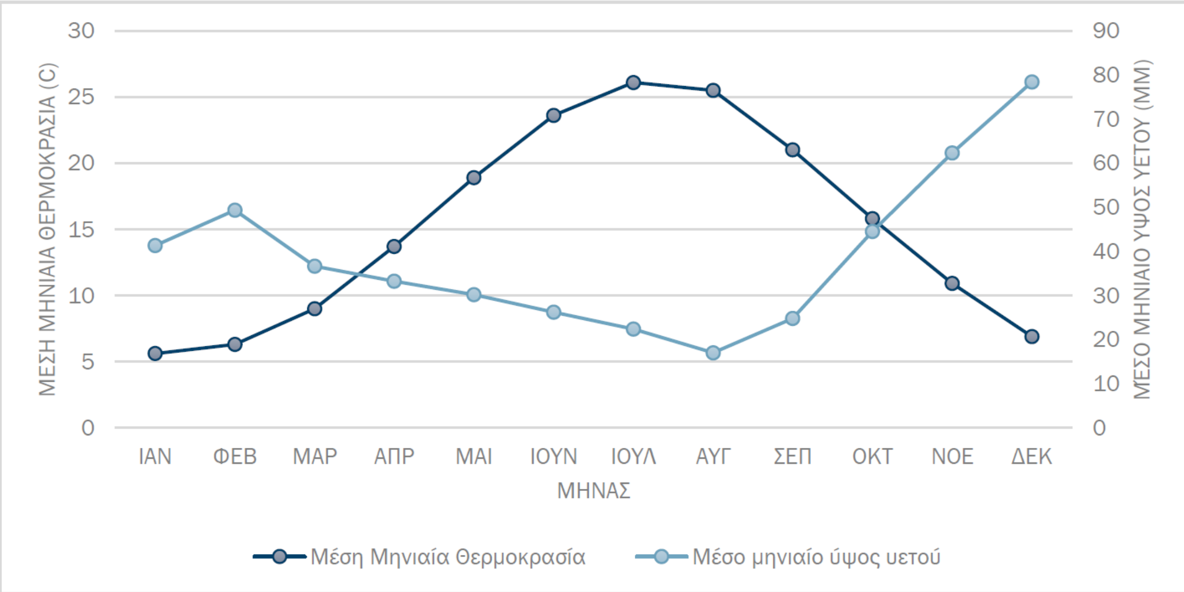


Figure 8‑6: Distribution of average monthly humidity

The Gaussen-Bagnouls ombrothermal diagram below shows the average monthly precipitation values in mm and temperature in degrees Celsius (oC). The diagram shows the months of the year on the X axis and has two Y axes. On the left side, the average monthly precipitation (P) in mm is shown and on the right side, the average monthly temperatures (T) in oC on a double scale of magnitude from the precipitation P = 2T. According to Bagnouls & Gaussen (1957), a month is characterized as "dry" when the total precipitation during its duration is equal to or less than twice the average temperature of Pmm ≤ 2T oC. When the precipitation curve is lower than the temperature curve, then P < 2T applies and this period is considered dry. The area between these two curves shows the duration and intensity of the dry period. As shown in the diagram below, the dry-hot season, for the study area, lasts from late April to October.

The following Figure presents the Gaussen-Bagnouls ombrothermal diagram of the study area. The diagram presents the monthly distribution of the average monthly temperature T in °C and the average monthly rainfall P in mm.



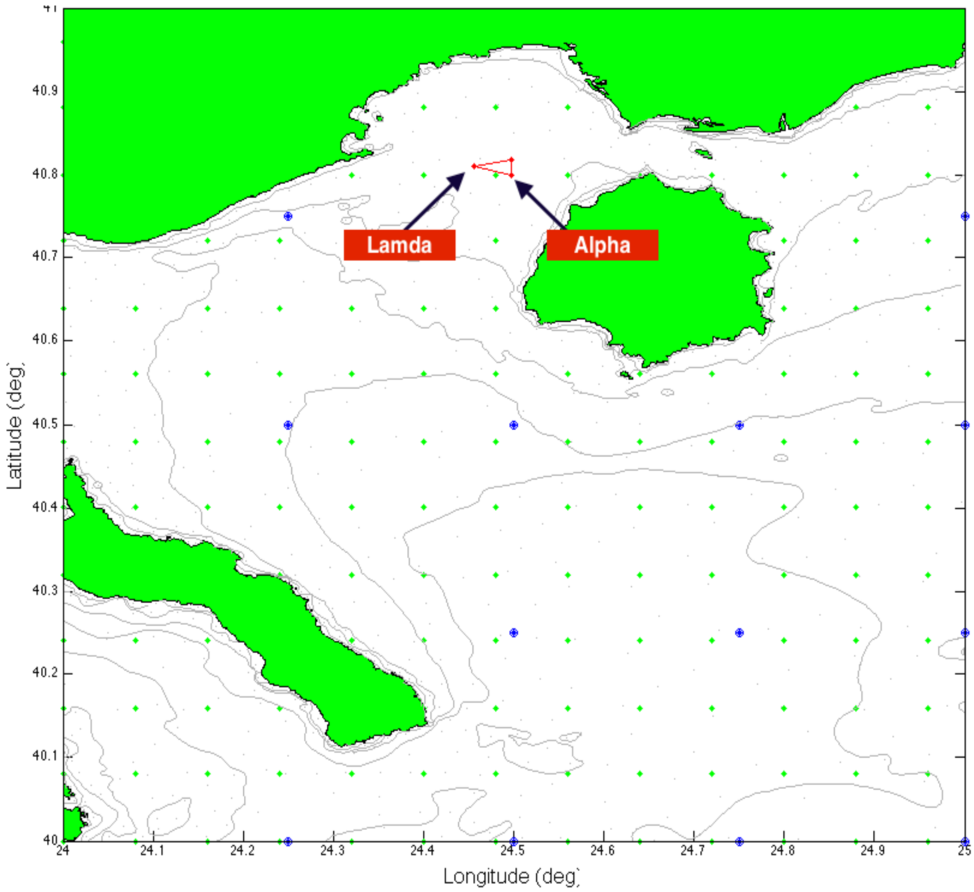
(Source: Kavala Meteorological Station, Hellenic National Meteorological Service (HNMS))

Figure 8–7: Average monthly temperature and average precipitation - Rainfall Diagram

8.2.2 Oceanographic Characteristics

8.2.2.1 General Information

In the context of the Environmental and Social Impact Assessment (ESIA) of the Prinos Offshore Development Project, Energean commissioned BMT ARGROSS UK in 2015 to prepare a special meteorological/oceanological (oceanographic) study for the Gulf of Kavala, where the offshore facilities that are also relevant to the Project under study (proposed pipeline, existing platforms) are identified and developed. The following Figure presents the areas of interest and reference locations, as included in the special meteorological/oceanological study.



(Source: Environmental and Social Impact Assessment (ESIA) for the Prinos Offshore Development Project, Energean 2015)

Figure 8-8: Areas of interest for meteorological/oceanographic study

The meteorological/oceanological study was based on global computer simulation data based on the "Climate Forecast System (CFS)". This system is a model that captures the global interaction between the Earth's oceans, land and atmosphere and provides hourly data with horizontal resolution up to half a degree (about 56 km) around the Earth for many variables. It also uses the latest scientific approaches to obtain or assimilate observations from data sources, including surface observations, balloon observations, aircraft and satellite observations.

In addition to the global CFS data, data from local meteorological stations in the Kavala area (Thassos island, Kavala airport) and from national meteorological stations were used to calibrate and benchmark the computer data simulations.

This meteorological/oceanological study contains statistical return data with relevant directions of 1 year, 10 years, 100 years and for wind speeds, wave height/period, current speeds and tidal variations. In addition, it contains monthly distributions of temperature in the atmosphere, sea surface/undersea, water density and salinity.

The main findings of this study are summarized in the following Sections.

8.2.2.2 Waves

With regard to the waves that develop in the area, according to the meteorological/oceanological study of BMT ARGROSS UK (ESIA Prinos Offshore Development Project, 2015), the annual frequency of significant wave heights (hs) at the offshore platform location – Lambda Prinos (Longitude: 24.4556801°E, Latitude 40.8106498°N – World Datum WGS84) is given in the following Table. The significant wave height is less than 1m, while extreme storms occur more frequently in the winter months and are characterized by southerly winds.

Wave Height Hs (m)		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	All
6,5	7,0	0	0	0	0	0	0	0	0	0	0	0	0	0
6,0	6,5	0,018	0	0	0	0	0	0	0	0	0	0	0	0,002
5,5	6,0	0	0,019	0	0	0	0	0	0	0	0	0	0	0,002
5,0	5,5	0	0	0	0	0	0	0	0	0	0	0	0	0
4,5	5,0	0,018	0,019	0	0	0	0	0	0	0	0	0,018	0,018	0,006
4,0	4,5	0	0,058	0,053	0	0	0	0	0	0	0,018	0,054	0,140	0,027
3,5	4,0	0,088	0,154	0,035	0	0	0	0	0	0	0,070	0,018	0,175	0,045
3,0	3,5	0,105	0,250	0,105	0,036	0,018	0	0	0	0	0,175	0,109	0,158	0,079
2,5	3,0	0,245	0,250	0,123	0,073	0,018	0	0	0	0,018	0,070	0,199	0,351	0,112
2,0	2,5	0,666	0,654	0,473	0,073	0,053	0	0	0	0,054	0,123	0,707	0,473	0,271
1,5	2,0	1,718	1,615	1,455	0,580	0,456	0,018	0,018	0,018	0,145	0,491	2,065	2,016	0,879
1,0	1,5	7,398	7,039	5,891	3,931	2,104	0,453	0,579	0,403	1,359	3,576	5,851	9,607	4,006
0,5	1,0	32,241	30,423	29,383	23,696	18,496	13,533	17,111	17,865	22,246	29,453	27,319	32,837	24,537
0,0	0,5	57,504	59,519	62,483	71,612	78,857	85,996	82,293	81,715	76,178	66,024	63,659	54,225	70,036
		100	100	100	100	100	100	100	100	100	100	100	100	100

Υπόμνημα
Συχνές εμφανίσεις
κόκκινο - 12 πιο συχνές
κίτρινο - επόμενες 24 πιο συχνές
πορτοκαλί - επόμενες 21 πιο συχνές
μπλε - όλες οι υπόλοιπες

(Source: Environmental and Social Impact Assessment (ESIA) for the Prinos Offshore Development Project, Energean 2015)

Figure 8–9: Annual frequency of significant wave heights

The maximum wave heights for the respective extreme repeatability conditions are given in the following Table. The maximum wave height predicted was 6.7m from a southerly direction. The highest waves during the year are from the south, despite the prevailing wind direction, which is the north-easterly. Waves from the south have large swells as they have time to develop within the Aegean Sea, while waves caused by north-easterly winds are smaller, as their location is very close to the coastline and the wave generation is limited. It should be noted that Thassos offers shelter from southerly waves.

Table 8–5: Maximum wave height (m) for the corresponding extreme repeatability conditions

Directions from	Recurrence period (years)			
	1	10	50	100
Storm Duration (hours)	4,8	3,3	2,5	2,2

Directions from	Recurrence period (years)			
	1	10	50	100
North	1,0	1,6	2,1	2,3
Northeast	1,7	2,4	2,8	3,0
East	1,6	2,2	2,7	2,9
Southeast	1,2	2,0	2,6	2,8
South	3,7	5,3	6,3	6,7
Southwest	1,8	2,4	2,8	3,0
West	0,6	1,3	1,8	2,0
Northwest	0,3	0,8	1,3	1,5
Multiple directions	3,7	5,3	6,3	6,7

(Source: Environmental and Social Impact Assessment (ESIA) for the Prinos Offshore Development Project, Energean 2015)

8.2.2.2 Tidal Data

According to the meteorological/oceanological study carried out as part of the ESIA of the Prinos Offshore Development Project (2015), the tidal ranges (based on data extracted from January 1992 to December 2014) in the study area are estimated to be relatively small. The following Table presents the tidal water level components.

Table 8–6: Tidal water level components

Tidal definition		Level (relative to Mean Sea Level - MSL)	Level (relative to Lowest Astronomical Tide - LST)
Higher astronomical tide (HAT)		0,23	0,46
Mean Tide of the Syzygies (average of high tide only) - MST		0,19	0,42
Mean Tide of the Syzygies (average of low and high tide) - MST		0,17	0,40
Mean Upper Tide (average of all high tides) - MST		0,13	0,35
Mean Lower Tide (average of all low tides) - MST		0,09	0,32
Mean Tide of the Quadrangulations - MST		0,02	0,25
Mean Sea Level - MSTL		0,00	0,23
Mean Shallow of the Quadrangulations - MSTL		-0,02	0,20
Mean Upper Shallow (average of all high shallow tides) - MSTL		-0,09	0,14
Mean Lower Shallow (average of all low shallow tides) - MSTL Syzygion (average of low and high tides) - MRS		-0,13	0,10
Mean Low Tide Syzygion (average of low tides) - MRS		-0,17	0,06
Lowest Astronomical Tide (LST)		-0,19	0,04

Tidal definition		Level (relative to Mean Sea Level - MSL)	Level (relative to Lowest Astronomical Tide - LST)
Higher astronomical tide (HAT)		-0,23	0,00

** Actual definition of MST but in some mixed semidiurnal tidal regimes it may be lower than MST, which is not expected.*
** Actual definition of MST but in some mixed semidiurnal tidal regimes it may be higher than MST, which is not expected.*
**** There is no need to separate the quadrature tides as the constants are very similar.*

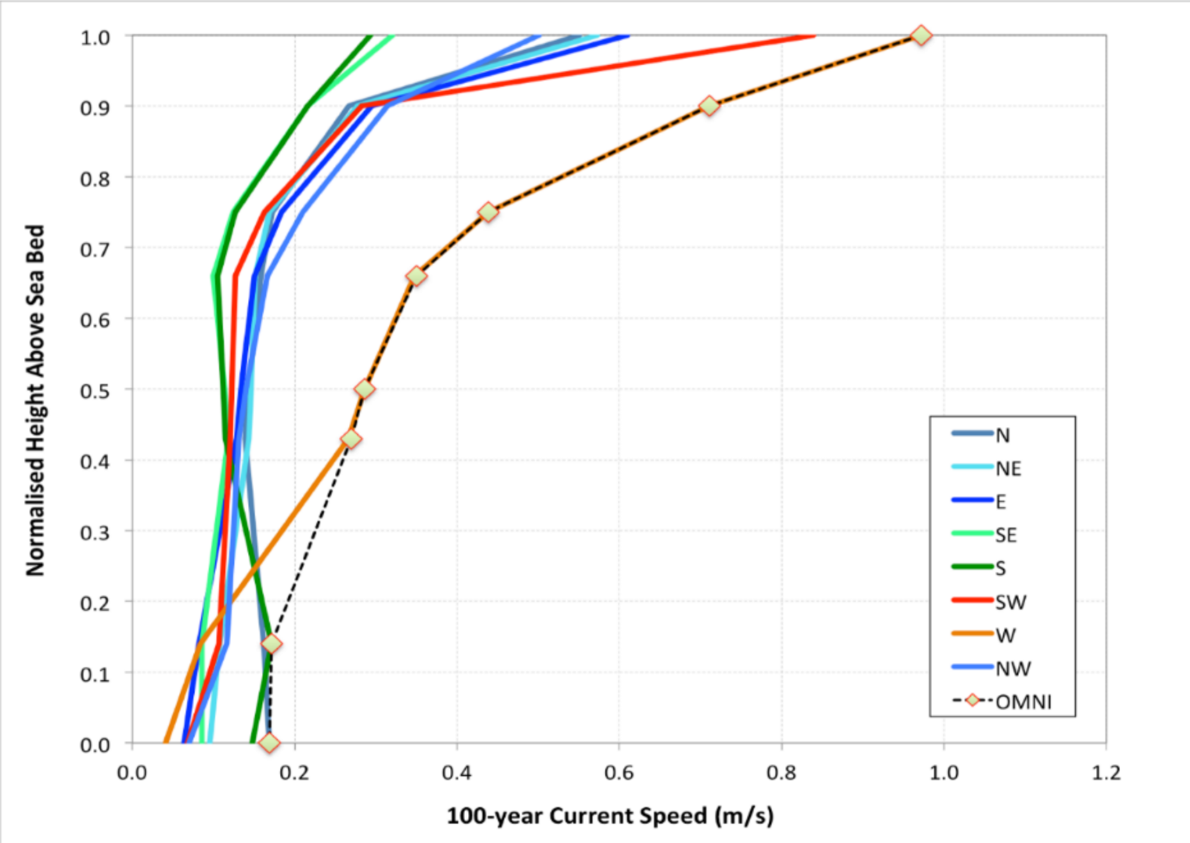
(Source: Environmental and Social Impact Assessment (ESIA) for the Prinos Offshore Development Project, Energean 2015)

8.2.2.3 Currents

According to the meteorological/oceanological study carried out as part of the ESIA of the Prinos Offshore Development Project (2015), tidal currents are considered to be essentially independent of the return period and are usually added subsequently. However, in the study area these currents are negligible and have been omitted from further analyses.

In the areas of interest of the meteorological/oceanographic study the water depth is sufficiently shallow and the current flow is oriented in the same directions for most of the vertical profile (small changes in the bottom flow are observed, but at these depths the magnitudes of the currents are small) to allow the analysis of extreme values at each depth to be addressed independently. The resulting extreme values are then combined to form the extreme value profiles per direction.

The following Figure illustrates the profile of the vertical currents per direction. The dominant base flow is westerly and equal to the omnidirectional flow throughout the upper 75% of the water column. At depth (below 25% of the water column) the current changes to a north/south orientation, but by this stage the flow has greatly diminished.



(Source: Environmental and Social Impact Assessment (ESIA) for the Prinos Offshore Development Project, Energean 2015)

Figure 8–10: Vertical current profiles by direction

8.2.3 Bioclimatic Characteristics

Regarding the conditions of the Mediterranean regions, the Emberger index is usually used, according to its synthetic formula, precipitation, average temperature and the average minimum temperature of the warmest and coldest months of the year are taken into account. Thus, the Mediterranean regions are divided into various bioclimatic floors.

This index is calculated as follows:

$$Q_2 = \frac{P}{\left(\frac{M+m}{2}\right)(M-m)} \Rightarrow Q_2 = \frac{2000P}{M^2 - m^2}$$

Where:

- P = average annual precipitation (mm)
- M = average maximum temperature of the warmest month*
- m = average maximum temperature of the coldest month*

* The variables M and m are expressed in absolute degrees of temperature, with 273°K corresponding to 0°C

The quotient Q is used as the ordinate on the coordinate axis, with the abscissa the index m, which in this case is expressed in degrees Celsius (°C). The above values are placed on the axes of a diagram that has been prepared in advance, which distinguishes the bioclimatic floors.

Based on the Emberger formula, for the period 1984-1999 (based on data from the Kavala MS) the index Q is calculated as follows:

$$Q = 2{,}000 \times 403.2 / (273+29.7)^2 - (273+3.0)^2 = 52{,}19$$

By placing the index value on the Emberger climate diagram, we observe that the Kavala Regional Unit belongs to the semi-arid bioclimatic floor, characterized by cold winters.

More specifically, the characteristic climate of the coastal zone of the region is characterized by hot, dry summers (circulation of subtropical and warm dry winds), cold and wet winters (circulation of relatively cool winds from the temperate zone), as well as by rainfall of approximately 300 -400 mm. The corresponding continental part of the PE tends to be different and is characterized by cool wet winters, dry summers and rainfall of approximately double the values of the coastal zone.

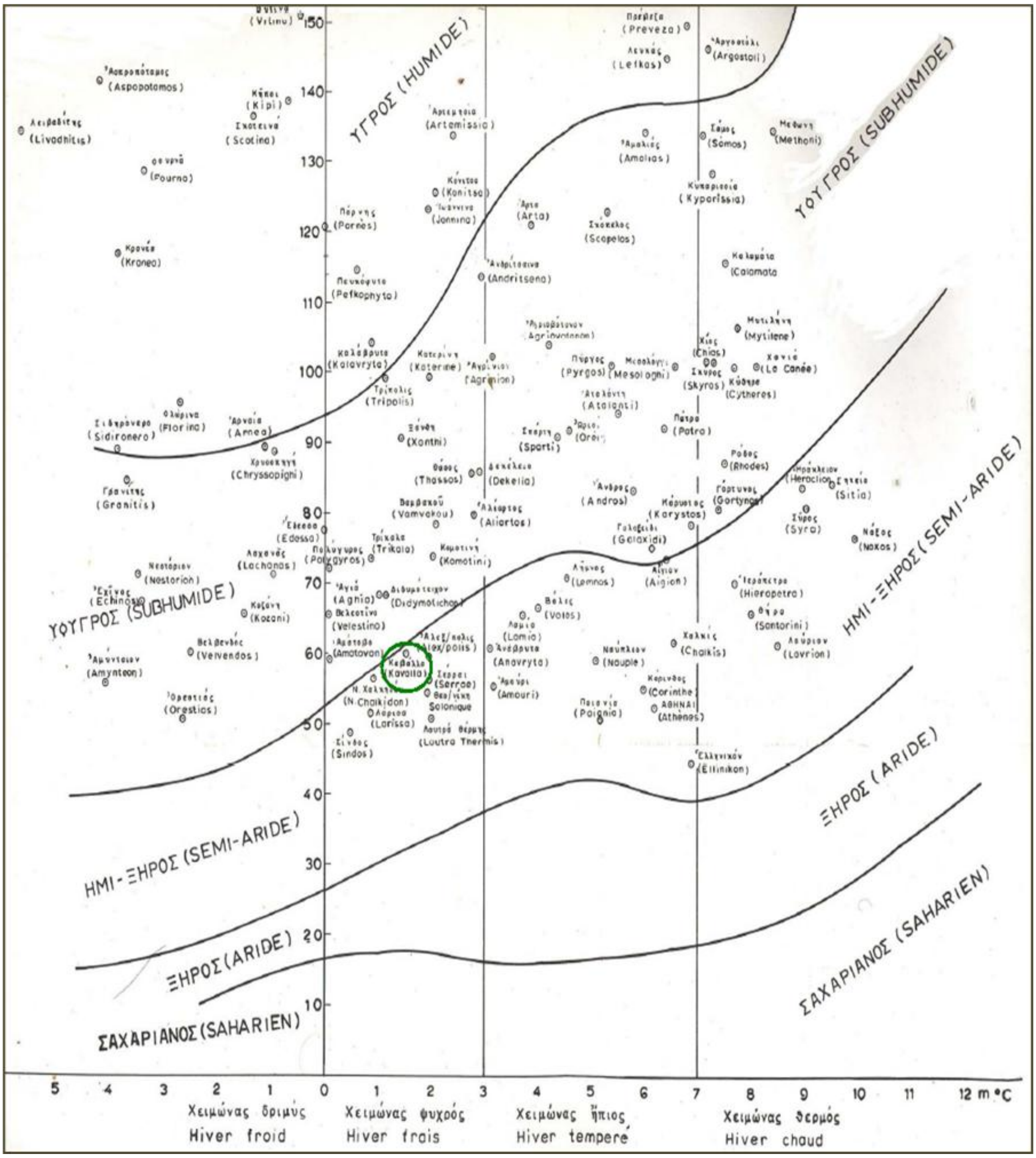
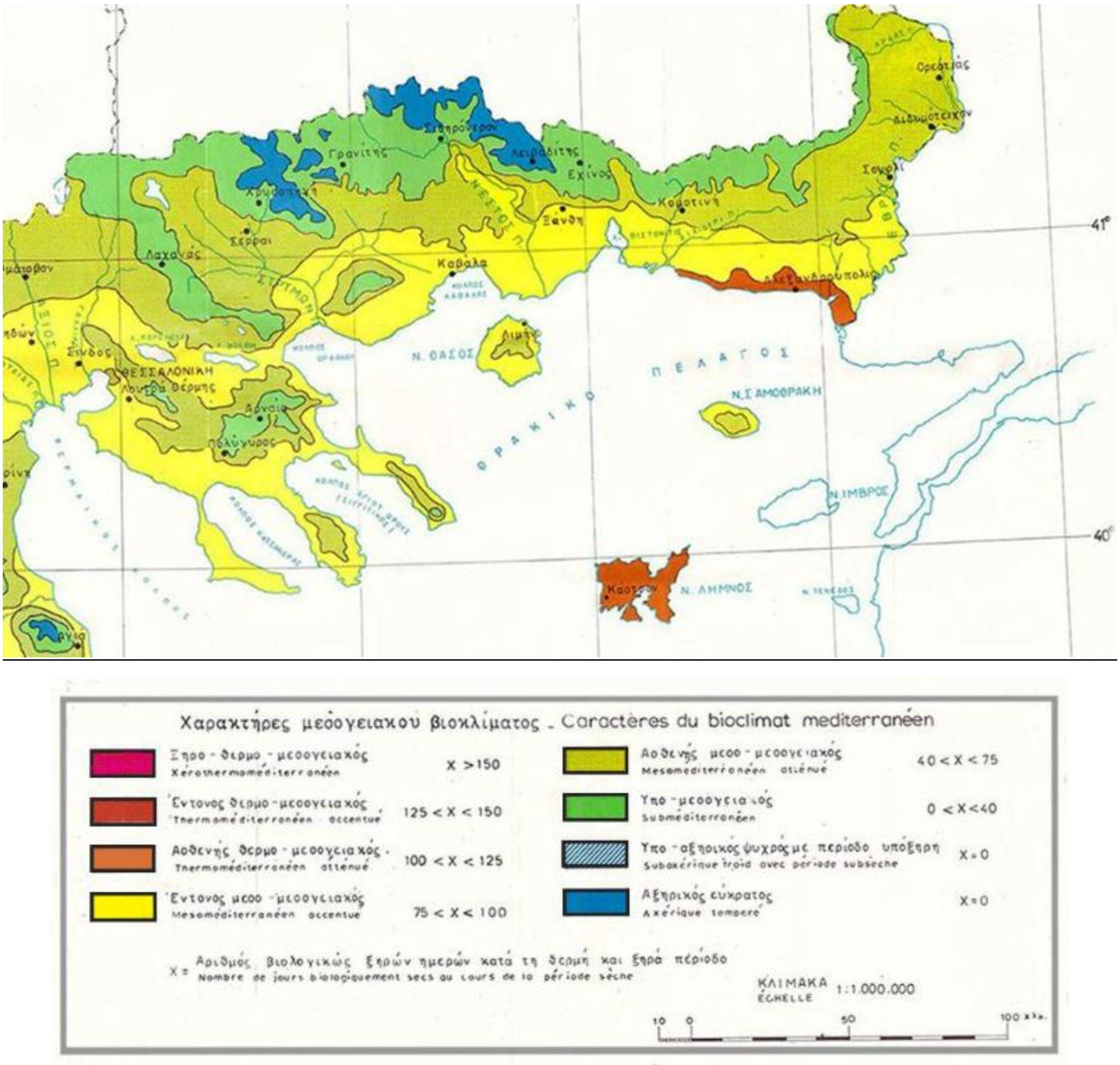


Figure 8–11: Emberger – Sauvage bioclimatic diagram in relation to the location of Kavala

In addition, the Dry-Heat Climate Index (Gaussen) has proven particularly useful in Mediterranean countries. It characterizes the intensity of the drought of the dry month and is determined by the number of days that are dry from a biological point of view. It is based on the observation that the dryness of an area depends on temperature, precipitation, relative humidity and the number of foggy days, and is derived from an empirical mathematical formula that takes all these parameters into account. The index allows a very good assessment of the bioclimatic conditions and the vegetation conditions of a Mediterranean area.

In general, the climate is characterized as Mediterranean where summer is the driest season. The main characteristic of the Mediterranean climate is summer drought. In the Mediterranean climate there is a clear contrast between the colder seasons, which are humid, and the hot summer season, which is always dry.

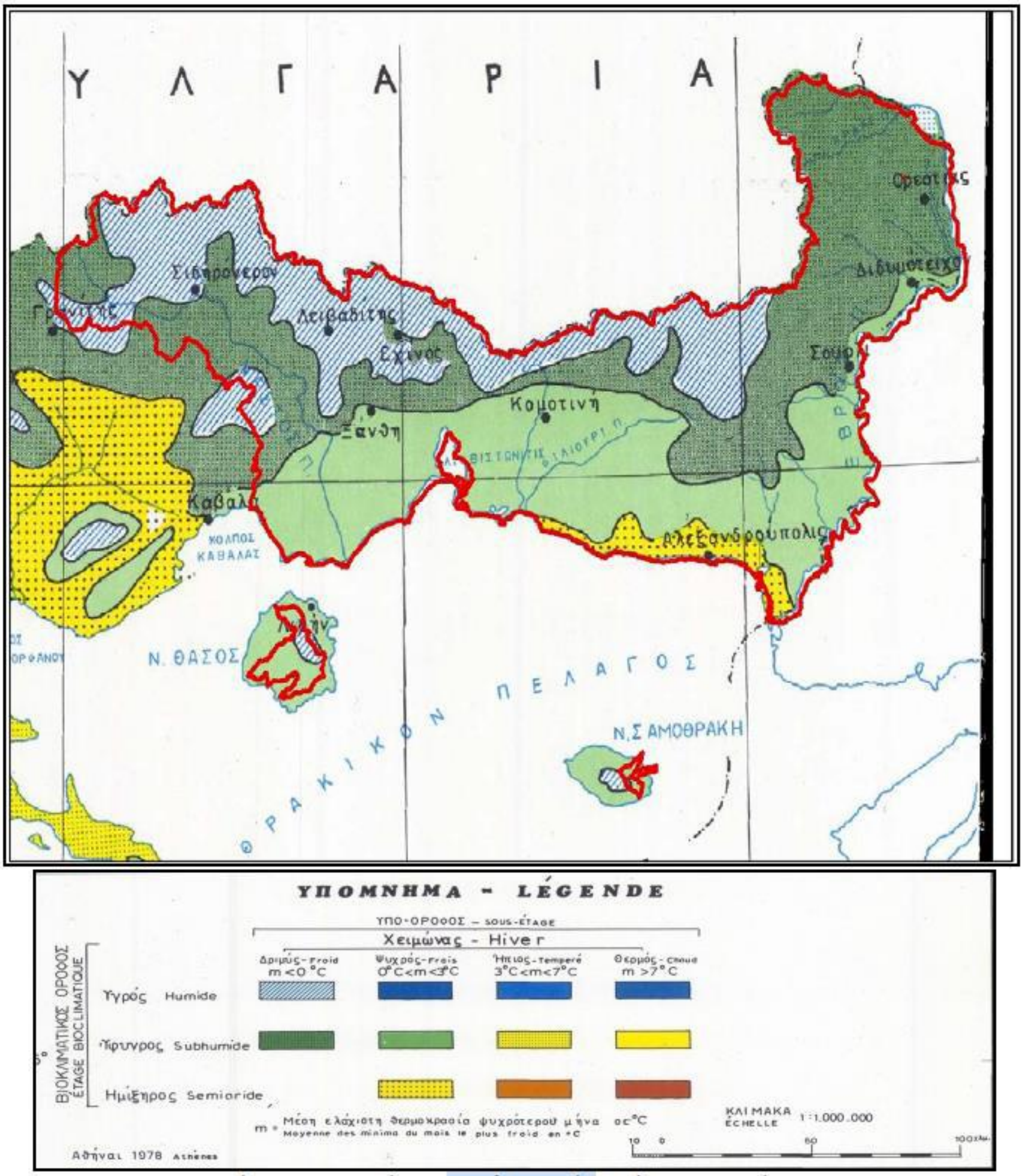
According to the following Figure, the study area is characterized by an intense meso-Mediterranean climate, where the number of biologically dry days during the hot and dry season ranges between 75 and 100 days.



(Source: Χάρτης Υπ. Γεωργίας, 1978)

Figure 8–12: Map of Bioclimatic conditions based on Gaussen's xerographic index

According to the Bioclimatic Floors Map of Greece, of the Forestry Stationology Department, of the Forest Research Foundation of the Ministry of Agriculture (Mavrommatis, 1978), the study area of the Project belongs to the humid bioclimatic floor with a cold winter of 0ºC<m<3ºC.



(Source: Μαυρομμάτης, 1978)

Figure 8–13: Map of Bioclimatic Floors of Greece

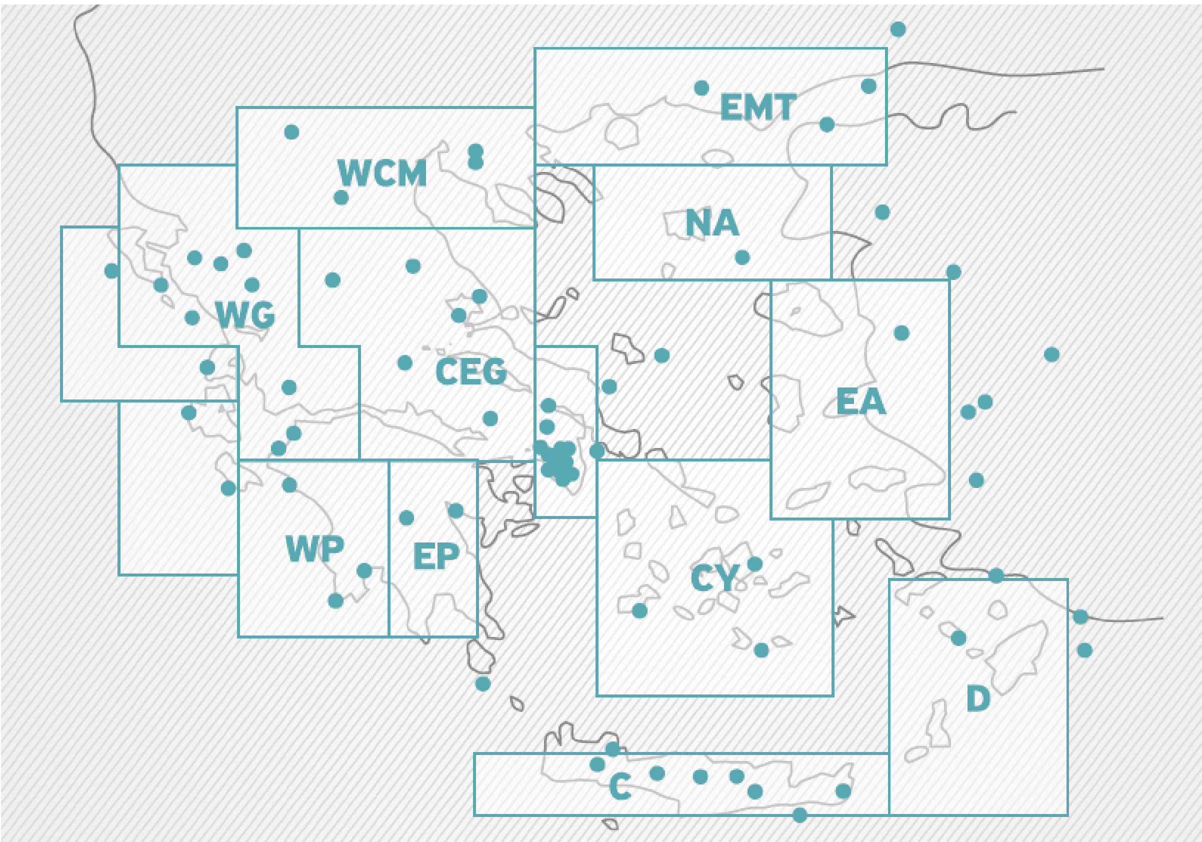
8.2.4 Climate Change - Extreme Weather Events

8.2.4.1 Climate Change

The development of a strategy for adaptation to climate change is a National and Regional obligation, arising from the Framework Convention on Climate Change (UNFCCC, 1992), the Paris Agreement (2015), the

Glasgow Climate Pact 2021 (COP26 Glasgow Climate Pact, 2021) and the commitments to the EU. With the Eastern Macedonia & Thrace Climate Change Action Plan (September 2023), the Region's strategy for addressing the threat of climate change is implemented, which has as its main objective the reduction of the Region's vulnerability to the impacts arising from climate change and its protection against it.

The overall objective of the Regional Climate Change Adaptation Plan is to contribute to strengthening the resilience of the Region of Eastern Macedonia and Thrace (REMT) to climate change in all sectoral policies, as described in the National Strategy for Adaptation to Climate Change, which means increasing the preparedness and capacity to address the impacts of climate change at local and regional level, developing a coherent approach and improving coordination. According to the Regional Climate Change Adaptation Plan, the Climate Change Impact Study Committee has divided Greece into climatic regions based on climatic and geographical criteria. REMT is a distinct climatic zone (EMT) as shown in the following Figure.



(Source: EMEKA, 2011)

Figure 8–14: The climatic zones of Greece

Based on the estimates of the IPCC Fifth Assessment Report (AR5), four (4) climate scenarios (Representative Concentration Pathways - RCPs) have been proposed,

which are linked to time series of concentrations of greenhouse gases, suspended particles and chemically active gases in the atmosphere, as well as to land use changes. The main parameters that determine these four different scenarios are the population growth rate, economic activities, lifestyle, energy sources, technological development, future land uses and general climate change policy. These scenarios include a reduction scenario (RCP2.6), two stabilization scenarios (RCP4.5 and RCP6.0) and a scenario of increasing greenhouse gas concentrations (RCP8.5).

The following is a brief description of the estimates of expected climate changes (from the Intermediate scenario (RCP4.5) and the Adverse scenario (RCP8.5)) for the period 2021-2030 compared to the average monthly values of the period 1961-1990.

Temperature

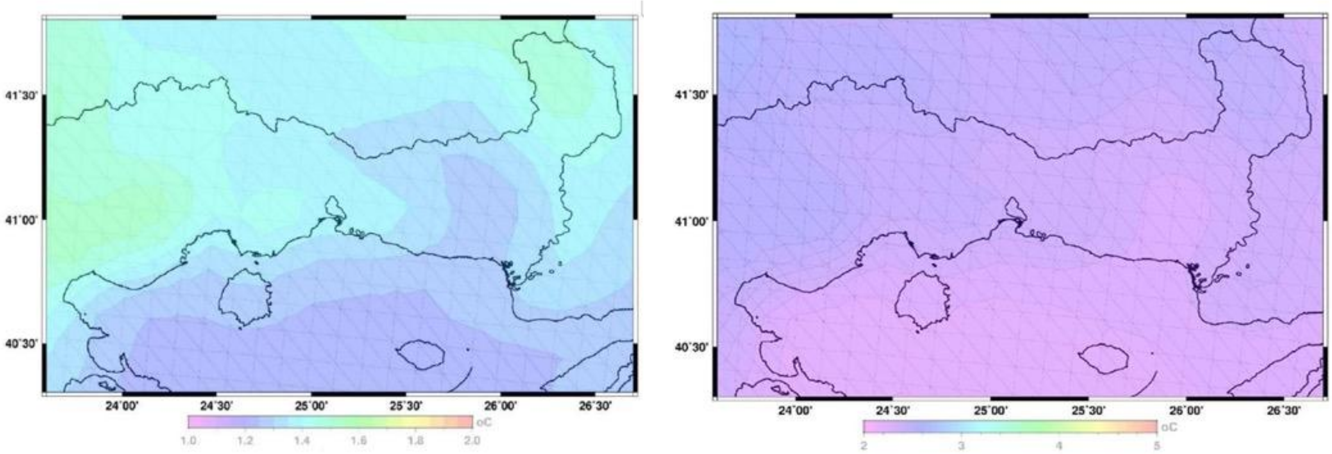
The climate simulations based on both (2) Scenarios of evolution of APT concentrations, RCP4.5 and RCP8.5, show as a general result the increase of the average air temperature throughout the region of Eastern Macedonia - Thrace in the future climate compared to the historical climate. In both (2) Scenarios the temperature increase is greater in the continental areas that are far from the influence of the sea. The largest increases are expected in the Regional Unit of Drama and in the northern areas of the Regional Unit of Evros, while smaller ones are expected in Thassos and the regions of Kavala and Rodopi. The following Table summarizes the average values and standard deviations of air temperature at 2m (°C) per Regional Unit (RU) of the Region of Eastern Macedonia and Thrace for the periods 1961-1990, 2021-2050 and 2071-2100.

Table 8–7: Average values and standard deviations of air temperature per RU for the periods 2021-2050 and 1961-1990, 2071-2100 and 1961-1990

Regional Unit	1961 – 1990		2021 - 2050				2071 - 2100			
			RCP4.5		RCP8.5		RCP4.5		RCP8.5	
Evros	10,99	±0,85	12,36	±0,85	12,79	±0,84	13,36	±0,84	15,31	±0,83
Thassos	13,44	±0,10	14,74	±0,08	15,12	±0,08	15,72	±0,08	17,30	±0,05
Rhodopi	10,42	±1,32	11,75	±1,34	12,18	±1,33	12,77	±1,33	14,63	±1,29
Xanthi	9,66	±2,02	11,04	±2,04	11,47	±2,02	12,06	±2,02	13,94	±1,96
Kavala	10,94	±1,43	12,35	±1,43	12,75	±1,42	13,35	±1,42	15,19	±1,35
Drama	7,27	±1,87	8,72	±1,89	9,14	±1,89	9,77	±1,87	11,77	±1,87

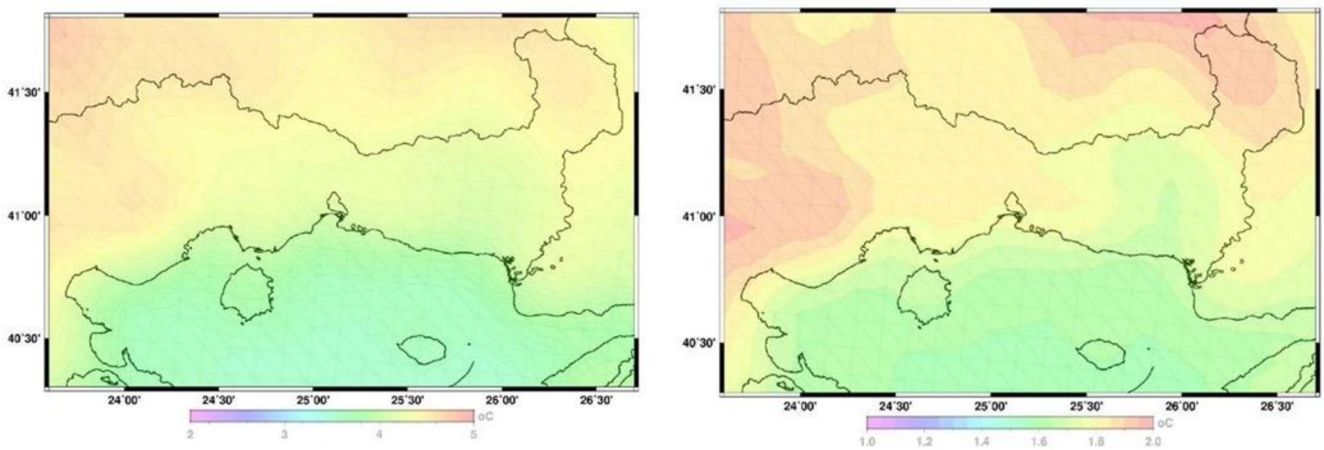
(Source: Regional Climate Change Adaptation Plan (RCAP) of Eastern Macedonia and Thrace, 2023)

Based on the RCP4.5 Scenario, in the period 2021-2050, the temperature is expected to increase in the Region by 1.2-1.6 oC and by 2.1-2.6 oC in the period 2071-2100 compared to the historical climate of the period 1961-1990 (Figure 8-15). Accordingly, based on the unfavorable RCP8.5 Scenario, the temperature is estimated to be higher by 3.5-4.5 oC in the period 2021-2050 and by 1.8-2.0oC in the period 2071-2100 compared to the period 1961-1990 (Figure 8-16).



(Source: Regional Climate Change Adaptation Plan (RCAP) of Eastern Macedonia and Thrace, 2023)

Figure 8–15: Average annual temperature – change (°C) between the periods 2021-2050 and 1961-1990 (left), 2071-2100 and 1961-1990 (right) for the RCP4.5 Scenario



(Source: Regional Climate Change Adaptation Plan (RCAP) of Eastern Macedonia and Thrace, 2023)

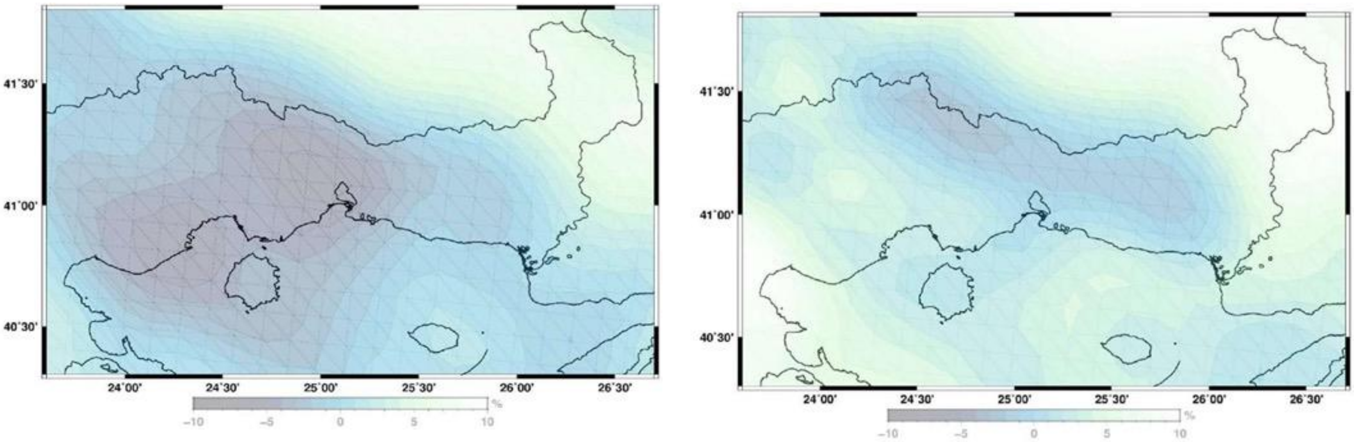
Figure 8–16: Average annual temperature – change (°C) between the periods 2021-2050 and 1961-1990 (left), 2071-2100 and 1961-1990 (right) for the RCP8.5 Scenario

Precipitation

Based on the results of climate simulations, the total precipitation that falls during the year is expected to decrease at the Regional level for both Scenarios of evolution of AtTH concentrations, especially towards the end of the century. The reduction in annual precipitation is expected to be significant in the RCP8.5 Scenario and milder in the RCP4.5 Scenario. The largest reductions in precipitation are predicted in both Scenarios in the areas of Xanthi and Kavala and subsequently in the areas of Drama and Thassos, while milder reductions are expected in the Rodopi region. In the Evros region, only in the case of the RCP8.5 Scenario for the period 2071-2100 are reductions in total precipitation expected on an annual basis.

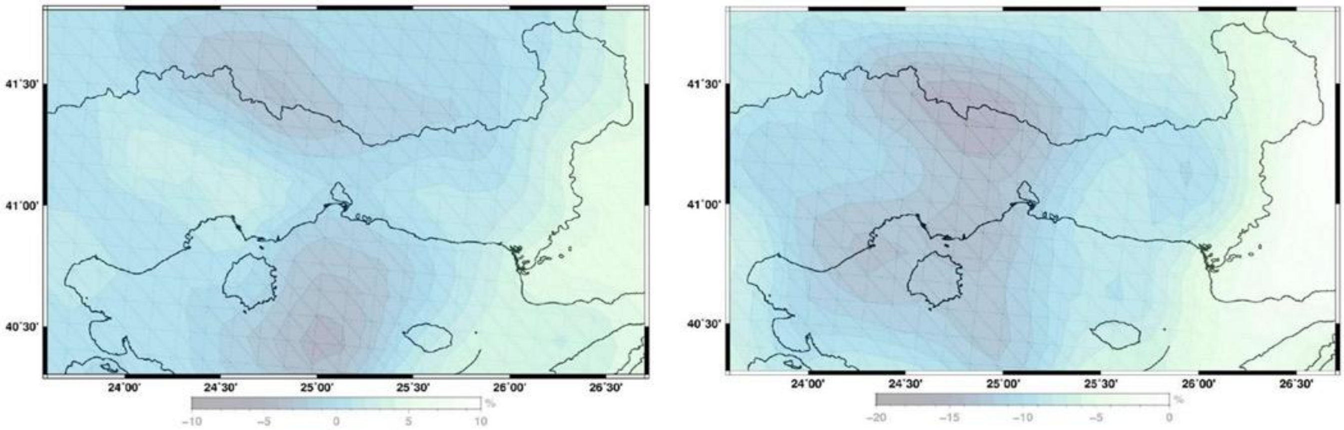
In the case of the mild RCP4.5 Scenario, a decrease in annual precipitation is predicted in most of the Region in both periods (2021-2050 and 2071-2100) compared to the historical climate of the period 1961-1990 with the exception of the northern areas of Evros. The decrease in the period 2021-2050 is of the order of 5% in the areas of Xanthi and Kavala and 2% - 4% in Thassos, Drama and Rodopi, while an increase of the order of 3.4% is predicted in Evros. In the case of the unfavorable RCP8.5 Scenario, no significant changes are expected in the period 2021-2050, the total precipitation in the period 2071-2100 is expected to decrease significantly in almost the entire Region. The expected reductions will exceed 11% in the Regional Units of Xanthi, Kavala, Drama and the region of Thassos, while in the region of Rodopi and Evros they will be smaller and will range around 10% and 6% respectively.

The following Figures present the change in annual and average annual precipitation between the periods 2021-2050 and 1961-1990, 2071-2100 and 1961-1990 according to the results of climate simulations for the RCP4.5 and RCP8.5 Scenarios.



(Source: Regional Climate Change Adaptation Plan (RCAP) of Eastern Macedonia and Thrace, 2023)

Figure 8–17: Change in average annual precipitation between the periods 2021-2050 and 1961-1990 (left), 2071-2100 and 1961-1990 (right) for the RCP4.5 Scenario



(Source: Regional Climate Change Adaptation Plan (RCAP) of Eastern Macedonia and Thrace, 2023)

Figure 8–18: Change in average annual precipitation between the periods 2021-2050 and 1961-1990 (left), 2071-2100 and 1961-1990 (right) for the RCP8.5 Scenario

On a seasonal basis in both periods and for both Scenarios, the largest decrease in precipitation both in percentage terms and in absolute numbers compared to the historical climate is expected in the autumn in all Regional Units, while an increase is expected in the winter months. Significant percentage decreases compared to the historical climate of the period 1961-1990 are expected in the RCP8.5 Scenario and in the summer months, which, however, due to the low amount of precipitation during this period, are not expected to be significant in absolute terms. The following Table presents the percentage change in total seasonal and annual precipitation (mm/year) per Regional Unit for the periods 2021-2050 and 2071-2100 with the period 1961-1990 according to the results of the climate simulations for the RCP4.5 and RCP8.5 Scenarios.

Table 8–8: Change in total seasonal and annual precipitation (mm/year) by Regional Unit for the RCP4.5 and RCP8.5 scenarios

Regional unit	Season	2021 - 2050		2071 - 2100	
		RCP4.5	RCP8.5	RCP4.5	RCP8.5
Drama	Winter	8.4%	23.7%	9.7%	4.5%
	Spring	6.0%	-0.8%	10.2%	-10.5%
	Summer	-1.4%	1.7%	2.2%	-15.4%
	Autumn	-25.9%	-24.8%	-20.1%	-28.2%
	Year	-2.6%	0.3%	-2.6%	-11.4%
Evros	Winter	23.4%	26.6%	13.0%	10.1%
	Spring	4.4%	0.9%	17.3%	0.2%
	Summer	1.5%	13.5%	0.2%	-11.5%
	Autumn	-18.8%	-24.6%	-13.2%	-27.8%
	Year	3.4%	2.7%	3.4%	-5.9%
Thasos	Winter	10.0%	21.4%	9.5%	2.7%
	Spring	11.2%	3.6%	16.7%	-7.1%
	Summer	-4.6%	28.1%	20.0%	-16.9%
	Autumn	-30.4%	-30.4%	-21.9%	-33.1%

Regional unit	Season	2021 - 2050		2071 - 2100	
		RCP4.5	RCP8.5	RCP4.5	RCP8.5
	Year	-3.8%	-0.2%	-3.8%	-12.7%
Ξάνθης	Winter	12.8%	25.3%	10.4%	6.8%
	Spring	4.3%	-0.7%	10.7%	-12.7%
	Summer	-3.4%	3.7%	0.6%	-19.6%
	Autumn	-35.2%	-31.1%	-25.8%	-34.9%
	Year	-5.0%	-0.8%	-5.0%	-13.5%
Καβάλας	Winter	9.3%	24.5%	11.5%	4.3%
	Spring	7.6%	3.8%	13.2%	-9.6%
	Summer	-4.9%	10.5%	7.5%	-16.5%
	Autumn	-32.9%	-29.2%	-20.1%	-33.2%
	Year	-4.9%	1.4%	-4.9%	-12.5%
Ροδόπης	Winter	21.4%	26.6%	11.1%	10.7%
	Spring	0.4%	-2.6%	8.1%	-9.9%
	Summer	-2.1%	8.8%	-1.1%	-19.2%
	Autumn	-30.8%	-29.8%	-22.9%	-30.2%
	Year	-1.9%	0.0%	-1.9%	-9.6%

(Source: Regional Climate Change Adaptation Plan (RCAP) of Eastern Macedonia and Thrace, 2023)

Snowfall

Based on the results of the climate simulations, significant reductions in snowfall are expected in the two Scenarios examined. According to the mild RCP4.5 Scenario, percentage reductions of 20-36% compared to the historical climate are expected in all Regional Units in the period 2021-2050, and reductions of 30-47% in the period 2071-2100. The reductions are even greater in the case of the RCP8.5 Scenario, where in the period 2021-2050 they are expected to range between 20-38% compared to the historical climate, which at the end of the century (2071-2100) are expected to rise to 56-72%. The largest reductions in snowfall in absolute terms are expected in the mountainous areas of Drama and Xanthi, that is, in the areas where the most snowfall is historically recorded at the regional level.

The following Table summarizes the changes in average annual snowfall per Regional Unit for the periods 2021-2050 and 2071-2100 with the period 1961-1990, as derived from the results of climate simulations for the RCP4.5 and RCP8.5 Scenarios and presented in the Regional Climate Change Adaptation Plan of Eastern Macedonia and Thrace (2023).

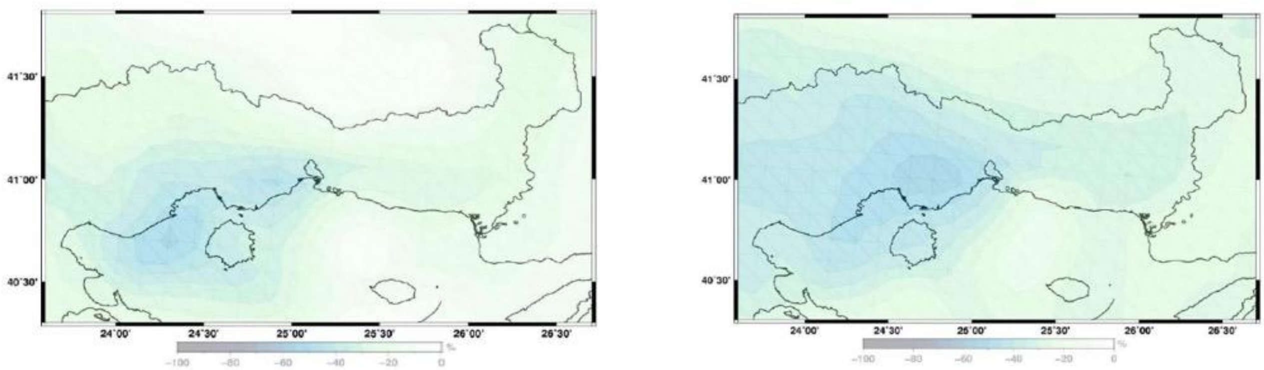
Table 8–9: Change in mean annual snowfall between the periods 2021-2050 and 1961-1990 (left), 2071-2100 and 1961-1990 (right) for the RCP4.5 and RCP8.5 Scenarios

Regional Unit	1961 – 1990		2021 - 2050				2071 - 2100			
			RCP4.5		RCP8.5		RCP4.5		RCP8.5	
Evros	73.3	±32.8	581	±27.6	57.9	±25.3	51.8	±22.5	32.1	±13.9
Thassos	31.4	±2.5	202	±2.1	22.6	±1.9	18.5	±1.8	10.7	±1.4
Rhodopi	66.9	±42.2	549	±38.6	49.1	±33.6	45.3	±29.7	27.6	±18.3

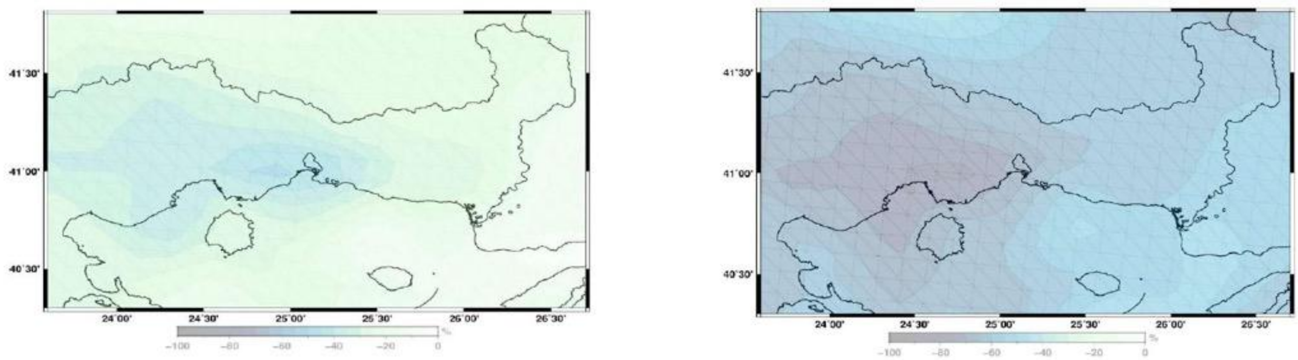
Regional Unit	1961 – 1990		2021 - 2050				2071 - 2100			
			RCP4.5		RCP8.5		RCP4.5		RCP8.5	
Xanthi	91.7	±62.8	728	±55.7	61.6	±45.7	56.3	±41.7	32.6	±25.1
Kavala	51.1	±19.1	329	±15.5	31.9	±12.6	27.1	±10.8	14.3	±6.4
Drama	151.6	±83.6	1189	±70.6	103.7	±62.6	93.9	±56.1	52.8	±34.9

(Source: Regional Climate Change Adaptation Plan (RCAP) of Eastern Macedonia and Thrace, 2023)

The following Figures present the changes in average annual snowfall per Regional Unit for the periods 2021-2050 and 2071-2100 with the period 1961-1990, as derived from the results of climate simulations for the RCP4.5 and RCP8.5 Scenarios.



(Source: Regional Climate Change Adaptation Plan (RCAP) of Eastern Macedonia and Thrace, 2023)Figure 8–19: Change in average annual snowfall between the periods 2021-2050 and 1961-1990 (left), 2071-2100 and 1961-1990 (right) for the RCP4.5 Scenario



(Source: Regional Climate Change Adaptation Plan (RCAP) of Eastern Macedonia and Thrace, 2023)

Figure 8–20: Change in average annual snowfall between the periods 2021-2050 and 1961-1990 (left), 2071-2100 and 1961-1990 (right) for the RCP4.5 Scenario

Rise of sea level

Throughout the 21st century, sea and ocean temperatures are projected to increase, particularly near the surface, for all atmospheric GHG concentration scenarios, with the largest increases in tropical and subtropical regions (Stocker et al., 2013). Global mean sea surface temperature is projected to increase by 1°C in the 2081-2100 period compared to 1986-2005 under the mild RCP 2.6 scenario and by more than 3°C under the adverse RCP8.5 scenario (Collins et al., 2013). According to the results of the CMIP5 simulations included in the IPCC 5th Assessment Report on climate change and in combination with simulation models of the dynamic evolution of the mass of large volumes, it is estimated that at the end of the century the global mean sea level will increase in the period 2081-2100 compared to the average value of the period 1986-2005 by an average of:

- 40 cm in the RCP2.6 scenario,
- 48 cm in the RCP4.5 and RCP6.0 scenarios
- 63 cm in the RCP8.5 scenario

The temporal evolution of the rise in the global mean sea level for the 2 scenarios examined in the PESPKA of the Region of Eastern Macedonia and Thrace (RCP4.5 and RCP8.5) is presented in the following Table for the individual years 2020, 2050 and 2080 and the periods 2021-2050 and 2081-2100 compared to the year 2000.

Table 8–10: Estimated rise (average and range) of global mean sea level in cm for the years 2020, 2050, 2080 and the periods 2021-2050 since 2000.

Scenario	2020	2021-2050	2050	2080	2081-2100	2100
RCP4.5	7 +/- 2	15 +/- 3	23 +/- 4	40 +/- 8	48 +/-14	54 +/- 17
RCP8.5	7 +/- 2	15 +/- 4	25 +/- 6	50 +/- 13	63 +/- 18	74 +/- 24

(Source: Regional Climate Change Adaptation Plan (RCAP) of Eastern Macedonia and Thrace, 2023)

For the period 2020-2050 the difference between the two (2) scenarios is negligible and results in a rise of the order of 23-25 cm since 2000, with a maximum value of 31 cm in the unfavorable RCP8.5 scenario. Towards the end of the century the differences between the two scenarios are significant and result in an average rise of 54 cm in the mild RCP4.5 scenario and 74 cm in the unfavorable RCP8.5 scenario, with a maximum range of 98 cm in 2100.

The following Table lists the coastal areas of medium and high vulnerability to Sea Level Rise (SLRS) according to the Climate Change Impact Report by the Research and Analysis Organization “Dianeosis” (2017).

Table 8–11: Coastal Areas of Medium and High Vulnerability to Sea Level Rise (SLR)

Regional unit	Degree of Tourism Development	Coastal Areas of Medium Vulnerability	Coastal Areas of High Vulnerability to the Mediterranean Sea
Region of Eastern Macedonia & Thrace	A1.Developed tourist areas	-	-
	A2.Developing tourist areas	Alexandroupolis Municipality (Alexandroupolis Municipality) Maroneia-Sapon Municipality Nestos Municipality (Keramoti Municipality, Chrysoupolis Municipality) Pangaeos Municipality	Municipality of Alexandroupolis (Municipality of Traianoupolis, Municipality of Feron) Municipality of Topeiros

(Source: Regional Climate Change Adaptation Plan (RCAP) of Eastern Macedonia and Thrace, 2023)

Wind speed

The average wind speed at the Region level is not expected to change significantly in both Scenarios of evolution of GHG concentrations throughout the Region. In the RCP4.5 Scenario, a small increase in the average annual wind speed of up to 3% maximum in the period 2021-2050 and up to 4% maximum in the period 2071-2100 is expected in most of the Region with the exception of the Evros and Rhodope regions. In the RCP8.5 Scenario, a small increase of up to 5% maximum in the period 2021-2050 in most of the Region is expected, while in the period 2071-2100 a small decrease of around 1% is expected in most of the Region with the exception of the northern continental areas.

The average wind speed based on the RCP4.5 Scenario for the time period 2031-2060 and 2071-2100 is presented in the following Figure.

(Source: Regional Climate Change Adaptation Plan (RCAP) of Eastern Macedonia and Thrace, 2023)

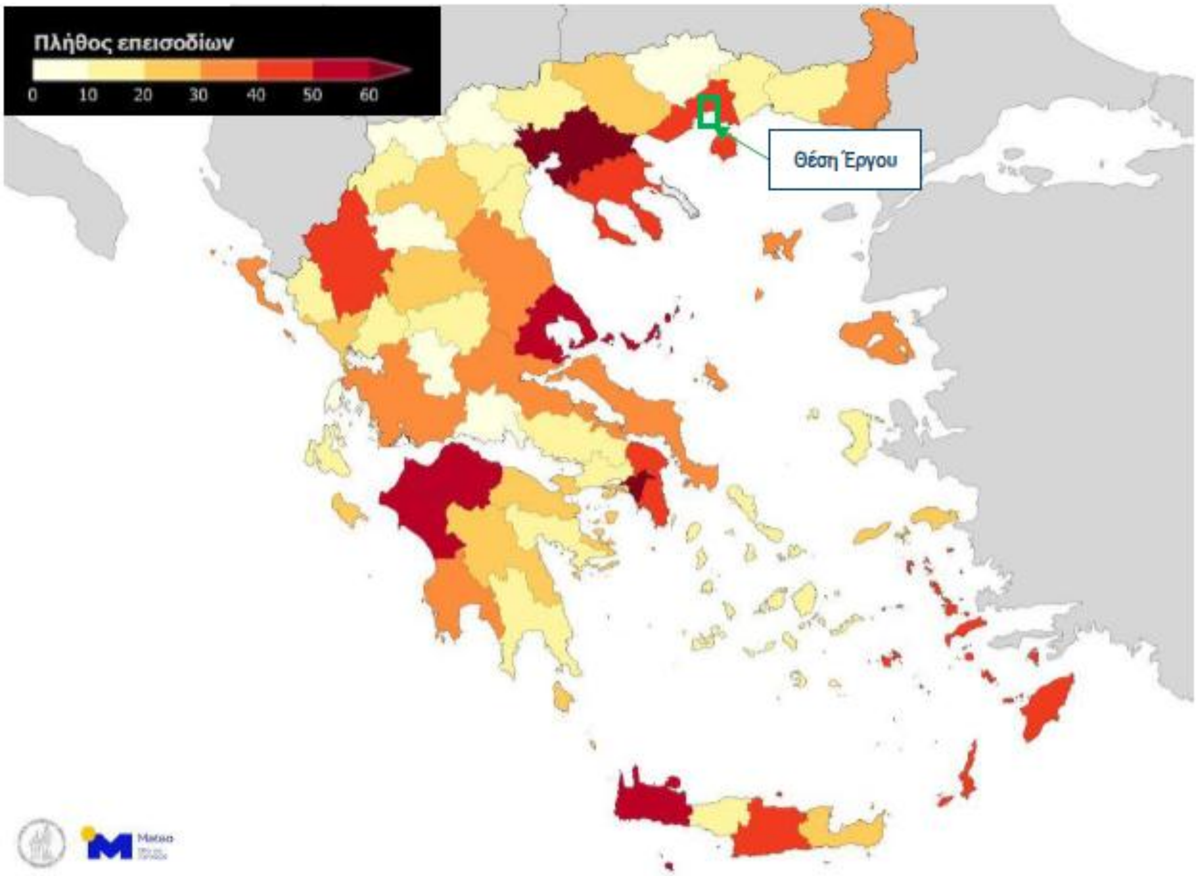
Figure 8–21: Average wind speed for the years 2031-2060 (m/sec)

(Source: Regional Climate Change Adaptation Plan (RCAP) of Eastern Macedonia and Thrace, 2023)

Figure 8–22: Average wind speed for the years 2071-2100 (m/sec)

8.2.4.2 Extreme Weather Phenomena

Over the last 20 years, the frequency and intensity of extreme weather events at national and regional levels have increased significantly due to climate change. According to the report of the National Observatory of Athens (NAO, 2023) on weather events with socio-economic impacts in Greece in the period 2000 - 2023, a total of 580 cases of weather events with negative socio-economic impacts and more were recorded. Extreme weather events resulted in 285 human losses, which were mainly caused by floods, lightning and windstorms. The following Figure presents the number of weather events per Regional Unit.



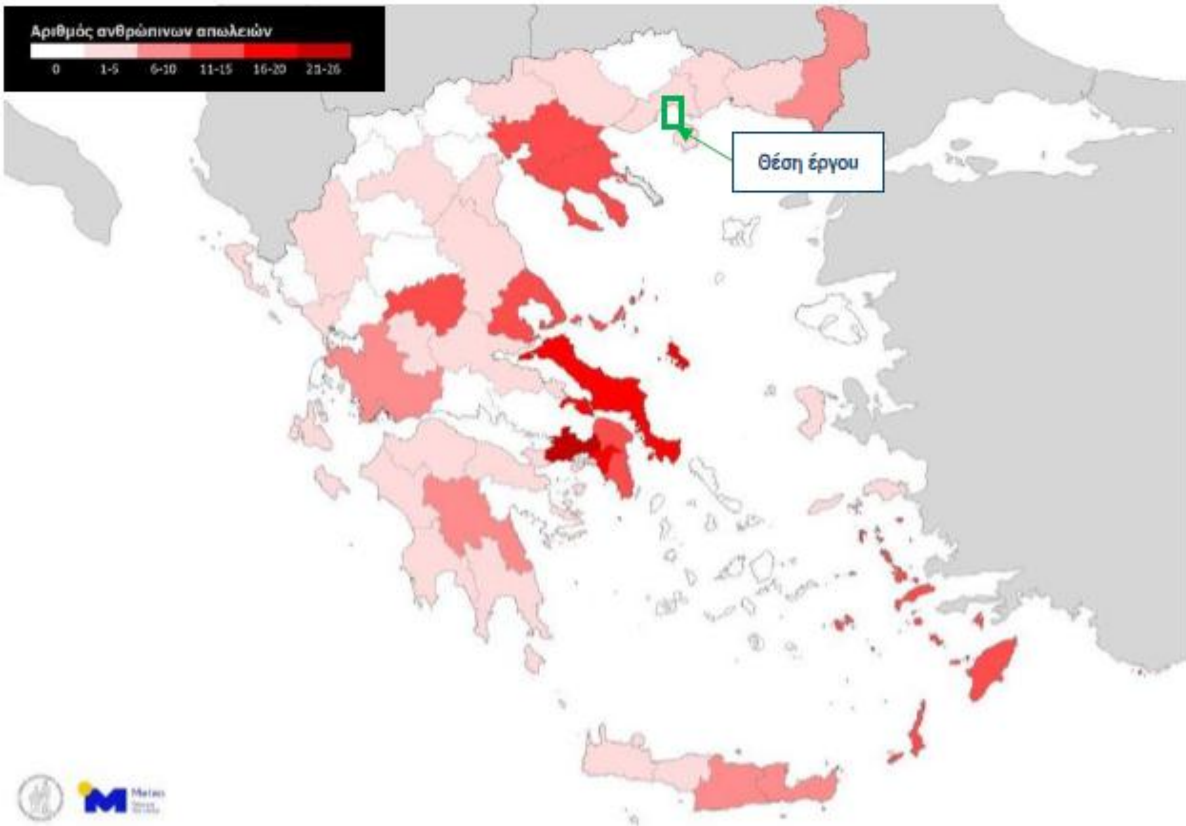
(Source: Meteo, National Meteorological Service, https://www.meteo.gr/article_view.cfm?entryID=3065, 06 June

2024)

Figure 8–23: Geographical distribution of the number of weather events per prefecture in the period 2000-2023

35% of the 580 incidents caused serious socio-economic impacts falling under category 3, which represents events that have either seriously affected a large part of the country or caused loss of life. The increase in events in the second twelve-year period 2000-2023 reached 70%. In the first twelve-year period, 215 weather events were recorded and in the second 365. The increase in serious events in the second twelve-year period was also significant, with the rate reaching 44%. Serious events also had serious impacts. The percentage of deaths from weather phenomena increased in the second twelve-year period by 77% compared to the first, with the number of deaths reaching 182, compared to the first twelve-year period when 103 were recorded. The largest number of incidents occurred in 2014, while the largest number of human losses was located in the Prefectures of Attica and Evia.

The following Figure presents the geographical distribution of human losses from weather phenomena by Regional Unit.



(Source: Meteo, National Meteorological Service, https://www.meteo.gr/article_view.cfm?entryID=3065, 06 June

2024)

Figure 8–24: Geographical distribution of human losses from weather phenomena by Regional Unit

According to the above, the Kavala Regional Administrative Region presents a high frequency of extreme weather events with 40-50 recorded episodes in the period 2000-2023, while the number of human casualties ranges between one (1) and five (5). The following Figure presents the weather events that have been recorded to date in the wider Project area.

(Source: Meteo, National Meteorological Service, https://meteo.gr/weatherEvents.cfm, June 18, 2024)

Figure 8–25: Weather events with social and economic impacts in the wider study area of the Project

According to the Meteo service of the National Observatory of Athens (NAO, 2024), up to the present time for 2024 ten (10) significant weather and climate events have occurred, which, however, were not recorded in the wider Project area.

8.3 MORPHOLOGICAL AND TOPOLOGICAL CHARACTERISTICS

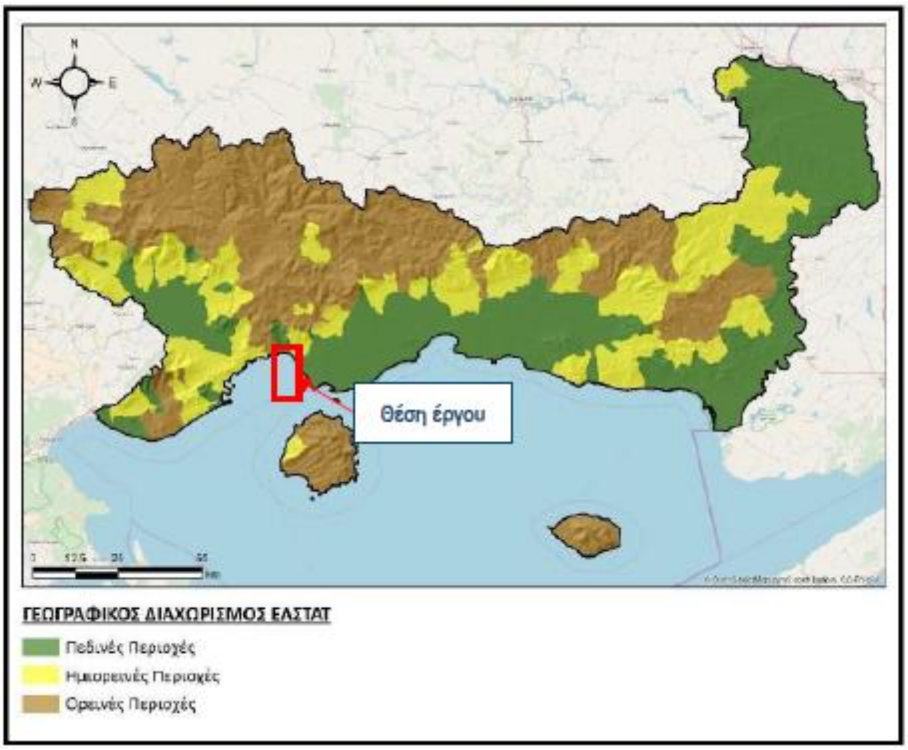
In order to better describe them, the topographic and morphological characteristics of the area under consideration are distinguished into Terrestrial and Marine.

It is noted that the concept of morphological characteristics at sea and at a great distance from the coast, can only be understood as bottom morphology (described in the next Paragraph), while possible topographic elevations are due to fixed installations, such as the existing platforms for the extraction and processing of extracted hydrocarbons.

8.3.1 Morphological and Topographical Characteristics in the Terrestrial Environment

8.3.1.1 Morphological Characteristics

The Region of Eastern Macedonia and Thrace (REMTH) is morphologically characterized by intense heterogeneity with a multitude of mountainous areas, coastal areas, rivers, wetlands and plains, with the total area characterized by 34% as mountainous, 26% as semi-mountainous and 40% as lowland as shown in the following Figure (ELSTAT, 2011). In particular, the territory of the Kavala RE is divided into mountainous 55%, semi-mountainous 24% and lowland 21%. The ends of the mountain ranges of Eastern Macedonia extend within its territory, such as Pangaio (1,956m), Symvolo (694m) and the Lekanis Mountains (1,298 m) (INSETE,2019).

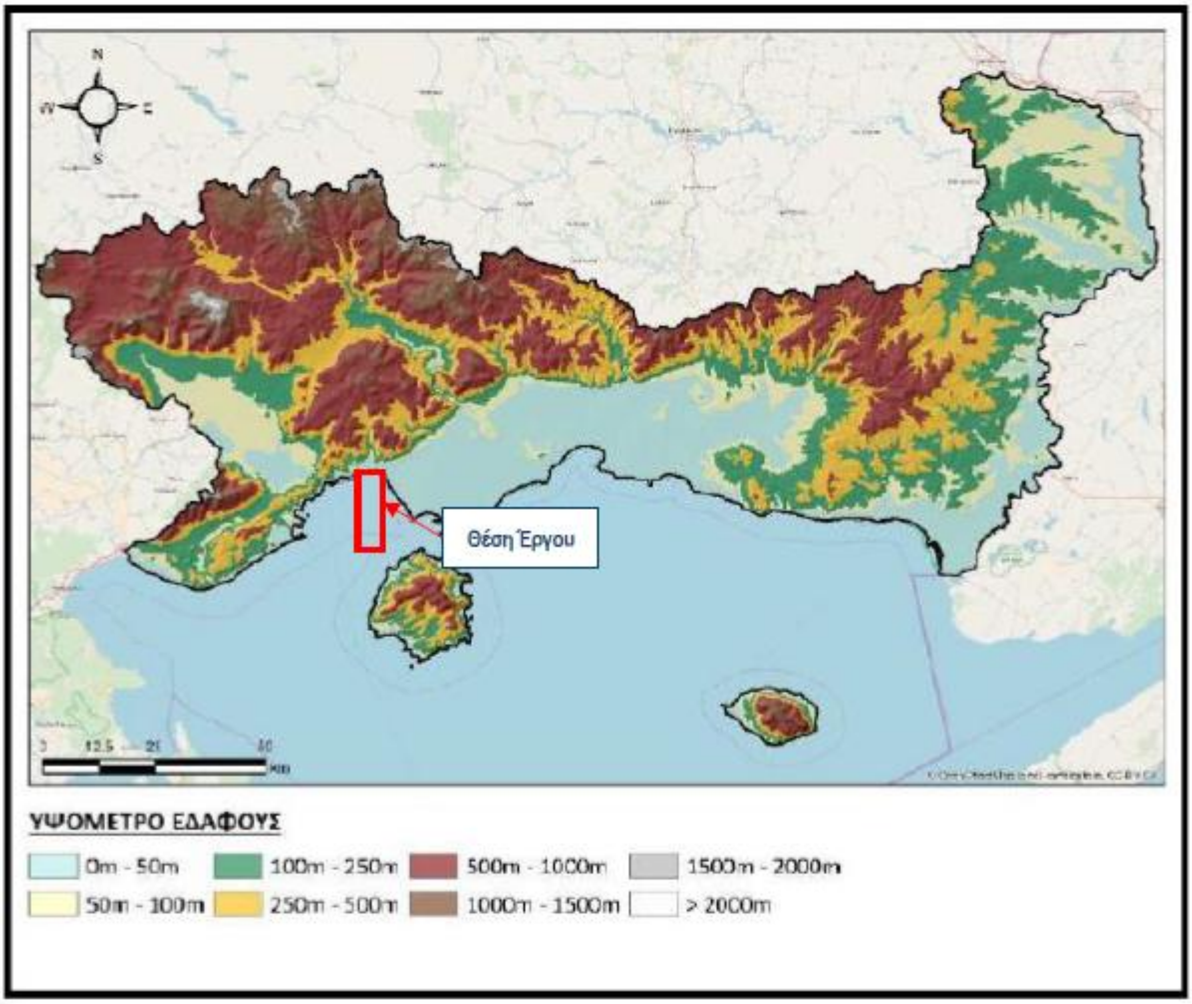


(Source: Regional Climate Change Adaptation PlanRegion of Eastern Macedonia and Thrace, September 2023)

Figure 8–26: **Characterization of the areas of RU EMT based on altitude**

The Thrace Water District (EL12) is defined to the north by the Greek-Bulgarian border line and the hydrocrit of the Nestos-Ochyros basins, to the east by the Greek-Turkish border line to the Gulf of Aenos, to the west by the hydrocrit of the Nestos-Ochyros, Nestos-Strimon, Nestos-Nea Karvalis stream basins and the hydrocrit of the coastal streams of Chrysoupoli to the Gulf of Kavala.

More specifically, in terms of morphology, the Orvilos-Vrontous-Menoiki mountain range can be seen in the western part of Drama Prefecture, inland and up to the Nestos River, Mount Falakro dominates, while further east from Nestos is the Rhodope mountain range. In the Kavala Regional Authority, the mountain ranges: Pangaio (1,956m), Symvolo (694m) and the Lekanis Mountains (1,298m) extend, while in Thassos there is Mount Ypsario (1,127m). The geomorphology and mountain ranges of the Region, depending on altitude, are presented in the following Figure.



(Source: Regional Climate Change Adaptation Plan Region of Eastern Macedonia and Thrace, September 2023)

Figure 8–27: Variation in ground elevation of Region of Eastern Macedonia and Thrace

In the wider area of the Thrace Water District, to which the Project's land facilities belong, three morphological zones are identified, according to the EIA of the 2nd Revision of the River Basin Management Plan for EL12.

• Morphological zone of the mountain mass: The mountainous part of the Thrace water district is dominated by the great Rhodope mountain range, which occupies the northern part of the area, with the highest peak Gyftokastro (1,827 m), in the Koula mountain range, on the border with Bulgaria. To the east, the mountain range gradually lowers to the boundaries of the Rhodope prefecture, from where the Eastern Rhodope begins, with the Papikio peak (1,483 m). The Koula mountain range forms the peaks of Haidou (1,525 m), Achlat Tsal (1,400 m) in the western part of Thrace, and ends abruptly in the Xanthi-Komotini plain.

• Morphological zone of areas with hilly relief: Morphologically, this zone is characterized by hilly relief with undulating to hilly slopes and is found mainly east of its basin (Abdira upland) but also on the edges of the mountain mass.

• Morphological plain zone: The zone includes the Xanthi-Komotini plain and the Vistonida basin that dominates the central part of the plain, the Nestos and Evros deltas. The Nestos delta area is characterized by small elevations (Toxotes area, maximum height 40m).

The distribution of elevations in the Thrace Regional Administrative Region is as follows: 21.89% of the area of the department has an altitude above 600 m, 30.15% between 200 and 600 m, and 49.77% has an altitude below 200 m. The terrain slopes in the Thrace Regional Administrative Region are as follows: 44.78% of the area of the department is characterized by flat terrain with slopes of 0-5%, 13.33% of the area of the department is characterized by undulating terrain with slopes of 5-10%, 27.88% of the area of the department is characterized by hilly terrain with slopes of 10-30%, and 15.82% of the area of the department is characterized by sloping terrain with slopes >30%. The distribution of elevations and the slopes of the relief are presented in the following Tables.

Table 8–12: Ground elevation of Thrace Regional Administrative Region

Altitude	Relief characterization	% area
0-200	Plain	49,77
200-600	Semi-mountainous	30,15
>600	Mountainous	21,89

(Source: Strategic Environmental Impact Assessment (SEIA), 2nd Revision of the RBMP for the 12th Thrace Region)

Table 8–13: Soil slopes of Thrace Regional Authority

Altitude	Relief characterization	% area
0-5%	Επίπεδο	44,78
5-10%	Κυματώδες	13,33
10-30%	Λοφώδες	27,88
>30%	Επικλινές	15,82

(Source: Strategic Environmental Impact Assessment (SEIA), 2nd Revision of the RBMP for the 12th Thrace Region)

(Source: Land surface slope map (Territory) – Ministry of Environment, 2019)

Figure 8–28: Land surface slope map with the location of the Project's onshore facilities

The lowland parts of the Region occupy significant areas and are separated from each other either by hilly sections or by mountainous areas, as follows:

Plain – semi-mountainous part of Orestiada

> It is located at the northernmost tip of Thrace, crossed by the Arda and Evros rivers and constitutes an important cultivable area.

Southern suburban section

> It is located east and south of the prefecture of Evros and includes a lowland zone along the Evros River, from Soufli to Peplos, while it is also integrated with the extensive Evros Delta. It also includes, to the west, the lowland parts of the hydrological basins of the Irini and Loutro streams and the small coastal plain to the east of Nea Makri.

Plain – semi-arid part of the Vistonida basin

It includes the lowland parts of Xanthi - Komotini and Sapponi, which are drained by the streams Kosynthos, Kompsatos, Aspropotamos, Vosvozi and Lisso.

Lowland part of the Nestos Delta basin

It includes the lowland part of the Nestos and Laspopotamus deltas, forming a single section.

Plain section of Drama – Philippi

It is located in the great tectonic depression of Drama and is surrounded by the mountains of Falakro, Menoikio, Pangaio, Symvolo and Lekanis. It is drained by the Aggitis River and the artificial moat of Philippi, where their waters are channeled into the Strymon River basin.

The most important rivers of the Thrace Water District, to which the Project's onshore facilities belong, are the Nestos and the Evros. These rivers are also transboundary rivers of the Thrace Water District, the waters of which Greece shares with Bulgaria (Nestos and Evros) and Turkey (Evros). Important tributaries of the Evros and also at the Thrace Water District level are the Ardas and the Erythropotamos, also transboundary rivers. Secondary rivers of the Thrace Region are the P. Lissos or Filiouris, the P. Kosynthos (Xanthi River) and the P. Kompsatos (often referred to as Xiropotamos due to its inscription as such on the maps of the Army Geographical Service (GYS) – in fact, Xiropotamos is the main tributary of the Kompsatos that passes through Thermes).

The Thrace Region includes only one natural lake, Lake Ismaris (or Mitrikou), while a significant number of reservoirs are located in it. The most important reservoirs are those of Thesavros and Platanovrissi on the Nestos River, which supply corresponding hydroelectric projects of the PPC.

The morphology of the coastal zone of the immediate study area is characterized by extensive sandy beaches with lakes, lagoons and strips of land. The Nestos River Delta is dominant in terms of morphology and topology. The lagoons closest to the project under consideration are those of Eratinos and Vasova. Rainwater forms many torrents towards the plain. The water from these torrents, which in the past formed marshes in the low-lying areas of the plain, reaches the sea through drainage channels. The plain, in large part, consists of light, sandy soil with a low water retention capacity. Regarding human intervention in the topographical and morphological characteristics of the wider area, it should be noted that the projects with the most significant impact are the Kavala airport, to the east of the land facilities, and the road projects (Egnatia Motorway and the Kavala - Xanthi National Road), the alignment of which is located to the north of the facilities.

8.3.1.2 Topographical Characteristics

8.3.1.2.1 Landscapes of Outstanding Natural Beauty

Landscape is an important component of the environment and the surrounding area of the population, whether it is considered ordinary or of outstanding beauty, according to the European Convention for Landscape. The Convention has been incorporated into Greek law by Law 3827/2010 (Government Gazette 30/A'/25.2.2010) and its objectives include promoting the protection and management of landscape and cultural heritage, as well as cooperation between Member States.

Furthermore, the current Greek landscape legislation includes Law 1465/1950, which supplements Law 5351/1932 and provides for the designation of Landscapes of Outstanding Natural Beauty (LNB) by the Ministry of Culture (YPPO).

Landscapes of Outstanding Natural Beauty are areas of great aesthetic and cultural value, which contribute to the protection and efficiency of natural resources due to their special natural or anthropogenic characteristics. These areas include traditional settlements, archaeological sites, monuments, as well as areas of environmental interest.

Furthermore, Law 3937/2011 "Conservation of biodiversity and other provisions" (Government Gazette 60/A'/31.03.2011) provides for the protection of remarkable landscapes, which include aesthetic forests, peri-urban forests, geoparks, wild landscapes, rural landscapes and urban landscapes, protected natural monuments and the Declared Landscapes of Outstanding Natural Beauty (TIFK) of Law 1465/1950.

Within the framework of the research project "Creation of a data bank for Greek Nature" of the National Technical University of Athens (NTUA), and in collaboration with the scientific team of the "CORINE Biotopes" project, a database of the most important areas of the Greek territory from the point of view of the value of Nature, including natural landscapes, was created, the FILOTIS database.

Within the study area, there are no declared Landscapes of Outstanding Natural Beauty (LNA) or Protected Natural Monuments.

According to the FILOTIS database, the closest Landscape of Outstanding Natural Beauty to the study area is the Aesthetic Forest of Amygaleonas, Kavala (with code AT4011109) as it was established as an aesthetic forest with Government Gazette 606/D/1979 and amended with Government Gazette 437/D/1981 (following Figure).

(Source: «FILOTIS» database», https://filotis.itia.ntua.gr/, 14/6/2024)

Figure 8–29: Landscape of Outstanding Natural Beauty (LNB)

8.3.1.2.2 Landscapes of the Eastern Macedonia & Thrace Region's Regional Landscape Area

According to the Revised Regional Landscape Strategy of the Region of Eastern Macedonia and Thrace, in Article 16 "Landscape Strategy Directions", landscapes are categorized into four zones: the landscape zones of International Value (IW), National Value (NV) and Regional Value (RV), as well as the zones of highly degraded landscapes (HDL).

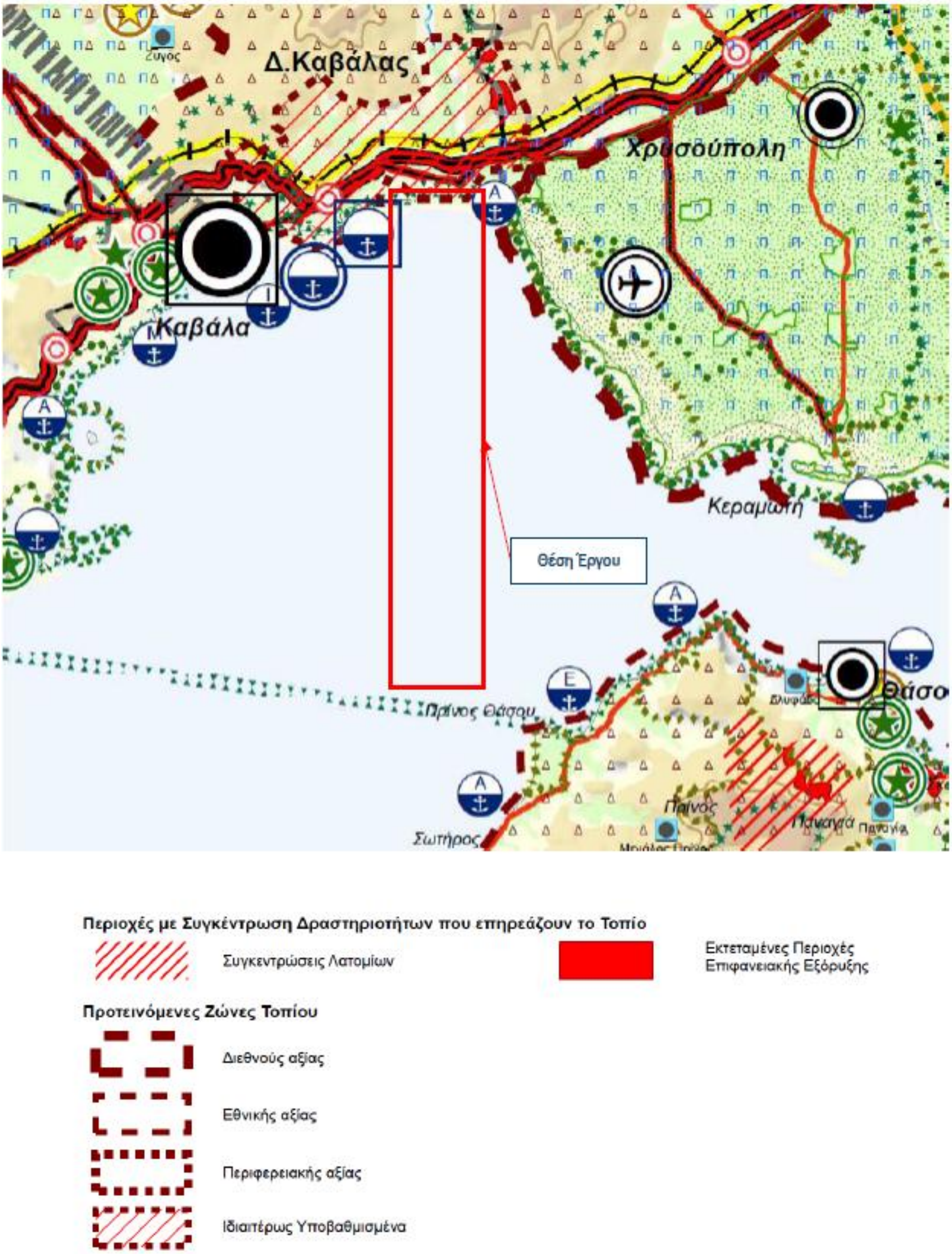
In order to optimally compare the remarkable landscapes of the Region, individual areas were created within the Special Unit for Landscape of the Revised Regional Landscape Strategy, which have the general characteristics that define a specific and special character as well as clear geographical boundaries. The following Table presents the landscape zones located in the Region and characterized / evaluated based on their value as International, National or Regional value or as Particularly Degraded, according to the Revised LPA of the Region of Eastern Macedonia and Thrace.

Table 8–14: Special landscape zones identified in the EMT

Landscape categories based on their value	
Of international value	Drama-Kavala Zone: Philippi Nestos Zone: Nestos Delta Evros Zone: Evros Delta Samothrace Zone: Samothrace
Of national value	Nestos Zone: Nestos Strait Rhodopi-Evros Zone: Maronia-Zone Thassos Zone: Thassos
Regional value	Nestos Zone: Thesavros and Platanovrissi Dams Rhodopi Mountain Range Zone: Rhodope Mountain Settlements Xanthi-Komotini Plain Zone: Porto Lagos, Lake Vistonida, lakes and lagoons and lakeside settlements
Particularly degraded	Drama-Kavala Zone: Egnatia (Kavala section)

(Source: Revised Regional Development Plan of the Region of Eastern Macedonia and Thrace)

According to Map P2.d of the Assessment and Review of the Spatial Planning and Sustainable Development Framework of the Region of Eastern Macedonia and Thrace for Landscape, the area of the Project's land installations is included in a zone of Particularly Degraded Landscape (PD), as shown in the following Figure.



(Source: Revised Regional Development Plan of the Region of Eastern Macedonia & Thrace)

Figure 8–30: Special landscape zones in the area of the Project's onshore facilities

Furthermore, as can be seen from the above Figure, near the Project's offshore facilities, there is a Zone of International Value (ZIV), the Nestos Zone, as well as Thassos, which is a Zone of National Value (ZIV).

8.3.1.2.3 8.3.1.2.3 Areas Related to the European Landscape Convention, which was ratified by Law 3827/2010 (A' 30)

The European Landscape Convention, also known as the Florence Convention, as ratified by the Greek State with Law 3827/2010 "Ratification of the European Landscape Convention" (Government Gazette 30/A/25.10.2010), aims to promote the protection of landscapes, their management and planning and to organize European cooperation on landscape issues.

According to the European Landscape Convention, each state must legally recognize landscapes as an indispensable component of the human environment, as an expression of the diversity of their common cultural and natural heritage, and as a foundation of their identity and to establish and implement landscape policies aimed at the protection, management and planning of landscapes.

Closer to the offshore facilities of the Project, based on the Regional Spatial Planning Framework of the Region of Eastern Macedonia and Thrace, the International Value Zone "Nestos Zone: Nestos Delta" is located. However, it is noted that all the facilities (onshore and offshore) of the proposed project are located outside the boundaries of this Landscape Zone.

For this special International Value zone, the following guidelines are given:

- As a priority, activate the planning tools for a unified approach to the zones inside and outside the park, the definition of tourist development zones as well as measures to limit construction.
- Integrate environmental practices into agriculture.
- Preservation of zones on the edges of habitats where there are failures in terms of creating productive agricultural areas and livestock farming is developed.
- Development of greenhouses in specific zones and development of hedges between them to avoid the creation of extensive areas with greenhouses.
- Connection with other remarkable landscapes through the proposed "Arc of wetlands and archaeological sites".

8.3.1.2.4 Topographical elevations related to the Project

Within the terrestrial study area, there are no topographic elevations related to the Project.

8.3.1.2.5 Elements of Landscape Importance and Vulnerability

Important factors that must be taken into account and that concern the installation of the Project under study are the dominant elements of the landscape, the variable factors (atmospheric conditions, distance, observer position, etc.), as well as the visual vulnerability and the absorptive capacity of the landscape.

Visual vulnerability refers to the extent to which the various human actions are visible within the landscape. Disturbances in higher parts of a landscape are more visible than those occurring in lower positions. On the contrary, any disturbance is much less visible in low positions, although the details of the intervention are more distinct, because the observation distance tends to become shorter. However, there is the possibility of covering the disturbances by vegetation and geomorphic formations (Chatzistathis and Ispikoudis 1995).

The visual absorptive capacity of the landscape is the relative, natural ability of a landscape to accept organized development or management activities and still maintain its visual character and the integrity of its view quality. The factors that influence this ability of the land or landscape to absorb modifications are slope, vegetation, observation distance, soil, landscape diversity and human activities (Hatzistathis and Ispikoudis 1995).

In the case of the Project under study, its distance from residential areas is satisfactory (the onshore facilities are approximately 2 km from Nea Karvali), in order to avoid negative impacts due to visual nuisance and noise.

8.3.1.2.6 Landscape of the Project Location Area

The landscape of the Project's terrestrial area is shaped by a set of characteristic elements, which are mainly the result of human presence and land uses (industrial landscape) in addition to natural factors (topographic relief, water, gentle vegetation).

The morphology of the soil, both of the location of the Project's terrestrial facilities and of the wider area, is characterized by areas of permanently irrigated land and cultivable areas at low altitude. The smooth relief of the soil allows the development of agriculture and crops such as sunflower.

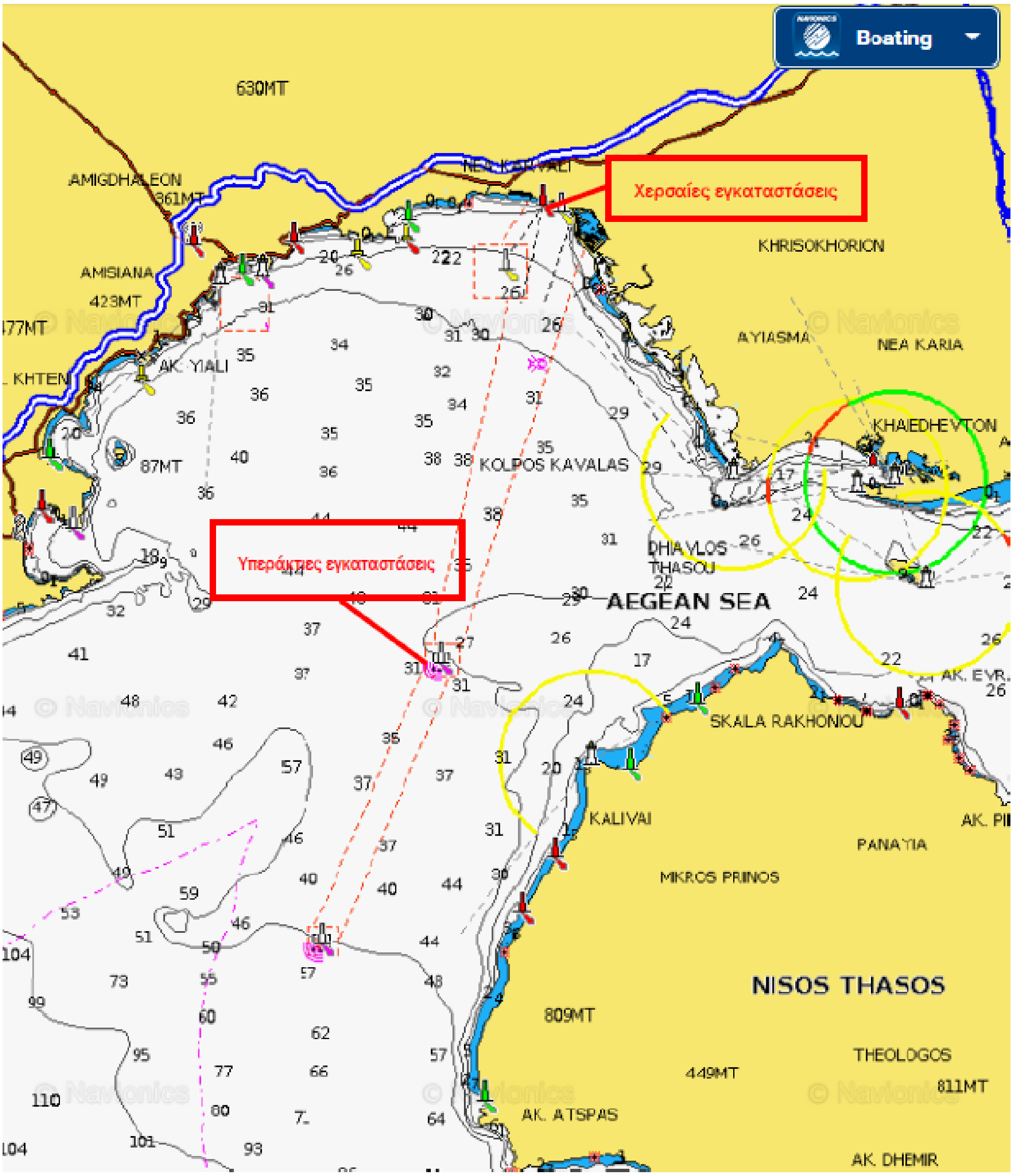
The image of the landscape is completed by the industrial zone in which the Project's terrestrial facilities are included, making the stamp of human presence and commercial activity noticeable.

Taking the above into account, the landscape of the study area can be characterized as moderately remarkable and interesting in terms of its aesthetic quality.

8.3.2 Morphological and Topographical Characteristics in the Marine Environment

8.3.2.1 Bathymetry in the Gulf of Kavala

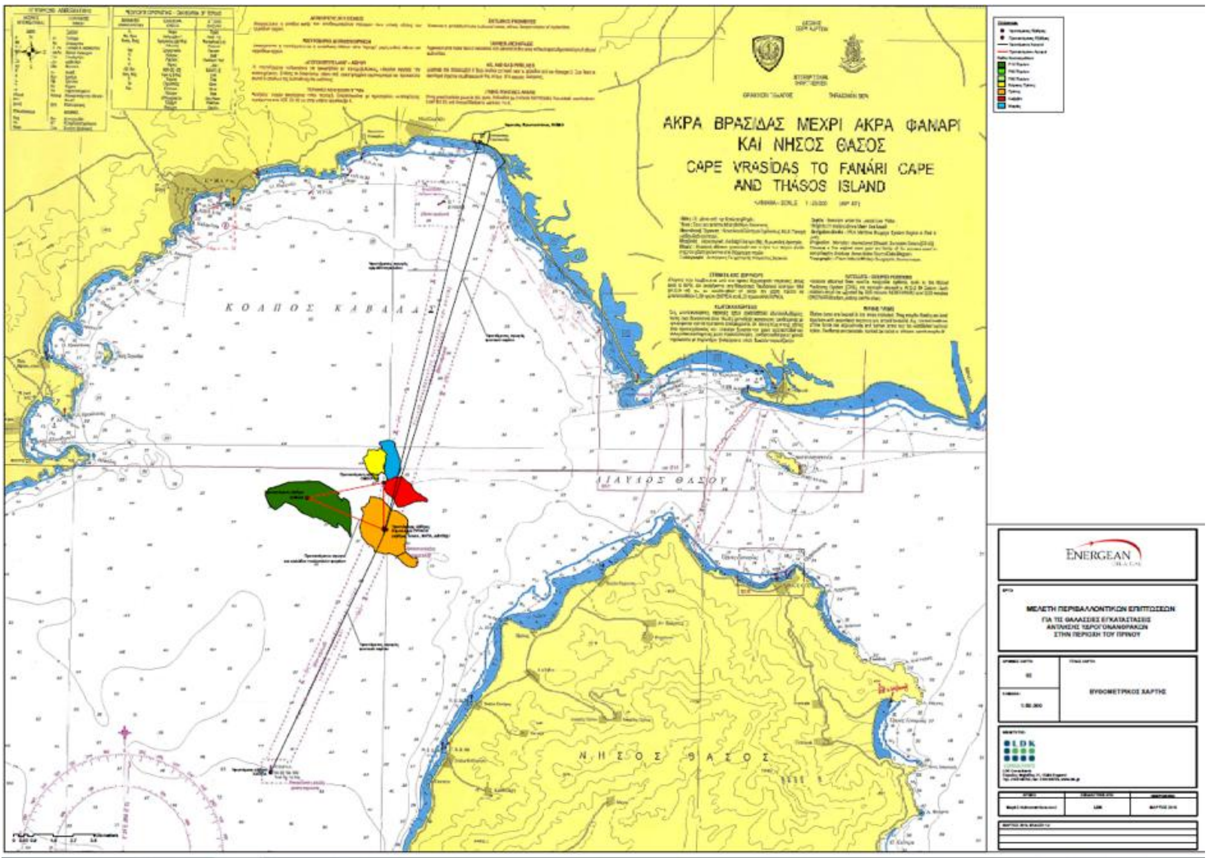
The average depth of the Gulf of Kavala is estimated at approximately 32 m, with a maximum depth of approximately 60 m in the basin west of Thassos. The Gulf communicates with the rest of the sea to the east through the Thassos Strait, 7.3 nautical miles wide, and to the southwest through the Thassos Basin, 20 nautical miles wide (Sylaios et.al, 2005). The bathymetry in the Gulf of Kavala and the Project area is schematically presented in the following Figure.



(Source: Navionics, https://webapp.navionics.com, 10-6-2024)

Figure 8–31: Bathymetric map of the Gulf of Kavala

According to the Bathymetric Map of the Army Geographical Service (AGS) (Figure 8-32) the depths in the wider area of the existing platforms range between 28-49 m (Table 8-15). The bathymetry of the area is constantly changing due to the sediments transported by the small rivers as well as by the main river formation which is the Nestos and its estuaries.



(Source: Bathymetric Map of the Gulf of Kavala, GIS, March 2016)

Figure 8–32: Bathymetric map of the Gulf of Kavala

Table 8–15: Bathymetry at existing and future platforms in the wider project area

Platform	Bathymetry (m)
Beta	28,60424
Alpha	28,60424
Delta	28,60424
Kappa	49,05974
Omicron*	32,55613
Lamda*	36,33371

** future platforms, part of the licensed expansion of the Prinos offshore facilities, are not part of the CO2 storage project under consideration*

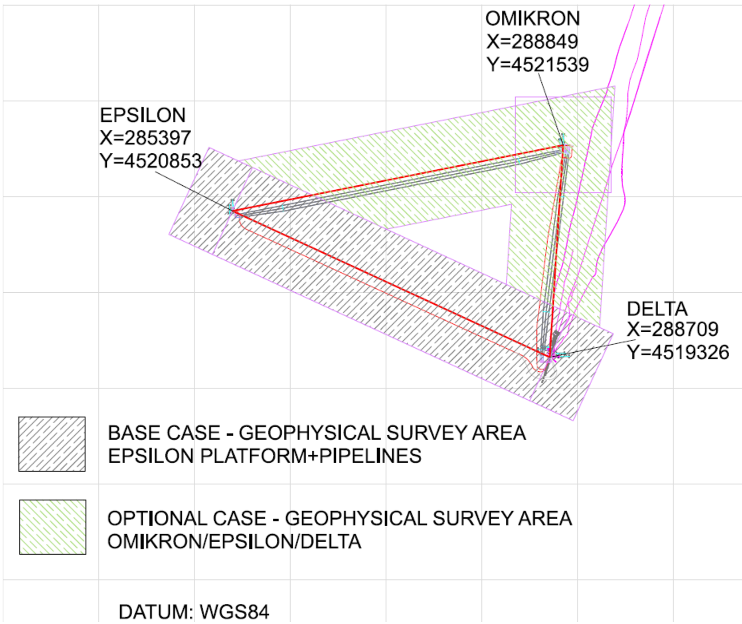
8.3.2.2 Geophysical Characteristics in the Wider Project Area

In the context of the Environmental and Social Impact Assessment (ESIA) for the “Prinos Offshore Development Project”, an additional geophysical study was carried out in March 2016, which provides comprehensive mapping of the seabed surface and subsoil (up to 100 m). The main objective of the study was to map the seabed and analyze shallow seabed stratigraphy through the processing and interpretation of multiple geophysical data collected from the Delta – Epsilon/Lambda-Omicron complex in the Prinos field in the Gulf of Kavala.

The main field activities carried out and related to the seabed morphology are:

- Detailed Bathymetric Study (Multiple and Single Beam Echo Sounders) to determine the water depth and seabed contours.
- Side scan sonar study (detailed imaging of the seabed surface to identify objects/obstacles/gas escape craters at the platform and pipeline locations).

The geophysical study area is presented in the Figure below.



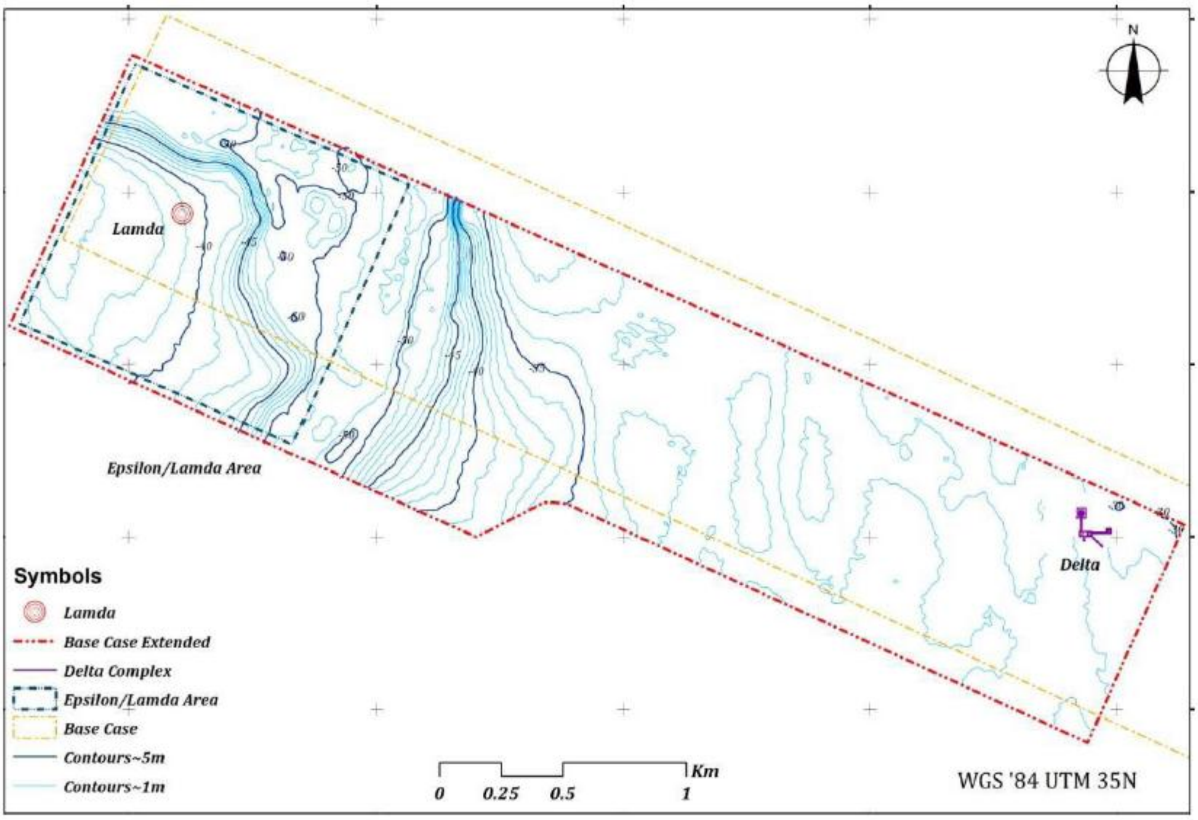
(Source: Preliminary study of the seabed of the Gulf of Kavala, Laboratory of Marine Geology and Physical Oceanography, Department of Geology, University of Patras, 2015)

Figure 8–33: Geophysical survey area

The results of the Geophysical and Geotechnical Study related to the morphology of the seabed are briefly presented below.

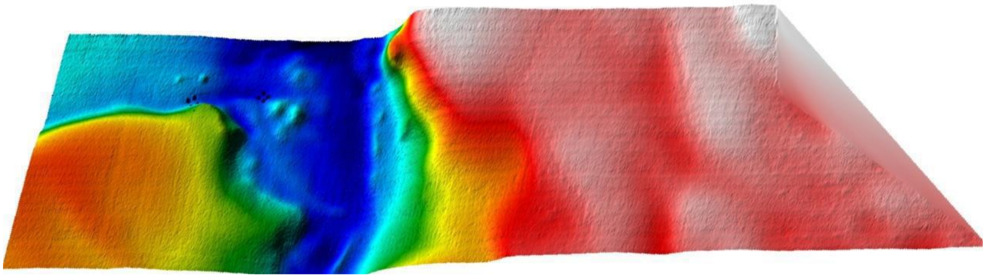
Detailed Bathymetric Study

The sea depth in the geophysical study area (Figure 8-33) ranges between 30 and 52m (Figure 8-34). The area can be divided into three parts based on bathymetry. The eastern part (the area between the Delta complex and the central part of the Research Area) is a bathymetrically high plateau and is characterized by a smooth bottom, which deepens smoothly from 30 m water depth in the Delta complex to 34 m water depth in the central part of the Research Area (dip <1o). The western part (including the Epsilon/Lamda platform area) is also a bathymetrically high plateau (37-41 m water depth), which deepens smoothly towards the east and north (dip ≈1o). The two bathymetrically high plateaus are separated by a deep section (50-52m water depth), which forms a channel, running roughly north-south. In the area between the channel and the western plateau, the seabed deepens with a low slope to the west (2o – 4o) and a moderate slope to the north (3o – 9o). The seabed between the eastern section and the channel is characterized by low slopes to the south and moderate to high slopes (up to 13o) to the north.



(Source: Preliminary study of the seabed of the Gulf of Kavala, Laboratory of Marine Geology and Physical Oceanography, Department of Geology, University of Patras, 2015)

Figure 8–34: Bathymetric map of the research area

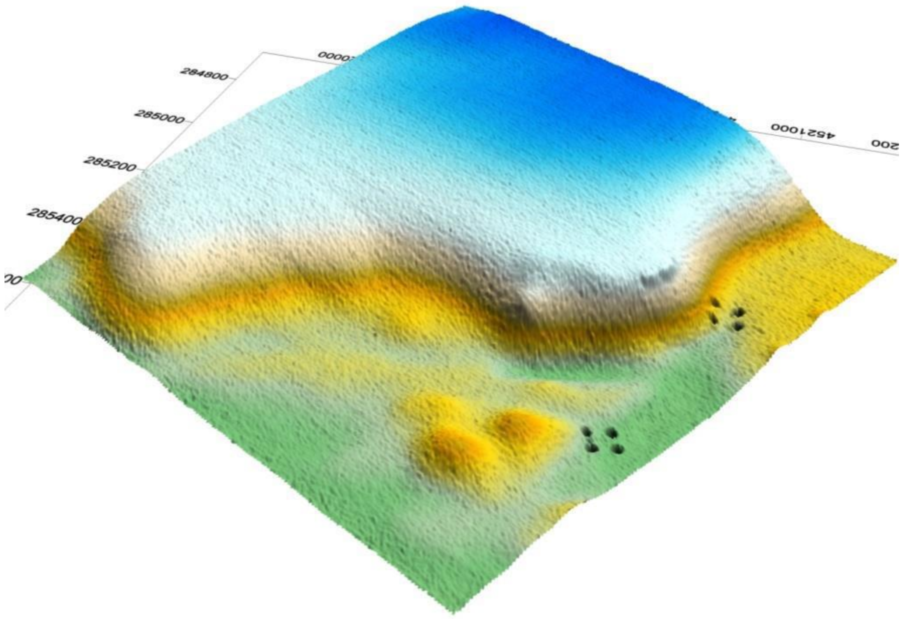


(Source: Preliminary study of the seabed of the Gulf of Kavala, Laboratory of Marine Geology and Physical Oceanography, Department of Geology, University of Patras, 2015)

Figure 8–35: 3D visualization of the research area (excluding the Delta complex area)

The bathymetry of the Epsilon/Lamda platform area is characterized by a plateau on the western side, with water depths ranging from 37 to 41 m, and a channel (deeper part) in the eastern and northern parts of the area. The gradient between these two morphological units is low to moderate in the southern part and moderate in the northern part.

In the northern part of the area, within the deeper part, eight small-scale circular depressions were recorded, approximately 25 m in diameter and 1.5 m deep. The location of the depressions forms two rectangles. These depressions have probably been formed by the weight of the legs of the two old drilling platforms. The identification of the drill tracks is a good indication that the bottom movement in the area is minimal (Figure 8-36).

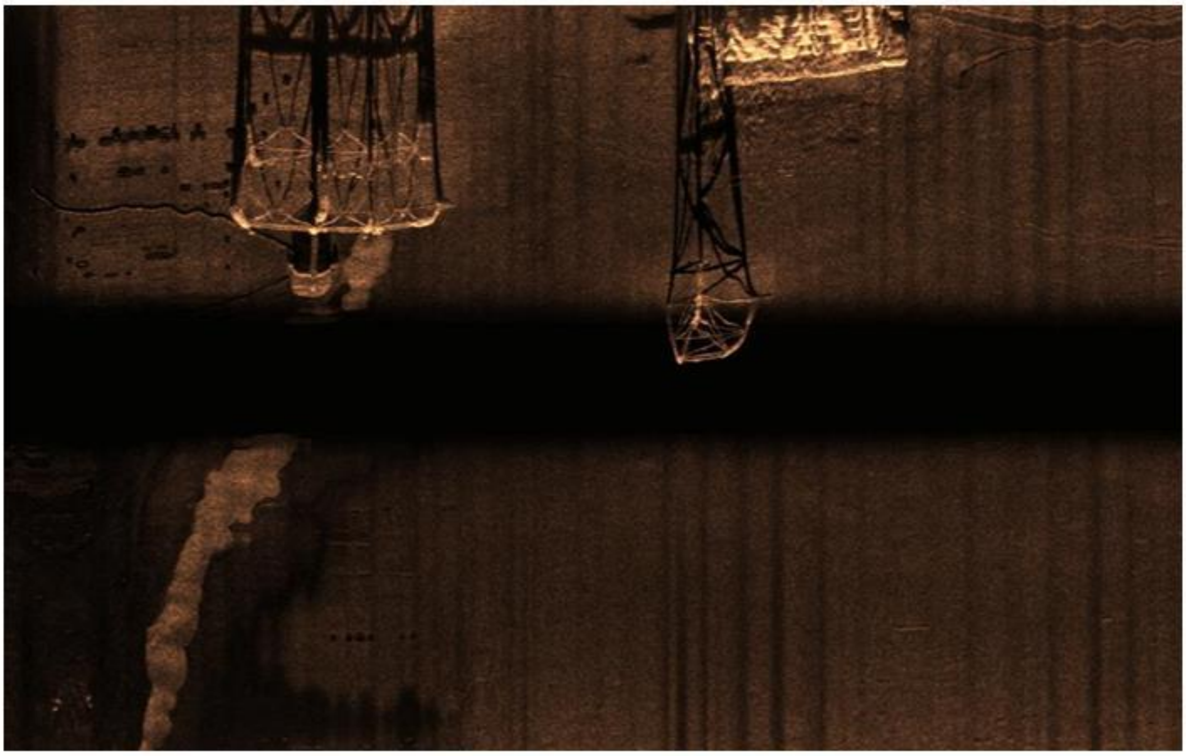


(Source: Preliminary study of the seabed of the Gulf of Kavala, Laboratory of Marine Geology and Physical Oceanography, Department of Geology, University of Patras, 2015)

Figure 8–36: 3D rendering of the Epsilon/Lamda rig area. Also shown are the depressions formed by the weight of the two old drilling rigs

Side Scan Transducer Study

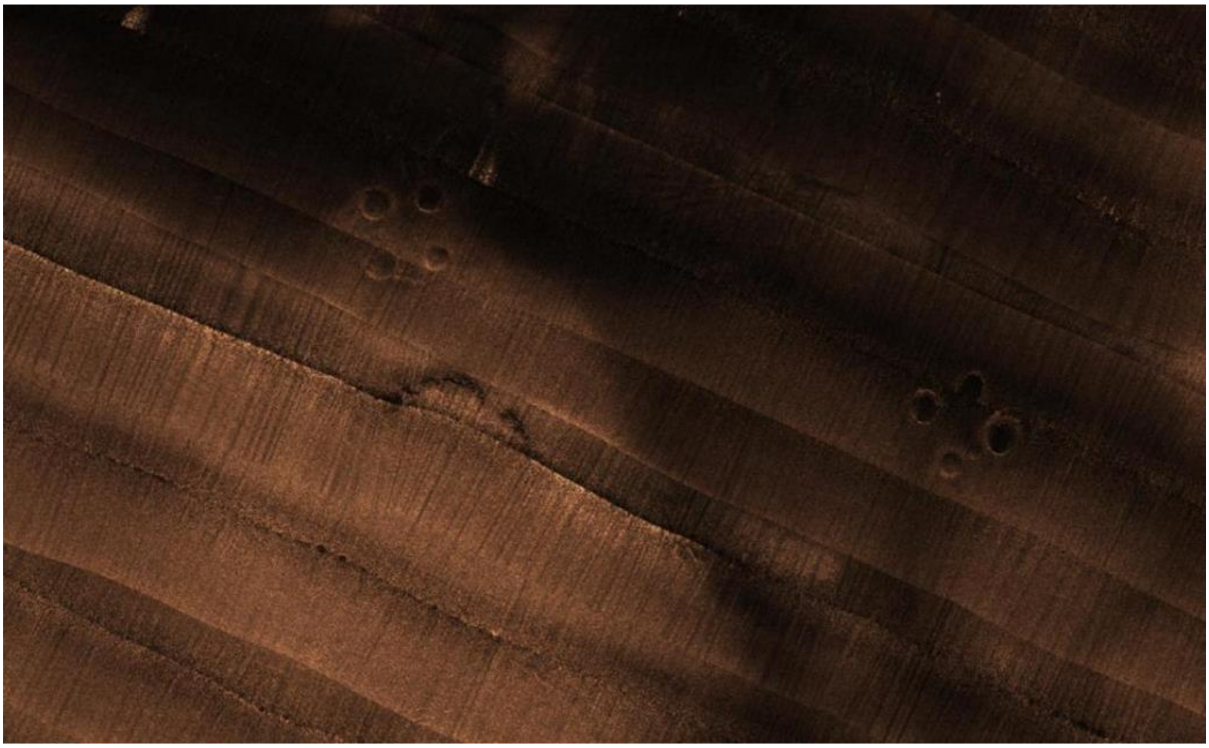
The side-scan sonar image does not show any significant seabed features or anomalies along the pipeline route and the location of the Lambda platform. There is also no evidence of gas vents or seabed craters. As expected, a narrow, engineered rock embankment covering the existing Delta to Kapa pipeline was identified, running in a North/South direction from the south side of the DELTA platform, as shown in the Figure below.



(Source: Preliminary study of the seabed of the Gulf of Kavala, Laboratory of Marine Geology and Physical Oceanography, Department of Geology, University of Patras, 2015)

Figure 8–37: **Seabed soils in the Gulf of Kavala**

The side scan sonar identified the geographic location of the previous drill holes (E1 and E2). This is a good indication that bottom movement is minimal in the area, given that the drilling rig was present at this location almost 15 years ago, as shown in the Figure below.



(Source: Preliminary study of the seabed of the Gulf of Kavala, Laboratory of Marine Geology and Physical Oceanography, Department of Geology, University of Patras, 2015)

Figure 8–38: **Seabed in the Gulf of Kavala**

8.3.2.3 Topographical elevations related to the Project

Topographical features of the marine study area include existing fixed offshore installations, such as platforms for the extraction and processing of extracted hydrocarbons.

8.4 GEOLOGICAL, SOIL AND TECTONIC CHARACTERISTICS

This Section records the geological characteristics of the terrestrial and marine environments of the wider study area, as well as the soil characteristics and tectonic elements of the area.

8.4.1 Geological Features in the Terrestrial Environment

The Regional Unit of Kavala is located in the geotectonic zone of Rhodope and is part of the tectonic depressions of the Tertiary period of Nestos and Vistonida.

Regarding the sedimentary rocks - that is, the series of sediments, it should be noted that the stratigraphic classification of these (which make up the entire wider area south of the mountainous zone, at great depth) from the surface of the base of the basins to the current surface, is as follows:

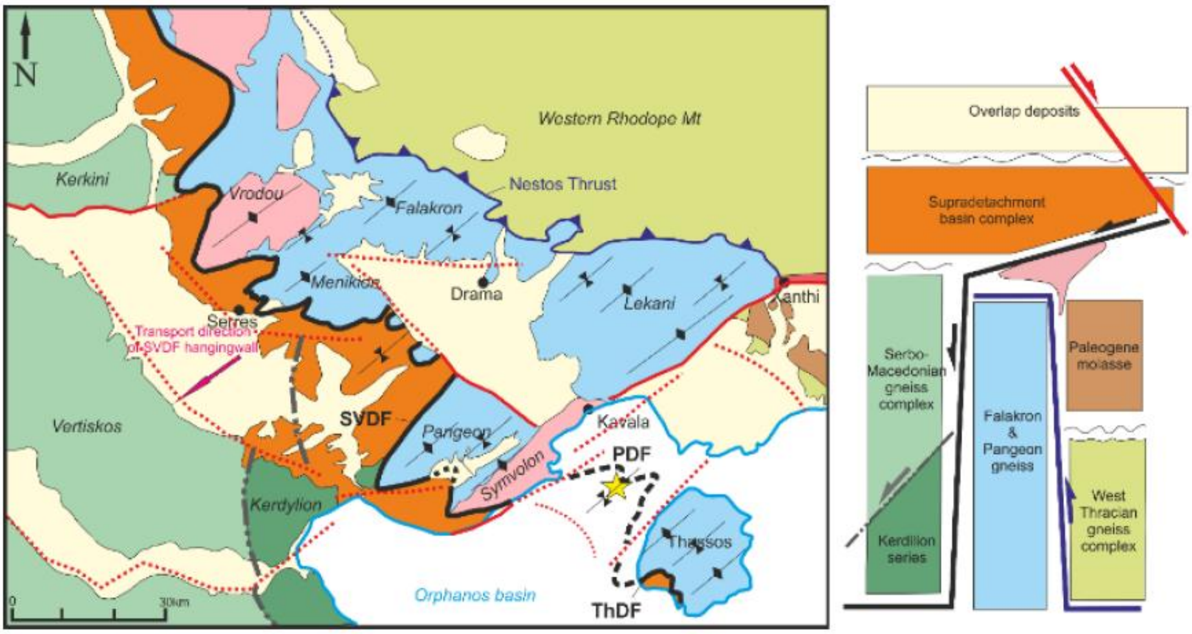
- Paleogene sediments: They constitute the majority of the hill ranges in the west and southwest of the Vistonida basin, being also the hydrocrit of the adjacent Nestos basin. At the same time, they are also found on the surface of this eastern area, southwest of the city of Komotini. At the base of this system, lithic rocks and gravel were found, while subsequently there is discontinuous (in the form of lenticular intercalations) nummulitic limestone. The Paleogene sedimentary series follows, which usually appears as layers of conglomerates, sandstone, marl and argillaceous shale. These formations, with regard to spring waters, are of very limited interest.

- Neogene sediments: This system constitutes the first sedimentary series for most of the Nestos basin. In many areas these Neogene sediments cannot be distinguished from those of the Plio-Quaternary periods, due to their common origin (river torrents) and their common character. A characteristic of Neogene sediments is the lack of development of clear and regular horizons, but the existence of a characteristic primary heterogeneity with lateral transitions and landslides.
- Quaternary sediments (recent and modern alluvium): Quaternary sediments and Pleio-Quaternary surfaces occupy a small area, while they are located at depth below more recent Quaternary alluvium. They come from the lateral fills and depositional materials from small streams with an outlet right at the edges. They consist of coarse-grained materials, cobbles, gravels, pebbles of various sizes - the composition of which is mainly gneiss, amphibolite and marble, as well as fine-grained materials, mainly from clayey silt and/or sandy materials.

Specifically, the Nestos plain can be considered to consist of soils that display common characteristics, such as:

- Common primary rocks, in the sense of Quaternary deposits - alluvial from small streams that arise from the various rocks of the basin and constitute a composite material, although it is mainly coarse and rarely of medium and small grain size.
- Lowland development and lack of horizons, due to the short-term influence of pedogenic factors (i.e., young age),
- Common primary rocks of water-bearing sand, with a depth of 0-4m and a thickness of up to 5m in most cases,
- Small relative thicknesses with a surface layer of 0 to 2m, often less than 0.7m,
- Rare occurrence of calcium carbonate,
- Excellent pH reaction 6.3 - 7.6
- Relief with moderate to gentle slope,
- Low content of Calcium (Ca), Nitrogen (N), Phosphorus (P) and organic substances and sufficient content of Potassium (K),
- Moderate to rapid initial infiltration and very slow to rapid final infiltration

Prinos is a small extensional basin within a general arrangement of Neogene basins extending from Northern Greece, the southern Bulgaria, North Macedonia to eastern Albania and constitute the Southern Balkan extensional system (Burchfiel et al. 2008). Extensional tectonics in the wider area of Rhodope and Eastern Macedonia began during the Late Cretaceous - Middle Eocene and has taken place within a regionally convergent tectonic environment (Burchfiel et al. 2008, Burg 2012). During the Middle Eocene - Late Oligocene, the transition from a regionally convergent to a regionally extensional tectonic environment occurred and was associated with abundant magmatism and the formation of sedimentary basins. The extension of this period was associated with lithospheric thinning, possibly related to changes in the geometry of the subducting plate, the dynamics of the mantle wedge, and the onset of plate folding along the Greek subduction zone.



(Source: Dinter et.al, 1998)

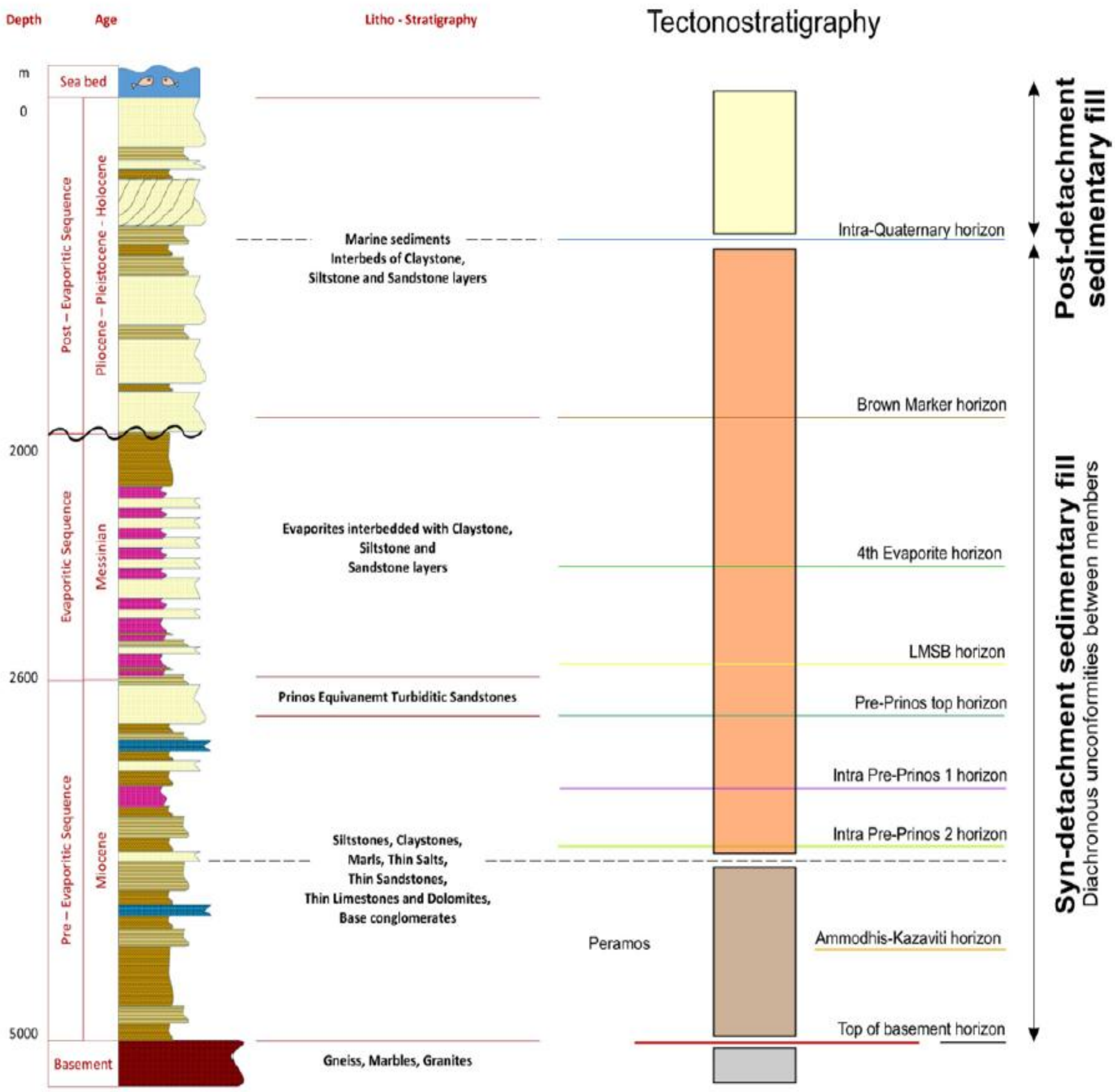
Figure 8–39: Generalized tectonic and geological structure of the Strymon basin, Drama, Kavala-Xanthi-Komotini and Prinos basin

As shown in the Figure above, the blue line with triangles indicates the early-middle Eocene Nestos thrust. The black thick lines indicate the location of the Strymon Valley detachment fault (SVDF) and the Thasos detachment to the south, the dashed/dotted line of the Kerdyli detachment to the west, and the dashed thick black line of the Prinos detachment. The detachment fault in the Prinos bedrock began in the early Miocene (21Ma) with the emplacement of the Vrontous and Symbolon plutonic granodiorite bodies (pink polygons) and the development of the Thasos detachment fault. The initiation of the SVDF and the Prinos Detachment Fault (PDF) at about 16 Ma was responsible for the detachment of the metamorphic core complex. The advanced extension associated with a combination of detachment faults and extension of the North Anatolian Fault was characterized by the development of high-angle faults (red) and associated cliffs. Pink polygons indicate the co-extensional plutonic intrusions, orange polygons indicate the spatial extent of the superdetachment basin complex and light yellow the overlying deposits.

In the chronostratigraphic column of the Prinos basin (Figure 8-40) three main series are clearly defined (Kiomourtzi, 2016):

- Pre-evaporitic series: It contains a variety of rocks with distinct depositional subenvironments. The older stratigraphic unit (Pre-Prinos group) is characterized by alternations of lagoonal, continental shelf and terrestrial environments, which indicates sedimentogenesis strongly influenced by the interaction between sea level changes and tectonism. The younger parts of the sequence (Prinos group) are represented by a series of stacked/homogenized high to very high energy turbidite flows, which are separated by flows dominated by low to very low energy mud. The age of the preexacultural sequence is mainly Tortonian (11.6Ma - 7.24Ma), but older ages (Langian - Serravallian) cannot be excluded.

- Evaporitic series: The evaporitic sequence is characterized by various layers of salt alternating with conglomerate. The total thickness of this sequence reaches 800 meters. To the north, the evaporites change laterally to thick anhydrites and limestones alternating with conglomerate, rich in marls. The anhydrite and dolomite layers are often intercalated with mudstones characterized by metadiagenetic anhydrite nodules.
- Post-evaporitic series: The post-evaporitic series is of Pliocene-Quaternary age, consisting of marine sands, silts and clays. Towards its upper part, it passes into a deltaic prograding sequence fed by the paleo-Nestos River and at shallower levels it is again penetrated by marine conglomerate sediments.



(Source: Technical Report for the CCS Exploration License Application, Energean, Αύγουστος 2022)

Figure 8–40: **Lithostratigraphic column of the Prinos basin**

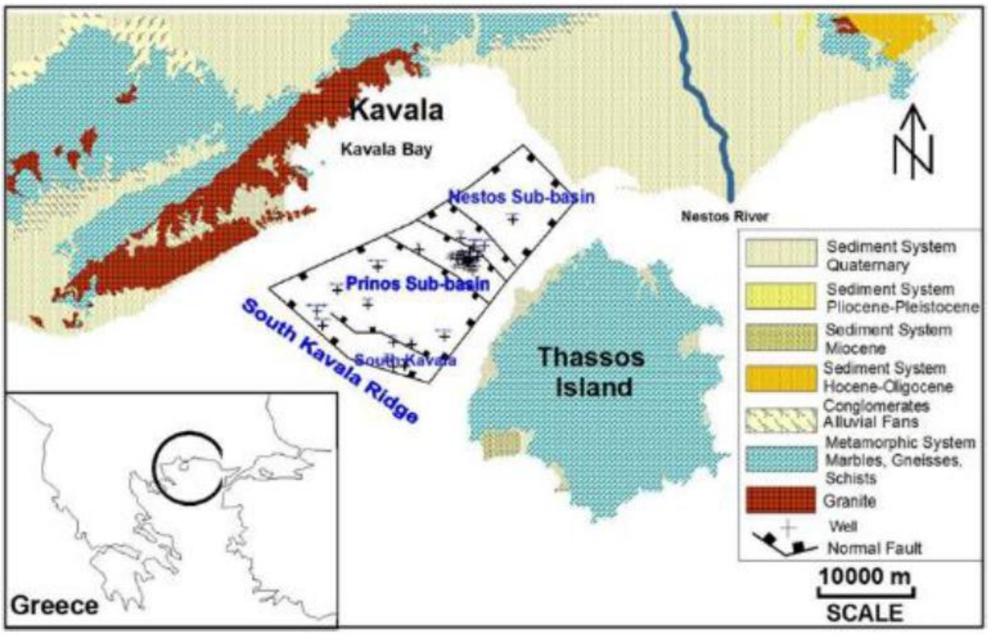
The Paleozoic basement consists of metamorphic rocks: gneiss, quartzite and dolomitic marble. The pre-evaporitic sequence, closely related to the Miocene tectonics, begins with continental deposits: conglomerates with large basement components, sandstones, limestones, mainly immature, claystones and it seems that there are thick carbonate rocks. The evaporitic sequence consists of two phases in each of the two sub-basins. In the north, anhydrite and limestone, as 3-5 m thick layers, alternate with sandstones, claystones and marls. The sequence in the southern part consists of 7-8 salt layers with increasing thickness towards the base, which alternate with conglomerates and have a total thickness of up to 800 m. The post-evaporitic sequence consists of pure conglomerates of mainly marine origin, as indicated by the presence of large numbers of Pliocene forminoids and algae. Towards the top, coarse clastic sediments with abundant mollusc remains indicate a deltaic, in accordance with the seismic uplift sequence.

8.4.2 8.4.2 Geological Features in the Marine Environment

8.4.2.1 Geological Characteristics of the Gulf of Kavala

In general, the Aegean is characterized by a multitude of sedimentary basins of the Tertiary period, some of which developed due to volcanic activity. At the beginning of the Eocene, faults formed which caused the fragmentation of the area. Some parts were uplifted, while others sank. Consequently, the sea entered the lower areas. In addition, the creation of Miocene molasses sediments in closed tectonic basins formed evaporites, under which hydrocarbon deposits are found within Messinian sandstone formations. At the same time, towards the end of the Oligocene and at the beginning of the Miocene, the last Alpine folds were formed, resulting in the folding of the Eocene-Oligocene formations. This was followed by the rupture of old faults, the uplift and subsidence of pieces, the creation of seas and lakes, while in the Thracian Sea a closed sea was formed, which created all the conditions for the trapping of hydrocarbons, as shown in the following Figure.

The extension of the Middle Eocene - Late Oligocene period was associated with lithospheric thinning which is probably related to changes in the geometry of the subducting plate, the dynamics of the mantle wedge and the beginning of the folding of the plate along the Greek subduction zone.



(Source: Kiomourtzi et al., 2008)

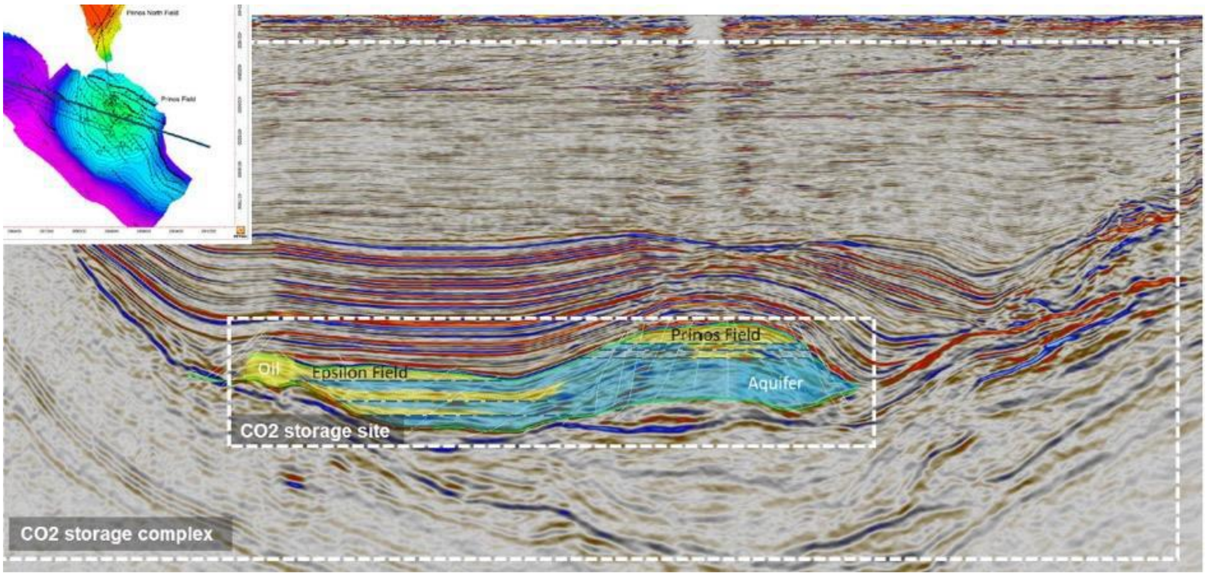
Figure 8–41 Geological map of the Prinos - Kavala sedimentary basin in the North Aegean Sea, with the location of oil and natural gas resources

The granulometric analysis of the sediments of the Gulf of Kavala shows that most of them are covered by fine-grained sediments with percentages of silt-clay between 85 and 95% (Lykousis 1984). Increased percentages of sand and silt, with high content of mica and silica, were found in the south-eastern part and along the north-eastern and eastern coasts of the bay. It is considered that the main source of fine-grained materials is the Nestos River. The distribution of these fine-grained materials is mainly due to the general cyclonic-anticyclonic movement of the waters (tides, air currents), the relatively low velocities of the bottom currents and the slope of the bottom. Finally, biogenic sand (pieces of echinoderms, mollusks) can be found in the central and southwestern part of the bay.

8.4.2.2 8.4.2.2 Geological Features in the Project Area

8.4.2.2.1 General Information

The Project area is located within the Prinos concession, with the potential CO2 storage site located within the Prinos and Epsilon structures, as shown in the following Figure.



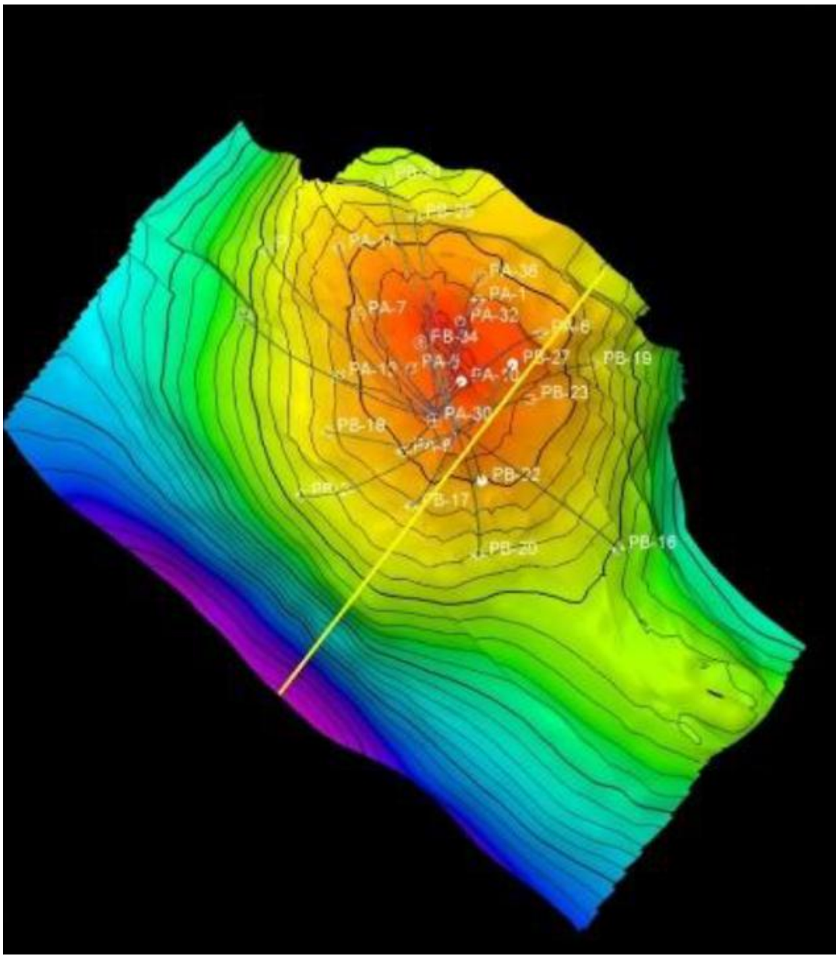
(Source: IENE, 14th Southeast Europe Energy Dialogue, Θεσσαλονίκη, Μάϊος 2023)

Figure 8–42 Overall visualization of the Prinos, Epsilon fields and the CO2 storage complex

The following sections describe the geological characteristics of both the Prinos and Epsilon fields, as well as the Prinos CO2 Storage Complex. As can be seen from the Figure above, there are indications that the aquifer zone between the two fields is partially connected. The Prinos field has been producing oil since 1981. This field is facing the arrival of water and the depletion of its reservoir pressure, which leads to a decrease in oil production, while water injection to maintain pressure has been effective for several decades. In the Epsilon field, production started in 2009 and continues to this day without water injection.

8.4.2.2.2 Prinos Field

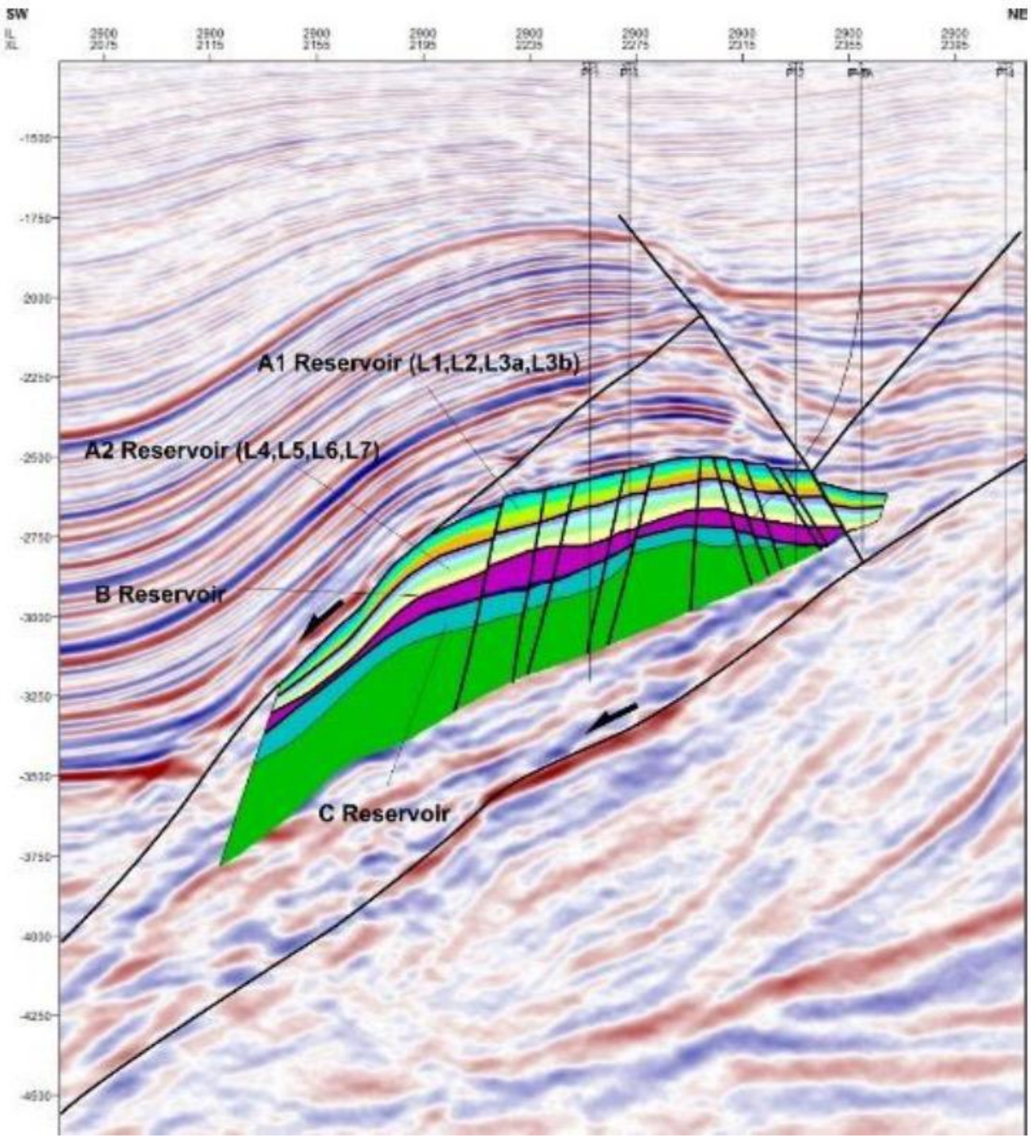
The proven productive reservoirs in the Prinos field are located at the top of the Pre-evaporitic sequence and mainly comprise turbidites (channel and distal fan turbidites) which were created during the rapid subsidence of the basin during the Miocene. They are usually found at depths of 2,490m - 2,790m TVDSS in the Prinos field area. Prinos is a relatively mature oil field extending over an area of approximately 5.9 km2, located 8km west of Thassos and 18km south off the Gulf of Kavala, as shown in the following Figure. The field was discovered in late 1973 by the Prinos-1 (P-1) well and was developed between 1974 and 1981 with an initial 24 wells, 12 from each platform (Alpha and Beta). By 2022, a total of 65 wells had been drilled (including side wells), 12 of which are currently in production, 3 are injecting seawater, and the rest have been suspended or abandoned.



(Source: Technical Report for the CCS Exploration License Application, Energean, Αύγουστος 2022)

Figure 8–43 Upper structure map of the A1 reservoir of the Prinos field

The Prinos field produced an undersaturated sour crude oil with a gravity of 27-29° API and high sulfur and asphaltene content. The field was slightly overpressured, with initial reservoir pressures ranging from 5,700-6,250 psia. The sandstones of the Prinos field can be subdivided into four (4) main reservoirs: based on the presence of horizons that dominate non-bearing shales. Reservoir A1 can be further divided into four sub-reservoirs (L1, L2, L3a, L3b) and reservoir A2 into four others (L4, L5, L6 & L7), as shown in the following Figure. Reservoirs A, B and C have three distinct OWC levels.



(Source: Technical Report for the CCS Exploration License Application, Energean, Αύγουστος 2022)

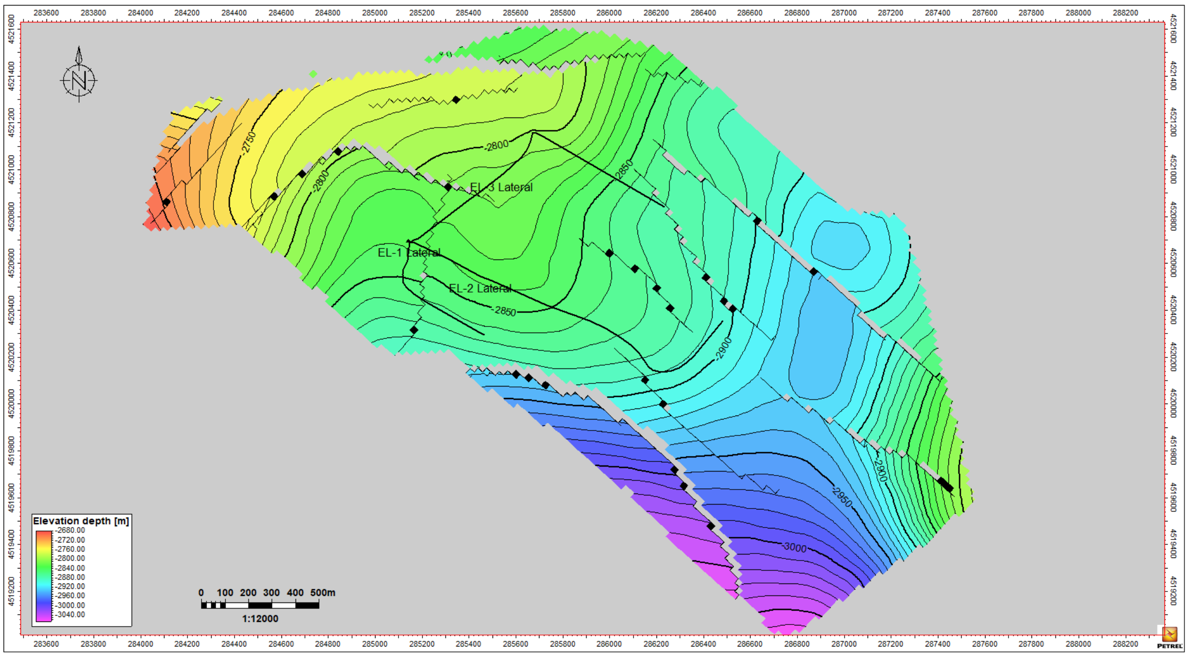
Figure 8–44 Section along the Prinos deposit

Petrographic interpretations have shown that reservoir A1 contains well-sorted and dominantly medium-grained sandstones, which are often characterized by fine-grained laminae. Reservoir A2 contains alternations of thin-bedded sandstones with medium-grained sandstones and well-sorted sandstones. Reservoir B is characterized by structureless sandstones that display a very well-defined texture. The grain size in these sandstones varies from fine to granular, but is usually medium to coarse sand. Reservoir B is also characterized by dolomite and sandy clay horizons.

8.4.2.2.3 Epsilon field

The Epsilon deposit (Figure 8-45) is located 4.5 km west-northwest of the Prinos deposit. It is a faulted anticlinal structure covering an area of approximately 4 km2 and is separated from the Prinos deposit by a structural low, a saddle point, to the east.

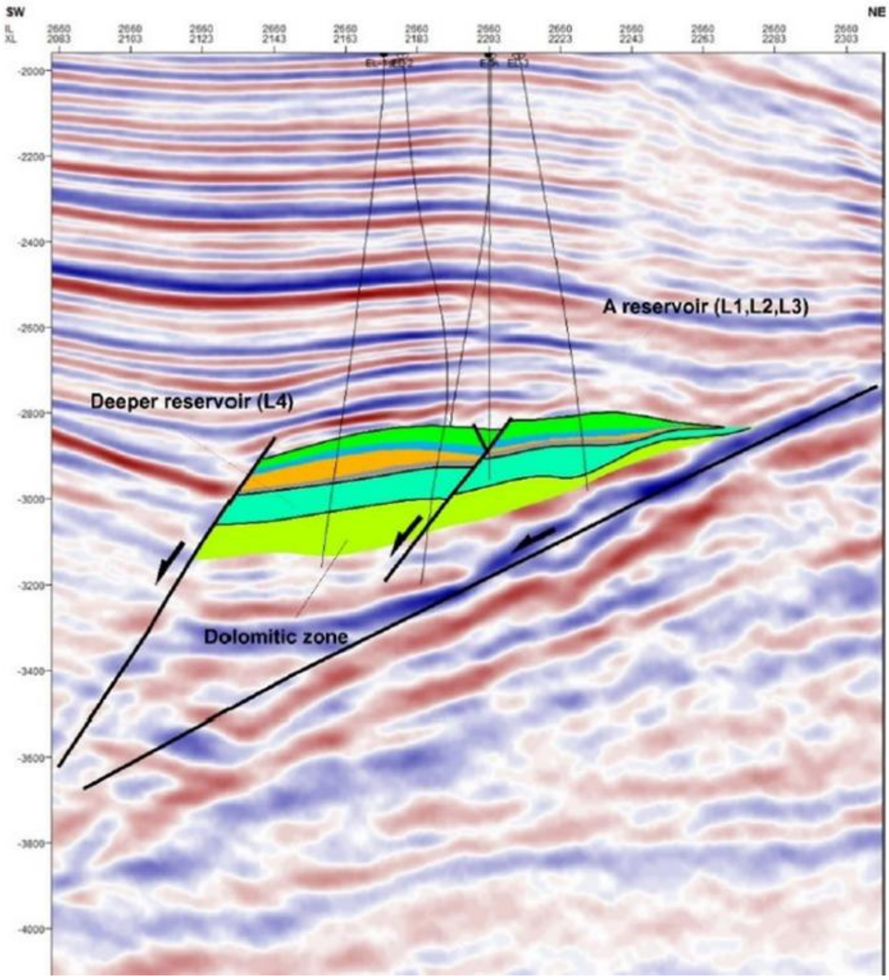
The Epsilon deposit was explored and discovered by the E-1 well in 2001 and confirmed by the E-1As lateral well in 2002. A productive two-foot horizontal ERD well, EA-H1, targeting the main compartment of the deposit was drilled from the Alpha platform (Prinou complex).



(Source: Technical Report for the CCS Exploration License Application, Energean, Αύγουστος 2022)

Figure 8–45 Upper structure map of reservoir A of the Epsilon field

The Epsilon reservoir is 300m thick, Φ=9%, NTG=40-90%, with a permeability of 2-5 mD. The reservoir contains moderately light sour crude oil (36° API), with a dissolved gas content of 349scf/bbl (62m3/m3) and a high asphaltene content. The initial pressure in reservoir A was 6230 psi and the temperature was 140°. The sandstones of the Epsilon reservoir can be subdivided into three (3) main reservoirs: reservoir A (L1, L2 & L3), deeper reservoir (L4) and dolomite zone, all clastic rocks (Figure 8-46). All reservoir units represent a series of accumulated/merged high- to very high-energy turbidite flows, which are separated by low- to very low-energy flows, dominated by mud- and sand-rich heteroliths.



(Source: Technical Report for the CCS Exploration License Application, Energean, Αύγουστος 2022)

Figure 8–46 Seismic section along the Epsilon field, where Reservoir A (L1, L2 & L3), the deepest reservoir (L4) and the dolomite zone can be distinguished

The heterolithic sand/mud lithologies exhibit mm- to cm-scale interbedding/layering, which is well developed and slightly wavy to continuous parallel in form. The sand layers typically exhibit sharp to locally erosive bases and sharp tops, are predominantly very fine to fine-grained, and appear moderately well sorted. The muds separating both reservoir units are dark gray in color, with organic components.

8.4.3 Soil Characteristics

8.4.3.1 Terrestrial Environment

The soils of the Nestos Delta and the wider area are alluvial deposits of the Nestos River, which are not homogeneous throughout their extent. The main composition varies between sandy and sandy loam. Pure sandy areas are observed in the old river beds, its branches and its estuaries, they are completely barren and have great depth. The presence of sand is due to the erosion and drift of the soils from the Rhodope and Falakro mountain complexes, which consist entirely of metamorphic or crystalline schist schists with a main composition of mica with quartz and mica and thus the sand is mainly quartz and less calcareous.

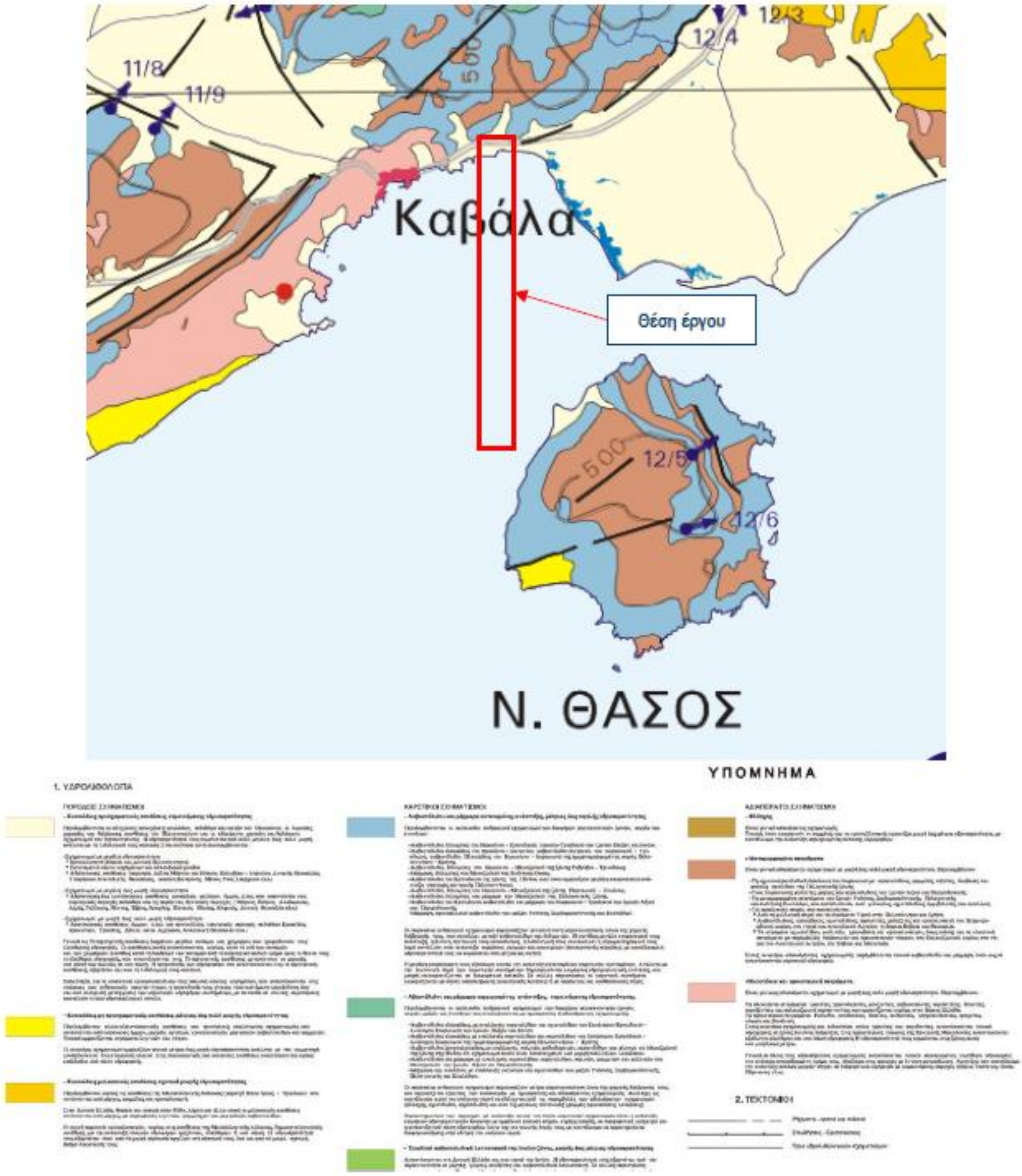
The Nestos River from its mountainous part enters directly into the Delta and therefore the materials it transports are basically coarse-grained sand and not clay. These materials accumulate at the estuary, resulting in the Delta level rising and expanding into the sea by approximately 100 m per year. Also, due to the direction of the prevailing winds from NE, the characteristic sand dunes do not form on the coast, but the extension of the land and the creation of lagoons are assisted.

According to the data of the 1st Revision of the River Basin Management Plan of the Eastern Macedonia Regional Authority (EL11), in the wider area of the Eastern Macedonia Regional Authority three types of aquifer systems are developed, the first within the Quaternary and Neogene deposits (granular system), the second within the permeable marbles (karst system) and the third in metamorphic and igneous rocks which are tectonic (fractured system). Specifically, the following are found:

- Granular aquifer systems
- Karst aquifer systems
- Fractured aquifer systems

According to the Hydrolithological map of the wider study area, it is observed that the area of the onshore installations of the project consists mainly of granular alluvial deposits of variable water permeability.

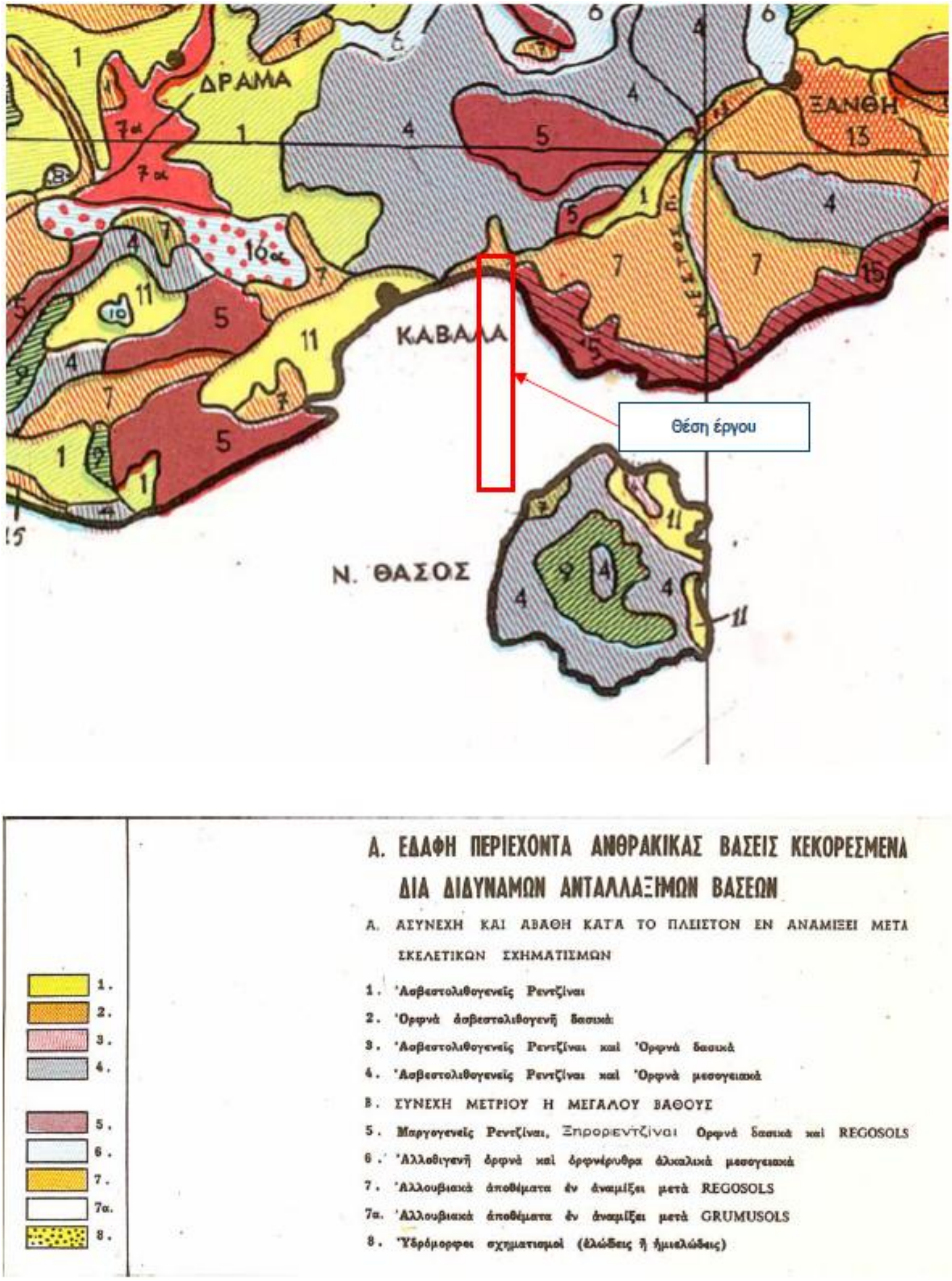
In coastal deltaic areas, formations with coarse to fine-grained deposits of pebbles, gravel, sand and silt are found, such as for example in the Nestos River Delta, as shown in the following Figure.



(Source: Ministry of Development, Water Resources Directorate, November 1996)

Figure 8–47 Hydrolithological map of onshore facilities and wider area

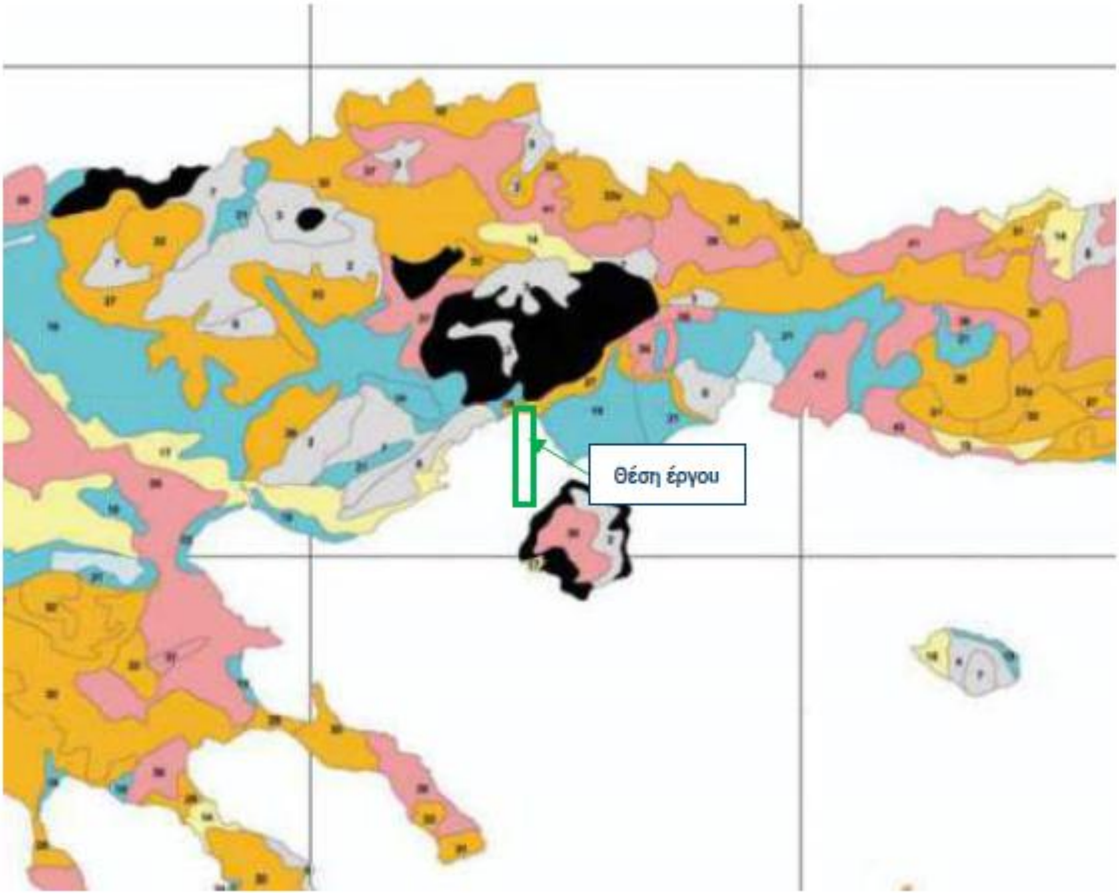
According to the Soil Map of the country (Katakouzinos, 1967) in the area of the Project's onshore installations, mainly saturated soils containing carbonate bases are observed, mostly continuous at medium or great depth. Marly formations, regosols and alluvial deposits are mainly encountered, as can be seen from the following Figure.



(Source : Soil map, Katakouzinos, 1967)

Figure 8–48 Soil map with marking of the Project's land facilities

According to the Map of Territorial Associations of Greece, of the National Committee against Desertification, of the Agricultural University of Athens, 2004 as shown in the following Figure, additional reference is made to each soil type depicted on the map and its sensitivity to desertification and edaphoponic or non-edaphoponic land use. Therefore, according to the said Map, the area of the project's terrestrial installations is located in soils of the Cambisols (CM) and Regosols (RG) type.



(Source: Map of Territorial Associations of Greece, National Committee against Desertification, Agricultural University of Athens, 2004)

Figure 8–49: Map of Territorial Unions

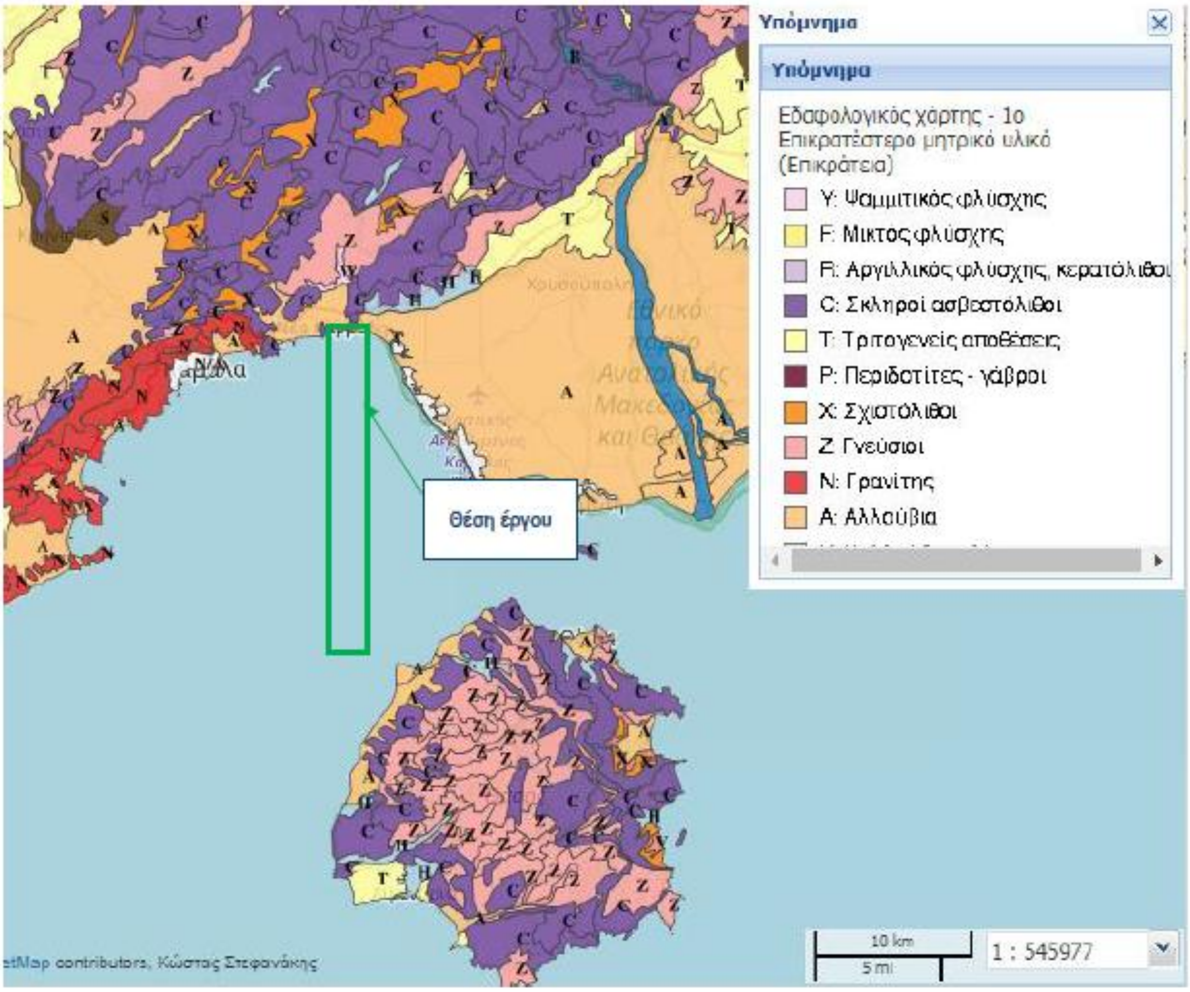
Cambisols (CM):

Cambisols (CM) are soils with little or moderate development of pedogenic horizons. This group includes moderately developed soils that have formed pedogenic horizons. The horizons have lost a percentage of Fe and Al bases and a range of easily disintegrated minerals and do not present illuvial horizons (layers with accumulation of soil components). They have a granular composition of fine clayey sand (LS) with moderate or high cation exchange capacity. These are soils that usually develop either on autochthonous parent materials or on alluvial deposits and are characterized by satisfactory fertility..

Regosols (RG):

These are gravelly soils or soils rich in coarse materials. These are soils formed from brittle alluvial materials or marine and lake sediments, exclusively from coarse-grained materials with a depth greater than 100 cm. These soils usually receive new materials at regular intervals.

Furthermore, according to the above geomorphological approved YPEN, the soils in the study area are characterized mainly by alluvium. Alluvial or alluvial deposits or sediments are the deposits of clay, sand, gravel and other sedimentary materials produced due to the flow of water in a river environment. Three types of alluvial deposits are common parent materials for soil formation: alluvial fans, floodplains, and deltas.



(Source: ΥΠΕΝ, http://mapsportal.ypen.gr/)

Figure 8–50: Soil Map - Predominant parent material

8.4.3.2 Seabed

As part of the PMP of the Prinos offshore facilities, in November 2023, sampling was carried out at 13 points in the Prinos Basin with the aim of determining the quality of the seabed of the study area, as shown in the following Figure.

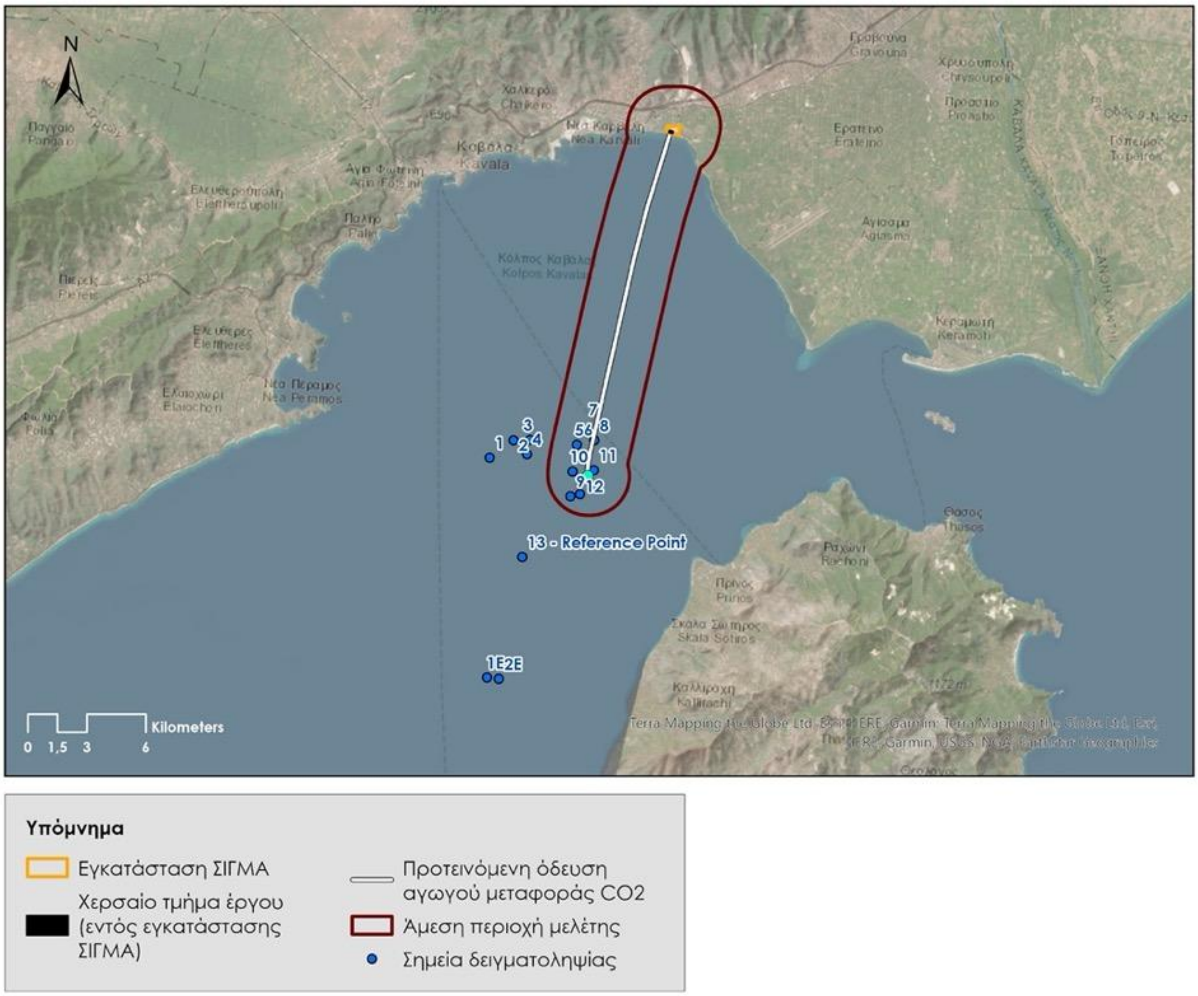


Figure 8-51: Sampling points for water and seabed quality analysis (November 2023)

The Table below presents the coordinates and depths of the sampling points.

Table 8-16: Granulometric analysis results (sampling November 2023)

No	X (WGS 84)	Y (WGS 84)	X (ΕΓΣΑ87)	Y (ΕΓΣΑ87)	Bathymetry (m)
13(R)	24,458888	40,760623	538732,575012	4512285,72938	40,22371
1	24,437743	40,805658	536922,831483	4517275,81976	36,943
2	24,451648	40,81388	538091,019005	4518194,43695	38,10651
3	24,461644	40,814405	538933,699241	4518257,08951	40,75853
4	24,460092	40,807827	538806,660162	4517526,18724	35,10134
5	24,48995	40,812742	541322,010954	4518085,43087	38,23281
6	24,490744	40,818238	541385,587972	4518695,89369	39,75599
7	24,503212	40,822313	542434,392622	4519154,23836	32,35225
8	24,500483	40,814949	542208,981652	4518335,46583	27,71849
9	24,487037	40,789089	541090,911501	4515458,51588	31,52274
10	24,487807	40,80052	541148,841615	4516727,75728	29,68481

No	X (WGS 84)	Y (WGS 84)	X (ΕΓΣΑ87)	Y (ΕΓΣΑ87)	Bathymetry (m)
11	24,500591	40,801407	542226,661981	4516832,24678	27,5491
12	24,492604	40,790124	541560,001932	4515575,95355	31,19172
1E	24,439994	40,704926	537168,795443	4506094,93419	47,43622
2E	24,447	40,704548	537760,770966	4506056,01116	47,03185

The results of the laboratory analyses of the marine sediment samples are summarized and interpreted below. The following Tables present the results of the granulometric analysis of the sampling carried out in November 2023 at 13 monitoring stations in the Gulf of Kavala during the preparation of the EIA "Prinos Offshore Development Project" in 2015.

Table 8-17: Granulometric analysis results (sampling November 2023)

Size	Unit	9 R1	9 R2	11 R1	11 R2	12 R1	12 R2	1E R1	1E R2	2 R1	2E R2	REF R1	REF R2
>4 mm	%	1,9	1,7	0,9	0,1	0,3	1,8	0,2	2,4	2,0	0,0	1,2	0,3
4 mm	%	7,3	9,3	5,5	4,8	6,1	6,4	8,4	12,5	6,1	5,8	8,0	5,2
3 mm	%	4,1	5,1	4,1	4,0	4,6	5,6	9,2	9,9	9,4	7,4	4,6	6,1
2 mm	%	4,7	5,3	6,2	6,4	6,6	4,2	13,4	10,0	8,2	8,2	4,9	4,7
1 mm	%	10,9	15,5	23,7	18,9	16,8	15,2	23,5	25,5	21,9	19,7	13,2	13,6
0,5 mm	%	22,8	29,1	33,2	36,5	29,6	23,6	20,3	18,6	18,5	19,9	21,5	21,9
0,25 mm	%	28,2	21,3	17,6	18,7	21,7	23,6	12,4	11,8	20,8	19,6	27,4	25,6
<0,25 mm	%	20,1	12,7	8,8	10,6	14,3	19,6	11,2	9,3	13,1	19,4	19,2	22,6

The values are reported in % of retained material.

Table 8–18: Results of analyses of general physicochemical parameters in sediment samples (sampling November 2023)

Parameter	Method	Quality Limits Staatscourant, The Netherlands, June 2000	Unit	Station 9 R1	Station 2E R2	Station 1E R1	Station 12 R1	Station REF R2	Station 1E R2	Station 12 R2	Station 9 R2	Station REF R1	Station 11 R1	Station 11 R2	Station 2E R1
TOC	APHA 4500	0,1 %	% DW	6,40%	2,90%	4,40%	3,10%	2,80%	9,50%	6,80%	5,70%	4,80%	6%	4,30%	5,10%
TN (Total Nitrogen)	Kjeldahl	50	ug/g DW	137	107	110	99,5	95,1	155	192	149	184	152	122	130
Μέταλλα															
Arsenic (As)	PG/ICP	55	ug/g DW	<0,5	<0,5	<0,5	<0,5	<0,5	<0,5	<0,5	<0,5	<0,5	<0,5	<0,5	<0,5
Cadmium (Cd)	PG/ICP	12	ug/g DW	<0,5	<0,5	<0,5	<0,5	<0,5	<0,5	<0,5	<0,5	<0,5	<0,5	<0,5	<0,5
Manganese (Mn)	PG/ICP		ug/g DW	243	171	207	250	146	258	317	268	162	267	277	171
Lead (Pb)	PG/ICP	530	ug/g DW	20	17,7	49,8	18	11,9	20	23,2	6,5	17,5	41,9	35,9	16,8
Iron (Fe)	PG/ICP		ug/g DW	2500	3060	4840	3050	2550	2620	2620	2900	3340	1920	3280	3060
Copper (Cu)	PG/ICP	73	ug/g DW	10,2	7,9	24	17	12,9	10,2	12,9	6,6	12	19,3	12,1	15,7
Chromium (Cr)	PG/ICP	380	ug/g DW	<0,3	<0,3	<0,2	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Zinc (Zn)	PG/ICP	620	ug/g DW	26,5	10,5	35,8	83,8	20,8	26,5	29,3	29,6	30,9	47,4	51,2	24,4
Cobalt (Ci)	PG/ICP	19	ug/g DW	<0,3	0,3	0,6	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	0,5
Molybdenum (Mo)	PG/ICP	200	ug/g DW	1,2	2,8	6	35,5	0,3	0,3	1,2	0,4	7,3	1	1,5	4,6
Nickel (Ni)	PG/ICP	44	ug/g DW	2,8	13,1	15,9	10,2	2,1	3,2	12,7	8,2	4,8	7,2	4,8	11,2
Πολυκυκλικοί Αρωματικοί Υδρογονάνθρακες (ΠΑΥ / PAHs)															
Naphthalene	EPA 8270	0,100	mg / kg	ND	ND	ND	ND	ND	<0,05	ND	ND	ND	ND	ND	ND
Acenaphthylene	EPA 8270	0,010	mg / kg	ND	<0,02	ND	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	ND	ND	<0,02
Acenaphthene	EPA 8270	0,010	mg / kg	ND	<0,02	ND	ND	<0,02	ND	ND	ND	ND	ND	ND	<0,02
Fluorene	EPA 8270	3	mg / kg	ND	ND	ND	ND	<0,02	ND	ND	ND	ND	ND	<0,02	<0,02
Phenanthrene	EPA 8270	0,500	mg / kg	ND	<0,02	<0,02	ND	<0,02	<0,02	<0,02	ND	ND	<0,02	<0,02	ND
Anthracene	EPA 8270	0,100	mg / kg	ND	<0,02	ND	ND	0,046	ND	<0,02	ND	ND	<0,02	ND	ND
Fluoranthene	EPA 8270	0,010	mg / kg	ND	<0,02	<0,02	ND	<0,02	<0,02	<0,02	ND	ND	<0,02	ND	ND
Pyrene	EPA 8270	0,010	mg / kg	ND	<0,02	<0,02	ND	<0,02	<0,02	<0,02	<0,02	ND	ND	ND	ND
Benzo[a]anthracene	EPA 8270	0,400	mg / kg	ND	<0,02	<0,02	ND	<0,02	<0,02	<0,02	ND	ND	ND	ND	ND
Chrysene	EPA 8270	11	mg / kg	ND	<0,02	ND	ND	<0,02	ND	<0,02	ND	ND	<0,02	ND	ND
Benzo[b]fluoranthene	EPA 8270	0,200	mg / kg	0,037	0,053	<0,02	ND	<0,02	ND	<0,02	<0,02	ND	<0,02	<0,02	ND
Benzo[k]fluoranthene	EPA 8270	2	mg / kg	ND	ND	ND	ND	<0,02	ND	ND	ND	ND	<0,02	ND	ND
Benzo[a]pyrene	EPA 8270	3	mg / kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzo[a,h]anthracene	EPA 8270	0,010	mg / kg	ND	<0,02	ND	ND	<0,02	ND	<0,02	ND	ND	ND	ND	ND
Benzo[g,h,i]perylene	EPA 8270	8	mg / kg	ND	<0,02	ND	ND	<0,02	ND	<0,02	ND	ND	ND	ND	ND
Ind Indeno(1,2,3-c,d) pyrene	EPA 8270	6	mg / kg	ND	<0,02	ND	ND	<0,02	ND	<0,02	<0,02	ND	ND	ND	<0,02

ND: Not Detected, Not quantified at the reference limit of the method.

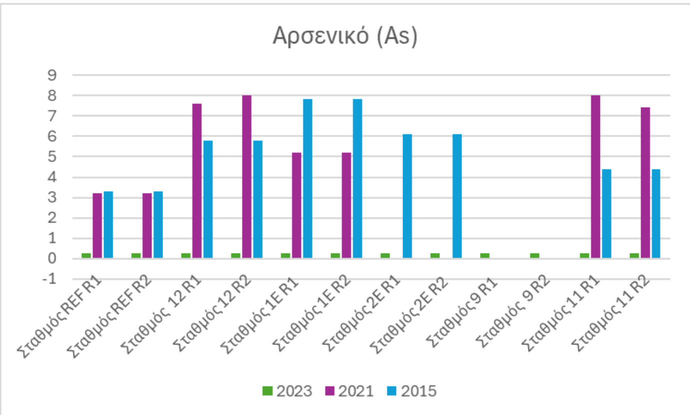
* Non-accredited test according to ISO 17025, No. 154 ESYD.

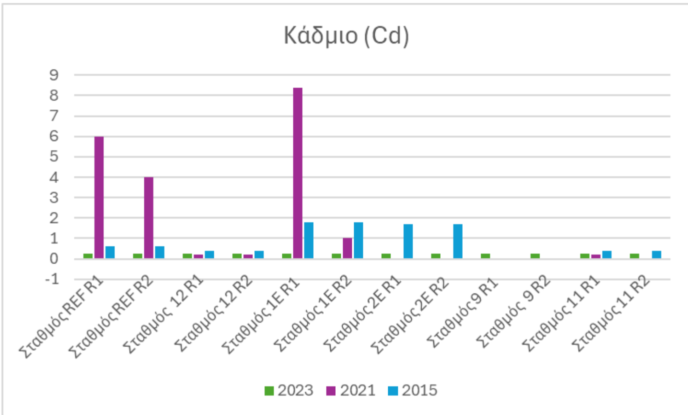
R: replicate, repeat sample Maximum Permissible Concentration (MPC): Maximum permissible concentration

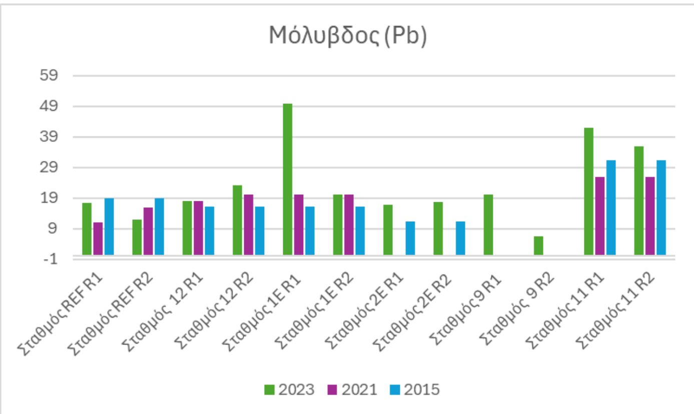
Examining the sampling stations as a whole, and comparing the results of the above Tables, with the corresponding analyses carried out in October 2015 (EIA of the "Prinos Offshore Development" Project, 2015) and July 2021 ("Monitoring Program Report" - hereinafter MRP-, 2020), it was found that no changes were noted in the values of the concentrations of Polycyclic Aromatic Hydrocarbons (PAHs). More specifically, in all repeat samples of the aforementioned sampling stations, the detected values are lower than the laboratory detection limit (<0.020 mg/kg), as well as lower than the EU thresholds for good environmental status of the marine environment.

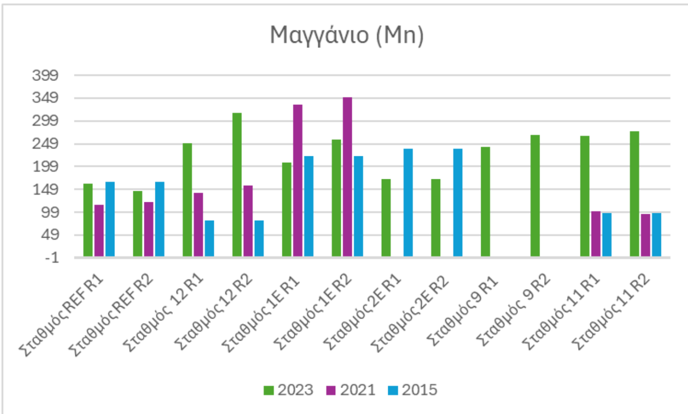
The study of the distribution of trace metal concentrations in sediments is important in the context of environmental pollution. Sediments exhibit less variation over time and are therefore preferred as monitoring tools for assessing pollution. Heavy metals enter the coastal environment from various sources, whether natural or anthropogenic, such as the release of domestic sewage and industrial waste. The variations in metal concentrations may reflect the mixing of sediments from different origins and contamination from a multitude of different pollution sources.

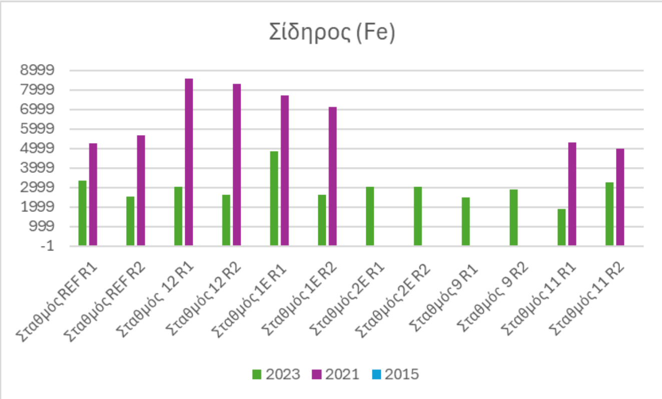
The following Figures present a comparative analysis of the concentrations of heavy metals in the repeated marine sediment samples collected in October 2015 (EIA of the "Prinos Offshore Development" Project, 2015), in July and June 2021 (EPP 2020) and in November 2023 (EPP 2023). It is clarified that the stations investigated in the context of this EPP 2023 are 9, 11, 12, 13-REF, 1E and 2E..

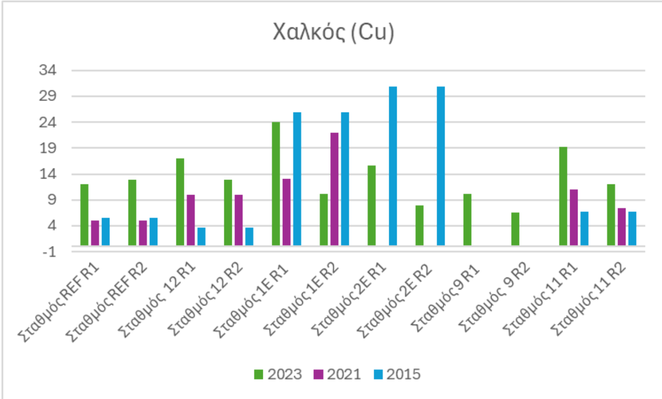


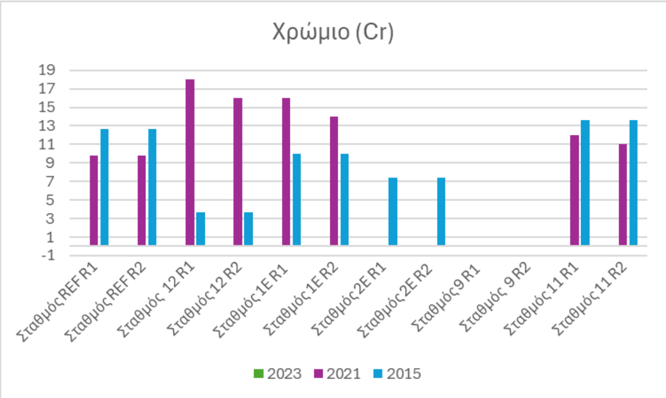


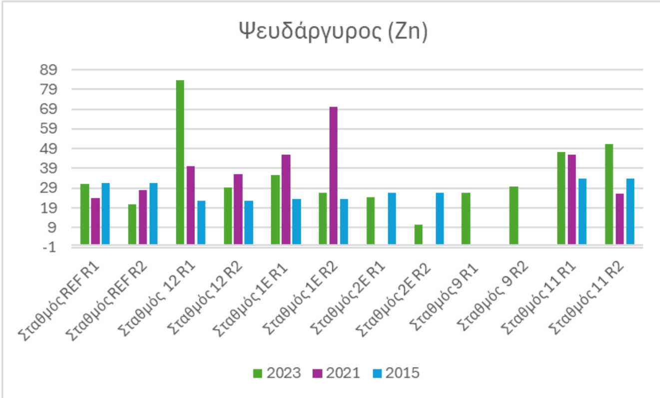


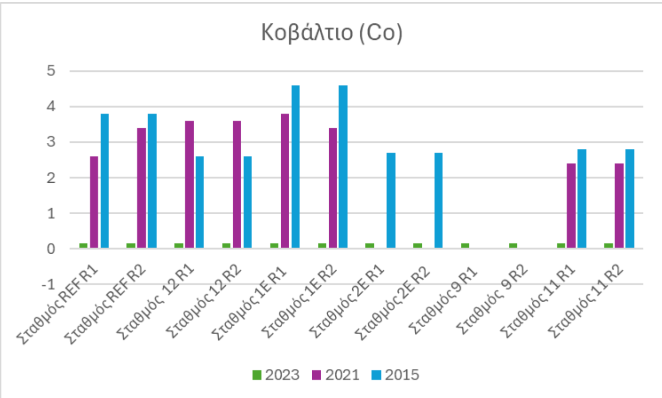


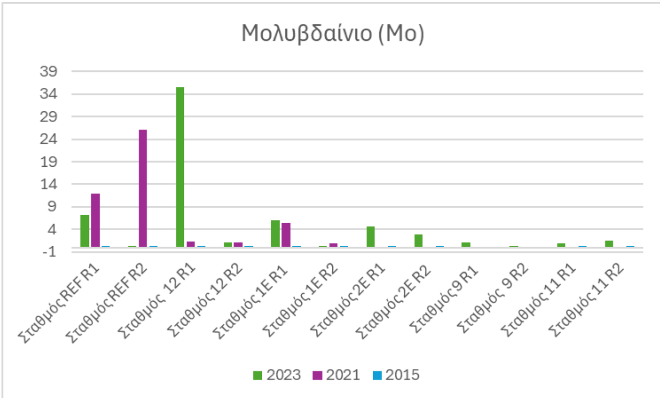

Σίδηρος (Fe)
8999
7999
6999
5999
4999
3999
2999
1999
999
-1
ΣταθμόςREF R1
ΣταθμόςREF R2
Σταθμός 12 R1
Σταθμός12 R2
Σταθμός1E R1
Σταθμός1E R2
Σταθμός2E R1
Σταθμός2E R2
Σταθμός9 R1
Σταθμός 9 R2
Σταθμός11 R1
Σταθμός11 R2
2023
2021
2015


Χαλκός (Cu)
34
29
24
19
14
9
4
-1
ΣταθμόςREF R1
ΣταθμόςREF R2
Σταθμός 12 R1
Σταθμός12 R2
Σταθμός1E R1
Σταθμός1E R2
Σταθμός2E R1
Σταθμός2E R2
Σταθμός9 R1
Σταθμός 9 R2
Σταθμός11 R1
Σταθμός11 R2
2023
2021
2015


Χρώμιο (Cr)
19
17
15
13
11
9
7
5
3
1
-1
ΣταθμόςREF R1
ΣταθμόςREF R2
Σταθμός 12 R1
Σταθμός12 R2
Σταθμός1E R1
Σταθμός1E R2
Σταθμός2E R1
Σταθμός2E R2
Σταθμός9 R1
Σταθμός 9 R2
Σταθμός11 R1
Σταθμός11 R2
2023
2021
2015


Ψευδάργυρος (Zn)
89
79
69
59
49
39
29
19
9
-1
ΣταθμόςREF R1
ΣταθμόςREF R2
Σταθμός 12 R1
Σταθμός12 R2
Σταθμός1E R1
Σταθμός1E R2
Σταθμός2E R1
Σταθμός2E R2
Σταθμός9 R1
Σταθμός 9 R2
Σταθμός11 R1
Σταθμός11 R2
2023
2021
2015


Κοβάλτιο (Co)
5
4
3
2
1
0
-1
ΣταθμόςREF R1
ΣταθμόςREF R2
Σταθμός 12 R1
Σταθμός12 R2
Σταθμός1E R1
Σταθμός1E R2
Σταθμός2E R1
Σταθμός2E R2
Σταθμός9 R1
Σταθμός 9 R2
Σταθμός11 R1
Σταθμός11 R2
2023
2021
2015


Μολυβδαίνιο (Mo)
39
34
29
24
19
14
9
4
-1
ΣταθμόςREF R1
ΣταθμόςREF R2
Σταθμός 12 R1
Σταθμός12 R2
Σταθμός1E R1
Σταθμός1E R2
Σταθμός2E R1
Σταθμός2E R2
Σταθμός9 R1
Σταθμός 9 R2
Σταθμός11 R1
Σταθμός11 R2
2023
2021
2015

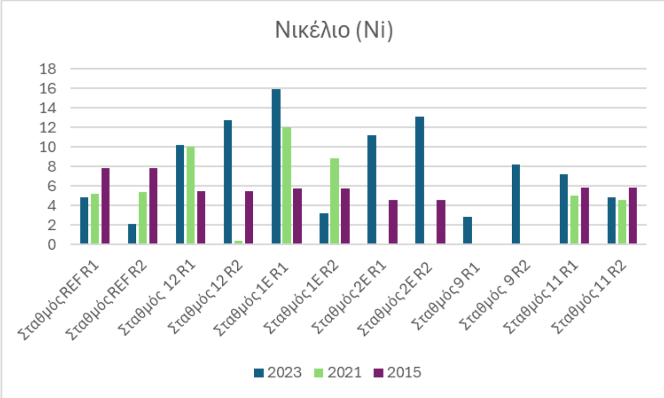
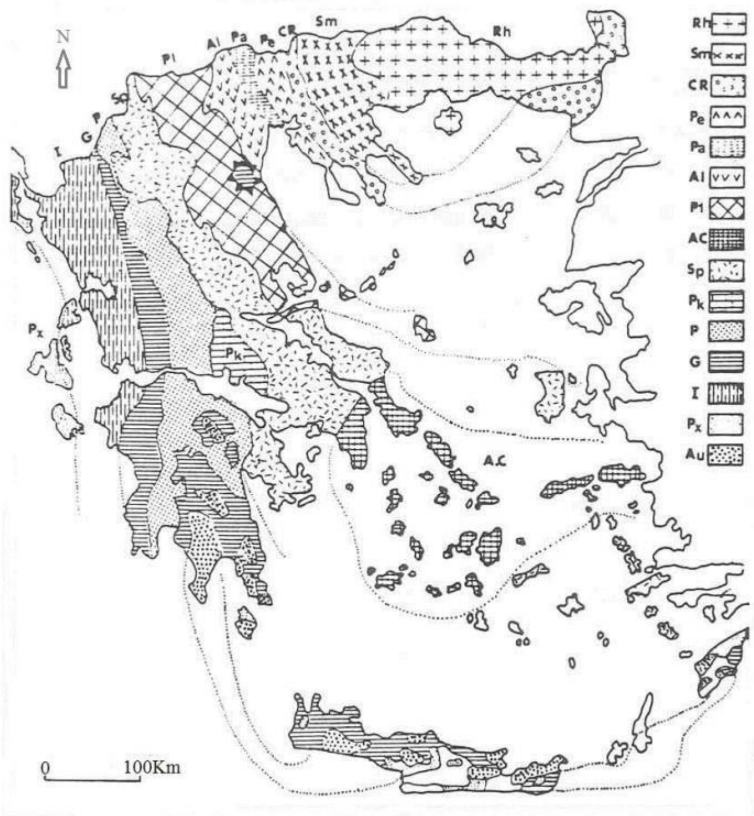


Figure 8–52: Comparative diagrams of heavy metal concentrations during field surveys 10/2015, 06-07/2021 and 11/2023

8.4.4 Tectonic Characteristics

8.4.4.1 Tectonism

The picture of the area from a tectonic point of view is particularly complex and it is assessed that the tectonic structures present in the wider study area have played an important role in shaping the geological conditions and the technical-geological characteristics of the formations. According to the Map below, the research area belongs to the Rhodope Massif, which is mainly structured by metamorphic rocks of high to medium metamorphism depth (gneisses & marbles) with intrusions of igneous rocks, as well as by sedimentary rocks (alluvial sediments).



(Source: ΑΠΘ, Μουντράκης)

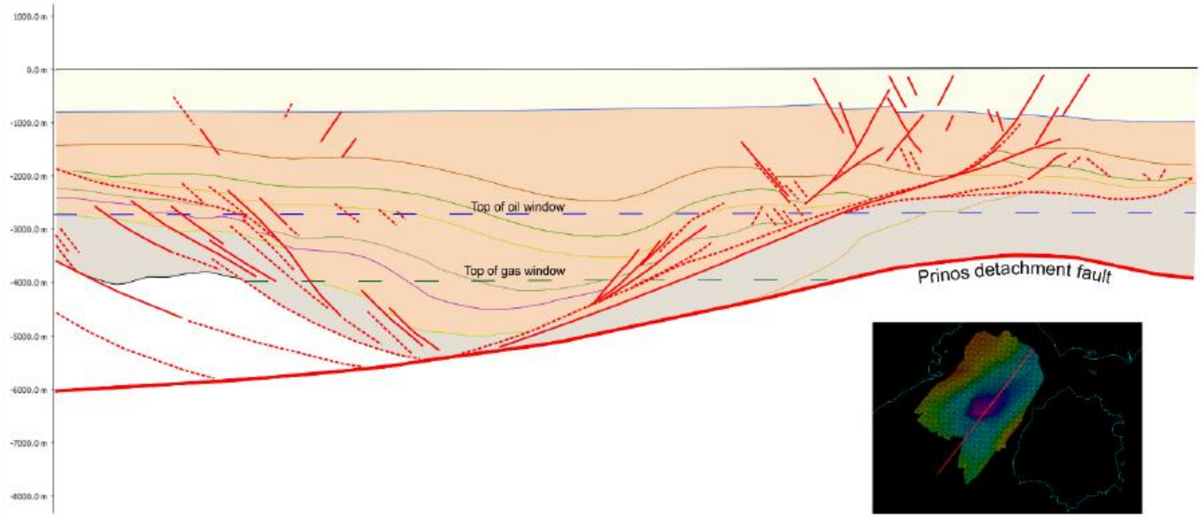
Rh: Rhodope mass, Sm: Serbomacedonian mass, CR: Peri-Rhodopic zone, (Pe: Paionia Zone, Pa: Paiko Zone, Al: Almopia Zone) = Axios Zone, Pl: Pelagonic zone, Ac: Attico-Cycladic Zone, Sp: Sub-Pelagonic Zone, Pk: Parnassos-Gionas Zone, P: Pindos Zone, G: Gavrovos-Tripoli Zone, I: Ionian Zone, Px: Paxos Zone, Au: "Talea" Mountains Zone.

Figure 8–53: Geotectonic map of the Hellenic Zones

The Rhodope Massif is a complex unit. The sequence of mantles that comprise it was formed by the Alpine convergence of the African plate with the Eurasian plate and is divided into two metamorphic complexes, the Northern Rhodope Core Complex (NRCC) and the Southern Rhodope Core Complex (SRCC). The Southern Rhodope Core Complex consists of two tectonic units, the lower (Pangaeos unit) and the upper one which is thrust onto the lower one through the Nestos fault (Papanikolaou & Panagopoulos 1981, Dinter 1998).

The tectonic structure of the Prinos Basin is the result of subsidence, southwest-northeast extension along low-angle faults during the exhumation of the core complex during the Miocene-Pliocene, and dextral strike-slip on northeasterly faults caused by the extension of the North Anatolian fault into the North Aegean during the Late Pliocene-Quaternary. Evidence from seismicity studies in Northern Greece (Burchfiel et al. 2006) shows that the (Late Pleistocene) Holocene deformation is characterized by N-S to NNE-SSE extension with only rare evidence of dextral strike-slip rupture (Jackson & McKenzie 1988).

A cross-section along the axis of the basin shows a northeast-dipping kilometer-scale half-trench forming an asymmetric trench. The older sediments dip northeast and are bounded on the east side by a series of low-angle, high-displacement faults and on the west side (South Kavala Ridge) by a zone of intermediate-dipping, lower-displacement faults. At shallower levels, high-angle faults locally disrupt the Pleisto-Quaternary sediments and near the basin sides bring them into contact with the metamorphosed basement rocks.



(Source: Technical Report for the CCS Exploration License Application, Energean, Αύγουστος 2022)

Figure 8–54: Generalized section along the Prinos basin

The above Figure shows a general cross-section across the Prinos Basin and depicts the mapped seismic horizons and the resulting tectonostratigraphic relationships. The co-rupture unit (orange polygon) exhibits a large-scale asymmetry with low-angle, high-displacement faults to the NE and intermediate-dipping, lower-displacement faults to the SW.

The faults in the Prinos Basin are either planar or non-planar (listric), either high-angle or low-angle, or a combination of these. Most of the faults in the Plio-Pleistocene unit are high-angle and are associated with complex intersections with older low-angle faults. The most important tectonic feature of the Prinos Basin is the Prinos Detachment Fault (PDF), a low-angle fault zone that separates the subsurface sediments from the metamorphic bedrock. This structure has a very clear expression in the seismic cube, which extends southwestward down the Southern Ridge of Kavala. The surface of the Prinos Detachment Fault has a large-scale co-morphoid Figure, with a wavelength > 10 km and a width of up to 1.5 km and the average direction of the main ripple is N56°E. In cross-section it represents a sharp knife-edge surface where all the faults of the super-detachment basin take root.

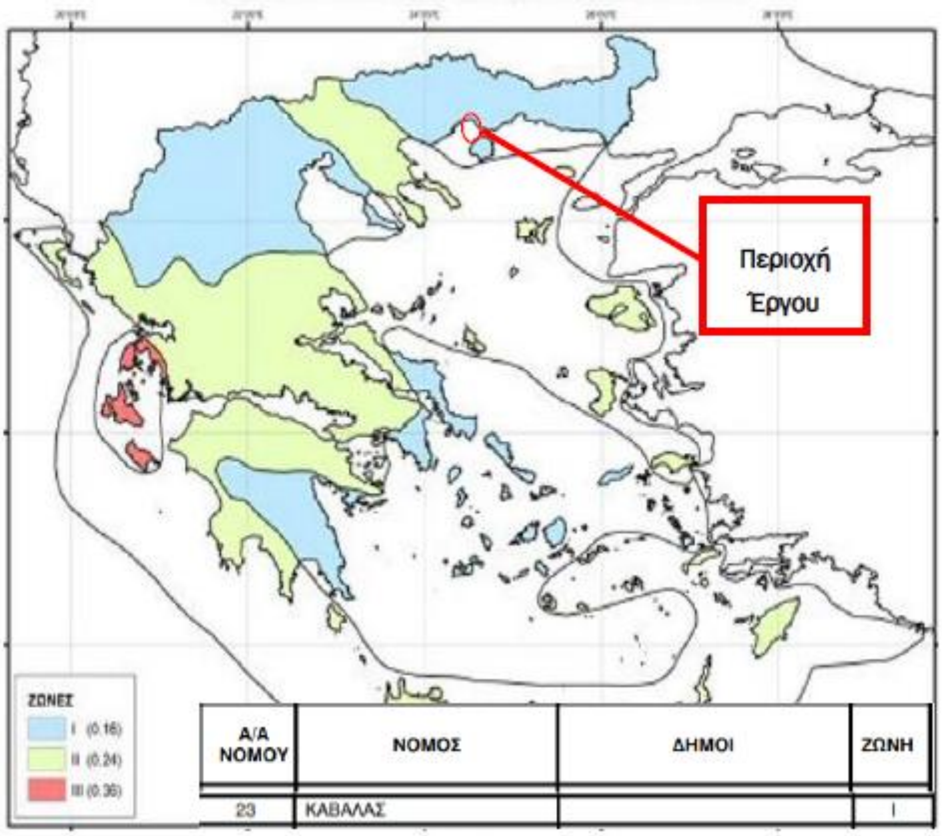
In addition to the faults, the Prinos Basin is characterized by several co-sedimentary folds. These folds are the result of overturning counterformations developed perpendicular to the direction of extension by the collapse of the hanging wall rocks over listric normal faults, or of conical folds with axes parallel to the direction of extension probably caused by compression perpendicular to the direction of extension. The latter is further supported by the fact that older co-sedimentary folds develop steeper limbs and greater width than younger ones.

In the context of the tectonic environment of the Prinos Basin, the Prinos and Epsilon fields are structural traps located on the hanging wall of a low-angle intrasedimentary listric fault with a flat-ramp-plate geometry and formed as submarine extensional wedges due to unstable slip.

The Nestos subbasin is located in the northern part and the Prinos subbasin, deeper than the previous one, in the southern part. The taphrogenetic basin is structured by anticlinal lines that are recycled, formed by faults with northwest and southwest dips, which are related to the trapping mechanism. These faults, which are still active today, were activated during sedimentation (syngenetic faults) and led to the domed anticlines of Prinos, North Prinos, Epsilon, Ammodou and South Kavala. The NE part of the Prinos basin was probably close from the first moment of its formation, while the SW basement began to rise from the Messinian period, forming the southern ridge of Kavala. The basin gradually became isolated from the open sea and turned into a lagoon.

8.4.4.2 Seismic Hazard

Regarding the seismicity of the wider area, the onshore and offshore area of the project is classified in seismic risk zone I, i.e. in the lower category (see Map below), according to the "Amendment of the Provisions of the Greek Anti-Seismic Regulation EAK 2000 due to the Revision of the Seismic Hazard Map Government Gazette 1154/B/12.08.2003".



(Source: Seismic Code, EAK 2000, Government Gazette 1154/12-8-2003)

Figure 8–55: Seismic hazard map of Greece

According to the seismotectonic investigation of the Kavala - Prinos area by the Geodynamic Institute, National Observatory of Athens (NAO)5, there are five (5) active faults which are summarized in the following Table and Figure 8-56. According to the seismotectonic investigation of the Kavala - Prinos area by the

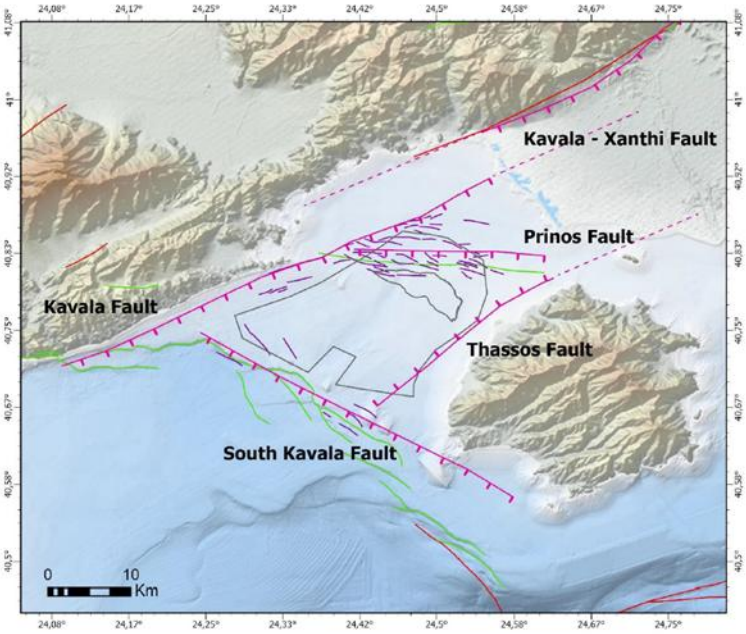
Geodynamic Institute, National Observatory of Athens (NAO), there are five (5) active faults which are summarized in the following Table and Figure 8-56.

Table 8–19: Active faults within the wider study area

α/α	Fault name	Direction	Dip-Direction	Dip (°)	Kinematics
1	South Kavala	NW-SE	SSW	60	Normal
2	Mid - Prinos	E-W	S	80	Normal
3	Kavala	NW-SE	SE	45	Slide
4	Thassos	NW-SE	NW	60	Normal
5	Kavala - Xanthi	NW-SE	SE	60	Slide

(Source: Seismotectonic Investigation of Kavala Area, NOA – ENERGEAN SA, Οκτώβριος 2023)

The fault model in the immediate Project area (Figure 8-56) includes the above five (5) main fault zones.



(Source: Seismotectonic Investigation of Kavala Area, NOA – Energean SA, Οκτώβριος 2023)

Figure 8–56: Map of relief and active faults in the Kavala - Prinos area [1]

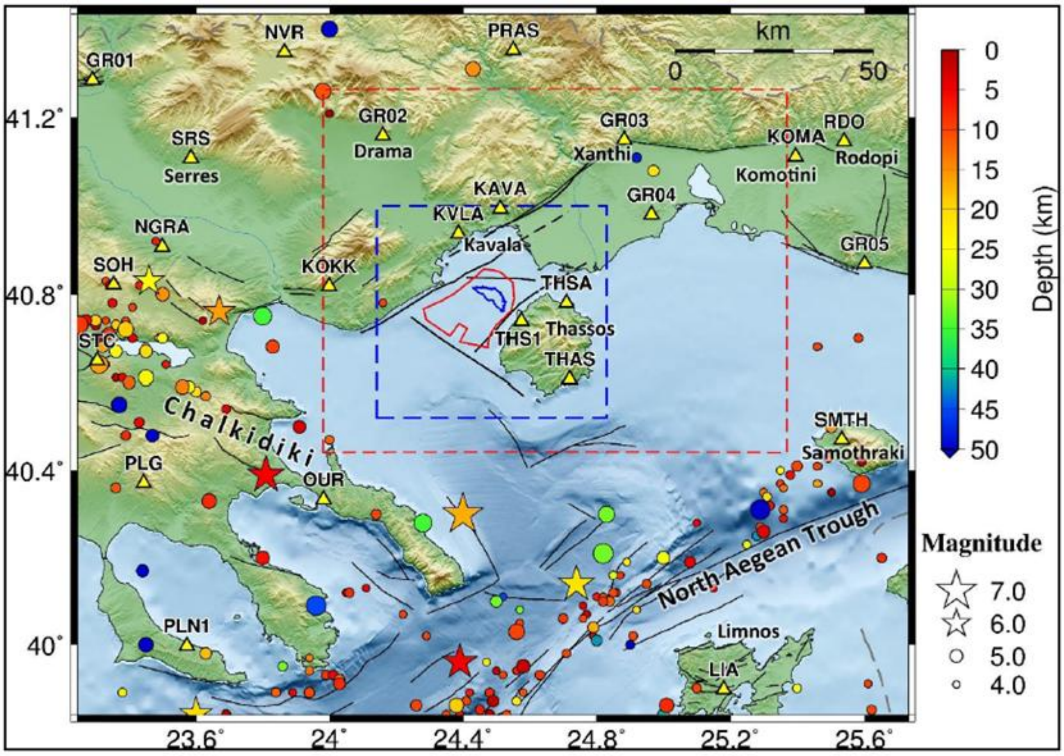
Based on the available data of the Geodynamic Institute of the National Observatory of Athens, the following Table presents the most significant seismic events that occurred in the wider area, within a radius of approximately 50km (or more) from the Project under study during the years 2016-2023. Based on the available data, the closest earthquake to the activity under study occurred on 08/12/2017 with an epicenter 28.3 m northwest of Serres and an intensity of 3.8 Richter.

[1] Fault colors as follows: red-NOAFAULTS, green-IGME (YPO-THERM project, Ioakeim et al. 2016), magenta & violet-ENERGEAN SA. The solid dark gray polygons indicate the storage complex and CO2 storage site.

Table 8–20: Significant seismic events in the wider study area for the years 2016-2023

Birth Time	Epicenter	G. Width	G. Length	Depth (km)	Magnitude
08/10/2016	11.2 km ΔΝΔ του Κιλκίς	40.9518°	22.7482°	13	3.7
18/11/2016	11.5 km Δ του Κιλκίς	40.9907°	22.7342°	11	4.7
16/11/2016	10.9 km Δ του Κιλκίς	40.9737°	22.7430°	11	4
10/11/2016	9.6 km ΔΝΔ του Κιλκίς	40.9630°	22.7631°	10	4.4
08/12/2017	28.3 km ΒΔ των Σερρών	41.2958°	23.3582°	10	3.8
07/04/2017	50.3 km ΝΝΑ του Πολύγυρου	39.9538°	23.6568°	12	4
25/06/2018	31.5 km ΑΒΑ της Θεσσαλονίκης	40.7120°	23.3049°	9	3,7
25/06/2018	32.7 km ΑΒΑ της Θεσσαλονίκης	40.7065°	23.3222°	11	4.1
21/04/2018	53.7 km ΝΔ των Καρυών	39.9366°	23.7703°	13	3.9
21/04/2018	54.5 km ΝΔ των Καρυών	39.9441°	23.7496°	13	4.7
16/01/2022	28.1 km Ν των Καρυών	39.9979°	24.2762°	8	4.5
16/01/2022	31.0 km ΝΝΑ των Καρυών	39.9787°	24.3355°	8	4.3
16/01/2022	32.2 km ΝΝΑ των Καρυών	39.9693°	24.3428°	7	4
16/01/2022	32.8 km ΝΝΑ των Καρυών	39.9628°	24.3354°	8	5.4
07/02/2023	22.3 km ΝΝΑ του Πολύγυρου	40.1832°	23.5161°	8	4.2

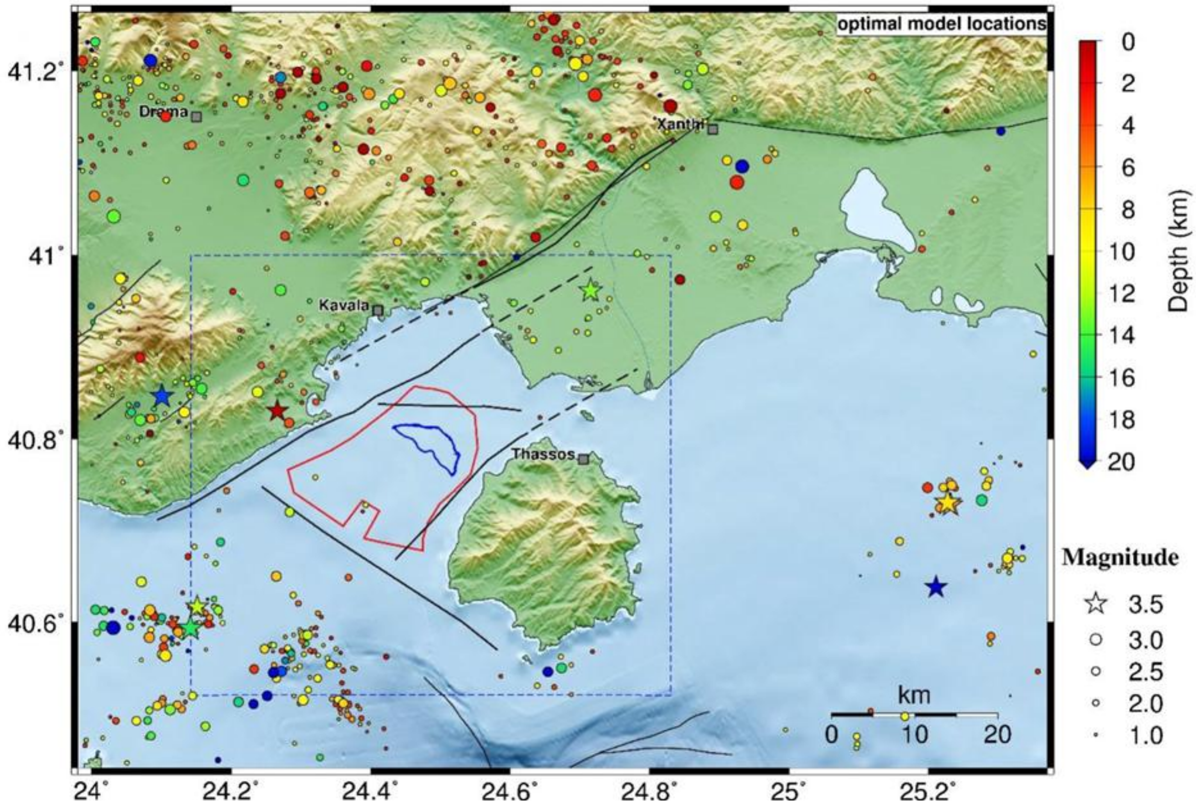
Figure 8-57 shows the seismicity of the study area for the years 1900-2009. It includes the offshore area of Prinos, Kavala and the surrounding land areas (blue dashed rectangle), the seismic stations (yellow triangles) and the wider study area (red rectangle). The color of the epicenters corresponds to the focal depth. Events with M≥6.0 are depicted as stars. The fault lines (in black) are derived from the NOAfaults v5.0 database (Ganas et al., 2013; Ganas, 2023) and from the internal report of Energean SA. The solid red and blue polygons denote the storage complex and the CO2 storage site, respectively.



(Source: List of seismic events 1900-2009, Makropoulos et.al 2012)

Figure 8–57: Seismicity of the years 1900-2009 in the wider study area

Figure 8-58 shows the seismicity of the study area for the years 2008-2023. The color of the epicenters corresponds to the focal depth. Events with M≥3.5 are depicted as stars. The fault lines (in black) come from the NOAfaults v5.0 database (Ganas et al., 2013; Ganas, 2023) and from the internal report of Energean SA. The solid red and blue polygons denote the storage complex and the CO2 storage site, respectively.



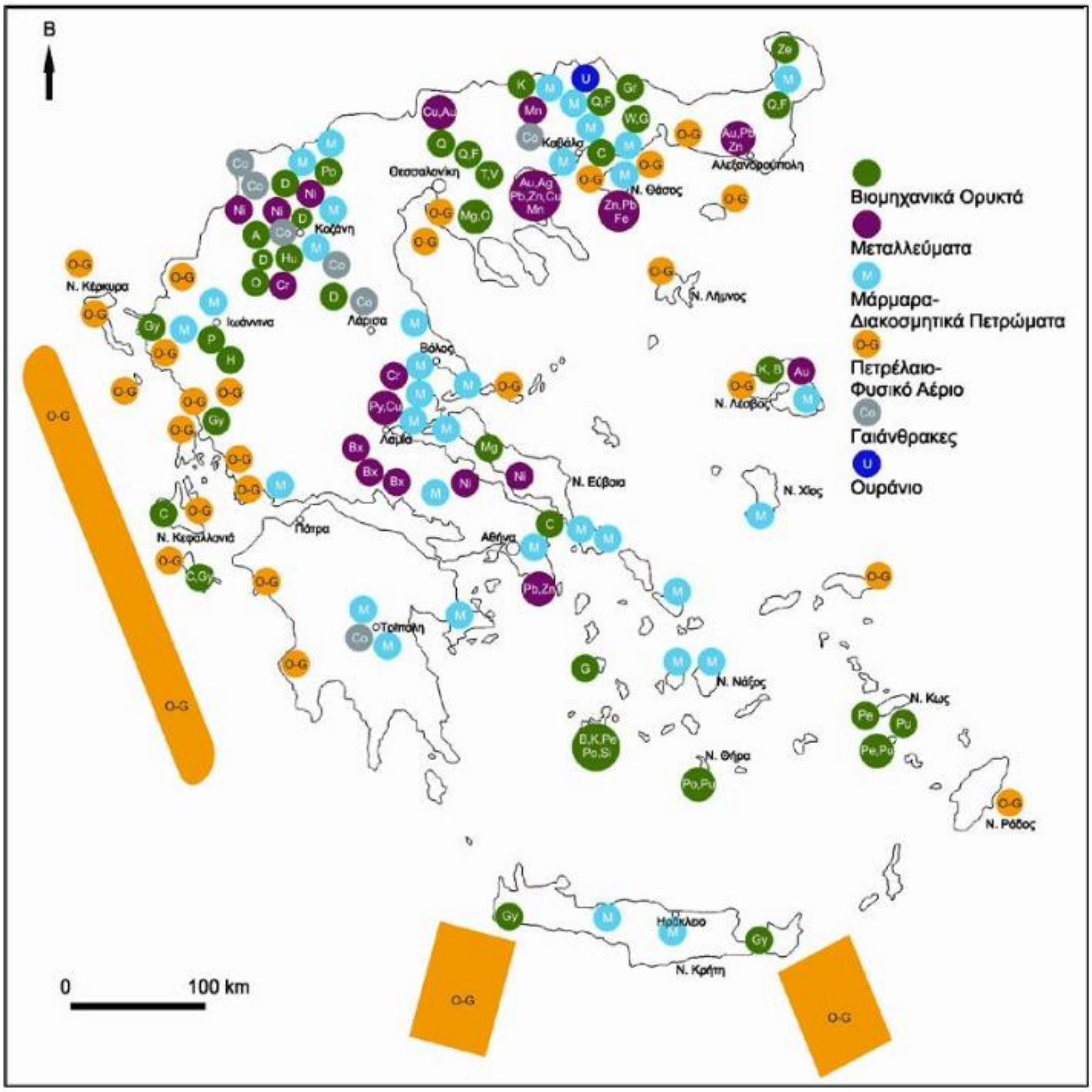
(Source: Seismotectonic Investigation of Kavala Area, NOA – Energean SA, Οκτώβριος 2023)

Figure 8–58: Seismicity of the years 2016-2023 in the immediate study area

As can be seen from the above Figures, seismicity in the immediate study area is very limited, while earthquakes are mostly located within the boundaries of the wider Project area.

8.4.5 Mineralogical – Geochemical characteristics

According to research by the Department of Mineralogy - Depositology of the Aristotle University of Thessaloniki (Tsirambidis A. & Filippidis A. 2013), the following formations are found in the Kavala area: Granite (Symbolou or Kavala granite), Coastal sands and Terrestrial deposits (bulkstones, loose conglomerates, pebbles, fine-grained material and red clays-clays.



(Source : Τσιραμπίδης Α. & Φιλιππίδης Α. 2013)

Figure 8–59: Mineralogical map of Greece

The Memorandum of the above Charter is as follows:

Industrial minerals and rocks

A=Attapulgite, B=Bentonite, C=White carbonates, D=Diatomite, F=Feldspars, G=Garnet, Gr=Graphite, Gy=Gypsum, H=Mineral salt, Hu=Chountite, K=Kaolin, Mg=Magnesite, O=Olivine, P=Phosphorites, Pe=Perlite, Po=Pozzolan, Pu=Kisserine, Q=Quartz, Si=Amorphous silica, T=Talc, V=Vermiculite, W=Wollastonite, Z=Zeolite

Minerals

Ag=Silver, Au=Gold, Bx=Bauxite, Cu=Copper, Cr=Chromium, Fe=Iron Oxides, Mn=Manganese, Ni=Nickel, Pb=Lead, Py=Pyrite, Zn=Zinc.

Marbles-Decorative stones

M=White to colored marbles, dolomites, travertines, onyxes, alabaster, sandstones, schists, volcanic rocks, zeolite-bearing tuffs.

Energy mineral resources

Co=Coal, O-G=Oil-Natural Gas, U=uranium deposit.

The above Figure depicts the distribution of Greece's mineral wealth and as can be seen in the Kavala Regional Unit, a multitude of minerals, industrial minerals and marbles are found. The most important centers of white marble are located in the Drama and Kavala Regional Units (including Thassos, which is world-famous for its snow-white dolomites).

According to the deliverable reports for the Exploration Permit prepared by Energean in November 2023, small quantities of CO2 already exist in Prinos, amounting to 1-3% of the fluids.

Chlorite, which is reported to react with CO2, is found in the Epsilon reservoir (wells EL-1-ST1, EL-2 and EL-3), with a total average of 1.7%, but appears to be insignificant in the Prinos reservoir (well PB-14), with a total average of 0.06%, and appears to be contained within rock fragments and therefore would not be particularly reactive, as it has a relatively small exposed surface area.

Calcite is present in small amounts (0.36%, both in the Epsilon and Prinos reservoirs). It is absent from the petrographic data. This may be due to a lack of recognition against the larger amount of dolomite or calcite within lithic fragments.

The Epsilon reservoir boreholes (EL-1-ST1, EL-2 and EL-3) contain more smectite/illite than the Prinos borehole (PB-14). The Epsilon reservoir boreholes contain less "illite and mica" than the Prinos borehole. The interpretation of this difference is not straightforward, as it appears that different approaches have been adopted for the quantification of smectite, illite and "mica" (muscovite). It is not easy to be certain that smectite (which can absorb CO2 and/or react with CO2 if it contains Mg, Fe or Ca) will play a significant role in these reservoirs, as even in the Epsilon EL-1-ST1, EL-2 and EL-3 wells, the smectite to smectite/illite ratio is about 20-25% (i.e., minor). The smectite that is present, as it appears to be intercalated with dioctahedral illite, is considered to be dioctahedral smectite (e.g. Al-rich montmorillonite or bindellite) as opposed to trioctahedral (e.g. Fe or Mg-rich saponite). Dioctahedral smectite is much more common in sandstones than trioctahedral smectite, but trioctahedral smectite is much more reactive to CO2, as it contains divalent Fe and Mg that can create magnesite and siderite carbonates.

Finally, within the Epsilon field formation, waters with particularly high salinity significantly greater than 300,000 mg/L are found. This extremely high salinity for the Epsilon formation water is due to the close stratigraphic and structural proximity of the Messinian evaporites.

8.5 MARINE ENVIRONMENT

8.5.1 Surface Water

8.5.1.1 Watersheds - Watersheds

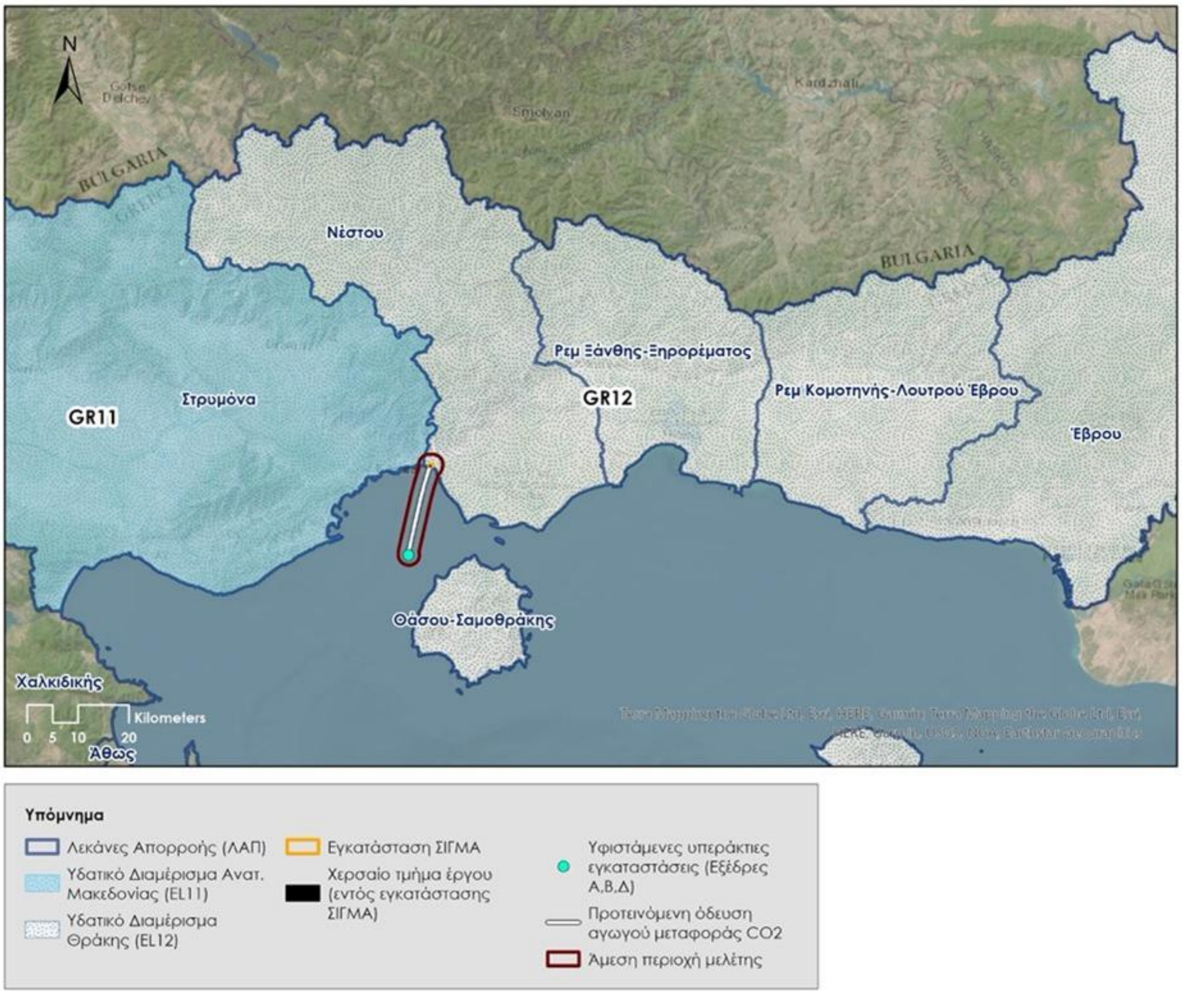
The project study area falls within the Water Districts (WD) of Eastern Macedonia (EL11) and Thrace (EL12), for which River Basin Management Plans (RBMPs) have been prepared, in accordance with the specifications of Directive 2000/60/EC, in application of Law 3199/2003 and Presidential Decree 51/2007 and have been approved by Decision 1005/12-09-2013 of the National Water Committee.

The 2nd Revision of the River Basin Management Plan of the Eastern Macedonia Water District (EL 11) was approved and published in accordance with the Government Gazette A 82/12.06.2024, while, respectively, the 2nd Revision of the River Basin Management Plan of the Thrace Water District (EL 12) was approved and published in accordance with the Government Gazette A 81/12.06.2024.

The Eastern Macedonia Water District (EL11) geographically extends to Central and Eastern Macedonia. To the east it borders the Thrace Water District (EL12) and to the west the Central Macedonia Water District (EL10). The total area of the district is 7,320 km2. From an administrative point of view, this area includes, in whole or in part, the Regional Units of Serres, Thessaloniki, Kilkis, Kavala and Drama. It includes one (1) unique River Basin, the Strymon River Basin (EL1106), according to Decision No. 706/2010 (Government Gazette 1383/B/2.9.2010) of the National Water Committee.

The Thrace Water District (EL12) extends north from the Greek-Bulgarian border line and the water table of the Nestos-Ochiros basins, east from the Greek-Turkish border line to the Gulf of Aenos, west from the water table of the Nestos-Ochiros, Nestos-Strimon, Nestos-Nea Karvalis stream basins and the water table of the coastal streams of Chrysoupoli to the Gulf of Kavala. The Thrace Water District includes five (5) River Basins, those of Nestos (EL1207), of Xanthi-Xirorematos Basin (EL1208), of Xanthi-Xirorematos Basin (EL1209), of Xanthi-Xirorematos Basin (EL1210), of Xanthi-Xirorematos Basin (EL1211), of Xanthi-Xirorematos Basin (EL1212), of Xanthi-Xirorematos Basin (EL1213), of Xanthi-Xirorematos Basin (EL1214), of Xanthi-Xirorematos Basin (EL1215), of Xanthi-Xirorematos Basin (EL1216), of Xanthi-Xirorematos Basin (EL1217), of Xanthi-Xirorematos Basin (EL1218), of Xanthi-Xirorematos Basin (EL1218), of Xanthi-Xirorematos Basin (EL1219 Komotini – Loutro Evros (EL1209), Evros (EL1210) and Thassos – Samothrace (EL1242), according to the No. 706/2010 (Government Gazette 1383/B/2.9.2010) Decision of the National Water Committee.

The following Figure presents the location, boundaries and main catchment areas of the Water Districts of Eastern Macedonia (EL 11) and Eastern Macedonia and Thrace (EL 12).



(Source: 2nd Review of River Basin Management Plans (RBMPs) of Eastern Macedonia (EL 11) and Thrace (EL 12), 2024)

Figure 8–60: Location, boundaries and main basins of the Water Districts of Eastern Macedonia (EL 11) and Thrace (EL 12))

The onshore facilities of the proposed project are located entirely within the Nestos River Basin, while the proposed pipeline route falls within the Nestos River Basin and the Strymona River Basin.

According to the 2nd Revision of the RBMP of the Thrace Regional Authority (EL12), within the boundaries of the Nestos LAP the following water systems are identified:

- 50 River Water Systems
- 2 Lake Water Systems and reservoirs
- 3 Transitional Water Systems
- 3 Coastal Water Systems
- 3 Groundwater Systems

Respectively, within the Strymona LAP (EL1106), the following water systems are identified:

- 83 River Water Systems
- 2 Lake Water Systems and reservoirs
- 1 Transitional Water System

- 4 Coastal Water Systems
- 15 Groundwater Systems

8.5.1.1.1 River Water Systems

In the Nestos LAP, 50 river water systems are identified that form the hydrographic network of 429.95 km in length. In detail, it includes 44 natural rivers of the YS, six (6) specially modified rivers of the YS, as presented in the following Table.

Table 8-21: River Water Systems of the Nestos Regional Water District (El1207)

α/α	Water District name	Code	Category	Length (km)	Direct Watershed (km2)	Cumulative Watershed (km2)	Average Annual Runoff (hm3)
Regional Water District Νέστου (EL1207)							
1	Nestos R.	EL1207R0002000002H	ΙΤΥΣ	15,05	15,44	2292,45	1161,69
2	Nestos R.	EL1207R0002000004H	ΙΤΥΣ	6,41	13,87	2127,62	1132,57
3	Nestos R.	EL1207R0002000005N	ΦΥΣ	20,08	101,17	2113,75	1130,04
4	Nestos R.	EL1207R0002000006N	ΦΥΣ	32,97	297,66	2012,58	1111,72
5	Nestos R.	EL1207R0002010001H	ΙΤΥΣ	9,42	18,52	2310,97	1164,37
6	Xirorema R.	EL1207R0002020003N	ΦΥΣ	17,82	149,4	149,40	26,83
7	Mavromitis R.	EL1207R0002040007N	ΦΥΣ	7,25	39,59	39,59	7,97
8	Kato Rema P.	EL1207R0002060008N	ΦΥΣ	9,31	62,16	62,16	15,60
9	CHRISOREMA R.	EL1207R0002080009N	ΦΥΣ	5,59	11,33	11,33	2,29
10	ANONYMO R.	EL1207R0002100010N	ΦΥΣ	5,3	43,34	43,34	6,56
11	MELISSOCHORIOU R.	EL1207R0002120011N	ΦΥΣ	8,78	30,19	48,23	8,88
12	MELISSOCHORIOU R.	EL1207R0002120012N	ΦΥΣ	1,71	18,04	18,04	3,89
13	ARKOUDORREMA R.	EL1207R0002140013N	ΦΥΣ	8,02	39,49	280,18	82,42
14	ARKOUDORREMA R.	EL1207R0002140014N	ΦΥΣ	22,77	61,39	240,70	74,88
15	ARKOUDORREMA R.	EL1207R0002140020N	ΦΥΣ	16,85	67,75	67,75	25,34
16	ARKOUDORREMA R.	EL1207R0002140117N	ΦΥΣ	2,67	17,74	17,74	3,94
17	ARKOUDORREMA R.	EL1207R0002140118N	ΦΥΣ	2,15	9,80	9,80	3,09
18	ARKOUDORREMA R.	EL1207R0002140215N	ΦΥΣ	6,43	30,72	55,54	16,92
19	ARKOUDORREMA R.	EL1207R0002140216N	ΦΥΣ	2,75	24,83	24,83	8,64
20	ARKOUDORREMA R.	EL1207R0002140319N	ΦΥΣ	5,48	28,47	28,47	10,61
21	Nestos R	EL1207R0002150021H	ΙΤΥΣ	6,99	13,42	1230,08	939,86
22	Diavolorema R.	EL1207R0002160022N	ΦΥΣ	15,35	37,90	201,33	59,89

α/α	Water District name	Code	Category	Length (km)	Direct Watershed (km2)	Cumulative Watershed (km2)	Average Annual Runoff (hm3)
23	Diavolorema R.	EL1207R0002160027N	ΦΥΣ	6,96	24,80	24,80	7,58
24	Diavolorema R.	EL1207R0002160123N	ΦΥΣ	4,6	14,12	14,12	3,49
25	Diavolorema R.	EL1207R0002160224N	ΦΥΣ	6,21	22,42	109,05	35,66
26	Diavolorema R.	EL1207R0002160225N	ΦΥΣ	11,86	86,60	86,60	29,64
27	Diavolorema R.	EL1207R0002160326N	ΦΥΣ	2,27	15,47	15,47	4,63
28	Megalo R.	EL1207R0002180028N	ΦΥΣ	15,55	42,3	127,48	38,43
29	Megalo R.	EL1207R0002180031N	ΦΥΣ	5,75	15,79	35,21	11,47
30	Megalo R.	EL1207R0002180032N	ΦΥΣ	4,39	19,41	19,41	6,77
31	Megalo R.	EL1207R0002180129N	ΦΥΣ	1,4	18,29	18,29	6,00
32	Megalo R.	EL1207R0002180230N	ΦΥΣ	6,93	31,69	31,69	11,20
33	Petrorema R.	EL1207R0002200033N	ΦΥΣ	4,07	14,45	35,83	11,35
34	Petrorema R.	EL1207R0002200034N	ΦΥΣ	7,01	21,38	21,38	7,63
35	Milou R.	EL1207R0002220035N	ΦΥΣ	5,32	31,62	31,62	9,17
36	Loutrou R.	EL1207R0002240036N	ΦΥΣ	13,57	80,30	202,06	56,41
37	Loutrou R.	EL1207R0002240037N	ΦΥΣ	17,45	66,28	121,76	41,34
38	Loutrou R.	EL1207R0002240038N	ΦΥΣ	7,19	55,49	55,49	19,46
39	Psichrorema R.	EL1207R0002260039N	ΦΥΣ	3,34	23,29	23,29	2,84
40	Despatis R	EL1207R0002280142N	ΦΥΣ	3,93	9,67	20,61	3,90
41	Despatis R	EL1207R0002280143N	ΦΥΣ	1,39	10,95	10,95	2,48
42	Despatis R	EL1207R0002280244N	ΦΥΣ	1,74	3,23	26,03	6,68
43	Despatis R	EL1207R0002280245N	ΦΥΣ	3,93	22,8	22,80	6,15
44	Despatis R	EL1207R0002280347N	ΦΥΣ	1,88	1,46	24,94	7,19
45	Despatis R	EL1207R0002280348N	ΦΥΣ	3,21	23,48	23,48	6,95
46	Milorema R.	EL1207R0002300049N	ΦΥΣ	7,99	93,66	93,66	16,47
47	Laspias P	EL1207R0005010050H	ΙΤΥΣ	4,49	21,97	229,17	39,65
48	Laspias P	EL1207R0005010051H	ΙΤΥΣ	10,7	207,2	207,20	36,59
49	Nestos R.	EL1207R0B02000040N	ΦΥΣ	17,86	61,44	273,4	694,71
50	Despatis R.	EL1207R0B02280041N	ΦΥΣ	19,66	46,72	118,30	89,91

(Source: 2nd Revision of the RBMP of the Thrace Water District (EL 12), 2024)

In the Strymonas River Basin District, 83 river water systems are identified as presented in the following Table. It includes 59 natural, 22 highly modified and two (2) modified water systems.

Table 8-22: River Water Systems of the Strymonas River Basin District

α/α	Water District name	Code	Category	Length (km)	Direct Watershed (km2)	Cumulative Watershed (km2)	Average Annual Runoff (hm3)
Regional Water District Strimona (EL1106)							
1	STRIMONAS R.	EL1106R0B02250072N	ΦΥΣ	10,18	92,1	10184,5	2098,20
2	MAVROREMA R.	EL1106R0002100249N	ΦΥΣ	6,33	6,72	31,5	7,16

α/α	Water District name	Code	Category	Length (km)	Direct Watershed (km2)	Cumulative Watershed (km2)	Average Annual Runoff (hm3)
3	BELITSAS R	EL1106R0002100238H	ΙΤΥΣ	16,01	92,63	688,9	113,46
4	ERITHROREMA R.	EL1106R0002100241N	ΦΥΣ	6,66	28,05	28,05	4,84
5	KOKKINOREMA R.	EL1106R0002100136N	ΦΥΣ	11,32	44,79	116,0	18,88
6	SRIMONIKO R.	EL1106R0002180067N	ΦΥΣ	16,08	59,36	59,36	5,86
7	SKAPANIS R.	EL1106R0002160065N	ΦΥΣ	40,97	161,51	161,51	12,58
8	PATERA R.	EL1106R0002100133N	ΦΥΣ	14,32	82,07	82,07	16,45
9	STRIMONAS R.	EL1106R0002000028H	ΙΤΥΣ	64,14	799,9	11342,40	2590,60
10	UNNAME R.	EL1106R0002140061H	ΙΤΥΣ	6,97	31,86	49,7	5,77
11	MEGALO R.	EL1106R0002120260N	ΦΥΣ	24,66	96,92	96,92	12,25
12	EZIOVIS R.	EL1106R0002080030N	ΦΥΣ	19,25	65,93	65,93	11,49
13	AGIAS PARASKEVIS R.	EL1106R0002040005N	ΦΥΣ	9,37	76,38	76,38	16,02
14	KASTROLAKKAS R.	EL1106R0002020004N	ΦΥΣ	5,72	50,17	50,17	9,22
15	ANONYMO R.	EL1106R0001010001N	ΦΥΣ	3,41	24,74	123,9	3,84
16	PLATANOREMA R.	EL1106R0003010088N	ΦΥΣ	5,9	39,36	39,36	8,48
17	VRYSI R.	EL1106R0007010091N	ΦΥΣ	2,79	39,25	39,25	5,84
18	ASPROCHOMA R.	EL1106R0009010092N	ΦΥΣ	17,21	113,84	113,84	28,96
19	XIROPOTAMOS R.	EL1106R0002200069N	ΦΥΣ	19,57	108,57	108,27	10,72
20	MAKROPOTAMOS R.	EL1106R0004010076N	ΦΥΣ	6,48	50,79	60,5	14,34
21	XIROPOTAMOS P.	EL1106R0002060421N	ΦΥΣ	13,99	92,72	357,9	42,71
22	MARMARA P.	EL1106R0005010089N	ΦΥΣ	29,16	233,94	233,94	68,39
23	MYLORREUMA R.	EL1106R0004040081N	ΦΥΣ	3,37	21,35	21,35	2,22
24	AGGITIS P.	EL1106R0002060007N	ΦΥΣ	14,52	164,32	2016,03	615,37
25	KROUSOVITIS P.	EL1106R0002100247N	ΦΥΣ	22,87	139,33	239,58	53,43
26	ACHLADITIS P.	EL1106R0002100251N	ΦΥΣ	7,21	52,46	61,3	11,02
27	MAVRORREMA R.	EL1106R0002100250N	ΦΥΣ	6,02	24,78	24,78	5,80
28	KOKKINORREMA R.	EL1106R0002100137N	ΦΥΣ	12,53	71,24	71,24	6,17
29	VATHYTOPOU R.	EL1106R0004020083N	ΦΥΣ	6,71	27,18	118,8	33,09
30	VATHYTOPOU R.	EL1106R0004020084N	ΦΥΣ	10,11	43,23	91,6	24,47
31	KROUSOVITIS P.	EL1106R0002100248N	ΦΥΣ	1,30	38,98	38,98	9,05
32	VRYSI R.	EL1106R0007010090H	ΙΤΥΣ	5,23	6,25	37,1	7,73
33	MYLORREUMA R.	EL1106R0004040080H	ΙΤΥΣ	3,73	7,94	7,94	6,41
34	MYLORREUMA R.	EL1106R0004030078H	ΙΤΥΣ	11,65	111,77	214,6	111,48
35	MYLORREUMA R.	EL1106R0004000079N	ΦΥΣ	10,16	95,15	103,1	16,98
36	VATHYTOPOU R.	EL1106R0004020082H	ΙΤΥΣ	5,40	20,57	139,40	40,99
37	STRIMONAS R.	EL1106R0002250070H	ΙΤΥΣ	8,74	44,11	10304,8	2117,92
38	KERKINITIS P.	EL1106R0002220073N	ΦΥΣ	4,55	18,79	237,80	69,83
39	STRIMONAS R.	EL1106R0002000003N	ΦΥΣ	13,49	71,78	15612,1	3281,81

α/α	Water District name	Code	Category	Length (km)	Direct Watershed (km2)	Cumulative Watershed (km2)	Average Annual Runoff (hm3)
40	SKAPANIS R.	EL1106R0002160063H	ΙΤΥΣ	8,67	25,99	207,5	17,78
41	ANONYMO R.	EL1106R0002140062N	ΦΥΣ	5,22	17,8	17,8	1,74
42	CHRYSORROES P.	EL1106R0002120156H	ΙΤΥΣ	12,17	21,19	47,1	6,17
43	CHRYSORROES P.	EL1106R0002120157N	ΦΥΣ	7,54	35,6	35,60	3,50
44	KROUSOVITIS P.	EL1106R0002100246H	ΙΤΥΣ	2,1	5,68	245,25	54,56
45	ERYTHRORREMA R.	EL1106R0002100239H	ΙΤΥΣ	7,48	17,89	45,9	6,76
46	AGIOU IOANNOU R.	EL1106R0002100031H	ΙΤΥΣ	10,85	182,67	1145,3	190,41
47	CHIMARROS DOXATOU	EL1106R0002060325H	ΙΤΥΣ	8,88	68,26	361,2	87,62
48	AGGITIS P.	EL1106R0002060006N	ΦΥΣ	14,66	221,43	2237,5	621,04
49	TAFROS PHILIPPON	EL1106R0002060217A	ΤΥΣ	17,55	244,39	588,8	160,73
50	BELITSAS P.	EL1106R0002100245H	ΙΤΥΣ	10,95	35,37	312,1	61,93
51	BELITSAS P.	EL1106R0002100244H	ΙΤΥΣ	11,01	132,2	444,3	84,11
52	BELITSAS P.	EL1106R0002100242H	ΙΤΥΣ	7,47	106,03	550,4	96,78
53	STRIMONAS R.	EL1106R0002250071H	ΙΤΥΣ	3,35	76,14	10260,7	2109,91
54	MAKROPOTAMOS R.	EL1106R0004010077N	ΦΥΣ	2,28	14,67	65,5	20,24
55	STRIMONAS R.	EL1106R0002010002N	ΦΥΣ	1,55	10,33	15622,4	3283,95
56	XIROPOTAMOS P.	EL1106R0002220175N	ΦΥΣ	6,61	35,12	35,12	10,29
57	KERKINITIS P.	EL1106R0002220074N	ΦΥΣ	19,49	184,36	219,0	64,32
58	KOKKINORREMA R.	EL1106R0002100134N	ΦΥΣ	5,09	62,51	183,2	26,93
59	VATHYRREMA R.	EL1106R0004020085N	ΦΥΣ	2,55	4,0	4,0	0,86
60	MAVROPOULI R.	EL1106R0002100253N	ΦΥΣ	5,96	8,81	8,81	1,58
61	XIROPOTAMOS R.	EL1106R0002200068N	ΦΥΣ	4,98	8,26	116,53	11,79
62	STRYMONIKOU R.	EL1106R0002180066N	ΦΥΣ	4,64	17,07	76,4	7,95
63	SKAPANIS R.	EL1106R0002160064N	ΦΥΣ	5,56	20,16	181,6	14,46
64	EZIOVIS R.	EL1106R0002080029N	ΦΥΣ	15,59	59,91	125,8	23,87
65	PIGADOULI R.	EL1106R0003010087N	ΦΥΣ	11,62	21,59	33,9	4,57
66	AGION ANARGYRON R.	EL1106R0002100132N	ΦΥΣ	7,39	8,35	273,7	48,78
67	LAKKOS R.	EL1106R0002060109N	ΦΥΣ	6,86	90,54	90,54	40,97
68	AGGITIS P.	EL1106R0002060108N	ΦΥΣ	32,55	262,88	499,1	211,87
69	KEFALARI R.	EL1106R0002060219N	ΦΥΣ	6,79	70,61	70,61	61,72
70	EPTAMYLOI R.	EL1106R0002100135N	ΦΥΣ	2,9	4,69	4,69	19,50
71	XIROPOTAMOS P.	EL1106R0002060423N	ΦΥΣ	5,42	115,81	115,81	1,61
72	XIROPOTAMOS P.	EL1106R0002060422H	ΙΤΥΣ	0,83	51,57	167,4	24,45
73	KEFALARI R.	EL1106R0002060218H	ΙΤΥΣ	6,07	17,02	87,6	19,03
74	CHIMARROS DOXATOU	EL1106R0002060420H	ΙΤΥΣ	5,57	44,65	763,78	169,31
75	MEGALO R.	EL1106R0002120054H	ΙΤΥΣ	9,18	30,92	184,6	23,93

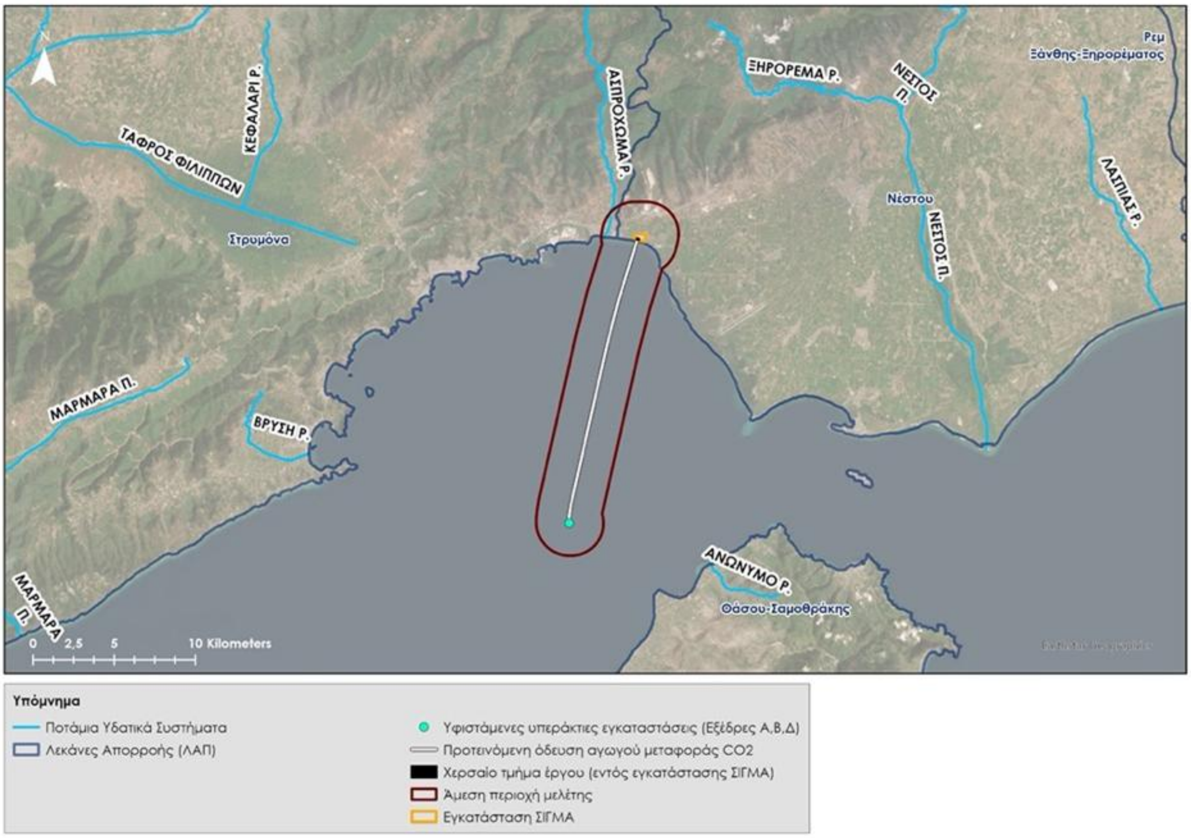
α/α	Water District name	Code	Category	Length (km)	Direct Watershed (km2)	Cumulative Watershed (km2)	Average Annual Runoff (hm3)
76	PHILIPPIANS' DRAIN	EL1106R0002060293A	ΤΥΣ	7,25	256,81	256,81	74,33
77	ANGISTROS P.	EL1106R0B02240094N	ΦΥΣ	3,32	85,43	85,43	15,23
78	CHIMARROS DOXATOU	EL1106R0002060326N	ΦΥΣ	4,14	292,95	292,95	26,04
79	ARCHANGELOS P.	EL1106R0002060112N	ΦΥΣ	4,40	68,46	68,46	34,55
80	XIROPOTAMOS P.	EL1106R0002060110N	ΦΥΣ	4,81	77,22	77,22	47,03
81	PIGON MYLOPOTAMOS R. - Z. PIGIS	EL1106R0002060414N	ΦΥΣ	11,96	96,01	96,01	21,19
82	PIGON AG. BARVARAS R.	EL1106R0002060416N	ΦΥΣ	1,35	1,81	1,81	63,32
83	PIGON AKRINOS R.	EL1106R0004020127N	ΦΥΣ	3,96	44,42	44,42	12,45

(Source: 2nd Revision of the RBMP of Eastern Macedonia (EL11), 2024)

The nearest river water systems in the wider Project area are presented in the following Table and Figure. Within the Project study area, the river YS Asprochoma P. (EL1106R0009010092N) with a total length of 17.21 km is recorded. It is located west of the Project's land installations, at a distance of approximately 1.7 km.

Table 8-23: River water systems located near the Project

Code ΥΣ	Name	Water District	Length	Distance from the nearest boundary of the Project study area
EL1207R0002000002H	NESTOS P.	WD NESTO (EL1207)	15,05 km	~15 km A
EL1207R0002020003N	XIROREMA P.	WD NESTO (EL1207)	17,82 km	~8,8 km BA
EL1106R0009010092N	ASPROCHOMA P.	WD STRYMONA (EL1106)	17,21 km	Εντός
EL1106R0007010090H	VRYSI P.	WD STRYMONA (EL1106)	5,23 km	~14,85 km Δ
EL1106R0005010089N	MARMARA P.	WD STRYMONA (EL1106)	29,16 km	~23,19 km Δ
EL1242R00020100180N	ANONYMO P.	WD THASSOS - SAMOTHRAKI (EL1242)	5,46 km	~6,81 km NA
EL1242R00040100181N	PORTES P.	WD THASSOS - SAMOTHRAKI (EL1242)	15,90 km	~14,08 NA
EL1106R0002060293A	PHILIPPINE MOOR	WD STRYMONA (EL1106)	7,25 km	~15,25 km Δ



(Source: 2nd Revision of the River Basin Management Plans (RBMPs) of Eastern Macedonia (EL11) and Thrace (EL12), 2024)

Figure 8–61: River water systems located near the Project

8.5.1.1.2 Lake Water Systems

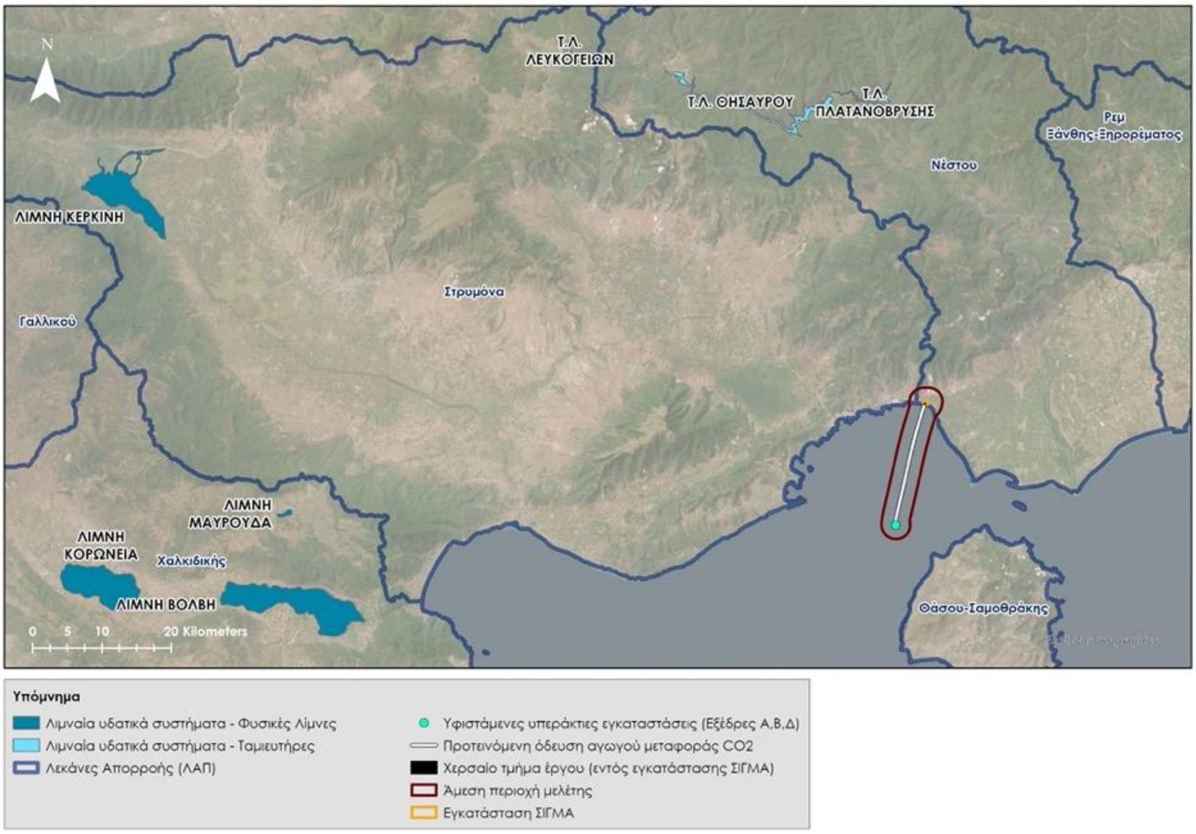
According to the 2nd Revision of the River Basin Management Plan of the Thrace Regional Authority (EL12), two (2) lake water systems (natural lakes and reservoirs) are recorded in the Nestos RBD. Correspondingly, according to the 2nd Revision of the River Basin Management Plan of the Eastern Macedonia Regional Authority (EL 11), two (2) lake water systems (natural lakes and reservoirs) are recorded in the Strymon RBD, as presented in the following Table and Figure. No lake water systems have been recorded in the study area.

In the context of the 1st revision of the RBMPs, reservoirs were considered to be highly modified RB rivers and not lacustrine RBWs, so they are referred to as “RBW rivers of lacustrine character”. However, the stagnant water conditions prevailing in the reservoirs define a hydrological and ecological framework that undoubtedly resembles that of lake HMs. In the 2nd revision, in accordance with the WFD Reporting Guidance 2022, the reservoirs are classified as lake HMs.

Table 8–24: Lake Water Systems located near the Project

Code ΥΣ	Name	Water District	Length	Distance from the nearest boundary of the Project study area
EL1207RLB02000001H	T.L. PLATANOVRYSIS	WD NESTO (EL1207)	3,17 km²	~40.11 km NW E
EL1207RL002150002H	T.L. THESAVROU R.	WD NESTO (EL1207)	15,27 km²	~40.2 km NW
EL1106L000002H	T. L. KERINI	WD AP STRIMONA (EL1106)	46,1 km²	~69 km NW
EL1106RL004040001H	T.L. LEFKOGEION	WD STRIMONA (EL1106)	1,1 km²	~111 km NW

(Source: 2nd Revision of the River Basin Management Plans (RBMPs) of Eastern Macedonia (EL11) and Thrace (EL12), 2024)



(Source: 2nd Revision of the River Basin Management Plans (RBMPs) of Eastern Macedonia (EL11) and Thrace (EL12), 2024)

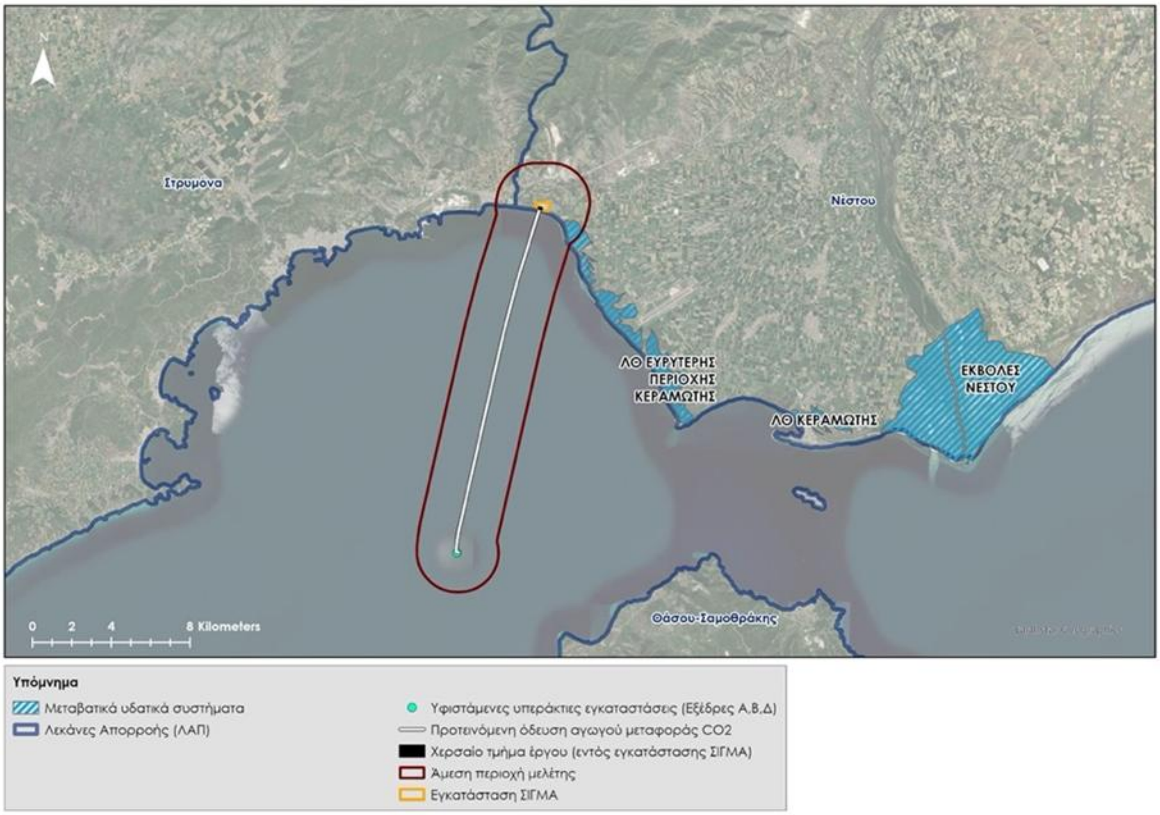
Figure 8–62: Lake water systems located near the Project

8.5.1.1.3 Transitional Water Systems

According to the 2nd Revision of the Watershed Plan of the Regional Development Authority of Thrace (EL12), three (3) transitional water systems are recorded in the Nestos RBD. Correspondingly, according to the 2nd Revision of the Watershed Plan of the Regional Development Authority of Eastern Macedonia (EL 11), one transitional water system is recorded in the Strymona RBD. Within the study area, the transitional water system of the Greater Keramoti Regional Development Authority (EL1207T0001N) is located, with a total area of 7.89 km2. The transitional water systems recorded near the Project are presented in the following Table and Figure.

Table 8–25: Transitional Water Systems located near the Project

Code	Name	Water District	Category	Area	Distance from the nearest boundary of the Project study area
EL1106T0001N	Mouths of the Strymonas River	Natura 2000 Protected Area of Strymonas (EL1106)	Natural Habitat	5,94 km^2	~50km NΔ
EL1207T0001N	Lagoons of the Keramoti Area	Natura 2000 Protected Area of Nestos (EL1207)	Natural Habitat	7,89 km^2	Inside
EL1207T0002N	Keramoti Lagoon	Natura 2000 Protected Area of Nestos (EL1207)	Natural Habitat	1,22 km^2	~13,5 km NA
EL1207T0003N	Mouths of the Nestos River	Natura 2000 Protected Area of Nestos (EL1207)	Natural Habitat	33,24 km^2	~18 km A



(Source: 2nd Revision of the River Basin Management Plans (RBMPs) of Eastern Macedonia (EL11) and Thrace (EL12), 2024)

Figure 8-63: Transitional water bodies located near the Project

8.5.1.1.4 Coastal Water Systems

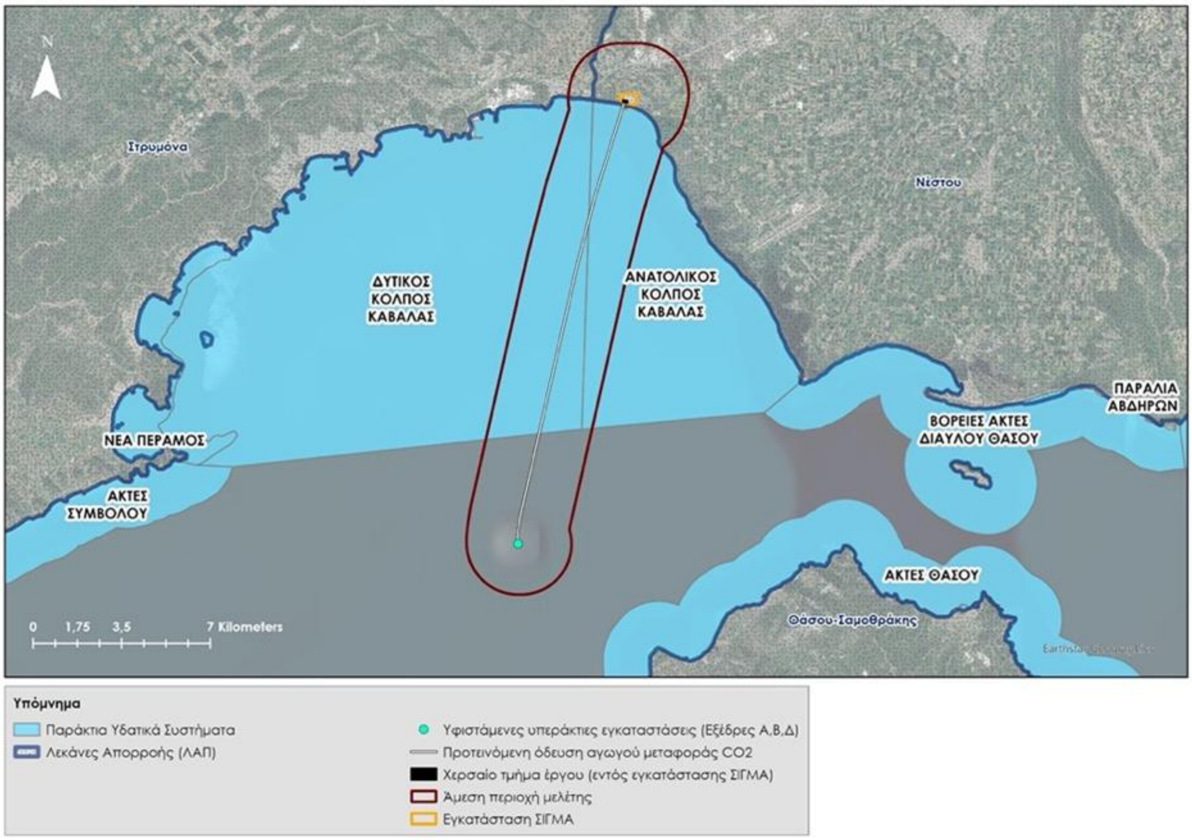
According to the 2nd Revision of the RBMPs of the Regional Authorities of Thrace and Eastern Macedonia (EGY, 2024), three (3) coastal water bodies are recorded in the Nestos LAP, while four (4) are recorded in the Strymona LAP. In the wider Project area, the following coastal water bodies are identified: EL1106C0004N "Gulf of Kavala-Western" and EL1207C0001N "Gulf of Kavala-Eastern" and PYS EL242C0012N "Coast of Thassos", the characteristics of which are summarized in the following Table. The study area, and specifically part of the proposed route of the project pipeline falls within two coastal WBs of the Nestos and Strymona LAPs. Specifically, it is located within the coastal MS Western Gulf of Kavala (EL1106C0004N) and the coastal MS Eastern Gulf of Kavala (EL1207C0001N).

Table 8-26: Coastal MS of the Project area

Code	Name	Water District	Area (km²)	Distance from the nearest boundary of the Project study area
EL1106C0004N	Western Gulf of Kavala	WD Strimona (EL1106)	183,16	Inside

Code	Name	Water District	Area (km²)	Distance from the nearest boundary of the Project study area
EL1207C0001N	Eastern Gulf of Kavala	WD Nestos (EL1207)	69,55	Inside
EL12242C0012N	Coast of Thassos	WD Thassos-Samothraki (EL1242)	198,30	~3 km

(Source: 2nd Revision of the River Basin Management Plans (RBMPs) of Eastern Macedonia (EL11) and Thrace (EL12), 2024)



(Source: 2nd Revision of the River Basin Management Plans (RBMPs) of Eastern Macedonia (EL11) and Thrace (EL12), 2024)

Figure 8–64: Coastal water bodies located near the Project

8.5.1.2 Surface Water Quality

According to the 2nd Revision of the RBMP of the Water Districts of Thrace and Eastern Macedonia, the quality of surface water systems refers to their ecological and chemical status. The following Table presents the surface water bodies of the WBs located near the Project, as well as the ecological and chemical status, as described in the RBMPs.

Table 8–27: Surface water quality near the Project

Water system category	Code	Name	Watershed	Ecological status / potential	Ecological status / potential	Overall status
River water bodies	EL1207R0002000002H	NESTOS P.	NESTOU (EL1207)	Good	Good	Good
River water bodies	EL1207R0002020003N	XIROREMA P.	NESTOU (EL1207)	Good	Good	Good
River water bodies	EL1242R00020100180N	ANONYMO P.	THASSOU - SAMOTHRAKIS (EL1242)	Good	Good	Good
River water bodies	EL1242R00040100181N	PORTES P.	THASSOU - SAMOTHRAKIS (EL1242)	Good	Good	Good
River water bodies	EL1106R0009010092N	ASPROCHOMA P.	STRYMONA (EL1106)	Good	Good	Good
River water bodies	EL1106R0007010090H	VRYSI P.	STRYMONA (EL1106)	Lower than good	Good	Lower than good
River water bodies	EL1106R0005010089N	MARMARA P.	STRYMONA (EL1106)	Good	Good	Good
River water bodies	EL1106R0002060293A	TAFROS PHILIPPON	STRYMONA (EL1106)	Lower than good	Good	Lower than good
Lake water bodies	EL1207RLB02000001H	PL. PLATANOVRYSIS P.	STRYMONA (EL1106)	Good	Good	Good
Lake water bodies	EL1207RL002150002H	PL. THESAVROU P.	NESTOU (EL1207)	Good	Good	Good
Lake water bodies	EL1106L000002H	T. L. KERINI P.	STRYMONA (EL1106)	Incomplete	Good	Incomplete
Transitional water bodies	EL1207T0001N	KERAMOTIS AREA EXT.	NESTOU (EL1207)	Unknown	Unknown	Unknown
Transitional water bodies	EL1207T0002N	KERAMOTI LAGOON	NESTOS (EL1207)	Unknown	Unknown	Unknown
Transitional water bodies	EL1207T0003N	NESTOS RIVER ESTUARY	NESTOS (EL1207)	Unknown	Good	Unknown
Transitional water bodies	EL1106T0001N	STRYMONAS RIVER ESTUARY	STRYMONAS (EL1106)	Unknown	Unknown	Unknown
Coastal water systems	EL1242C0012N	THASOS COAST	THASOS-SAMOTHRACE (EL1242)	High	Good	High
Coastal water systems	EL1207C0001N	EASTERN GULF OF KAVALA	NESTOS (EL1207)	Moderate	Good	Moderate

Water system category	Code	Name	Watershed	Ecological status / potential	Ecological status / potential	Overall status
	EL1106C0004N	WESTERN GULF OF KAVALA	STRYMONAS (EL1106)	Moderate	Good	Moderate

(Source: 2nd Revision of the River Basin Management Plans (RBMPs) of Eastern Macedonia (EL11) and Thrace (EL12), 2024))

Regarding the quality of the coastal water systems in the wider Project area, a study team from LDK conducted seawater sampling in November 2023 at six (6) points in the Gulf of Kavala. Specifically, these samplings and sample analyses were carried out within the framework of the 2023 Annual Environmental Monitoring Report (AEM 2023), which concerns the implementation of the environmental control program of the Prinos Offshore Development, in accordance with the requirements of the Environmental Terms Approval Decision (ETAD) 8413/24.04.2018/YPEN.

The following Table and Figure present the total number of sampling stations investigated for seawater quality.

Table 8‑28: Coordinates of all seawater sampling stations in the Gulf of Kavala

Sampling points (SP)	X EGSA 87	Y EGSA 87	X WGS 84 (degrees)	Y WGS 84 (degrees)
9	541090,91	4515458,52	24,487037	40,789089
11	542226,66	4516832,25	24,500591	40,801407
12	541560,00	4515575,95	24,492604	40,790124
1E	537168,80	4506094,93	24,439994	40,704926
2E	537760,77	4506056,01	24,447000	40,704548
Reference Station	538732,58	4512285,73	24,458888	40,760623

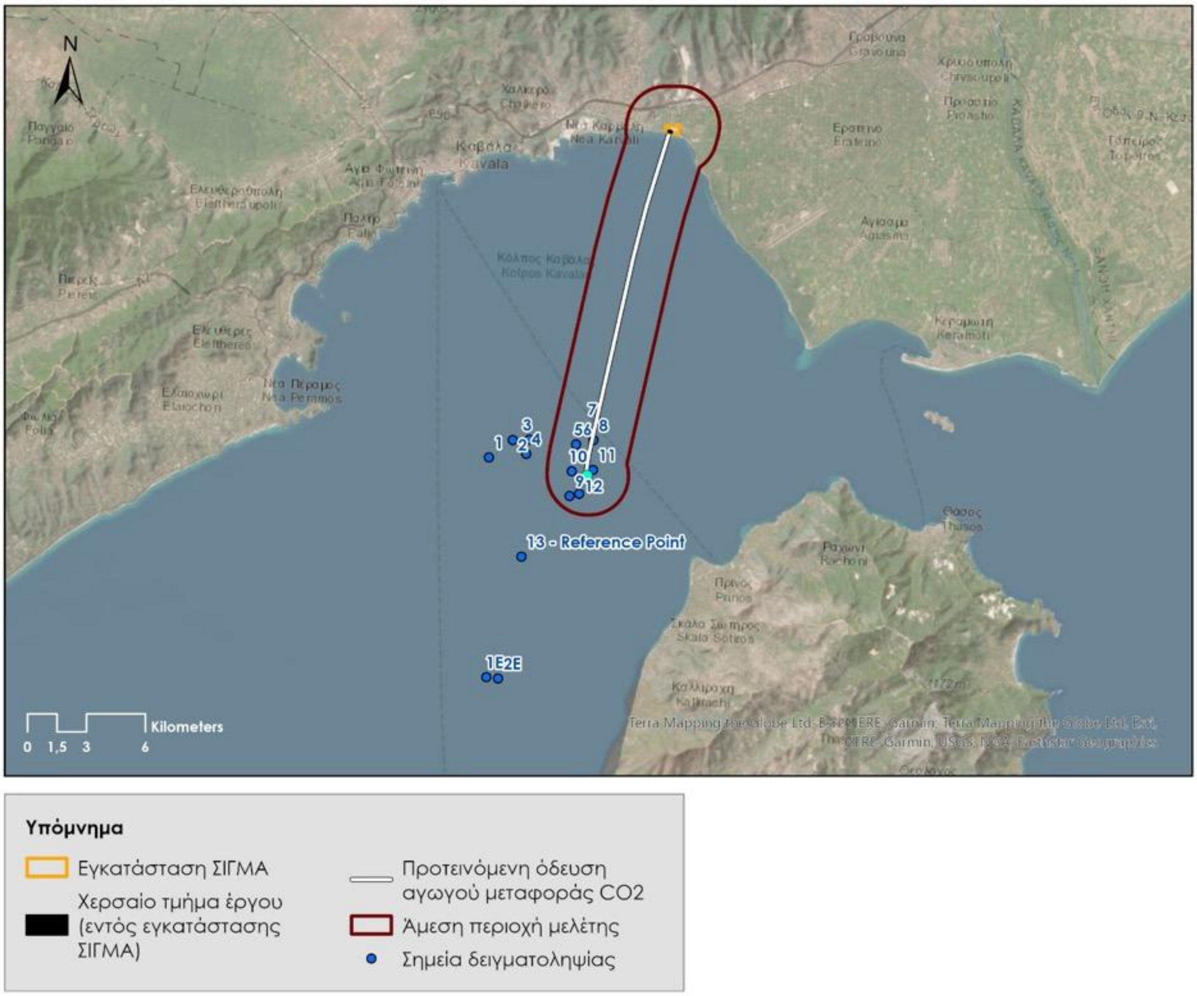


Figure 8-65: Sampling points for water quality analysis (November 2023))

The results of the chemical analyses per sampling point are presented in detail for each point in the Tables below.

Table 8–29: Results of analyses of general physicochemical parameters in seawater samples sample from a depth of 10 m from the surface

Parameter	Method	Quality Limits of Annex I of Joint Ministerial Decree No. 51354/2641/ E103/2010, Ministerial Decree No. 170766/2016	Unit	ΣΔ 9 SW R1	ΣΔ 9 SW R2	ΣΔ 11 SW R1	ΣΔ 11 SW R2	ΣΔ 12 SW R1	ΣΔ 12 SW R2	ΣΔ 1E SW R2	ΣΔ 1E SW R1	ΣΔ 2E SW R1	ΣΔ 2E SW R2	ΣΔ REF SW R1	ΣΔ REF SW R2
Βάθος			m	10		10					10	10		10	
pH				8,3		8,3					8,18	8,31		8,19	
Θερμοκρα-σία			°C	19,7		20,8					20,5	19,4		21,8	
Μετρήσεις σε εργαστήριο Θρεπτικά															
Αμμωνία	APHA 4500-NH3 F		mg / l	0,13	<0,025	<0,025	<0,025	<0,025	<0,025	<0,025	<0,025	<0,025	<0,025	<0,025	<0,025
Θειϊκά	0.628 Ion Chromatography		mg / l	2900	2900	2800	2800	3000	2900	3000	2900	2900	2900	2900	3100
Νιτρώδη	Merck Spectr/t 114776		mg / l	<0,02	<0,02	<0,02	<0,02	0,02	0,02	<0,02	0,02	0,02v	0,03	0,02	<0,02
Νιτρικά	Merck Spectr/t 114776		mg / l	12,2	13,8	9,3	9	11,5	10,4	8,7	10,6	12	8,2	12	12,9
Φωσφορικά	Merck Spectr/t 114776		mg / l	<0,04	0,72	<0,04	<0,04	0,1	0,05	<0,04	<0,04	<0,04	<0,04	0,28	0,67
Μετρήσεις σε εργαστήριο PAHs															
Benzo[a]pyrene	Lab. method based on EPA 525.3	0,020 μg/l	μg / l	ND	0,0052	ND	ND	ND	ND	ND	<0,003	ND	ND	ND	ND
Benzo[b]-fluora-nthene	Lab. method based on EPA 525.3	0,010 μg/l	μg / l	ND	0,0065	ND	<0,005	ND	<0,005	<0,005	<0,005	<0,005	<0,005	<0,005	<0,005

Parameter	Method	Quality Limits of Annex I of Joint Ministerial Decree No. 51354/2641/ E103/2010, Ministerial Decree No. 170766/2016	Unit	ΣΔ 9 SW R1	ΣΔ 9 SW R2	ΣΔ 11 SW R1	ΣΔ 11 SW R2	ΣΔ 12 SW R1	ΣΔ 12 SW R2	ΣΔ 1E SW R2	ΣΔ 1E SW R1	ΣΔ 2E SW R1	ΣΔ 2E SW R2	ΣΔ REF SW R1	ΣΔ REF SW R2
Benzo[K]-fluora-nthene	Lab. method based on EPA 525.3	0,010 μg/l	μg / l	ND	<0,00 5	ND	ND	ND	ND	<0,00 5	ND	ND	<0,00 5	<0,00 5	ND
Benzo-[g,h,i]pe-rylene	Lab. method based on EPA 525.3	0,010 μg/l	μg / l	ND	<0,00 5	ND	<0,00 5	ND	ND	<0,00 5	ND	ND	ND	ND	ND
Indeno (1,2,3,-c,d) pyrene	Lab. method based on EPA 525.3	0,010 μg/l	μg / l	ND	<0,00 5	ND	ND	ND	ND	<0,00 5	ND	ND	ND	ND	ND
Acena-phthene	Lab. method based on EPA 525.3	0,010 μg/l	μg / l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Acena-phthylene	Lab. method based on EPA 525.3	0,010 μg/l	μg / l	<0,01	ND	ND	ND	<0,01	<0,01	<0,01	<0,01	<0,01	ND	<0,01	<0,01
Anthra-cene	Lab. method based on EPA 525.3	0,020 μg/l	μg / l	ND	<0,01	ND	ND	<0,01	ND	ND	ND	<0,01	ND	ND	ND
Benzo[a]-anthracene	Lab. method based on EPA 525.3	0,010 μg/l	μg / l	<0,01	<0,01	<0,01	<0,01	ND	<0,01	ND	<0,01	ND	<0,01	<0,01	ND
Chrysene	Lab. method based on EPA 525.3	0,010 μg/l	μg / l	ND	<0,01	<0,01	ND	ND	<0,01	<0,01	ND	ND	ND	ND	ND
Dibe-nzo[a,h]-anthracene	Lab. method based on EPA 525.3	0,010 μg/l	μg / l	ND	ND	ND	ND	ND	ND	<0,00 5	ND	ND	ND	ND	ND
Fluora-nthene	Lab. method based on EPA 525.3	0,030 μg/l	μg / l	ND	0,018	<0,01	ND	ND	<0,01	ND	ND	ND	<0,01	<0,01	ND
Fluorene	Lab. method based on EPA 525.3	0,020 μg/l	μg / l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Parameter	Method	Quality Limits of Annex I of Joint Ministerial Decree No. 51354/2641/ E103/2010, Ministerial Decree No. 170766/2016	Unit	ΣΔ 9 SW R1	ΣΔ 9 SW R2	ΣΔ 11 SW R1	ΣΔ 11 SW R2	ΣΔ 12 SW R1	ΣΔ 12 SW R2	ΣΔ 1E SW R2	ΣΔ 1E SW R1	ΣΔ 2E SW R1	ΣΔ 2E SW R2	ΣΔ REF SW R1	ΣΔ REF SW R2
Naphtha-lene	Lab. method based on EPA 525.3	0,100 μg/l	μg / l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene	Lab. method based on EPA 525.3	0,060 μg/l	μg / l	ND	0,016	<0,01	ND	ND	<0,01	ND	ND	ND	<0,01	<0,01	ND
Phena-nthrene	Lab. method based on EPA 525.3	0,030 μg/l	μg / l	ND	<0,01	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

*The quality limit refers to the Maximum Permissible Concentration as defined for the Netherlands through the report Staatscourant, The Netherlands, June 2000

** Non-accredited test according to ISO 17025, No. 154 ESYD.

*** The maximum legal limits are described and explained in terms of their correct use in directives 98/83/EC 3-11-1998 and 2013/51/EURATOM 22-10-2013, their amendments and their corresponding adaptations to Greek legislation

Amendment of no. 51354/2641/E103/2010 of the joint ministerial decision (Β΄ 1909), in compliance with the provisions of Directive 2013/39/EU "amending Directives 2000/60/EC and 2008/105/EC as regards priority substances in the field of water policy" of the European Parliament and of the Council of 12 August 2013 and other relevant provisions".

R': REPLICATE (REPLICATE SAMPLE)

ND: NOT DETECTED (NOT DETECTED)

SΣ: SAMPLING STATION

Table 8–30: Results of analyzes of general physicochemical parameters in seawater samples sampled from the bottom

Parameter	Method	Quality Limits of Annex I of Joint Ministerial Decree No. 51354/2641/E103/2010, Ministerial Decree No. 170766/2016	Units	SS 9 SW R1	SS 9 SW R2	SS 11 SW R1	SS 11 SW R2	SS 12 SW R1	SS 12 SW R2	SS 1E SW R2	SS 1E SW R1	SS 2E SW R1	SS 2E SW R2	SS REF SW R1	SSΔ REF SW R2
Depth			m	25			20				35	35		25	
pH			pHunits	8,23			8,29				8,14	8,22		8,18	
Temperature			°C	21			19,9				21,1	21,3		22,8	
Laboratory measurements Nutrients															
Ammonia	APHA 4500-NH3 F		mg / l	<0,025	<0,025	<0,025	<0,025	<0,025	<0,025	<0,025	0,12	<0,025	<0,025	0,27	<0,025
Sulfates	0.628 Ion Chromatography		mg / l	3000	3000	3000	2900	3100	3000	3000	3000	3100	3100	3000	2900
Nitrogen	Merck Spectr/t 114776		mg / l	<0,02	<0,02	<0,02	0,02	<0,02	<0,02	0,02	0,02	0,03	<0,02	0,03	0,02
Nitrates	Merck Spectr/t 114776		mg / l	8,1	8,4	9,4	10,8	10,7	11	9,4	12,9	9,3	8,1	11,1	5,6
Phosphorates	Merck Spectr/t 114776		mg / l	<0,04	<0,04	<0,04	<0,04	0,22	<0,04	<0,04	0,2	0,05	<0,04	<0,04	<0,04
Laboratory measurements PAHs															
Benzo[a]pyrene	Lab. method based on EPA 525.3	0,020 μg/l	μg / l	ND	ND	<0,003	ND	ND	ND	ND	0,003	ND	0,005	ND	ND
Benzo[b]fluoranthene	Lab. method based on EPA 525.3	0,010 μg/l	μg / l	ND	<0,005	<0,005	ND	<0,005	ND	ND	<0,005	<0,005	0,007	<0,005	<0,005

Parameter	Method	Quality Limits of Annex I of Joint Ministerial Decree No. 51354/2641/E103/2010, Ministerial Decree No. 170766/2016	Units	SS 9 SW R1	SS 9 SW R2	SS 11 SW R1	SS 11 SW R2	SS 12 SW R1	SS 12 SW R2	SS 1E SW R2	SS 1E SW R1	SS 2E SW R1	SS 2E SW R2	SS REF SW R1	SSΔ REF SW R2
Benzo[K]fluoranthene	Lab. method based on EPA 525.3	0,010 μg/l	μg / l	ND	ND	<0,005	ND	ND	ND	<0,005	<0,005	ND	<0,005	<0,005	<0,005
Benzo[g,h,i]perylene	Lab. method based on EPA 525.3	0,010 μg/l	μg / l	<0,005	ND	<0,005	ND	ND	ND	ND	<0,005	ND	<0,005	ND	ND
Indeno (1,2,3,-c,d) pyrene	Lab. method based on EPA 525.3	0,010 μg/l	μg / l	ND	ND	<0,005	ND	ND	ND	ND	<0,005	ND	<0,005	ND	ND
Acenaphthene	Lab. method based on EPA 525.3	0,010 μg/l	μg / l	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Acenaphthylene	Lab. method based on EPA 525.3	0,010 μg/l	μg / l	<0,01	ND	<0,01	ND	<0,01	<0,01	ND	<0,01	<0,01	<0,01	<0,01	<0,01
Anthracene	Lab. method based on EPA 525.3	0,020 μg/l	μg / l	ND	ND	<0,01	ND	ND	ND	<0,01	ND	ND	<0,01	<0,01	ND
Benzo[a]-anthracene	Lab. method based on EPA 525.3	0,010 μg/l	μg / l	ND	ND	<0,01	ND	ND	ND	<0,01	<0,01	ND	<0,01	<0,01	ND
Chrysene	Lab. method based on EPA 525.3	0,010 μg/l	μg / l	ND	ND	<0,01	ND	ND	ND	<0,01	<0,01	ND	<0,01	ND	ND
Dibenzo[a,h]-anthracene	Lab. method based on EPA 525.3	0,010 μg/l	μg / l	ND	ND	<0,005	ND	ND	ND	ND	ND	ND	<0,005	ND	ND

Parameter	Method	Quality Limits of Annex I of Joint Ministerial Decree No. 51354/2641/E103/2010, Ministerial Decree No. 170766/2016	Units	SS 9 SW R1	SS 9 SW R2	SS 11 SW R1	SS 11 SW R2	SS 12 SW R1	SS 12 SW R2	SS 1E SW R2	SS 1E SW R1	SS 2E SW R1	SS 2E SW R2	SS REF SW R1	SSΔ REF SW R2
Fluora-nthene	Lab. method based on EPA 525.3	0,030 μg/l	μg / l	ND	ND	<0,01	ND	ND	ND	<0,01	<0,01	ND	0,013	ND	ND
Fluorene	Lab. method based on EPA 525.3	0,020 μg/l	μg / l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	Lab. method based on EPA 525.3	0,100 μg/l	μg / l	ND	<0,1	ND	ND	ND	<0,1	ND	ND	ND	ND	ND	ND
Pyrene	Lab. method based on EPA 525.3	0,060 μg/l	μg / l	ND	ND	<0,01	ND	ND	ND	<0,01	<0,01	ND	0,011	ND	ND
Phenanthrene	Lab. method based on EPA 525.3	0,030 μg/l	μg / l	ND	ND	ND	ND	ND	ND	<0,01	ND	ND	ND	ND	ND

*The quality limit refers to the Maximum Permissible Concentration as defined for the Netherlands through the report Staatscourant, The Netherlands, June 2000

** Non-accredited test according to ISO 17025, No. 154 ESYD.

*** The maximum legal limits are described and explained in terms of their correct use in directives 98/83/EC 3-11-1998 and 2013/51/EURATOM 22-10-2013, their amendments and their corresponding adaptations to Greek legislation

Amendment of no. 51354/2641/E103/2010 of the Joint Ministerial Decision (B΄ 1909), in compliance with the provisions of Directive 2013/39/EU "amending Directives 2000/60/EC and 2008/105/EC as regards priority substances in the field of water policy" of the European Parliament and of the Council of 12 August 2013 and other relevant provisions".

R': REPLICATE

ND: NOT DETECTED Not quantified at the reference limit of the method.

SS: SAMPLING STATION'

The above chemical analysis results were evaluated and compared based on the quality standards referred to in Greek Legislation and more specifically in Joint Ministerial Decision 51354/2641/E103/2010 (Government Gazette 1090/B/08.12.2010). In Ministerial Decision No. M.A. ΕΠ 51354/2641/E103/2010 (ΦΕΚ 1090/B/08.12.2010), as amended by the Minister of Environment, Housing and Urban Affairs, 170766/22.01.2016 (ΦΕΚ 69/B/22.1.2016), establishes the Environmental Quality Standards (EQS) for the concentrations of certain pollutants and priority substances in surface waters, in compliance with the provisions of Directive 2008/105/EK of the European Parliament and of the Council of 16 December 2008 "on Environmental Quality Standards (EQS) in the field of water policy and amending and subsequently repealing Council Directives 82/176/EEC, 83/513/EEC, 84/156/EEC, 84/491/EEC and 86/280/EEC and amending Directive 2000/60/EC of the European Parliament and of the Council", as well as on the concentrations of specific pollutants in inland surface waters and other provisions.

Regarding the concentrations of PAHs, in all repeat samples of seawater, including the samples of the Reference Station, these are lower than the detection limit (<0.005 mg/L), as well as lower than the EU and national thresholds for the Good environmental status of the marine environment (Annex I of Joint Ministerial Decision No. 51354/2641/E103/2010, Ministerial Decision No. 170766/2016). Similar concentrations were recorded in the 2021 sampling (as part of the 2020 EPA), where in those samples the PAH concentrations in the seawater samples were lower than the detection limit. Therefore, there are no indications of a burden on the marine environment of the examined area from the operation of the Project by PAHs.

Regarding the nutrient concentrations, it is noted that at the present time there are no institutionalized limits in Greek legislation. The interpretation of the results of the laboratory analyses of nutrients was based on scientific articles, which present corresponding results of physicochemical analyses on seawater samples collected in the North Aegean (Zak et al. 2021, Pavlidou & Georgopoulos 2001 and Souvermezoglou et al. 2014). More specifically, according to Zak et al., (2021), the expected concentrations of sulfates (SO42-) in seawater range at 2,700 mg/L. Similar results were recorded in the measurements carried out in the repeated seawater samples at all depths, as the average values ranged from 2,900 mg/L – 3,008 mg/L.

The concentrations of ammonia (NH3), phosphates (PO_4^{3-}), nitrites (NO2-) and nitrates (NO3-) ranged at similar levels in all repeated samples, including the samples from the Reference Station, as they correspond to the concentrations recorded in the samplings carried out over the last 30 years in Greece and in particular in the North Aegean according to Souvermezoglou et al. 2014.

In conclusion, as confirmed by the above data and those included in the 1st Revision of the RBMPs of the Regional Authorities of Thrace and Eastern Macedonia, it is estimated that the ecological status and the chemical status of the surface waters examined are assessed as "good".

8.5.2 Swimming Waters

According to the Bathing Water Identity Register dictated by the European Directive 2006/7/EC, the following are indicative data for the bathing beaches located near the area.

The bathing water identity provides information on the physical and geographical conditions of the coastal area, on the hydrological characteristics of the bathing waters, as well as on the assessment of the potential pollution risks in the area.

The following Table presents the results of the bathing water assessment, as described in the Bathing Water Identity Register of Greece of the National General Secretariat for Waters.

Table 8-31: Bathing water quality from 2019 to 2022 in the wider study area

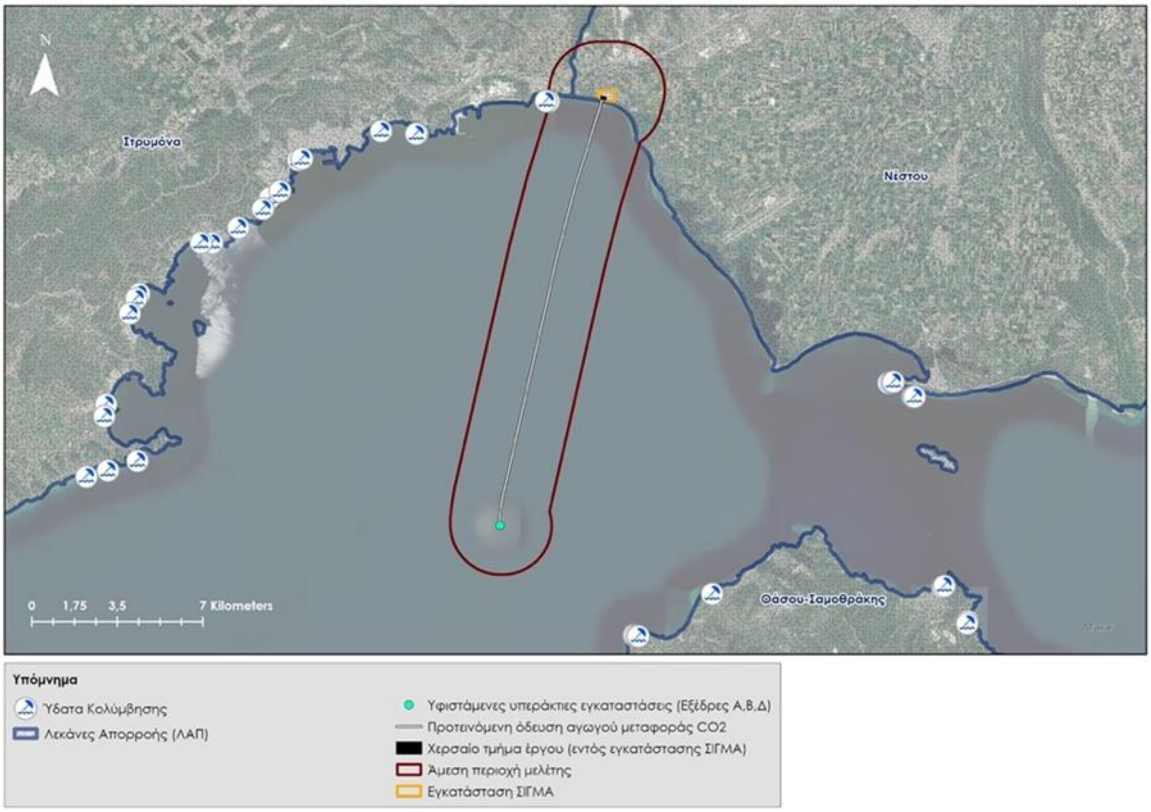
Monitoring Station Code	Monitoring Station Name	Results 2019	Results 2020	Results 2021	Results 2022
ELBW129011017	Λίμνη Ραχωνίου	Good	Excellent	Excellent	Excellent
ELBW129011018	Θάσος Δασύλλιο 1	Excellent	Excellent	Excellent	Excellent
ELBW129011025	Θάσος Δασύλλιο 1	Excellent	Excellent	Excellent	Excellent
ELBW129011014	Λιμεναρια	Excellent	Excellent	Excellent	Excellent
ELBW119012008	Νέα Καρβάλη	Excellent	Excellent	Excellent	Excellent
ELBW119012011	Άσπρη Άμμος	Excellent	Excellent	Excellent	Excellent
ELBW119012009	Περιγιάλι	Excellent	Excellent	Excellent	Excellent
ELBW119012013	Ραψάνη 2	Excellent	Excellent	Excellent	Επαρκής
ELBW119012005	Ραψάνη 1	Good	Excellent	Excellent	Επαρκής
ELBW119012006	Καλαμίτσα	Good	Excellent	Excellent	Excellent
ELBW119012007	Μπάτης	Excellent	Excellent	Excellent	Excellent
ELBW119012010	Τόσκα	Excellent	Excellent	Excellent	Excellent
ELBW119012004	Παληό	Excellent	Excellent	Excellent	Excellent
ELBW119014013	Νέα Ηρακλείτσα	Excellent	Excellent	Excellent	Excellent
ELBW119014015	Νέα Πέραμος	Excellent	Excellent	Excellent	Excellent
ELBW119014016	Αμμόλοφοι	Excellent	Excellent	Excellent	Excellent
ELBW119014018	Ocean View	Excellent	Excellent	Excellent	Excellent

(Source: Greece Bathing Water Profiles Register, https://bathingwaterprofiles.gr/map)

Within the study area is located the beach "Nea Karvali" (ELBW119012008), which according to the Ministry of Environment and Forestry belongs to the Gulf of Kavala and more specifically is part of the wider Ormos Valtos, which is oriented south. The coast is sandy in its entirety, has a length of 1,700 m, while its average width is estimated at 20 m. The coastal zone is natural, with sparse and low surface vegetation. Marine biodiversity mainly includes chlorophyll and to a lesser extent brown algae that form meadows on the seabed. Arthropods (crabs) and water birds, such as cormorants, occasionally appear on the shore front. The pressures on this beach mainly concern the liquid waste that is processed at the Kavala Wastewater Treatment Plant (WWTP), which is designed for an equivalent population of 96,000 inhabitants.

Additional pressures concern the docking area for small private vessels located approximately 80 m from the bathing area, the fishing channels of the adjacent aquaculture and the estuary of the Aspropotamos stream, which is continuous and potentially carries pollutant loads from the wider area characterized by agricultural activity.

The following Figure presents the bathing waters located in the wider area of the Project.



(Source: Greece's bathing water identity register, https://bathingwaterprofiles.gr/map)

Figure 8–66: Swimming waters near the Project

8.5.3 Groundwater

8.5.3.1 Underground Water Systems

According to the 2nd Revision of the Thrace RBMPs (EL 12), three (3) groundwater systems are identified in the Nestos LAP. Correspondingly, according to the 2nd Revision of the Eastern Macedonia RBMPs (EL 11), 15 groundwater systems are recorded in the Strymona LAP. The following Table provides detailed information on the WD RBMPs.

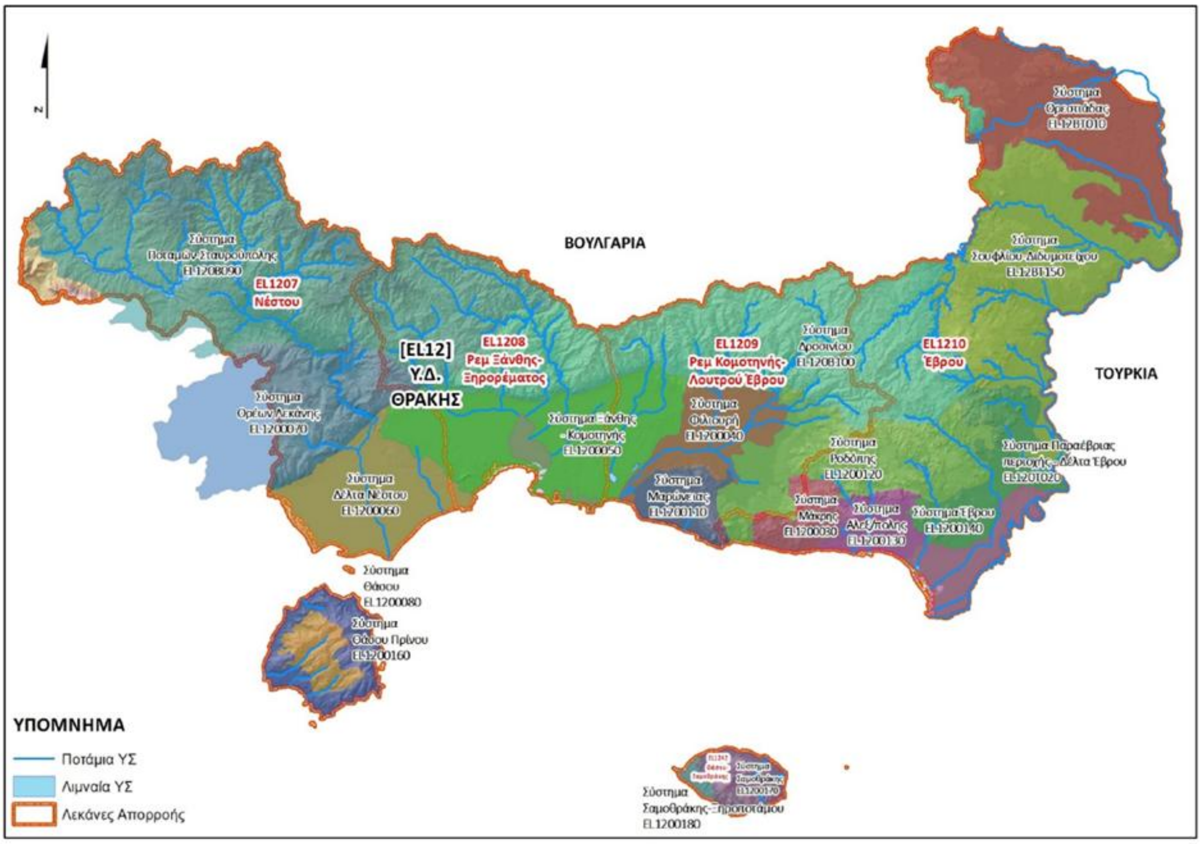
Table 8–32: Groundwater Systems of the Nestos and Strymonas Offshore Development Areas (ODAs)

Code	Name	WD	Area (km²)
EL1200060	NESTOS DELTA SYSTEM	WD Nestos (EL1207)	554,76
EL1200070	BASIN MOUNTAIN SYSTEM	WD Nestos (EL1207)	949,69
EL120B090	RIVER SYSTEM – STAVROUPOLIS	WD Nestos (EL1207)	2.423,15
EL1100010	SERRES SYSTEM	WD Strimonas (EL1106)	2.244,91
EL110B020	AKISTRO SYSTEM	WD Strimonas (EL1106)	153,75

Code	Name	WD	Area (km²)
EL110B030	BALACROS SYSTEM	WD Strimonas (EL1106)	722,98
EL1100040	MENIKIO – AGITI SYSTEM	WD Strimonas (EL1106)	425,28
EL1100050	DRAMAS SYSTEM	WD Strimonas (EL1106)	736,15
EL1100060	PANGAEOS SYSTEM	WD Strimonas (EL1106)	229,23
EL1100070	MARMARA SYSTEM	WD Strimonas (EL1106)	92,43
EL1100080	ANO POROION – BELES SYSTEM	WD Strimonas (EL1106)	320,20
EL1100090	ASPROVALTA SYSTEM	WD Strimonas (EL1106)	27,28
EL1100100	KROUSION – KERDYLION SYSTEM	WD Strimonas (EL1106)	913,33
EL1100110	BRONDOS SYSTEM	WD Strimonas (EL1106)	436,83
EL1100120	NEVROKOPIO SYSTEM	WD Strimonas (EL1106)	105,83
EL1100130	SYMBOLOS – KAVALAS SYSTEM	WD Strimonas (EL1106)	376,37
EL1100140	ELEFTHERON – NEAS PERAMOS SYSTEM	WD Strimonas (EL1106)	19,24
EL1100150	OFRYNIOS SYSTEM	WD Strimonas (EL1106)	75,53

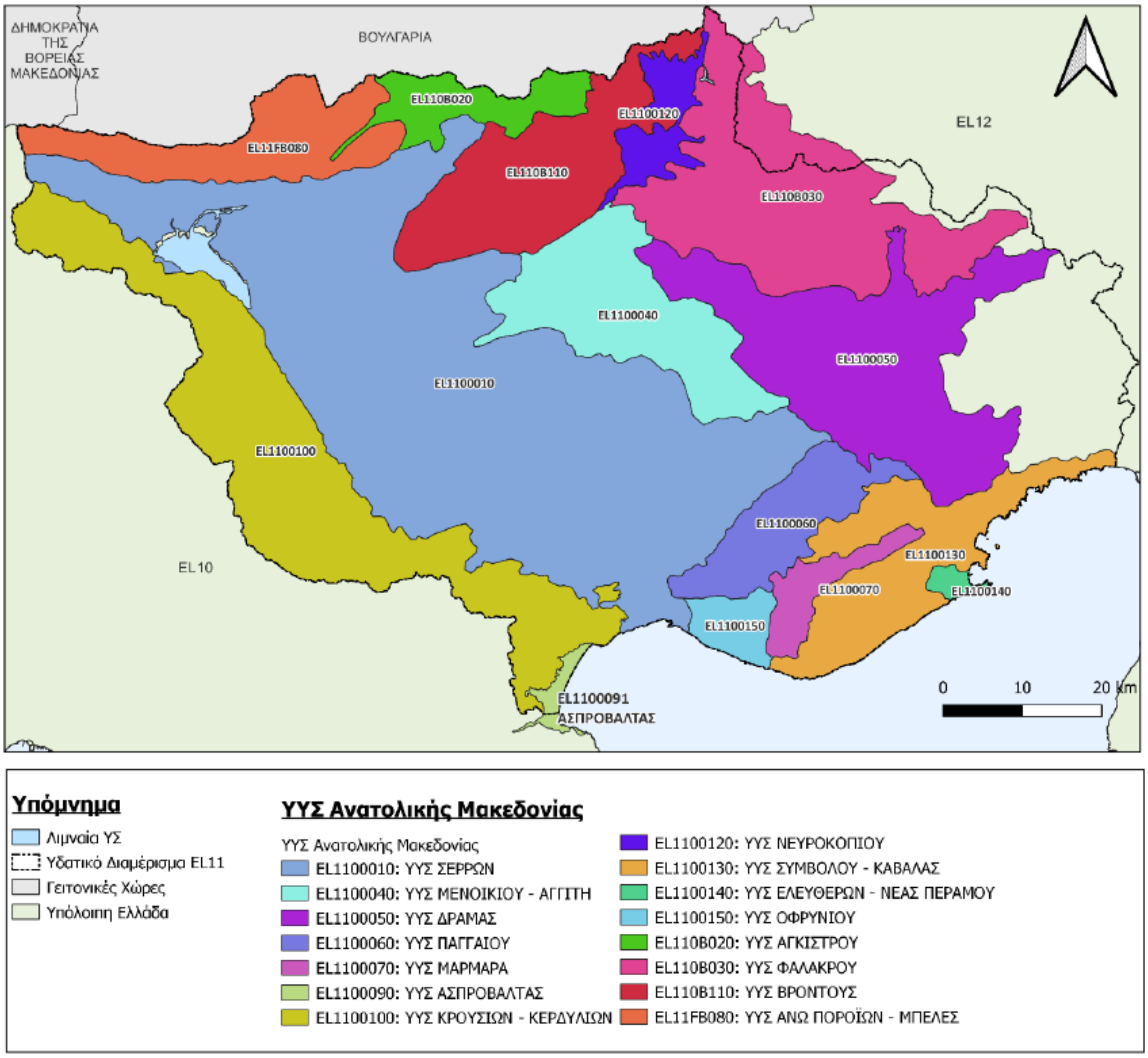
(Source: 2nd Revision of the River Basin Management Plans (RBMPs) of Eastern Macedonia (EL11) and Thrace (EL12), 2024))

The following Figures illustrate the groundwater systems that fall within the water districts of Thrace and Eastern Macedonia.



(Source: 2nd Revision of the River Basin Management Plans (RBMPs) of Eastern Macedonia (EL11) and Thrace (EL12), 2024))

Figure 8–67: Underground Water Systems of the Thrace Region (EL 12)



(Source: 2nd Revision of the River Basin Management Plans (RBMPs) of Eastern Macedonia (EL11) and Thrace (EL12), 2024))

Figure 8–68: Underground Water Systems of the Eastern Macedonia Region (EL 11)

The study area falls within three (3) groundwater systems (following Figure):

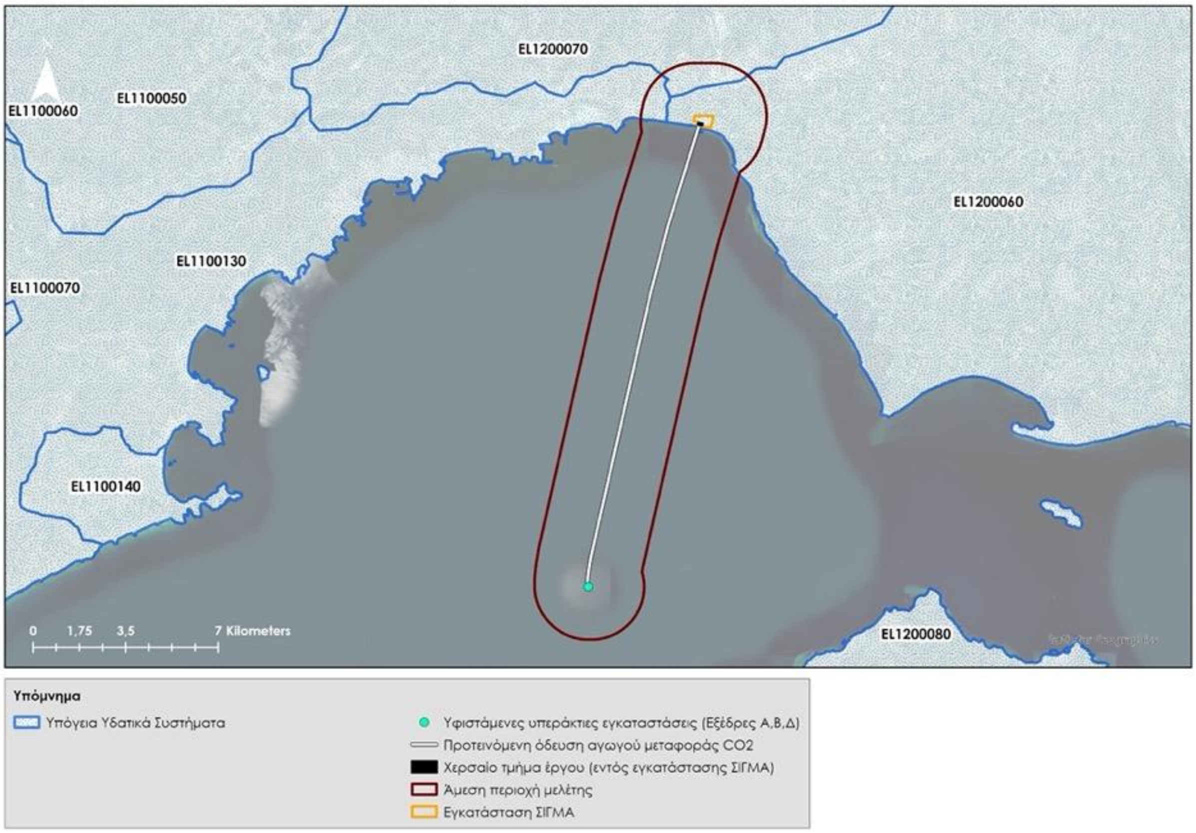
- • In the Nestos Delta HSR (EL1200060).
- • In the Basin Mountains HSR (EL1200070).
- • In the Symvolos – Kavala HSR (EL1100130) .

<u>The onshore facilities fall entirely within the Nestos Delta Water Management Authority.</u>.

The Nestos Delta Aquifer (EL1200060) is an alluvial aquifer system and has an area of 555.11 km2. The waters of the Aquifer mainly cover irrigation needs and secondarily water supply, livestock and industrial needs. With surface waters it is associated with the Nestos River and the Nestos Delta and with terrestrial ecosystems - protected areas it is associated with SPA GR1150010 (Nestos Delta and Keramoti Lagoons - Wider Area and Coastal Zone) and SPA GR1150001 (Nestos Delta and Keramoti Lagoons and Thasopoula Island). It should be noted that the HYS partially belongs (its eastern part) to the newly defined area vulnerable to nitrate pollution (plain east and west of Lake Vistonida), according to Joint Decision 190126/2013 (Government Gazette 983B/23-04-2013) (SMPE SDWD YD 12, 2017).

The HYS of the Ores of the Basin belongs to the Nestos River basin (WD EL1207), while a large part of it is located within the Strymon River basin (WD EL1106) and a much smaller part in the Xanthi-Xirorema River basin (WD EL1208). It is included in the Thrace Basin (EL12) although a large part of it is located in the Eastern Macedonia Basin (EL11). It is a karst aquifer system with a total area of 949.48 km2. The waters of the Aquifer are utilized to meet water and irrigation needs. With surface waters it is associated with the Nestos River and the Nestos Delta and with terrestrial ecosystems - protected areas it is associated with SPA GR1120004 (Nestos Straits) and SCI GR1120005 (Nestos Aesthetic Forest) (SMPE SDWD YD 12, 2017). It is noted that this Aquifer belongs to the Register of Protected Areas.

The Symvolos - Kavala Aquifer is a fractured aquifer system. It is located in the Strymon River basin (WD EL1106) and geographically belongs to the Eastern Macedonia Region (EL11). It has an area of 374.72 km2, a maximum length of 50 km and a maximum width of 15 km. The waters of the YS cover water supply and irrigation needs. With surface waters it is associated with the Nest Dam and with terrestrial ecosystems - protected areas it is associated with the SCI GR1150005 (Peaks of Mount Pangaeus) (SMPE SDWD YD 11, 2017)



(Source: 2nd Revision of the River Basin Management Plans (RBMPs) of Eastern Macedonia (EL11) and Thrace (EL12), 2024))

Figure 8-69: Underground Water Systems near the Project

8.5.3.2 Groundwater Quality

According to the 2nd Revision of the WDW of the Thrace and Eastern Macedonia Water Districts, the quality of groundwater systems refers to their quantitative and chemical status. Specifically, the following Table presents in detail the status of the groundwater systems in the WD Strymonas and WD Nestos.

Table 8-33: Assessment of the condition of the underground substations of the Nestos (EL1207) and Strymon (EL1106) WDs

Code	Name	WD	Quantitative State	Chemical State	Local trace element excesses
EL1200060	NESTOS DELTA SYSTEM	WD Nestos (EL1207)	Good	Bad	As, Al
EL1200070	BASIN MOUNTAIN SYSTEM	WD Nestos (EL1207)	Good	Good	-
EL120B090	RIVER SYSTEM – STAVROUPOLIS	WD Nestos (EL1207)	Good	Good	-
EL1100010	SERRES SYSTEM	WD Strimonas (EL1106)	Good	Good	As, Ni
EL110B020	ANGISTROS SYSTEM	WD Strimonas (EL1106)	Good	Good	-

Code	Name	WD	Quantitative State	Chemical State	Local trace element excesses
EL110B030	MENIKIO – FALAKRO SYSTEM	WD Strimonas (EL1106)	Good	Good	-
EL1100040	AGITI SYSTEM	WD Strimonas (EL1106)	Good	Good	-
EL1100050	DRAMA SYSTEM	WD Strimonas (EL1106)	Good	Good	Al
EL1100060	PANGAEOS SYSTEM	WD Strimonas (EL1106)	Good	Good	-
EL1100070	MARMARA SYSTEM	WD Strimonas (EL1106)	Good	Good	-
EL1100080	ANO POROION - BELES SYSTEM	WD Strimonas (EL1106)	Good	Good	-
EL1100090	ASPROVALTA SYSTEM	WD Strimonas (EL1106)	Good	Good	-
EL1100100	KROUSION – KERDYLION SYSTEM	WD Strimonas (EL1106)	Good	Good	-
EL1100110	BRONTOS SYSTEM	WD Strimonas (EL1106)	Good	Good	-
EL1100120	NEVROKOPIO SYSTEM	WD Strimonas (EL1106)	Good	Good	-
EL1100130	SYMBOLOS – KAVALA SYSTEM	WD Strimonas (EL1106)	Good	Good	-
EL1100140	ELEFTHERON – NEAS PERAMOS SYSTEM	WD Strimonas (EL1106)	Bad	Bad	-
EL1100150	OFRYNIOS SYSTEM	WD Strimonas (EL1106)	Bad	Bad	-

8.5.4 8.5.4 Flood Risk Management Plans (FRMPs)

Part of the Project study area (onshore facilities) falls within the FD12 "Thrace" for which a Flood Risk Management Plan (FRMP) has been prepared and approved in accordance with Government Gazette 2688/B/2018. The onshore facilities are located within the boundaries of the Potentially High Flood Risk Zone (PHRF) named "Xanthi - Komotini Plain (Low-lying Zones of the rivers Nestos, Kosynthos, Kompsatos, Aspropotamos, Bosbozi, Filiouri and riparian areas of Lake Vistonida" and code GR12RAK0001 with a total area of 1956.44 km2, as shown in the following Figure. The nearest area with a history of a significant flood event is located approximately 3.5km NE.

It is also noted that the onshore facilities fall within the flooded areas for T=100 years (flood from rising sea level).

Flood intensity assessment and flood impact assessment (T50)

- River flows: The area flooded by river flows, for a return period T=50 years, amounts to 327.82 km2.
- Lake flows: The area flooded by flood, for a return period T=50 years, from lakes Vistonida and Ismarida amounts to 56.98 km2.

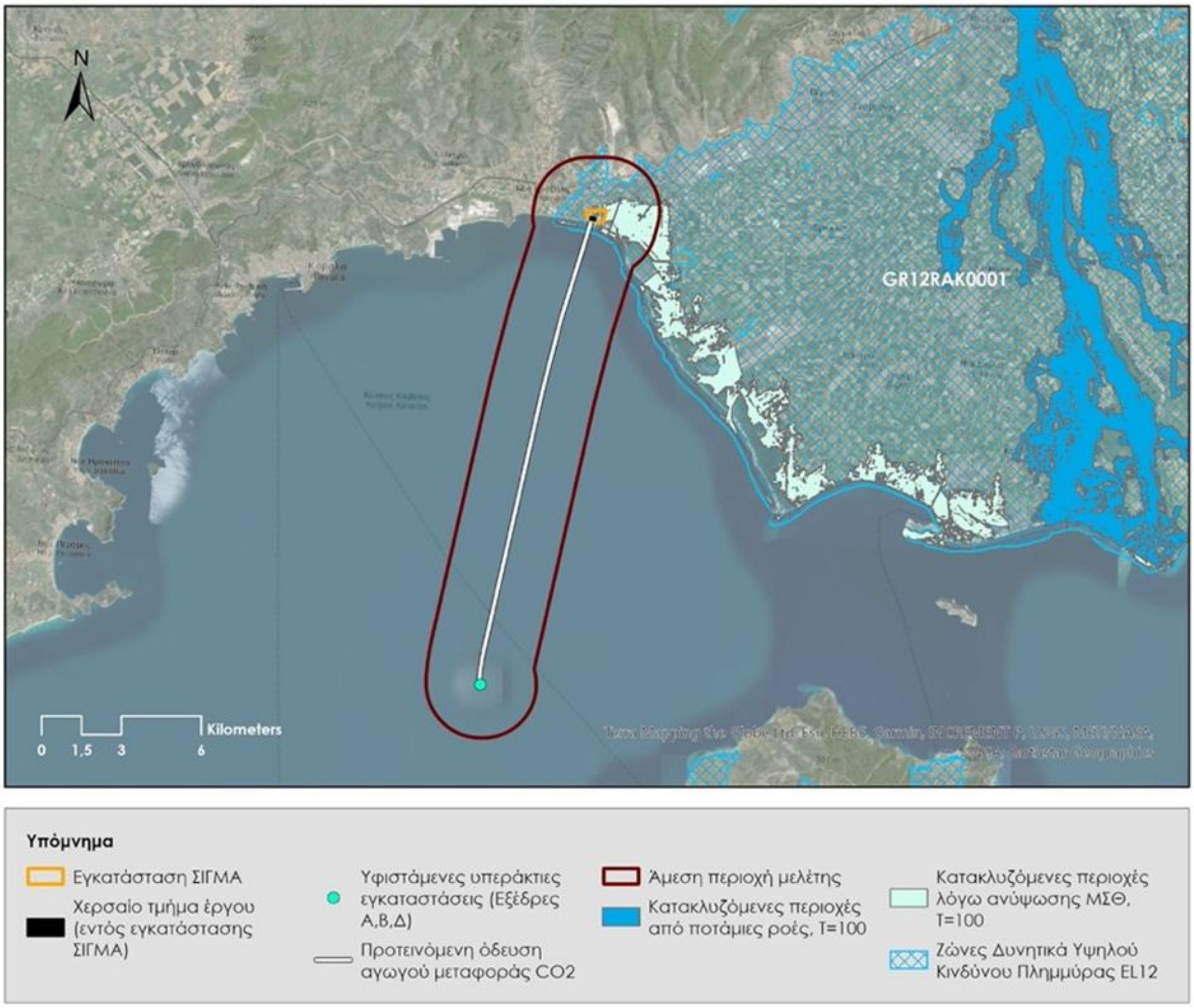
- **Mean Sea Level Rise: The area flooded by flood, caused by the rise in mean sea level, for a return period T=50 years, amounts to 54.91 km2**

Within the inundation area resulting from the rise of the Mean Sea Level for T=50 years, three settlements are recorded (Keramoti, Dasochori and Lagos) with a total indicative potentially affected population of 1,889 inhabitants, rural areas with rice crops of 4.16 km2 and other crops of 20.34 km2, fourteen stables with 2,045 animals in total, 3.30 km of road network, one airport (the state airport of Kavala) and two industries falling under the provisions of the SEVESO Directive. In addition, two educational buildings, four sports facilities, a regional clinic and touristically developed areas and touristically developing areas with scope for the development of alternative forms of tourism are recorded. Finally, four underground water abstraction systems for human consumption ("Filiouri System", "Xanthi - Komotini System" and "Nestos Delta System" "Maronia System"), ten bathing water areas ("Ammoglossa - Keramoti", "Myrodato", "Magna", "Porto Lagos", "Porto Molo", "Avdira", "Mandra", "Agios Ioannis", "Arogi" and "Imeros") and two Natura 2000 areas, both of which constitute Special Areas of Conservation (SAC) ("Lakes and Lagoons of Thrace - Wider Area and Coastal Zone" and "Nestos Delta and Keramoti Lagoons - Wider Area and Coastal Zone").

Flood intensity assessment and flood impact assessment (T100)

- **• River flows: The size of the area flooded by river flows, with a return period of T=100 years, within the ZDYKP GR12RAK0001, amounts to 381.90 km2.**
- **• Lake flows: The area flooded by a flood, for a return period of T=100 years, from lakes Vistonida and Ismarida amounts to 63.28 km2.**
- **• Mean Sea Level Rise: The rise in the mean sea level causes flooding, which for a return period of T=100 years, amounts to 66.18 km2.**

Within the inundation area resulting from the rise of the Mean Sea Level for T=100 years, four settlements are recorded (Chaidefto, Keramoti, Dasochori and Lagos) with a total indicative potentially affected population of 2,277 residents, rural areas with rice crops of 5.41 km2 and other crops of 27.88 km2, 24 stables with 2,252 animals in total, 3.62 km of road network, one airport (the state airport of Kavala) and two industries that fall under the provisions of the SEVESO Directive. In addition, five educational buildings, six sports facilities, one regional clinic, tourist-developed areas and tourist-developing areas with scope for the development of alternative forms of tourism and one PPC substation are recorded. Finally, four underground water systems for the abstraction of water for human consumption are recorded ("Filiouri System", "Xanthi - Komotini System" and "Nestos Delta System" "Maronia System"), ten bathing water areas ("Ammoglossa - Keramoti", "Myrodato", "Magnana", "Porto Lagos", "Porto Molo", "Avdira", "Mandra", "Agios Ioannis", "Arogi" and "Imeros") and two Natura 2000 areas, both of which constitute Special Areas of Conservation (SAC) ("Lakes and Lagoons of Thrace - Wider Area and Coastal Zone" and "Nestos Delta and Keramoti Lagoons - Wider Area and Coastal Zone").



(Source: Flood Risk Management Plan of the Thrace Regional Administration, 2018)

Figure 8–70: Excerpt from the Flood Hazard Map for T100 in the Project area

8.6 ATMOSPHERIC ENVIRONMENT - AIR QUALITY

Air pollution is the presence in the atmosphere of any kind of substance, in a concentration or duration that can cause negative effects on health, living organisms and ecosystems and generally make the environment unsuitable for its desired uses. Under certain conditions, air pollution can reach levels that can create undesirable living conditions.

The Ministry of Environment and Natural Resources (Department of Air Quality) established the National Air Pollution Monitoring Network (EDPAR) in 2001. The Department of Air Quality operates the network of stations in the Attica region and one station in Aliartos, Viotia for the needs of the Transboundary Pollution Transfer Program. In the remaining regions, the stations are operated by the regional administrations. According to the data of the National Air Quality Monitoring Agency and the Annual Air Quality Report (2022), the closest Air Pollution Monitoring Station to the Project and the only one in operation in the EMT is located in Kavala (WGS84 Projection System - Latitude: 40.93666 and Longitude: 24.412419, altitude 2 m). At this station, the pollutants that are measured are SO_2, NO_x, CO, O_3, $ΑΣ_{10}$, $ΑΣ_{2.5}$, C_6H_6.

The following Table summarizes the monthly averages of the pollutants measured at the urban-background station Kavala – 2, as included in the Annual Air Quality Report (2022).

Table 8–34: Measured pollutants at Kavala station -2 (in μg/m3) for the year 2022

Pollutant	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Limit value
SO_2	3	3	5	5	4	2	3	3	7	8	7	8	125
NO	17	11	5	5	4	4	4	5	5	9	11	22	
NO_2	26	28	19	19	17	16	19	20	18	26	26	31	200
O_3	26	30			30	26					32	20	120
C_6H_6			1,0	0,7	0,5	0,5	0,5	0,7	0,9	1,9	2,8	4,4	5

(Source: Annual air quality report (ΥΠΕΝ, 2022))

Based on the above data and compared to the limit values (Section 5.5.1 of this EIA), it is estimated that the concentrations of gaseous pollutants in the wider Project area are at low levels compared to the statutory limits.

In the context of the Annual Monitoring Report of the Prinos Offshore Development Project (2021), continuous monitoring of gaseous emissions of H2S and explosive mixtures was carried out during the year by the installed sensors, with the aim of ensuring the safety of the personnel of the facilities. No exceedances of the concentrations of gaseous emissions of H2S and explosive mixtures were noted.

Potential air quality burden in the wider project area, theoretically, may arise from the various industrial facilities in the wider area, from the industrial and mining activity of Energean (onshore and offshore facilities), the Greek Fertilizers and Chemicals ELFE S.A., the activity at the port of Philippos B, as well as at the ports of Kavala and Keramoti and road traffic (Egnatia Odos, secondary connection roads and urban road network of Kavala).

8.7 ACOUSTIC ENVIRONMENT

Airborne (atmospheric) noise

Noise pollution is defined as unwanted sound or sound occurring at an inappropriate time and place. More specifically, noise is understood as sound that is undesirable due to its effects on people, structures, in which it can cause fatigue or other dysfunction, as well as the obstruction of the perception and understanding of other sounds.

Noise is one of the most important factors in the degradation of the environment and therefore the quality of life. The type of effects of noise on human health has been a key field of research and study for many years. Today, it has been sufficiently documented that the effects of noise on humans are divided into physiological and psychological.

Noise can have negative effects on the following systems:

- Noise pollution is defined as unwanted sound or sound occurring at an inappropriate time and place. More specifically, noise is understood as sound that is undesirable due to its effects on people, structures, in which it can cause fatigue or other dysfunction, as well as the obstruction of the perception and understanding of other sounds.

- Noise is one of the most important factors in the degradation of the environment and therefore the quality of life. The type of effects of noise on human health has been a key field of research and study for many years. Today, it has been sufficiently documented that the effects of noise on humans are divided into physiological and psychological.
- Noise can have negative effects on the following systems:

It is noted that, according to the World Health Organization (WHO), on the one hand, "health" is not considered only the absence of disease but more generally physical and psychological well-being, on the other hand, there is a proven biological mechanism according to which noise causes substantial adverse effects on hearing in the form of temporary or permanent hearing loss.

The following three cases linking noise to health are now recognized internationally:

- Noise has an adverse effect on the human hearing system.
- Noise has an adverse effect on mental and physical health, given its contribution to the creation of stress.
- Noise has a decisive impact on people who already suffer from some disease or abnormal physiology.

Certain segments of the population are more vulnerable to higher noise levels, for example people suffering from hypertension or who have mental health problems, etc. Finally, in addition to the above health-related effects, noise annoyance has an impact on the individual's performance capacity and, by extension, corresponding adverse socio-economic effects.

Noise has an irregularly fluctuating sound pressure level. For this reason, indicators have been established that take this fact into account for the description of noise annoyance.

It is natural that the criterion for whether noise is acceptable or not is related to people's reaction to noise or the effects of noise on activities or human health in general. Such criteria are annoyance, obstruction of conversation, sleep disturbance, etc.

The existing state of the acoustic environment of the wider project area is in a moderate state, given the industrial nature of the onshore part of the study area. The main sources of noise in the area are industrial noise from the facilities operating in the area (Energean Oil and Gas, Hellenic Fertilizers and Chemicals ELFE S.A., quarries), noise from activity in the commercial port of Philippos B, vehicle traffic on the road network of the area, including heavy vehicles, due to industrial activity, noise from maritime traffic and from typical urban activities in settlements in the area.

The operation of the existing offshore facilities included in the study area is continuous and therefore there are no significant fluctuations in the level of noise generated. As part of the Annual Monitoring Report of the Prinos Offshore Development Project, noise measurements were carried out at seven (7) points within the Gulf of Kavala following Directive 2002/49/EC of the European Parliament in September 2021. The indicator used to calculate the noise at the points where the measurements were taken is Lden which results from the Lday, Levening and Lday indicators.

The index is derived based on the following equation:

$$Lden = 10\lg\frac{1}{24}(12 * 10^{\frac{Lday}{10}} + 4 * 10^{\frac{Levening+5}{10}} + 8 * 10^{\frac{Lnight+10}{10}})$$

Below is the Table of measurements and calculations for the seven points in the area of the Prinos offshore facilities, from September 6 to 10, 2021.

Figure 8–71: Noise measurement locations, September 2021

Table 8–35: Noise measurements

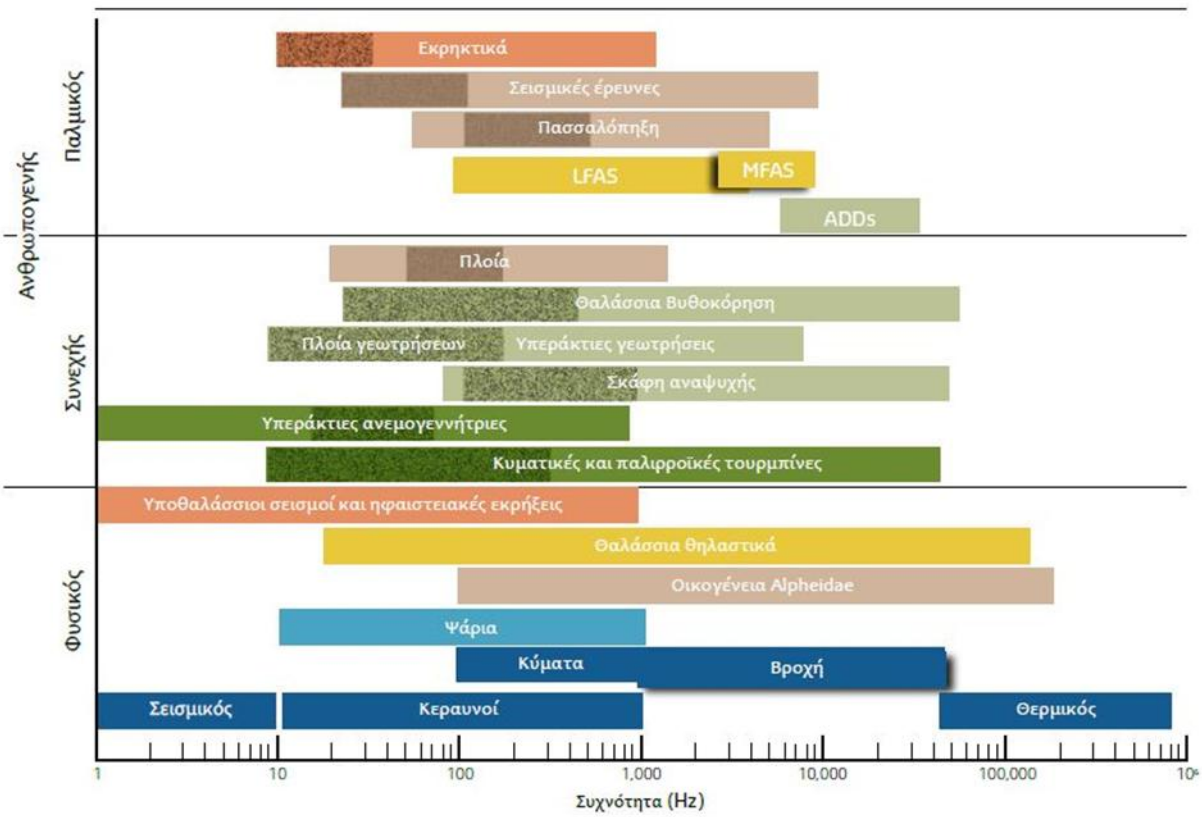
Location	Coordinate Y	Coordinate X	Lday	Levening	Lnight	Lden
1	40°48'20.37"B	24°26'15.87"A	40	42	41	47
3	40°48'51.86"B	24°27'41.92"A	41	44	42	49
10	40°48'1.87"B	24°29'16.11"A	47	44	42	50
11	40°48'5.06"B	24°30'2.13"A	45	46	41	49
12	40°47'24.45"B	24°29'33.38"A	44	40	42	48
1E	40°42'17.73"B	24°26'23.98"A	40	41	40	47
13	40°45'38.24"B	24°27'32.00"A	42	40	41	47

Underwater noise

Anthropogenic underwater noise, which is officially classified as a Source of pollution of the marine environment, is recognized as a very complex global issue that needs to be effectively addressed (Prospathopoulos A., 2017). Anthropogenic underwater noise is distinguished into pulsed and continuous/non-pulsated sound (environmental noise) in the marine environment. Pulsed sounds are produced by offshore construction activities (e.g. installation of cables and pipelines, offshore wind farms, oil rigs, port projects, explosives, underwater excavations, etc.), sonar (naval-military sonars, echo sounders - fishing sonars), seismic surveys (operation of echo sounders for the search for oil and natural gas deposits) and acoustic deterrence and harassment systems.

Continuous sounds are produced by the operation of offshore industrial facilities (e.g. oil rigs, dredging, drilling, wind turbines, etc.), maritime traffic (merchant shipping, fishing vessels, recreational and marine sports, military vessels and coast guard activities, etc.) and offshore renewable energy infrastructure (tidal and wave energy, offshore wind farms, etc.).

The following Figure presents the frequencies of anthropogenic (pulsed and continuous) and natural noise sources.



(Source: European Marine Board IVZW Future Science Brief 7 - Addressing underwater noise in Europe, 2021)

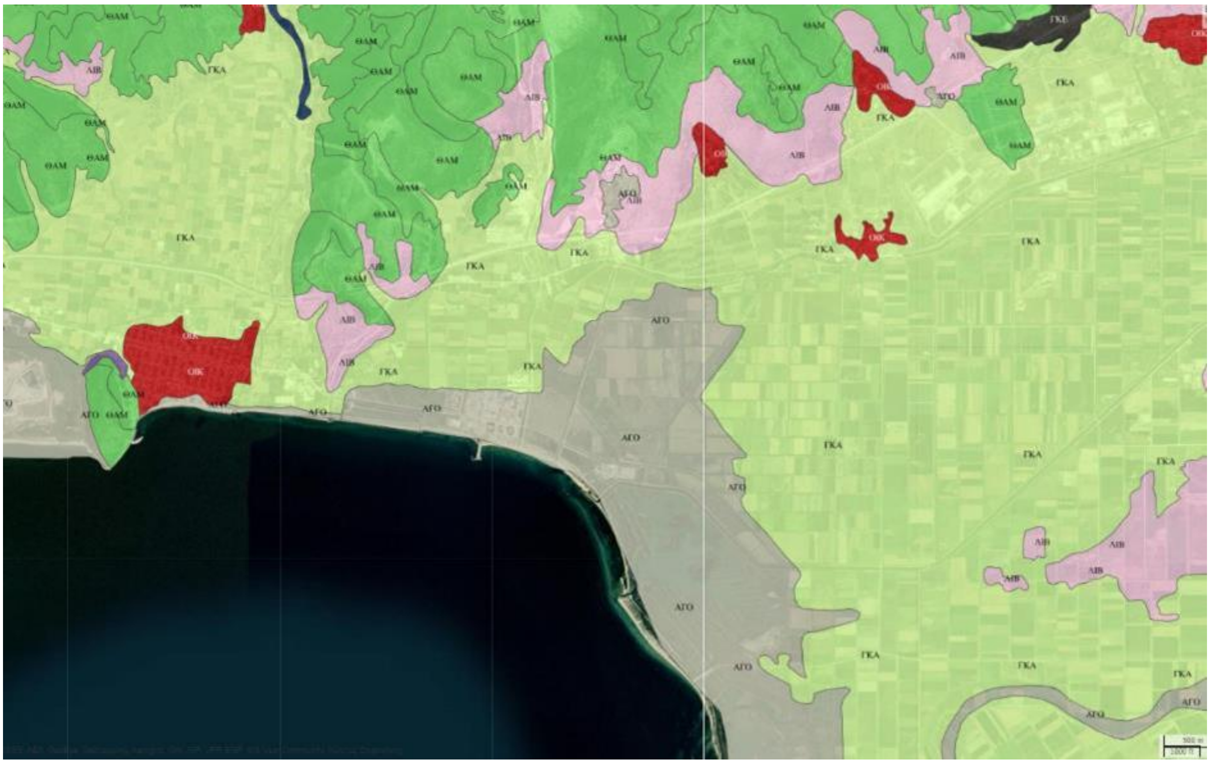
Figure 8–72: Frequencies of man-made and natural noise sources

According to Figure 8-72, low frequencies are those ranging between 1 Hz – 500 Hz, medium frequencies are those ranging between 500 Hz – 10 kHz and high frequencies are those ranging between 10 kHz – 200 kHz (Tasker et al., 2010). Considering that the underwater noise in the offshore study area is mainly caused by ship traffic and existing offshore drilling, the frequency of the noise sources is characterized as medium.

8.8 BIOTIC ENVIRONMENT

8.8.1 Terrestrial Habitats

According to the Vegetation and Land Use Map of the Geospatial Information Portal of the Ministry of Environment and Energy (MEE) (following Figure), the study area includes barren lands (ΑΓΟ), the settlement of Karvali (ΟΙΚ), meadows - sparse woody vegetation (ΛΙΒ), shrubs (ΘΑΜ) and agricultural crops (ΓΚΑ). It is noted, however, that according to available aerial photographs (Google Earth) NE of the Project's onshore installation, in the locations where barren lands are recorded, agricultural crops are observed.



Source: ΥΠΕΝ https://mapsportal.ypen.gr/layers/geonode:anat_mak_thr_tel)

Figure 8–73: Vegetation and land use map (Region of Eastern Macedonia and Thrace))

According to the following Figure, the study area includes a small part of the SAC GR1150010 "Nestos Delta and Keramoti Lagoons – Wider Area". The habitat types of SAC GR1150010, which occur within the immediate study area of the Project, are presented in the following Table.

Table 8–36: Terrestrial habitat types of SAC GR1150010 located within the study area

Code	Habitat types
1160	Sea and ocean
1057	Permanently irrigated mixed land
1021	Agricultural/processing cluster
1410	Mediterranean salt marshes (Juncetalia maritimi)
1210	Annual vegetation between high and low tide limits
72A0	Rose beds
1150	Coastal lagoons
1080	Water bodies

It is worth noting that within the immediate study area, west of the SAC GR1150010, the wetland EL51000303 has been identified: COASTAL ELOS N. KARVALIS, with an area of 1628.44 acres.

According to the following Figure, outside the part of the study area that falls within the SAC GR1150010 and specifically in front of the SIGMA land facilities, sand dunes are identified where a large mixture of different habitat types is observed. The area in question was wetland and was drained in a large part to be used for cultivation. Wetland areas, influenced by the Nestos River, are also found west of Nea Karvali and which have been degraded to create the fertilizer factory.

A detailed description of the terrestrial habitats is provided in Section 1.1.B1.i of the SEAS of the Project under study..

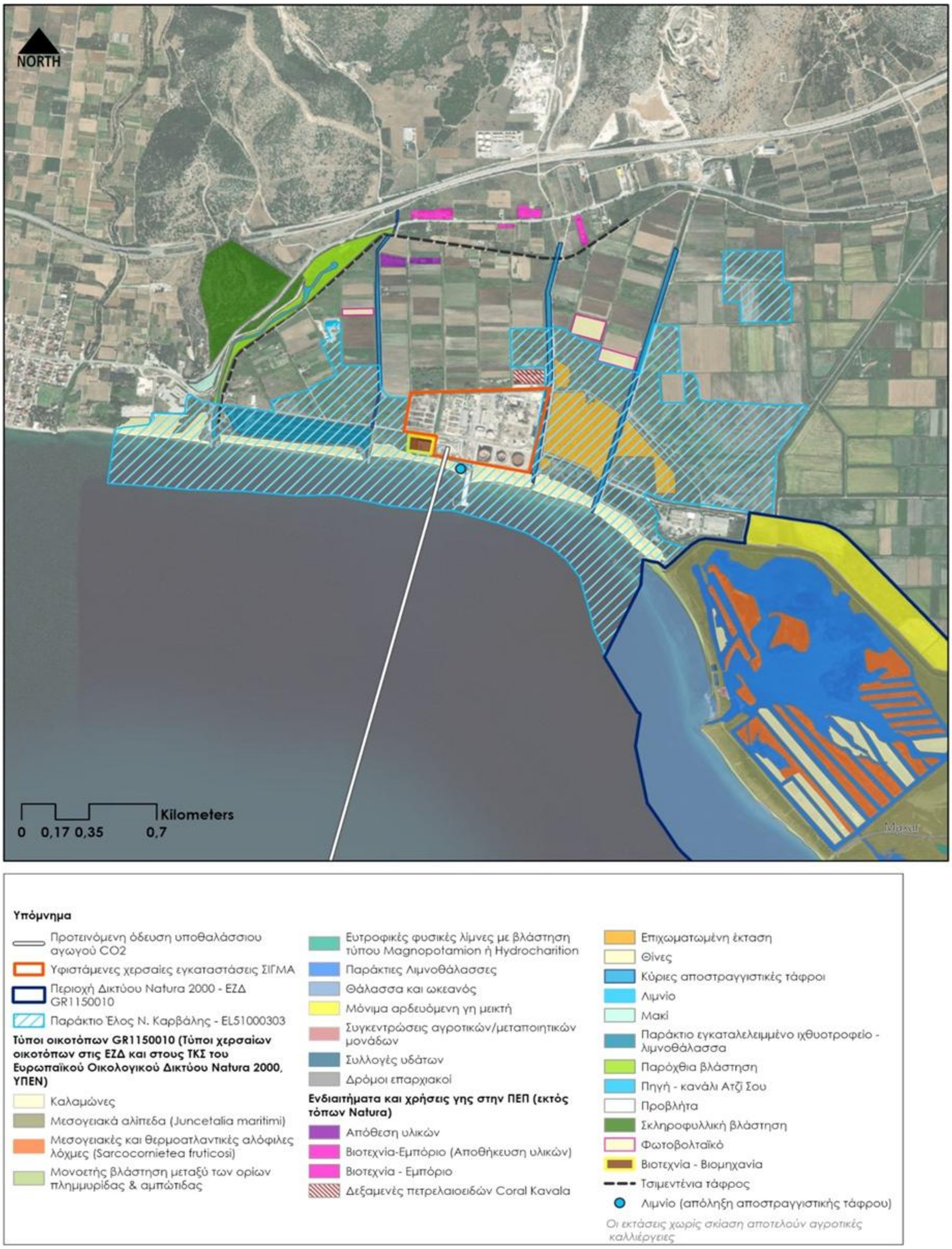


Figure 8–74: Land cover and habitat types of SAC GR1150010

8.8.2 Terrestrial Mammals

According to the Project's SEAS in the wider Project area, the species of terrestrial mammals (see the following Table) found in the wider area concern the European hedgehog (Erinaceus roumanicus), the blind mole (Talpa caeca or Talpa europaea), the jackal (Canis aureus), the fox (Vulpes vulpes), the ferret (Martes foina), the otter (Lutra lutra) and the wildcat (Felis silvestris). A detailed description is provided in Section 1.1.B1.ii.1 of the SEAS.

Table 8–37: Terrestrial mammal species in the wider Project area

Scientific name	Greek name	IUCN	Red book	Directive 92/43
Talpa caeca ή Talpa europaea	Τυφλασπάλακας ή Ασπάλακας	LC	DD	
Erinaceus roumanicus	Σκατζόχοιρος Ευρωπαϊκός	LC	NE	
Canis aureus	Τσακάλι	LC	EN	
Vulpes vulpes	Αλεπού	LC	NE	
Martes foina	Κουνάβι	LE	NE	
Lutra lutra	Βίδρα	NT	EN	II
Felis silvestris	Αγριόγατα	LC	NE	IV

Note:
Directive "on the conservation of natural habitats and of wild fauna and flora" 92/43/EEC:
II: Annex II (Species whose conservation requires the designation of conservation areas). For these species, it is necessary to ensure the maintenance or, where appropriate, the restoration at a favourable conservation status of the natural habitat types and their habitats in their natural range.
IV: Annex IV (Species requiring strict protection)
V: Annex V (Animal and plant species of Community interest whose capture in the wild and exploitation may be subject to management measures)
* : "priority species": the species referred to in the item for the conservation of which the Community has particular responsibility.
Conservation status
IUCN:
Global Threat Status. The category in which the species are classified according to the IUCN criteria is indicated. The symbols are the same as the Red Book of Threatened Animals of Greece.
Red Book of Threatened Animals of Greece:
• CR - CRITICALLY ENDANGERED: Taxa that face an extremely high risk of extinction from their natural habitat in the near future.
• EN - ENDANGERED: These taxa are not Critically Endangered, but face a very high risk of extinction in their natural habitat in the near future.
• VU - VULNERABLE: Taxa that do not fall into the above categories but face a high risk of extinction in the medium term.
• NT - NEAR THREATENED: A taxon that has been assessed as not belonging to one of the three previous risk categories, but is nevertheless close to meeting the relevant criteria and is therefore likely to be included in them in the near future.
• LC - LEAST CONCERN: A taxon that has been assessed as not belonging to the Critically Endangered, Endangered, Vulnerable or Near Threatened categories. They are usually relatively common or widespread species.
• DD - DATA DEFICIENT: A taxon for which there is insufficient data to assess their status based on their distribution and/or the status of their populations. That is, a taxon may have been studied and its biology known, but appropriate data on its distribution or abundance are lacking. If these are found, the Poorly Known species may prove to be in fact at risk.
• NE - NOT EVALUATED: Taxa that have not yet been assessed against the previous criteria.

8.8.3 Chiroptera

According to the Project's SEAS, two (2) species of bats and six (6) groups of bat species were recorded in the wider area. These groups were formed when, due to significant overlap in the characteristics of the recorded calls between different species, it was not possible to accurately identify each species. The groups of species that were defined are the following: Myotis myotis/blythi, Myotis capaccinii/daubentoni, Pipistrellus kuhlii/Pipistrellus nathusii, Pipistrellus pipistrellus/Miniopterus schreibersii, Pipistrellus pipistrellus/Pipistrellus pygmaeus/Miniopterus schreibersii and Pipistrellus pygmaeus/Miniopterus schreibersii.

Bats were recorded mainly in areas with water surfaces, such as canals and fish farms, which function as important resources for the bats' foraging and survival. The highest species abundance was recorded in a canal near the old National Road, in the northern part of the project area, where almost all species and species groups of bats were identified. A significant presence of bats was also noted in the fish farming area west of the Sigma factory. The species Hypsugo savii, Myotis capaccinii/Myotis daubentonii and Pipistrellus kuhlii/Pipistrellus nathusii were recorded near the factory. The exact locations of the species records are presented in detail in Section 1.1.B1.ii.2 of the Project SEAS.

The following Table presents the species and species groups recorded during the field surveys for this study. This table also gives the presence of species present in the wider area of the National Park of Eastern Macedonia and Thrace (EPAMATH) as derived from the results of the monitoring and assessment of the conservation status of species and habitat types in the area of responsibility of the EPAMATH Management Body.

Table 8-38: Bat species recorded in the Environmental Monitoring Program (EMP) and in the region of Eastern Macedonia and Thrace (EPAMATH)

Scientific name	Greek name	IUCN	Red book	Directive 92/43	ROP Research EOA	2015 Supervision Programme	Observations
Eptesicus serotinus	Τρανονυχτερίδα	LC	LC	IV	v	v	
Hypsugo savii	Βουνονυχτερίδα	LC	LC	IV	v	v	
Miniopterus schreibersi	Πτερυγονυχτερίδα	NT	NT	II, IV	v	v	
Myotis aurascens	Στεπομυωτίδα	LC	DD	IV		v	
Myotis myotis/blythi	Τρανομυωτίδα/ Μικρομυωτίδα	LC/LC	NT/LC	II, IV	v	v	
Myotis capaccinii/daubentoni	Ποδαρομυωτίδα/ Μυωτίδα του Daubenton	VU/LC	NT/VU	II, IV	v	v	
Myotis emarginatus	Πυρρομυωτίδα	LC	NT	II, IV		v	
Nyctalus lasiopterus	Μεγάλος νυκτοβάτης	VU	VU	IV		v	
Nyctalus leisleri	Μικρονυκτοβάτης	LC	LC	IV		v	
Nyctalus noctula	Νυκτοβάτης	LC	DD	IV		v	
Pipistrellus kuhlii	Λευκονυχτερίδα	LC	LC	IV		v	
Pipistrellus nathusii	Νυχτερίδα του Nathusius	LC	DD	IV		v	
Pipistrellus pipistrellus	Νανονυχτερίδα	LC	DD	IV		v	
Pipistrellus pygmaeus	Μικρονυχτερίδα	LC	DD	IV		v	

Scientific name	Greek name	IUCN	Red book	Directive 92/43	ROP Research EOA	2015 Supervision Programme	Observations
Plecotus austriacus	Σταχτιά Ωτονυχτερίδα	NT	DD	IV		v	
Rhinolophus blasii	Ρινόλοφος του Blasius	LC	NT	II, IV		v	
Rhinolophus ferrumequinum	Τρανορινόλοφος	LC	LC	II, IV		v	
Rhinolophus hipposideros	Μικρορινόλοφος	LC	LC	II, IV		v	
Tadarida teniotis	Νυχτονόμος	LC	LC			v	
Vespertilio murinus	Παρδαλονυχτερίδα	LC	LC	IV		v	
Other groups recorded							
Pipistrellus kuhlii / Pipistrellus nathusii	Λευκονυχτερίδα	LC/LC	LC/DD	IV	v		The species are already mentioned above
Pipistrellus pipistrellus / Miniopterus schreibersii	Νανονυχτερίδα / Πτερυγονυχτερίδα	LC/NT	DD/NT	II, IV	v		The species are already mentioned above
Pipistrellus pipistrellus / Pipistrellus pygmaeus / Miniopterus schreibersii	Νανονυχτερίδα / Μικρονυχτερίδα / Πτερυγονυχτερίδα	LC/LC /NT	DD/ DD /NT	II, IV	v		The species are already mentioned above
Pipistrellus pygmaeus / Miniopterus schreibersii	Μικρονυχτερίδα / Πτερυγονυχτερίδα	LC/NT	DD /NT		v		The species are already mentioned above

Legend:

Directive "on the conservation of natural habitats and of wild fauna and flora" 92/43/EEC:

II: Annex II (Species whose conservation requires the designation of conservation areas). For these species, it must be ensured that the natural habitat types and their habitats are maintained or, where appropriate, restored to a favourable conservation status in their natural range.

IV: Annex IV (Species requiring strict protection)

V: Annex V (Animal and plant species of Community interest whose capture in the wild and exploitation may be subject to management measures)

* : "priority species": the species referred to in the item for the conservation of which the Community has particular responsibility.

Conservation status

IUCN:

Global Threat Status. The category in which the species are classified according to the IUCN criteria is indicated. The symbols are the same as the Red Book of Threatened Animals of Greece.

Red Book of Threatened Animals of Greece:

• CR - CRITICALLY ENDANGERED: Taxa that face an extremely high risk of extinction from their natural habitat in the near future.

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• VU - VULNERABLE: Taxa that do not fall into the above categories but face a high risk of extinction in the medium term.

• NT - NEAR THREATENED: A taxon that has been assessed as not belonging to one of the three previous risk categories, but is nevertheless close to meeting the relevant criteria and is therefore likely to be included in them in the near future.

• LC - LEAST CONCERN: A taxon that has been assessed as not belonging to the Critically Endangered, Endangered, Vulnerable or Near Threatened categories. They are usually relatively common or widespread species.

• DD - DATA DEFICIENT: A taxon for which there is insufficient data to assess their status based on their distribution and/or the status of their populations. That is, a taxon may have been studied and its biology known, but appropriate data on its distribution or abundance are lacking. If these are found, the Poorly Known species may prove to be in fact at risk.

• NE - NOT EVALUATED: Taxa that have not yet been assessed against the previous criteria.

8.8.4 Amphibians and Reptiles

The amphibian and reptile species recorded in the wider Project area are presented in the following Table. In detail, two (2) amphibian species and 15 reptile species are found.

These amphibian and reptile species are mainly found in the springs, ditches and sand dunes. The Greek tortoise (Testudo graeca) occurs in high densities in the sand dunes east of the Project's land facilities, while the ditches and irrigation networks constitute important habitats for the river turtle. Finally, the extensive sand dunes of the area are suitable for the nesting of loggerhead sea turtles (Caretta Caretta).

The detailed description of these species is presented in Section 1.1.B1.ii.3 of the Project's SEAS.

Table 8–39: Amphibian and reptile species in the wider Project area

Scientific name	Greek name	IUCN	Red book	Direct 92/43
Amphibians				
Hyla arborea	Δενδροβάτραχος		LC	IV
Pelophylax kurtmuelleri	Λιμνοβάτραχος των βαλκανίων	LC	LC	V
Reptiles				
Caretta caretta	Χελώνα Καρέττα	EN	EN	II*
Chelonia mydas	Χελώνα Μύδας	EN	EN	II*
Dermochelis coriacea	Δερματοχελώνα	CR	CR	IV
Emys orbicularis	Βαλτοχελώνα	NT	NT	II
Mauremys rivulata	Ποταμοχελώνα	LC	LC	II
Testudo hermanni	Μεσογειακή χελώνα	NT	VU	II
Testudo graeca	Ελληνική χελώνα	NT	LC	II
Pseudopus apodus	Τυφλίτης	LC	LC	IV
Lacerta viridis	Σμαραγδόσαυρα	LC	LC	IV
Dolichophis caspius	Αστραπόφιδο	LC	LC	IV
Elaphe quatuorlineata	Λαφιάτης	NT	LC	II
Malpolon monspessulanus	Σαπίτης	LC	LC	
Natrix natrix	Νερόφιδο	LC	LC	
Platyceps najadum	Σαΐτα	LC	LC	IV
Telescopus fallax	Αγιόφιδο	LC	LC	IV

Legend:
Directive "on the conservation of natural habitats and of wild fauna and flora" 92/43/EEC:
II: Annex II (Species whose conservation requires the designation of conservation areas). For these species, it must be ensured that the natural habitat types and their habitats are maintained or, where appropriate, restored to a favourable conservation status in their natural range.
IV: Annex IV (Species requiring strict protection)
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• NE - NOT EVALUATED: Taxa that have not yet been assessed against the previous criteria..

8.8.5 Marine Habitats

According to the geospatial data for the assessment of the spread of seagrass meadows (Panayiotidis et al. 2022, Topouzelis et al. 2018), the presence of marine seagrass meadows is estimated in the wider study area of the Project. The marine seagrass communities include 4 species: Posidonia oceanica, Cymodocea nodosa, Zostera noltei and Halophila stipulacea. Their distribution pattern along the coasts varies depending on the species, with the endemic species Posidonia oceanica showing the widest distribution. The total coverage of Posidonia oceanica meadows amounts to approximately 2,500 km2 and 25-35% (~600 to 800 km2) of this area is included in the Natura 2000 network. The species Cymodocea nodosa shows a wide spread but on a smaller scale. The species Zostera noltei has a limited and local presence related to the presence of freshwater, while the Lessepsian species Halophila stipulacea has also been recorded on the coasts of the Mediterranean Sea.

According to the field work carried out in the wider Project area during the periods 06.11.2023 – 09.11.2023, 26.06.2021 – 27.06.2021 and 11.10.2015 – 19.10.2015, areas of soft substrate (mainly sandy) with vegetation of the marine phanerogam Cymodocae nodosa which is sporadically dense and areas of soft substrate without vegetation have been recorded. In particular, areas with Cymodocae nodosa are found at depths of up to 1.5 m, while a zone of soft substrate without vegetation is observed, which extends to 3 m depth. From 3 m to 4 m depth, areas with Cymodocae nodosa vegetation are observed, while from 4 m to approximately 7 m the soft substrate is not vegetated.

During the field observations carried out within the framework of the Project's SEAS, no Posidonia meadows were observed in the eastern part of the Project's land facilities. It is noted, however, that according to the following Figure and the available data assessing the spatial distribution of marine phanerogam meadows according to Panayiotidis et al. 2022 and Topouzelis et al. 2018, the presence of Posidonia meadows in the areas in front of the Project's land facilities is possible. A detailed description is provided in Section 1.1.B1.i.2.1 of the Project's SEAS.

Figure 8–75: Available data for estimating the spatial distribution of marine phanerogam meadows according to Panayiotidis et al. 2022 and Topouzelis et al. 2018

In the context of the Annual Environmental Monitoring Report 2023 (AEM 2023), which is related to the implementation of the environmental control program of the Prinos Offshore Development in accordance with the requirements of the Environmental Conditions Approval Decision (ECAD) 8413/24.04.2018/YPEN, marine sediment sampling was carried out at six (6) stations within the wider study area. Based on the laboratory results of the granulometric analysis of the sediment samples (Table below), a muddy substrate is expected at these stations..

Table 8–40: Granulometric analysis results

Size	Unit	9 R1	9 R2	11 R1	11 R2	12 R1	12 R2	1E R1	1E R2	2 R1	2E R2	REF R1	REF R2
>4 mm	%[2]	1,9	1,7	0,9	0,1	0,3	1,8	0,2	2,4	2,0	0,0	1,2	0,3
4 mm	%	7,3	9,3	5,5	4,8	6,1	6,4	8,4	12,5	6,1	5,8	8,0	5,2
3 mm	%	4,1	5,1	4,1	4,0	4,6	5,6	9,2	9,9	9,4	7,4	4,6	6,1
2 mm	%	4,7	5,3	6,2	6,4	6,6	4,2	13,4	10,0	8,2	8,2	4,9	4,7
1 mm	%	10,9	15,5	23,7	18,9	16,8	15,2	23,5	25,5	21,9	19,7	13,2	13,6
0,5 mm	%	22,8	29,1	33,2	36,5	29,6	23,6	20,3	18,6	18,5	19,9	21,5	21,9
0,25 mm	%	28,2	21,3	17,6	18,7	21,7	23,6	12,4	11,8	20,8	19,6	27,4	25,6
<0,25 mm	%	20,1	12,7	8,8	10,6	14,3	19,6	11,2	9,3	13,1	19,4	19,2	22,6

Source: Annual Environmental Monitoring Report 2023 (EEM 2023), which relates to the implementation of the environmental control program of the Prinos Offshore Development in accordance with the requirements of the Environmental Terms Approval Decision (AEPO) 8413/24.04.2018/YPEN)

8.8.6 Benthic Communities

In the context of the Annual Environmental Monitoring Report 2023 (AEMR 2023), which is related to the implementation of the environmental control program of the Prinos Offshore Development in accordance with the requirements of the Environmental Conditions Approval Decision (AEPO) 8413/24.04.2018/YPEN, the LDK study team carried out sampling in November 2023 at six (6) stations (9, 11, 12, 13-REF, 1E and 2E) in the wider project area. A total of four (4) replicate samples were collected from each station, which were analyzed in an accredited laboratory for the evaluation and assessment of the ecological status of the area.

Specifically, the quality elements related to the benthos and proposed by the MSFD 2008/56 were used, namely the diversity H and the richness S of benthic macroinvertebrate species. For the quality element “ratio of opportunistic to tolerant species” the BENTIX index (Simboura & Zenetos, 2002) was used, as proposed by Simboura et al (2013). The statistical processing of the data was carried out using the PRIMER 6.0 package. The following Figure and Table present the sampling stations.

[2] The values are reported in % of retained material.

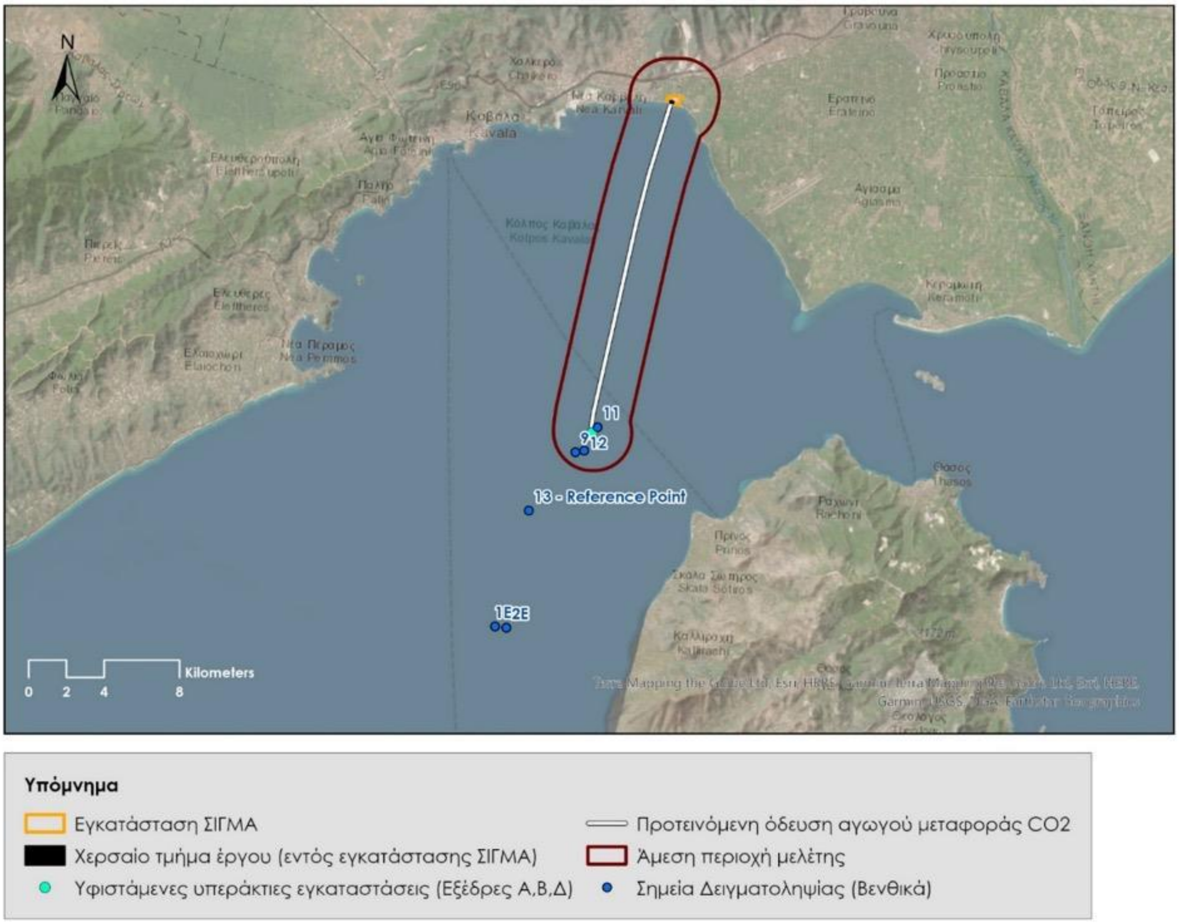


Figure 8-76: Sampling points for benthic community analysis

Table 8-41: Sampling points for benthic community analysis

Sampling Station (SS)	X EGSA 87	Y EGSA 87	X WGS 84 (μοίρες)	Y WGS 84 (μοίρες)
9	541090,91	4515458,52	24,487037	40,789089
11	542226,66	4516832,25	24,500591	40,801407
12	541560,00	4515575,95	24,492604	40,790124
1E	537168,80	4506094,93	24,439994	40,704926
2E	537760,77	4506056,01	24,447000	40,704548
13 - Reference Point	538732,58	4512285,73	24,458888	40,760623

Based on laboratory analyses, 1024 individuals belonging to 132 species or higher taxa were identified. Polychaetes represent 40% of the species and 48% of the individuals, while mollusks represent 46% of the species and 24% of the individuals. Significant abundance was found in arthropods (18%) and miscellaneous (5%). Echinoderms and sipunculoids were less represented. Stations 9 and 11 had the greatest species richness and diversity, with station 9 also having the highest number of individuals.

The community structure of the samples showed similarities with previous studies in the Gulf of Kavala. Stations 9 and 12 showed the greatest similarity, while stations 1E and 2E were more heterogeneous, mainly due to the absence of specific species in the replicate samples. SIMPER analysis identified three species that characterize station 2E. PCA analysis of physicochemical data showed that most stations are similar, with exceptions in cobalt and molybdenum values in specific replicate samples.

The following Table presents the values for the qualitative elements of species diversity, species richness and BENTIX and the characterization of the environmental status. The classification according to the WFD is also given. It is observed that the ecological quality of the stations varies from "Good" to "Moderate", with the exception of station 9 of platform D, where the ecological quality is "High".

Table 8–42: Values for the qualitative elements of species diversity, species richness and BENTIX and characterization of the environmental status. The classification according to the WFD is also given.

Sampling Station	Platform	Species richness S	Classification by S	Variety H	Classification by H	BENTIX	Classification by BENTIX	EQR	Classification according to WFD	Classification according
1E	K	10	GEnS	1,88	GEnS	3,87		0,6	Good	Good
2E	K	12		2,37		4,02		0,7	Good	Moderate
9	D	25		2.49	GEnS	3,02		0,5	Moderate	Good
11	D	23		2,96	GEnS	4,51		0,8	High	Good
12	D	17		2,66	GEnS	3,96		0,7	Good	Good

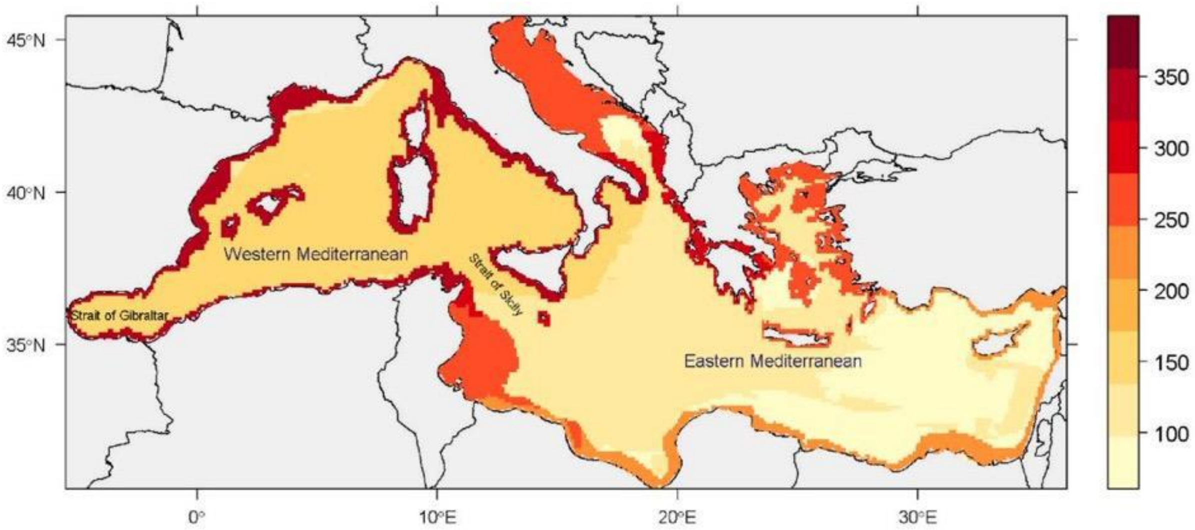
(Source: Annual Environmental Monitoring Report 2023 (EEM 2023), which relates to the implementation of the environmental control program of the Prinos Offshore Development in accordance with the requirements of the Environmental Terms Approval Decision (AEPO) 8413/24.04.2018/YPEN)

The benthic communities are typical of the Mediterranean and do not show significant impact from the activities of the area. In conclusion, it is estimated that the ecological status of the area is on average moderate to Good.

8.8.7 Fish Species

The Mediterranean Sea, although representing a small part of the world's oceans, is home to an exceptionally rich and diverse biodiversity. In detail, it includes approximately 17,000 species, which represent 4–18% of global marine biodiversity, and includes species from temperate, cosmopolitan, subtropical, Atlantic and Indo-Pacific regions. This richness is due to its diverse geological and climatic history, which has created conditions for the development of both temperate and subtropical species, making it a real biodiversity hotspot with approximately 20-30% endemic species.

The following Figure shows the fish species richness index for the Mediterranean Sea, which shows an average of 170 fish species per cell, ranging from 81 to 372 species per cell. The distribution of the index shows a longitudinal gradient with higher values in the western part of the basin and lower values in the southeastern part.



(Source: Carmezin et al. (2022). A mesoscale analysis of relations between fish species richness and environmental and anthropogenic pressures in the Mediterranean Sea)

Figure 8–77: Fish species richness index for the Mediterranean Sea

The Aegean Sea is divided into two sub-regions in terms of the distribution of the ichthyofauna: (a) the northern Aegean, a roughly rectangular basin, separated from the southern Aegean by the Cyclades archipelago and characterized by a cold-water fauna, and (b) the southern Aegean characterized by more thermophilic species, as well as migratory species from the Red Sea. Specifically, according to Simboura et al. (2019) the Greek ichthyofauna is divided into (a) small pelagic fish, mainly sardine (Sardina pilchardus) and anchovy (Engraulis encrasicolus) which are mainly concentrated in the northern Aegean, (b) large pelagic fish (swordfish and tuna) which migrate along the Mediterranean, and (c) demersal or benthic fish which live in close connection with the bottom and are also more abundant in the northern Aegean.

The following Table presents the dominant fish species found in the Thracian Sea according to depth, as analyzed in the scientific article by Papaconstantinou et al. (2007).

Table 8–43: Dominant fish species and protection status in the Thracian Sea based on abundance ranking for the various depth groups identified by dispersion analysis

Species	Protection status - Berne Convention	Protection status Habitats Directive 2009/147/EC
Fish species at a depth of 16-28 m mean similarity: 67.8 SD: 4.9		
Arnoglossus laterna	Not included	Not included
Serranus hepatus	Not included	Not included
Diplodus annularis	Not included	Not included
Gobius niger	Not included	Not included
Mullus barbatus	Not included	Not included
Trisopterus minutus capelanus	Not included	Not included
Spicara flexuosa	Not included	Not included

Species	Protection status - Berne Convention	Protection status Habitats Directive 2009/147/EC
Trigla lucerna	Not included	Not included
Merlangius merlangus euxinus	Not included	Not included
Scorpaena notata	Not included	Not included
Merluccius merluccius	Not included	Not included
Gobius paganellus	Not included	Not included
Solea vulgaris	Not included	Not included
Cepola rubescens	Not included	Not included
Είδη ψαριών σε βάθος 30-90 m μέση ομοιότητα: 73,8 SD: 7,1		
Serranus hepatus	Not included	Not included
Trisopterus minutus capelanus	Not included	Not included
Mullus barbatus	Not included	Not included
Arnoglossus laterna	Not included	Not included
Merluccius merluccius	Not included	Not included
Spicara flexuosa	Not included	Not included
Lepidotrigla cavillone	Not included	Not included
Cepola rubescens	Not included	Not included
Deltentosteus quadrimaculatus	Not included	Not included
Callionymus maculatus	Not included	Not included
Scyliorhinus canicula	Not included	Not included
Citharus linguatula	Not included	Not included
Lophius budegassa	Not included	Not included
Serranus cabrilla	Not included	Not included
Symphurus ligulatus	Not included	Not included
Gaidropsarus sp.	Not included	Not included
Raja clavata	Not included	Not included
Arnoglossus thori	Not included	Not included
Fish species at a depth of 100-190 m average similarity: 73.6 SD=4.4		
Trisopterus minutus capelanus	Not included	Not included
Merluccius merluccius	Not included	Not included

Species	Protection status - Berne Convention	Protection status Habitats Directive 2009/147/EC
Argentina sphyraena	Δεν περιλαμβάνεται	Δεν περιλαμβάνεται
Lophius budegassa	Δεν περιλαμβάνεται	Δεν περιλαμβάνεται
Lepidorhombus boscii	Δεν περιλαμβάνεται	Δεν περιλαμβάνεται
Arnoglossus laterna	Δεν περιλαμβάνεται	Δεν περιλαμβάνεται
Scyliorhinus canicula	Δεν περιλαμβάνεται	Δεν περιλαμβάνεται
Lepidotrigla cavillone	Δεν περιλαμβάνεται	Δεν περιλαμβάνεται
Callionymus maculatus	Δεν περιλαμβάνεται	Δεν περιλαμβάνεται
Cepola rubescens	Δεν περιλαμβάνεται	Δεν περιλαμβάνεται
Serranus hepatus	Δεν περιλαμβάνεται	Δεν περιλαμβάνεται
Capros aper	Δεν περιλαμβάνεται	Δεν περιλαμβάνεται
Phycis blennoides	Δεν περιλαμβάνεται	Δεν περιλαμβάνεται
Aspitrigla cuculus	Δεν περιλαμβάνεται	Δεν περιλαμβάνεται
Trigla lyra	Δεν περιλαμβάνεται	Δεν περιλαμβάνεται
Mullus barbatus	Δεν περιλαμβάνεται	Δεν περιλαμβάνεται
Fish species at a depth of 100-190 m average similarity: 73.6 SD=4.4		
Hymenocephalus italicus	Δεν περιλαμβάνεται	Δεν περιλαμβάνεται
Gadiculus argenteus argenteus	Δεν περιλαμβάνεται	Δεν περιλαμβάνεται
Lepidorhombus boscii	Δεν περιλαμβάνεται	Δεν περιλαμβάνεται
Micromesistius poutassou	Δεν περιλαμβάνεται	Δεν περιλαμβάνεται
Coelorhynchus coelorhynchus	Δεν περιλαμβάνεται	Δεν περιλαμβάνεται
Phycis blennoides	Δεν περιλαμβάνεται	Δεν περιλαμβάνεται
Lophius budegassa	Δεν περιλαμβάνεται	Δεν περιλαμβάνεται
Argentina sphyraena	Δεν περιλαμβάνεται	Δεν περιλαμβάνεται
Merluccius merluccius	Δεν περιλαμβάνεται	Δεν περιλαμβάνεται
Galeus melastomus	Δεν περιλαμβάνεται	Δεν περιλαμβάνεται
Trigla lyra	Δεν περιλαμβάνεται	Δεν περιλαμβάνεται
Capros aper	Δεν περιλαμβάνεται	Δεν περιλαμβάνεται

(Source: Papaconstantinou, C., Machias, A., Somarakis, S., & Tsimenides, N. (2007). State of Hellenic Fisheries. Institute of Marine Biological Resources, Hellenic Centre for Marine Research)

According to the Standard Data Form of the Natura area GR1150014, the protected ichthyofauna species of the shad (Alosa fallax) is found in the study area. This species is a species of Annex II of Directive 92/43/EC. The following ichthyofauna species of Annex II of Directive 92/43/EC are also mentioned in the SID of GR1150010: Alosa fallax, Aphanius fasciatus, Barbus strumicae, Cobitis taenia Complex and Rhodeus amarus. A more detailed analysis is given in the SEAS of the Project.

8.8.8 Plankton

The Aegean Sea, and more generally the eastern Mediterranean, is characterized by low nutrient concentrations, plankton production and biomass. The hydrographic structure of the water column in the North Aegean is influenced by the inflow of brackish waters from the Black Sea through the Dardanelles, which creates intense salinity stratification in the upper layers throughout the year (Psarra et al. 2022). In addition, the Black Sea waters, which are significantly colder in spring, form a 20 m thick surface layer in the North Aegean, which is colder than the underlying waters at the same time.

The North Aegean, due to the influence of the Black Sea waters, is relatively more productive than the highly oligotrophic southern part. The main zooplankton-feeding fish in the area is the anchovy (Engraulis encrasicolus). The main zooplankton groups include holoplankton (Chaetognatha, Cladocera, Annelida, Copepoda, Thaliacea, Euphausiacea, Cnidaria, Mollusca, Pteropoda, Siphonophora) and meroplankton (gastropod larvae, bivalve larvae). In the surface layer (0-50 m), Copepoda, Cladocera and Annelida occur in greater abundance in coastal areas, while Chaetognatha and Thaliacea are more abundant in pelagic areas. Below the surface layer, Copepoda constitute the majority of the zooplankton, while Chaetognatha increase in abundance compared to the surface. The abundance of the main groups decreases sharply with depth, with the exception of molluscs, which show an increasing trend.

According to the available bibliographic information and with regard to phytoplankton, picoplankton prevails and contributes most to the total production of chlorophyll a (Chla) and total primary production in the North and South Aegean. Microplankton follows in abundance ratios of total Chla and total primary production and pheptoplankton has the lowest contribution. It is noted that no specific surveys have been carried out in the project area and thus information is not available for the specific location.

8.8.9 Marine Mammals

The North Aegean is rich in nutrients, which flow in from rivers (Sylaios et al., 2005) and from the Black Sea (Poulos et al., 1997). This area includes important marine and coastal protected areas that have been recognized at both national and international and European levels. These areas include Natura 2000 sites, Important Marine Mammal Areas (IMMAs) and Critical Cetacean Habitats (ACCOBAMS-CCHs).

The project study area falls within ACCOBAMS Zone 9 in the North-East Mediterranean (Thracian Sea) and the Important Marine Mammal Area “North Coast and Islands of the Thracian Sea”. It also falls within the protected area of the Natura 2000 Network, SPA & SCI GR1150014 “Marine Area of Kavala - Thassos”, which has an area of 75,686.03 ha and includes the Thassos sea channel and the Gulf of Kavala. This area hosts one of the largest fishing grounds in the country and is considered extremely important for populations of rare, endangered and vulnerable cetaceans.

Cetaceans found in the area include dolphins, harbour porpoises (Phocoena phocoena) and the Mediterranean monk seal (Monachus monachus). The Mediterranean monk seal is a species of Annex II of Directive 92/43/EEC and uses the area mainly for feeding, as it does not include a terrestrial part for its reproduction (Notarbartolo di Sciara et al., 2016).

The area is also considered important for the Porpoise, with the shallow and productive waters constituting a critical habitat for the local population. Together with the marine area of Thrace, these areas are among the most important in the Mediterranean for the survival of the species.

The high productivity of the marine environment, due to the adjacent river deltas and the extensive plateau of the Thracian Sea, creates ideal habitats for coastal dolphins, such as the Bottlenose Dolphin (Tursiops truncatus) and the Common Dolphin (Delphinus delphis). Local populations thrive in this area more than in the southern Aegean or Ionian Sea, making the area an important population reserve for the Eastern Mediterranean.

During the recordings carried out in the context of the preparation of the SEAS of the project, bottlenose dolphins, common dolphins, porpoises were observed in the wider project area. A detailed description is provided in Section 1.1.B1.ii.4 of the SEAS of the project.

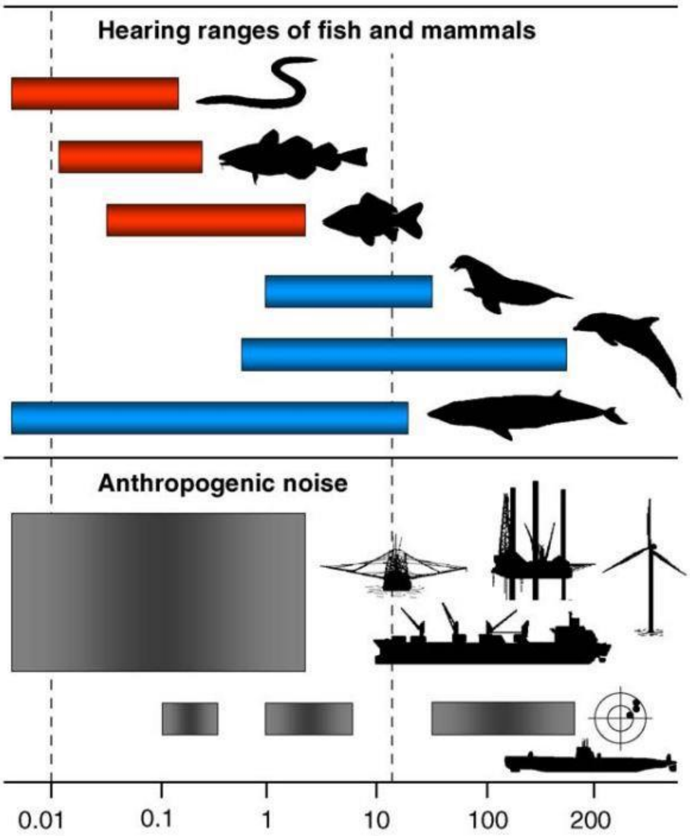
Marine mammals (whales, dolphins, porpoises and pinnipeds) use sound for various purposes, such as communication, to locate their mates, to search for prey, to avoid predators and dangers and for short or long range navigation. Depending on the intensity (sound pressure level) of the Source, the period (frequency) and the distance between the Source and the receiver, sound can affect marine organisms in various ways. The acoustic bandwidth of cetaceans can be divided into three functional groups, low, medium and high as described in the Table below.

Table 8–44: Dominant fish species and protection status in the Thracian Sea based on abundance ranking for the various depth groups identified by dispersion analysis

Functional Listening Group	Estimated Acoustic Range Zone
Low-frequency cetaceans	7Hz to 36kHz
Mid-frequency cetaceans	150Hz to 160Hz
High-frequency cetaceans	200Hz to 165kHz
Pinnipeds in water	40Hz to 90kHz
Pinnipeds in air	42Hz to 52kHz

Source: NOAA Fisheries (2018). Revision to Technical Guidance for Assessing Effects of Anthropogenic Sound on Marine Mammal Hearing, https://www.noaa.gov/)

The following Figure illustrates the auditory range of cetaceans and fish, according to Stabbekorn et al. (2010).



(Source: Slabbekoorn, H., et al. (2010). A noisy spring: the impact of globally rising underwater sound levels on fish. Trends in Ecology & Evolution, 25(7), 419-427.)

Figure 8–78: Cetacean acoustic bandwidth (Hz)

8.8.10 Sea Turtles

As part of the fieldwork on cetaceans and seabirds for the preparation of the Project's MEOA, emphasis was also placed on recording the presence of sea turtles. For sea turtles, an additional survey was carried out on the coast 1km on either side of the SIGMA land facilities as well as on the coast up to Keramoti where the bird fauna surveys were carried out in order to record dead animals and possible signs of nesting. All available data on dead turtles that had washed up on the shore were also collected.

Sea turtles, and mainly loggerhead turtles, are identified from animals that have washed up on the shore, probably after death or after being caught in fishing nets or by propeller strikes. During fieldwork in the wider area, 5 dead loggerhead turtles were recorded, 4 on the shore and one floating in the sea, and one loggerhead turtle dead on the shore. The deaths that have been recorded are many, which indicates that the species gathers in the area to feed or that currents lead the dead animals to the shore.

Specifically, based on data from the NGO Archelon, which deals with sea turtles in the last 4 years (2020 – 2023), 81 sea turtle strandings have been recorded within the SPA GR1150014:

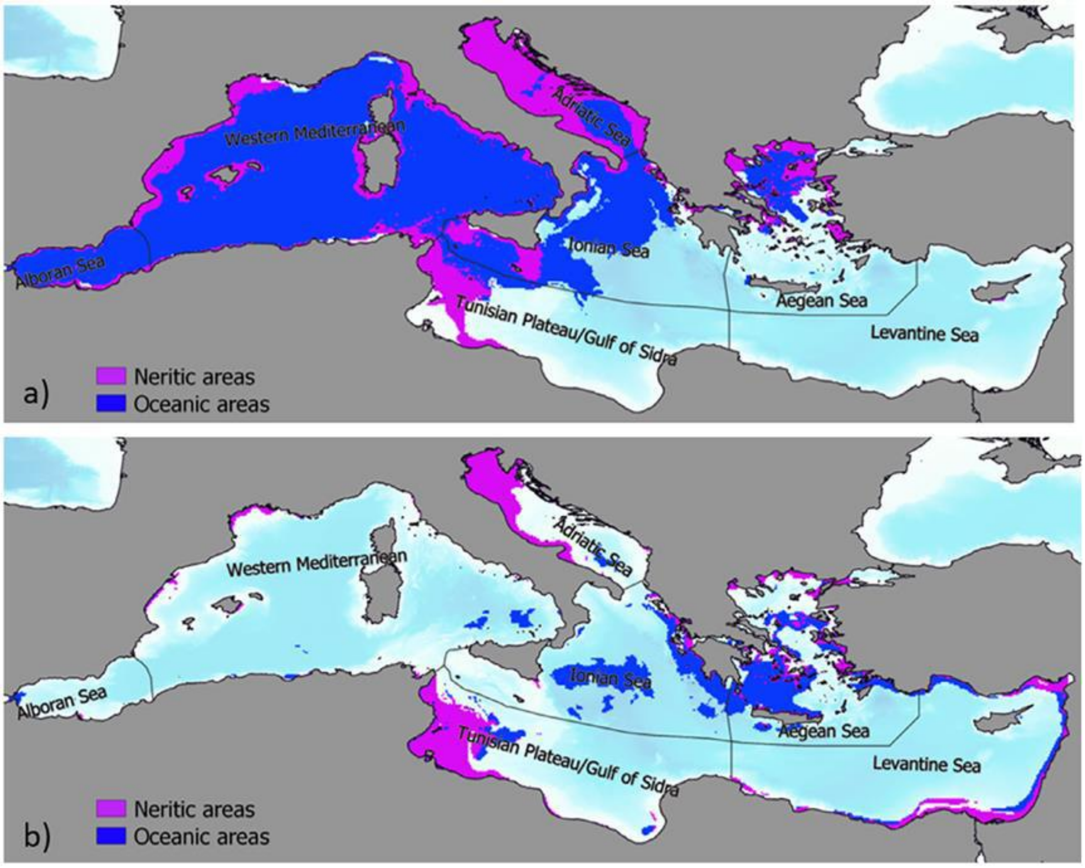
- 71 loggerhead turtles of the species Caretta caretta
- 4 loggerhead turtles of the species Chelonia mydas
- 1 Dermochelys coriacea (Leatherback turtle)

- 5 cases where it was not possible to identify the species, however they are classified in the Chelonidae family.

The presence of the species in the area has been known for a long time. According to data from the port authority and the management body of the national park of Eastern Macedonia and Thrace, as reported in the amphibian and reptile monitoring project in 2012-13, 5 loggerhead turtles and one loggerhead turtle were identified on the coast from Nea Karvali to the beach of Imeros, Komotini.

According to the "National Action Plan for the sea turtle (Caretta caretta) in Greece", the area is not included in the nesting zones, without mentioning the different sporadic nesting sites, which in Greek seas represent 445 nests / year, 15% of the total and recorded nesting. Nevertheless, there is a tendency for nesting on the coasts of islands in the North Aegean.

The following Figure shows the foraging areas of the loggerhead sea turtle. (a) refers to juveniles and (b) refers to adults, according to presence data from 1991 to 2020 (Chatzimeros et al 2021).



(Source: Chatzimeros et al 2021.)

Figure 8–79: Foraging areas of the loggerhead sea turtle

A more detailed description of the characteristics of sea turtles in the Project area is given in the relevant SEAS.

8.8.11 Birdlife

The study area falls within the SPA & SCI GR1150014 "Marine Area of Kavala and Thassos", SAC GR1150001 "Nestos Delta and Keramoti Lagoons and Thasopoula Island" and SPA GR1150010 "Nestos Delta and Keramoti Lagoons – Wider Area" of the Natura 2000 Network. The marine area of the project is included in the Important Bird Area (IBA) with code GR250 and name "Gulf of Kavala and marine area of Thassos", while within the study area is also the area GR012 with name "Nestos Delta and Coastal Lagoons".

Within the framework of the SEAS, the required number of days of fieldwork were carried out for the relevant Natura 2000 areas during the period March - June and September - October 202, while recent recording data provided by the Non-Governmental Organizations (NGOs) Hellenic Ornithological Society and Archelon were also used. Existing data were also provided by OFYPEKA.

Regarding the bird fauna, the fieldwork covered the end of the wintering period, the spring migration, the breeding period, and for some species the post-breeding period (e.g. the Eurasian Cormorant). The autumn migration was also recorded, while the wintering period was covered bibliographically. 3 methods were applied to record the bird fauna in the marine environment:

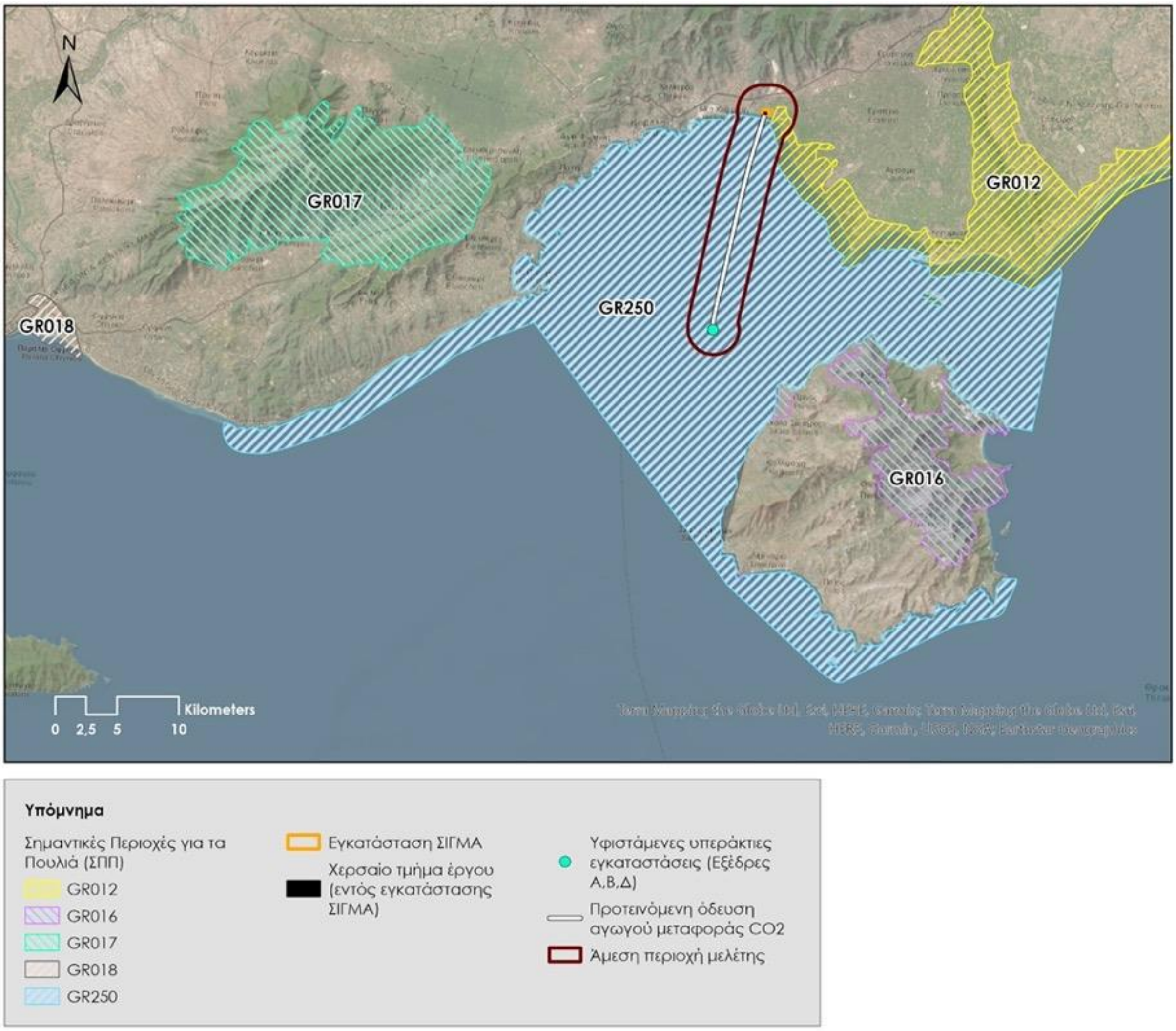
- Visual recordings from vessels using the European Seabirds at Sea «ESAS» method
- Visual recordings from vessels along the coastline include the recording of birds and other fauna species in the coastal marine and terrestrial zone from a vessel.
- Visual recordings from pre-selected viewpoints on the coast include the recording of birds and other fauna species in the coastal marine and terrestrial zone from observational viewpoints on the coast.

For the recording of birdlife in the terrestrial and wetland environment, Direct observation (Look-and-See) was applied, which concerns the recording of birds from selected observation points that are selected based on the existing knowledge of the area regarding the species of interest and their habitats (e.g. Hadjicharalambous et al., 2004) in order to estimate the distribution and abundance of birdlife. The points were selected so as to cover the area under consideration to the greatest possible extent.

The SAC & SCI GR1150014 "Marine Area of Kavala Thasos" is located within the administrative boundaries of the Region of Eastern Macedonia and Thrace and has an area of 75,686.03 ha. The area partially overlaps with the Important Bird Area GR250 "Gulf of Kavala and marine area of Thassos". The area marginally overlaps with the Ramsar site "Nestos Delta and adjacent lagoons" (area code: 56) mainly east of the Nestos estuary.

SPA GR1150001 "Nestos Delta and Keramoti Lagoons and Thasopoula Island", is located within the administrative boundaries of the Region of Eastern Macedonia and Thrace, the Regional Units of Xanthi and Kavala and has an area of 23,028.11 ha. The largest part of the area overlaps with the Natura 2000 network area SAC GR1150010 "Nestos Delta and Keramoti Lagoons - Wider Area and Coastal Zone. The area is located within the boundaries of the National Park of Eastern Macedonia and Thrace as it was in force until 2012, which however no longer legally exists, as well as the Important Bird Area GR012 "Nestos Delta and coastal lagoons", while it partially overlaps with the Wildlife Refuge K769 "Kotza Orman Nestos Municipality of Topeiros". The area is included within the Ramsar site Nestos Delta and adjacent lagoons (area code: 56). The area is managed by the Nestos - Vistonida and Rodopi National Parks Management Unit, OFYPEKA.

The international importance of the area is further enhanced by its inclusion in the network of Important Bird Areas (IBA) as defined by Birdlife International. As can be seen from the Figure below, the marine area of the project is included in the Important Bird Area (IBA) with code GR250 and name “Gulf of Kavala and marine area of Thassos”, while within the study area is also located the area GR012 with name “Nestos Delta and Coastal Lagoons”. In the wider area is also located the area with code GR016 and name “Island of Thassos and Xironisi”.



(Source: Hellenic Ornithological Society, HOS)

Figure 8–80: Important Bird Areas (IBAs)

8.9 ENVIRONMENTALLY PROTECTED AND SENSITIVE AREAS

The National System of Protected Areas consists of all areas that fall under one or more of the categories of article 19 of Law 1650/1986 (Government Gazette 160 A), with the aim of effectively protecting biodiversity and their other ecological values.

According to Article 19 of Law 1650/1986 (as amended by Article 46 of Law 4685/2020):

1 Biodiversity protection areas are defined as terrestrial, aquatic, marine or mixed natural or semi-natural areas with a recorded presence of natural habitat types and species of international, Union importance and/or Greek interest that require protection and conservation. The areas included in the National List of Sites of the European Ecological Network Natura 2000 are defined as biodiversity protection areas and are distinguished into Special Areas of Conservation (SAC), Special Protection Areas (SPA) and proposed Sites of Community Importance (SCIs), according to their more specific classification in Annex I and the attached Tables 1 and 2 of the joint decision of the Ministers of Environment and Energy and Rural Development and Food No. 50743/2017 (B' 4432).

2 Regardless of inclusion in the Natura 2000 network, protected areas can be characterized as follows:

A. National parks. National Parks, whether terrestrial, marine or mixed, are defined as large natural or semi-natural areas in which large-scale ecological functions take place with characteristic species and types of natural habitats of Union importance and/or Greek interest, which require protection and conservation. National Parks may be named based on their physical-geographical characteristics and/or on their historical, spatial and/or administrative identity. National Parks may include two or more Natura 2000 areas and/or Biodiversity Protection Areas, especially when these are characterized by a wide range of ecosystem functions with common spatial, physical-geographical and/or abiotic characteristics.

B. Wildlife Sanctuaries (WSAs). Wildlife Refuges (WRF) are areas (terrestrial, wetland, marine or mixed) that are assessed as suitable for the development of populations of wild fauna and flora or as habitats for reproduction, feeding, wintering of wild fauna species, or as areas for fish reproduction and spawning. They may be named based on their spatial and/or administrative identity. Ecological corridors between protected areas may also be designated as Wildlife Refuges.

Γ. Protected Landscapes and Protected Natural Formations. Protected landscapes and protected natural formations are, respectively, functional parts of nature or individual creations of nature (areas or elements of a point character), which have a particular ecological, geological or geomorphological value or contribute to the preservation of natural processes and the protection of natural resources, such as trees, stands of trees and shrubs, marine protective vegetation, riparian and coastal vegetation, natural fences, waterfalls, springs, gorges, dunes, reefs, caves, rocks, petrified forests, trees or parts thereof, paleontological findings, coral geomorphological formations and geotopes. Protected natural formations that have a monumental character are specifically characterized as preserved natural monuments. It is possible to characterize individual areas within National Parks, Biodiversity Protection Areas and/or Wildlife Refuges as Protected Natural Formations and to include them within zones of graduated protection of these areas..

In the areas of paragraphs 1 and 2 above, one or more protection and management zones from the following are defined by presidential decree:

A. **Absolute Nature Protection Zone:** Absolute nature protection zones are defined as areas with extremely sensitive types of natural habitats, and/or with habitats of extremely sensitive species, whose presence and representativeness is estimated to be very high or whose condition requires extremely strict protection.

B. **Nature Protection Zone:** Nature protection zones are defined as areas with natural habitat types and/or habitats of species whose presence and representativeness is assessed as high or whose condition requires strict protection. In these zones, the natural environment is protected from activities or interventions that may substantially alter its natural condition, composition or evolution for the worse.

Γ. **Habitat and Species Conservation Zone:** Habitat and species conservation zones are defined as areas that are subject to appropriate management to ensure a satisfactory level of conservation of the protected objects (natural habitat types and species of Union importance and/or national interest) that they host.

Δ. **Sustainable Natural Resources Management Zone:** Sustainable natural resource management zones are defined as areas of protected areas in which the protected object can coexist with relevant cultural values and/or anthropogenic activities that promote sustainable natural resource management and/or sustainable development, that is, that which serves environmental protection, economic development, social cohesion and the response to climate change. Anthropogenic activities within this zone, when they may lead to a deterioration in the degree of conservation of the protected object in the protected area and in particular the conservation status of the protected object at national level, are subject to appropriate regulations based on the relevant provisions of the protected area designation act and the relevant Management Plan.

By article 27 of Law 4685/2020, the Natural Environment and Climate Change Organization - OFYPEKA - has been established as a Legal Entity of Private Law supervised by the Ministry of Environment and Natural Resources and 24 Protected Areas Management Units within it. With the integration into the Natural Environment and Climate Change Organization of the Management Body of the Nestos Delta - Vistonida - Ismarida and Thassos and the Management Body of the Rhodope Mountains, the Management Unit of the Nestos-Vistonida and Rhodope National Parks operates with headquarters in Porto Lagos of the Xanthi Regional Municipality and an annex in Mesochori of Paranesti. The MD is subordinate to the Directorate of Protected Areas Management (Sector A) of the General Directorate of OFYPEKA (Management Unit 2).

8.9.1 Areas of the National System of Protected Areas

8.9.1.1 Natura 2000 Network

8.9.1.1.1 General Information

At European level, the Natura 2000 network is a European Ecological Network of sites hosting natural habitat types and habitats of species considered to be of high ecological importance. Directive 92/43/EEC (also known as the Habitats Directive) was adopted in 1992 in response to the Bern Convention to promote the conservation of biological diversity, taking into account economic, social, cultural and regional criteria. Directive 92/43/EEC is the cornerstone of European nature conservation policy and is structured around two central pillars::

1 The Natura 2000 network of protected areas.

2 A system for the protection of species of fauna and flora of Community interest.

The Directive provides for the creation of a pan-European network of protected areas called Natura 2000. Two types of areas participate in this.

1 Areas designated as Sites of Community Interest (SCI) because they contain important habitat types of Annex I, and/or host important species of Annex II of Directive 92/43/EEC.

2 Areas classified as Special Protection Areas (SPA) which host bird species listed in Annex I of Directive 2009/147/EC (which codified and replaced Directive 79/409/EC) and/or other important migratory bird species.

Based on the provisions of the Directive, the inclusion of SCIs in the Natura 2000 network takes place in 3 stages:

1 Each Member State proposes a list of sites, indicating which natural habitat types from those listed in Annex I and which local species from those listed in Annex II are present on each site. The criteria followed in this procedure are set out in Annex III to the Directive. The sites proposed by the Member States are designated as "Proposed Sites of Community Importance" (pSCI).

2 Following an assessment by the European Commission, based on the criteria of Annex III, the list of sites proposed for inclusion is finalized and the sites are designated as Sites of Community Importance (SCI or SCI). According to paragraph 4 of Article 4 of the Directive, from this stage onwards, the provisions of Article 6 apply.

3 After the acceptance of the national list of SACs, the Member States, within a period of 6 years, declare these areas as "Special Areas of Conservation" (SACs), completing the integration of these areas into the Natura 2000 Network. In this context, the Member States are obliged to undertake specific measures to conserve and restore the habitats and species of each area to a favourable conservation status.

SPA areas, after their designation by the member states, are automatically included in the Natura 2000 network without following the process of the above stages.

The Directive aims to protect approximately 200 habitat types and 1,000 species included in its Annexes and considered to be of European interest, based on the criteria of the Directive. In particular:

- Annex I lists the protected habitat types.
- Annex II lists around 900 species whose habitats have been designated as Special Areas of Conservation (SACs) and are included in the Natura 2000 network. These areas should be managed in accordance with the ecological requirements of the species.
- Annex IV lists over 400 species, which should be subject to a strict protection regime throughout their natural range within the EU, both within and outside Natura 2000 sites.
- Annex V lists over 90 species for which Member States must ensure that exploitation and removal from the wild do not adversely affect their favourable conservation status.

The Habitats Directive was incorporated into national legislation through Joint Ministerial Decision 33318/3028/1998 establishing measures and procedures for the conservation of natural habitats and wild fauna and flora, as amended by Joint Ministerial Decision 14849/853/E103/4-4-2008 and in force. In addition, Law 3937/2011 on the Conservation of Biodiversity established the National System of Protected Areas (including Natura 2000 areas), as amended by Joint Ministerial Decision 50743/2017 (revision of the national list of Natura 2000 areas), as well as general guidelines and regulations for their conservation.

The Project under consideration is located within the protected area Natura 2000 SAC & SPA GR1150014 “Marine Area of Kavala Thassos”. In the wider study area, the Natura 2000 SPAs GR1150010 “Nestos Delta and Keramoti Lagoons – Wider Area”, SPA GR1150001 “Nestos Delta and Keramoti Lagoons and Thasopoula Island” and SPA GR1150012 “Thassos (Mount Ypsario and coastal zone)” are located.

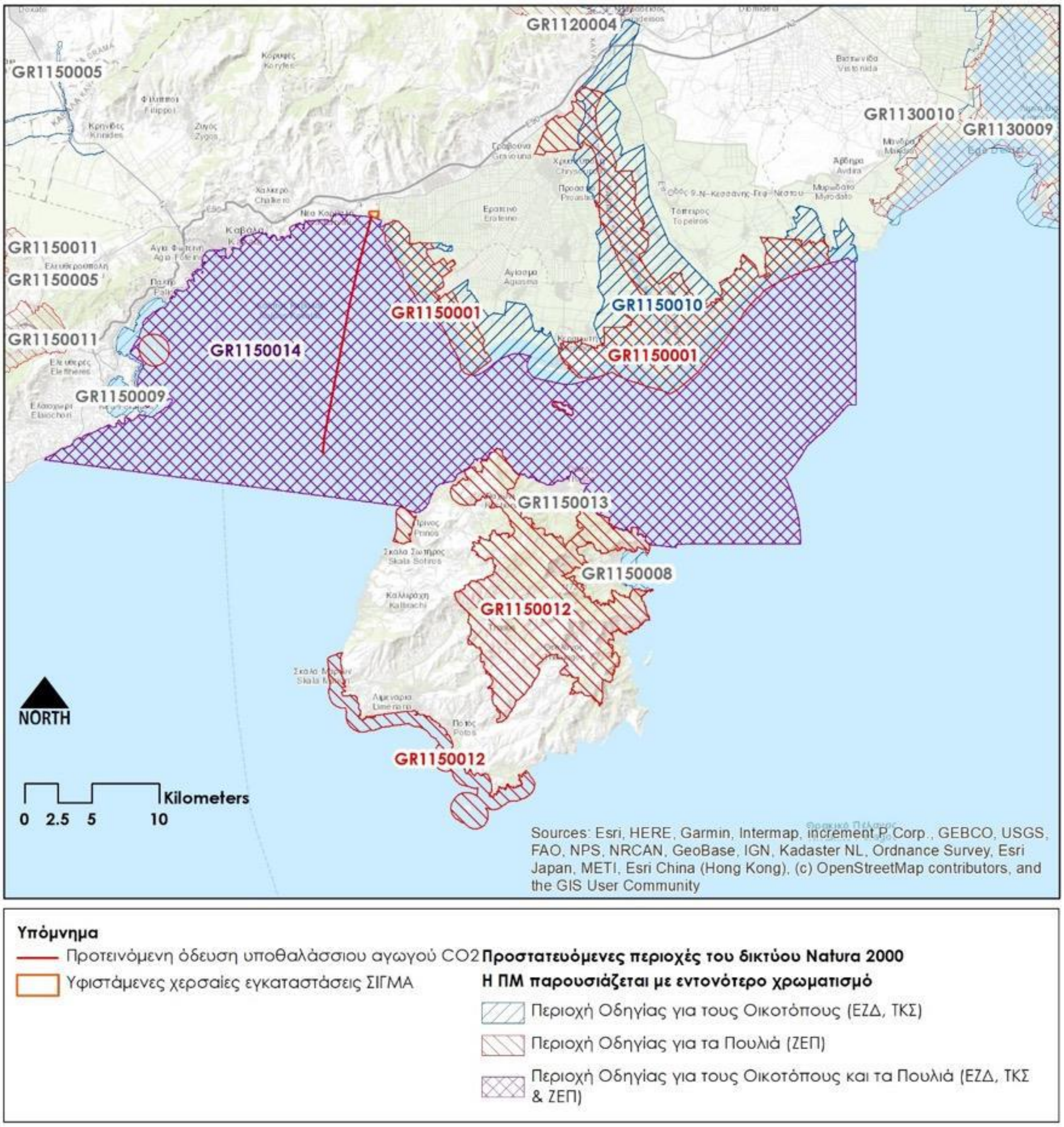


Figure 8–81: SAC & SCI GR1150014, SPA GR1150001, SAC GR1150010 and SAC GR1150012

8.9.1.1.2 SCI and SAC GR1150014 "Marine Area of Kavala Thassos"»

One (1) species of ichthyofauna and two (2) species of marine mammals occur (see Table below). There is insufficient data regarding their conservation status..

Table 8–45: Species in the SCI & SPA GR1150014 referred to in Article 4 of Directive 2009/147/EC and listed in Annex II of Directive 92/43/EEC and site assessment for them

Species			Population per area (Natura site)						Area assessment (Natura site)			
Species group	Code	Scientific name	Type	Size		Unit	Category, population data	Data quality	A/B/C/D	A/B/C		
				Min	Max				Pop.	Con.	Iso.	Glo.

Species			Population per area (Natura site)						Area assessment (Natura site)			
F	1103	*Alosa fallax*	r	0	0		P	DD	D			
M	1351	*Phocoena Phocoena*	p				P	DD	D			
M	1349	*Tursiops truncatus*	p				P	DD	D			

Legend
Species group: A = Amphibians, B = Birds, F = Fish, I = Invertebrates, M = Mammals, P = Plants, R = Reptiles
Species: Latin species name
Type: p = resident, r = breeding, c = congregating, w = wintering
Size: i = individuals, p = pairs
Data pop. category: C = common, R = rare, V = very rare, P = present or population size in individuals (i) or pairs (p).
Data quality: G= Good, M= Moderate, P= Deficient, DD= Data deficient
Pop.: Population: Relative size and density of the species in the area in relation to the total population within the national boundaries. A: 100%>=p> 15%, B: 15%>=p>2%, C: 2%>=p>0, D: non-significant population. Data from SDF
Con.: Conservation: degree of conservation of habitat features that are important for the species and potential for restoration. A: excellent conservation, B: Good conservation, C: moderate or limited conservation. Data from SDF

Source: Standard Data Form GR1150014 "Marine Area of Kavala Thassos")

2 bird species of Annex I of Joint Ministerial Decision 37338/1807/E.103 appear (see the following Table). Regarding the degree of conservation of habitat characteristics that are important for the species and restoration possibilities (conservation), there is insufficient data.

Table 8–46: Bird species of Annex I of Joint Ministerial Decree 37338/1807/E.103 in the area of SAC & SPA GR1150014

Species			Population per area (Natura site)						Area assessment (Natura site)			
Species group	Code	Scientific name	Species group	Code		Scientific name	Species group	Code	Scientific name	Species group		
				Min	Max				Pop.	Con.	Iso.	Glo.
B	A392	*Phalacrocorax aristotelis desmarestii*	r	168	182	p	P	G				
B	A392	*Phalacrocorax aristotelis desmarestii*	c	580	1000	i	P	G				
B	A464	*Puffinus yelkouan*	c	500	2000	i	P	G				

Species	Population per area (Natura site)	Area assessment (Natura site)
Legend Species group: B= Birds Species: Latin species name Type: p = resident, r = breeding, c = congregating, w = wintering Size: i= individuals, p= pairs Data pop. category: C = common, R = rare, V = very rare, P = present or population size in individuals (i) or pairs (p). Data quality: G= Good, M= Moderate, P= Deficient, DD= Data deficient Pop.: Population: Relative size and density of the species in the area in relation to the total population within the national boundaries. A: 100%>=p> 15%, B: 15%>=p>2%, C: 2%>=p>0, D: insignificant population. Data from SDF Con.: Conservation: degree of conservation of habitat features that are important for the species and possibilities for restoration. A: excellent conservation, B: Good conservation, C: moderate or limited conservation. Data from SDF Iso.: Isolation: Degree of isolation of the population present in the area in relation to the natural distribution of the species. A: Isolated (almost) population, B: Non-isolated population, but located on the edge of the distribution area, C: Non-isolated population, within the wider distribution area. Glo.: Global: Overall assessment of the value of the site for the conservation of the species. A: excellent, B: Good, C: Adequate.		

Source: Standard Data Form GR1150014 "Marine Area of Kavala Thassos")

8.9.1.1.3 SAC GR1150010 "Nestos Delta and Keramoti Lagoons – Wider Area"

22 habitat types (HT) of Annex I of Directive 92/43/EC are displayed, of which: three (3) are priority habitats (1150, 3170 and 91E0), 9 are habitats with conservation status A, 10 with conservation status B, 2 with conservation status C, while for 1170 there is insufficient data (Table below).

Table 8-47: Habitat types of Annex I of Directive 92/43/EC in SAC GR1150010

Code	Description	PF	Area (ha)	Data quality	Representa bility	Relative surface	Conse-rvation	Global
					A / B / C / D	A / B / C	A / B / C	A / B / C
1110	Sandbanks permanently covered by shallow seawater	0	2918.51	P	A	C	B	B
1130	River estuaries	0	17.8589	G	B	A	B	B
1140	Muddy and sandy flats exposed at low tide	0	0	G	C	-	A	A
1150*	Coastal lagoons	1	849.685	G	A	B	B	B
1170	Reefs	0	0	G	D	-	-	-
1210	Annual vegetation between high and low tide	0	34.0677	G	A	B	C	B
1310	Primary vegetation with Salicornia and other annual species of muddy and sandy zones	0	23.0126	G	B	C	A	B

Code	Description	PF	Area (ha)	Data quality	Representability	Relative surface	Conse-rvation	Global
					A / B / C / D	A / B / C	A / B / C	A / B / C
1410	Mediterranean salt flats (Juncetalia maritimi)	0	1632.68	G	B	A	B	B
1420	Mediterranean and thermo-Atlantic halophilic thickets (Sarcocornetea Fruticosi)	0	424.974	G	A	B	A	A
2110	Atypical moving dunes	0	85.4206	G	B	B	A	B
2120	Moving dunes of the coastline with Ammophila arenaria («white dunes»)	0	107.283	G	A	B	A	B
2190	Wet hollows between the dunes	0	13.578	G	A	B	B	B
2220	Dunes with Euphorbia terracina	0	80.1886	G	B	A	A	A
3150	Eutrophic natural lakes with Magnopotamion or Hydrocharition vegetation	0	11.2101	G	A	C	B	B
3170	Mediterranean seasonal marshes	1	0.05	G	B	C	C	C
3280	Mediterranean rivers with permanent flow of Paspalo-Agrostidion and dense vegetation in the form of a curtain of Salix and Populus alba on their banks	0	422.582	G	A	A	B	A
62A0	Dry grassy formations of the eastern Mediterranean (Scorzoneratalia villosae)	0	332.525	G	C	C	B	C
6420	Wet Mediterranean grasslands with tall grasses of Molinio-Holoschoenion	0	1127.64	G	B	A	B	B

Code	Description	PF	Area (ha)	Data quality	Representability	Relative surface	Conse-rvation	Global
					A / B / C / D	A / B / C	A / B / C	A / B / C
91E0	Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)	1	513.846	G	B	A	A	A
91F0	Mixed forests with Quercus robur, Ulmus laevis, Ulmus minor, Fraxinus excelsior or Fraxinus angustifolia (Ulmenion minoris) along large rivers	0	157.452	G	A	A	B	A
92A0	Forests – galleries with Salix alba and Populus alba	0	623.623	G	A	B	A	A
92D0	Southern riparian forests – galleries and thickets (Nerio-Tamaricetea and Securinegion tinctoriae)	0	672.515	G	A	B	A	A

Legend
H.T. Code: Four-digit habitat type code
H.T. Description: Habitat type name
PF: Priority habitat (Value 0 or 1: Priority habitat)
Area (ha): Area of the H.T. in hectares
Data quality: G= Good, M= Moderate, P= Insufficient, DD= Data deficient
Representativeness: provides a measure of "how typical" a habitat type is. A (excellent), B (Good), C (sufficient), D (not significant presence).

(Source: Standard Data Form GR1150010 "Nestos Delta and Keramoti Lagoons – Wider Area")

Five (5) species of ichthyofauna, two (2) species of invertebrates, six (6) species of reptiles, three (3) species of mammals and two (2) species of amphibians occur (see Table below). The conservation status is B for six (6) of these species, C for seven (7) species and there is insufficient data for five (5) species.

Table 8–48: Species in SAC GR1150010 referred to in Article 4 of Directive 2009/147/EC and listed in Annex II of Directive 92/43/EEC and site assessment for them

Species			Population per area (Natura site)						Area assessment (Natura site)			
Species group	Code	Scientific name	Species group	Code		Scientific name	Species group	Code	Scientific name	Species group		
				Min	Max				Pop.	Con.	Iso.	Glo.

Species			Population per area (Natura site)						Area assessment (Natura site)			
F	1103	*Alosa fallax*	r	0	0		P	DD	C	C	C	C
F	1152	*Aphanius fasciatus*	p	0	0		C	-	B	B	C	B
F	5263	*Barbus strumicae*	p	0	0		C	DD	-	B	C	B
F	6963	*Cobitis taenia Complex*	p	0	0		C	DD	-	B	C	B
F	5339	*Rhodeus amarus*	p	0	0		C	DD	-	B	C	B
I	1043	*Lindenia tetraphylla*	p	0	0		P	-	C	B	C	B
I	1037	*Ophiogompus Cecilia*	p	0	0		P	-	B	B	C	C
R	1279	*Elaphe quatuorlineata*	p	0	0		P	-	A	C	A	A
R	1220	*Emys ombicularis*	p	0	0		C	-	B	C	C	C
R	2373	*Mauremys rivulata*	p	0	0		C	-	B	C	C	C
R	1219	*Testudo graeca*	p	0	0		R	-	C	C	C	C
R	1217	*Testudo hermanni*	p	0	0		P	-	B	C	C	C
R	6095	*Zamenis situla*	p	0	0		P	-	D	-	-	-
M	1355	*Lutra lutra*	p	0	0		-	-	B	C	A	B
M	1351	*Phocoena Phocoena*	p	0	0		P	DD	D	-	-	-
M	1349	*Tursiops truncates*	p	0	0		P	DD	D	-	-	-
A	1193	*Bombina variegate*	p	0	0		C	-	D	-	-	-
A	1171	*Triturus karelinii*	p	0	0		V	-	D	-	-	-

Legend

Species group: A = Amphibians, B = Birds, F = Fish, I = Invertebrates, M = Mammals, P = Plants, R = Reptiles

Species: Latin species name

Type: p = resident, r = breeding, c = congregating, w = wintering

Size: i = individuals, p = pairs

Data pop. category: C = common, R = rare, V = very rare, P = present or population size in individuals (i) or pairs (p).

Data quality: G= Good, M= Moderate, P= Deficient, DD= Data deficient

Pop.: Population: Relative size and density of the species in the area in relation to the total population within the national boundaries. A: 100%>=p> 15%, B: 15%>=p>2%, C: 2%>=p>0, D: non-significant population. Data from SDF

Con.: Conservation: degree of conservation of habitat features that are important for the species and potential for restoration. A: excellent conservation, B: Good conservation, C: moderate or limited conservation. Data from SDF

(Source: Standard Data Form GR1150010 “Nestos Delta and Keramoti Lagoons – Wider Area”)

8.9.1.1.4 SAC GR1150001 "Nestos Delta and Keramoti Lagoons and Thasopoula Island"»

206 bird species of Annex I of Joint Ministerial Decision 37338/1807/E.103 are listed with Good conservation (B) of the habitat characteristics that are important for the species (conservation), except for 15 species for which there is insufficient data (see the following Table).

Table 8–49: Bird species of Annex I of Joint Ministerial Decree 37338/1807/E.103 in SPA GR1150001

Species			Population per area (Natura site)						Area assessment (Natura site)			
Specie s group	Code	Scientific name	Specie s group	Code		Scientifi c name	Specie s group	Cod e	Scientifi c name	Species group		
				Min	Max				Pop.	Con .	Iso .	Glo .
B	A293	Acrocephalus melanopogon	c				P		C	B	C	B
B	A296	Acrocephalus palustris	c				P		C	B	C	B
B	A295	Acrocephalus schoenobaenu s	r				P		C	B	C	B
B	A297	Acrocephalus scirpaceus	r				P		C	B	C	B
B	A168	Actitis hypoleucos	c				P		C	B	C	B
B	A247	Alauda arvensis	r				P		C	B	C	B
B	A247	Alauda arvensis	w				P		C	B	C	B
B	A229	Alcedo atthis	r	2	2	p	P		C	B	C	B
B	A229	Alcedo atthis	w	3	7	i	P		C	B	C	B
B	A054	Anas acuta	w	1	380	i	P		C	B	C	B
B	A857	Spatula clypeata	w	140	430	i	P		C	B	C	B
B	A052	Anas crecca	w	1	440	i	P		C	B	C	B
B	A855	Mareca penelope	w	842	1662	i	P		C	B	C	B
B	A053	Anas platyrhynchos	r	1	29	p	P		C	B	C	B
B	A053	Anas platyrhynchos	w	20	930	i	P		C	B	C	B
B	A856	Spatula querquedula	c	50	100	i	P		C	B	C	B
B	A856	Spatula querquedula	r	2	11	p						

Species			Population per area (Natura site)						Area assessment (Natura site)			
B	A889	Mareca strepera	r	3	3	p	P		C	B	C	B
B	A889	Mareca strepera	w	19	69	i	P		C	B	C	B
B	A394	Anser albifrons albifrons	w	36	329	i		G	B	B	C	B
B	A043	Anser anser	w	1	63	i		G	C	B	B	B
B	A042	Anser erythropus	w	0	1	i		G	A	B	B	B
B	A255	Anthus campestris	r				P		C	B	C	B
B	A258	Anthus cervinus	c				P		C	B	C	B
B	A257	Anthus pratensis	c				P		C	B	C	B
B	A259	Anthus spinoletta	w				P		C	B	C	B
B	A256	Anthus trivialis	w				P		C	B	C	B
B	A228	Tachymarptis melba	c				P		C	B	C	B
B	A226	Apus apus	r				P		C	B	C	B
B	A227	Apus pallidus	r				P		C	B	C	B
B	A091	Aquila chrysaetos	r	2	2	p	P		C	B	C	B
B	A859	Clanga clanga	w	1	13	i		G	C	B	B	B
B	A404	Aquila heliaca	c	2		i		G	A	B	B	B
B	A858	Clanga pomarina	r	3	4	p		G	B	B	B	B
B	A028	Ardea cinerea	r	70	110	p		G				
B	A028	Ardea cinerea	w	64	192	i						
B	A029	Ardea purpurea	r	3	8	p		G	A	B	C	B
B	A222	Asio flammeus	r	1	1	p						
B	A222	Asio flammeus	w				P		C	B	C	B
B	A221	Asio otus	r	1	2	p						
B	A059	Aythya ferina	w	9	90	i	P		C	B	C	B
B	A061	Aythya fuligula	w	1	40	i	P		C	B	C	B
B	A060	Aythya nyroca	r	5	5	p						
B	A021	Botaurus stellaris	r	1	1	p		G	B	B	B	B
B	A215	Bubo bubo	p				R		B	B	C	B
B	A215	Bubo bubo	r	1	1	p						
B	A133	Burhinus oedicnemus	r	2	7	p		G	C	B	C	B
B	A087	Buteo buteo	r	8	8	p	P		C	B	C	B

Species			Population per area (Natura site)						Area assessment (Natura site)			
B	A087	Buteo buteo	w	30	90	i		G	C	B	C	B
B	A403	Buteo rufinus	c				P		C	B	B	B
B	A403	Buteo rufinus	r	1	1	p	P		C	B	B	B
B	A243	Calandrella brachydactyla	r				P		C	B	C	B
B	A149	Calidris alpina	c				P		C	B	C	B
B	A149	Calidris alpina	w	1	390	i	P		C	B	C	B
B	A147	Calidris ferruginea	c				P		C	B	C	B
B	A145	Calidris minuta	w	1	450	i	P		C	B	C	B
B	A146	Calidris temminckii	c				P		C	B	C	B
B	A224	Caprimulgus europaeus	r				P		C	B	C	B
B	A138	Charadrius alexandrinus	r	1	7	p		G	C	B	C	B
B	A138	Charadrius alexandrinus	w	1	21	i						
B	A137	Charadrius hiaticula	c				P		C	B	B	B
B	A734	Chlidonias hybrida	w	300	300	i		G	C	B	C	B
B	A198	Chlidonias leucopterus	c	600	600	i		G	C	B	C	B
B	A197	Chlidonias niger	c	300	300	i		G	C	B	C	B
B	A030	Ciconia nigra	r	3	3	p		G	B	B	B	B
B	A080	Circaetus gallicus	r	4	4	p	P		C	B	C	B
B	A081	Circus aeruginosus	r	10	10	p		G	A	B	C	B
B	A081	Circus aeruginosus	w	22	58	i		G	A	B	C	B
B	A082	Circus cyaneus	w	1	6	i		G	B	B	C	B
B	A084	Circus pygargus	c				P		C	B	C	B
B	A231	Coracias garrulus	r	2	9	p	P		C	B	C	B
B	A113	Coturnix coturnix	c				P		C	B	C	B
B	A113	Coturnix coturnix	r				P		C	B	C	B
B	A212	Cuculus canorus	r				P		C	B	C	B
B	A036	Cygnus olor	r	1	20	p						
B	A036	Cygnus olor	w	37	266	i		G	C	B	C	B

Species			Population per area (Natura site)						Area assessment (Natura site)			
B	A738	Delichon urbicum (urbica)	r				P		C	B	C	B
B	A868	Leiopicus medius	p				P		C	B	C	B
B	A429	Dendrocopos syriacus	r	20	20	p	P		C	B	B	B
B	A236	Dryocopus martius	p				P		C	B	B	B
B	A236	Dryocopus martius	r	1	25	p						
B	A773	Ardea alba	w	10	60	i		G	A	B	B	B
B	A026	Egretta garzetta	c	200	200	i		G	A	B	C	B
B	A026	Egretta garzetta	r	90	190	p		G	B	B	C	B
B	A026	Egretta garzetta	w	22	40	i		G	B	B	C	B
B	A447	Emberiza caesia	c				P		C	B	C	B
B	A382	Emberiza melanocephala	r				P		C	B	C	B
B	A269	Erithacus rubecula	w				P		C	B	C	B
B	A101	Falco biarmicus	w	1	2	i		G	B	B	C	B
B	A098	Falco columbarius	w	4	4	i		G	C	B	C	B
B	A100	Falco eleonorae	c			i		G	C	B	B	B
B	A103	Falco peregrinus	w	1	2	i	P		C	B	C	B
B	A099	Falco subbuteo	r	5	5	p	P	G	C	B	C	B
B	A097	Falco vespertinus	c	20	30	i		G	C	B	C	B
B	A321	Ficedula albicollis	c				P		C	B	C	B
B	A322	Ficedula hypoleuca	c				P		C	B	C	B
B	A442	Ficedula semitorquata	c				P		C	B	C	B
B	A657	Fringilla coelebs all others	r				P		C	B	C	B
B	A125	Fulica atra	r				P		C	B	C	B
B	A125	Fulica atra	w	3950	12660	i	P		C	B	C	B

Species			Population per area (Natura site)						Area assessment (Natura site)			
B	A153	Gallinago gallinago	w	1	30	i		G	C	B	C	B
B	A002	Gavia arctica	w	2	9	i		G	B	B	B	B
B	A001	Gavia stellata	w	2	2	i		G				
B	A135	Glareola pratincola	r	2	19	p		G	C	B	C	B
B	A078	Gyps fulvus	c			i		G	B	B	C	B
B	A130	Haematopus ostralegus	r	2	21	p	P		C	B	C	B
B	A130	Haematopus ostralegus	w	2	2	i						
B	A075	Haliaeetus albicilla	c	1	5	i		G	A	B	B	B
B	A075	Haliaeetus albicilla	r	1	1	p		G	A	B	B	B
B	A707	Hieraaetus fasciatus (Aquila fasciata)	c					G	C	B	B	B
B	A092	Hieraaetus pennatus (Aquila pennata)	c					G	C	B	C	B
B	A131	Himantopus himantopus	r	25	25	p	P		C	B	C	B
B	A299	Hippolais icterina	c				P		C	B	C	B
B	A479	Cecropis daurica	r				P		C	B	C	B
B	A251	Hirundo rustica	r				P		C	B	C	B
B	A022	Ixobrychus minutus	r	1	7	p	P		C	B	C	B
B	A233	Jynx torquilla	c				P		C	B	C	B
B	A338	Lanius collurio	r				P		C	B	C	B
B	A339	Lanius minor	r				P		C	B	C	B
B	A341	Lanius senator	r				P		C	B	C	B
B	A179	Larus ridibundus	w			i		G	C	B	C	B
B	A181	Larus audouinii	c				R		B	B	B	B
B	A180	Larus genei	w	13	60	i		G	A	B	C	B
B	A176	Larus melanocephal us	c					G	A	B	C	B
B	A176	Larus melanocephal us	r	160	160	p		G	A	B	C	B
B	A862	Hydrocoloeus minutus	c				P		C	B	C	B

Species			Population per area (Natura site)						Area assessment (Natura site)			
B	A292	Locustella luscinioides	r				P		C	B	C	B
B	A246	Lullula arborea	w				P		C	B	C	B
B	A271	Luscinia megarhynchos	r				P		C	B	C	B
B	A242	Melanocorypha calandra	r				P		C	B	C	B
B	A069	Mergus serrator	w	1	1	i		G	C	B	C	B
B	A230	Merops apiaster	r				P		C	B	C	B
B	A073	Milvus migrans	r	1	1	p	P		B	B	C	B
B	A073	Milvus migrans	w	1	8	i	P		B	B	C	B
B	A074	Milvus milvus	c					G	A	B	B	B
B	A262	Motacilla alba	r				P		C	B	C	B
B	A261	Motacilla cinerea	w				P		C	B	C	B
B	A260	Motacilla flava	r				P		C	B	C	B
B	A319	Muscicapa striata	c				P		C	B	C	B
B	A319	Muscicapa striata	r				P		C	B	C	B
B	A077	Neophron percnopterus	c			i		G	B	B	C	B
B	A159	Numenius tenuirostris	c				P		A	B	B	B
B	A023	Nycticorax nycticorax	c	20	50	i		G	C	B	C	B
B	A278	Oenanthe hispanica	r				P		C	B	C	B
B	A277	Oenanthe oenanthe	r				P		C	B	C	B
B	A337	Oriolus oriolus	r				P		C	B	C	B
B	A21 4	Otus scops	p				P		C	B	C	B
B	A21 4	Otus scops	r	1	4	p						
B	A094	Pandion haliaetus	c					G	B	B	C	B
B	A355	Passer hispaniolensis	r				P		C	B	C	B
B	A020	Pelecanus crispus	c	150	200	i		G	C	B	B	B
B	A020	Pelecanus crispus	w	100	350	i		G	C	B	B	B

Species			Population per area (Natura site)						Area assessment (Natura site)			
B	A019	Pelecanus onocrotalus	c	100	150	i		G	A	B	B	B
B	A072	Pernis apivorus	r	4	4	p	P	G	C	B	C	B
B	A392	Phalacrocorax aristotelis desmarestii	r	6	6	p		G	A	B	C	B
B	A392	Phalacrocorax aristotelis desmarestii	w	20	40	i	P	G	C	B	B	B
B	A391	Phalacrocorax carbo sinensis	w	60	2500	i		G	B	B	C	B
B	A875	Microcarbo pygmaeus	w	50	170	i		G	A	B	B	B
B	A170	Phalaropus lobatus	c				P		B	B	B	B
B	A663	Phoenicopteru s roseus	w	380	1310	i		G	B	B	C	B
B	A273	Phoenicurus ochruros	w				P		C	B	C	B
B	A274	Phoenicurus phoenicurus	c				P		C	B	C	B
B	A572	Phylloscopus collybita s. str.	w				P		C	B	C	B
B	A314	Phylloscopus sibilatrix	c				P		C	B	C	B
B	A316	Phylloscopus trochilus	c				P		C	B	C	B
B	A234	Picus canus	p				P		C	B	B	B
B	A234	Picus canus	r	2	17	p						
B	A034	Platalea leucorodia	w	10	16	i	P		C	B	C	B
B	A032	Plegadis falcinellus	c	100	200	i		G	B	B	C	B
B	A140	Pluvialis apricaria	w	110	120	i	P		C	B	C	B
B	A141	Pluvialis squatarola	w	1	60	i	P		C	B	C	B
B	A005	Podiceps cristatus	r	1	2	p	P		C	B	B	B
B	A005	Podiceps cristatus	w	50	300	i	P		C	B	B	B
B	A008	Podiceps nigricollis	w	20	70	i		G	C	B	C	B
B	A892	Zapornia parva	c				P		C	B	B	B
B	A893	Zapornia pusilla	c				P		C	B	B	B
B	A464	Puffinus yelkouan	w	700	1000	i		G	C	B	B	B

Species			Population per area (Natura site)						Area assessment (Natura site)			
B	A132	Recurvirostra avosetta	w	40	160	i	P		C	B	C	B
B	A249	Riparia riparia	r				P		C	B	C	B
B	A275	Saxicola rubetra	c				P		C	B	C	B
B	A189	Gelochelidon nilotica	r	1	1	p		G	C	B	C	B
B	A894	Hydroprogne caspia	w	2	2	i		G	C	B	C	B
B	A863	Thalasseus sandvicensis	w	1	10	i		G	C	B	C	B
B	A193	Sterna hirundo	r	5	21	p		G	B	B	C	B
B	A210	Streptopelia turtur	r				P		C	B	C	B
B	A351	Sturnus vulgaris	r				P		C	B	C	B
B	A351	Sturnus vulgaris	w				P		C	B	C	B
B	A310	Sylvia borin	c				P		C	B	C	B
B	A304	Sylvia cantillans	r				P		C	B	C	B
B	A309	Sylvia communis	r				P		C	B	C	B
B	A574	Sylvia curruca	c				P		C	B	C	B
B	A397	Tadorna ferruginea	w	72	72	i		G	A	B	B	B
B	A048	Tadorna tadorna	r	1	20	p	P		C	B	C	B
B	A048	Tadorna tadorna	w	21	156	i	P		C	B	C	B
B	A166	Tringa glareola	c	30	50	i	P		C	B	C	B
B	A164	Tringa nebularia	w	1	1	i		G	C	B	C	B
B	A165	Tringa ochropus	w	1	1	i	P		C	B	C	B
B	A163	Tringa stagnatilis	c				P		C	B	C	B
B	A162	Tringa totanus	r	1	6	p	P		C	B	C	B
B	A162	Tringa totanus	w	30	70	i	P		C	B	C	B
B	A285	Turdus philomelos	c				P		C	B	C	B
B	A232	Upupa epops	r				P		C	B	C	B
B	A728	Vanellus (Hoplopterus) spinosus	r	2	21	p						
B	A142	Vanellus vanellus	r	1	1	p						

Species			Population per area (Natura site)						Area assessment (Natura site)			
B	A142	Vanellus vanellus	w	170	440	i	P	G	C	B	C	B
B	A167	Xenus cinereus	c				R		B	B	B	B

Legend

Species group: B= Birds

Species: Latin species name

Type: p = resident, r = breeding, c = congregating, w = wintering

Size: i= individuals, p= pairs

Data pop. category: C = common, R = rare, V = very rare, P = present or population size in individuals (i) or pairs (p).

Data quality: G= Good, M= Moderate, P= Deficient, DD= Data deficient

Pop.: Population: Relative size and density of the species in the area in relation to the total population within the national boundaries. A: 100%>=p> 15%, B: 15%>=p>2%, C: 2%>=p>0, D: insignificant population. Data from SDF

Con.: Conservation: degree of conservation of habitat features that are important for the species and possibilities for restoration. A: excellent conservation, B: Good conservation, C: moderate or limited conservation. Data from SDF

Iso.: Isolation: Degree of isolation of the population present in the area in relation to the natural distribution of the species. A: Isolated (almost) population, B: Non-isolated population, but located on the edge of the distribution area, C: Non-isolated population, within the wider distribution area.

Glo.: Global: Overall assessment of the value of the site for the conservation of the species. A: excellent, B: Good, C: Adequate.

(Source: Standard Data Form GR1150001 "Nestos Delta and Keramoti Lagoons and Thasopoula Island")

8.9.1.1.5 SAC GR1150012 “Thassos (Mount Ypsarios and coastal zone)”

48 species of bird fauna of Annex I of Joint Ministerial Decision 37338/1807/E.103 are listed (see Table below). Regarding the degree of conservation of habitat characteristics that are important for the species and restoration potential (conservation), 6 species show Excellent conservation (A), 28 species show Good conservation (B), 2 species (Alauda arvensis, Chlidonias leucopterus) show moderate or limited conservation and for 12 species there is insufficient data.

Table 8–50: Measured pollutants at the Kavala -2 station (in μg/m3) for the year 2022 Bird species of Annex I of Joint Ministerial Decision 37338/1807/E.103 in SPA GR1150012

Species			Population per area (Natura site)						Area assessment (Natura site)			
Species group	Code	Scientific name	Type	Size		Unit	Category, population data	Data quality	A/B/C/D	A/B/C		
				Min	Max				Pop.	Con.	Iso.	Glo.
B	A402	*Accipiter brevipes*	r	4	4	p	-	G	C	A	C	B
B	A247	*Alauda arvensis*	c	0	0	-	C	DD	C	C	C	C
B	A229	*Alcedo atthis*	w	5	5	p	-	G	C	B	C	B
B	A229	*Alcedo atthis*	p	5	10	p	-	G	C	B	C	B
B	A226	*Apus Apus*	r	0	0	-	C	DD	C	B	C	C
B	A028	*Ardea cinerea*	w	0	0	-	P	DD	D	-	-	-
B	A215	*Bubo bubo*	p	2	4	p	-	G	C	A	C	B
B	A087	*Buteo buteo*	w	5	0	p	-	M	-	A	-	-

Species			Population per area (Natura site)						Area assessment (Natura site)			
B	A087	*Buteo buteo*	p	5	0	p	-	M	C	A	C	B
B	A224	*Caprimulgus europaeus*	r	0	0	-	C	DD	C	-	C	B
B	A198	*Chlidonias leucopterus*	c	0	0	-	P	DD	D	C	-	-
B	A080	*Circaetus gallicus*	r	2	4	p	-	G	C	A	C	B
B	A738	*Delichon urbicum*	r	0	0	-	C	DD	C	B	C	B
B	A026	*Egratta garzetta*	c	0	0	-	-	DD	D	B	-	
B	A447	*Emberiza caesia*	r	0	0	-	C	DD	C	B	C	B
B	A447	*Emberiza caesia*	c	0	0	-	P	DD	C	B	C	B
B	A379	*Emberiza hortulana*	r	0	0	-	P	DD	C	B	C	B
B	A379	*Emberiza hortulana*	c	0	0	-	P	DD	C	B	C	B
B	A100	*Falco eleonorae*	c	30	60	i	-	G	C	B	C	B
B	A103	*Falco peregrinus*	p	5	6	p	-	G	B	B	C	B
B	A321	*Ficedula albicollis*	c	0	0	-	P	DD	C	-	C	C
B	A320	*Ficedula parya*	c	0	0	-	P	DD	C	-	C	C
B	A131	*Himantopus Himantopus*	c	0	0	-	P	DD	D	B	-	-
B	A439	*Hippolais olivetorum*	c	0	0	-	P	DD	C	B	C	C
B	A439	*Hippolais olivetorum*	r	0	0	-	R	DD	D	B	-	-
B	A251	*Hirundo rustica*	r	0	0	-	C	DD	C	B	C	B
B	A023	*Nycticorax nycticorax*	c	0	0	-	P	DD	D	-	-	-
B	A337	*Oriolus oriolus*	r	2	0	i	-	M	C	B	C	B
B	A337	*Oriolus oriolus*	c	0	0	-	C	DD	C	B	C	B
B	A072	*Pernis apivorus*	r	3	0	p	-	M	C	A	C	B
B	A392	*Phalacrocorax aristotelis desmarestii*	r	150	0	P	-	M	B	B	C	A
B	A663	*Phoenicopterus roseus*	c	0	0	-	P	DD	-	-	-	-
B	A249	*Riparia riparia*	c	0	0	-	C	DD	C	-	C	C
B	A193	*Sterna hirundo*	c	0	0	-	C	DD	C	-	C	C
B	A885	*Sternula albifrons*	c	0	0	-	C	DD	C	-	C	C

Species			Population per area (Natura site)						Area assessment (Natura site)			
B	A210	*Streptopelia turtur*	r	0	0	-	C	DD	C	B	C	B
B	A440	*Sylvia ruppeli*	r	0	0	-	C	DD	C	B	C	C
B	A228	*Tachymarptis melba*	r	0	0	p	-	M	B	B	C	A

Legend
Species group: B= Birds
Species: Latin species name
Type: p = resident, r = breeding, c = congregating, w = wintering
Size: i= individuals, p= pairs
Data pop. category: C = common, R = rare, V = very rare, P = present or population size in individuals (i) or pairs (p).
Data quality: G= Good, M= Moderate, P= Deficient, DD= Data deficient
Pop.: Population: Relative size and density of the species in the area in relation to the total population within the national boundaries. A: 100%>=p> 15%, B: 15%>=p>2%, C: 2%>=p>0, D: insignificant population. Data from SDF
Con.: Conservation: degree of conservation of habitat features that are important for the species and possibilities for restoration. A: excellent conservation, B: Good conservation, C: moderate or limited conservation. Data from SDF
Iso.: Isolation: Degree of isolation of the population present in the area in relation to the natural distribution of the species. A: Isolated (almost) population, B: Non-isolated population, but located on the edge of the distribution area, C: Non-isolated population, within the wider distribution area.
Glo.: Global: Overall assessment of the value of the site for the conservation of the species. A: excellent, B: Good, C: Adequate.

(Source: Standard Data Form GR1150012 "Thassos (Mount Ypsarios and coastal zone)")

8.9.1.2 National Park of Eastern Macedonia and Thrace

The National Park of Eastern Macedonia and Thrace, as established in 2008 by the Joint Ministerial Decision (JMD) 44549/2008 (Government Gazette 497/A/17-10-2008), includes the protected areas of the Nestos Delta wetland, the lakes Vistonida and Ismarida and the surrounding areas, with a total land and water area of 930,000 acres.

The institutionalized management of the National Park of Eastern Macedonia and Thrace is the Nestos Delta Vistonida-Ismarida Management Body, which is a private, non-profit legal entity and was established in April 2003 by the Ministry of Environment and Energy. The management of the National Park should be compatible with the requirements of the relevant Management Plan.

The wetland complex of the National Park is one of the most important in Greece, due to its large area and its high biological, aesthetic, scientific, educational and geomorphological value. The purpose of the National Park is the effective protection of habitats and rare species of flora and fauna that live and reproduce in the area. More than 326 species of birds have been observed in the National Park during the nesting period, wintering or simply as they pass through the area. In addition, there is a wide variety of fish, amphibians and reptiles. The wetland is also an important habitat for otters, wolves, roe deer and many other mammals.

The main habitats are as follows:

- Sandy areas: apart from birds, which prefer sandy arid areas, only plants adapted to harsh conditions live here, such as the sea lily.
- Salt marshes and salt pans: These areas are periodically flooded by brackish or salty water. In them we can find plants tolerant to salt, as well as animals adapted to this adverse environment.
- Reed meadows: these are important feeding grounds for storks, birds of prey and many other bird species

- **Reed beds: Reed beds are ideal nesting grounds for a significant number of birds and a wide variety of species.**
- **Tambourine thickets, riparian forests: protected zones in forests provide ideal conditions under which many birds of prey can reproduce and find sufficient food.**

Within the National Park area, the specific Protected Areas that are defined and their boundaries follow the natural characteristics or artificial elements of the area. In these Protected Areas, only specific uses and activities are permitted, which are specified in Joint Ministerial Decision 44549/2008. During the Environmental Licensing Process of new or existing projects located within the National Park, consultation with the Nestos Delta Management Body Vistonida-Ismarida is required.

The following Table presents the Protected Areas in descending order of ecological importance with regard to their uses and activities within their boundaries.

Table 8–51: Zones of the National Park of Eastern Macedonia and Thrace

Zone	Uses / Activities
Zone A	Nature Conservation Area
Zone B	Protected Landscapes
Zone Γ	Eco-Development Area
Zone Δ	Regional Zone of National Park

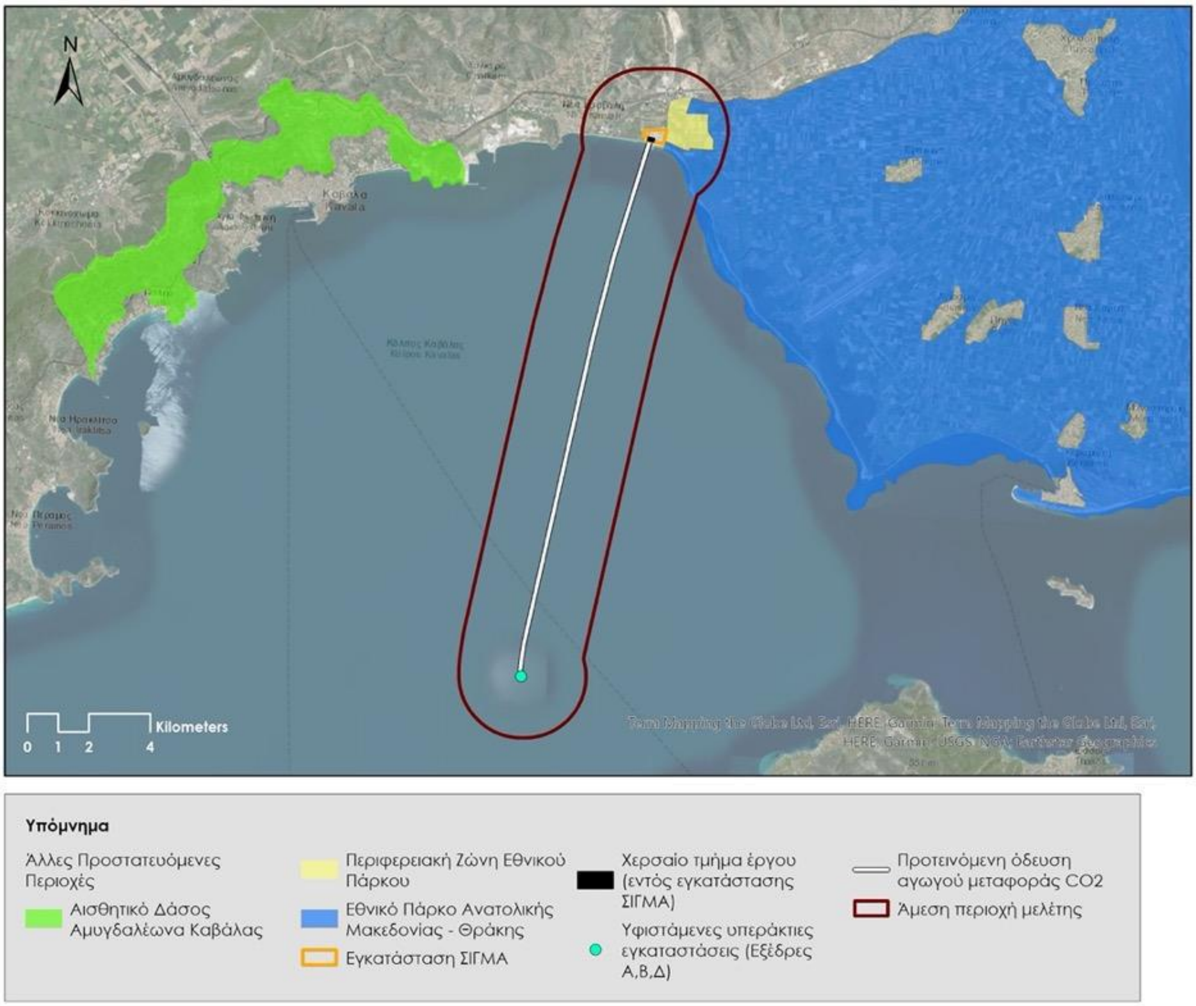


Figure 8–82: National Park of Eastern Macedonia and Thrace

As can be seen from the above Figure, within the study area of the Project is part of the National Park of Eastern Macedonia - Thrace as well as its Peripheral Zone.

8.9.1.3 Wildlife Sanctuaries

The establishment of the first permanent Game Reserves, within the administrative boundaries of the Forestry Department of Thassos, resulted in a permanent ban on hunting and was implemented through Ministerial Decision 38098/1976 (Government Gazette 744/B/4.6.1976). The Game Reserves were subsequently renamed Wildlife Reserves (WSRs), as they are known today, an amendment implemented by Article 57 of Law 2637/1998 (Government Gazette 200/A/08.27.1998).

The current Law 3937/2011 (Government Gazette 60/A/31.03.2011) defines the WZs (Wildlife Reserves) in paragraph 4.3 of Article 5 as "... natural areas (terrestrial, wetland or marine), which are of particular importance as important places for the growth of wild flora or as habitats for reproduction, feeding, wintering of wild fauna species, or as areas for fish reproduction and spawning, or, finally, as important marine habitats...". In addition, it provides that ecological corridors among other categories of protected areas can also be characterized as WZs.

In the areas of permanent refuges, it is prohibited: the hunting of any game and any species of wild fauna, as well as the capture of any species of wild fauna for non-research purposes.

The project study area does not include a designated LCA (paragraph 3 of Article 6 of Law 3937/2011). The LCAs that exist within the wider Project area are shown in the Figure below.

The Table below summarizes the closest KAZ in the study area as well as their distance from the Project's onshore facilities.

Table 8–52: Brief description of the Wildlife Refuges (WRF) and their distances from the project's land facilities

α/α	Wildlife Sanctuary	Code	Official Gazette	Distance from land facilities (km)
1	Kastene Dag Municipality of Orinou	K854	625/B/2001	4,8
2	Agios Timotheos - Koupia	K59	733/B/1976	7,6
3	Kotza Orman Nestou	K769	908/B/2001	16,3
4	Domuz Orman (Avdira)	K51	458/B/1985	28,3

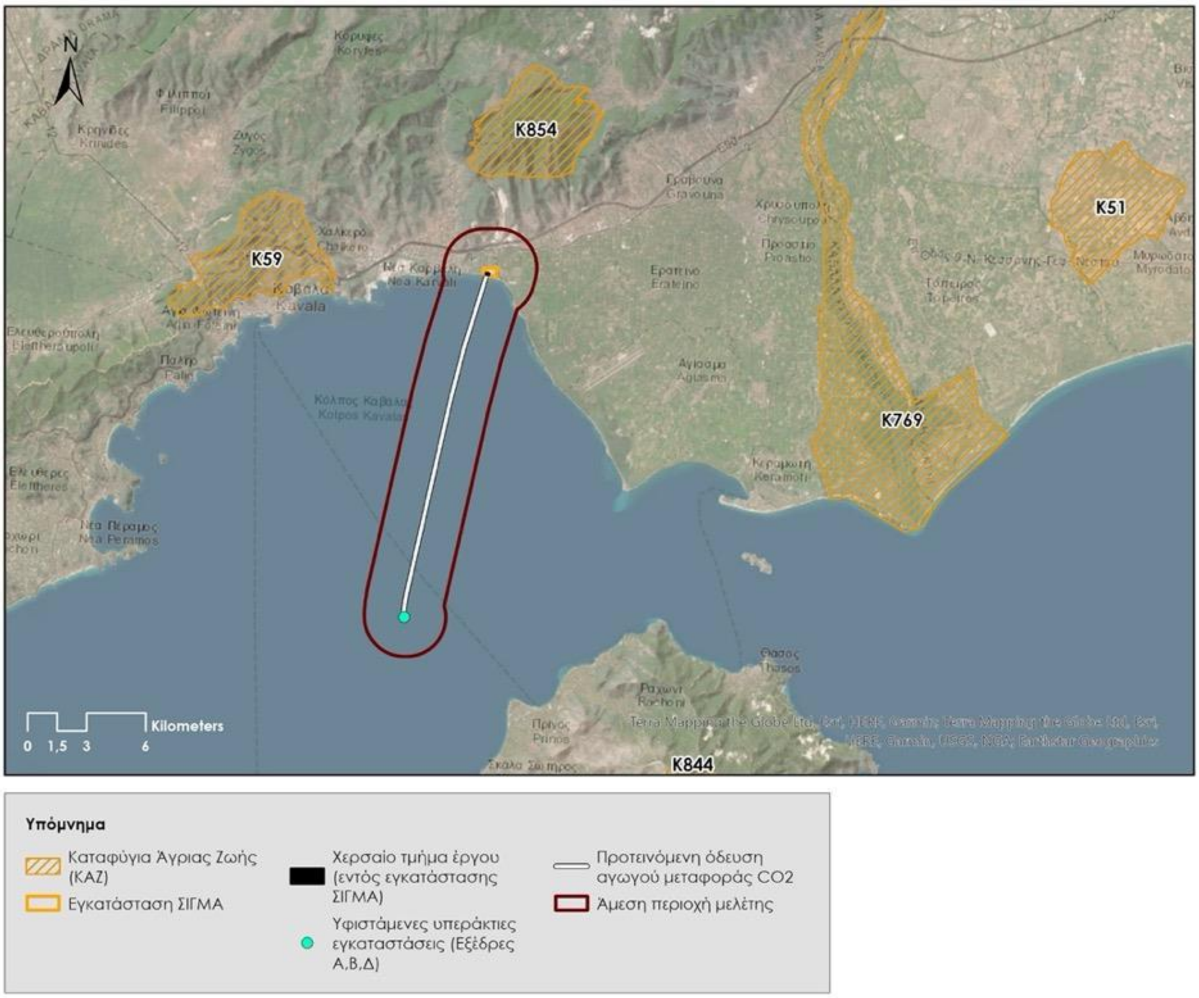


Figure 8-83: Wildlife Refuges within the wider Project area

8.9.1.4 Aesthetic Forests

Aesthetic Forests have been established under the forest legislation and include forest landscapes of particular aesthetic and ecological interest, which aim, in addition to protecting nature, to give the public the opportunity to get to know and enjoy the natural environment through various recreational activities. 19 areas of the country have been designated as Aesthetic Forests, occupying a total area of 32,506 ha.

In the wider study area, in the Kavala Regional Municipality, the "Amygdaleona Aesthetic Forest of Kavala" is located, with a total area of 2522.77ha, at an altitude of 473m, as shown in the following Figure.

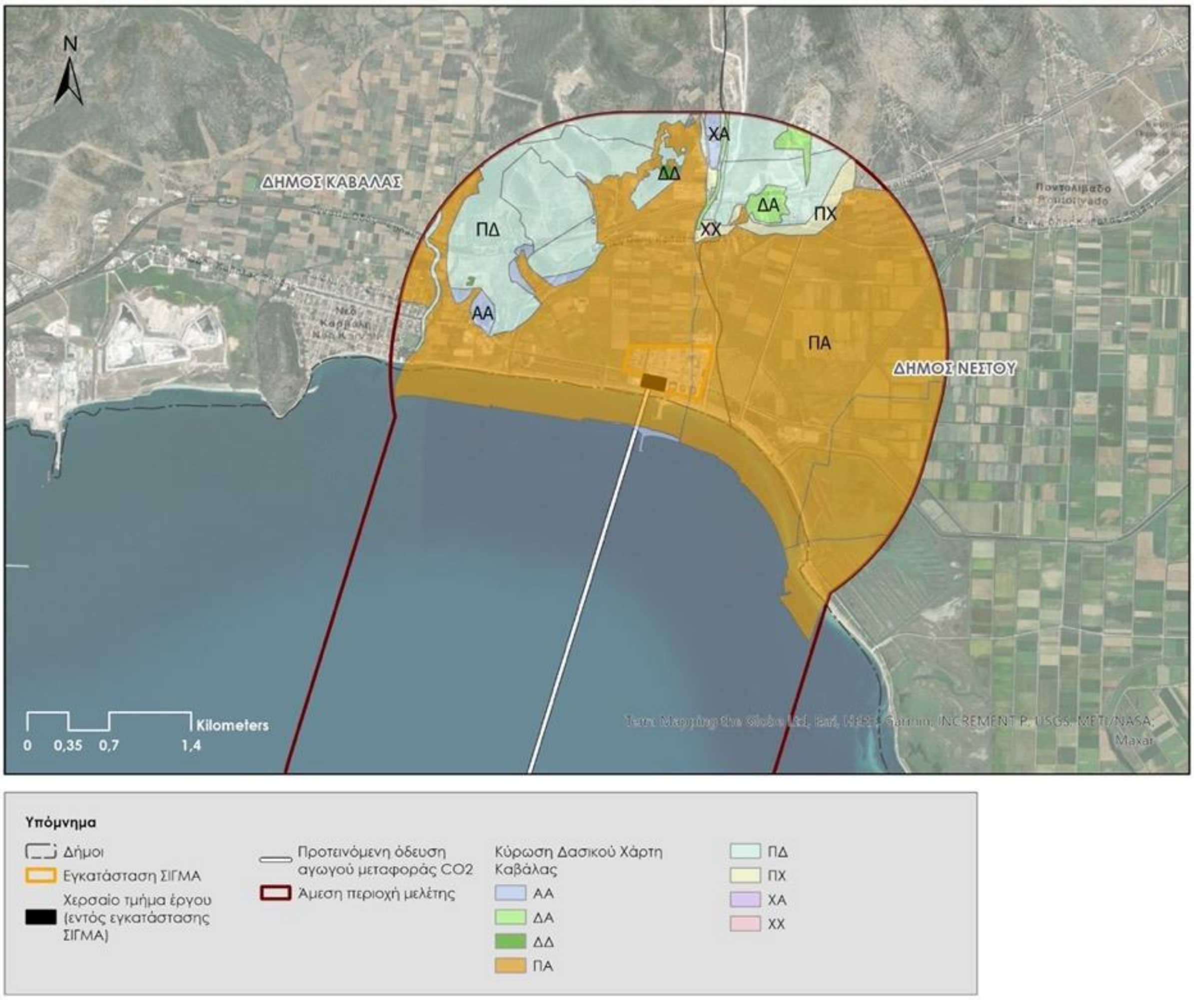
Figure 8–84: Aesthetic Forest of Amygdaleona, Kavala

This is an artificial forest with great recreational and social value for the residents of Kavala, given that the land area of the prefecture of Kavala does not have many forests and recreational areas except for Pangaio, the Nestos area and the coast. The proximity of the forest to a densely populated urban and industrial center is very important.

Until 1914, the forest consisted of scrublands, heathlands and bare rocky areas, while until 1980, an artificial forest of Scots pine and cypress was established in a large part of it (approximately 8,500 ha). In 1985, a large part of the forest was destroyed and has been replanted in the last 20 years, according to data from the NTUA "PHILOTIS" database.

8.9.2 Forests and Woodlands

With the decision no. 385085/31-10-2022 of the Secretary General of Forests of the Ministry of Environment and Energy (Government Gazette 777/Δ΄ /7-11-2022), the Forest Maps of the Regional Administrative Organizations of Kavala and Thassos were ratified. Based on the provisions of the above decision and according to posted data from the website of the Hellenic Cadastre, the following excerpt is obtained using the geospatial data of the Hellenic Cadastre, where the land facilities of the Project are depicted.



(Source: Ratification of the Kavala Forest Charter 2022)

Figure 8–85: Forested and non-forested areas within the wider area

The land facilities are located within areas with codes AA: Other form – coverage in older aerial photographs and PA: Final acts and characterization decisions – non-forest (as shown in the Figure above), which are not included in the restrictions of forest legislation.

The following Tables present the percentages and coverage of the immediate study area by forest, reforestation or other types of land.

Table 8–53: Percentage and area of forested areas within the immediate study area by category

Character code	Character description	Area in the immediate study area (km2)	Occupancy rate in the immediate study area (%)
ΠΑ	Final acts and designation decisions - Non-forest	9,495	74,01
ΠΧ	Final acts & designation decisions - Grasslands	0,207	1,61
ΧΧ	Grasslands in older aerial photographs / Grasslands in recently taken aerial photographs and in the autopsies or in the cadastral maps of Law 248/1976.	0,006	0,05

Character code	Character description	Area in the immediate study area (km2)	Occupancy rate in the immediate study area (%)
ΔΑ	Forests and forest lands in older aerial photographs or pre-existing data / Other forms of coverage in aerial photographs and in the autopsies or in the cadastral maps of Law 248/1976.	0,184	1,44
ΧΑ	Grassland areas in older aerial photographs / Other form - coverage in aerial photographs and in autopsies or in cadastral maps of Law 248/1976.	0,012	0,09
ΠΔ	Final acts and decisions of characterization - forest	2,703	21,07
ΑΑ	Other form - coverage in older aerial photographs / Other form - coverage in recently taken aerial photographs.	0,177	1,38
ΔΔ	Forests and forest areas in older aerial photographs or pre-existing data / Forests and forest areas in recently taken aerial photographs and in autopsies or in cadastral maps of Law 248/1976.	0,044	0,34

Table 8–54: Percentage and area of forested areas within the immediate study area overall

Character code	Character description	Area in the immediate study area (km2)	Occupancy rate in the immediate study area (%)
Forests and woodlands	ΑΔ, ΔΑ, ΔΔ, ΠΔ	2,9322	22,85
Other land forms	ΑΑ, ΠΑ	9,673363	75,39
Grassland areas	ΠΧ, ΧΑ, ΧΧ	0,225	1,75
Forests and afforested areas	ΑΝ-ΑΔ, ΔΑ-ΑΝ, ΔΔ-ΑΝ, ΠΔ-ΑΝ	0	0
Other land forms	ΑΑ-ΑΝ, ΠΑ-ΑΝ	0	0

8.9.3 Other Natural – Ecologically Sensitive Areas

8.9.3.1 Landscapes of Outstanding Natural Beauty (LNB)

Regarding Landscapes of Outstanding Natural Beauty (LNB), the following were examined in the context of this study:

- ☐ The Landscapes of Outstanding Natural Beauty, which resulted from the research program of the Ministry of Environment, Public Works and Public Works (1995) on the topic "Demarcation and Determination of Protection Measures for Landscapes of Outstanding Natural Beauty" and are listed in the "Database for Greek Nature – PHILOTIS" of the National Technical University of Athens. In this database, newer TIFKs have been added which had not been identified by the program "Demarcation and Determination of Protection Measures for LONBs" and
- ☐ The LONBs that resulted from Law 1465/1950, which supplements Law 5351/1932 "On Antiquities". These are areas that include a significant part of the natural environment with

remarkable aesthetic value, which requires protection and preservation of natural and cultural resources and where various restrictions and prohibitions are imposed on anthropogenic activities, including the control and limitation of construction, the establishment of special morphological elements in buildings and various structures, etc. The responsibility for Landscapes of Outstanding Natural Beauty (LNA) was transferred from the Ministry of Culture to the Environmental Planning Directorate of the Ministry of Environment, Public Works and Public Works (now Ministry of Environment and Public Works), based on Presidential Decree 161/1984 (Government Gazette 54 A').

In the wider study area of the Project under consideration, the Landscapes of Outstanding Natural Beauty are identified, which are presented in the following Table. The TIFK that is closest to the immediate area of the Project is highlighted in blue font.

Table 8–55: LONB in the Municipalities of Kavala and Thassos

Code LONB	Name LONB	Municipality	Area (ha)
AT4011109	Aesthetic Forest of Amygdaleona, Kavala	Kavala	2522.77
AT4011047	Agios Ioannis, Kavala	Kavala	22.59
AT4011049	Neighborhood (Hersonissos) of Panagia Kavala	Kavala	33.55
AT4011113	Nea Peramos	Kavala	369.74
AT5011001	Ancient Thassos	Thassos	137.57
AT5011002	Panagia or Anastasion of Thassos	Thassos	383.27
AT5011028	Kinyra of Thassos	Thassos	1609.24

Source: Database on Greek Nature – PHILOTIS)

Source: Filotis Base, NTUA)

Figure 8–86: Landscapes of Outstanding Natural Beauty near the Project area

<u>The closest Landscape of Outstanding Natural Beauty (LNB) to the Project's land facilities is the non-institutional LNB named "Amygdaleona Aesthetic Forest of Kavala" and code AT4011109, approximately 5.6km west of them.</u>

8.9.3.2 Natural Monuments

Natural Monuments include individual trees or groups of trees with particular botanical, ecological, aesthetic, historical, or cultural value. This category also encompasses areas of significant ecological, paleontological, geomorphological, or other interest. Their establishment is implemented according to the Forest Code. A total of 69 Natural Monuments have been declared in Greece. Most of these monuments occupy very small areas

According to Law 3937/2011 (Government Gazette 60/A/31.03.2011), Natural Monuments are included in the category of "Protected Landscapes and Protected Natural Formations" within the National System of Protected Areas

Natural Monuments are located both outside and at considerable distance from the project study area. The closest to the studied activity is situated in the Xanthi Prefecture (the Beech Forest in Tsichla Chaïntou, Xanthi).

8.9.3.3 Ramsar Wetlands

The Convention on Wetlands of International Importance, especially as Waterfowl Habitat, also known as the "Ramsar Convention" – named after the Persian city where it was signed in 1971 – provides for the protection of wetland ecosystems.

According to Article 1 of the Convention, wetlands are defined as:"…natural or artificial areas consisting of marshes with herbaceous vegetation, non-exclusively rain-fed marshes with peat substrate, peatlands, or water. These areas are permanently or temporarily flooded with water, which may be stagnant or flowing, fresh, brackish, or saline, and also include areas covered by seawater with a depth at low tide not exceeding six meters. Wetlands may also include riparian or coastal zones adjacent to wetlands, islands, or marine water bodies, which are deeper than six meters at low tide…".

Each Contracting Party to the Convention must designate at least one wetland of international importance. According to the most recent survey, the 158 countries that have ratified the Convention have designated 1,828 wetlands of international importance.

The Convention was ratified by Greece through Legislative Decree 191/1974 (Government Gazette 350/A/11.20.1974), which was later amended by Law 1751/1988 (Government Gazette 26/A/02.09.1988) and Law 1950/1991 (Government Gazette 84/A/05.31.1991) "On the Ratification of Amendments to the Ramsar Convention." The Greek wetlands designated as wetlands of international importance (Ramsar Wetlands) since August 21, 1975, number 10 and cover an area of 1,635,010 square meters. It should be noted that, by signing and ratifying the Ramsar Convention, Greece has undertaken to conserve and properly manage all of its wetlands through local, regional, and international activities and collaborations.

The Montreux Record is a subset of the Ramsar Wetlands List, established during the 4th Conference of the Contracting Parties, held from 27 June to 4 July 1990 (Recommendation 4.8, Ramsar Convention). Its purpose was to record all Ramsar wetlands at risk of changes in their ecological character, thereby obligating the Contracting Parties to take urgent measures to prevent or reverse such changes.

When the Montreux Record was initially created, all 10 Greek wetlands were included. However, in 1999, three were removed—the Small Prespa Lake, Lake Kerkini, and the Evros Delta. Today, 7 of the 10 Greek wetlands remain on the Montreux Record.

<u>In the immediate area of the project, within the boundaries of the Municipality of Nestos, there is one (1) Ramsar Wetland, which is also included in the Montreux Record.</u>

<u>This wetland (see Figure) is named "Nestos Delta and Adjacent Lagoons," with a total area of 21,930 ha, and it was designated under the Ramsar Convention in 1975.</u>

(Source: Oikoskopio WWF, http://www.oikoskopio.gr/map/ , 10-6-2024)

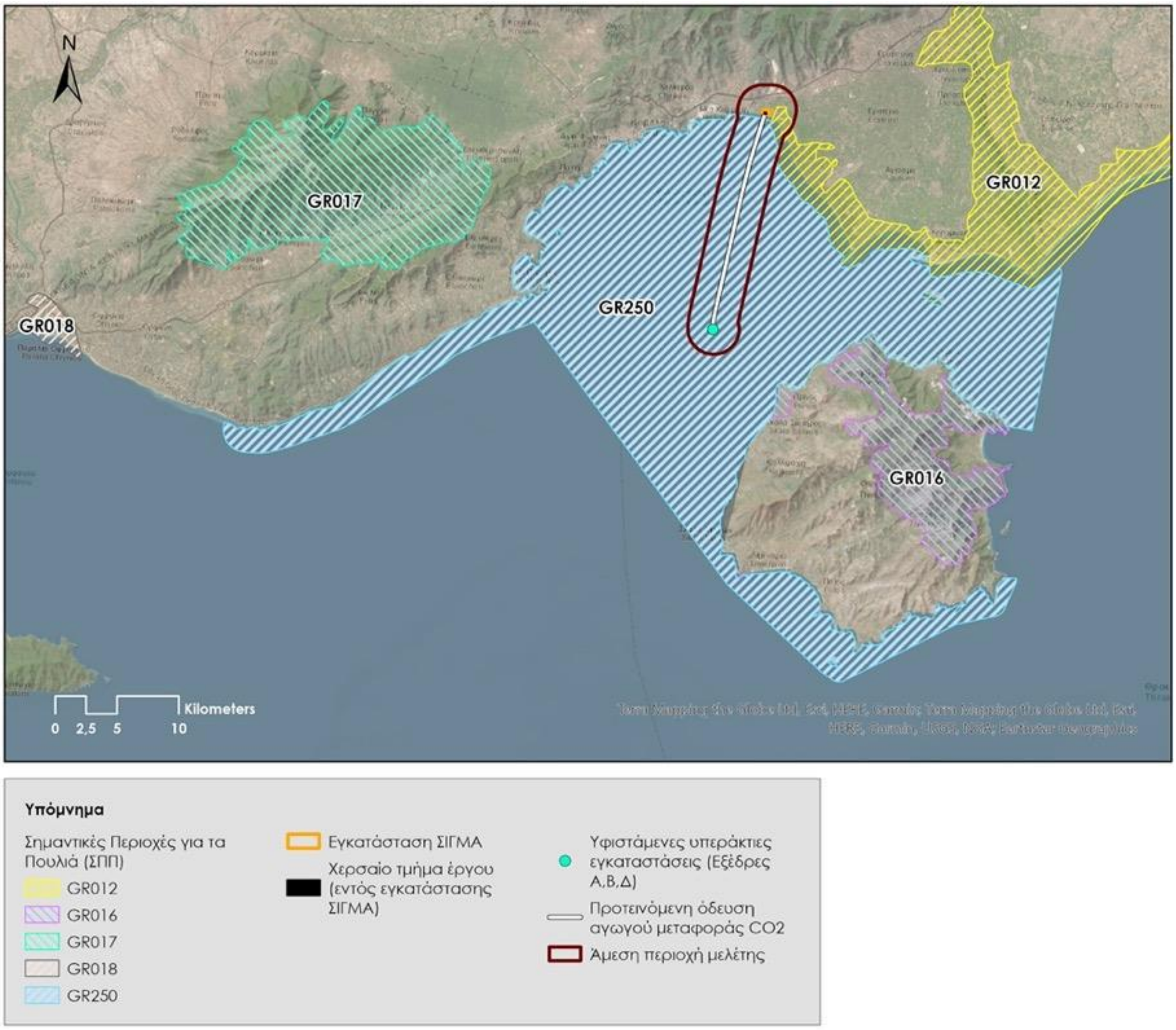
Figure 8–87: Ramsar Site "Nestos Delta and Adjacent Coastal Lagoons" in Relation to the Project Facilities

8.9.4 Other Protected Areas

8.9.4.1 Important Bird Areas (IBAs)

Important Bird Areas (IBAs) have been identified and delineated by BirdLife International. The general objective of BirdLife International is to update IBA data through its partners every four years. A specific objective is to record bird species (for the IBA sites) using standardized field protocols, which include reporting threats that may affect the birds or their habitats, conservation actions taking place in the area, and the bird species observed.

As shown in the figure below, the marine area of the project is included in the Important Bird Area (IBA) with code GR250, named "Gulf of Kavala and Marine Area of Thasos," while within the study area lies the site GR012, named "Nestos Delta and Coastal Lagoons." In the broader area, the site with code GR016, named "Thasos Island and Xironisi," is also located.



(Source: Hellenic Ornithological Society (HOS))

Figure 8–88: Important Bird and Biodiversity Areas (IBAs)

Gulf of Kavala and Marine Area of Thasos – GR250

According to the report “Important Areas for Seabirds in Greece,” LIFE07 NAT/GR/000285 – Hellenic Ornithological Society (HOS/BirdLife Greece, 2012), the species meeting the criteria for SPA GR250 “Gulf of Kavala and Marine Area of Thasos” include *Phalacrocorax aristotelis* and *Puffinus yelkouan*. This marine SPA encompasses the entire Gulf of Kavala, the Thasos Strait, the coastal waters along the southern part of Thasos Island, and along the mainland up to Drakopetra in the west.

This SPA has been designated due to its importance for the European Shag (*Phalacrocorax aristotelis desmarestii*) and the Yelkouan Shearwater (*Puffinus yelkouan*). Specifically, the area includes the foraging and maintenance marine zones for the largest breeding population of Shags in Greece, which breed within the Natura 2000 SPA GR1150001 “Nestos Delta and Keramoti Lagoons and Thasopoula Island” and the Natura SPA GR1150012 “Thasos (Ypsario Mountain and Coastal Zone),” representing approximately 10% of the national breeding population of the species.

Thasos Island and Xironisi – GR016

The area includes Mount Ypsari, featuring steep rocky slopes, extensive grasslands, maquis shrublands, forests of Turkish Pine (*Pinus brutia*), Black Pine (*Pinus nigra*), and deciduous broadleaf trees. The area also encompasses the islets surrounding Thasos as well as the densely vegetated Xironisi islet, located southwest of Kavala, characterized by vertical rocky cliffs. In the northwest of the island, at Prinos Bay, there is a coastal wetland with reed beds (*Phragmites* spp.), and near the settlement of Maries, there is another wetland with stagnant freshwater. The coastal and surrounding marine zone is highly important for seabirds, both as a breeding area and a feeding ground.

Since 1985, wildfires have burned approximately 60% of the island, yet the area still retains a significant proportion of forest cover. Extensive olive groves, large marble quarries, and intensive livestock farming (mainly sheep and goats) are the main land uses, while tourism has been developing in recent years.

Marble quarrying has destroyed parts of the area and continues to expand, while the disturbance caused by this activity affects a large portion of it. Intensive fishing with trawlers (reducing fish stocks, disturbance during breeding) and entanglement (in nets and longlines) threaten the species *Puffinus yelkouan* and *Phalacrocorax aristotelis*. Other threats include poaching, overgrazing, forest fires, and uncontrolled landfills, which lead to an increase in the population of *Larus michahellis*, which in turn predate on seabird chicks and eggs. Residential development seriously affects the coastal wetland at Prinos, while tourism development and recreational activities impact the coastal zones of the area and the islet of Panagia. In recent years, seabird colonies have been disturbed by recreational fishermen, which negatively affects their breeding process.

Nestos Delta and Coastal Lagoons – GR012

This wetland is of great importance for waterbird species. It constitutes a complex of wetlands, with the most significant element being the southern section of the Nestos River, 29 km in length, including its estuary and riparian forest. West of the estuary, there are six lagoons (Vassova, Erateinou, Agiasma, Kokkala-Pigon, Keramoti, Monastiraki), extensive sandy beaches, salt marshes, and freshwater marshes. On the eastern side, salt marshes and extensive freshwater wetlands (permanent or seasonal) dominate. The area also includes the lakes of Chrysoupoli, which consist of 18 small freshwater lakes (remnants of old Nestos River channels), as well as Thasopoula Island. The 'Kotsa Orman' forest, covering approximately 450 hectares, is one of the largest hydrophilous forests in Greece. The main human activities in the area include agriculture, livestock farming, fishing, and tourism.

8.9.4.2 Critical Habitats for Cetaceans According to the International ACCOBAMS Convention

The Agreement on the Conservation of Cetaceans in the Black Sea, the Mediterranean Sea, and Contiguous Atlantic Area (ACCOBAMS) aims at the regional conservation of cetaceans. Under this intergovernmental agreement, the member countries commit to protect all cetacean species and their habitats within the Agreement's area of application.

In this context, ACCOBAMS members and its Scientific Committee have identified Critical Habitats for Cetaceans (CCHs). These are areas essential for the survival and maintenance of healthy cetacean populations. They include marine habitats important for feeding, reproduction, and nurturing of calves, as well as areas significant for migration.

In Greek waters, a total of **8 Critical Habitats for Cetaceans** have been identified (Figure 8-20):

- Kalamos
- Eastern Ionian Sea and Gulf of Corinth
- Saronic Gulf and Southern Euboean Gulf
- Marine area of the Northern Sporades
- Northern Aegean Sea
- Marine area of the Dodecanese
- Ambracian Gulf
- Southwest Crete and Hellenic Trench

ACCOBAMS emerged from consultations among four conventions:

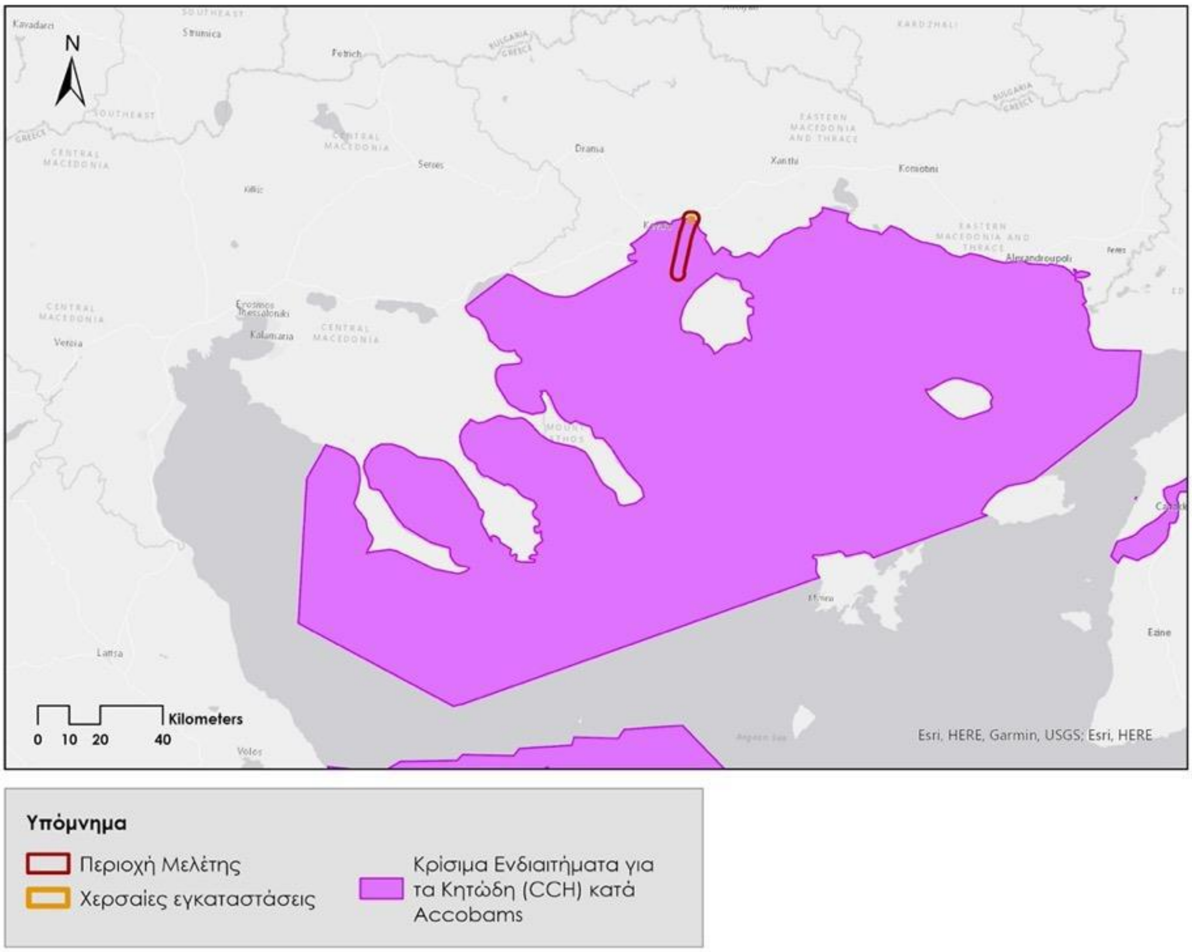
- The Barcelona Convention for the protection of the Mediterranean Sea and its coastal areas, and its Protocol concerning specially protected areas and biodiversity in the Mediterranean,
- The Bonn Convention on the conservation of migratory species of wild animals,
- The Bern Convention on the conservation of European wildlife and natural habitats,

Due to the migratory nature of these species, the agreement was established under the auspices of the Bonn Convention (UNEP/CMS).

The agreement area consists of all the waters of the Black Sea, the Mediterranean Sea, and the adjacent Atlantic area west of the Strait of Gibraltar. The area includes the Pelagos Sanctuary, dedicated to marine mammals in the northwestern Mediterranean, which was established by France, Italy, and Monaco. ACCOBAMS is the first agreement that obliges the countries of these regions to cooperate for the conservation of cetaceans. An innovative aspect of this agreement is the inclusion of non-coastal countries, whose maritime activities may pose risks to cetacean conservation.

In 2010, the ACCOBAMS Parties adopted a resolution to extend the geographic scope of the agreement area to include the exclusive economic zones of Spain and Portugal. As of 2022, the agreement has 24 Parties: Albania, Algeria, Bulgaria, Croatia, Cyprus, Egypt, France, Georgia, Greece, Italy, Lebanon, Libya, Malta, Monaco, Montenegro, Morocco, Portugal, Romania, Slovenia, Spain, Syria, Tunisia, Turkey, and Ukraine.

Overall, the study area falls within the boundaries of ACCOBAMS Zone 9 in the Northeastern Mediterranean (Thracian Sea), as shown in the following **figure.**



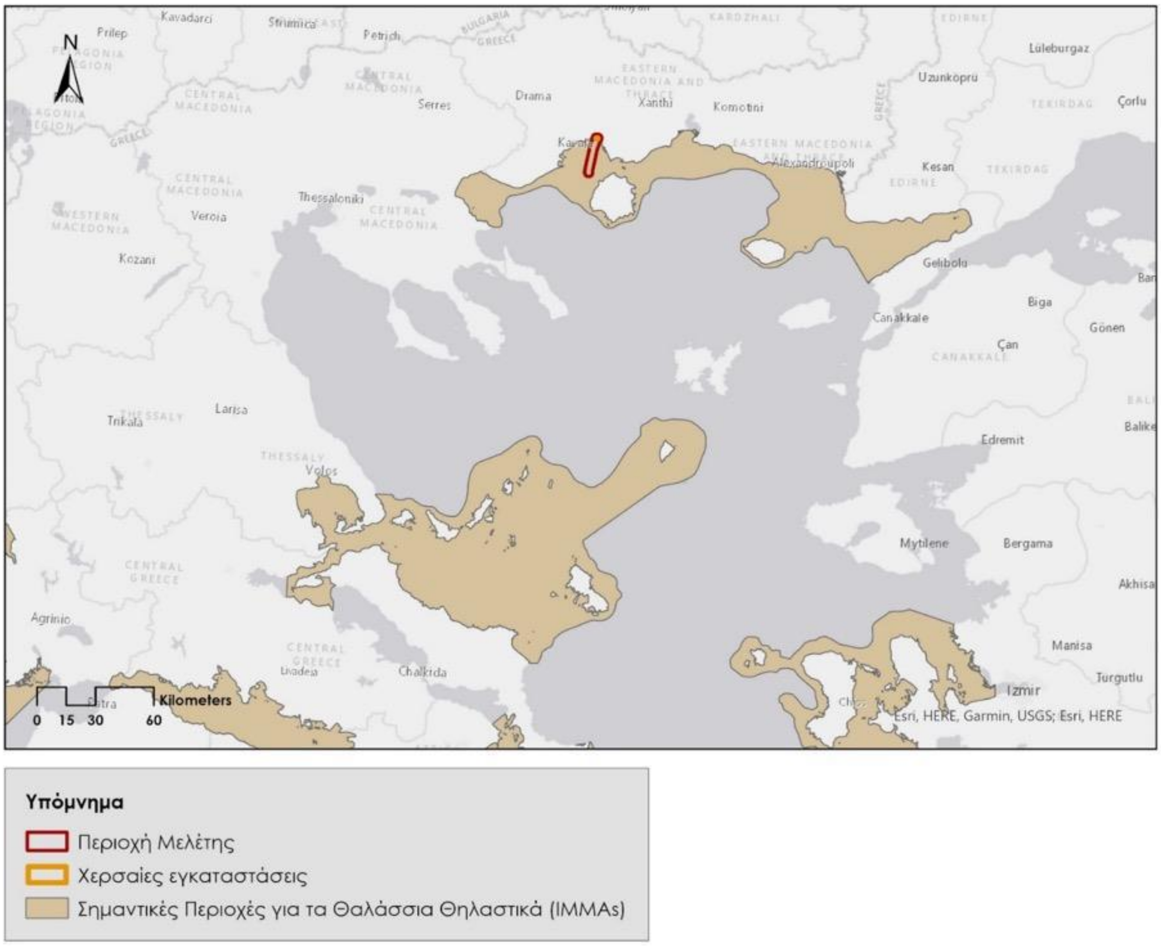
(Source: Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area, https://accobams.org/)

Figure 8–89: Critical Habitats for Cetaceans in the Northeastern Mediterranean according to the ACCOBAMS Agreement

The indicator species of the study area in the Northern Aegean, located within ACCOBAMS Zone 9, are marine mammals. The dolphins present include **Tursiops truncatus** (bottlenose dolphin), **Delphinus delphis** (common dolphin), and **Stenella coeruleoalba** (striped dolphin). Additionally, the **Monachus monachus** (Mediterranean monk seal) occurs, and various whale species, such as **Balaenoptera physalus** (fin whale), appear occasionally. The presence of these species highlights the ecological significance of the area and underscores the need for ongoing protection and conservation efforts under international agreements such as ACCOBAMS.

8.9.4.3 Important Marine Mammal Areas-IMMAs

Important Marine Mammal Areas (IMMAs) are defined as discrete habitat areas that are significant for marine mammal species and can be delineated and managed for their protection and conservation. IMMAs consist of areas that are important at a local level for protection and/or monitoring. The term “Important” in the context of IMMA classification refers to any perceived value associated with the marine mammals within the IMMA, aimed at improving the conservation status of these species or populations. IMMA identification is carried out by experts through a systematic process, which is independent of any political or socio-economic conditions, and is intended to contribute to existing national and international marine mammal conservation tools in relation to marine protected areas, including Ecologically or Biologically Significant Areas (EBSAs) and Key Biodiversity Areas (KBAs).



(Source: Important Marine Mammal Areas, https://www.marinemammalhabitat.org/immas/)

Figure 8–90: Important Marine Mammal Areas (IMMAs) identified in the study area of the northern coast of the islands of the Thracian Sea

<u>As shown in the figure above, the study area falls within the Important Marine Mammal Area named “Northern Coast and Islands of the Thracian Sea,” covering a total area of 5,441 km².</u>

Within these waters, four species of marine mammals have been identified along the northern coast and around the islands of the Thracian Sea:

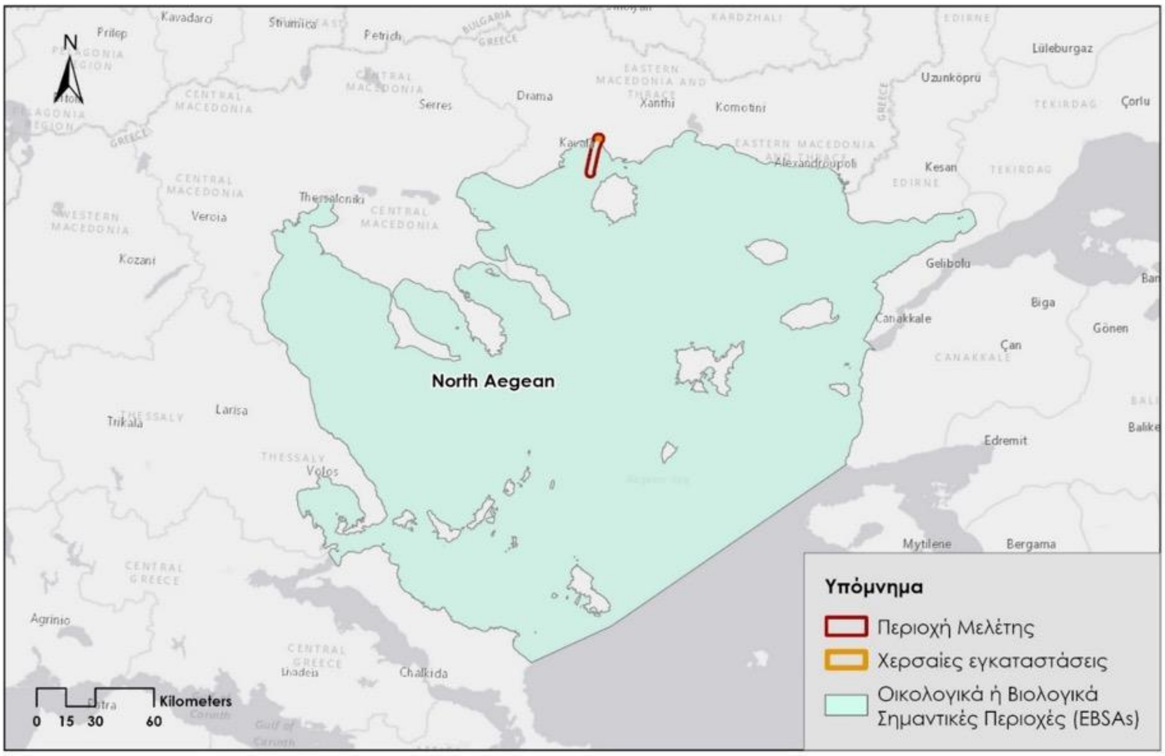
- Monachus Monachus (Mediterranean monk seal)
- Tursiops *truncatus* (bottlenose dolphin)
- Delphinus *delphis* (common dolphin)
- Stenella coeruleoalba (striped dolphin)

The presence of these species highlights the ecological importance of the area and emphasizes the need for ongoing protection and conservation efforts under international frameworks such as the IMMAs (Northern Coast and Islands of the Thracian Sea Important Marine Mammal Area – IMMA, 2014).

8.9.4.4 Ecologically or Biologically Significant Areas-EBSAs

Ecologically or Biologically Significant Areas (EBSAs) are pelagic regions important for their ecological and biological characteristics, such as the provision of food, critical habitats, and breeding grounds. These areas were identified in 2008 through a process under the United Nations Convention on Biological Diversity, applying specific scientific criteria. The region is particularly productive due to the inflow of waters from large rivers, upwellings, and nutrient-rich waters from the Black Sea. It includes some of the most important fishing grounds in the Aegean Sea. The area hosts rare species of cetaceans and corals, as well as one of the largest marine parks in the Mediterranean, which supports a significant population of Mediterranean monk seals.

The Northern Aegean region (see Figure) has been recognized as one of the three Ecologically or Biologically Significant Areas (EBSAs) in Greece and is included in the MID 17 EBSA zone according to geospatial data.



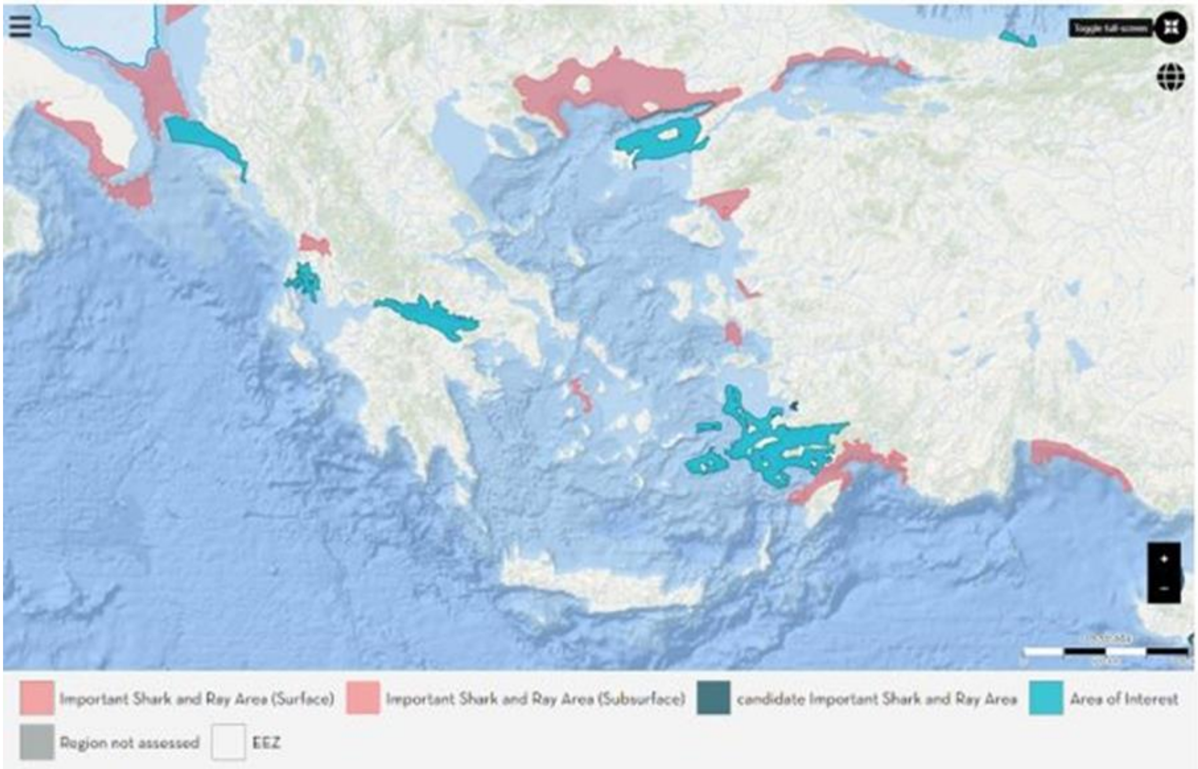
(Source: Important Marine Mammal Areas, https://www.marinemammalhabitat.org/immas/)

Figure 8–91: Ecologically or Biologically Significant Areas (EBSAs) Identified in the Northern Aegean Study Area

8.9.4.5 Important Shark and Rays Areas - ISRAs

In May 2023, the first meeting was held among experts from around the world with the aim of delineating critical habitats for sharks, rays, and chimaeras throughout the Mediterranean and Black Sea (ISRAs). ISRAs are defined by the IUCN Shark Specialist Group (SSC Shark Specialist Group) as “discrete, three-dimensional habitat and ecosystem sections that are important for one or more shark species and are manageable for their conservation.” Although they do not constitute protected areas, their delineation will allow policymakers to take into account the use of habitats by sharks, rays, and chimaeras when developing and implementing management measures. Beyond the total of 85 candidate ISRAs that were identified, 17 areas were designated as Areas of Interest (AoI), as the scientific evidence is insufficient; however, these areas are likely to be important for multiple species. The delineation of ISRAs relies on the best available scientific information to identify areas that are most critical for the long-term survival of sharks, rays, and chimaeras globally. These areas include sites where the species mate, reproduce, feed, rest, aggregate, or make stopovers during migration. The workshop also encouraged further collaboration among regional experts to develop research projects and build knowledge regarding critical habitats and ecosystems in these areas.

The continental shelf of the Thracian Sea is located in the northernmost part of the Aegean Sea. It is characterized by a diverse coastal and shelf morphology that includes several gulfs and two islands (Thasos and Samothrace). It features an extensive continental shelf, primarily covered by seagrass meadows and sandy–muddy substrates. Nutrient-rich rivers and waters from the Black Sea support the high biological productivity of the area. The region coincides with an Ecologically or Biologically Significant Marine Area, 12 key biodiversity areas, 10 Natura 2000 sites, five Ramsar sites, and two national parks. Within this area, there are threatened species (e.g., *Aetomylaeus bovinus*), species with limited distribution (e.g., *Raja radula*), reproductive areas (e.g., *Scyliorhinus canicula*), and unquantified aggregations (e.g., *Dasyatis pastinaca*).



(Source: https://isea.com.gr/delineation-of-isras)

Figure 8–92: Important Areas for Sharks and Rays (ISRAs) in the Study Area

8.10 ANTHROPOGENIC ENVIRONMENT

8.10.1 Spatial Planning and Land Use

8.10.1.1 Wider Area

The existing facilities and the total area of the proposed Project are located in the Gulf of Kavala, approximately 8 km west of Thasos and 18 km south of the Kavala coastline. The Gulf of Kavala is situated in the Northeastern Aegean and forms part of the Thracian Sea.

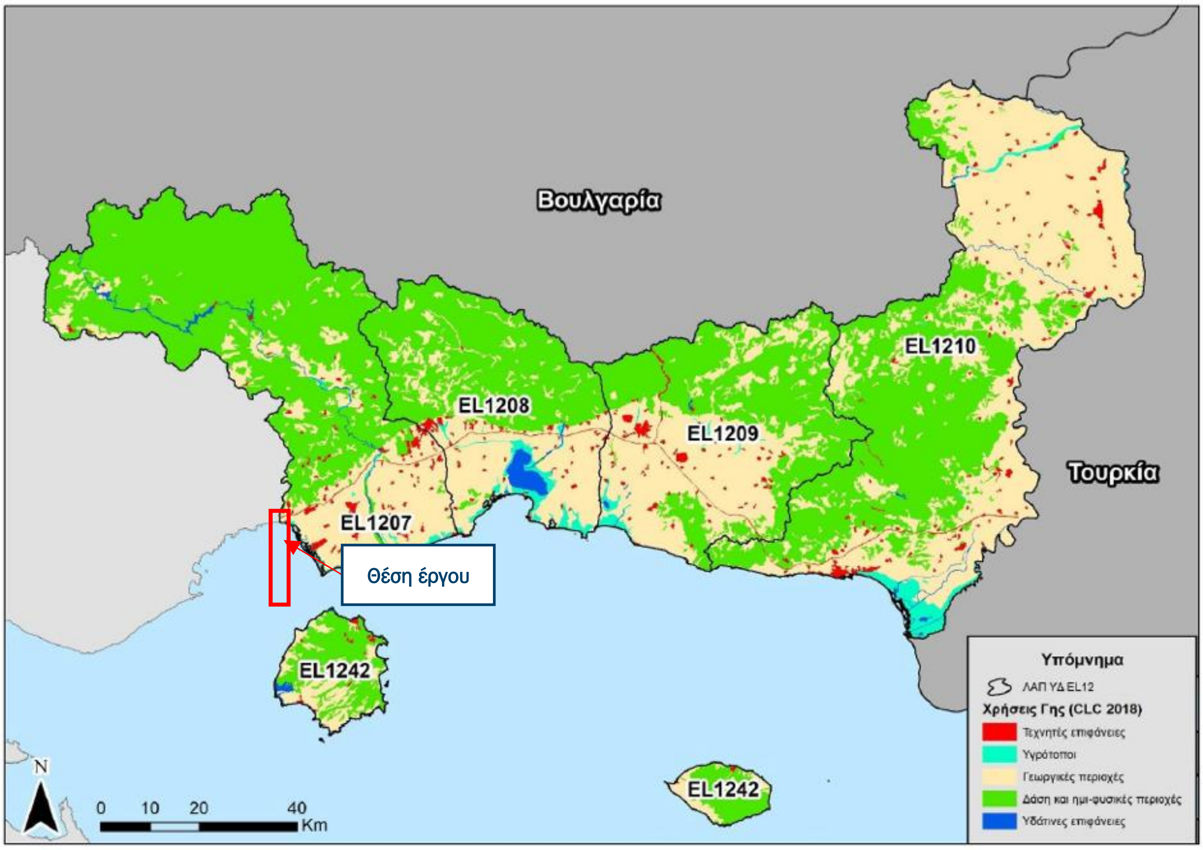
Kavala is the most developed urban center of Eastern Macedonia and Thrace. It is located at the very edge of the road axis between Thessaloniki and the Turkish borders, while its geostrategic position is further enhanced by the second largest commercial gateway of the Egnatia Odos, situated east of the city. Kavala has a large port and an equally significant marina in the city center, which, together with the port of Nea Peramos and the marina of Nea Iraklitsa, among others, make it one of the most important fishing centers in Greece. The city hosts one of the largest fish markets in the Mediterranean, where products are distributed to domestic and international markets. The development of the fishing industry necessitated the establishment of the Fisheries Research Institute in Kavala, which is one of only three such institutes operating in Greece.

As a commercial and industrial center, Kavala ranks second in Northern Greece, after Thessaloniki. In addition to tobacco industries, tobacco warehouses and food and salted food processing factories, the city also hosts rice mills, while tobacco from Macedonia and Thrace is exported through its port.

The onshore facilities of the Project fall within the Kavala Municipal Unit of the Municipality of Kavala, bordering the Municipality of Nestos, as shown in the figure below.

According to the revised Regional Spatial Planning Framework of the Region of Eastern Macedonia and Thrace (Government Gazette ΦΕΚ/ΑΑΠ/248/25-10-2018), the majority of land in the Region of Eastern Macedonia and Thrace is occupied by agricultural and arable land, as the primary sector remains highly significant for the region, employing a substantial portion of its population, as illustrated in the figure below.

Specifically, the coastal area from the estuaries of the Nestos River up to the limits of Nea Karvali consists largely of lagoons and marshlands.



(Source: SEA of the 2nd Revision of the River Basin Management Plan – WD EL12)

Figure 8–93: Land Uses of the Thrace Water District EL12

As observed in the figure above and in the table below, the majority of the area is covered by forests and agricultural land. Among the remaining land uses, artificial surfaces occupy a small portion, while wetlands and water bodies account for a very minor fraction.

Table 8–56: Land Use Distribution in the Thrace River Basin District (EL12), by WD

WD	Agricultural areas	Forests and semi-natural areas	Artificial surfaces	Wetlands	Water bodies
EL1207	25,1%	70,5%	1,9%	1,4%	1,0%
EL1208	34,4%	51,9%	2,4%	6,7%	4,6%
EL1209	44,2%	52,2%	2,1%	0,9%	0,6%
EL1210	62,3%	31,4%	2,1%	3,1%	1,0%
EL1242	33,7%	64,6%	1,7%	0,1%	0,0%
ΥΔ12	**42,8%**	**51,7%**	**2,1%**	**2,2%**	**1,2%**

Source: SEA of the 2nd Revision of the River Basin Management Plan – WD EL12

According to data from the Hellenic Statistical Authority (ELSTAT, 2011), the distribution of the area of Greece and the Kavala Regional Unit is presented in the following table. The distribution refers to the following land use/cover categories: (a) agricultural areas, (b) forests and semi-natural areas, (c) covered areas, and (d) artificial areas. It should be noted that, at the present time, corresponding data for the current year are not available from ELSTAT.

Table 8-57: Distribution of Areas by Major Land Use/Cover Categories

Total area (thousand stremmas)	Agricultural areas						Forests Semi-natural areas				Covered areas				Artificial areas			
	Arable land	Permanent crops	Pastures / Transitional forested or shrubland areas	Pastures / Areas with combinations of shrub and/or herbaceous vegetation	Pastures – Areas with sparse or no vegetation	Heterogeneous agricultural areas	Forests	Transitional forest-shrubland areas	Combinations of shrub and/or herbaceous vegetation	Areas with sparse or no vegetation	Inland waters	Inland wetlands	Coastal wetlands	Urban development / Built-up urban areas	Industrial and commercial areas	Transport networks	Mines, waste disposal sites, and construction sites	Artificial non-agricultural green areas, sports and cultural facilities
Greece	131.982	21.181	7.491,8	880,0	9.152	4.421	22.011	22.412	11.607	23.950	4.510	1.197	108,2	485	1.913	212,6	156,3	270,5
EMT	4.389	148,7	412,6	476,1	50,0	794,6	4.151,2	1.535,1	1.273,7	409,5	129,8	0,7	219,7	151,8	26,1	1,8	9,1	0,4
Kavala Perfecture	503,5	74,0	54,5	132,3	1,3	148,2	507,5	203	326,8	80,6	8,2	0,6	36,5	29,6	3,3	0,6	6,1	0,0

(Source: ELSTAT, 2011)

In the broader onshore area of the Project, the following have been designated:

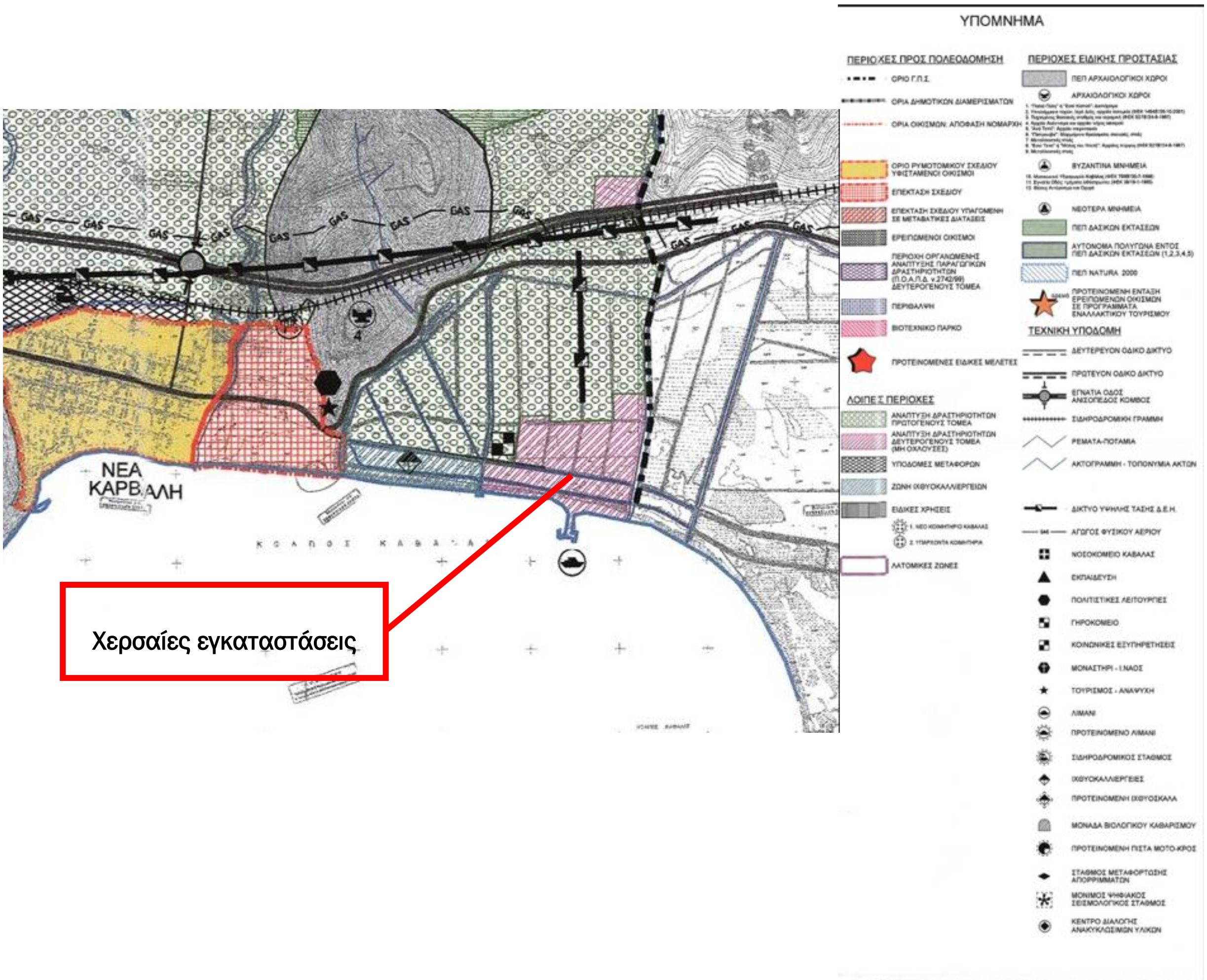
- The General Urban Plan (GUP) of the Municipality of Kavala (decision no. 5248π.ε./04-02-2013), published in Government Gazette 69/ΑΑΠ/11-03-2013.
- For Nea Karvali in the Prefecture of Kavala, a Local Urban Layout Plan has been approved, published in Government Gazette 487/Δ/1989-08-07, titled *"Approval of Local Urban Layout Plan in the Community of Nea Karvali, Prefecture of Kavala, for the designation of a site for the construction of a regional market."*.
- Residential Control Zone (ZOE) in areas outside formal town plans and outside settlement limits of communities established before 1923, covering the Municipality of Kavala (Prefecture of Kavala) and the communities of Amissia, Amygdaleonas, Nea Karvali, Chalkero, and Kokkinoxoma, according to Presidential Decree 14-06-1989 (Government Gazette 437-Δ-1989), as amended by Government Gazette 326/Δ/1995.
- The General Urban Plan (GUP) of the settlement of Chrysoupoli, published in Government Gazette 814/Δ/26-08-1987.

It should also be noted that the tender for the **Local Spatial Plan (LSP) of the Municipality of Kavala**, under Law 4447/2016 *"Spatial Planning – Sustainable Development and Other Provisions"*, which includes the municipal unit of Filippoi, is currently under evaluation.

The **General Urban Plan (GUP) of Kavala** aims to establish guiding principles for urban planning to achieve sustainable residential development. Specifically, it seeks to:

1. Gradually highlight and organize the spatial structure,
2. Ensure the residential organization of settlements with the desired balance of urban parameters, protect the environment, and curb unregulated construction by establishing development criteria that promote the most efficient use of settlement expansions,
3. Upgrade the environment, particularly in degraded areas, by providing the necessary social infrastructure, technical facilities, and controlling land uses according to urban planning standards and suitability criteria and
4. Protect, enhance, and environmentally upgrade the centers, cultural hubs, and traditional cores of settlements, as well as green spaces and other elements of the natural, archaeological, historical, and cultural environment of cities, settlements, and surrounding areas.

The main land uses in proximity to and within the Project's onshore facilities, according to the Land Use Map of the GUP, are presented in the following **figure**.



(Source: Land Use Map, General Urban Plan of the Municipality of Kavala (Government Gazette 69/ΑΑΠ/11-03-2013))

Figure 8–94: Designated Land Uses near the Project's Onshore Facilities

The onshore SIGMA facilities of the Project are located within the Zoning Regulation Area (ZOE) of the Municipality of Kavala, as established by Government Gazette 437-Δ-1989, as also shown in the following figure.

Source: Map P11-A of the Zoning Plan of the Municipality of Kavala (Government Gazette 437-D-1989)

Figure 8–95: Areas of the Zoning Plan (ZOE) of the Municipality of Kavala within the study area

As observed in the figure above, the onshore facilities of the Project fall within Zone 1d of the Land Use Zoning Plan (ZOE) of the Municipality of Kavala, designated for "existing nuisance-causing uses."

8.10.1.2 Immediate Study Area

Corine Land Cover (CLC 2018)

In the broader area of the project, the vast majority of residential areas and areas of secondary and tertiary sector production (industrial and commercial zones) are concentrated in the coastal zone, which is most often located along the main road and the Drama–Kavala–Xanthi development axis.

The same applies to the main transportation facilities, as well as to arable agricultural land, permanent crops, and pastures. The proportion of irrigated land is higher than that of arable land, which is related to the irrigation channels coming from the Nestos River to the Kavala plain, also located within the eastern wetland of the Kavala Regional Unit. The following table presents the land uses in the Kavala Regional Unit according to the Corine Land Cover (CLC 2018) database.

Table 8–58: Land Cover in the Kavala Regional Unit

Regional Unit of Kavala		
Land Cover Category	**Area (km²)**	**Percentage (%)**
Urban fabric	35.655	1,68
Productive activities and other artificial surfaces	24.700	1,17
Irrigated agricultural areas	246.922	11,65
Arable land	173.310	8,18
Tree crops	74.775	3,53

Regional Unit of Kavala		
Heterogeneous agricultural areas	228.813	10,80
Coniferous forests	228.813	10,80
Broadleaf and mixed forests	321.578	15,17
Forest and shrubland areas	655.466	30,93
Natural pastures - grasslands	180.632	8,52
Areas with sparse vegetation	36.744	1,73
Burnt areas	8,431	0,40
Wetlands	25.960	1,22
Water bodies	18,702	0,88
Total	2.119.203	100

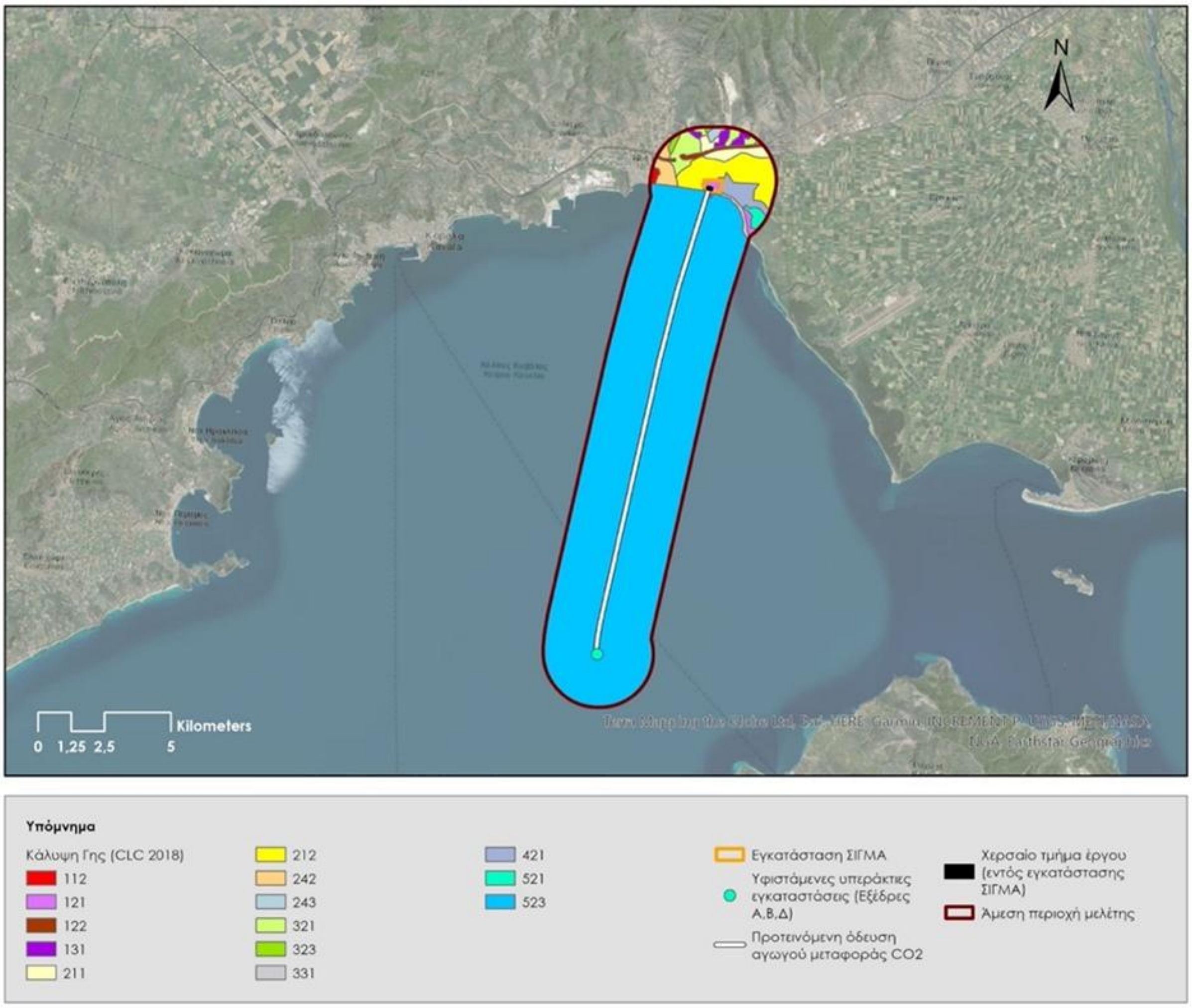
(Source: Corine Land Cover, 2018)

In this case, in the immediate study area, the largest portion of the facilities falls under the land use category "Sea – Oceans" with the code CLC 523, while the terrestrial facilities of the Project are located within "industrial and commercial zones" with the code CLC 121, as presented in the following **Table** and illustrated in the subsequent **Figure**.

Table 8–59: Land Cover within the Study Area

Regional Unit of Kavala			
Land cover category	**CLC Code**	**Area (km^2)**	**Percentage (%)**
Discontinuous urban fabric	112	0,19	0,21
Industrial and commercial zones	121	0,56	0,63
Road and railway networks	122	0,54	0,60
Mineral extraction sites	131	0,82	0,92
Non-irrigated arable land	211	1,18	1,33
Permanently irrigated land	212	4,26	4,77
Complex cultivation patterns	242	1,21	1,36
Land primarily used for agriculture with significant areas of natural vegetation	243	0,3	0,34
Natural pastures	321	0,67	2,20
Sclerophyllous vegetation	323	0,41	0,46
Beaches, dunes, sands	331	0,27	0,30
Coastal marshes	421	1,14	1,29
Coastal lagoons	521	0,39	0,44
Seas and oceans	523	76,07	85,16
Total		89,33	100%

(Source: Corine Land Cover, 2018)



(Source: Corine Land Cover,2018)

Figure 8–96: Land cover in the study area

Revised Regional Framework for Spatial Planning and Sustainable Development of Eastern Macedonia and Thrace (EMT) – Government Gazette 248/A.A.P./25.10.2018

The existing offshore and onshore facilities are aligned with the guidelines and specifications set by the Revised Regional Framework for Spatial Planning and Sustainable Development (PPCHSAA) – Government Gazette 248/A.A.P./25.10.2018 – of the Region of Eastern Macedonia and Thrace.

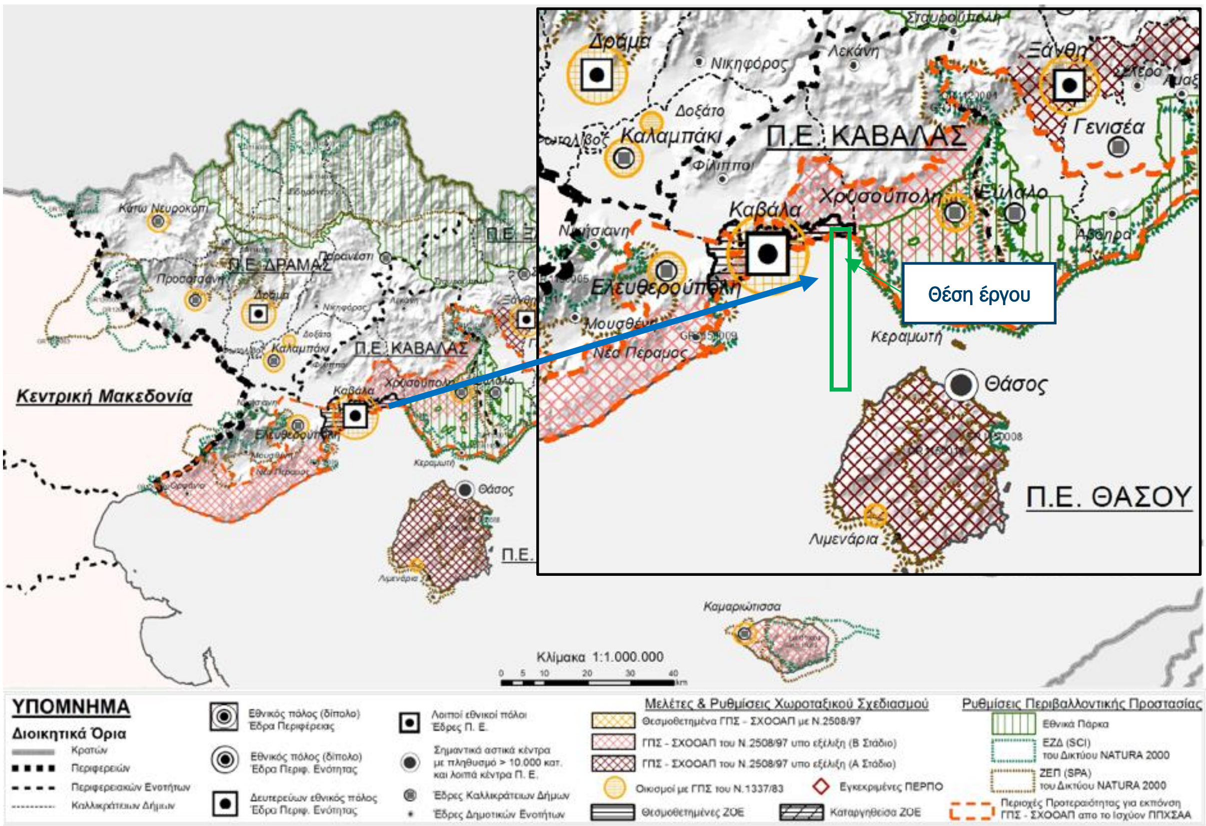
It is noted that the planned Regulatory Plan for Kavala has not been completed, while the corresponding planning through the General Urban Plans (GPS) / Spatial and Urban Planning Plans (SCHOOAP), as the main tools for regulating land use at the municipal level, is also significantly delayed in the EMTH Region.

The General Urban Plan (GUP) of Kavala follows the provisions and guidelines of the Revised Regional Framework for Spatial Planning and Sustainable Development of the Region of Eastern Macedonia and Thrace. The main proposals include the organization of the area of productive activities on the eastern side of Nea Karvali, where the large phosphate fertilizer industrial facility and the existing B.I.O.P.A. (Industrial

Area) are located, into a well-structured hub. Additionally, the role of the city is reaffirmed in relation to the PPRDS (Regional Spatial Planning and Sustainable Development Framework) provisions, through the developmental prospects set by the GUP for Kavala. It identifies the main developmental axes for the Municipality of Kavala, which can be summarized as follows:

- Highlighting Kavala as an urban center with cross-Balkan significance.
- Establishing Kavala as the hub of the broader development triangle of Drama – Kavala – Xanthi.
- Promoting Kavala as a tourist city, while simultaneously offering high-level technology and educational services.
- Enhancing the attractiveness of settlements by preparing residential hubs and concurrently improving and enriching social and technical infrastructure, so they can function as outlets for the Drama – Kavala – Xanthi triangle.
- Protecting the rural landscape and agricultural land, and restructuring the production model through regulation of land uses and construction.
- Protecting and showcasing natural ecosystems and individual natural features of special environmental/ecological interest.
- Highlighting and utilizing the historical center of Kavala through redevelopment and upgrading, and integrating cultural environment elements (traditional settlements, monuments, and archaeological sites) into tourism and recreation networks.
- Rationalizing the expansion of residential development in an organized manner with a targeted approach, alongside strict measures to limit unplanned construction.

The following figure illustrates the spatial planning and environmental protection regulations in Eastern Macedonia and Thrace (EMT), according to Map A.1.1.a.4 of the Revised Regional Framework for Spatial Planning and Sustainable Development of the respective Region.



(Source: Assessment of the Implementation of the Statutory PPXSA – Stage A2 – Map A.1.1.a.4)

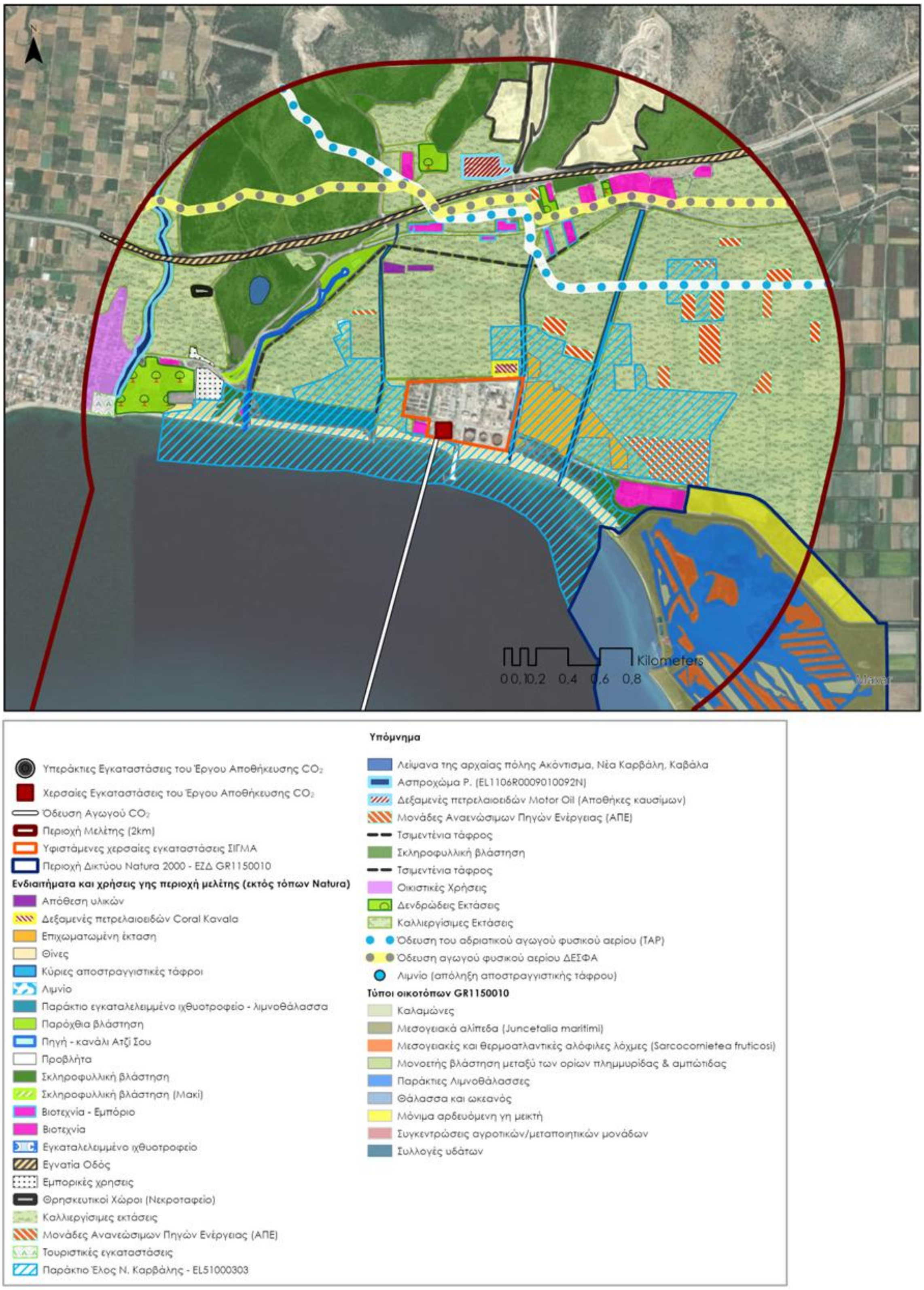
Figure 8–97: Provisions of the Revised Regional Framework for Spatial Planning and Sustainable Development of EMT

As observed in the above **figure**, <u>the area of the Project's terrestrial facilities is a priority area for the preparation of a General Urban Plan (GUP) or a Spatial and Urban Planning Scheme (ΣΧΟΟΑΠ – Open City Spatial and Settlement Organization Plan).</u>

Spatial Planning in the Project Area

In the terrestrial part of the immediate study area of the Project, fieldwork was conducted to record the existing land uses. The terrestrial part of the immediate study area covers a total area of approximately 10 km².

The recording of these land uses is depicted on the **Land Use Map** attached in the **Appendix of Maps and Plans of this study**. The following **figure** and **table** present the main land uses within the study area (near the Project's terrestrial facilities), their respective areas, and their percentages relative to the total area of the Immediate Study Area.


Kilometers
0 0,1 0,2 0,4 0,6 0,8
Υπόμνημα
Υπεράκτιες Εγκαταστάσεις του Έργου Αποθήκευσης CO2
Χερσαίες Εγκαταστάσεις του Έργου Αποθήκευσης CO2
Όδευση Αγωγού CO2
Περιοχή Μελέτης (2km)
Υφιστάμενες χερσαίες εγκαταστάσεις ΣΙΓΜΑ
Περιοχή Δικτύου Natura 2000 - ΕΖΔ GR1150010
Ενδιαιτήματα και χρήσεις γης περιοχή μελέτης (εκτός τόπων Natura)
Απόθεση υλικών
Δεξαμενές πετρελαιοειδών Coral Kavala
Επιχωματωμένη έκταση
Θίνες
Κύριες αποστραγγιστικές τάφροι
Λιμνίο
Παράκτιο εγκαταλελειμμένο ιχθυοτροφείο - λιμνοθάλασσα
Παρόχθια βλάστηση
Πηγή - κανάλι Ατζί Σου
Προβλήτα
Σκληροφυλλική βλάστηση
Σκληροφυλλική βλάστηση (Μακί)
Βιοτεχνία - Εμπόριο
Βιοτεχνία
Εγκαταλελειμμένο ιχθυοτροφείο
Εγνατία Οδός
Εμπορικές χρησεις
Θρησκευτικοί Χώροι (Νεκροταφείο)
Καλλιεργίσιμες εκτάσεις
Μονάδες Ανανεώσιμων Πηγών Ενέργειας (ΑΠΕ)
Τουριστικές εγκαταστάσεις
Παράκτιο Έλος Ν. Καρβάλης - EL51000303
Λείψανα της αρχαίας πόλης Ακόντισμα, Νέα Καρβάλη, Καβάλα
Ασπροχώμα Ρ. (EL1106R0009010092N)
Δεξαμενές πετρελαιοειδών Motor Oil (Αποθήκες καυσίμων)
Μονάδες Αναενώσιμων Πηγών Ενέργειας (ΑΠΕ)
Τσιμεντένια τάφρος
Σκληροφυλλική βλάστηση
Τσιμεντένια τάφρος
Οικιστικές Χρήσεις
Δενδρώδεις Εκτάσεις
Καλλιεργίσιμες Εκτάσεις
Όδευση του αδριατικού αγωγού φυσικού αερίου (TAP)
Όδευση αγωγού φυσικού αερίου ΔΕΣΦΑ
Λιμνίο (απόληξη αποστραγγιστικής τάφρου)
Τύποι οικοτόπων GR1150010
Καλαμώνες
Μεσογειακά αλίπεδα (Juncetalia maritimi)
Μεσογειακές και θερμοατλαντικές αλόφιλες λόχμες (Sarcocornietea fruticosi)
Μονοετής βλάστηση μεταξύ των ορίων πλημμυρίδας & αμπώτιδας
Παράκτιες Λιμνοθάλασσες
Θάλασσα και ωκεανός
Μόνιμα αρδευόμενη γη μεικτή
Συγκεντρώσεις αγροτικών/μεταποιητικών μονάδων
Συλλογές υδάτων

(Source: Fieldwork by the LDK Team, own processing)

Figure 8–98: Land Uses within the Study Area

Table 8–60: Main Land Uses within the Study Area

Land Uses	Area (km^2)	Percent (%)
Material Disposal	16243	0,16%
Small Industry – Commerce	235299	2,38%
Tree Crops / Orchards	166500	1,69%
Oil Tanks	50160	0,51%
Abandoned Fish Farm	3321	0,03%
Egnatia Motorway	136117	1,38%
Commercial Uses	35598	0,36%
Landfilled Area / Filled Land	184114	1,86%
Dunes	210798	2,13%
Religious Sites (Cemetery)	4783	0,05%
Croplands / Cultivations	5554331	56,24%
Main Drainage Ditches	90986	0,92%
Quarry	303058	3,07%
Lagoon	5605	0,06%
Renewable Energy Units (RES)	340979	3,45%
Residential Uses	169343	1,71%
Coastal Abandoned Fish Farm - Lagoon	93305	0,94%
Riparian Vegetation	86142	0,87%
Source - Atzi Sou Channel	17300	0,18%
Pier	7787	0,08%
Sclerophyllous Vegetation	2145293	21,72%
Tourist Facilities	18634	0,19%
TOTAL	**9875698**	**100,00%**

As shown in the above **table** and the corresponding **figure**, the largest percentage of the area is occupied by Cultivated Lands and Forest Areas. These uses cover 51.71% and 11.37%, respectively, of the total examined area. Another significant land use in the area is the Vasovas Fish Farm, accounting for 7.14%, and Scattered Shrublands at 5.56%.

Cultivated Lands are found surrounding the Project site.

8.10.1.3 Marine Spatial Planning

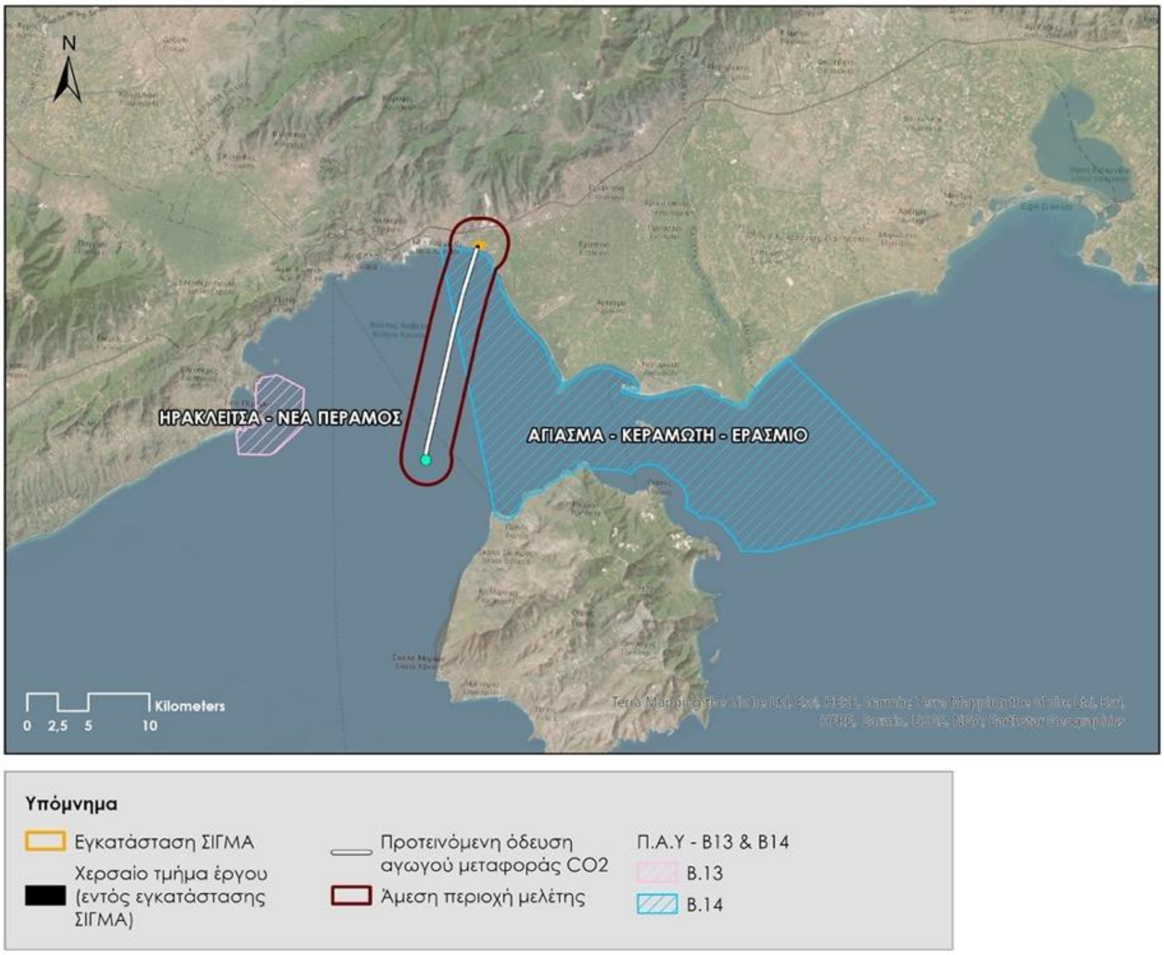
Directive 2014/89/EU on Marine Spatial Planning (hereinafter MSP) was transposed into Greek legislation through Law 4546/2018 (Government Gazette 101/A/2018), as amended by Law 4759/2020 and is currently in force. According to Article 3 of Law 4546/2018, as amended by Article 19 of Law 4759/2020, MSP is the process by which the competent authority analyzes and organizes human activities in marine areas to achieve an integration of ecological, environmental, economic, social, and cultural factors with the aim of promoting the sustainable development of marine economies and marine areas, and the sustainable use of marine resources.

The primary competent authority for the preparation, implementation, and evaluation of MSP is the Ministry of Environment and Energy (Article 14, paragraph 1 of Law 4546/2018). The implementation duties are hierarchically delegated to the General Secretariat of Spatial Planning and Urban Environment – General Directorate of Spatial Planning – Directorate of Spatial Planning.

Given the absence of an established Marine Spatial Framework and the corresponding Marine Spatial Plans, spatial planning in the marine area of the proposed project is defined by the existing marine spatial planning, namely the applicable Special and Regional Spatial Planning Frameworks. These frameworks concern specific economic sectors (renewable energy sources, industry, aquaculture, etc.) and include spatial planning guidelines for the development of each sector in the terrestrial, coastal, and to a lesser extent, marine areas.

At the national level, marine uses have not been formally established except for the Special Spatial Planning and Sustainable Development Framework (ΕΠΧΣΑΑ) for Aquaculture, which was enacted in November 2011 (Government Gazette 2505/B/2011).

According to the Draft Special Spatial Planning Framework for Aquaculture Activities (Government Gazette 2505 B/04.11.2011), part of the project falls within the Aquaculture Development Zone (Π.Α.Υ.) B14 "Agiasma - Keramoti - Erasmio" (fish farming, shellfish farming, other aquatic organisms), while it is located 10.6 km away from Zone B13 "Iraklitsa – Nea Peramos," as shown in the following **figure**. These Aquaculture Development Zones are classified as Type B, meaning areas designated for aquaculture development with potential for further expansion.



(Source: Government Gazette 2505 B/04.11.2011, own processing)

Figure 8–99: Aquaculture Development Zones (AQUACULTURE DEVELOPMENT AREAS)

<u>However, it is important to emphasize that all coastal and offshore facilities of the proposed project will be developed at sites with existing faciliies or at locations where restrictions are already in place due to the presence of the offshore Prinos gas extraction project (e.g., the CO2 transport pipelines will be installed within an already designated zone).</u>

According to the Detailed Documentation Text of the Update of the Environmental Impact Study (EIS) for the 2nd Revision of the Spatial and Development Plans[3], a total of twenty-nine (29) aquaculture units currently operate in the Thrace Marine District (EL12), of which 24 are registered in the Registry of Aquaculture Product Producers Holding Veterinary Code Numbers for Fish. Of these 29 units, nine (9) involve fish farming (6 freshwater and 3 marine), and twenty (20) involve mussel farming in coastal waters.

[3] *Σημειώνεται πως το Αναλυτικό Κείμενο Τεκμηρίωσης της «Επικαιροποίησης του Μητρώου Προστατευόμενων Περιοχών» της 2ης Αναθεώρησης του ΣΔΛΑΠ για το ΥΔ Θράκης (EL12) δεν έχει ακόμη αναρτηθεί. Ωστόσο είναι διαθέσιμο στα σχετικά κείμενα που έχουν τεθεί υπό Διαβούλευση στον επίσημο ιστότοπο του ΥΠΕΝ (https://wfdver.ypeka.gr/el/project/consultation-el12-45-2revision-protected-areas-gr/)*

All marine aquaculture operations are located within the Aquaculture Development Zones (ΠΑΥ) B.14 and D.2 as defined in Joint Ministerial Decision 31722/4.11.2011.

Within the boundaries of the Thrace Marine District (EL12), there are twenty-five (25) potentially exploitable lagoons. Of these, eighteen (18) lagoons and two (2) lakes, namely Ismarida and Vistonida, are currently being exploited. The exploited lakes and lagoons cover a total area of approximately 77,200 stremmas (7,720 hectares). The most significant among these is Lake Vistonida, with an area of 45,000 stremmas. Additionally, important exploitable fishing grounds include the lagoons of Agiasma, Erateinos, and Vassova in the wider Keramoti area, as well as the lagoons of Rodopi (Porto Lagos, Lagos, Ismarida, etc.).

Within the framework of the 1st Management Plan, seven (7) coastal aquatic systems were included in the Environmental Impact Study (EIS) as protected areas under Directive 2006/113/EC, related to the Aquaculture Development Zones listed in Table 1 of the Annex of Joint Ministerial Decision 31722/4.11.2011: EL1207C0001N Eastern Gulf of Kavala, EL1207C0002N Northern Shores of Thasos Channel, EL1207C0003N Avdira Beach, EL1208C0004N Vistonikos Gulf, EL1208C0005N Western Shores of Thracian Sea, EL1210C0006N Eastern Shores of Thracian Sea and EL1242C0012N Shores of Thasos.

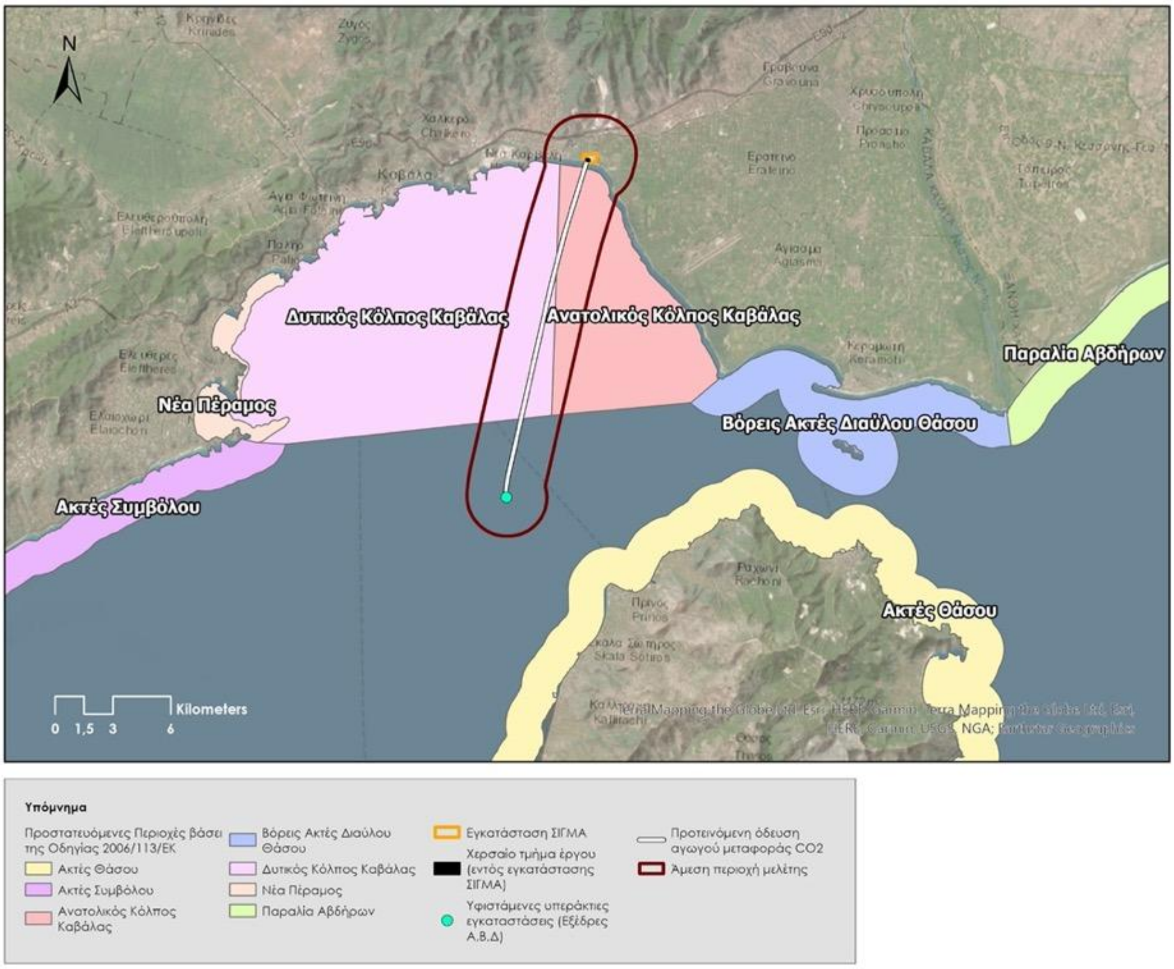
In the Thrace Water District, under Regulations 178/2002, 852/2004, 853/2004, 854/2004, 882/2004, and Presidential Decree 79/2007 (Government Gazette 95/A/2007), as amended by Law 4472/2017 (Government Gazette 74/A/2017), six (6) areas—production and fishing zones for live bivalve mollusks—have been identified. Specifically, according to the Prefectural Decision AP22510/19-12-2016, in the Evros Regional Unit, two live bivalve mollusk fishing areas, K2 and K3, were designated, which correspond to the coastal sites EL1210C0006N and EL1210C0009N, respectively. In the Rhodope Regional Unit, under Prefectural Decision AP 4508/26-4-2017, a production and fishing zone for live bivalve mollusks was designated, corresponding to the coastal site EL1208C0004N.

In the Kavala Regional Unit, the following areas were also designated by Prefectural Decision: the Agiasma Production Area (A.P. 04/339/17.01.2017), the Vasovas Production Area (A.P. 04/340/17.01.2017), and the Keramoti Bay Production Area (A.P. 04/338/17.01.2017), which correspond to the coastal sites EL1207C0001N and EL1207C0002N. Considering the above, the coastal site EL1210C0009N, associated with the K3 Live Bivalve Mollusk Fishing Zone, is also included in the protected areas of the Environmental Impact Study (EIS). According to Decision A.P. 22557/19.12.2016, bivalves harvested from K3 may be made available for human consumption only after processing in Cleaning Centers. The harvested species is mussels (Mytilus galloprovincialis) from natural stocks (wild species).

Thus, according to the 2nd Revision of the Environmental Impact Study (EIS), one additional coastal Water Body (WB) is included, with code EL1210C0009NSH and name “Evros Coasts.”

According to the 2nd Revision of the WFD (EL11), in the **Water District of Eastern Macedonia** (EL11) there are a total of sixteen (16) aquaculture units, of which three (3) are fish farms, seven (7) are mussel farms, and six (6) are spirulina farms. Additionally, within the coastal water system “Strymonikos Gulf” (EL1106C0001N), there is one (1) marine Mediterranean fish farm and five (5) mussel farms. The four (4) coastal water systems of the Eastern Macedonia Water District (EL11) are also included.

The following are the areas located within the study area or in the wider surrounding region.



(Source: 2nd Revision of the SDWD, own processing)

Figure 8–100: Protected areas according to Directive 2006/113/EC in the project area

Table 8–61: Protected areas according to Directive 2006/113/EC

S/N	Area Code	Area Name	Connection to WS	Distance from the Project (km)
1	EL1106C0002NSH	Symvolou Coast	EL1106C0002N	12,8km
2	EL1106C0003NSH	Nea Peramos	EL1106C0003N	12km
3	EL1106C0004NSH	Western Gulf of Kavala	EL1106C0004N	Within the Protected Area (PA)
4	EL1207C0001NSH	Eastern Gulf of Kavala	EL1207C0001N	Within the Protected Area (PA)
5	EL1207C0002NSH	Northern Shores of the Thasos Channel	EL1207C0002N	9,3km
6	EL1207C0003NSH	Avdira Beach	EL1207C0003N	25km
7	EL1242C0012NSH	Thasos Coasts	EL1242C0012N	9km

8.10.2 Structure and Functions of the Anthropogenic Environment

The area is located in the Kavala Regional Unit, which consists of the Regional Units (RUs) of Kavala and Thasos, created by the division of the Kavala Prefecture into mainland and island sections, respectively.

The Kavala Regional Unit consists of 3 municipalities and 11 municipal units (MUs):

- Municipality of Pangaio ▪
  - MU of Eleftheroupoli
  - ▪ MU of Eleftheres
  - ▪ MU of Orfano
  - ▪ MU of Paggaio
  - ▪ MU of Pieria
- Municipality of Kavala ▪
  - MU of Kavala
  - ▪ MU of Philippi
- Municipality of Nestos ▪
  - MU of Keramoti
  - ▪ MU of Oreino
  - ▪ MU of Chrysoupoli

The **Thasos Regional Unit** consists of one municipality and one municipal unit according to the current administrative structure and division of the region, established in 2011 in accordance with the provisions of the Kallikratis program.

The municipalities of the Kavala and Thasos Regional Units have coastlines, and their main settlements are either coastal or near the sea.

The most populous municipality of the prefecture is Kavala. The main characteristics of the Municipality of Kavala are as follows:

- It constitutes the classic example of a municipality structured around a major urban center and its surrounding areas.
- The largest part of its territory is coastal, but it also includes a significant mountainous section.
- It consists of a radial settlement network with one central hub and six satellite settlements..
- The city of Kavala serves as the administrative center, providing services to all residents of the Kavala Prefecture.
- It is a center for academic education and research
- It has comprehensive services and urban and social infrastructure.

Kavala is the capital of the Kavala Prefecture. It is an important port and commercial center in northern Greece. It is also the seat of the Holy Metropolis of Philippi, Neapolis, and Thasos, and it concentrates a significant portion of the cultural resources of the Prefecture.

8.10.3 Cultural Heritage

The Ephorate of Antiquities of Kavala, based in Kavala and with jurisdiction over the Regional Units of Kavala and Thasos, is responsible for matters concerning the implementation of archaeological legislation and the protection of immovable and movable antiquities from the earliest times up to 1830.

The Service for Modern Monuments and Technical Works of Eastern Macedonia and Thrace is a regional department of the Ministry of Culture and Sports, headquartered in Xanthi, with jurisdiction over the Regional Units of Evros, Rhodope, Xanthi, Drama, Kavala, and Thasos. Its work focuses on the protection, restoration, and promotion of modern monuments (those dating after 1830).

The Ephorate of Underwater Antiquities is a Special Regional Service of the Ministry of Culture (formerly the Ministry of Culture and Sports), with jurisdiction across the entire Greek territory. Established in 1976 (Government Gazette 207/A/10-8-1976), its mission is the protection of underwater antiquities, which include shipwrecks of ancient vessels, settlements, or ancient harbor facilities located in seas, lakes, and rivers. Since 2003, when shipwrecks and aircraft wrecks over 50 years old from the date of sinking were declared monuments, including the movable objects they contain due to their historical, technological, scientific, and cultural significance (Government Gazette 1701/B/19-11-2003), the Ephorate of Underwater Antiquities has also been responsible for their protection.

The Region of Eastern Macedonia and Thrace has a high level of cultural and historical heritage: 34 traditional settlements, 56 archaeological sites, and 43 recognized museums.

The main archaeological sites in the Regional Unit of Kavala are summarized in the following **table.**

Table 8–62: Major archaeological sites in the Prefecture of Kavala

Archaeological Site	Type of Protection	Protection Status
Archaeological site of Philippi		
It is located on the Kavala–Drama provincial road. The archaeological site includes the remains of the ancient city of Philippi, comprising the acropolis, the walls, the theater, the agora, and the cemeteries (Eastern and Western), as well as the hills and the battlefield of the Battle of Philippi. It also includes the Byzantine cemetery and funerary chapel, the basilicas outside the walls, the funerary monument of C. Vibius Quartus, the prehistoric settlement of Dikili Tash, the Arch of the Egnatia Road, and the Zygakti River.	• Type of protection by the Ministry of Culture: Designation • Responsible Authority: Ephorate of Antiquities of Kavala • World Heritage: YES • European Cultural Heritage: YES	• Ministerial Decision 15794, Government Gazette: 35/B/1962-02-02 • Ministerial Decision 15813, Government Gazette: 36/B/1962-02-03 • Ministerial Decision 15813, Government Gazette: 179/B/1962-05-26 • Ministry of Culture/Directorate General of Antiquities & Cultural Heritage/Directorate of Prehistoric & Classical Antiquities/Department of Monuments/Ref. Φ18/171892/91557/11622/5399, Government Gazette: 357/AAP/2013-10-09

Archaeological Site	Type of Protection	Protection Status
Ancient city and harbor of Thasos (Underwater area). The commercial and military harbors of Thasos are located at the site of the modern city harbor, and the first fortification of the harbor dates to the late 6th / early 5th century BC. More generally, this monument is cited as an example for understanding the 'enclosed' military harbors, which were an integral part of ancient cities and were constructed throughout antiquity, from the Archaic period to the late Hellenistic period.	• Type of protection by the Ministry of Culture: Designation • Responsible Authority: Ephorate of Underwater Antiquities	• Ministry of Culture/ARCH/A1/Ref. Φ18/52652/2146, Government Gazette: 74/B/1987-02-05 • Ministerial Decision YPAITHPA/General Secretariat of Culture/Directorate General of Antiquities & Cultural Heritage/Directorate of Prehistoric & Classical Antiquities/Department of Monuments/Ref. Φ43/69887/33898/4701/2361, Government Gazette: 166/AAP/2013-05-15
The Aliki Peninsula is located in the southeast of Thasos and, after the city of Thasos, is one of the most important archaeological sites on the island, featuring significant visible monuments and a period of occupation from the 7th century BC to the 7th century AD.	• Type of protection by the Ministry of Culture: Designation • Responsible Authority: Ephorate of Antiquities of Kavala	• Ministerial Decision 9763, Government Gazette: 415/B/1962-11-19 • Ministerial Decision Φ31/28167/2649/74, Government Gazette: 166/B/1977-03-03 • Ministerial Decision Ministry of Culture/A1/Φ18/14306/532, Government Gazette: 244/B/1985-05-02

Beyond the major archaeological sites of the Prefecture presented in the table above, the following are other notable archaeological sites and monuments of the Prefecture of Kavala:

- Byzantine Castle of Chrysoupoli on the Strymonas River
- Early Christian Basilica of Kipi
- Dikili Tash
- Byzantine Tower of Apollonia
- Acropolis of Kavala
- Medieval Aqueduct of Kavala
- Imaret
- Tower of Apollonia at Loutra Eleftheron
- Tower of Thymonia
- Palataki of Thasos

The marine area of the Gulf of Kavala, where all offshore installations (existing and new) are located, has been thoroughly investigated, and there is no evidence of significant underwater archaeological findings. Over time, the shallow waters and the type of seabed do not allow for the preservation of any potential remains.

Within the study area, the following archaeological sites and monuments have been identified:

Nea Karvali, Kavala ▪

  - Site Category: Terrestrial Archaeological Site
  - Responsible Authority: Ephorate of Antiquities of Kavala
  - Protection Status: Ministerial Decision 21220, Government Gazette: 527/B/1967-08-24

- Remains of the ancient city of Akontisma, Nea Karvali, Kavala ▪

- Site Category: Ancient Monument
- Description: Remains of the ancient city of Akontisma, Nea Karvali, Kavala
- Responsible Authority: Ephorate of Antiquities of Kavala
- Protection Status: Ministerial Decision 21220, Government Gazette: 527/B/1967-08-24

At a short distance from the study area, the following archaeological sites and monuments are also located (the respective distances are presented in the **table** below):

Chalkero, Kavala▪

- Site Category: Terrestrial Archaeological Site
- Description: The archaeological site includes remains of a cultic character, as well as quarries.
- ▪ Responsible Authority: Ephorate of Antiquities of Kavala
- ▪ Protection Status: Ministerial Decision Ministry of Culture/GDA/ARCH/A1/Φ43/54780/3306, Government Gazette: 1464/B/2001-10-26

Eskitepe Lefkis, Kavala ▪

- Site Category: Terrestrial Archaeological Site
- ▪ Description: Remains of an ancient wall
- ▪ Responsible Authority: Ephorate of Antiquities of Kavala
- ▪ Protection Status: Ministerial Decision 21220, Government Gazette: 527/B/1967-08-24

- I. Church of Saint Gregory, Nea Karvali, Kavala ▪
  - Site Category: Modern Monument
  - Description: The Church of Saint Gregory in Nea Karvali was established in 1924 and is a replica of the Byzantine church of Karvali in Cappadocia. It is associated with the memories of refugees for their homeland and houses the relic of Saint Gregory of Nazianzus
  - Responsible Authority: Ephorate of Antiquities of Kavala
  - Protection Status: Ministerial Decision Ministry of Culture/ARCH/B1/Φ37/1184/22, Government Gazette: 274/B/1987-06-02

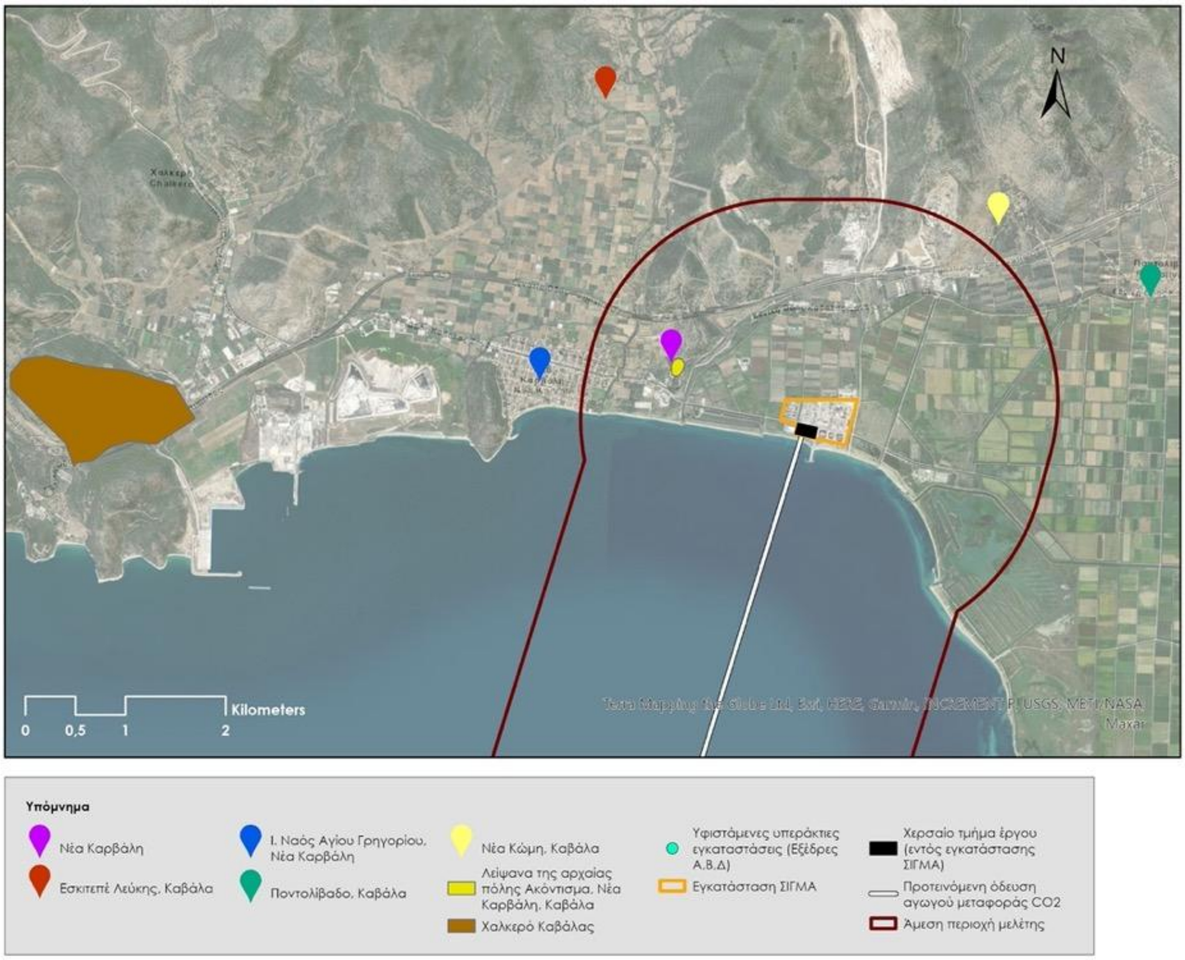
▪ Pontolivado, Kavala

- Site Category: Terrestrial Archaeological Site
- Description: In Pontolivado, Kavala, there are remnants of walls, a residential complex, and finds from Classical and Hellenistic periods. The site is identified with the ancient city of Pistyros.
- Responsible Authority: Ephorate of Antiquities of Kavala
- Protection Status: Ministerial Decision Ministry of Education/ARCH/A1/Φ18/68159/3413, Government Gazette: 93/B/1980-01-31

- Nea Komi, Kavala
  - Site Category: Terrestrial Archaeological Site
  - Description: In Nea Komi, Kavala, a Roman-era fortress is preserved
  - Responsible Authority: Ephorate of Antiquities of Kavala
  - Protection Status: Ministerial Decision Ministry of Education/ARCH/A1/Φ18/68159/3413, Government Gazette: 93/B/1980-01-31

Table 8–63: Archaeological sites and monuments within or in close proximity to the Study Area

S/N	Monument - Temple	Distance from onshore facilities (km)	Study Area
1	Chalkero, Kavala	6	Outside
2	Eskitepe Lefki, Kavala	3.6	Outside
3	Nea Karvali, Kavala	1.15	Inside
4	Remains of the ancient city of Akontisma, Nea Karvali, Kavala	0.98	Inside
5	1. Church of Saint Gregory, Nea Karvali, Kavala	2.26	Outside
6	Pantolivado, Kavala	3.3	Outside
7	Nea Komi, Kavala	2.4	Outside



(Source: https://www.arxaiologikoktimatologio.gov.gr/en)

Figure 8–101: Archaeological sites and monuments within or near the Study Area

Traditional settlements are residential complexes of particular historical, urban, architectural, folkloric, social, and aesthetic character, which developed from the 16th to the 19th century. The table below presents the settlements that have been designated as Traditional in the Prefecture of Kavala, pursuant to Presidential Decree 19-10-1978 (Government Gazette 594/D/13.11.1978).

Table 8–64: Traditional settlements in the Regional Units of Kavala and Thasos

Local Government Unit (LGU)	Traditional Settlement	Proposed Notable 1975 / Protection Level[4]
Eleftheroupoli	• Kipia (Bostanli) • Chrysokastron	• Econ./BP3 • Econ./BP3 – Reg. Spatial/BP3
Thasos	• Alyki • Theologos • Kastro • Mariai • Palaiochorion • Panagia (Anastasion) • Potamia • Prinos	• Residential / Industrial Area 2 – Regional Spatial / Industrial Area 1 • Residential / Industrial Area 2 – Part of Residential / Industrial Area 1 – Regional Spatial / Industrial Area 2 • - • Residential / Industrial Area 2 – Regional Spatial / Industrial Area 2 • - • Residential / Industrial Area 3 – Part of Residential / Industrial Area 2 – Regional Spatial / Industrial Area 1 • Residential / Industrial Area 3 • Residential / Industrial Area 1 – Regional Spatial / Industrial Area 1
Kavala	• Palia Kavala	• Part of Residential Area / Industrial Area 2
Orinos	• Kechrokampos • Kryonerion (Karga) • Makrychorion • Platamon	• Residential / Industrial Area 3 – Part of Residential Area / Industrial Area 2 • Residential / Industrial Area 3 – Regional Spatial / Industrial Area 2 • Residential / Industrial Area 3 – Part of Residential Area / Industrial Area 2 • -
Orfanos	• Podochorio	• Residential / Industrial Area 2 – Regional Spatial / Industrial Area 3
Pangaio	• Palaiochorion	• -
Pieria	• Moustheni • Domatia (Samakovo) • Melissokomion • Mesoropi • Pyrgochorion	• Residential / Industrial Area 3 – Part of Residential Area / Industrial Area 2 • Residential / Industrial Area 3 – Part of Residential Area / Industrial Area 2 – Regional Spatial / Industrial Area 2 • - • Residential / Industrial Area 3 – Regional Spatial / Industrial Area 2 • Residential / Industrial Area 3 – Regional Spatial / Industrial Area 3
Filippoi	• Zigos • Korifai	• - • Residential / Industrial Area 3 – Part of Residential Area / Industrial Area 2

4 https://portal.tee.gr/portal/page/portal/teetkm/GRAFEIO_TYPOY/TEXNOGRAFIMA_2007/%D4%C5%D7%CD%CF%C3%D1%C1%D6%C7%CC%C1%20336/12-13_0.pdf

(Source: http://estia.minenv.gr/)

(Source: TEE, Keppa Ch., 2007)

Figure 8–102: Traditional settlements of Eastern Macedonia and Thrace

Regarding the **cultural events** held every year, they include, among others:

- The "Eleftheria" festival, held in the second half of the year, in June, in Kavala.
- The Naval Week in Kavala.
- The Grape Festival, held during August and September in the village of Elaiochori.
- The traditional fair in Chrysoupoli.
- The Potato Festival in Lekani.
- The Kazavitiana festival, in September, in Ano Prinos on Thasos.
- The Klydonas celebration in Kavala.

8.11 SOCIO-ECONOMIC ENVIRONMENT

8.11.1 Demographic Data

The proposed project is located in the Gulf of Kavala, between the mainland and the island of Thasos, within the administrative region of Eastern Macedonia and Thrace, in the Kavala Regional Unit. The Regional Units (RUs) geographically correspond to the respective prefectures, except for the Kavala and Thasos RUs, which were formed by splitting the Kavala Prefecture into mainland and island sections, respectively. The Kavala Prefecture and the municipalities within the RUs of Kavala and Thasos are Kavala, Pangaio, Nestos, and Thasos. The municipalities of the Kavala and Thasos RUs have coastlines, and the main settlements are either coastal or located near the sea.

According to the Hellenic Statistical Authority, the Region of Eastern Macedonia and Thrace has a permanent population of 562,201 residents, making it the 6th most populous region in the country. The permanent population decreased by 7.6% during the period 2011–2021. This decline is greater than the national average (-3.1%) and is the second largest among regions after the Region of Western Macedonia (-10.3%). The population evolution by region for the period 2011–2021 is presented in the following **table.**

Table 8–65: Permanent population evolution by Region

Territorial Unit	2011	2021	Change 2011/2021
TOTAL COUNTRY	10,816,286	10,482,487	-3.1%
REGION OF EASTERN MACEDONIA AND THRACE	608,182	562,201	-7.6%
REGION OF CENTRAL MACEDONIA	1,882,108	1,795,669	-4.6%
REGION OF WESTERN MACEDONIA	283,689	254,595	-10.3%
REGION OF EPIRUS	336,856	319,991	-5.0%
REGION OF THESSALY	732,762	688,255	-6.1%
REGION OF CENTRAL GREECE	547,390	508,254	-7.1%
REGION OF IONIAN ISLANDS	207,855	204,532	-1.6%
REGION OF WESTERN GREECE	679,796	648,220	-4.6%
REGION OF PELOPONNESE	577,903	539,535	-6.6%
REGION OF ATTICA	3,828,434	3,814,064	-0.4%
NORTHEASTE AEGEAN REGION	199,231	194,943	-2.2%
SOUTH AEGEAN REGION	309,015	327,820	6.1%
REGION OF CRETE	623,065	624,408	0.2%

(Source: ELSTAT (Population censuses))

At the regional unit (PE) level, a larger decrease is observed in the Kavala PE compared to the Thasos PE (-7% and -4.8%, respectively), and at the municipal level, the greatest decrease concerns the Nestos Municipality (-9%), as shown in the **table** below.

Table 8–66: Evolution of the permanent population in the Kavala Prefecture by Regional Unit (PE) and Municipality

Territorial Unit	2011	2021	Change 2011/2021
PE KAVALA	124,897	116,195	-7.0%
MUNICIPALITY OF KAVALA	70,501	66,376	-5.9%
MUNICIPALITY OF NESTOS	22,331	20,311	-9.0%
MUNICIPALITY OF PANGAIO	32,085	29,508	-8.0%
PE THASOS	13,770	13,104	-4.8%
MUNICIPALITY OF THASOS	13,770	13,104	-4.8%

(Source: ELSTAT (Population censuses))

Regarding the gender distribution in the Region of Eastern Macedonia and Thrace, women number 286,397, accounting for 50.7% of the population, while men number 275,804, representing 49.3% of the population, according to the 2021 Population Census (see the following **Table**).

Table 8–67: Population evolution by gender in the Prefecture of Kavala, by Regional Unit and Municipality

Territorial Unit	Total 2011	Males	Females	Total 2021	Males	Females
Kavala Regional Unit	124,917	48.7%	51.3%	116,195	48.5%	51.5%
Municipality of Kavala	70,501	48.2%	51.8%	66,376	48.0%	52.0%
Municipality of Nestos	22,331	49.5%	50.5%	20,311	49.5%	50.5%
Municipality of Pangaio	32,085	49.3%	50.7%	29,508	49.1%	50.9%
Thasos Regional Unit	13,770	49.3%	50.7%	13,104	48.7%	51.3%
Municipality of Thasos	13,770	49.3%	50.7%	13,104	48.7%	51.3%

(Source: ELSTAT (Population censuses))

Population trends should also be examined in relation to the age structure of the population. According to the Regional Development Program of the Region of Eastern Macedonia and Thrace 2021-2025[5], the population of the region tends to be older, and the ratio of elderly individuals requiring support to the working-age population indicates a pronounced age dependency. The corresponding dependency ratio[6] reached 0.367 in 2019, a value higher than that of the country as a whole (0.346). The increase in the population aged 65 and over is striking across all OECD countries. This growth has been particularly rapid for the population aged 80 and above. Between 2019 and 2050, the share of the population aged 80 and over is expected to more than double in OECD member countries, from 4.6% to 9.8% on average. In Greece, it is estimated that by 2050, more than one in eight people will be 80 years old or older[7].

The age distribution of Greece and of the Region of Eastern Macedonia and Thrace, as well as its change between 2011 and 2021 according to the 2011 and 2021 Population Censuses, is presented in the **table** below.

Table 8–68: Age distribution of the Region of Eastern Macedonia and Thrace and of the entire country

	2011	2021	Change 2011/2021	2011	2021	Change 2011/2021
Age Group	TOTAL COUNTRY			REGION OF EASTERN MACEDONIA AND THRACE		
0-19	2,122,544	1,946,707	-8.3%	124,254	107,947	-13.1%

[5] https://www.eydamth.gr/#

[6] The ratio of people aged 65 and over to those aged 15–64

[7] *OECD (2021), Health at a Glance 2021: OECD Indicators, OECD Publishing, Paris, https://doi.org/10.1787/ae3016b9-en.*

	2011	2021	Change 2011/2021	2011	2021	Change 2011/2021
20-39	2,986,172	2,309,697	-22.7%	159,679	121,426	-24.0%
40-59	2,972,949	3,139,368	5.6%	159,189	159,951	0.5%
60+	2,734,621	3,086,715	12.9%	165,060	172,877	4.7%

(Source: ELSTAT (Population censuses))

The **total fertility rate** is used to determine the level of generational replacement, which in developed countries is considered to be 2.1. According to ELSTAT data, in Greece this rate has declined from 2.2 in 1980 to 1.5 in 2021, as illustrated in the **figure** below.

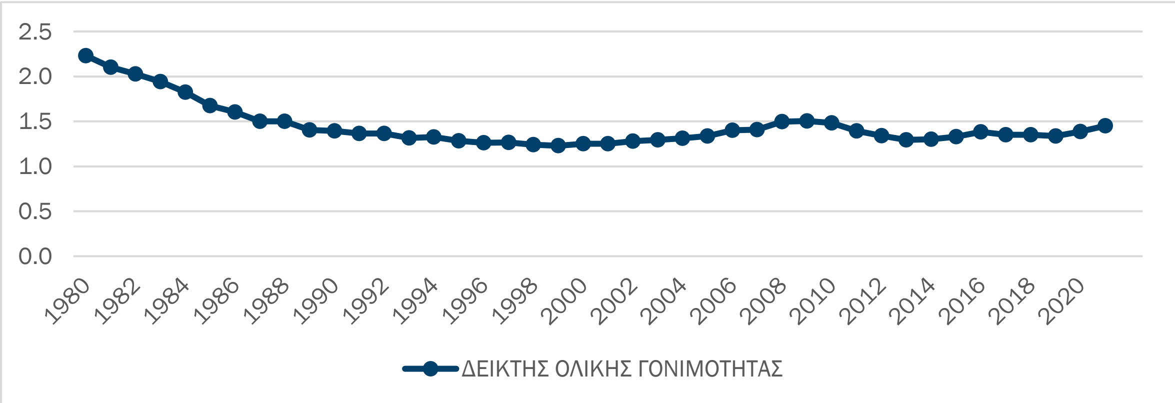


Figure 8–103: Evolution of the total fertility rate in Greece between 1980 and 2021

The age distribution of the population, combined with the low fertility rate, forms a concerning demographic pattern. Demographic models for future trends indicate that the aging population pattern, increasingly evident across EU regions, is expected to have serious impacts on a wide range of policy areas, affecting the school-age population, healthcare, labor force participation, social protection, social security issues, and public finances, among others[8].

Population density, defined as the number of inhabitants of an area in relation to its size measured in square kilometers, highlights not only population trends but also the degree of urbanization. According to data from the European Statistical Office, in 2022, the population density in the Region of Eastern Macedonia and Thrace was the 5th lowest in the country, with 40 inhabitants per square kilometer compared to 80.3 for the country overall and 109.1 in the EU on average.

[8] *https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Archive:%CE%A0%CE%BB%CE%B7%CE%B8%CF%85%CF%83%CE%BC%CE%B9%CE%B1%CE%BA%CE%AD%CF%82_%CF%83%CF%84%CE%B1%CF%84%CE%B9%CF%83%CF%84%CE%B9%CE%BA%CE%AD%CF%82_%CF%83%CE%B5_%CF%80%CE%B5%CF%81%CE%B9%CF%86%CE%B5%CF%81%CE%B5%CE%B9%CE%B1%CE%BA%CF%8C_%CE%B5%CF%80%CE%AF%CF%80%CE%B5%CE%B4%CE%BF&oldid=152553*

The estimation of the seasonal population is based on the data presented in the Revised National Waste Management Plan 2020 - 2030[9] which uses information from ELSTAT on overnight stays in the country's tourist accommodations (hotels, rental rooms, camping sites). Only overnight stays related to inbound tourism, i.e., foreign visitors, were considered. According to the data, the percentage distribution of the seasonal population in 2018 for the Region of Eastern Macedonia and Thrace reached 1.66%. The following table presents the overnight stays and the equivalent population for the entire country and for the Region of Eastern Macedonia and Thrace for the years 2008 to 2018.

Table 8–69: Overnight stays and equivalent population for the entire country and for the Region of Eastern Macedonia and Thrace for the years 2008 to 2018

YEAR	TOTAL COUNTRY – overnight stays	TOTAL COUNTRY – equivalent population	REGION OF EASTERN MACEDONIA AND THRACE – overnight stays	REGION OF EASTERN MACEDONIA AND THRACE – overnight stays
2008	57.568.739	157.723	631.898	1,731
2009	56.012.384	153.459	624.268	6,958
2010	58.783.363	161.050	610.097	6,332
2011	65.421.835	179.238	710.365	7,713
2012	61.313.878	167.983	711.598	8,259
2013	68.993.000	189.022	899.788	11,735
2014	80.174.000	219.655	958.407	11,457
2015	85.155.000	233.301	1.112.229	14,527
2016	87.913.000	240.858	1.050.161	12,545
2017	97.033.832	265.846	1.251.121	16,132
2018	102.571.336	281.017	1.287.793	16,168

(Source: Modified National Waste Management Plan 2020–2030)

8.11.2 Economic Activities and Labor market

8.11.2.1 Key Economic Indicators and Production Structure

From 2008 to 2016, Greece lost more than a quarter of its GDP in constant prices, while the unemployment rate increased by approximately 16 percentage points. Additionally, GDP per capita in purchasing power

[9] http://www.opengov.gr/minenv/wp-content/uploads/downloads/2022/10/%CE%A4%CE%A1%CE%9F%CE%A0%CE%9F%CE%A0%CE%9F%CE%99%CE%97%CE%9C%CE%95%CE%9D%CE%9F-%CE%95%CE%98%CE%9D%CE%99%CE%9A%CE%9F-%CE%A3%CE%A7%CE%95%CE%94%CE%99%CE%9F-%CE%94%CE%99%CE%91%CE%A7%CE%95%CE%99%CE%A1%CE%99%CE%A3%CE%97%CE%A3-%CE%91%CE%A0%CE%9F%CE%92%CE%9B%CE%97%CE%A4%CE%A9%CE%9D_%CE%95%CE%A3%CE%94%CE%91_2020-2030_%CE%A4%CE%95%CE%9B%CE%99%CE%9A%CE%9F.pdf

standards fell to 67.4% of the EU average in 2018, down from 93.3% in 2008. At the same time, the ratio of non-performing loans (NPLs) to total loans soared to around 50%, accompanied by a large wave of emigration of educated Greeks (brain drain) and significant disinvestment, with major economic and social consequences[10]. The Greek economy, after returning to growth in 2017 and successfully exiting the European Stability Mechanism support program in August 2018, continued its recovery in 2019, despite the slowdown of the global economy, with the growth rate stabilizing at around 2% before the COVID-19 pandemic. The COVID-19 pandemic had a particularly negative impact on GDP growth and the fiscal recovery of the global economy. In 2021, the Greek economy experienced significant growth, at around 8.3%. In addition to the GDP increase, exports also rose, and unemployment decreased[11]. In 2022 and 2023, despite an adverse international environment, the Greek economy continued to grow at a high rate. Real GDP increased by 5.9% in 2022, mainly due to higher private consumption and investments, as well as a strong rebound in tourism, and by 2% in 2023, driven primarily by private consumption, exports, and investments. Labor market developments were also favorable, with the unemployment rate decreasing in 2022 and declining further in 2023. The unemployment rate fell to 11.1% (from 12.4% in 2022), while the long-term unemployment rate also showed a significant decline.[12].

According to the latest macroeconomic forecasts of the European Commission for Greece[13], economic growth is expected to remain broadly stable at 2.3% in 2024 and 2025. Investments are projected to increase significantly as the implementation of the Recovery and Resilience Plan (RRP) accelerates and financing conditions improve. However, these investments are likely to drive higher demand for imports of both goods and services, which is expected to reduce the positive contribution of net exports in 2024–2025.

At the regional level, as noted in the Regional Development Program of Eastern Macedonia and Thrace 2021-2025[14], the region's GDP declined from 2010 (€9.2 billion) to 2017 (€6.95 billion), following the national pattern of the Greek economic crisis. According to data from the European Statistical Office (Eurostat), the GDP of Eastern Macedonia and Thrace has recovered after the end of the pandemic, reaching €8.12 billion in 2022, which corresponds to 3.93% of the national GDP (8th among the regions).

The GDP of each region in 2022, as well as the evolution of the GDP of Eastern Macedonia and Thrace between 2011 and 2022, are shown in the following figures.

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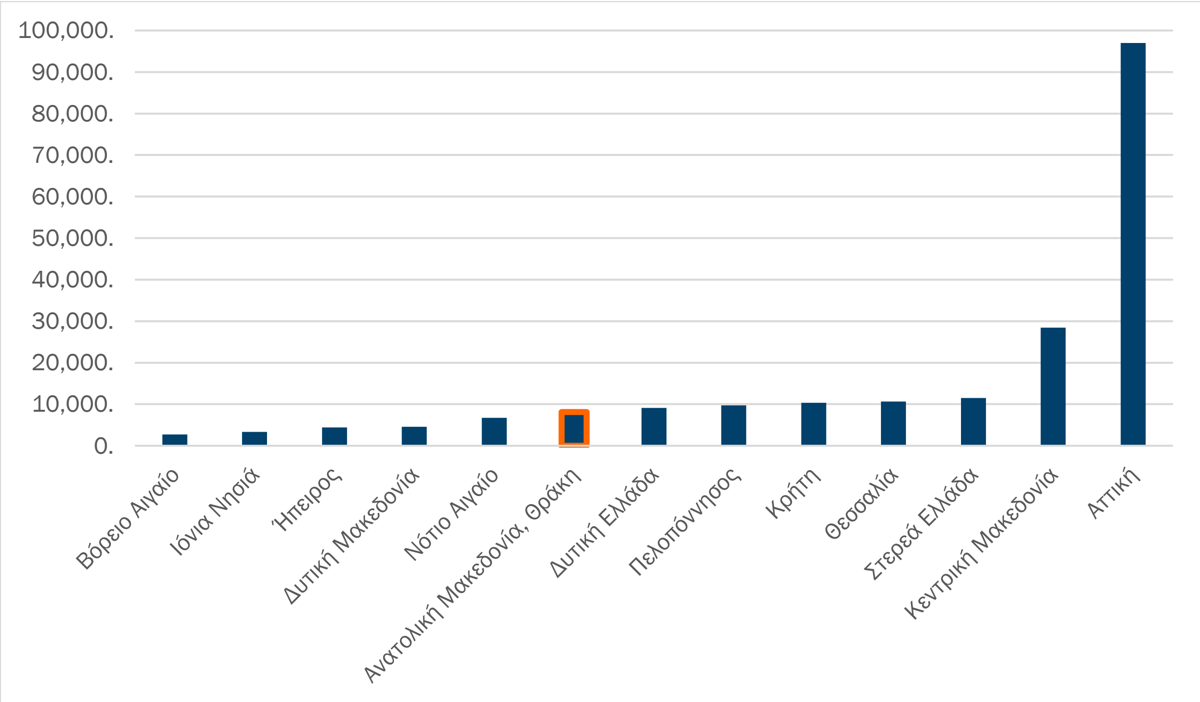
[10] *https://www.bankofgreece.gr/enimerosi/grafeio-typoy/anazhthsh-enhmerwsewn/enhmerwseis?announcement=fc915812-ab24-47ab-9e60-a566653a1f42*

[11] *https://www.enterprisegreece.gov.gr/h-ellada-shmera/giati-ellada/h-ellhnikh-oikonomia*

[12] *Reports of the Governor of the Bank of Greece 2022 & 2023, https://www.bankofgreece.gr/ekdoseis-ereyna/ekdoseis/ekthesh-dioikhth*

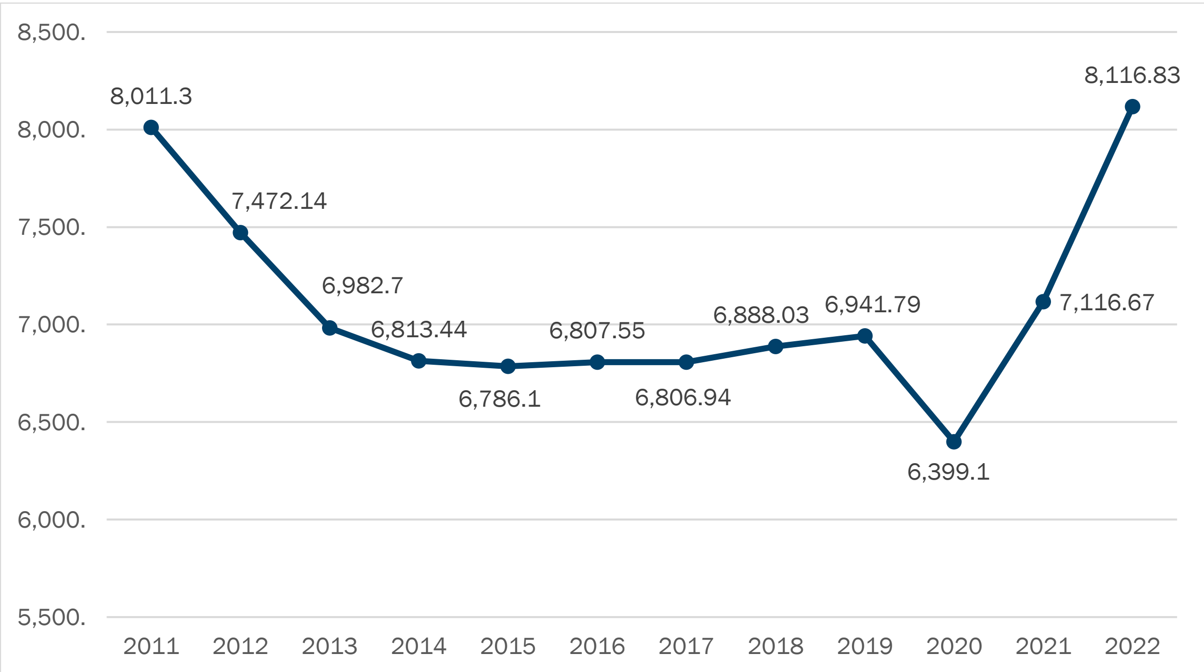
[13] *https://economy-finance.ec.europa.eu/economic-surveillance-eu-economies/greece/economic-forecast-greece_el*

[14] https://www.eydamth.gr/#



(Source: Eurostat)

Figure 8–104: GDP Evolution of Regions in 2022 (million €)



(Source: Eurostat)

Figure 8–105: Evolution of the GDP of the Region of Eastern Macedonia and Thrace between 2011 and 2022 (million €)

According to the 2021 Report of the Small Business Institute – General Confederation of Professionals, Craftsmen, and Merchants of Greece (IME GSEVEE)[15], at the level of Regional Units, in 2018, the Regional Units of Kavala and Thasos accounted for 27% of the Region's GDP, compared to the GDP of the Evros Regional Unit. During the economic crisis, between 2008 and 2016, the GDP of the Kavala and Thasos Regional Units combined decreased by 31.3%, from €2.571 billion in 2008 to €1.767 billion in 2016. <u>This decline is significantly higher than both the average reduction of the Region of Eastern Macedonia and Thrace (-28.1%), the average of Northern Greece (-26.5%), and the national average (-28%).</u>

Regarding the development dynamics of the Region of Eastern Macedonia and Thrace, according to the recent report by the Foundation for Economic & Industrial Research (IOBE) on social and economic trends in Greek regions[16], between 2019 and 2021, <u>the Region managed to recover its pre-pandemic GDP level. In 2021, it also recorded the second-highest change in Gross Value Added (GVA) compared to the pre-pandemic level, with an increase of +3.1%.</u>

The EU Regional Competitiveness Index (RCI) measures a region's ability to offer an attractive environment for both businesses and residents. According to the latest edition updated in 2023[17], while the competitiveness of the Greek economy as a whole has significantly improved compared to 2016, it still lags considerably behind the EU average (73.1 for Greece versus 99 for the EU-27). At the level of the Region of Eastern Macedonia and Thrace, in contrast to its developmental dynamics in terms of GDP, the RCI is the second-lowest nationally (56.2), ranking the region 225th out of 234 regions in the EU.[18].

In the Region of Eastern Macedonia and Thrace, there are significant resources that continue to constitute key production factors and, at the same time, opportunities for business and productive activities, such as: non-metallic minerals, geothermal fields, high-productivity land, forest and water resources. <u>The economy is characterized by a production model oriented mainly towards the agricultural sector and the processing of strong inputs from the primary sector, as well as a significant accumulation of invested capital, mainly in the form of infrastructure.</u>

8.11.2.1.1 Primary Sector

According to the "Eastern Macedonia and Thrace" 2021-2027[19], Program, the Region of Eastern Macedonia and Thrace has historically shown economic specialization in the agricultural sector, with the share of Gross Value Added (GVA) nearly double the national level. This highlights a significant interconnection between the primary sector and the other two productive sectors (manufacturing and tourism). In fact, it was the second

[15] https://imegsevee.gr/wp-content/uploads/2021/05/meta-covid-kavala.pdf
[16] https://iobe.gr/docs/research/RES_01_11032024_REP_GR.pdf
[17] https://ec.europa.eu/regional_policy/assets/regional-competitiveness/index.html#/
[18] https://ec.europa.eu/regional_policy/assets/regional-competitiveness/index.html#/
[19] https://www.eydamth.gr/images/site_2017/ArticleID_516/ProgrammaPAMTH_2021_2027.pdf

region in the country after the Peloponnese in terms of the highest percentage of employment in the primary sector (25% in 2019), which was more than double the corresponding national figure (11% in 2019).

However, regarding the productivity of the primary sector, the region ranks lowest in the country and is also below the EU average. This is partly due to the characteristics of the workforce (advanced age, insufficient level of professional training and specialization), the absence of scientific and technical support for the production process, the reluctance of young people to work in agriculture, and the lack of collaboration among producers.

In the agriculture and livestock sector, according to the 2021 ELSTAT census data, the **Utilized Agricultural Area (UAA)** in Greece is estimated at 28,244,494.8 stremmata (1 stremma = 0.1 hectares). In the Region of Eastern Macedonia and Thrace, the UAA decreased by 10.8% between 2009 and 2020, reaching 3,092,124.2 stremmata, with an average UAA per holding of 87.1 stremmata..

The following table presents the number of agricultural holdings and the utilized agricultural area for the entire country and for the Region of Eastern Macedonia and Thrace.

Table 8–70: Number of agricultural holdings and utilized agricultural area, 2020 (stremmas)

Geographical Unit	Number of Holdings	Holdings with Utilized Agricultural Area	Holdings with Irrigated Area	Irrigated Area (stremmas)	Utilized Agricultural Area (stremmas)
Greece	530.679	525.284	326.256	9.606.841,1	28.244.494,8
Eastern Macedonia and Thrace	36.188	35.512	3.092.124,2	26.950	3.092.124,2

(Source: ELSTAT, 2021)

The distribution of holdings by main categories of use in the Region of Eastern Macedonia and Thrace, and their changes between the years 2009 and 2020, are presented in the **table** below.

Table 8–71: Distribution of holdings by main categories of use, 2009–2020, in stremmata

Main category of use	2009	2020	Change
Arable crops	41.606	28.125	-32,4 %
Vineyards and raisin vineyards	4.678	3.654 -	-21,9 %
Tree crops	14.465	12.686	-12,3 %
Greenhouses	252	280	+11,1 %
Other areas	25.815	22.438	-13,1 %

(Source: ELSTAT, 2021)

In the livestock sector, in the Region of Eastern Macedonia and Thrace, according to the 2021 ELSTAT census data, in 2020 there were 156,421 livestock units in operation, showing a decrease of 28% compared to 2009. The majority of the units concern poultry farming and sheep production, as shown in the table **below.**

Table 8–72: Holdings with animals, by type of animal, 2009–2020

Main category of use	2009	2020	Change
Cattle	3.373	1.919	-43,1 %

Main category of use	2009	2020	Change
Sheep and goats	4.220	2.537	-39,9 %
Goats	2.877	1.735	-39,7 %
Pigs	1.152	284	-75,3 %
Poultry	19.839	6.635	- 66,6 %

(Source: ELSTAT, 2021)

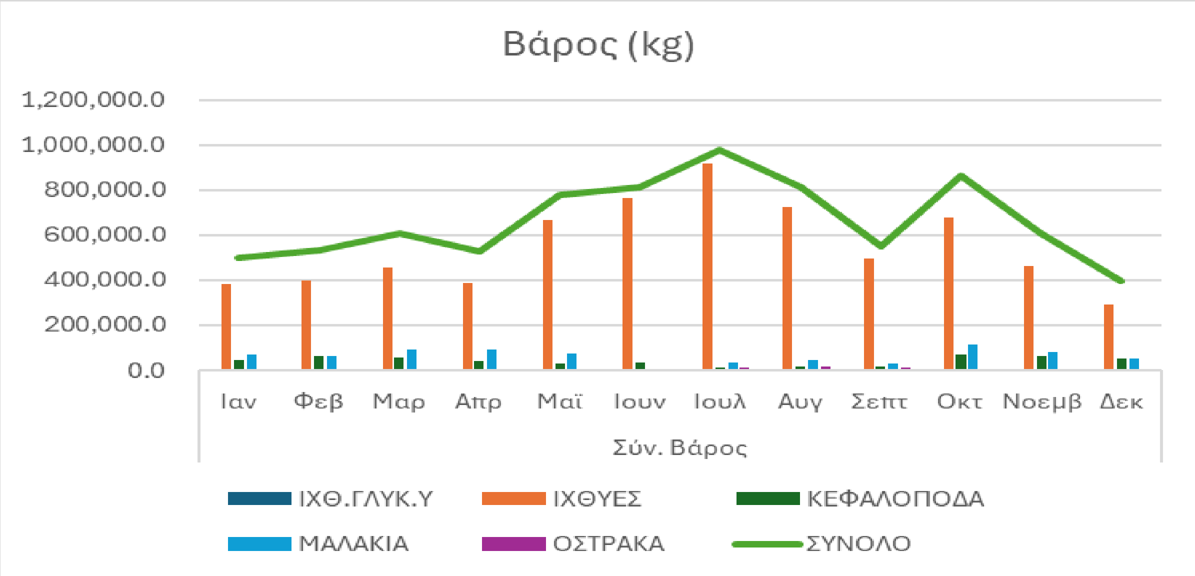
The fisheries and aquaculture sector is particularly dynamic, showing growth across all Regional Units of the Region. Fish farming and shellfish farming units are mainly located in the coastal wetlands, with smaller numbers in inland waters. The coastal fishing sector is also an important productive branch for the Region, present in all Regional Units with a maritime front. According to the results of the 2022 Survey of Marine Fisheries with Motorized Vessels, the largest quantities of the country's catches are found in the fishing areas of the Strymonikos and Kavala Gulfs, the coasts of Thasos Island, and the Thracian Sea, totaling 16,299.2 tons, which accounts for 25,0%[20] f the national catch.

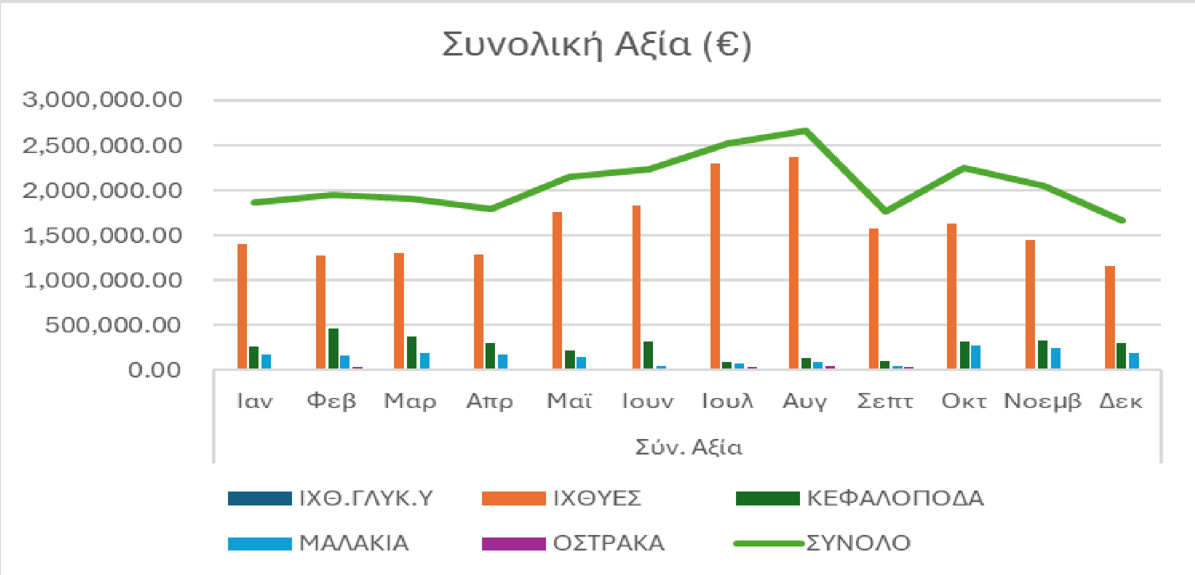
As stated in the Strategic Plan of the Municipality of Kavala 2023[21], in domestic production, the most notable quantities come from freshwater aquaculture—particularly rainbow trout, among fish, anchovy, sardine, cod, red mullet, and farmed gilthead seabream, among cephalopods, octopus and musky octopus, among mollusks, deepwater pink shrimp and among shellfish, the Mediterranean mussel. The following figures present the weight and total value of catches related to the Kavala Fish Auction, according to data from the Hellenic Central Markets and Fisheries Organisation (OKAA) for 2023[22].

[20]https://www.statistics.gr/el/statistics?p_p_id=documents_WAR_publicationsportlet_INSTANCE_qDQ8fBKKo4lN&p_p_lifecycle=2&p_p_state=normal&p_p_mode=view&p_p_cacheability=cacheLevelPage&p_p_col_id=column-2&p_p_col_count=4&p_p_col_pos=1&_documents_WAR_publicationsportlet_INSTANCE_qDQ8fBKKo4lN_javax.faces.resource=document&_documents_WAR_publicationsportlet_INSTANCE_qDQ8fBKKo4lN_ln=downloadResources&_documents_WAR_publicationsportlet_INSTANCE_qDQ8fBKKo4lN_documentID=506607&_documents_WAR_publicationsportlet_INSTANCE_qDQ8fBKKo4lN_locale=el

[21] https://kavala.gov.gr/getattachment/o-dimos/diafaneia-sto-dimo/epixeirisiako-programma/%CE%95%CF%80%CE%B9%CF%87%CE%B5%CE%B9%CF%81%CE%B7%CF%83%CE%B9%CE%B1%CE%BA%CF-%CE%A0%CF%81%CE%BF%CE%B3%CF%81%CE%B1%CE%BC%CE%BC%CE%B1-%CE%94%CE%B7%CE%BC%CE%BF%CF%85-%CE%9A%CE%B1%CE%B2%CE%B1%CE%BB%CE%B1%CF%82-2021-2023-%CE%91-%CE%A6%CE%91%CE%A3%CE%97.pdf

[22] https://www.okaa.gr/gr/organismos/open-data/





(Source: Hellenic Organization of Central Markets and Fisheries S.A., 2023)

Figure 8–106: Aggregate Fisheries Catch Statistical Bulletins (2023)

Fisheries Restricted Areas (FRAs) are geographically defined areas where all or certain fishing activities are prohibited or restricted, either temporarily or permanently, in order to improve the conservation and sustainable exploitation of living aquatic resources and to protect marine ecosystems.

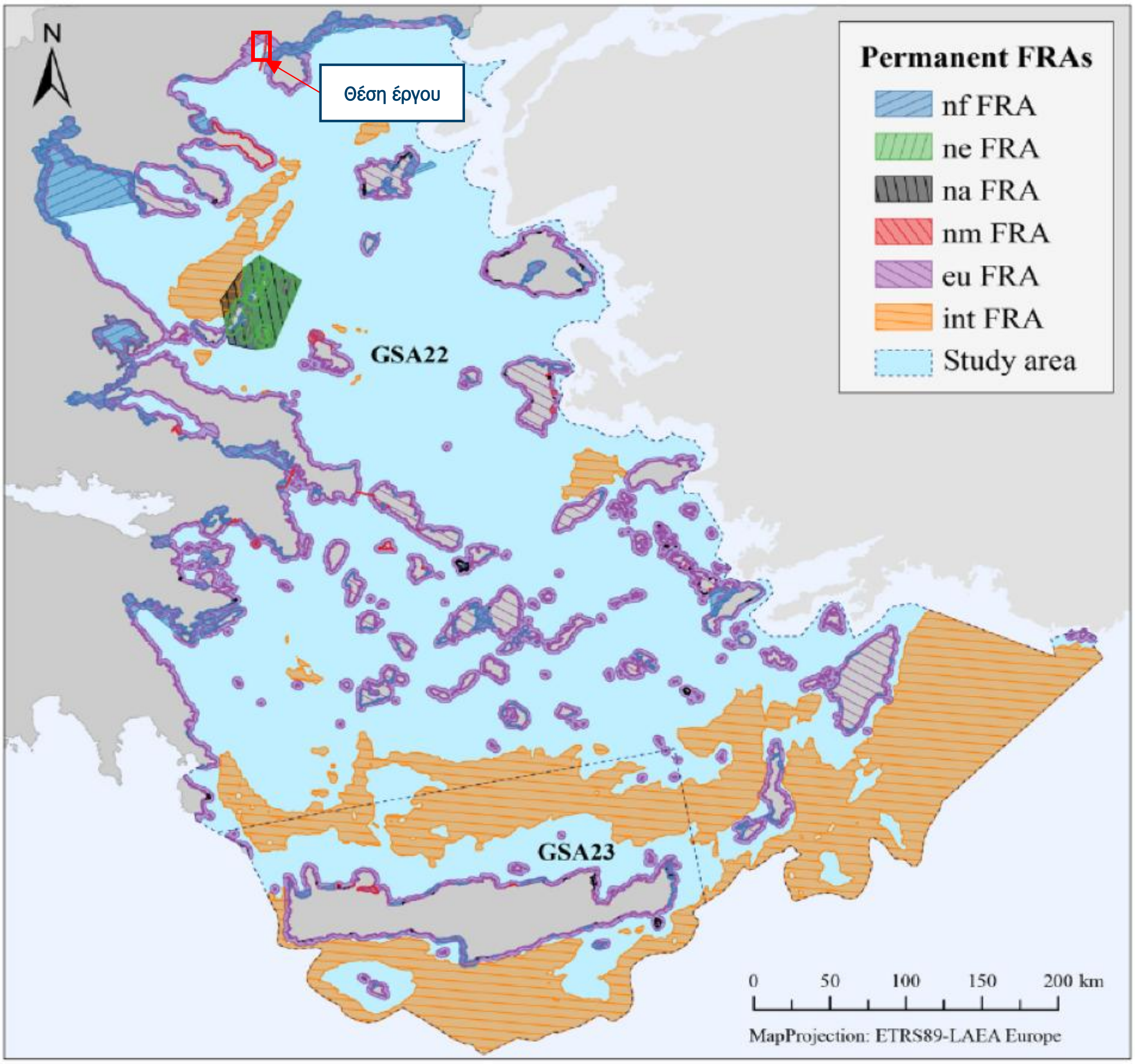
The Fishing Restricted Areas (FRAs), according to a study whose results have been published in the journal *Mediterranean Marine Science*, include[23]:

- FRAs established by national restrictions on fishing activities issued under fisheries legislation (nfFRAs)

[23] https://maritime-spatial-planning.ec.europa.eu/practices/reviewing-and-mapping-fisheries-restricted-areas-aegean-sea

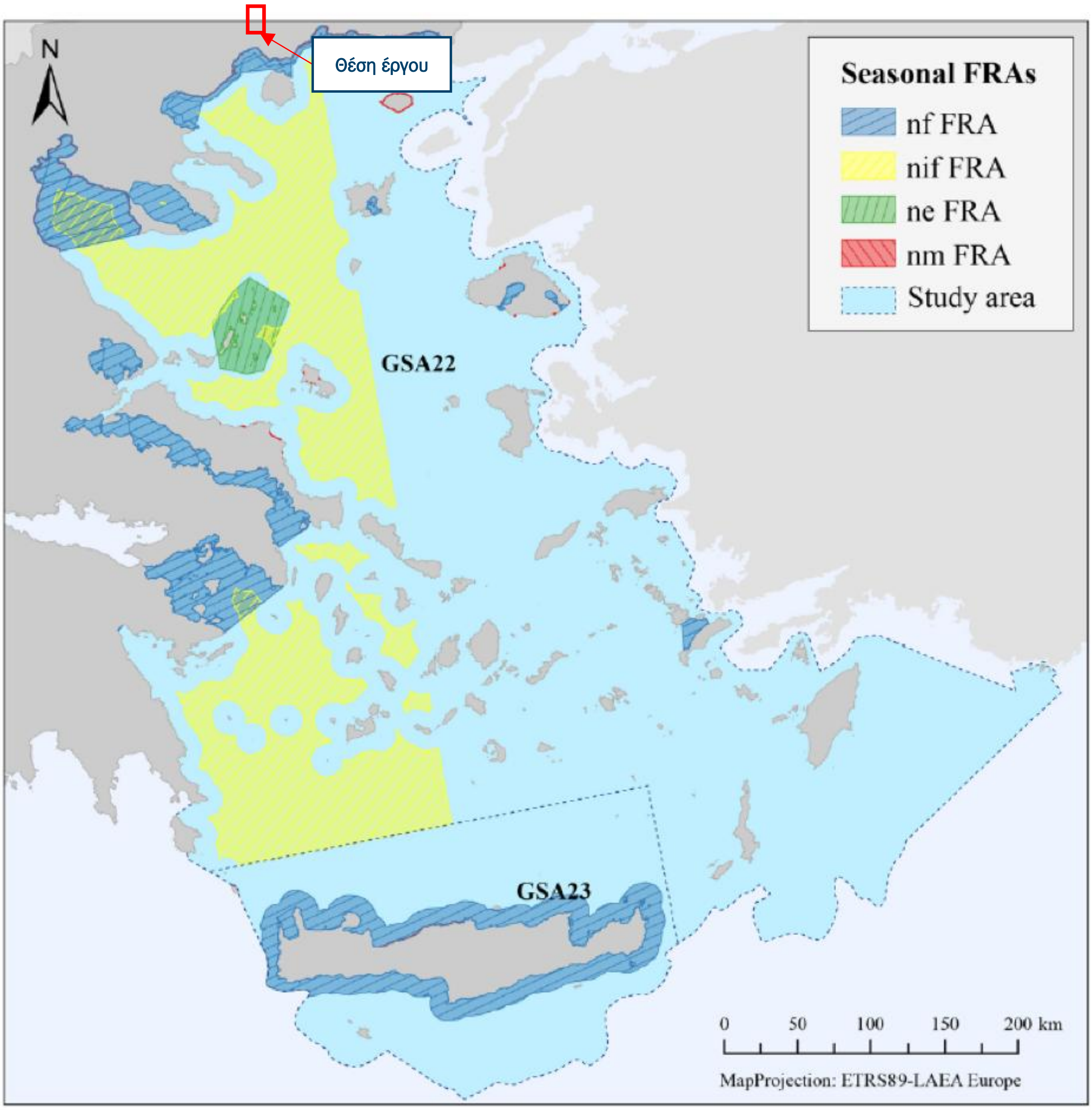
- FRAs established under national environmental legislation related to nature protection areas (neFRAs)
- FRAs established under national archaeological legislation (naFRAs)
- FRAs established under national maritime legislation (nmFRAs)
- FRAs established by the European Union (eu-FRAs)
- FRAs established by international fisheries organizations (intFRAs)

The **figure** below depicts the permanent and seasonal FRAs..



(Source: https://maritime-spatial-planning.ec.europa.eu/practices/reviewing-and-mapping-fisheries-restricted-areas-aegean-sea)

Figure 8–107: Permanent Fishing Restricted Areas (FRAs)



(Source: https://maritime-spatial-planning.ec.europa.eu/practices/reviewing-and-mapping-fisheries-restricted-areas-aegean-sea)

Figure 8–108: Seasonal Fishing Restricted Areas (FRAs)

Table 8–73: Local Restrictions in the Jurisdiction of the Port Authority of Kavala

Prohibition	Relevant Legislation
Fishing with any type of stationary fishing gear (nets, traps, longlines) is prohibited from June 15 to September 15 each year at a distance of less than 300 m from the shore.	A.P.: 3111.4β/4/96/18-07-1996, Decision of K.L. Kavala
Entry of any person, vessel, submarine, or floating craft into the safety maritime zone of the platforms is prohibited at a distance of 500 meters radially, throughout the year	Article 10 E.K.L. No. 03 / 24-01-1980 (Government Gazette 63B'/1980)
Fishing over seabeds with marine vegetation, especially *Posidonia oceanica* or other marine phanerogams, is prohibited	KAN EK 1967/2006, Ministerial Decision 167378/2007 (Government Gazette 241D)
Bottom trawling is prohibited at a distance of two (2) nautical miles from the coasts of Thrace – Eastern Macedonia (from the Evros River estuaries to the Ierissos Gulf) from March to November each year	Article 5 §2 of Royal Decree 917/66 (Government Gazette 248A)
Mechanical trawling is prohibited in the Gulf of Kavala (inside the line connecting Cape Vrasidas, Eleftheres Bay, Pachy Thasos, and the line connecting Cape Kalogeros, Thasos, to the estuaries of the Nestos River) from April to October each year	Article 10 §1 of Royal Decree 917/66 (Government Gazette 248A)
Mechanical trawling is prohibited at a distance of 3 nautical miles radially from the estuaries of the Nestos River	Article 7 §1 of Royal Decree 917/66 (Government Gazette 248A)
Fishing with trawl nets is prohibited within a 3 nautical mile radius from the estuaries of the Strymon River	Article 7 §1 of Royal Decree 917/1966 (Government Gazette 248A)
Recreational fishing (using rods, lines, handlines, etc.) from land is prohibited in the Thasos port area: a) Eastern breakwater of the marina (Red Lighthouse), b) Along the entire length of the inclined ramps of the new ferry port, c) In the section of the old port from the height of "Angelika" Hotel to the café-bar "Karanti", Period: May 1 – September 30 of each year	Protocol No.: 2134.1/01/10/29-10-2010 – Decision of the Kavala Port Authority
Recreational fishing (using rods, lines, handlines, etc.) from land is prohibited in the Keramoti port area from the Keramoti pier up to the commercial port, except for the commercial port itself, where fishing is allowed only in the area between the port guardhouse and the commercial port, and within 50 meters. All year round	Protocol No.: 2134.1/11/11/18-10-2011 – Decision of the Kavala Port Authority
Fishing with trawl nets, dredges, purse seines, or similar nets operated from a vessel is prohibited in the Keramoti maritime area of Kavala, which is defined as within the first 20 meters of depth measured from the coastline and between coordinates 24°43.102'E and 24°48.056'E.	Ministerial Decision No.: 2886/142447 /26-02-2019 (Government Gazette 105D)
Fishing with trawl nets, dredges, purse seines, nets dragged from a vessel, or similar gear is prohibited in the maritime area of Eastern Thasos (Koinyra), defined within the first depth contour of 30 meters from the shoreline, and between the parallel coordinates 40°40.397'N and 40°38.706'N.	Ministerial Decision No. 2886/142447 / 26-02-2019 (Government Gazette 105D)
Fishing with trawl nets, dredges, purse seines, nets dragged from a vessel, or similar gear is prohibited in Northwestern Thasos within the first depth contour of 20 meters from the shoreline, specifically in the maritime area enclosed by the imaginary line connecting the following points: A: 40 40.878N' 24 31.362'E B: 40 40.998'N 24 30.922'E Γ: 40 48.909'N 24 33.68' E Δ: 40 47.16' N 24 44.691'E E: 40 45.311'N 24 44.637'E	Ministerial Decision No. 2886/142447 / 26-02-2019 (Government Gazette 105D)
Fishing with trawl nets, drag nets (grigri), purse seines or similar nets operated from a vessel is prohibited in the marine area of the Strymonikos Gulf, within the first 30 meters of depth measured from the coastline and between the longitudes 23°47.034'E and 23°52.937'E.	Ministerial Decision No. 2886/142447 / 26-02-2019 (Government Gazette 105D)

Prohibition of Daytime Purse Seine Fishing (Grigri): Fishing using the daytime purse seine (grigri) is prohibited throughout the year in the marine area from the sandy tip of Kavala Gulf to the lighthouse of Porto Lagos Bay, at a distance of 4 nautical miles from the shore, and from Cape Achlada of Imeros, Rhodope, to the lighthouse of Porto Lagos Bay, at a distance of 2 nautical miles from the shore.	PD 1358/1981 (Government Gazette 338 A/81)
Prohibition of All Fishing Except Purse Seines (Grigri) – Seasonal Restriction: From May 1st to May 31st every year, fishing with any fishing gear, except circular nets (Grigri), is prohibited in the marine area defined as follows: **Western boundary:** Starting from the line defined by points A and A' and extending peripherally south of Thasos Island, at a distance of 6 nautical miles from the coastline. **Eastern boundary:** Up to the line defined by points B and B'. **Coordinates:** A: 40.636347 N / 24.513459 E (40°38′10.8″ N / 24°30′48.5″ E) A': 40.691549 N / 24.404509 E (40°41′29.6″ N / 24°24′16.2″ E) B: 40.625510 N / 24.782801 E (40°37′31.8″ N / 24°46′56.1″ E) B': 40.570700 N / 24.891820 E (40°34′14.6″ N / 24°53′30.6″ E)	PD 24/2018 (Government Gazette 51 A)
Prohibition of Any Fishing from Shore or Over Docked Vessels in Central Kavala Port: All forms of fishing from land or over vessels using any fishing gear are prohibited in the central port of Kavala, recreational fishing using rod and line is permitted only in the area between piers No. 1 and No. 3 in front of the Kavala Customs Office, **provided the area is not being used for vessel mooring.,** recreational fishing is completely prohibited when passenger/cargo vessels are docking or when special measures are imposed by the port authority, throughout the year.	Ref. No.: 2132.18/4237/22/25-10-2022 – Decision of the Kavala Port Authority

(Source: Fisheries Control Directorate, https://alieia.hcg.gr/prohibitions/local/KABALA.php)

8.11.2.1.2 Secondary Sector

The secondary sector of production includes mineral resource exploitation, manufacturing (industry and crafts), energy production, and construction (building construction, civil engineering works, etc.). According to the "Eastern Macedonia and Thrace" 2021–2027 Program, the secondary sector employed 12% of the workforce in 2017, while its Gross Value Added (GVA) in the regional economy was approximately 19%. The sector shows a particularly high dependence on the primary sector, as it mainly involves the utilization of agricultural production (food and beverage industry, textiles, tobacco) and quarrying–mining resources, as well as the processing of other raw materials (chemical industries, non-metallic minerals, etc.). The majority of enterprises are small in size.

The structure of the sector includes three main branches: mineral resource exploitation, manufacturing, and construction. Within the first branch, two categories stand out today: oil exploitation in the Regional Units of Kavala and Thasos, and marble quarries in the Regional Units of Kavala and Drama. In recent years, slate quarries in Eleftheroupoli have also emerged, developing in the southeastern part of the Paggaio Mountain in the Regional Unit of Kavala. Manufacturing activities are concentrated along major road axes in organized industrial zones or in clusters of enterprises, with higher density near large urban centers The sector lags in competitiveness compared to neighboring regions and countries, particularly Bulgaria, due to significant differences in taxation and state aid, and Central Macedonia, due to its proximity to major urban centers and multimodal transport networks.

A key characteristic of the sector is prolonged recession, resulting from the closure of large units and the relocation of others to neighboring countries. The few new and dynamic units that are established tend to choose locations outside organized industrial zones, despite the fact that existing Industrial Areas (BIPEs) have both hosting capacity and development prospects. Most of these areas have integrated significant infrastructure (connections to road axes, water and electricity networks, optical fibers, wastewater disposal, and treatment facilities), which provide notable advantages.

8.11.2.1.3 Tertiary Sector

The tertiary sector absorbs the largest share of employment. It includes activities in public administration, scientific and technical services, services related to arts and entertainment, real estate management services, as well as sectors such as trade, accommodation, food services, transportation, and communications, while a very small percentage concerns financial and insurance services.

The trade, hospitality, and recreation sectors experienced an unprecedented downturn due to the pandemic, with incalculable consequences in terms of business viability, employment positions, and reduced consumer purchasing power

The tourism sector shows upward trends in international arrivals, giving it a more dynamic role within the broader Balkan and Mediterranean region. According to the 2022 Annual Report on Competitiveness and Structural Adjustment in Tourism by the Institute of the Greek Tourism Confederation (INSETE)[24], the revenues of the Region of Eastern Macedonia and Thrace from tourism in 2022 accounted for 2% (€508 million) of the country's total revenues, while the direct contribution of tourism to the Region's GDP reached 6%. At the national level, the direct contribution of tourism to Greece's GDP in 2022 was approximately 11.5% or €23.9 billion. According to INSETE's study *"Greek Tourism* 2030"[25], only 1.9% of Greece's travel agencies operate in the Region of Eastern Macedonia and Thrace. Of these, 20.2% are located in the Regional Unit of Thasos, while 18.3% are in the Regional Unit of Kavala. In the Region, only 1.0% of Greece's vehicle rental companies operate, with slightly more than half (50.3%) located in Thasos and 31.8% in Kavala.

The Region increased its workforce in the accommodation and food service sectors by 2.0% between 2010 and 2019, one of the highest rates in the country.

The main beaches are:

- For the Regional Unit of Kavala: Ammoglossa – Keramoti 1, Tosca Beach, Batis, Ammolofos, Nea Iraklitsa, Nea Iraklitsa – Remvi, Nea Peramos, Ofrinio / Touzla, Sarakina, Orfani, Timari, Costa Vita, Psatha, Vrasidas, Almyra, Ocean View, Sarakina, Apollonia
- For the Regional Unit of Thasos: Makryammos, Pefkari 2 / Alexandra Beach, Prinos Dasylio 2 / Ilio Mare Beach, Skala Kallirachis, Skala Marion, Atspas, Fari, Trypiti, Limenaria, Metallia, Pefkari Potou, Pefkari, Potos, Agios Antonios, Rosogremos, Oxya, Psili Ammos, Astris, Salonikios, Giola, Livadi, Arsanas, Thymonia, Skidia, Alyki, Ai Giannis, Paradeisos, Loutros, Koinyra, Krini, Chrysi Akti,

[24] https://insete.gr/wp-content/uploads/2020/05/23-12_Eastern_Macedonia_Thrace.pdf
[25] https://insete.gr/wp-content/uploads/pdf/perifereies/an-makedonia-and-thraki-analusi.pdf

Skala Potamias, Chrysi Ammoudia, Vathi, Marmaradika, Saliara, Archangelos, Agios Vasileios, Nysteri, Glyfada, Glykadi, Glyfoneri, Pachys, Skala Rachoniou, Skala Sotiros, Limenas Thasou

The passenger port of Kavala, "APOSTOLOS PAVLOS," serves as the main cruise ship reception port in the Region of Eastern Macedonia and Thrace. Floating docks have been installed, allowing the mooring of recreational boats: 68 berths for boats longer than 10 m, 115 berths for boats shorter than 10 m, and 16 berths for boats of any length. Thasos has a marina with 280 berths. Additionally, the Region hosts three shelters or anchorages for tourist boats (two in Thasos and one in Kavala) with a total of 184 berths.

In 2023, Kavala Airport recorded a 19% increase in arrivals, and on the island of Thasos, ferry traffic increased by 17%, according to data released by the Central Port Authority of Kavala. Over two million passengers traveled to and from Thasos via the Keramoti–Limenas route. At the main passenger port "Apostolos Pavlos," a total of 35 cruise ships docked in 2023, carrying more than 20,000 passengers.

The **table** below presents the turnover of businesses in the Accommodation and Food Services sectors in the regional units of Kavala and Thasos.

Table 8–74: Turnover of businesses in the Accommodation and Food Services sectors, 2019–2023

Regional Unit	2019	2020	2021	2022	2023
Thasos	€ 32,714,362	€ 9,232,867	€ 24,933,595	€ 37,201,866	€ 45,241,822
Kavala	€ 15,370,596	€ 8,063,903	€ 11,278,329	€ 20,453,089	€ 28,351,321

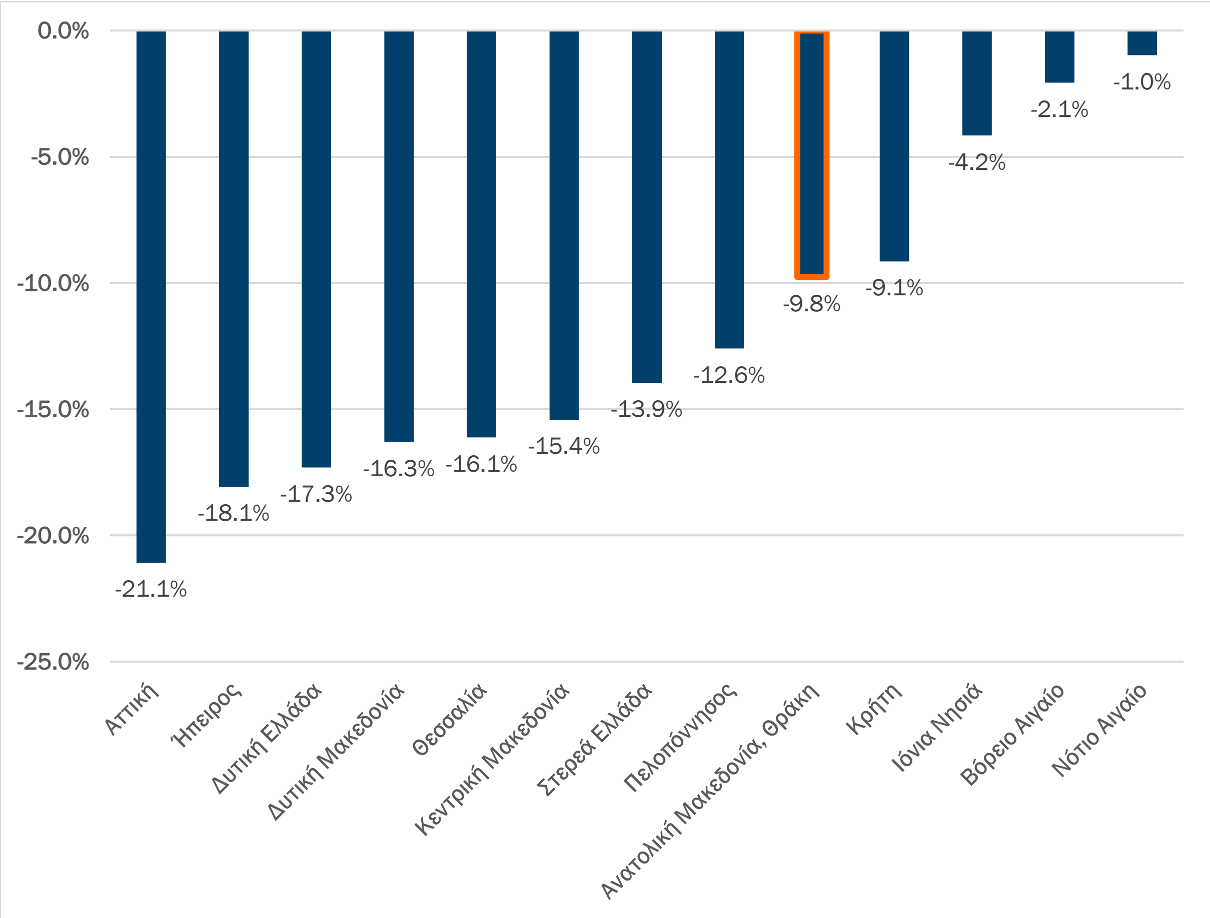
(Source: ELSTAT)

8.11.2.2 Employment and Unemployment

Employment and good working conditions support economic stability, the development of social networks, and health. Employment data also serve as an important barometer of a region's economic activity and help in understanding its current and future trajectory. Below are data related to the labor market and working conditions

According to the OECD Report on Regional Policy for Greece after 2020[26], between 2007 and 2018, the economic crisis caused significant job losses in Greece, totaling approximately 725,000 positions. Ten out of the 13 regions in Greece employed 9% to 20% fewer people in 2018 than in 2007. In the Region of Eastern Macedonia and Thrace, job losses reached 9.8%.

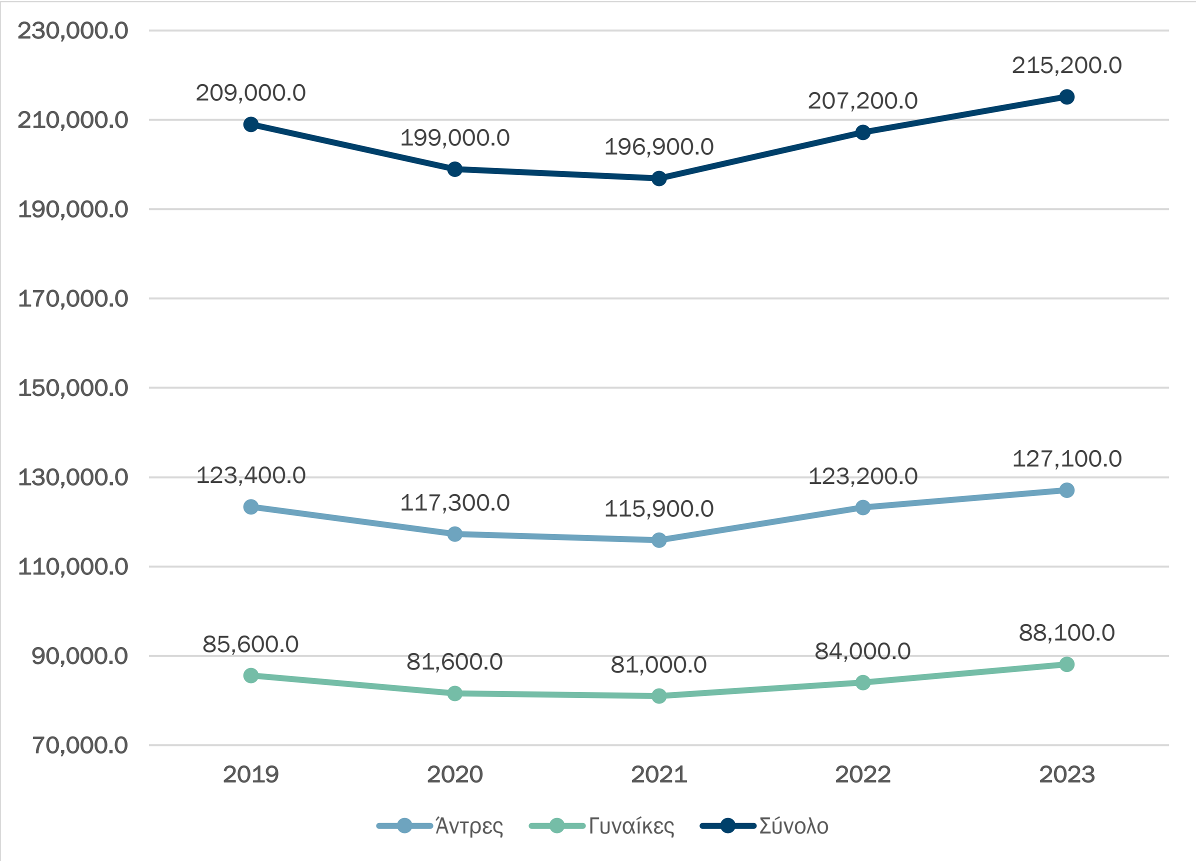
[26] *OECD (2020), Regional Policy for Greece Post-2020, OECD Territorial Reviews, OECD Publishing, Paris, https://doi.org/10.1787/cedf09a5-en.*



(Source: OECD)

Figure 8–109: Changes in employment by Region, 2007–2018

Employment of 15-64 year-olds in the Region of Eastern Macedonia and Thrace showed a gradual increase between 2015 and 2019. However, the dual crises—a health crisis (COVID-19) and the subsequent economic crisis—caused significant new negative impacts on the labor market. Below is the evolution of employment (15-64 years) from 2019 onwards.



(Source: Eurostat)

Figure 8-110: Evolution of Employment (Ages 15-64) and Gender Distribution in the Region of Eastern Macedonia and Thrace, 2019-2023

ELSTAT conducts the Labor Force Survey every year, which, in addition to employment data, includes estimates of the population, the economically active population, employment and unemployment indicators, among others. The Economically Active Population constitutes the labor force of the economy and includes individuals aged 15 and over who are both able and willing to work. People over 15 years old represented 85% and 86% of the country's population in 2015 and 2020, respectively, of which 52% and 51% in 2015 and 2020, respectively, comprised the economically active population. In 2023, this percentage is estimated at 52.2%.

Regarding the economically active population in the individual regions, in the Region of Eastern Macedonia and Thrace, the percentage for 2023 reaches 50.1%, ranking the region 5th from the bottom among the 13 regions.

According to ELSTAT data, the three sectors that employed the largest number of workers in the Region of Eastern Macedonia and Thrace in 2021 were: 1) wholesale and retail trade, repair of motor vehicles and motorcycles, transportation and storage, accommodation and food service activities, 2) public administration and defense, education, human health and social work activities and 3) agriculture, forestry and fishing.

Table 8-75: Gross Value Added and Employment by sector in the Region of Eastern Macedonia and Thrace, 2021

Sector	GVA (Current prices, in million €)	Employed persons
Agriculture, Forestry and Fishing	485	56.925,6
Mining and Quarrying, Manufacturing, Electricity, Gas, Steam and Air Conditioning Supply, Water Supply, Sewerage, Waste Management and Remediation Activities	1,301	20.138,5
Construction	105	8.294,4
Wholesale and Retail Trade, Repair of Motor Vehicles and Motorcycles, Transportation and Storage, Accommodation and Food Service Activities	1.294	62.141,0
Information and Communication	101	2.381,2
Financial and Insurance Activities	166	2.320,4
Real Estate Activities	663	576,2
Professional, Scientific and Technical Activities, Administrative and Support Service Activities	176	12.600,0
Public Administration and Defense, Education, Human Health and Social Work Activities	1,749	61.051,4
Arts, Entertainment and Recreation, Other Service Activities, Activities of Households as Employers, Undifferentiated Goods- and Services-Producing Activities of Households for Own Use, Activities of Extraterritorial Organizations and Bodies	159	7.262,4

(Source: ELSTAT)

The table below presents the employment situation for the Region of Eastern Macedonia and Thrace in the 4th quarter for the years 2020 to 2023[27],[28],[29],[30].

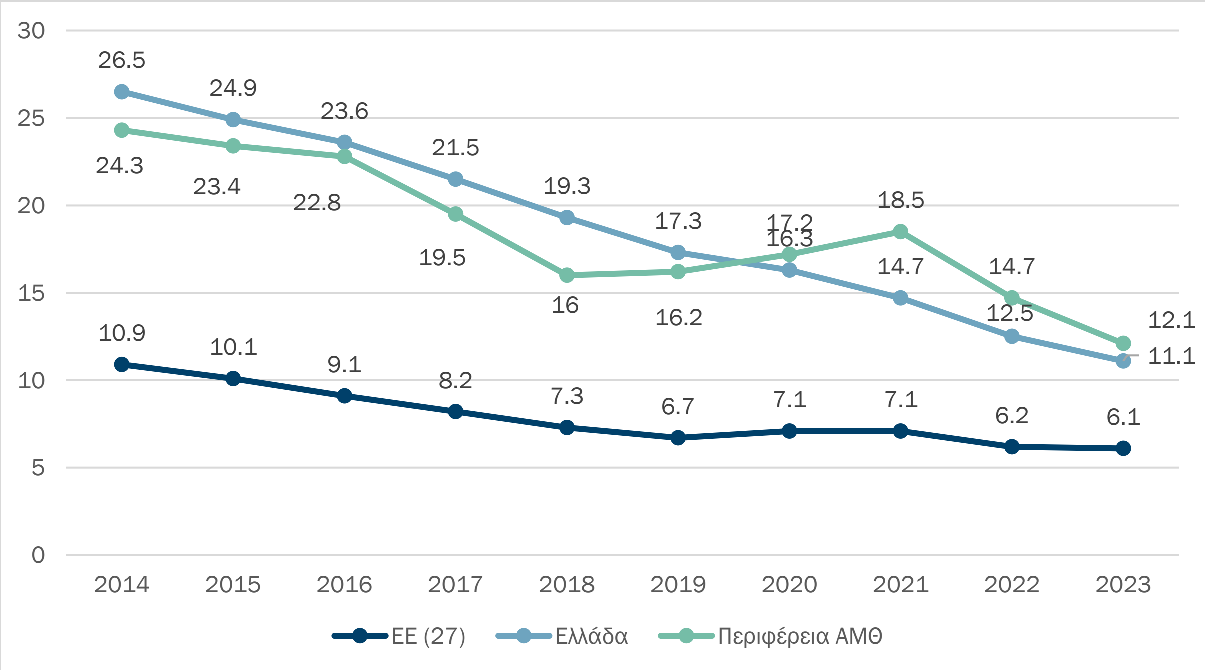
Table 8-76: Employment status in the Region of Eastern Macedonia and Thrace, 4th quarter 2020-2023

	Employed (In thousands)	Unemployed (In thousands)	Persons outside the labor force (In thousands)	Unemployment rate	Labor force participation rate
4th quarter 2020	202,0	43,3	260,5	17,7%	48,5%
4th quarter 2021	210,1	39,1	256,2	15,7%	49,3%
4th quarter 2022	217,4	34,7	252,8	13,8%	49,9%
4th quarter 2023	227,8	24,6	252,3	9,7%	50,0%

[27] https://www.statistics.gr/el/statistics/-/publication/SJO01/2020-Q4
[28] https://www.statistics.gr/el/statistics/-/publication/SJO01/2021-Q4
[29] https://www.statistics.gr/el/statistics/-/publication/SJO01/2022-Q4
[30] https://www.statistics.gr/el/statistics/-/publication/SJO01/2023-Q4

(Source: Source)

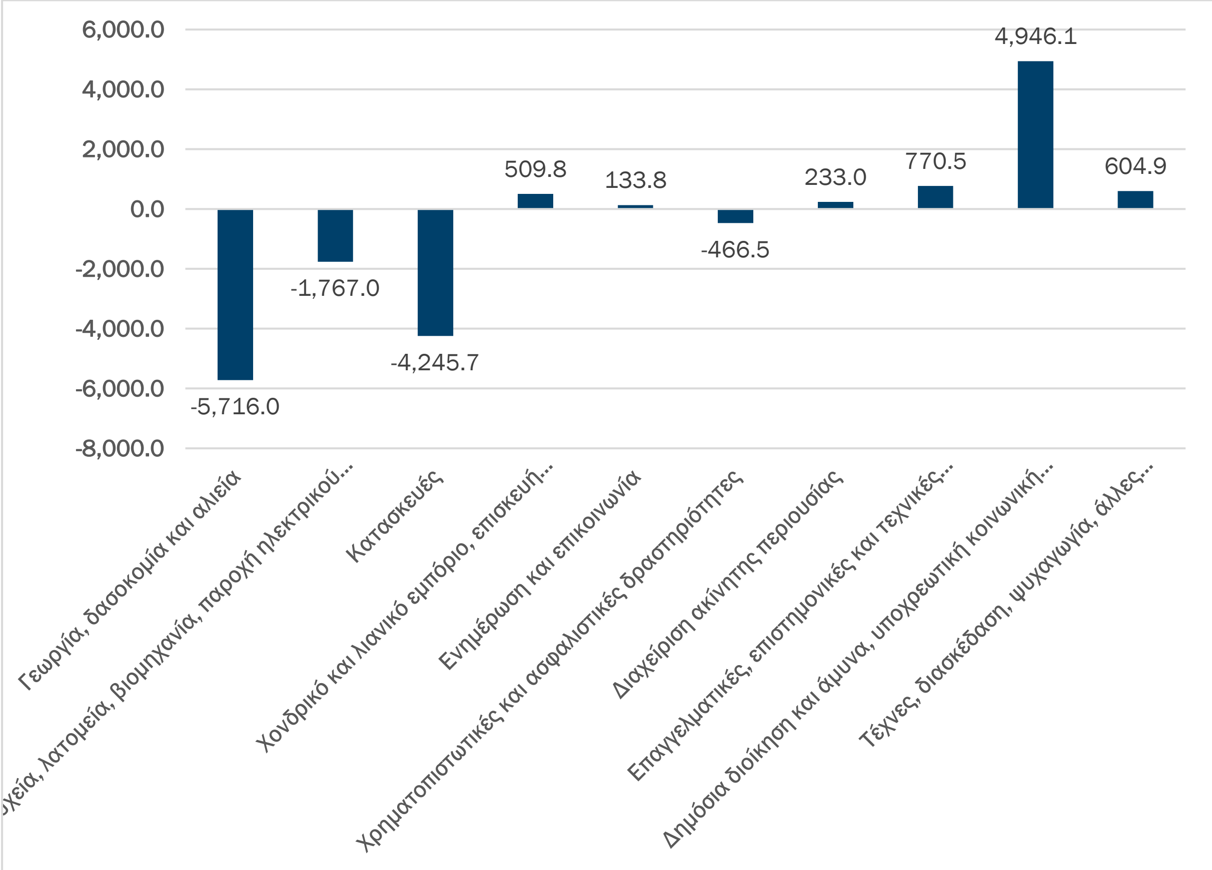
The successive crises have also negatively affected unemployment levels in the Region of Eastern Macedonia and Thrace. Despite the recovery, the Region's unemployment levels remain higher than the national rate and significantly above the EU average, as shown in the **figure** below.



(Source: Eurostat)

Figure 8–111: Unemployment rate trends (%) 2014–2023

Between 2010 and 2021, the largest decrease in the number of employed persons was recorded in the construction sector and in agriculture, forestry, and fishing (−4,245 and −5,716 respectively), while the largest increase was recorded in the sector of Public Administration and Defense, Education, Human Health, and Social Work activities (+4,946).



(Source: EISTAT)

Figure 8–112: Changes in the number of employed persons by sector, 2010–2021

At the Regional Unit level, according to the Operational Program of the Municipality of Kavala 2023[31]

- Before the economic crisis, unemployment in the Regional Unit of Kavala had reached 9.4% in 2008, higher than the national rate of 7.8%.
- During the crisis, for example in 2013, unemployment in the Regional Unit of Kavala rose to 23.2%, but this increase was smaller than the national rise
- After 2015, unemployment in the Regional Unit of Kavala began to decline at a faster rate than both the national average and that of the Region of Eastern Macedonia and Thrace, reaching 10.1% in 2019.

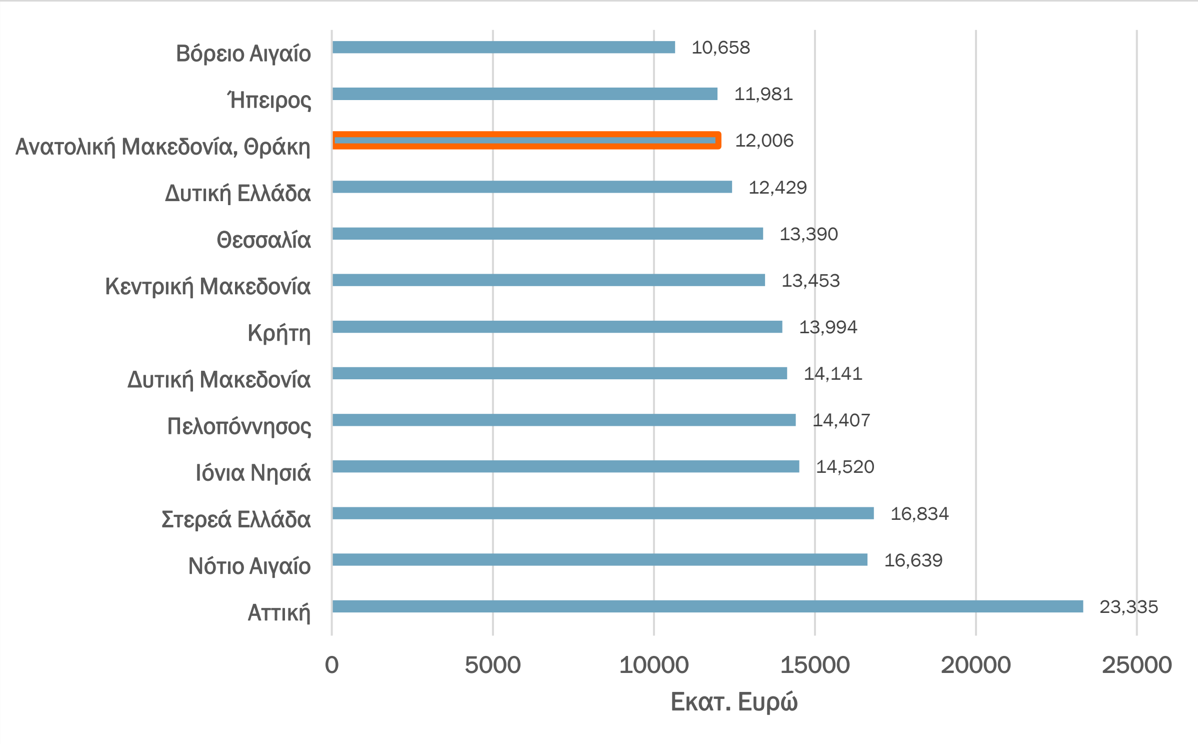
Comparatively, the unemployment pattern in the Regional Unit of Kavala follows that of less agricultural areas. That is, while regions with a higher share of agricultural production experienced a smaller increase in unemployment during the crisis, as the country emerged from the crisis, after 2015–2016, the regions with a larger share in the secondary and tertiary sectors experienced a greater decline in unemployment.

[31] https://kavala.gov.gr/getattachment/o-dimos/diafaneia-sto-dimo/epixeirisiako-programma/%CE%95%CF%80%CE%B9%CF%87%CE%B5%CE%B9%CF%81%CE%B7%CF%83%CE%B9%CE%B1%CE%BA%CE%BF-%CE%A0%CF%81%CE%BF%CE%B3%CF%81%CE%B1%CE%BC%CE%BC%CE%B1-%CE%94%CE%B7%CE%BC%CE%BF%CF%85-%CE%9A%CE%B1%CE%B2%CE%B1%CE%BB%CE%B1%CF%82-2021-2023-%CE%91-%CE%A6%CE%91%CE%A3%CE%97.pdf

8.11.2.3 Income and Living Conditions

According to the Regional Development Program of the Region of Eastern Macedonia and Thrace 2021-2025[32], per capita GDP, which started at €15,000 in 2010, fell to €11,500 in 2017. The decrease was gradual until 2015 and began to recover from 2016, reaching €11,900 in 2018 (at current prices).

In 2021, the Region of Eastern Macedonia and Thrace ranked third from the bottom in this indicator compared to the other regions of the country, remaining below the corresponding national indicator (€17,058). Notably, its per capita GDP is about half the level recorded for Attica, which holds the highest position.



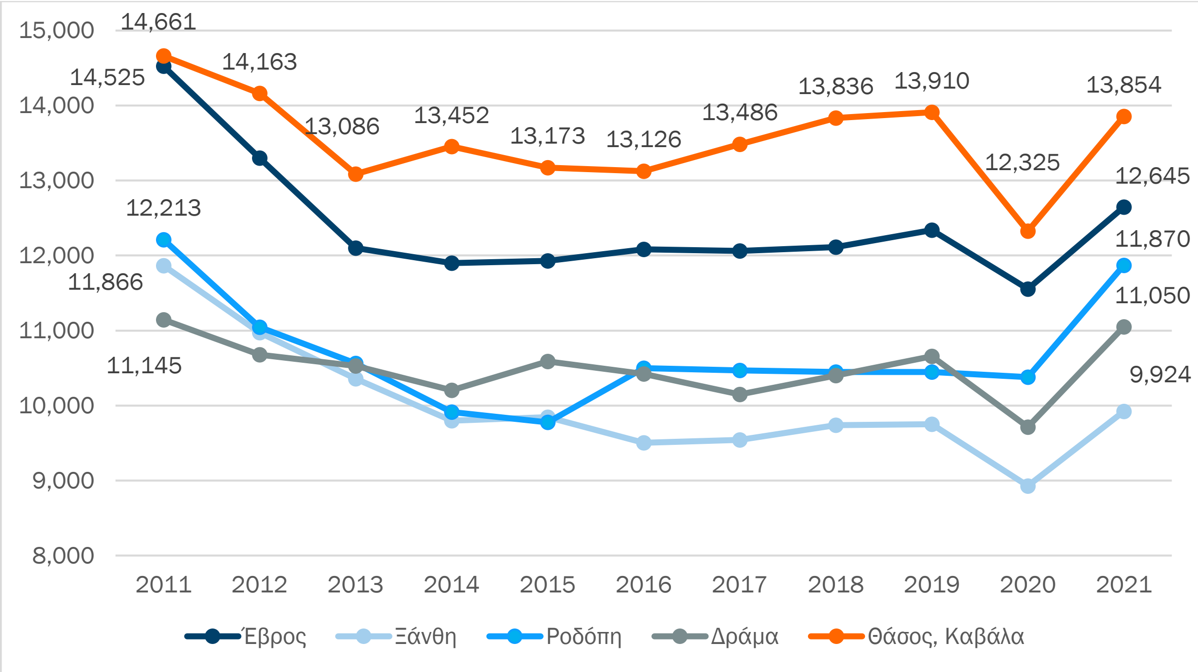
(Source: ELSTAT)

Figure 8-113: Per capita Gross Domestic Product by region, 2021

At the Regional Unit level, according to ELSTAT data, the Regional Unit of Kavala records the highest GDP per capita.

The Regional Units of Kavala and Thasos account for 27% of the Region's Gross Domestic Product, approximately the same level as the GDP of the Regional Unit of Evros.

[32] https://www.eydamth.gr/#



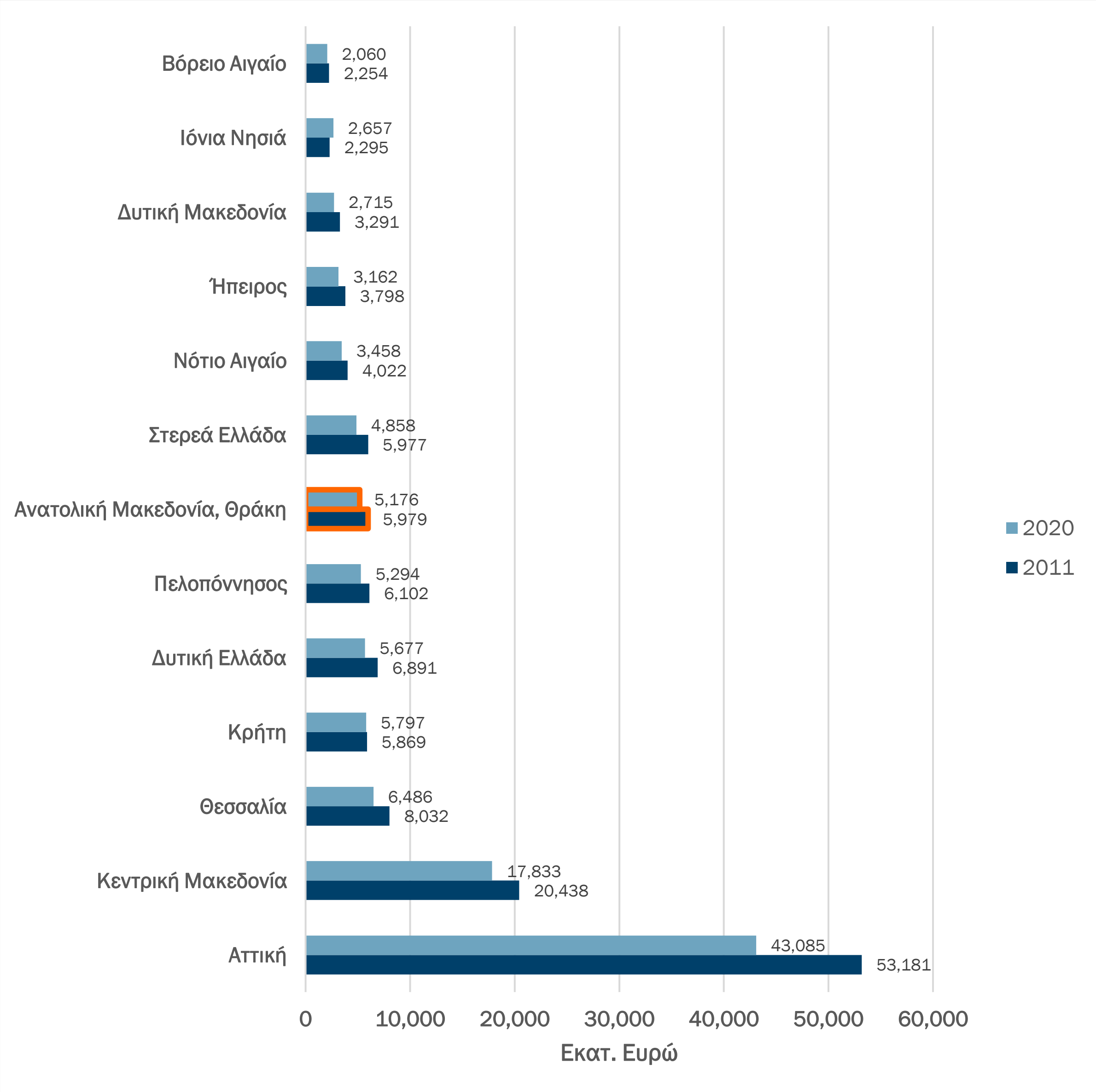
(Source: ELSTAT)

Figure 8–114: Per capita Gross Domestic Product by Prefecture in the Region of Eastern Macedonia and Thrace, 2011–2021

The **Net Disposable Income** of households is the income that a household can spend or save (after paying taxes and social security contributions and receiving social benefits) and is used as an indicator of the standard of living.

According to data from the European Statistical Office[33], the net disposable income of households in the Region of Eastern Macedonia and Thrace amounted to €5,176.45 million in 2020, down from €5,978.95 million in 2011.

[33] *https://ec.europa.eu/eurostat/databrowser/view/NAMA_10R_2HHINC__custom_3644517/default/table?lang=en*



(Source: Eurostat)

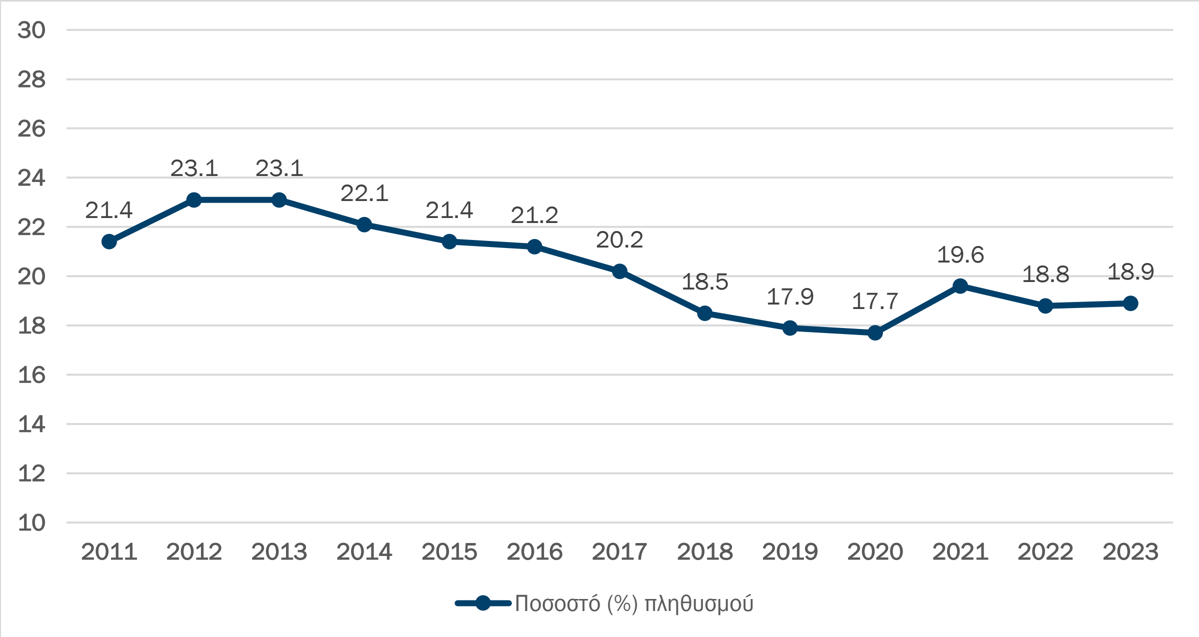
Figure 8–115: Net Disposable Income of Households by Region, 2011–2020

Based on data from the Household Income and Living Conditions Survey (ELSTAT)[34], in 2023 (income reference period 2022), the population at risk of poverty or social exclusion amounted to 26.1% of the country's population (2,658,400 individuals), showing a decrease of 0.2 percentage points compared to

34 https://www.statistics.gr/el/statistics?p_p_id=documents_WAR_publicationsportlet_INSTANCE_qDQ8fBKKo4lN&p_p_lifecycle=2&p_p_state=normal&p_p_mode=view&p_p_cacheability=cacheLevelPage&p_p_col_id=column-2&p_p_col_count=4&p_p_col_pos=1&_documents_WAR_publicationsportlet_INSTANCE_qDQ8fBKKo4lN_javax.faces.resource=document&_documents_WAR_publicationsportlet_INSTANCE_qDQ8fBKKo4lN_ln=downloadResources&_documents_WAR_publicationsportlet_INSTANCE_qDQ8fBKKo4lN_documentID=521338&_documents_WAR_publicationsportlet_INSTANCE_qDQ8fBKKo4lN_locale=el

2022 (26.3%). The poverty threshold is set at €6,030 per year for a single-person household and €12,663 for households with two adults and two dependent children under 14 years of age. It is defined as 60% of the median total equivalent disposable income of households, which was estimated at €10,050, while the average annual disposable income of households in the country was estimated at €18,755.

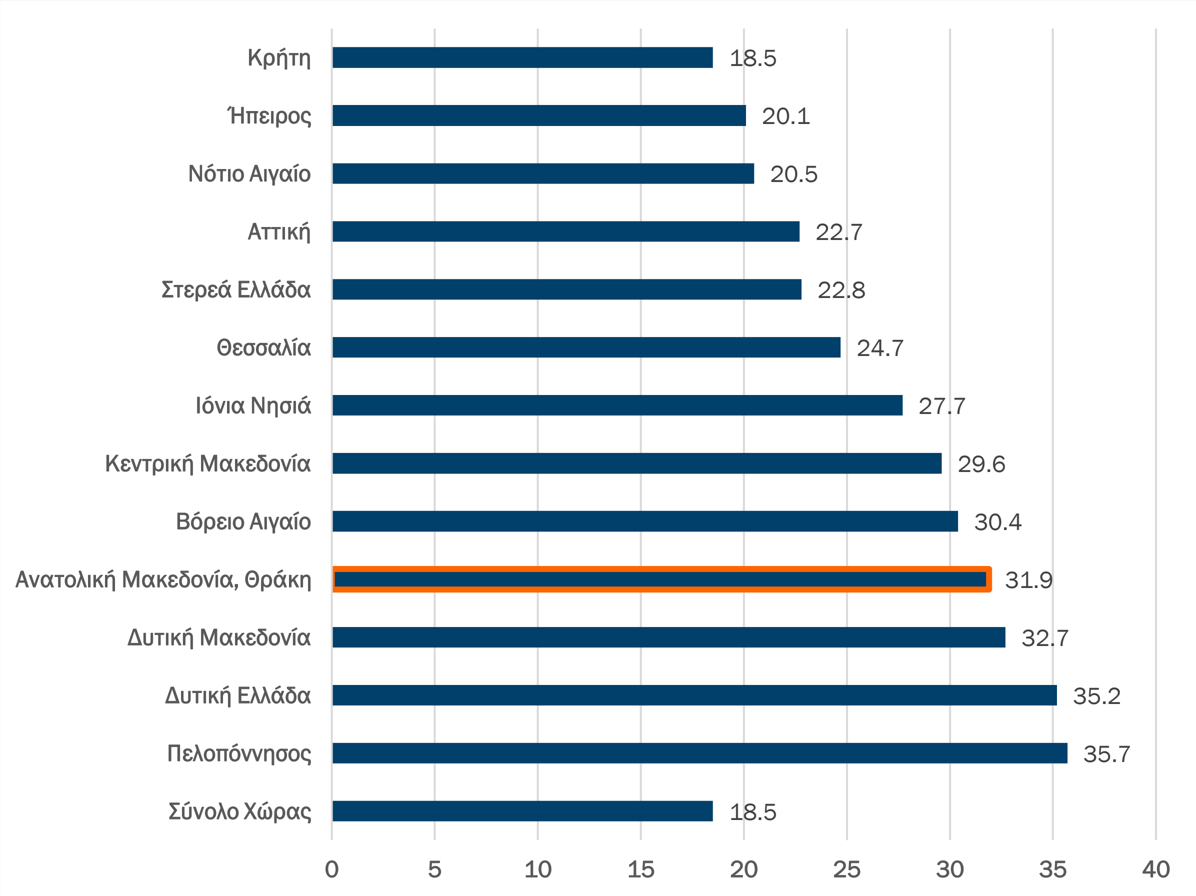
The change in the percentage of the population at risk of poverty is shown in the **figure** below.



(Source: ELSTAT)

Figure 8–116: Percentage of the population at risk of poverty, 2011–2023

In six (6) Regions (Crete, Epirus, South Aegean, Attica, Central Greece, and Thessaly), the risk of poverty or social exclusion is lower than the national average, while in the remaining seven (7) Regions (Peloponnese, Western Greece, Western Macedonia, Eastern Macedonia and Thrace, North Aegean, Central Macedonia, and the Ionian Islands), the corresponding rates are higher, as shown in the **figure** below.

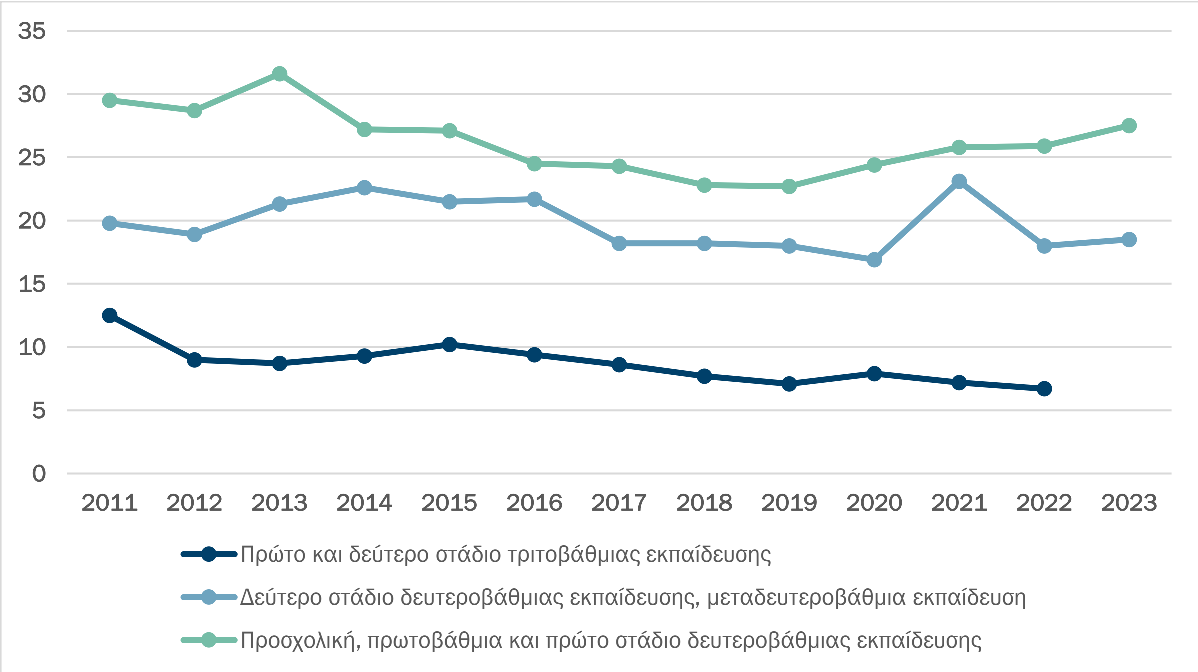


(Source: ELSTAT)

Figure 8–117: Percentage of the population at risk of poverty by Region, 2023

Regarding certain characteristics of the population at risk of poverty, employed individuals aged 18 and over face a lower risk of poverty compared to the unemployed and the economically inactive (e.g., homemakers). The risk of poverty for employed individuals aged 18 and over stands at 9.9%, marking a decrease of 0.7 percentage points compared to 2022. For the unemployed, the risk of poverty is significantly higher at 48.0%, with a notable gender gap (55.5% for men and 42.6% for women). The risk of poverty for the economically inactive (excluding retirees) increased by 2.3 percentage points compared to 2022, reaching 31.4%. The risk of poverty for employed individuals aged 18–64 is 9.8%, reflecting a decrease of 0.8 percentage points from 2022. Among full-time employees, the risk is 9.0%, while for part-time employees it rises to 21.8%.

Data from studies highlight the correlation between educational attainment and living conditions. In the figure below, based on the 2023 Household Income and Living Conditions Survey, the connection between education level and the reduction of poverty risk is shown. The higher the level of education, the lower the risk of poverty. For 2023, the risk of poverty is estimated at 27.5% for those who have completed pre-primary, primary, and the first stage of secondary education, 18.5% for those who have completed the second stage of secondary education and post-secondary education, and 6.7% for those who have completed the first and second stages of tertiary education.

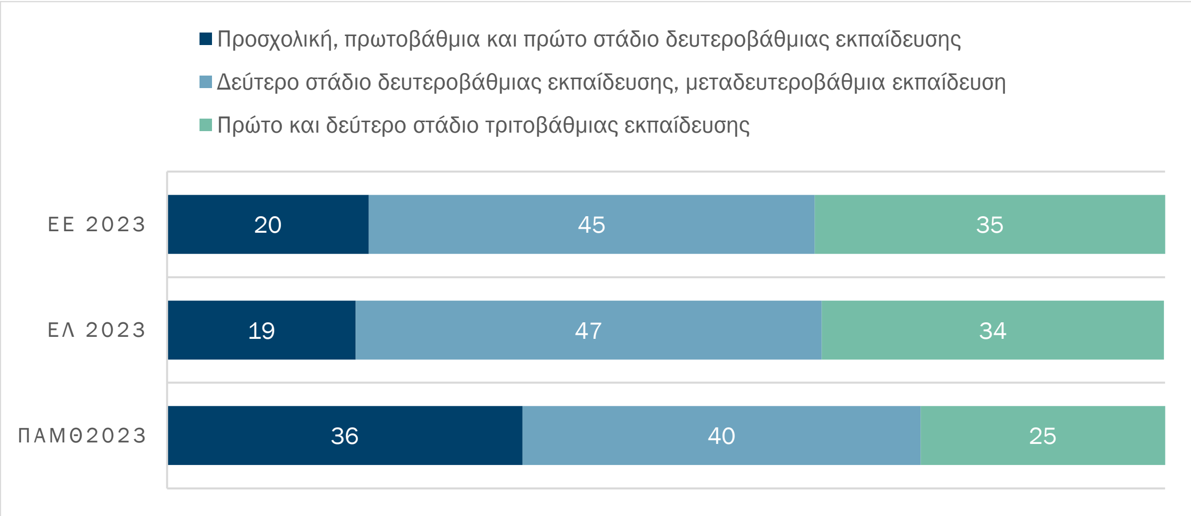


(Source: ELSTAT)

Figure 8–118: Percentage of the population aged 16 and over at risk of poverty by educational level: 2011–2023

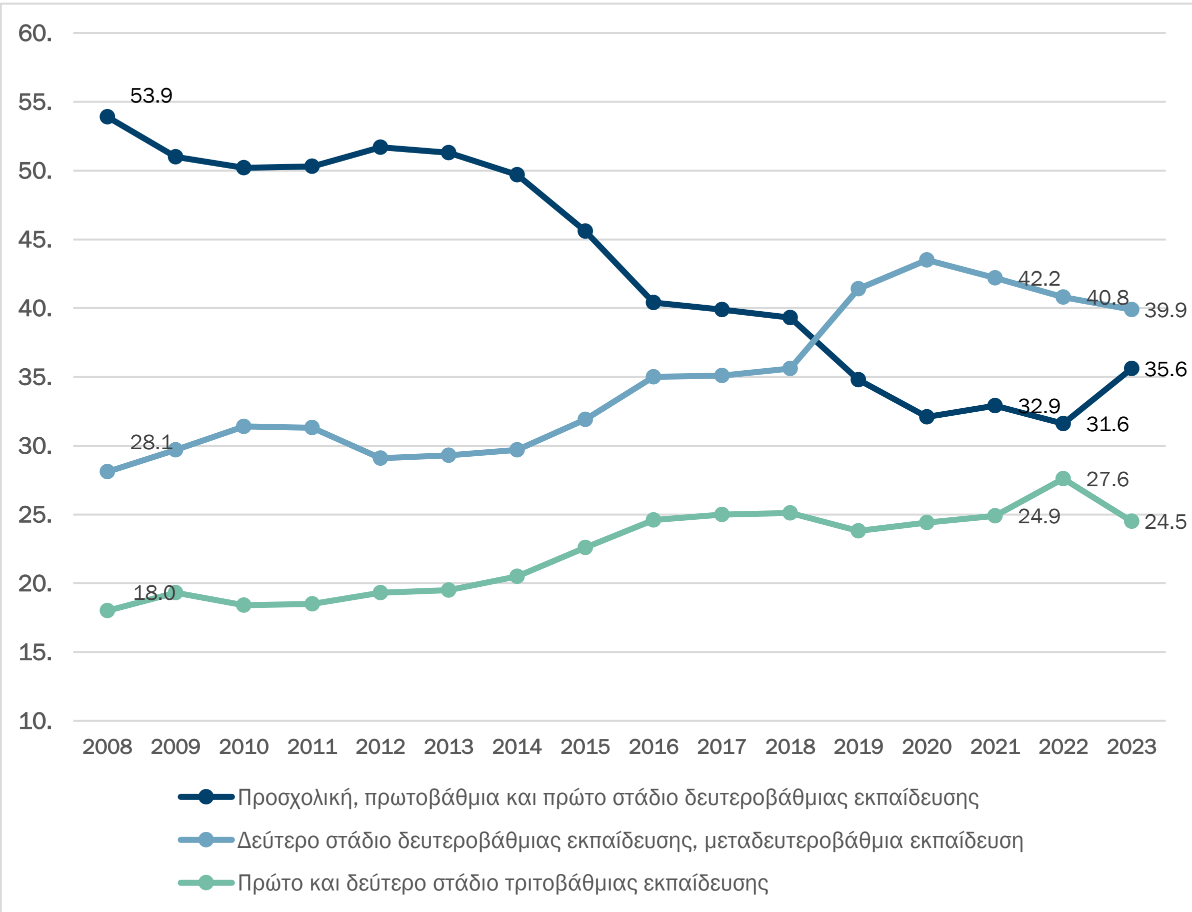
The figures below present the population by educational level in 2023 in the EU, Greece, and the Region of Eastern Macedonia and Thrace, as well as the evolution of educational attainment in the Region from 2008 to 2023, according to data from the European Statistical Office[35]. It is worth noting that, since 2008, in the Region the share of the population aged 25–64 who have completed both the second stage of secondary education and post-secondary education, or the first and second stages of tertiary education, has increased compared to the share that has completed pre-primary, primary, and the first stage of secondary education. Nevertheless, the percentages in 2023 remain lower than the national and EU averages.

[35]https://ec.europa.eu/eurostat/databrowser/view/edat_lfse_04/default/table?lang=en&category=reg.reg_educ.reg_educ_



(Source: Eurostat)

Figure 8–119: Population by educational level in the EU, Greece (EL), and EMT (%): 2023



(Source: Eurostat)

Figure 8–120: Trends in educational attainment in EMT (%), 2008–2023

8.12 SOCIAL AND TECHNICAL INFRASTRUCTURE

8.12.1 Social Infrastructure

8.12.1.1 Health Services

Most EU countries have achieved universal coverage for a significant set of health services. With Law 4368/2016 and the Joint Ministerial Decision A3(γ)/GP/oik.25132/4-4-2016, the right to free access to all public health facilities was established for the provision of nursing and medical care to uninsured and vulnerable social groups[36]. This legislation established universal health coverage for all Greek citizens, including more than 2 million people who had lost coverage during the crisis due to long-term unemployment or inability to meet contributions. The National Health System provides access to an integrated package of services, which includes primary care, diagnostic tests, specialized outpatient care, and inpatient hospital care.

Health expenditures have increased but remain relatively low compared to most other EU countries. In 2021, health spending accounted for 9.2% of GDP, compared to the EU average of 11.0%. Total funding for health expenditures as a percentage of GDP in Greece for 2022 was even lower, at 8.5%[37].

In 2021, Greece spent €1,874 per capita on health, less than half the average total health expenditure across the EU. Public spending constitutes the main source of financing (62%), but it is significantly lower than the EU average of 81%. The majority of private expenditure takes the form of out-of-pocket payments (33%), a share that far exceeds the EU average of 15%. Inpatient care represents the largest category of health spending (42%), followed by pharmaceuticals (30%), compared with EU averages of 28% and 18%, respectively. In contrast, Greece spends much less on outpatient care, both in absolute terms and as a percentage of total health expenditure (21%), despite efforts to expand the availability and utilization of primary care[38].

The resources of the healthcare system exhibit spatial heterogeneity due to historical, demographic, geographic, and other factors. The tables below present the capacity of the healthcare system by Region, both in absolute numbers and per 100,000 inhabitants for 2022.

[36] *https://www.moh.gov.gr/articles/health/anaptyksh-monadwn-ygeias/3999-prosbash-twn-anasfalistwn-sto-dhmosio-systhma-ygeias*

[37]https://www.statistics.gr/el/statistics?p_p_id=documents_WAR_publicationsportlet_INSTANCE_qDQ8fBKKo4lN&p_p_lifecycle=2&p_p_state=normal&p_p_mode=view&p_p_cacheability=cacheLevelPage&p_p_col_id=column-2&p_p_col_count=4&p_p_col_pos=1&_documents_WAR_publicationsportlet_INSTANCE_qDQ8fBKKo4lN_javax.faces.resource=document&_documents_WAR_publicationsportlet_INSTANCE_qDQ8fBKKo4lN_ln=downloadResources&_documents_WAR_publicationsportlet_INSTANCE_qDQ8fBKKo4lN_documentID=519085&_documents_WAR_publicationsportlet_INSTANCE_qDQ8fBKKo4lN_locale=el

[38] *OECD, State of Health in the EU – Greece: Health Profile 2023*

Table 8–77: Healthcare system capacity (number) by region, 2022

Territorial Unit	Health Centers	Doctors	Nurses	Other staff	Medical Equipment	Public Hospitals	Private Hospitals	Private Clinics
TOTAL COUNTRY	311	3.513	5.153	3.426	3.726	124	4	139
REGION OF EASTERN MACEDONIA AND THRACE	20	147	398	206	334	6		10
REGION OF CENTRAL MACEDONIA	46	531	925	538	606	17	1	24
REGION OF WESTERN MACEDONIA	11	122	211	99	147	5		4
REGION OF EPIRUS	20	126	349	165	202	5		2
REGION OF THESSALY	21	166	484	199	247	5		27
REGION OF CENTRAL GREECE	22	169	312	191	193	8		2
ERGION OF IONIAN ISLANDS	12	68	82	58	102	5		1
REGION OF WESTERN GREECE	29	211	365	235	205	10		4
REGION OF PELOPONNESE	30	167	327	204	300	8		2
REGION OF ATTICA	57	1.417	1.218	996	742	35	2	53
REGION OF NORTHERN AEGEAN	10	51	115	159	209	5		2
REGION OF SOUTHERN AEGEAN	14	112	111	119	172	7	1	1
REGION OF CRETE	19	226	256	257	267	8		7

(Source: ELSTAT)

Table 8–78: Healthcare system capacity (per 100,000 people) by region, 2022

Territorial Unit	Health Centers	Doctors	Nurses	Other staff	Medical Equipment	Public Hospitals	Private Hospitals	Private Clinics
TOTAL COUNTRY	3	34	49	33	36	1	0	14
REGION OF EASTERN MACEDONIA AND THRACE	4	26	71	37	60	1	0	2
REGION OF CENTRAL MACEDONIA	3	30	52	30	34	1	0	1
REGION OF WESTERN MACEDONIA	4	48	83	39	58	2	0	2
REGION OF EPIRUS	6	39	109	52	63	2	0	1
REGION OF THESSALY	3	24	71	29	36	1	0	4
REGION OF CENTRAL GREECE	4	33	62	38	38	2	0	0
REGION OF IONIAN ISALNDS	6	33	40	28	50	2	0	0
REGION OF WESTERN GREECE	4	33	56	36	32	2	0	1
REGION OF PELOPONNESE	6	31	61	38	56	1	0	0
REGION OF ATTICA	1	37	32	26	19	1	0	1
REGION OF NORTHERN AEGEAN	5	26	59	81	107	3	0	1
REGION OF SOUTHERN AEGEAN	4	34	34	36	53	2	0	0
REGION OF CRETE	3	36	41	41	43	1	0	1

(Source: ELSTAT)

The total number of hospital beds (both intensive care and general) gradually decreased from 2000, reaching 4.3 beds per 1,000 inhabitants in 2021, a figure below the EU average of 4.8 beds. The COVID-19 pandemic put pressure on hospital beds in both intensive care and general units during peak periods, and in the most affected areas, beds in private facilities sometimes had to be used.[39].

[39] *OECD, State of Health in the EU – Greece: Health Profile 2023*

In the Region of Eastern Macedonia and Thrace, according to the IOBE[40], report on social and economic trends in the Greek regions, the number of inpatient hospital beds per 100,000 people increased by 55 between 2013 and 2021, reaching 439, which is higher than the national average of 427. The number of physicians per 100,000 people also increased by 55 during the same period, reaching 534, but remains below the national average of 629.

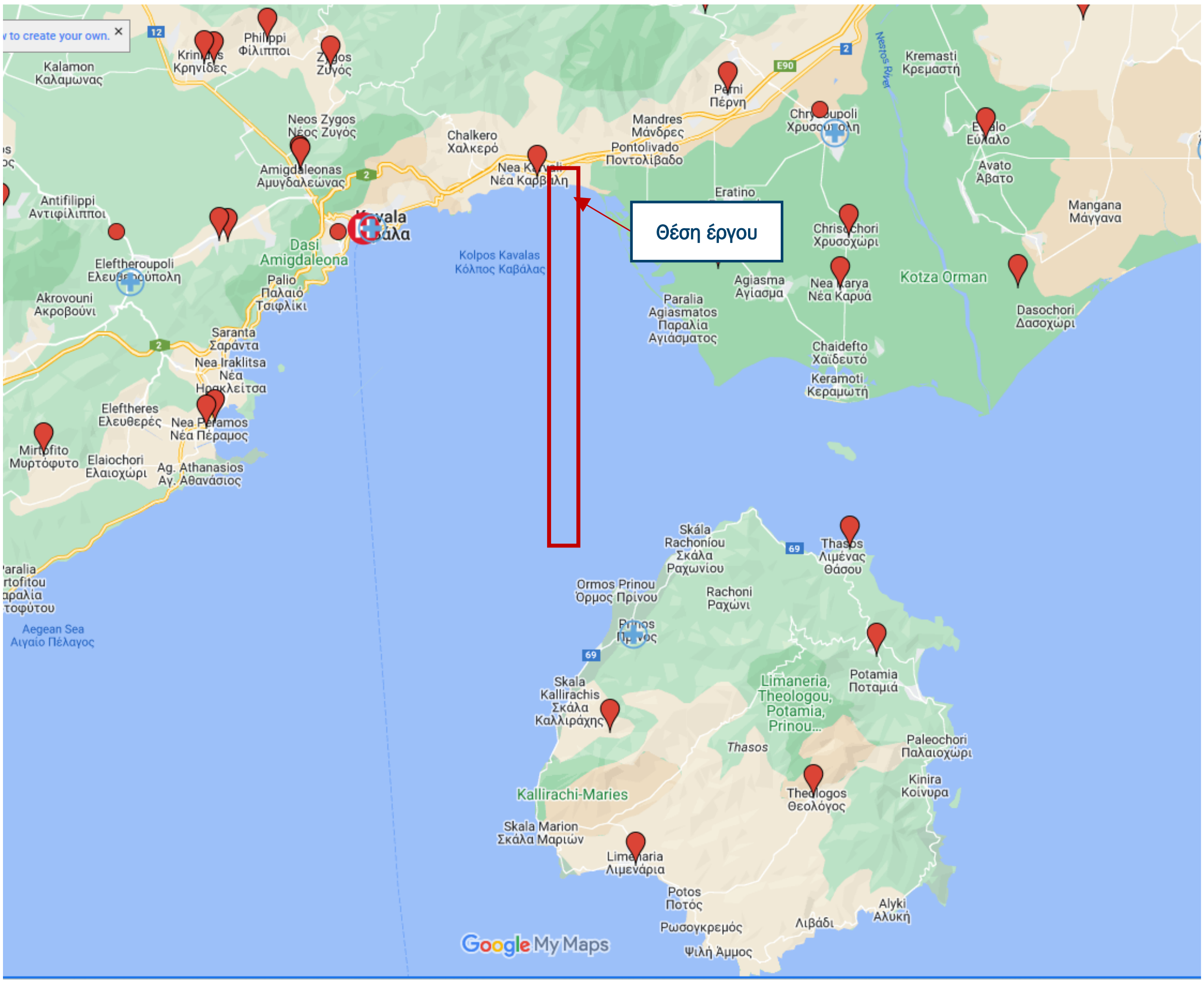
The public health facilities of the Kavala regional unit fall under the 4th Health Region of Macedonia and Thrace. The Kavala Health Unit has the following infrastructure:

- The General Hospital (GH) of Kavala is part of the National Health System and provides primary and secondary healthcare services equally to all citizens, regardless of their economic, social, or professional status. It serves as the main general hospital of the area.
- Under the administration of the General Hospital, there are the Chryssoupoli Center for Physical Medicine and Rehabilitation (KE.F.I.AP.), which provides healthcare and nursing services to inpatients and outpatients suffering from muscular, nervous, circulatory, skeletal, or respiratory system conditions, as well as individuals of all ages with physical or cognitive disabilities; and the Kavala Mental Health Center, which aims to promote mental health, address mental disorders, and support rehabilitation. Additionally, under the hospital's responsibility and within the framework of the community operational program "Psychargos Phase A," a hostel operates for the inclusion and reintegration of individuals with mental illnesses into the labor market, accommodating ten residents.
- The administration of the General Hospital of Kavala also oversees the Health Centers of the prefecture, along with their regional clinics:
  - Eleftheroupoli Health Center
  - ▪ Chryssoupoli Health Center
  - ▪ Prinos Health Center
  - ▪ Mental Health Center

Below are the hospitals, health centers, regional clinics, and other public health facilities of the 4th Health Region of Macedonia and Thrace, located around the Gulf of Kavala[41].

[40] https://iobe.gr/docs/research/RES_01_11032024_REP_GR.pdf

[41] https://www.4ype.gr/4i-y-pe/enopoiimenos-chartis-ygeias/



Νοσοκομεία   Κέντρα Υγείας   Περιφερειακά Ιατρεία   Άλλες δομές υγείας

Figure 8–121: Public Health Structures

Regarding the transport of patients or injured persons to healthcare facilities, this is undertaken by the National Center for Emergency Care (EKAB). EKAB is part of the National Health System. In cases of emergencies, accidents, or incidents, first aid is provided by local healthcare facilities until the injured can access more specialized care at general hospitals or larger health centers if needed (e.g., Thessaloniki).

Finally, the issue of access to healthcare services is also significant. A key indicator, derived from the European Union Statistics on Income and Living Conditions (EU-SILC), is the self-reported unmet need for medical care due to cost, geographic distance, or waiting lists. During the crisis (2016), the percentage of the population in Greece reporting problems accessing care or having unmet medical needs reached 13.1%, compared to just 2.8% for the European average—the second highest rate in the EU after Estonia. This rate decreased to 9% of the population in 2021 but remained the second highest in Europe, considerably higher than in most other European countries. According to a recent report by IOBE[42], Eastern Macedonia and

[42] https://iobe.gr/docs/research/RES_01_11032024_REP_GR.pdf

Thrace is one of the regions where self-reported access problems are particularly high, reaching 11.7% in 2022.

8.12.1.2 Social protection

The Survey of Social Care Units (Public Law) conducted by ELSTAT is carried out every two years and aims to record non-financial data of these units, such as the staff they employ and the number of people they host or serve. According to the most recent survey for the year 2021[43], at the national level, there are 55 Social Welfare Centers (KKP) and 23 units of other Public Law Entities (NPDD) in operation. The table below presents the units (NPDD) for the years 2019 and 2021, broken down by category.

Table 8–79 Number of Social Care Units (Public Law Entities – NPDD) for the years 2019 and 2021 by category

Category of Social Care Units	2019		2021	
	Regional Social Welfare Center Units	Other Legal Entity of Public Law Units	Regional Social Welfare Center Units	Other Legal Entity of Public Law Units
TOTAL COUNTRY	54	23	55	23
Units for Persons with Disabilities/Chronic Conditions	28	8	28	8
Child Protection Units	16	5	17	5
Rehabilitation & Recovery Units for Persons with Disabilities and Other Vulnerable Groups	10	4	10	4
Other Vulnerable Groups	0	6	0	6

(Source: ELSTAT)

In 2021, at the Social Welfare Centers (ΚΚΠ), both the number of beneficiaries in residential and non-residential care and the number of employees decreased compared to 2019. In other Legal Entities of Public Law (ΝΠΔΔ), a decrease was observed in residential care beneficiaries, while the number of non-residential care beneficiaries and employees increased, as shown in the table below.

[43]https://www.statistics.gr/el/statistics?p_p_id=documents_WAR_publicationsportlet_INSTANCE_qDQ8fBKKo4lN&p_p_lifecycle=2&p_p_state=normal&p_p_mode=view&p_p_cacheability=cacheLevelPage&p_p_col_id=column-2&p_p_col_count=4&p_p_col_pos=1&_documents_WAR_publicationsportlet_INSTANCE_qDQ8fBKKo4lN_javax.faces.resource=document&_documents_WAR_publicationsportlet_INSTANCE_qDQ8fBKKo4lN_ln=downloadResources&_documents_WAR_publicationsportlet_INSTANCE_qDQ8fBKKo4lN_documentID=486894&_documents_WAR_publicationsportlet_INSTANCE_qDQ8fBKKo4lN_locale=el

Table 8–80 Social Care Units, Employees, and Beneficiaries for the years 2019 and 2021

	2019		2021	
	Regional Social Welfare Center Units	Other Regional Social Welfare Center Units	Regional Social Welfare Center Units	Other Regional Social Welfare Center Units
TOTAL COUNTRY – number of units	54	23	55	23
Employees	2.352	457	2.339	563
Beneficiaries of Residential Care	2.322	685	2.205	589
Beneficiaries of Non-Residential (Day) Care	791	405	616	462

(Source: ELSTAT)

In 2021, the Region of Eastern Macedonia and Thrace had 6 public Social Care Units (NPDD), serving 7.2% of the beneficiaries (278 people) and employing 7.4% of the staff (215 people). The Regional Social Welfare Center of Eastern Macedonia and Thrace, based in Kavala, is the only public body in the region operating in the sensitive field of social welfare. Its main purpose is to supervise, coordinate, and direct actions of modern social policy, aiming at social care and protection of families, children, youth, the elderly, persons with disabilities, the chronically ill, and vulnerable population groups within the region

Two branches of the Regional Social Welfare Center of Eastern Macedonia and Thrace are located in Kavala:

- Kavala Child Protection Branch: This operates 24/7 and is classified as a closed-care unit for children aged 5–18 at risk. The facility provides housing, meals, clothing, education, medical care, social and psychological support, and implements alternative child protection programs.
- Kavala Chronic Conditions Branch: Located in Eleftheroupoli, this is an open social care unit where pre-vocational workshops operate and high-quality therapy and rehabilitation services are provided for persons with disabilities over 18 years old. In addition to therapeutic programs, numerous educational and recreational activities are also offered.

8.12.1.3 Educational Infrastructure

As previously mentioned, studies highlight the correlation between educational attainment levels and living conditions. Compulsory education in Greece consists of:

- Two years of mandatory attendance for children in Kindergarten
- Six years of attendance in Primary School
- Three years of attendance in Gymnasium (Lower Secondary School)

The typical educational system in Greece includes:

- Primary Education
- Secondary Education
- Secondary Chance Schools
- Post-Gymnasium Vocational Education and Training, Level 3
- Post-Secondary Vocational Training, Level 5

- ### Higher Education

In Greece, education is provided free of charge across all three educational levels—primary, secondary, and higher education—and is primarily funded through the state budget via resources from the Ministry of Education and Religious Affairs. The state budget consists of two main parts: the Regular Budget, which covers operational expenses, and the Public Investment Budget, which finances the Public Investment Program (PIP).

Regional educational authorities contribute to the planning of educational policy at the regional level. The main administrative and governance structure for school education at the regional level is the Regional Directorate of Primary and Secondary Education.

The tables below present the number of primary and secondary school units, teaching staff, and enrolled students for the entire country and for the Region of Eastern Macedonia and Thrace for the school years 2020/2021 and 2021/2022, according to ELSTAT[44],[45] data. It can be observed that between these school years, the number of school units in the region decreased in kindergartens, primary schools, junior high schools, and high schools. A decrease is also noted in teaching staff (except in kindergartens) and enrolled students (except in junior high schools).

Table 8–81 Number of School Units, Teaching Staff, and Enrolled Students – Kindergartens

	Number of School Units		Teaching staff		Enrolled students	
	2020/2021	2021/2022	2020/2021	2021/2022	2020/2021	2021/2022
TOTAL PUBLIC	4.904	4.901	16.615	17.488	154.311	153.108
TOTAL PRIVATE	722	817	1.323	1.721	20.797	24.264
EMT	320	315	937	966	9.600	9.462

(Source: ELSTAT)

Table 8–82 Number of school units, teaching staff, and enrolled students – Primary Schools

	Number of School Units		Teaching staff		Enrolled students	
	2020/2021	2021/2022	2020/2021	2021/2022	2020/2021	2021/2022
TOTAL PUBLIC	4.242	4.202	70.720	68.928	564.836	543.398
TOTAL PRIVATE	160	159	3.953	3.629	41.564	40.634
EMT	327	315	4.151	4.015	32.397	30.943

[44] https://www.statistics.gr/documents/20181/ead51219-dfc6-9542-c5ca-be2976c87c0e

[45] https://www.statistics.gr/documents/20181/8fa5c436-3169-54c0-3ad1-1474a9caef0e

(Source: ELStAT)

Table 8–83 Number of school units, teaching staff, and enrolled students – Middle Schools

	Number of school units		Teaching staff		Enrolled students	
	2020/2021	2021/2022	2020/2021	2021/2022	2020/2021	2021/2022
TOTAL PUBLIC	1.727	1.732	38.559	37.396	311.111	312.078
TOTAL PRIVATE	98	109	2.508	2.419	17.471	20.335
EMT	100	99	2.226	2.171	17.730	17.750

(Source: ELSTAT)

Table 8–84 Number of school units, teaching staff, and enrolled students – Lyceums

	Number of school units		Teaching staff		Enrolled students	
	2020/2021	2021/2022	2020/2021	2021/2022	2020/2021	2021/2022
TOTAL PUBLIC	1.262	1.268	22.216	21.511	215.182	214.205
TOTAL PRIVATE	93	103	2.137	2.055	15.113	16.871
EMT	64	63	1.087	1.036	11.023	10.795

(Source: EISTAT)

In the prefecture of Kavala, according to the data of the Regional Directorates of Primary and Secondary Education of the Region of Eastern Macedonia and Thrace, the following school units are in operation[46]:,[47]

- 87 Kindergartens
- 65 Primary schools
- 43 Gymnasiums and Lyceums

Higher education in Greece is provided by Higher Education Institutions (a total of 25) and consists of two distinct sectors:

- The university sector, which includes Universities, Polytechnics, and the Athens School of Fine Arts
- The technological sector, which includes Technological Educational Institutes (TEI) and the Higher School of Pedagogical and Technological Education (ASPETE).

It is noted that all TEIs in the country have now been incorporated into University Institutions. All higher education institutions in Greece are public. The duration of studies in most university faculties is four years, except for the faculties of Polytechnic Schools, Agricultural Schools, Dentistry and Pharmacy

[46] http://dipe.kav.sch.gr/

[47] https://dide-new.kav.sch.gr/

departments, the School of Fine Arts, and ASPETE, where it is five years, while in Medical Schools it is six years. The list of Higher Education Institutions is presented below.[48]:

1 Athens School of Fine Arts

2 Higher School of Pedagogical and Technological Education (Former Name: School of Teachers of Vocational & Technical Education)

3 Agricultural University of Athens (Former Name: Higher Agricultural School of Athens)

4 Agricultural University of Athens (Incorporated: TEI of Central Greece)

5 Democritus University of Thrace

6 International Hellenic University (Incorporated: TEI of Central Macedonia, TEI of Eastern Macedonia and Thrace, TEI of Thessaloniki)

7 National Technical University of Athens

8 National and Kapodistrian University of Athens (Incorporated: TEI of Central Greece)

9 Hellenic Open University

10 Hellenic Mediterranean University (Resulted from: TEI of Crete)

11 Ionian University (Incorporated: TEI of Ionian Islands)

12 Athens University of Economics and Business (Former Name: Higher School of Economics and Business Sciences – ASOEE)

13 University of the Aegean

14 University of West Attica (Resulted from: Technological Educational Institute of Athens, Technological Educational Institute of Piraeus)

15 University of Western Macedonia (Incorporated: TEI of Western Macedonia – Former TEI of Kozani)

16 University of Thessaly (Incorporated: University of Central Greece, TEI of Central Greece, TEI of Thessaly – Former TEI of Larissa)

17 University of Ioannina

18 University of Crete

19 University of Macedonia

20 University of Patras (Incorporated: TEI of Western Greece – Former TEI of Patras)

21 University of the Peloponnese (Incorporated: TEI of Western Greece – Former ATEI of Patras, TEI of Peloponnese)

22 University of Piraeus (Former Name: Higher Industrial School of Piraeus)

[48] https://www.doatap.gr/enhmerosh/idrumata-ellados/

23 Panteion University of Social and Political Sciences

24 Technical University of Crete

25 Harokopio University

The leading academic and research institutions in the Region of Eastern Macedonia and Thrace are the Democritus University of Thrace and the International Hellenic University. The following schools of the International Hellenic University are operating in the Kavala Prefecture:

Table 8–85 Schools in Kavala

School	Type of Educational Institution	City
Chemistry	University	Kavala
Informatics	University	Kavala
Physics Department	University	Kavala
Administrative Science and Technology	University	Kavala
Accounting and Finance	University	Kavala

(Source: https://aeitei.gr/index.php?idrima=100)

According to data from the European Statistical Office, participation in IECSD (International Standard Classification of Education) level 6 education has increased by 22% across the country and by 30% in the Region of Eastern Macedonia and Thrace between 2013 and 2021. Also, IECSD level 7 education has increased by 98% nationwide and by 147% in the Region of Eastern Macedonia and Thrace. However, in IECSD level 8 education (Doctorate or equivalent), although there is a 47% increase nationally, a 1% decrease is observed in the Region. The data from the European Statistical Office are presented in the following table.

Table 8-86 Registered Students in IECSD (International Standard Classification of Education) Levels 6, 7, and 8 Education, 2013-2021

	IECSD Level 6 Bachelor or equivalent		IECSD Level 7 Master's or equivalent		IECSD Level 8 PhD or equivalent	
	2013	2021	2013	2021	2013	2021
EU 27	10.262.400	11.058.492	5.186.679	5.435.376	-	671.828
National Total	588.201	715.148	48.072	94.971	23.011	33.713
EMT	31.282	40.601	2.124	5.245	1.689	1.678

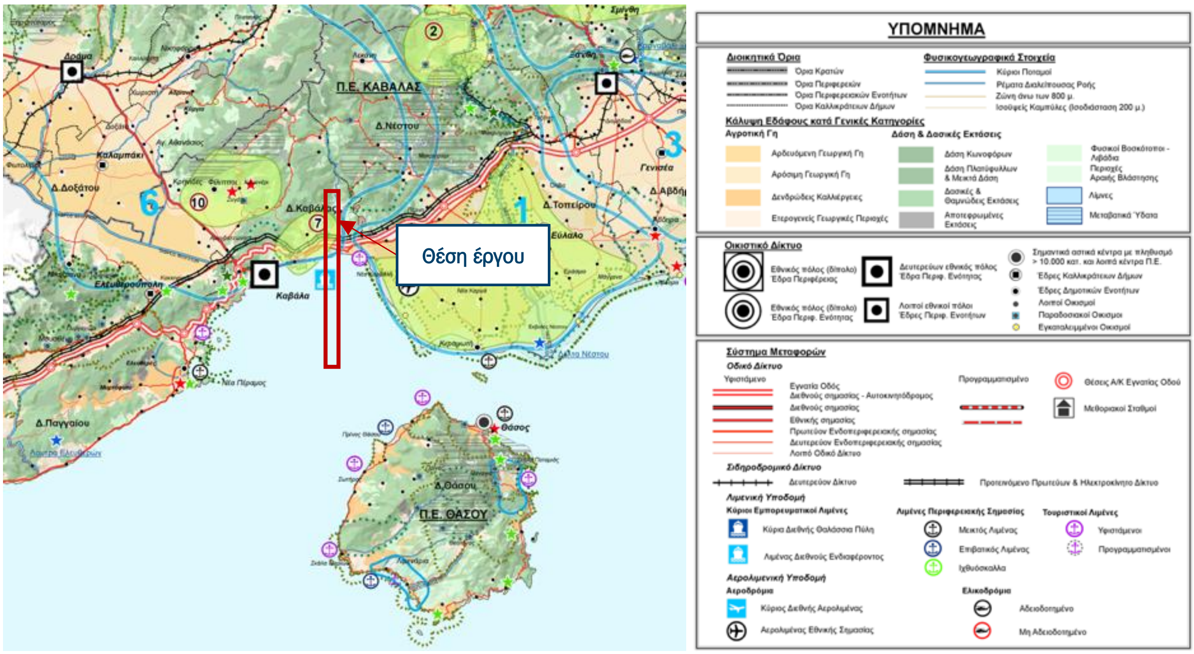
(Source: Eurostat)

8.12.2 Transport Infrastructure

8.12.2.1 Road Network

The established road network of the Region of Eastern Macedonia and Thrace includes national and provincial roads and has a total length of 3,191 km (828 km National Network, 2,363 km Provincial Network). Specifically, important transport axs for this Region are the Egnatia Highway, which connects the Region with mainland Greece and neighboring Turkey, as well as its vertical axes, which connect its settlements and provide access to Bulgaria (e.g., Alexandroupoli - Ormenio, Komotini - Nymphaia, Xanthi – Echinos - Greek-Bulgarian border, Drama – Nevrokopi - Exochi).

The national and provincial road network is sufficiently dense, in good condition, and allows for smooth access. Coastal areas are connected to each other via regional roads. The following figure illustrates the road axs of the Region of Eastern Macedonia and Thrace.



(Source: Regional Spatial Planning Framework of the Region of Eastern Macedonia and Thrace, 2018 (Government Gazette 248 / AAP / 29-12-2017))

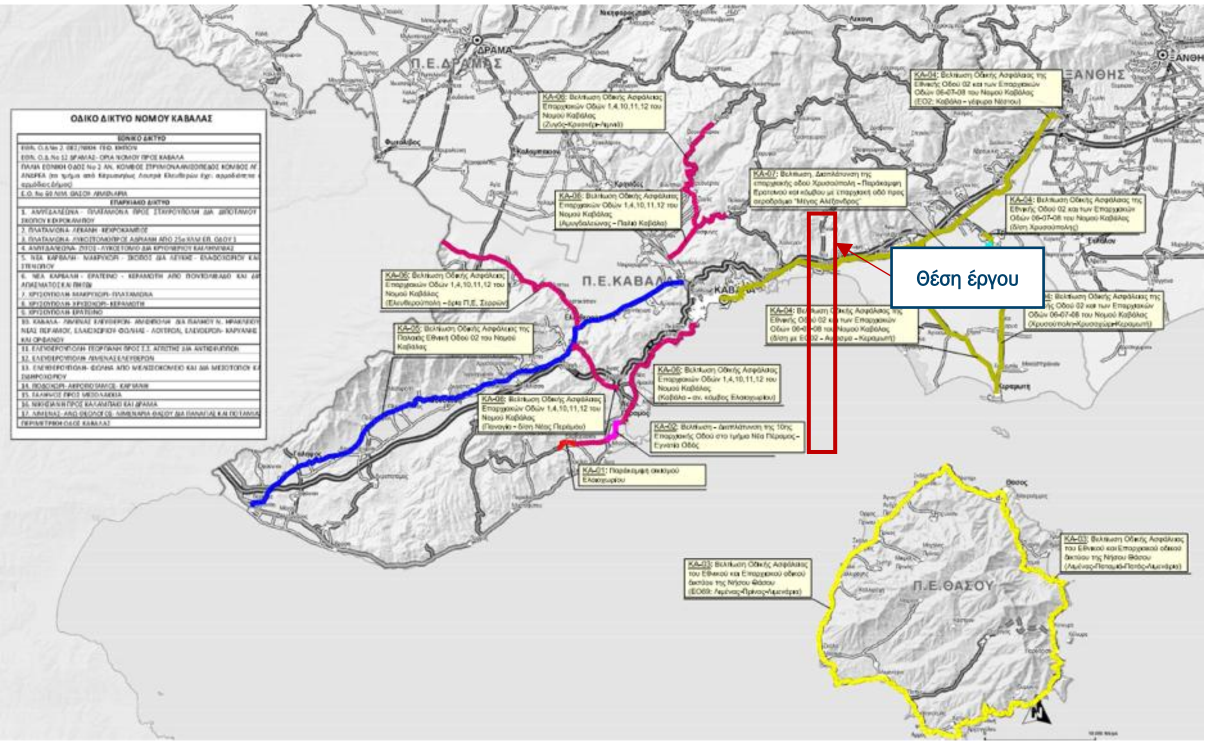
Figure 8-122: Road and Railroad Axs of the Kavala Regional Unit

At the municipal level, the condition of the municipal road network is not satisfactory. The roads connecting the municipal districts to each other and to the municipal seat of the Municipality of Kavala provide a satisfactory level of transportation service, but they usually do not meet the specifications in terms of alignment, pavement quality, or safety equipment.

It is noted that according to the "Operational Program of the Region of Eastern Macedonia and Thrace 2014-2020", specific interventions are proposed to improve road safety along the entire length of the Region's road network. The main objective of the "Integrated EMT Road Safety Plan" project is to draft a documented and comprehensive plan to improve road safety in the Region. In this case, for the Regional Unit of Kavala, the following actions were proposed:

- **Improvement - Widening of the 10th Provincial Road in the section Nea Peramos - National Road**
- **Improvement of road safety on the national and provincial network of N. Thassos**
- **Improvement of road safety on National Road 02 and Provincial Roads 06-07-08 in the Kavala Prefecture**
- **Improvement - Widening of the provincial road Chrysoupoli - Erateino bypass and the junction with the provincial road toward "Megas Alexandros" Airport.**

Overall, the proposed actions for the Kavala Regional Unit, as described in the aforementioned 2014-2020 Operational Program, are presented in the following Figure.



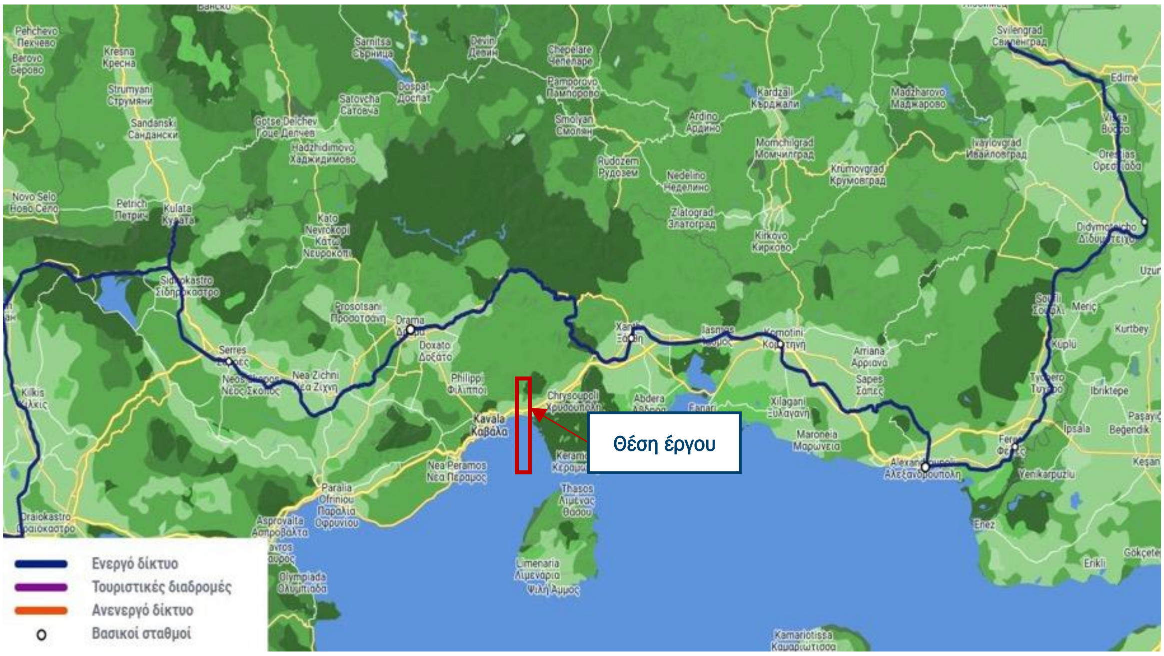
(Source: Operational Program of the Region of Eastern Macedonia and Thrace 2014-2020, 2014)

Figure 8-123: Proposed Road Network Improvement Actions in Kavala Prefecture (OSOA - EMT 2014-2020)

8.12.2.2 Railroad Network

In the Region of Eastern Macedonia and Thrace, there is a railroad network that connects Thessaloniki with Ormenio in Evros and the Greek-Bulgarian border, passing thru all urban centers except Kavala. It is worth noting that passenger train services are not currently operating in the Region of Eastern Macedonia and

Thrace. The following figure illustrates the railroad network in the wider area of the Project. The nearest station is in Xanthi, located approximately 37 km northeast of the Project's onshore facilities.



(Source: Hellenic Railroads Organization, https://ose.gr/, June 19, 2024)

Figure 8-124: Railroad network in the Region of Eastern Macedonia and Thrace

8.12.2.3 Ports

In the Region of Eastern Macedonia and Thrace, the main ports are those of Alexandroupoli and Kavala. The ports in the region include those of Porto Lagos, Thassos, Kamariotissa (on Samothrace), Keramoti, Nea Karvali, Prinos, and the Eleftheres - Peramos port. The nearest port to Nea Karvali, "Philippos II," is located approximately 6.2 km southwest of the Project's onshore facilities.

According to data from the Annual Report on Competitiveness and Structural Adjustment in the Tourism Sector for the year 2022 (INSETE, 2023), passenger traffic in the Region of Eastern Macedonia and Thrace shows a decrease of -5% (from 71.5 million in 2019 to 67.8 million in 2022). Between 2019 and 2022, passenger traffic at the Region's ports decreased by -5% (from 4.6 million in 2019 to 4.3 million in 2022).

Specifically, the picture was mixed, with the ports of Kavala (-7%, from 2.2 million in 2019 to 2.1 million in 2022) and Thassos (-7%, from 2.0 million in 2019 to 1.9 million in 2022) showing a decrease in traffic, while the port of Alexandroupolis (+20%, from 271 thousand in 2019 to 326 thousand in 2022) showed an increase, as shown in the following **table**.

Table 8-87 Domestic Passengers at the Ports of the Eastern Aegean Region. Macedonia & Thrace by Regional Unit, 2019-2022

Regional Unit	2019	2021	2022	%Δ (2019-2021)	%Δ (2019-2022)
Kavala	2.246.326	1.374.953	2.097.170	-39%	-7%
Thasos	2.042.972	1.220.169	1.903.160	-40%	-7%
Evros	270.844	259.064	326.038	-4%	-20%
EMT	4.560.142	2.854.186	4.326.368	-37%	-5%

(Source: INSETE,2023)

The Port of Kavala is a Port of International Interest according to the national ranking of ports under No. 8315.2/02/07/02.02.2007 JMD (Official Gazette 202/B/16.02.2007). Specifically, it serves i) the fishing fleet, ii) tourism, iii) passengers to and from Thassos, Lemnos, Mytilene, and Samothrace, and iv) water sports. It has an extensive land area consisting of a zone of varying width that extends for a total length of 3,000 meters in front of the city of Kavala and includes the Central Port and the Fish Market. Overall, the Port of Kavala currently has:

- **Total dredging of approximately 2 km, including the breakwater berths**
- **Administrative and technical support buildings**
- **Warehouses, shelters, and other facilities**

The port of Nea Karvali, named "Philippos B," is used for commercial purposes. The ports of Keramoti (Keramoti - Thassos Ferry) and the main port of Thassos are also considered important for use by passengers and the fishing fleet. The port of Prinos and the Limenaria of the Regional Unit of Thasos, as well as the port of Nea Peramos, primarily serve local passenger transport. The latter also serves to transport workers to oil extraction facilities.

Tourism and yachting are located in zones within existing ports, harbors, and fishing shelters. There are no scheduled connections between them, while the exclusive yacht port (marina) in Limenaria, Thassos, with a capacity of 70 recreational boats (compared to the 230 recreational boats that were planned in the R.F.S.P.S.S), was included in the Competitiveness and Shipping sector program on 26/09/2011.

The following **figure** illustrates the nearest ports in the study area.

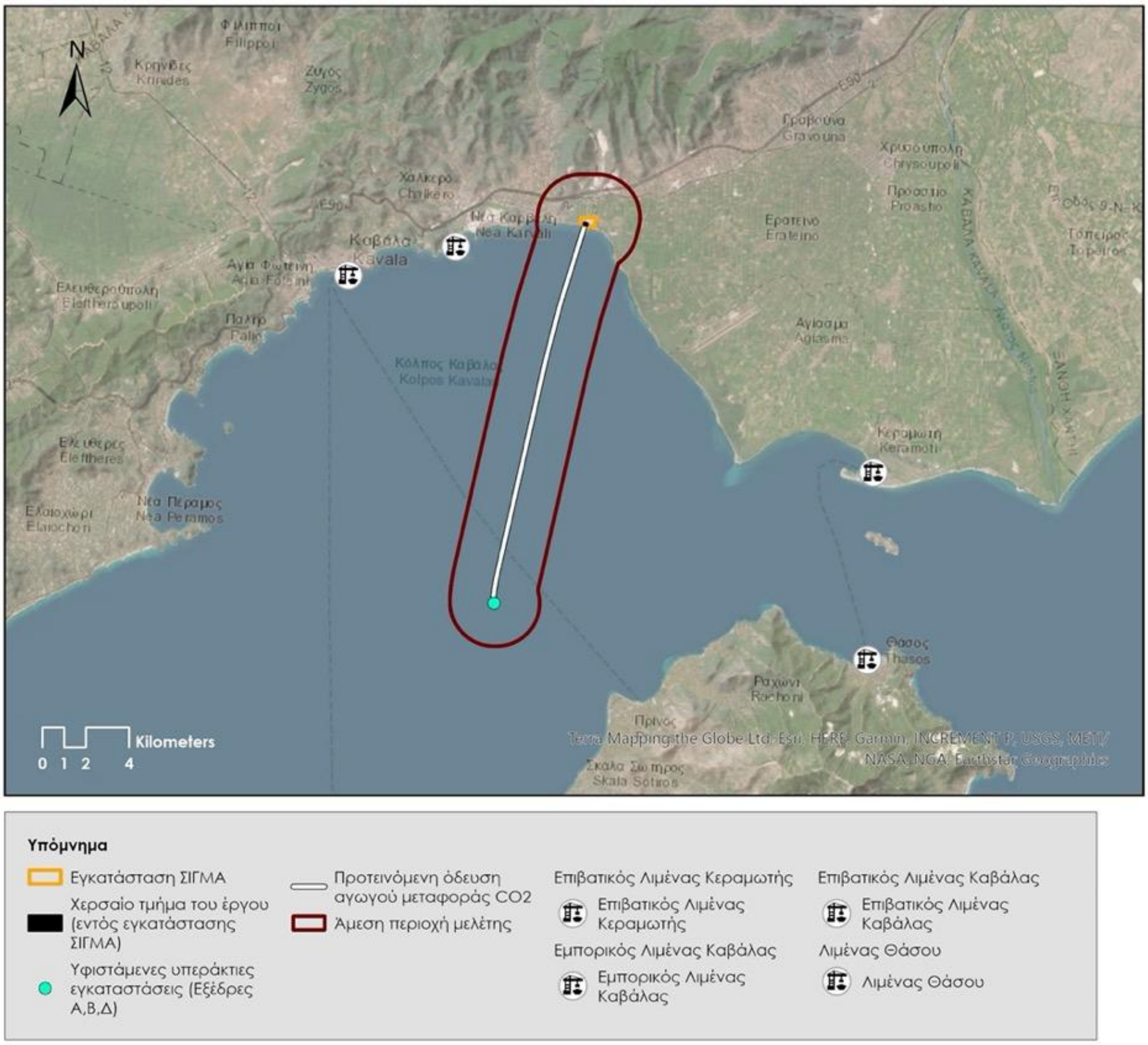


Figure 8-125: Map of ports near the study area

The following tables show the number of passengers arriving at the ports of Kavala, Keramoti, and Thassos in recent years.

Table 8-88 Passenger Traffic at the Ports of Kavala, Keramoti, Thasos, and Samothrace

Passengers boarding ferries and ships at the port				
Year	Kavala Port	Thassos Port	Keramoti	Samothrace
2023				
C quarter 2023	114.187	693.688	612.325	51.408
B quarter2023	40.918	240.796	262.263	16.981
A quarter2023	14.166	63.910	59.338	7.031
2022				
D quarter 2022	20.189	82.689	66.716	9.694
C quarter 2022	126.310	612.157	533.259	49.553
B quarter 2022	36.691	201.951	215.284	15.472

Passengers boarding ferries and ships at the port				
A quarter 2022	9.839	50.429	47.428	5.985
2021				
D quarter 2021	13.791	63.861	53.517	7.326
C quarter 2021	89.681	429.362	344.408	43.174
B quarter 2021	18.158	112.247	113.016	8.027
A quarter 2021	4.047	28.863	28.811	3.616
2020				
D quarter2020	11.829	45.676	37.197	5.634
C quarter 2020	70.369	267.096	228.247	32.912
B quarter 2020	11.820	56.342	64.088	5.568
A quarter 2020	17.734	57.712	50.606	5.309

(Source: ELSTAT, 2024)

The movement of coastal shipping vessels between 2015 and 2018 showed a significant increase of approximately 43%, while passenger movement showed a much smaller increase of around 10%. Between 2019 and 2021, ferry traffic remained almost stable, while passenger traffic decreased by approximately 46%, which is justified by travel restrictions due to the COVID-19 pandemic.

Regarding cruise traffic, the movement of cruise ships decreased significantly, by approximately 70%, from 2016 to 2018, and there was a similar decrease of about 70% in cruise passengers during the same period. As expected for the period 2019-2021, due to the COVID-19 pandemic that broke out worldwide, cruise traffic continued to decline by approximately 60%, with a similar decline of around 60% for cruise passengers. Essentially, 2020, which also saw the lowest number of cruise ships at the Central Port of Kavala, was a global pause in cruise activity due to the pandemic. The following table shows cruise passenger traffic for the years 2019-2023.

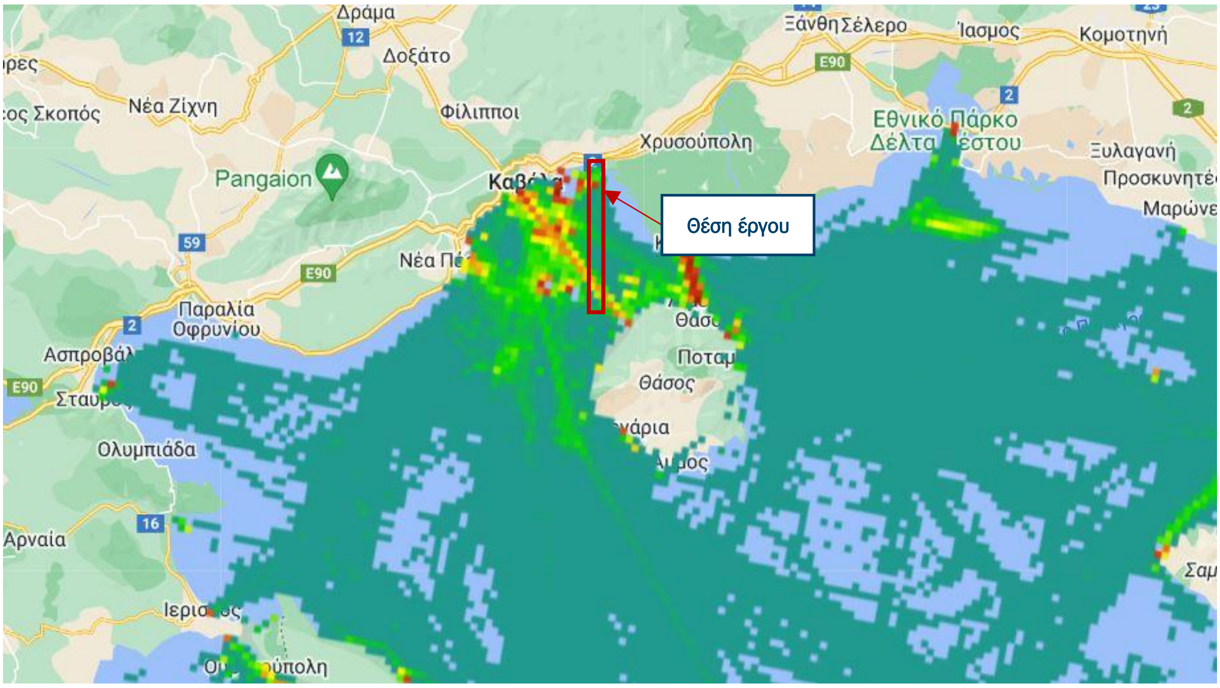
It is noted that the Port of Kavala is the only EMT port that records cruise ship traffic. In the period 2019-2022, the picture is positive, with an increase in cruise ship traffic at the port of Kavala by +400% (from 7 cruise ships in 2019 to 35 cruise ships in 2022).

Table 8–86 Passenger cruise traffic "Apostolos Pavlos Port"

Year	Cruise passengers
2019	2.699
2020	45
2021	938
2022	13.315
2023	20.777

(Source: ELSTAT, 2024)

Four ferry lines depart from the port of Kavala: "Kavala – Lemnos", "Kavala – Samothrace", "Alexandroupoli – Kavala", and "Kavala – Ormos Prinou – Thassos", as shown in the following Figure, which also presents the vessel traffic density in the wider Project area.



(Source: Oikoskopio, http://www.oikoskopio.gr/map/, June 19, 2024)

Figure 8-126: Kavala Port Route Density Map

8.12.2.4 Airports

In the Region of Eastern Macedonia and Thrace, there are two (2) civilian airports operating: Kavala "Megas Alexandros" and Alexandroupolis "Demokritos". The Regional Unit of Kavala is served by "Megas Alexandros" Airport, located in Chrysoupoli, approximately 7km southeast of the Project's land facilities. Regular flights to and from Athens are operated at this airport, with a stable number of 36 weekly flights (18 "Kavala-Athens" flights and 18 "Athens-Kavala" flights), as well as international charter flights during the summer.

The following **figure** shows the locations of the airports located in the Region of Eastern Macedonia and Thrace.

(Source: Regional Spatial Planning Framework of the Region of Eastern Macedonia and Thrace, 2018 (Government Gazette 248 / AAP / 29-12-2017))

Figure 8–122: Airport locations within Eastern Macedonia and Thrace (EMT)

8.12.3 Technical Infrastructure

8.12.3.1 Water Supply / Irrigation

As mentioned in Section 8.5.1.1, the study area falls within the WD Nestos of the Water District of Thrace (EL 12) and the WD Strymon of the Water District of Eastern Macedonia (EL 11).

The services of Water Supply – Treated or Clean Drinking Water and Sewerage (collection and treatment of wastewater up to secondary treatment) are generally provided by Municipal Water Supply and Sewerage Enterprises (DEYA) or by services of Local Government Organizations (OTA), in cases where DEYA have not been established.

Specifically, in Water District 12 of Thrace, water supply and sewerage services are provided by seven (7) DEYA and ten (10) Local Government Organizations (Municipalities). In particular, services are provided in WD Nestos (EL1207) by the DEYA of Nestos and Xanthi. In addition, water supply services are provided by the Municipalities of Drama, Kato Nevrokopi, Myki, Paranesti, and Topeiros. Similarly, in Water District 11, water supply and sewerage services are provided by seven (7) DEYA and seven (7) Local Government Organizations (Municipalities). Specifically, in the Regional Unit of Kavala, water supply services are provided by the DEYA of Kavala and the DEYA of Paggaio.

Based on the SEA of the 2nd Revision of the River Basin Management Plan of the Water District of Eastern Macedonia (EL 11), which is in the consultation stage, 550 water abstraction points have been recorded in the Water District from which water intended for human consumption is drawn. Of these, the vast majority (94.3% of the total) concern 519 boreholes, while 31 concern springs (5.7% of the total).

Similarly, according to the SEA of the 2nd Revision of the River Basin Management Plan of the Water District of Thrace (EL 12), in the Water District of Thrace (EL12) 724 water abstraction points have been recorded from which water intended for human consumption is drawn. Of these, the majority (55.8% of the total) are boreholes (404), springs amount to 315 (43.5% of the total), while three (3) water abstraction points (0.4% of the total) concern wells, and two (2) water abstraction points (0.2% of the total) concern surface waters. The latter refer to the Aisymi Reservoir (EL1210RL009010004H), which is used for the water supply of the Municipality of Alexandroupolis, and the Chionorema stream (Western tributary of the Vozvozis – EL1209R0000030090N), which is used for the water supply of the Municipality of Komotini.

The study area falls within three (3) groundwater bodies: the GW Delta Nestos (EL1200060), the GW Oreon Lekanis (EL1200070), and the GW Symbolo – Kavala (EL1100130). The onshore facilities fall entirely within the GW Delta Nestos. The abstractions from the GW Oreon Lekanis (EL1200070) for water supply correspond to 6.42×10^6 m³. Similarly, the water supply abstractions from the GW Symbolo – Kavala (EL1100130) correspond to 1.54×10^6 m³.

According to Phase A of the Operational Program for the Municipality of Kavala (2023), the Municipality is served for its water supply needs by DEYAK, which has been operating since 1984. This water supply network has a length of 300,000 km and includes 44,270 water meters, 19 water supply boreholes, while the average annual consumption amounts to 4,265,454 m³.

Within the onshore facilities of the Project, one (1) active water abstraction point (EMS Code 1200011770795) is identified, as presented in the following Figure from the National Water Abstraction Points Registry (EMS, http://lmt.ypeka.gr/public_view.html). This point falls within the WD Nestos and is a coastal water abstraction point.

(Source: EMSY, http://lmt.ypeka.gr/public_view.html, 21 June 2024)

Figure 8–128: Map of the National Water Abstraction Points Registry in the project installation area

Irrigation

According to the 2nd Revision of the River Basin Management Plan, in the Water District of Thrace the annual estimated water abstractions for irrigation amount to 660.34×10^6 m³, which represent 91% of the total abstractions of the WD. In WD Nestos (EL1207), the total annual water abstractions for all activities and uses were estimated at 180.5×10^6 m³, based on the annual needs of the WD. In agriculture (irrigated land), which is the main water user, 91.63% (165.4×10^6 m³) of the total water demand is consumed, 4.85% (8.75×10^6 m³) in water supply, 0.55% (1.06×10^6 m³) in livestock farming, and 2.96% (5.35×10^6 m³) in industry.

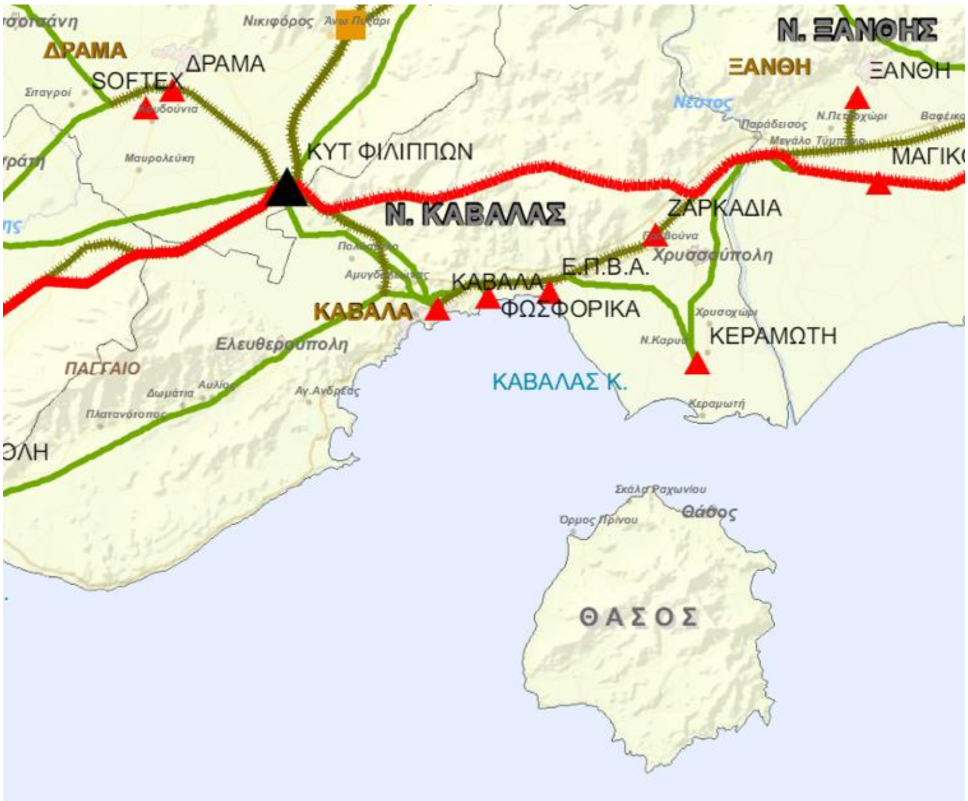
Similarly, in the Water District of Eastern Macedonia, total annual water abstractions amount to 815.9×10^6 m³, of which irrigation in WD Strymon accounts for 762.7×10^6 m³ (93.5%).

According to Phase A of the Operational Program for the Municipality of Kavala (2023), 35 boreholes have been identified in the Municipality for irrigation purposes.

8.12.3.2 Energy

Electric Power

In the Region of Eastern Macedonia and Thrace, according to official data from the Independent Power Transmission Operator (ADMIE), the state of the electricity transmission network appears to be satisfactory. It consists of a network of high, medium, and low voltage. The energy distributed is produced by the stations operating within the Region. The substations closest to the study area are: YS PHOSPHORIKA 150/20kV and YS KAVALA 150/20kV. Within the onshore facilities of the Project is located the substation YS KAVALA OIL (EPVA) 150/20kV.



(Source: ADMIE, https://www.admie.gr/systima/perigrafi/hartis-grammon, 21 June 2024)

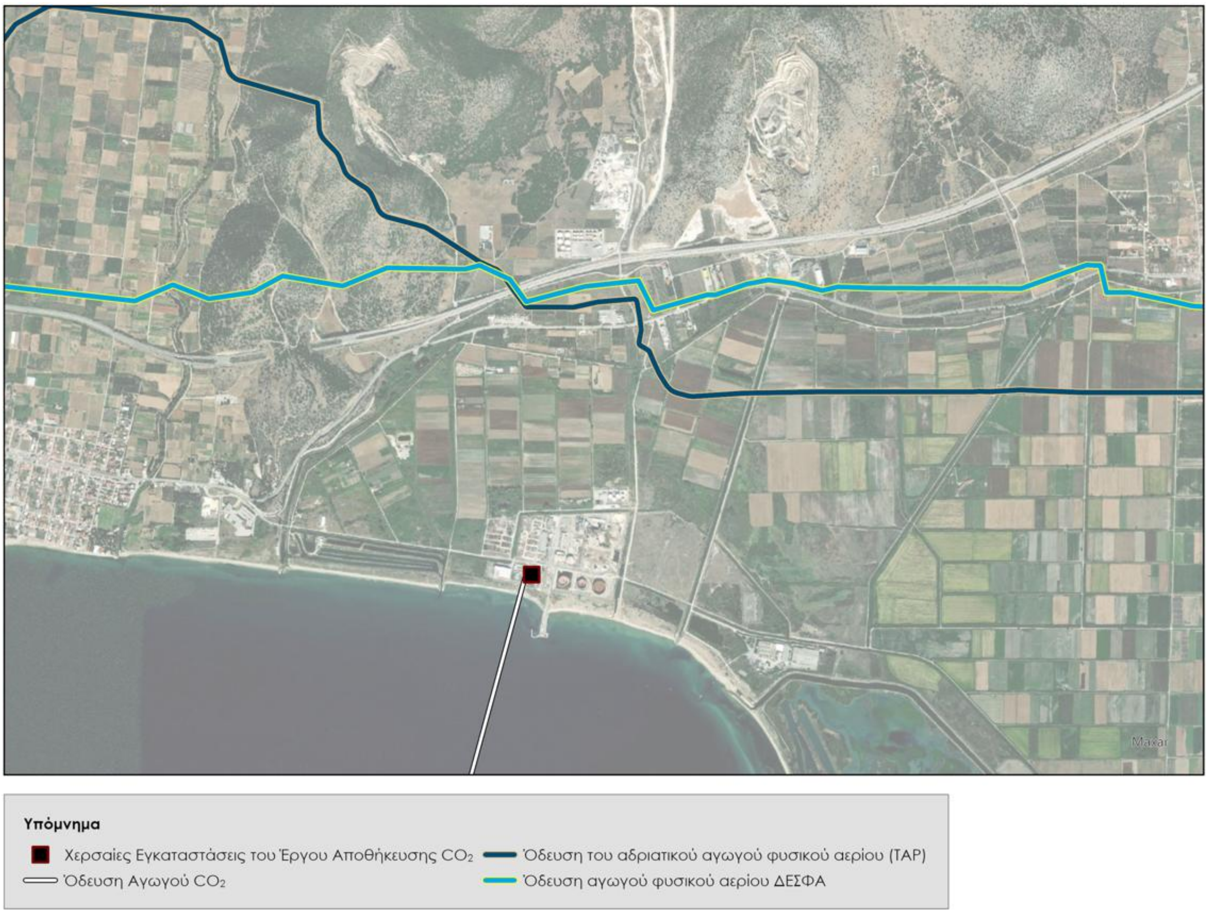
Figure 8–129: Map of the National Water Abstraction Points Registry in the project installation area

Natural Gas

The national natural gas transmission system constructed by DESFA crosses the study area from Kipoi towards Thessaloniki. The pipeline of the National Natural Gas Transmission System (ESMFA) passes at a distance of 1.3 km north of the onshore facilities of the Project. At the site of the ESMFA pipeline valve station in Kavala, a metering station is located for the purpose of supplying the city of Kavala and the nearby towns of Palio and Eleftheroupoli. The construction of a 66 km natural gas distribution network in Kavala is expected to be completed within 2024, while works for consumer connections are in progress. Kavala is the fifth city in the Region of Eastern Macedonia and Thrace to be connected to natural gas, after Alexandroupoli, Drama, Xanthi, and Komotini, with Orestiada to follow shortly.

The KAVALA OIL industry in the immediate area of the proposed Project has been connected to the ESMFA via a 6'' high-pressure pipeline, approximately 2 km in length, including necessary facilities (valve station, pig trap station, hot tapping) and a metering station.

At a distance of 1 km north of the onshore facilities of the Project passes the Trans Adriatic Pipeline (TAP).

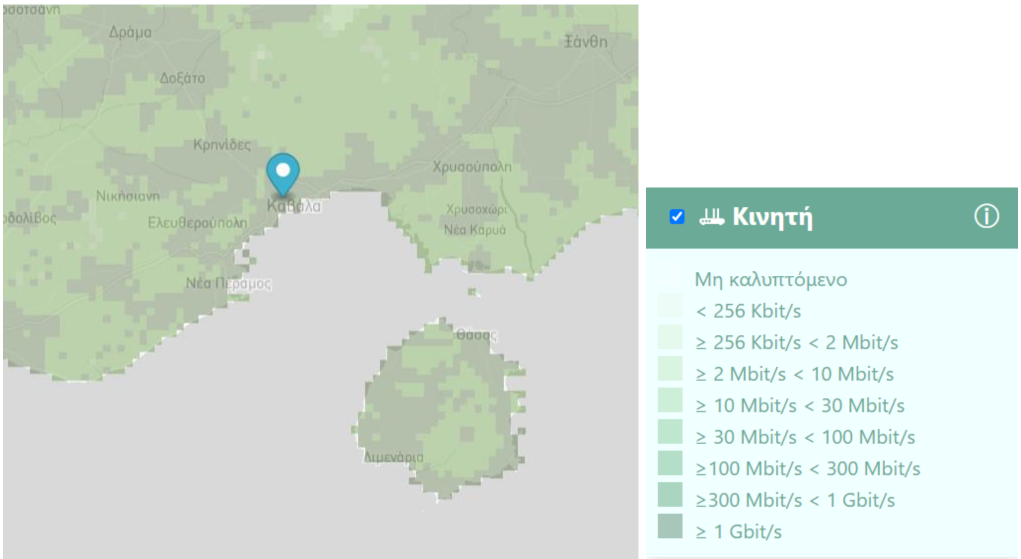


(Source: RSP of EMT, Ministerial Decision ΥΠΕΝ/ΔΧΩΡΣ/68605/1092 (Government Gazette 248/AAP/25-10-2018))

Figure 8–130: Routing of natural gas pipelines in the area of the Project's Onshore Facilities

8.12.3.3 Telecommunications

According to the Hellenic Telecommunications and Post Commission (EETT), the zone of direct influence is served by the fixed and mobile telephony networks of private providers. Regarding the existing broadband infrastructure, the wider study area, as can be seen from the map below, is served by the available broadband service networks.



(Source: Broadband Map & Network Registry)

Figure 8–131: Mobile telephony map of the wider study area

8.12.4 Environmental Infrastructure

8.12.4.1 Wastewater Management Infrastructure

Regarding wastewater management infrastructure, from the total population of the Eastern Macedonia and Thrace Region, 48% belongs to settlements connected through sewerage networks to the WWTPs of A' priority settlements (sensitive recipient, equivalent population over 10,000 inhabitants, deadline 31.12.1998) & B' priority settlements (normal recipient, equivalent population over 15,000 inhabitants, deadline 31.12.2000).

In the wider study area and within the Regional Unit of Kavala as well as Thasos, the following wastewater treatment plants (Table 8-90) are located and operational, which comply with the limits of Directive 91/271/EEC. Respectively in Figure 8-132 are presented the wastewater treatment installations located near the study area, according to the data of the Special Secretariat for Water of the Ministry of Environment and Energy. The nearest WWTP is located at a distance of about 7.5 km SW of the land facilities of the Project.

Table 8–90 Wastewater Treatment Plants (WWTPs) near the study area

WWTP Name	WWTP Code	Treatment Type	Total incoming flow to the WWTP (m^3/day)	Recipient
CHRYSOUPOLI	EL115011018	Secondary treatment with nitrogen removal and disinfection	1.951	EL1150110180

WWTP Name	WWTP Code	Treatment Type	Total incoming flow to the WWTP (m^3/day)	Recipient
KAVALA	EL115001016	Secondary treatment with nitrogen and phosphorus removal	13.500	EL1150010160
PALAIO TSIFLIKI	EL11500101117	Secondary treatment with nitrogen and phosphorus removal	1.200	EL115001011170
NEA PERAMOS KAVALAS	EL1150030115	Secondary treatment with nitrogen and phosphorus removal and disinfection	1.834	EL11500301150
THASOS	EL1150040116	Secondary treatment with nitrogen and phosphorus removal and disinfection	1.123	EL11500401160
PHILIPPI	EL1150100118	Secondary treatment with nitrogen and phosphorus removal and disinfection	2.430	EL11501001180
ELEFTHEROUPOLI	EL1150020114	No data available	2.400	EL11500201140

(Source: Special Secretariat for Water, Wastewater Treatment Plants Operational Monitoring Database, 19 June 2024)

(Source: Special Secretariat for Water, Wastewater Treatment Plants Operational Monitoring Database, 19 June 2024)

(Figure 8–132: Wastewater Treatment Plants (WWTPs) in the wider study area)

8.12.4.2 Solid Waste Management Infrastructure

According to the approved Regional Waste Management Plan (PESDA 2016) for Eastern Macedonia and Thrace (EMT), in the Regional Unit (R.U.) of Kavala approximately 56,035 tonnes of MSW were produced in 2020, along with 4,099 tonnes/year of sludge from WWTPs, and 29 tonnes/year of sludge from tourist facilities for 2015. The existing Sanitary Landfills (XYTA) of the Region of Eastern Macedonia and Thrace are presented in the following table:

Table 8–91: Sanitary Landfills (XYTA) in the Region of Eastern Macedonia and Thrace

No.	Landfill	Municipalities Served
1	Kavala	Kavala, Nestos, Paggaio, Drama, Doxato, Prosotsani, Paranesti, K. Nevrokopi
2	Alexandroupoli	Alexandroupoli, Soufli, Komotini, Maroneia–Sapes, Arriana, Iasmos
3	Thasos	Thasos
4	Samothraki	Samothraki
5	Xanthi	Xanthi, Myki, Avdira, Topeiros
6	North Evros	Didymoteicho, Orestiada

(Source: Regional Waste Management Plan – PESDA, 2016)

For the purposes of solid waste management in the Municipality of Kavala, the Kavala Sanitary Landfill (XYTA) and the Kavala Waste Treatment Plant (MEA) are in operation. It is noted that the expansion of the existing Kavala Landfill by 31 stremmas on an adjacent plot above the current operating site is expected to be completed. With the operation of the "waste factory" (or so-called MEA) in the wider Aspri Ammos area, the facility will be converted into a Sanitary Landfill for Residues (XYTY).

The monthly variation of Municipal Solid Waste (MSW) generated in the Municipality of Kavala and entering the Kavala Landfill during the period 2017–2020 is summarized in the following table:

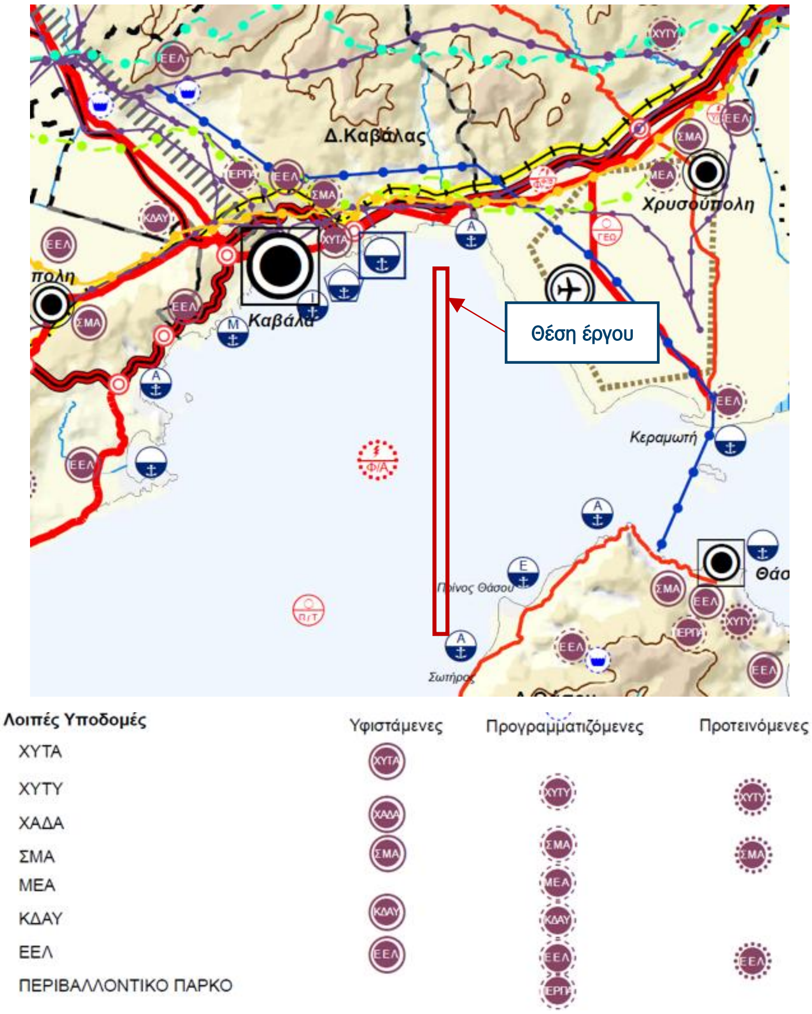
Table 8–92: Monthly variation of MSW in the Municipality of Kavala (2017–2020)

Month	Share of annual MSW production
JANUARY	6,80%
FEBRUARY	6,59%
MARCH	7,66%
APRIL	8,37%
MAY	9,15%
JUNE	8,42%
JULY	10,02%
AUGUST	9,75%
SEPTEMBER	8,66%
OCTOBER	8,77%
NOVEMBER	8,17%
DECEMBER	7,65%

(Source: Regional Waste Management Plan – PESDA, 2016)

As observed, during the tourist season from May to September, approximately 46% of the total annual production is expected, while during the two-month period of July–August, approximately 19.8% of the total annual production of MSW (Municipal Solid Waste) in the Municipality of Kavala is expected. In contrast, MSW production appears to be at its lowest during the period of January–February (approximately 6.8% and 6.6%, respectively, of the total annual MSW production).

The transfer of both mixed waste and recyclable materials currently takes place at the Kavala Transfer Stations (ΣΜΑ), Chrysoupoli Transfer Station, and Eleftheroupoli Transfer Station.



(Source: Regional Spatial Framework of Eastern Macedonia and Thrace, 2018)

Figure 8–133: Existing Solid Waste Management Facilities in the Regional Unit of Kavala (2016)

8.13 EXISTING PRESSURES ON THE HUMAN AND NATURAL ENVIRONMENT

8.13.1 Pressures in the Thrace River Basin District (EL12)

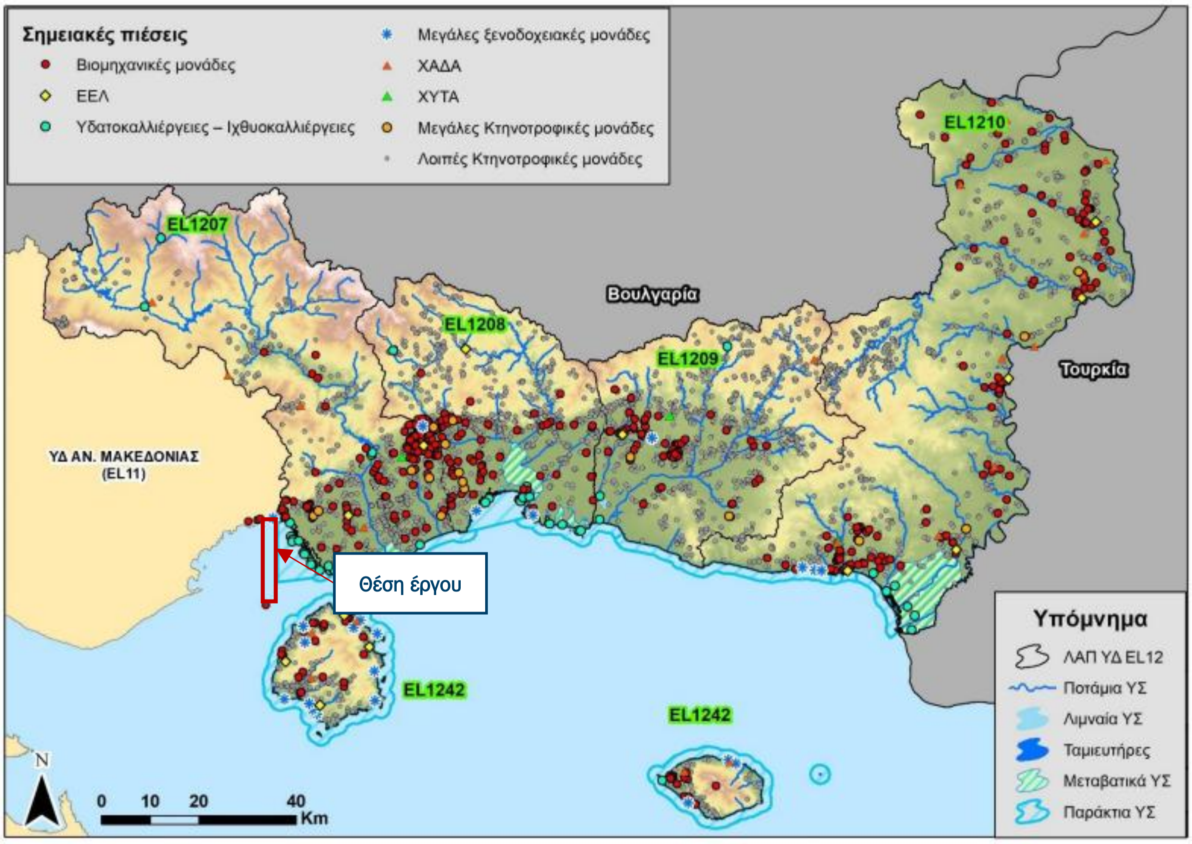
Within the framework of the preparation of the 2nd Revision of the River Basin Management Plan for Thrace (EL12), the anthropogenic pressures and their impacts on each surface and groundwater system were identified. According to Directive 2000/60/EC, anthropogenic pressures on water systems are defined as the totality of human activities that affect or may affect the water systems in the area where they take place. The categories of pollution sources are distinguished as follows:

- Point sources of pollution: Wastewater Treatment Plants (WWTPs), sewer network discharges into natural recipients, large hotels, industrial units, livestock farms, aquaculture – fish farming, leaks from uncontrolled landfills and sanitary landfills.
- Diffuse sources of pollution: Agricultural activities, urban wastewater not connected to WWTPs, pastoral livestock farming, impact on water bodies from other sources.
- Water flow regulation projects and hydromorphological alterations
- Water abstractions
- Other types of anthropogenic pressures.
- Impact on water bodies from other sources

The potential anthropogenic pressures on the environment of the wider study area (Kavala Regional Unit) are as follows:

- Overexploitation of land, uncontrolled use of groundwater for irrigation, and excessive discharge of waste into the aquifer
- Pollution from fertilizers and pesticides,
- Wastewater treatment plants,
- Sanitary landfills and uncontrolled dumping sites,
- Industries in the project area,
- Marine traffic,
- Fishing activities and aquaculture,
- Tourism,
- Mines and quarries,
- Livestock farming.

The point sources of pressure in the Thrace Water District (EL12) are illustrated in the following **Figure**.



(Source: 2nd Revision of the River Basin Management Plan (RBMP) for Water District 12 – Thrace)

Figure 8–123: Point sources of pressure in the Thrace Water District (EL12)

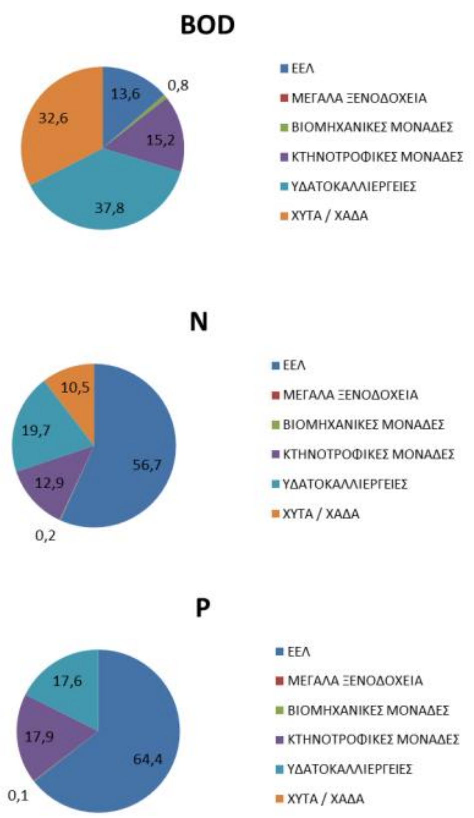
According to the 2nd Revision of the River Basin Management Plan for the Thrace Water District (EL12), in the Nestos Water Body (EL1207), the total annual loads resulting from the sum of individual point sources are 1,093 tn/year BOD, 421 tn/year N, and 79 tn/year P, as shown in the following table.

Table 8–87 Total annual loads of BOD, N, and P generated from point sources of pollution in the Nestos Water Body (EL1207)

POINT SOURCES OF POLLUTION	BOD (tn/y)	N (tn/y)	P (tn/y)
Industrial Facilities	8,73	0,66	0,09
Leachate from landfills (OLD/NEW)	356,00	44,00	0,00
Wastewater Treatment Plants (WWTPs)	148,98	238,82	51,12
Large hotel units	0,00	0,00	0,00
Aquaculture - Fishfarms	412,90	83,01	13,95
Large livestock units	166,72	54,46	14,17
TOTAL	1093,33	420,95	79,33

(Source: 2nd Revision of the River Basin Management Plan (RBMP) for Water District 12 – Thrace)

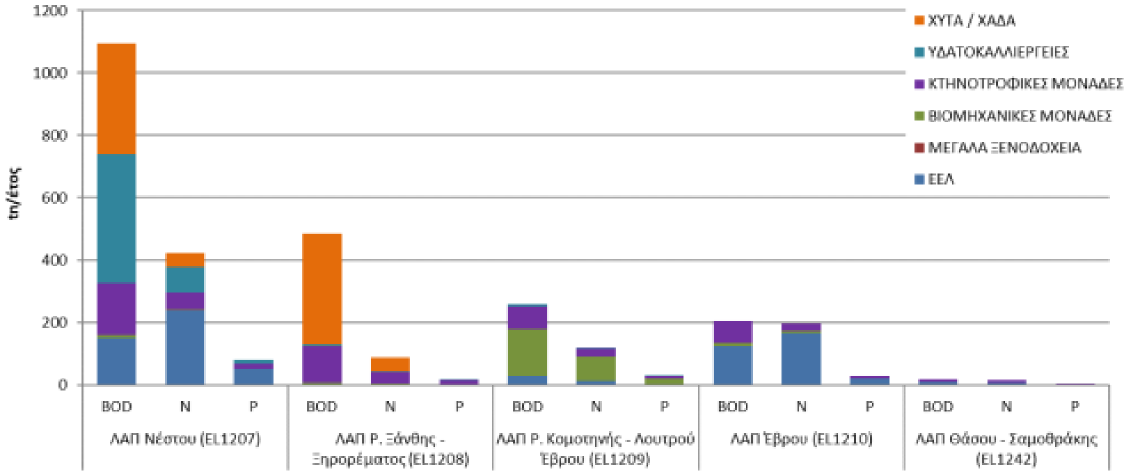
In the **figures** below, the annual load distribution of BOD, N, and P is presented for the Nestos WFD Body (EL1207)



(Source: 2nd Revision of the River Basin Management Plan (RBMP) for Water District 12 – Thrace)

Figure 8–124: Distribution of annual loads of BOD, N, and P from point sources in the Nestos Water Body (EL1207) of the Thrace Water District (EL12)

The following **Figure** presents the total annual loads (BOD, N, P) from wastewater treatment plants (WWTPs) for each Water Body of the Thrace Water District (EL12).



(Source: 2nd Revision of the River Basin Management Plan for the Thrace Water District (EL12))

Figure 8–125: Distribution of annual loads of BOD, N, and P from point sources in the Thrace Water District (EL12)

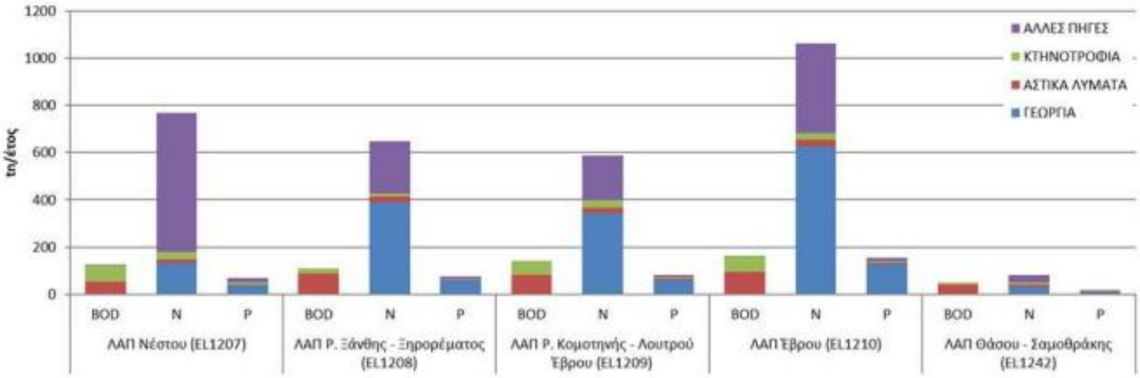
In addition to the aforementioned point sources, in the Nestos LPA there are also diffuse pollution sources such as agricultural activities, urban wastewater not connected to WWTPs, livestock farming (both extensive and intensive), and water impacts from other sources. Specifically, in this LPA (EL1207), the total annual surface loads resulting from the sum of the individual diffuse pressures are 124 tn/year BOD, 769 tn/year N, and 70 tn/year P, as shown in the following **Table**.

Table 8–88 Total annual surface loads of BOD, N, and P generated from diffuse sources in the Nestos LPA (EL1207)

LAND USE	BOD (tn/y)	N (tn/y)	P (tn/y)
Urban Wastewater	51,77	14,79	3,08
Agricultural	0,00	132,60	38,78
Livestock	71,73	31,47	6,89
Other sources	0,00	590,38	21,59
TOTAL	123,50	769,24	70,34

(Source: 2nd Revision of the RBMP (River Basin Management Plan) of the Thrace Water District (EL12))

The following **Figure** presents the final annual quantities of surface pollutant loads BOD, N, and P generated across the entire Water District. It should be noted that pollutants produced by livestock units, although constituting a point source of pollution, are included under diffuse pressures and are considered in this section.



(Source: 2nd Revision of the River Basin Management Plan (RBMP) – Water District 12, Thrace)

Figure 8–126: Total Annual Surface Loads of BOD, N, and P from Diffuse Pollution Sources in the Individual Water Management Units (WD) of the Thrace Water District

Overall, what is observed from the evaluation of both point and diffuse pollution sources for the Nestos WMA (EL1207) is that this WMA appears to be more heavily impacted than the others, mainly due to the large number of pastoral livestock farms.

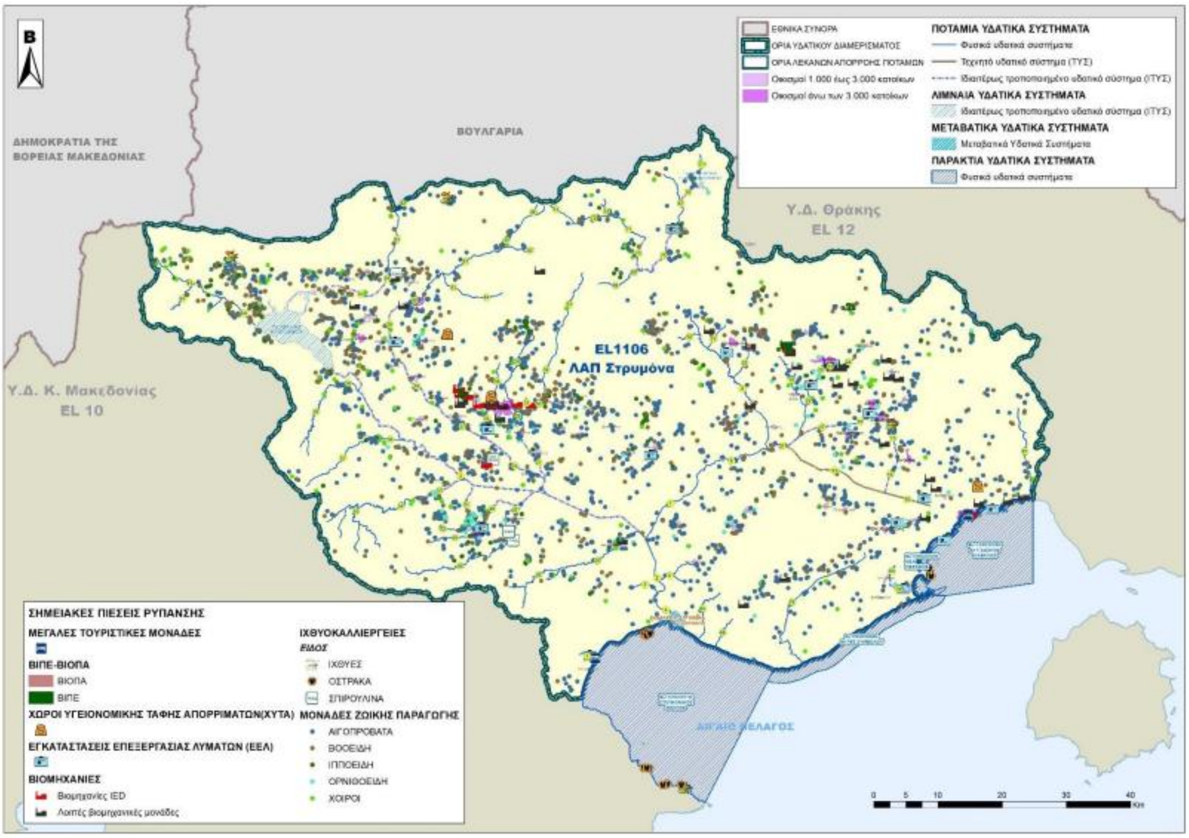
As a general conclusion, it appears that the area of the Thrace Water District (EL12) is primarily affected by intensive livestock activity (point and diffuse), industrial facilities, and aquaculture operations (EGY, 2024 Pressures).

Regarding point sources of pollution in the areas surrounding the terrestrial facilities of the project, it should be noted that these mainly concern industrial areas and activities. Similarly, the main diffuse pressures in the same areas arise from the presence of agricultural and aquaculture facilities and activities.

8.13.2 Pressures in the Eastern Macedonia Water District (EL11)

Within the framework of the preparation of the 2nd Revision of the River Basin Management Plan for Eastern Macedonia (EL11), anthropogenic pressures and their impacts on each surface and groundwater system were identified. According to Directive 2000/60/EC, anthropogenic pressures on water systems are defined as all human activities that affect or have the potential to affect the water systems in the area where they are carried out.

The following **figure** summarizes the total point-source pressures in the **Eastern Macedonia Water District (EL11).**



(Source: 2nd Revision of the River Basin Management Plan (RBMP) of Water District 11, Eastern Macedonia)

Figure 8–127: Point-source pressures in the Eastern Macedonia Water District (EL11)

In the Strimonas Water Body (EL1106), the total annual loads resulting from the sum of individual point-source pressures are 921.2 tn/year BOD, 451.8 tn/year N, and 93.3 tn/year P. The total loads generated by point-source pollution are presented in the following table.

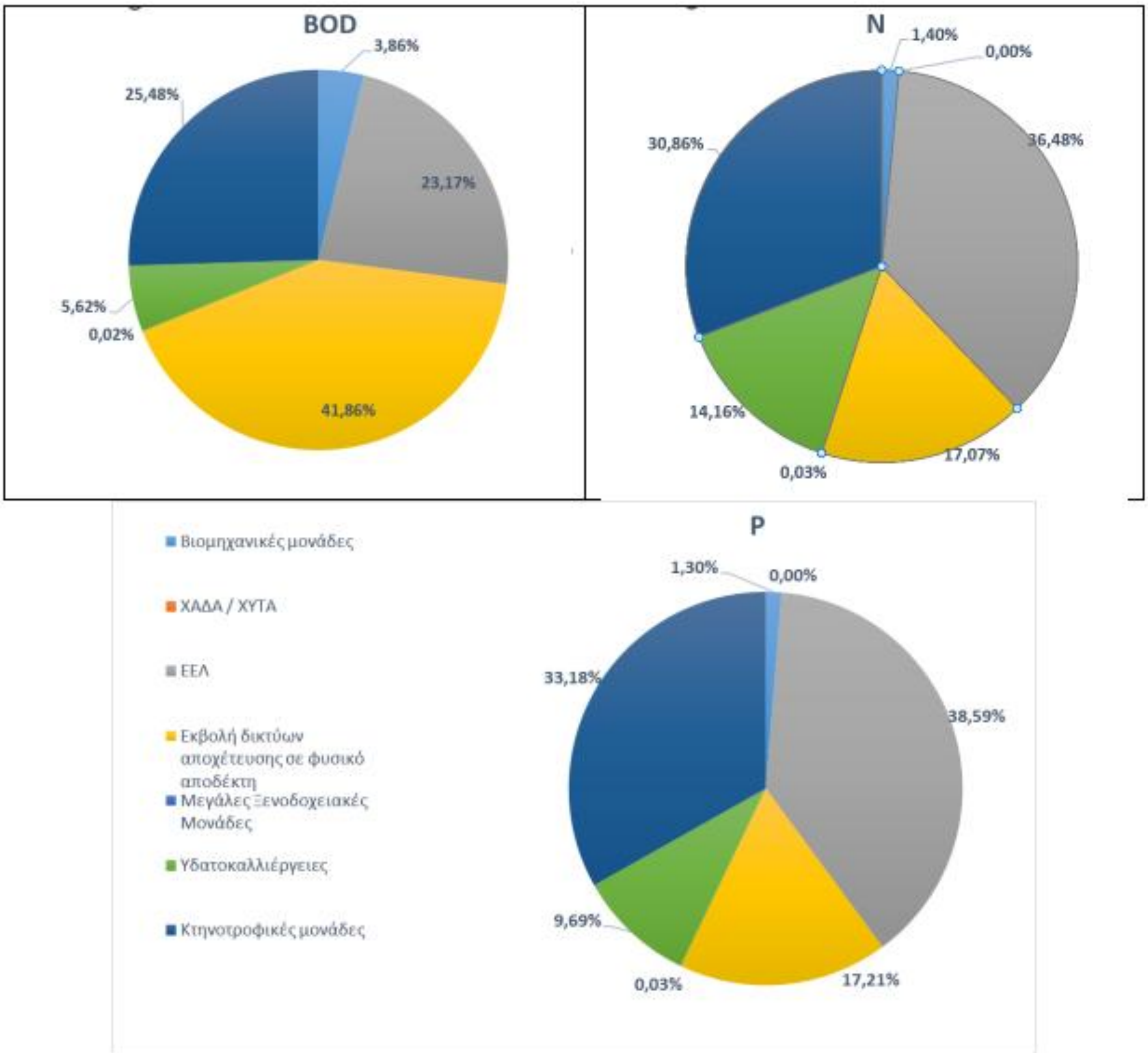
Table 8–89 Total annual loads of BOD, N, and P generated from point-source pollution in the Strimonas Water Body (EL1106).

Point Sources of Pollution	BOD (tn/y)	N (tn/y)	P (tn/y)
Idustrial Units	35,6	6,3	1,2
Leachate from landfills and waste disposal sites	0,0	0,0	0,0
Wastewater Treatment Plants	213,4	164,8	36,0
Sewer network discharge into natural receivers (*)	385,6	77,1	16,1
Lsrge hotel units	0,18	0,14	0,03
Aquaculture – Fish farming	51,8	64,0	9,0
Large livestock farms	234,7	139,5	31,0
TOTAL	921,2	451,8	93,3

(Source: 2nd Revision of the River Basin Management Plan (RBMP) of Water District 11, Eastern Macedonia)

(*)*It should be noted that approximately 90% of the loads come from the settlements of Doxato and K. Nevrokopi, for which, at the time of this study, the Wastewater Treatment Plants (WWTPs) were under construction, with an expected operational start in 2022–2023. Once the WWTPs begin operation, the above-mentioned loads will decrease accordingly*

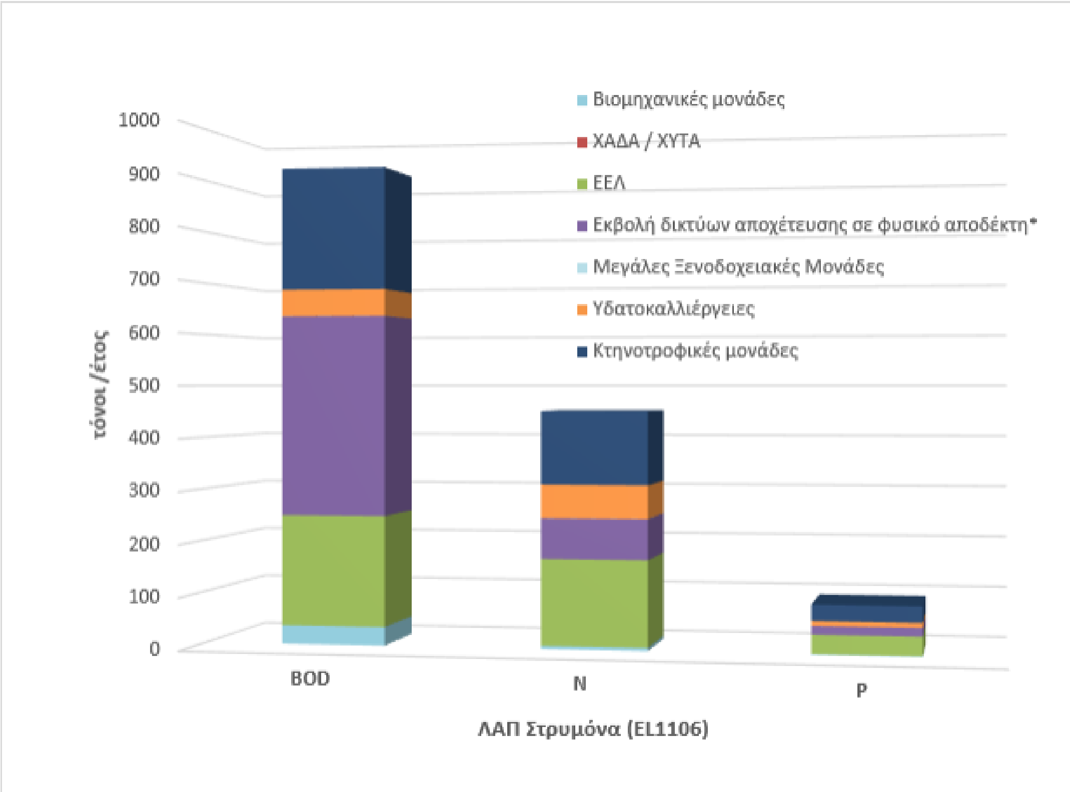
The following figures present, for the Struma River Catchment Area (EL1106), the distribution of the annual loads of BOD, N, and P.



(Source:2nd Revision of the River Basin Management Plan (RBMP) of Water District 11, Eastern Macedonia)

Figure 8–128: Distribution of annual loads of BOD, N, and P from point sources in the Struma River Catchment Area (EL1106) of the Eastern Macedonia Water District (EL11).

The following **figure** presents the total annual loads (BOD, N, P) from wastewater treatment plants (WWTPs) for each River Basin District (WD) of the Eastern Macedonia Water District (EL11).



(Source: 2nd Revision of the River Basin Management Plan (RBMP) for Water District 11 of Eastern Macedonia)

Figure 8–129: Annual distribution of BOD, N, and P loads from point-source pressures in the Water District of Eastern Macedonia (EL11)

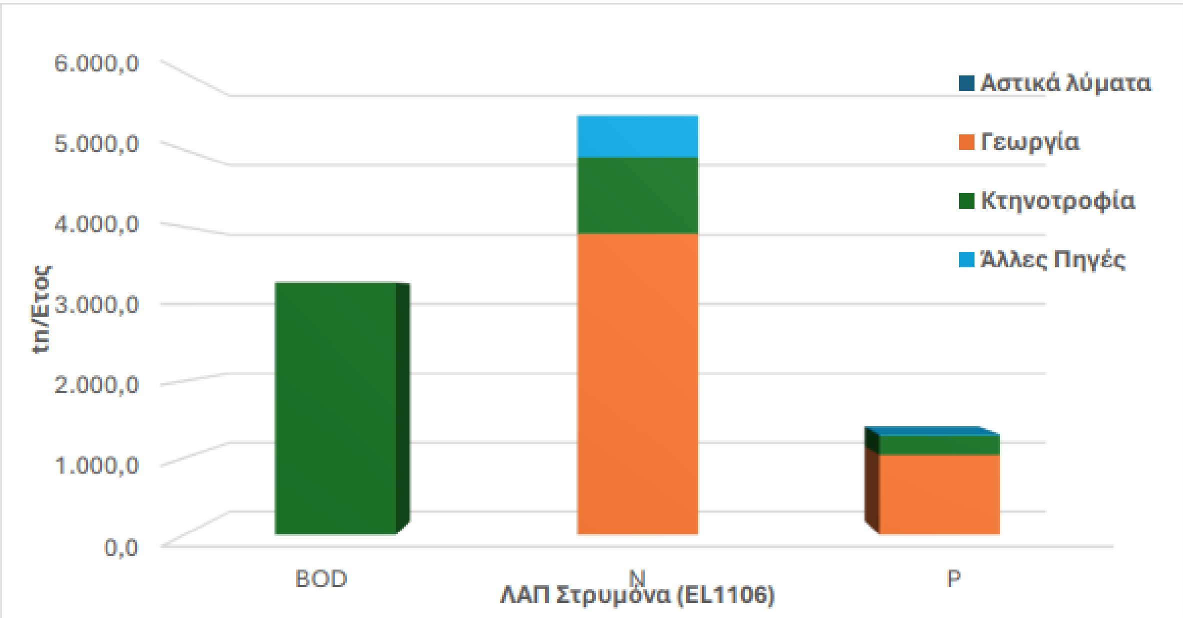
In addition to the aforementioned point-source pressures, in the Struma River Basin (EL1106) there are also diffuse pollution sources such as agricultural activities, urban wastewater not discharged to WWTPs, livestock farming (both pastoral and confined), and water pollution from other sources. Specifically, in this basin (EL1106), the total annual surface loads resulting from the sum of individual point-source pressures are 5,114.3 t/year BOD, 5,965.4 t/year N, and 1,415.1 t/year P, as shown in the following **Table**.

Table 8–90 Total annual surface loads of BOD, N, and P generated from diffuse sources in the Nestos River Basin (EL1207)

LAND USE	BOD (tn/y)	N (tn/y)	P (tn/y)
Urban Wastewater	1833,2	523,8	109,2
Agricultural	0,0	3912,8	1037,6
Livestock	3281,1	991,7	252,0
Othe sources	-	537,1	16,3
TOTAL	5114,3	5965,4	1415,1

(Source: 2nd Revision of the River Basin Management Plan (RBMP) for Water District 11 of Eastern Macedonia)

In the **figure** below, the total annual amounts of surface pollutant loads BOD, N, and P produced in the said water management unit (WD) are presented. It should be noted that the pollutants originating from livestock units, although considered point sources of pollution, are included in the calculation of diffuse pressures and are taken into account in this section.



(Source: 2nd Revision of the Environmental Impact Assessment (EIA) for Water District 11 of Eastern Macedonia)

Figure 8–130: Total annual surface loads of BOD, N, and P generated in the Struma LAP (EL1106) of Water District Eastern Macedonia (EL11) from diffuse pollution sources

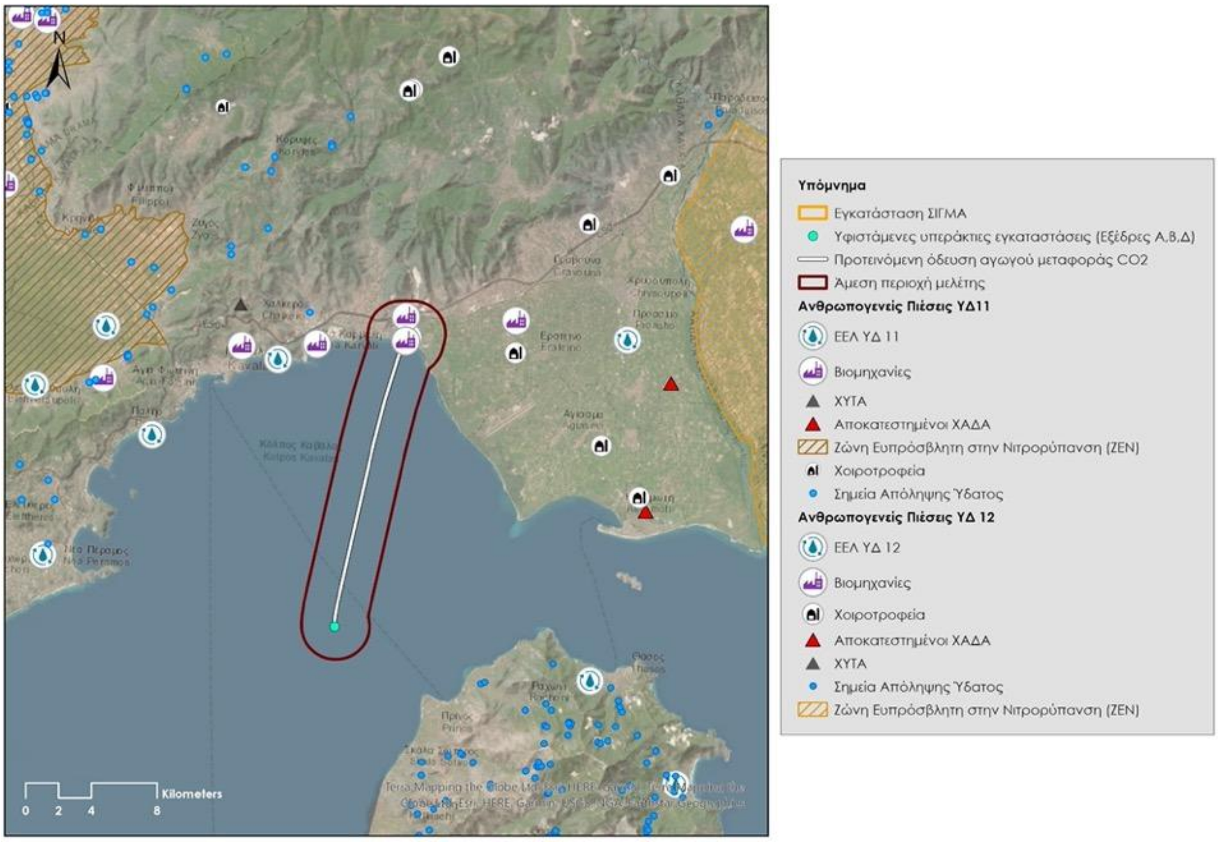
Overall, the evaluation of both point and diffuse pollution sources for the Struma LAP (EL1106) shows that this LAP appears more impacted than the others, mainly due to the large number of major livestock facilities.

As a general conclusion, the entire Water District of Eastern Macedonia (EL11) is primarily burdened by intensive livestock activity (both point and diffuse sources), industrial facilities, and sewerage networks (EGY, 2024 Pressures).

8.13.3 Pressures in the Vicinity of the Project

As observed in the following **figure**, the main sources of pressure in the vicinity of the Project are:

- Wastewater Treatment Plants (WWTPs)
- Industries and facilities subject to SEVESO Directive provisions (e.g., the "Hellenic Fertilizers ELFE S.A." industry)
- Industries and facilities subject to IPPC Directive requirements (e.g., the livestock farm "Afoi Kioutsoukosta – Kreka S.A." in Chrysoupoli, Kavala)
- Illegal or controlled landfill sites (e.g., dumps, sanitary landfills)
- Other polluting facilities, such as pig farms, poultry farms, slaughterhouses, etc.



(Source: 1st Revision of the Environmental Impact Assessment Study for Water Resources (EIA) of Thrace[49])

Figure 8–131: Main anthropogenic pressures in the area near the Project

The treated industrial liquid waste from the Project's onshore SIGMA facility is discharged into its immediate marine area. The final disposal of both treated liquid waste and stormwater into the marine recipient (Kavala Gulf) is carried out in accordance with Prefectural Decision No. A.P. 6924/1987 (Government Gazette

[49] *It should be noted that this map has been created based on the spatial data of anthropogenic pressures from the 1st Revision of the Environmental Impact Assessment (EIA) of the Water District of Thrace (EL12) and the Water District of Eastern Macedonia (EL11), as the data from the 2nd Revision have not yet been published.*

475/3-9-1987) "Designation of the recipient for industrial waste and urban sewage in the Prefecture of Kavala."

Apart from the Project's onshore industrial facilities, another pressure on the nearby environment comes from the fertilizer and chemical industry (Hellenic Fertilizers ELFE S.A.), which discharges its treated industrial wastewater into its immediate marine area.

The livestock facility "Afoi Kioutsoukosta – Kreka S.A." in Chrysoupoli, Kavala, is located approximately 6 km from the Project's onshore facilities and falls under the IPPC Directive. This facility represents a pollution load in the wider area; however, it has a secondary treatment unit, with the treated wastewater discharged first into an adjacent drainage ditch and ultimately into the marine environment.

8.14 ENVIRONMENTAL EVOLUTION TRENDS WITHOUT THE PROJECT

Regarding the state of the natural environment, as it is expected to be in the future in the area of the project development and its associated infrastructure, no significant changes from the existing anthropogenic pressures are anticipated.

At the locations of the project's onshore facilities, anthropogenic activities are expected to continue dominating in the future, as they are part of existing industrial installations and activities with an extremely low degree of naturalness. Similarly, no noteworthy changes are expected in the flora and fauna species.

Likewise, the offshore facilities of the proposed project are situated in areas/locations with existing industrial infrastructures (industrial facilities for mineral extraction). Therefore, both in the short and medium term, anthropogenic activities are expected to continue dominating the locations of the project's offshore facilities.

In conclusion, regarding future environmental conditions without the implementation of the proposed project, the following is estimated: The state expected to develop in the area of the proposed project over the next 20 years does not appear to differ significantly from the current situation. These areas and their specific characteristics are not suitable for any other type of development (specifically, no population settlement is expected at the immediate project sites, and therefore no construction of technical infrastructure is planned).

Evaluating the above and considering the projected development trends in the area with or without the implementation of the project under study, the following should be noted regarding future environmental conditions (with the construction and operation of the project):

- The natural environment is not expected to be significantly affected in the areas of the onshore facilities, as these areas are not distinguished by their naturalness, being part of existing onshore facilities and activities.
- In general, the natural environment is expected to experience local degradation in the area of influence of the offshore works, while it will remain at current levels in the rest of the study area, since impacts on the biotic elements of the immediate study area are expected to be of limited geographic scale.
- Land uses are not expected to change

In the case that the proposed project under study is not constructed, a series of positive socio-economic impacts in the area, which were described in detail in the relevant **Chapter 4** of the project feasibility study, will not be realized.

Evolution of the Nestos Delta

The Nestos Delta was shaped almost exclusively by natural factors until 1945, after which a dynamic human influence is observed. The most notable anthropogenic effects include the eastward shift of the Nestos riverbed by four kilometers and the construction of drainage and irrigation networks, which began in 1953 with the drainage of marshes and wet soils that were subsequently converted to agricultural use.

As observed in the **figures** below, the entire coastal zone is characterized by erosion due to the operation of three hydroelectric and irrigation dams along the Nestos River, particularly in the deltaic area, with an estimated reduction of sediment supply compared to the historical sediment delivery to the deltaic zone by 84% due to the damming of the Nestos River.

(Source: Pontos et.al,2022)

Figure 8–132: Impacts of river dams on the coastal zone of the Nestos River estuary

For protection against coastal erosion, measures have been taken to safeguard the coastal pipeline east of the Asprochoma stream before Nea Karvali, while the coastal sections of the Erateinos and Agiasma lagoons have been reinforced with rows of stones measuring 800 m and 1,000 m, respectively.

The construction of the 150 m-long pier at the SIGMA onshore facilities of the Project appears to have contributed to a retreat of approximately 35 meters on the western side of the coast.

The following figures present the evolution of the area of the Project's onshore facilities over the period 1968–2023.

(Source: Search Availability – Aerial Photography Sales https://gis.ktimanet.gr/gis/apr/)

Figure 8–133: Aerial photographs from 18.3.1968 (left) and 13.11.1978 (right) showing the drainage network for the area of the Project's onshore facilities.

(Source: : Search Availability – Aerial Photography Sales https://gis.ktimanet.gr/gis/apr/)

Figure 8–134: Aerial photographs from 27.5.1983 (left) and 10.11.2023 (right) showing the drainage network for the area of the Project's onshore facilities.

As can be observed from the above **Figures**, drainage networks are distinguishable since 1968, while the coastal areas have remained natural. By 1983, material deposition had begun in the wetland east of the onshore facilities.

From the 2023 Figure, the aquaculture facility can be seen west of the plant, the abandoned "Xifias" factory lies to the east, and the remaining wetlands persist after the reclamation of an area of approximately 200 stremmas (~20 hectares).

8.15 RISKS TO HUMAN HEALTH, CULTURAL HERITAGE, AND/OR THE ENVIRONMENT MAINLY DUE TO ACCIDENTS OR DISASTERS

8.15.1 General

This **section** presents the risks to human health, cultural heritage, and/or the environment due to accidents and disasters, in accordance with the requirements of Directive 2014/52/EU, which was transposed into Greek law through the following legislation:

- Joint Ministerial Decision (KYA) oik.5688/2018: "Amendment of the annexes of Law 4014/2011 (Government Gazette 209/A) according to Article 36A of this law, in compliance with Directive 2014/52/EU 'amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment' of the European Parliament and of the Council of 16 April 2014" (Government Gazette 988/B/2018), and
- Joint Ministerial Decision 1915/2018: "Amendment of Ministerial Decisions No. 48963/2012 (Government Gazette B' 2703) and No. 170225/2014 (Government Gazette B' 135), issued under the authorization of Law 4014/2011 (Government Gazette 209/A), in compliance with Directive 2014/52/EU on the amendment of Directive 2011/92/EU concerning the assessment of the effects of certain public and private projects on the environment," of the European Parliament and of the Council dated 16 April 2014 (Government Gazette 304/B/2018).

The following are definitions of terms related to the subject of the paragraph. More specifically:

- Natural disaster: The probability of occurrence of a potentially disastrous event such as extreme weather phenomena that occur in nature (e.g., storms, floods, extreme temperatures) or hazards related to the ground (e.g., subsidence, landslides, earthquakes) which may cause an event within a given time period and specific geographic area. According to Directive 2014/52/EU, natural disasters include floods, sea level rise (associated with climate change), and earthquakes. The United Nations (UN), in 1992, defined natural disasters as serious disruptions of the functioning of a society, causing widespread human, material, or environmental losses that exceed the ability of the society to cope using its own resources. According to the UN, natural disasters kill approximately 90,000 people and affect 160 million people worldwide every year.
- Major accident: Directive 2014/52/EU does not provide a corresponding definition of a major accident. A relevant definition is provided in Directive 2012/18/EU on the control of major-accident hazards involving dangerous substances, where a major accident is defined as an event—such as a large release, fire, or explosion—resulting from uncontrolled developments during the operation of any establishment covered by the directive, which causes serious immediate or delayed risks to human health or the environment, inside or outside the establishment, and involves one or more dangerous substances.<u>In general, a major accident can be considered an event that causes serious damage to human health, well-being, and/or the environment, either immediately or with a delay, such as loss of life, permanent injury, or permanent/long-term damage to environmental components that cannot be remedied with minor cleanup and restoration efforts.</u>
- Exposure: People, property, systems, or other elements located within hazard zones and therefore subject to potential losses (UNISDR Terminology on Disaster Risk Reduction, United Nations, 2009).

- Vulnerability: The characteristics and conditions of a community, system, or asset that make it susceptible to the harmful effects of hazards (UNISDR Terminology on Disaster Risk Reduction, United Nations, 2009).
- Risk of occurrence: The probability that an impact will occur, combined with the result or consequences of that impact on a receptor (if it occurs) (UNISDR Terminology on Disaster Risk Reduction, United Nations, 2009)
- A significant impact can be considered as the impact of an event that leads to loss of life, permanent injury, or long-term damage to an environmental sector.

The literature mentions various methods of distinguishing and classifying natural disasters, based on their causes and severity. The World Health Organization classifies natural disasters into the following categories:

- Hydrological, such as floods
- Geophysical, including earthquakes, volcanic eruptions, and landslides
- Meteorological, such as storms and thunderstorms
- Climatological, such as extreme very high or very low temperatures and natural fires.
- Biological, caused by the exposure of living organisms to pathogenic microorganisms.

Regarding the time scale of occurrence of natural phenomena, the size-frequency relationship reflects the intensity of the damage that can be caused by a specific disastrous event, as a result of its magnitude multiplied by its frequency of occurrence. Generally, large-scale events do not occur frequently enough to be considered the most significant, while phenomena that occur more often are usually of lesser intensity. Therefore, the average consequences are calculated by multiplying the size of the event by its frequency of occurrence.

In Greece, the most common natural disasters are due to earthquakes, heavy rainfall and floods, fires that can lead to deforestation of areas which, when steeply sloped, promote the occurrence of landslides, and heatwaves

Beyond natural disasters, there are also technological disasters, which are primarily considered man-made. Technological disasters usually result from technological hazards that are initially not properly managed, or from technological incidents (accidents) caused by human errors, equipment failures, organizational or administrative dysfunctions, etc., and which get out of control. However, they can also be the result of other natural disasters (earthquakes, lightning, heavy rainfall, etc.) or deliberate human actions. In general, technological disasters are considered to occur infrequently (i.e., they have a very low probability of occurrence) but have potentially very serious impacts.

Technological disasters, depending on their intensity and extent, may cause loss of life or injuries (both to workers at the accident site and to the population located permanently or passing “nearby” — see the relevant guidelines on the definition of “nearby” — at the accident location), destruction of property, disruption of social and economic life, and environmental degradation.

The usual classification of technological accidents is as follows:

- Chemical accidents at industrial facilities: occur at industrial sites (production, processing, or storage) resulting in severe environmental pollution from the release of heavy metals and toxic chemical substances.

- Accidents involving the transportation of hazardous materials: happen during the transport of dangerous goods by various means of transport (road, rail, maritime, air).
- Transportation accidents: road, rail, maritime, air. These are conventional transportation accidents, which usually result in loss of human life and injuries, but do not have significant impacts on the environment.
- Dam failure: occurs rarely but has major impacts, both in terms of loss of human life and on the environment.
- Nuclear accidents: usually involve the release of radioactive elements into the environment and have long-term impacts on both human health and the environment.

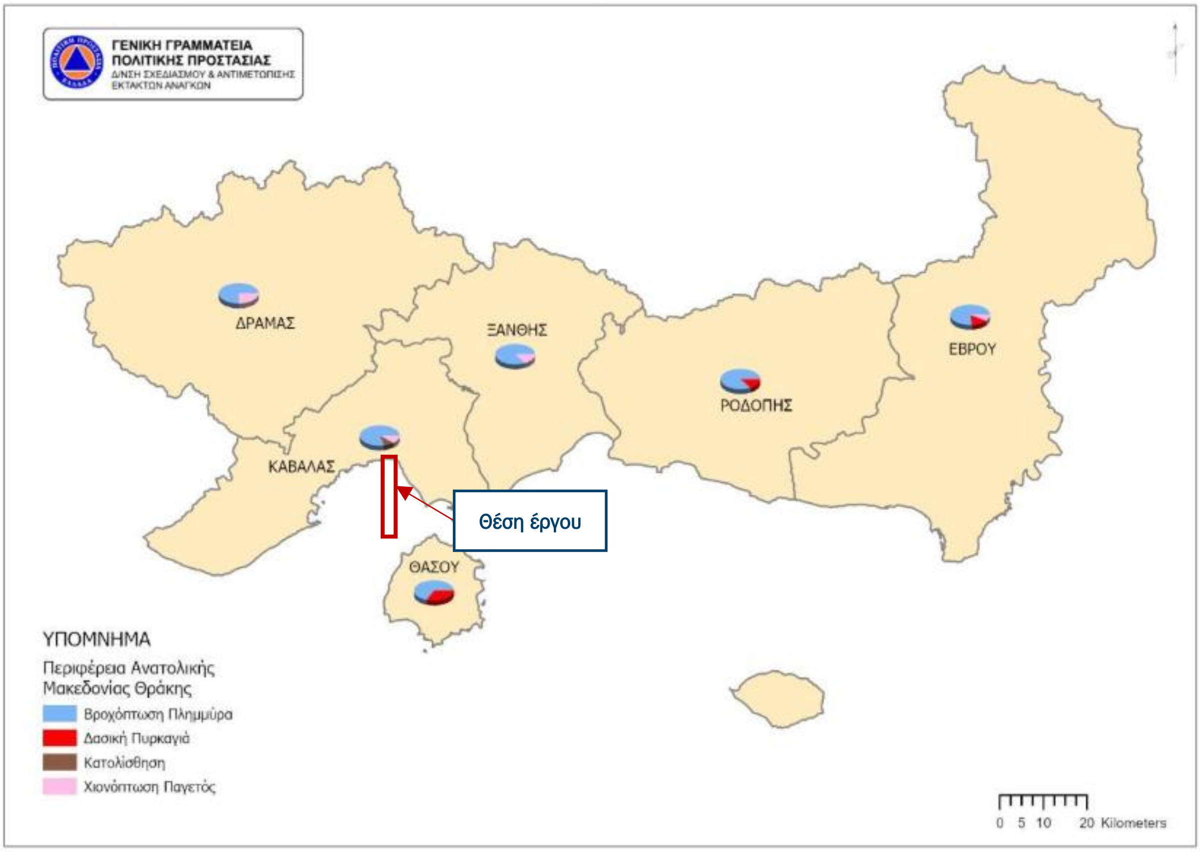
Although environmental disasters are generally not everyday occurrences and therefore are not often responsible for deaths or material damage, their potential for unexpected catastrophic losses makes them highly significant and defines their character. Environmental disasters share certain common **characteristics**:

- The source of the disastrous event is clear and produces characteristic outcomes (e.g., a flood causes deaths by drowning).
- The warning time is usually short.
- The majority of losses caused, whether in human lives or property, occur immediately following the event.
- The risk of exposure is largely involuntary, usually due to populations residing in hazardous areas.
- The disaster has such intensity and scale that it requires an immediate response.

This section describes the potential risks of serious accidents or disasters in the study area caused by external factors (outside the Project), in accordance with the requirements of Joint Ministerial Decision 1915/2018, taking into account the information presented in the previous sections of Chapter 8. The potential risks of serious accidents or disasters from external factors to which the project under study is potentially vulnerable, considering the guidelines of Directive 2014/52/EU, primarily concern natural causes and include, in order of priority:

- Natural Disasters: ▪ Flooding from inland waters,
  - Flooding from coastal waters,
  - Sea level rise,
  - Extreme weather events (windstorms, lightning, frost, hail),
  - Fires,
  - Landslides, slope failures due to flooding and/or erosion,
  - Earthquakes,
  - Pandemics (e.g., COVID-19, H1N1).
- Man-made accidents / disasters: ▪
  - Road accidents (vehicle collisions, vehicle rollovers, explosions, fires, etc.),
  - Air accidents (helicopter/aircraft crashes),
  - Technological accidents / disasters resulting from failures of existing infrastructure or other human activities (fuel stations, livestock units, photovoltaic plants, agriculture, etc.).
  - Sabotage (e.g., arson, vandalism, explosive device, use of radioactive, nuclear, biological, and chemical substances, other unlawful acts).

The following **figure** presents the distribution of the number of emergency declarations in the Region of Eastern Macedonia and Thrace by type of disastrous event during the period 2014–2020, according to the "Statistical Overview of Emergency Declarations" of the General Secretariat for Civil Protection (GSCP).



(Source: GSCP, 2020)

Figure 8–135: Distribution of emergency declarations by category of natural phenomenon in the EMT (Eastern Macedonia and Thrace)

As observed from the above **figure**, throughout the EMT, the main recorded disastrous events concern extreme rainfall, floods, and forest fires, followed—at a lesser extent—by snowfalls and frost, and finally by landslides.

The following sections provide a more detailed description of these hazards, the likelihood of their occurrence in the broader study area, and their potential intensity, taking into account the existing condition of the area's natural and human-made environment.

8.15.2 Natural Disasters

8.15.2.1 Seismic Hazard

The Greek territory is located at the boundary of contact and convergence between the African lithospheric plate and the Eurasian plate. For this reason, active tectonics in the area are intense, with Greece exhibiting the highest seismicity in Europe, as it releases half of the energy generated by earthquakes across the whole of Europe (European Spatial Planning Observation Network (ESPON), 2006).

Earthquake is a phenomenon that occurs without clear warning, cannot be prevented, and despite its short duration, can cause significant material damage to human infrastructure, resulting in serious injuries and loss of human lives.

Greece holds the first place in Europe in terms of seismicity and the sixth worldwide. Its geographical position coincides with a region of the planet where major geotectonic phenomena take place, such as the convergence of the African and the Euro-Asian lithospheric plates, resulting in the high seismicity observed in this area.

Seismic risk in the project area is analyzed in Section 8.4.4.2 of this Environmental Impact Study (EIS).

8.15.2.2 Flood Risk

Part of the Project study area falls within the Water District (ΥΔ) 12 "Thrace," for which a Flood Risk Management Plan (FRMP) has been developed and approved according to Government Gazette 2688/B/2018. The Project's terrestrial facilities are located within the boundaries of the Potentially High Flood Risk Zone (PHFRZ) named "Xanthi - Komotini Plain (Low River Zones of Nestos, Kosynthos, Kompsatos, Aspropotamos, Bosbos, Filiouris rivers, and riparian areas of Lake Vistonida)" with the code GR12RAK0001.

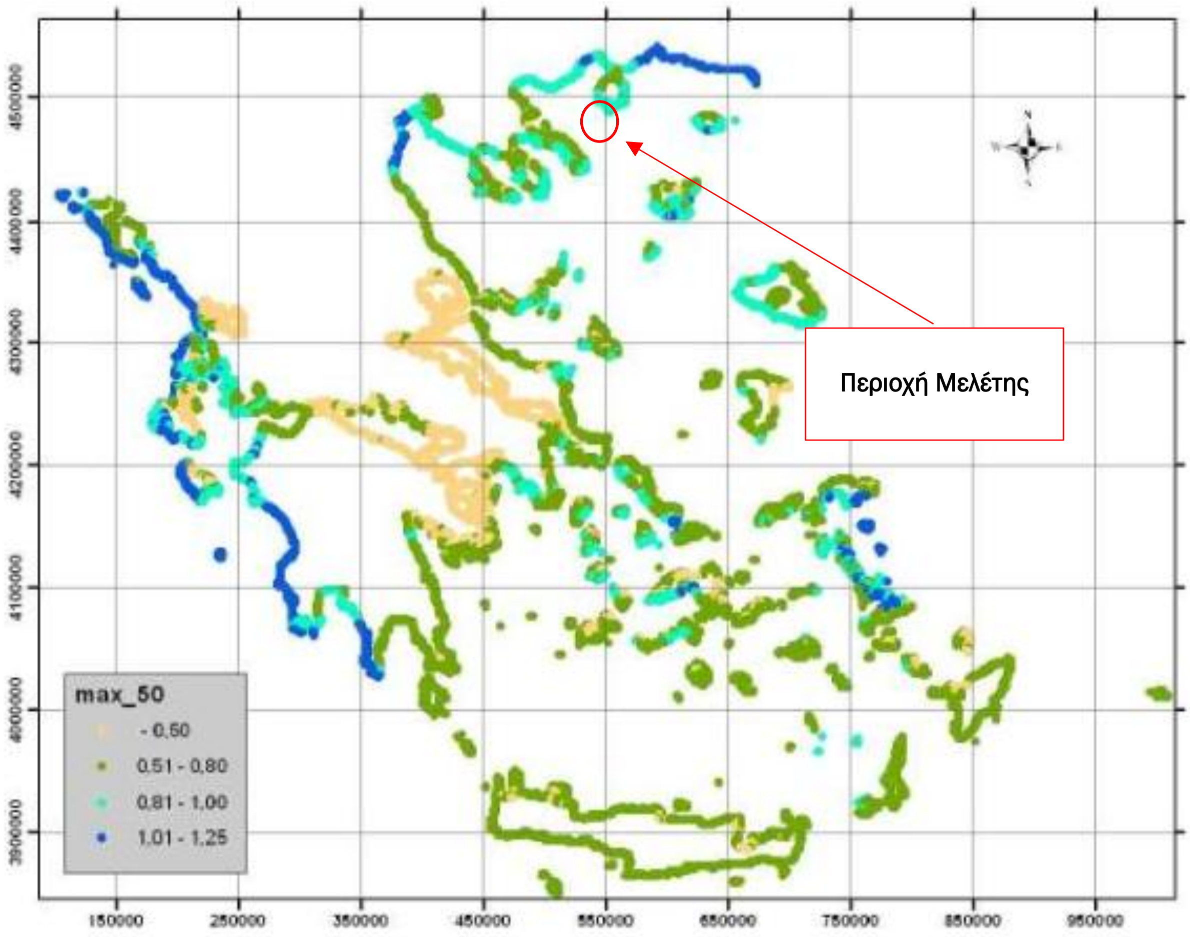
In this PHFRZ, the area inundated by river flows for a return period of T=50 years amounts to 327.82 km², for T=100 years it amounts to 381.90 km², and for T=1000 years it reaches 656.22 km². Within the PHFRZ and for T=50 years, areas with water depth greater than 1 meter are located along the courses of the Nestos, Kosynthos, Kompsatos, and Filiuri rivers and on both sides of these rivers.

The flood risk in the Project area is analyzed in **Section 8.5.4** of this Environmental Impact Study (EIS).

8.15.2.3 Rise of Mean Sea Level (MSL)

According to Deliverable 5 of the Flood Risk Maps of the Flood Risk Management Plan (FRMP) for Water District 12 (YD12), the rise of the Mean Sea Level (MSL) due to wave action is estimated as 7% of the open sea wave height. The maximum wave height is determined by calculating the values of wave height in each of the eight main wind directions and is derived from the fetch length, wind speed, and wind duration.

In the following figure, the maximum rise of the Mean Sea Level (MSL) along the coastline for a return period of 50 years is presented.



(Source: Flood Risk Management Plan, Water District 12 (YD12) Thrace (Government Gazette 2690/B/2018))

Figure 8–136:Total maximum sea level rise along the Aegean coastline due to wave action (for a 50-year return period)

According to the Approved Flood Risk Management Plan of the Thrace River Basin District (Government Gazette 2688/B/2018), it is noted that for a 100-year return period, the meteorological tide is not expected to change significantly, while the wave-induced flooding will be 10-20% greater. Therefore, to estimate the sea level rise for the 100-year return period, the astronomical tide is combined with the meteorological tide and the wave flooding increased by 15%. At this stage, a reliable estimation of flooding corresponding to a 1,000-year return period is not possible.

Taking into account that:

- Coastal urban areas generally have some form of embankment or wave protection about 1.0 m above the Mean Sea Level (MSL)
- Irrigated areas are usually about 1.0 m above the MSL
- Wetlands are around the MSL but are subject to periodic flooding,

it was estimated that the coastal areas considered at risk are those where a sea level rise of at least 1 meter is projected.

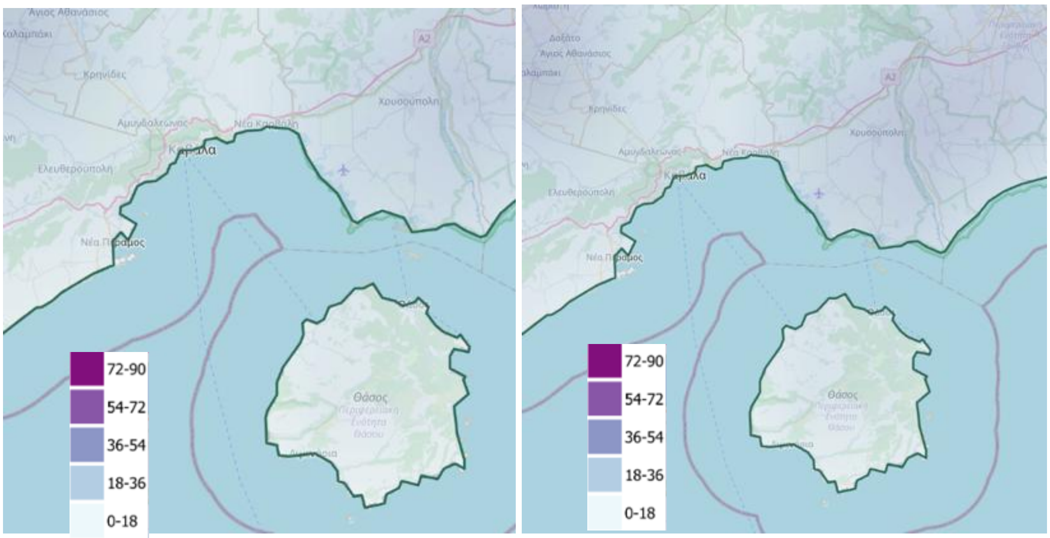
In the Thrace Water District, the Coastal Flood Risk Zone (ΖΔΥΚΠ) GR12RAK0001 presents a risk, as it borders coastal waters and the total estimated sea level rise (SLR) exceeds 1 meter. Specifically, the total SLR is estimated at 1.11 meters and 1.23 meters for return periods of T=50 and T=100 years, respectively. The land installations fall within the inundated areas for the T=100-year return period.

8.15.2.4 Extreme Weather Events

The risks arising from extreme meteorological events are the following:

- Storm – Hurricane: Like any other meteorological phenomenon, it depends on the specific local conditions of the area and is influenced by factors such as air mass movement, humidity, temperature changes, etc. Floods and storms are among the most significant natural hazards in Europe in terms of economic losses. Factors contributing to the intensity of their impacts on the affected area include intensity, duration, surface conditions, morphology, and slope of the drainage basin. Specifically, for the study area, according to records from the nearest meteorological station, wind conditions are relatively mild, and strong winds are not very frequent but do occur. Therefore, the area's vulnerability to storms and winds is at a moderate level, and the corresponding risk to human health, cultural heritage, and/or the environment is present.
- Extreme temperatures: The occurrence of extreme (low or high) temperatures poses a real risk mainly to human life. However, in Greece, mortality rates due to this risk are low and are not evaluated as significant. In areas where there is no intense urban presence or dense building structures—such as the study area—the vulnerability to extreme temperatures is very limited. Consequently, the related risk to human health, cultural heritage, and/or the environment is not considered significant.

  The following Figures present the number of very hot days (TX > 35°C) for the years 2031-2060 under the two climate scenarios RCP 4.5 (absolute values) and RCP 8.5 (absolute values).



(Source: Adaptive Greece, https://geo.adaptivegreecehub.gr/ ,2024)

Figure 8–137: Number of very hot days (TX > 35 °C) for climate scenarios RCP 4.5 (left) and RCP 8.5 (right)

As observed from the above figures, the study area is expected not to experience extreme temperatures.

As mentioned in more detail in **Section 8.2.4.2**, the Regional Unit of Eastern Macedonia–Thrace exhibits a low to moderate frequency of extreme weather events, with 10–20 recorded incidents during the period 2000–2020. Of these, 10–15 incidents had very serious social and economic impacts, resulting in 1–10 human casualties depending on the prefecture.

The incidents with social and economic impacts recorded in the Regional Unit of Eastern Macedonia–Thrace during the period 2000–2020 mainly involve flash floods, totaling 16–30 events, with 1–5 incidents occurring in the prefectures of Xanthi, Rhodope, and Drama. Additionally, there were windstorms with 1–4 events reported, except in the Prefecture of Kavala, where the frequency was higher, with 5–8 events.

Taking the above into account, the likelihood of extreme weather events occurring in the study area is estimated to be low, with impacts ranging from minor to moderate intensity.

8.15.2.5 Risks of Landslides / Subsidence / Slope Failures

The term **landslide** describes a movement of rock material from the higher position of a slope to the lower one under the influence of gravity.

The Project area falls within the Water Districts (WD) of Eastern Macedonia (EL11) and Thrace (EL12), for which Flood Risk Management Plans (FRMP) have been developed according to Government Gazettes 2690/B/2018 and 2688/B/2018, respectively.

According to the current FRMP of WD12, the annual soil erosion in the study area (the land installations area of the Project) is estimated to range from very low to low in certain locations (0 t/ha - 10 t/ha), while a small portion falls within areas with an increased percentage of transported sediments, as shown in the following **Figure**.

(Source: Flood Risk Management Plan, River Basin District 12 Thrace (Government Gazette 2688/B/2018))

Figure 8–138: Excerpt from the soil erosion vulnerability map of the Flood Risk Management Plan, River Basin District 12.

According to the current Flood Risk Management Plan (FRMP) for River Basin District 11, the annual soil erosion in the study area is estimated to range from very low to locally low (0 t/ha – 10 t/ha), while a small section falls within areas with an increased rate of sediment transport, as shown in the following **figure**.

(Source: Flood Risk Management Plan, RBD11 Eastern Macedonia (Government Gazette 2690/B/2018))

Figure 8–139: Excerpt from the soil erosion vulnerability map of the FRMP RBD11

The project's onshore facilities are located approximately 70 meters from the coast. The new conditions created by climate change, as well as the increased frequency of extreme weather events, continuously strengthen the sea's power regarding coastal erosion, especially in island areas.

The rise in sea level, more frequent and intense storms, and changes in wave patterns contribute to accelerating coastal erosion worldwide. The impacts of coastal erosion extend both environmentally and socioeconomically, as they negatively affect the appearance and prospects of coastal areas.

<u>It is noted that within the scope of the Project under study, no large-scale works are carried out on the shoreline and beach, therefore, the risk of coastal erosion is considered limited.</u>

8.15.2.6 Fire Risks

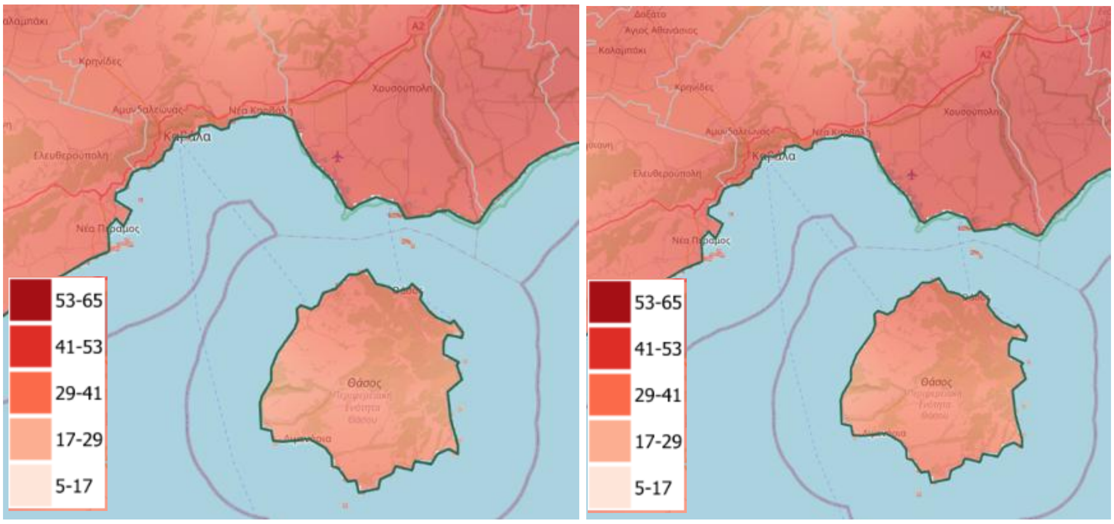
Regardless of the causes of forest fires, certain natural, geomorphological, and meteorological factors significantly influence their behavior. Specifically, solar radiation, air temperature, and ground surface temperature can facilitate the ignition process of fires. Furthermore, the elevation of the area affects both temperature and humidity levels—factors that are crucial for fire spread. At the same time, fire intensity increases as it moves uphill on slopes, since hot air preheats the vegetation ahead. Finally, vegetation itself plays a decisive role in the risk of fire ignition, given that different plant species exhibit varying degrees of flammability.

Fires, and particularly forest fires, constitute one of the most significant threats to natural ecosystems, property, and human lives in Greece. The main causes include agricultural activities such as burning dry grass, discarding lit cigarettes, dumping waste in forests and forested areas and subsequently burning it as a management method, malicious acts (arson), and accidents (traffic incidents, industrial accidents, mechanical equipment failures, etc.).

As a phenomenon, fire primarily depends on three key factors: temperature, the presence of oxygen, and the available fuel (its quantity, type, and moisture content).

Forest fires in Greece occur primarily within the “Mediterranean zone,” meaning areas at altitudes below 600 m. These regions are mainly covered with pines, kermes oaks, strawberry trees, and other vegetation rich in flammable material, where 95% of fires are recorded. However, their occurrence is not excluded in higher-altitude areas (mountainous terrain), especially in years when conditions are favorable for ignition. The site of the facility under study is classified as agricultural land, while the area surrounding the proposed facilities includes tracts of dense natural vegetation.

The following **figure** presents the Fire Risk Index during the Fire Season based on predictions from the EEA for the period 2031-2060, under the climate scenarios RCP 4.5 and RCP 8.5. <u>According to the figure, the study area is classified within a Medium risk zone (FS=29-41).</u>



(Source: Adaptive Greece, https://geo.adaptivegreecehub.gr/, 2024)

Figure 8–140: Fire Risk Index during the Fire Prevention period (FS) for 2031-2060, for climate scenarios RCP 4.5 (left) and RCP 8.5 (right)

Also, according to data from the Hellenic Fire Service (HFS), in 2023 a total of 1,171 rural and forest fires occurred in the Regional Unit of Eastern Macedonia & Thrace, of which 264 were in the Prefecture of Kavala, as shown in the table below.

Table 8–91 Burned Areas (stremmas) in the Regional Unit of Kavala in 2023

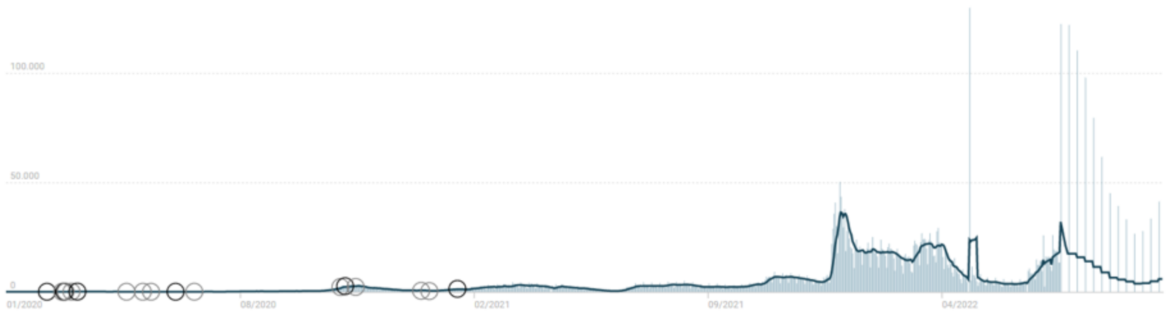
Areas	Burned Areas (stremmas)
Forests	12.001,5
Forest Areas	273,27
Groves	0,04
Grasslands	1216,7
Reeds - Marshes	243,68
Agricultural Areas	1609,36
Crop Residues	80,06
Landfills	0,5
Total Regional Unit of Kavala	15.425,11
Total Eastern Macedonia & Thrace	995.604,14

8.15.2.7 Pandemic/Infectious Diseases

A pandemic is an epidemic that exceeds the boundaries of a region or country and spreads worldwide. Historically, several pandemics have been recorded, such as the HIV pandemic, the influenza pandemics of 1918–1920 and 2009 (H1N1). The pandemic of the novel coronavirus disease 2019 (COVID-19), which is currently affecting the planet, was caused by the SARS-CoV-2 virus and began in December 2019. The virus was first detected in the Wuhan region of China and since then has spread to more than 114 countries around the world. This extensive spread of the virus is the reason for the global concern, and the World Health Organization (WHO) declared COVID-19 a pandemic on March 11, 2020.

The new strain of coronavirus SARS-CoV-2 spreads from person to person through droplets from coughing or sneezing, and symptoms usually appear within 2–5 days (maximum incubation period of 14 days) after infection. According to WHO estimates, each patient infects 1.4–2.5 other people (by comparison, in seasonal flu each patient infects on average 1.3 other people). Symptoms of infection in cases requiring hospitalization mainly include fever, cough, and respiratory distress, and chest X-rays have shown severe lesions in both lungs.

The progression of COVID-19 cases in Greece from February 2020 to October 2022 is presented in the following **figure**.



(Source: https://covid19.gov.gr/covid19-live-analytics/, 7/10/2022)

Figure 8–141: COVID-19 Case Trends in Greece 2020-2022

The first emergency measures to address the pandemic were implemented on February 28 at a local level in affected areas, eventually leading to a nationwide movement restriction (lockdown) on March 23, which ended in May 2020. Since then, at least 10 different vaccines have been developed and authorized by official regulatory authorities. To date, 21,350,000 COVID-19 vaccinations have been administered. More than 7,600,000 citizens have completed their vaccination regimen, placing Greece 12th out of the 27 EU countries in terms of the percentage of people vaccinated with at least one dose, exceeding the EU average. Regarding booster doses, 5,845,000 citizens have received a booster shot. Additionally, over 555,000 citizens have been vaccinated with a second booster dose to date.

According to the health security and Covid-19 infection protection map (following Figure), the Regional Unit of Kavala is classified as a Level 2 (Surveillance) area. Taking the above into account, the likelihood of a pandemic occurrence is assessed as Moderate and of Low intensity regarding its socio-economic impacts on the region.

(Source: https://covid19.gov.gr/wp-content/covid-measures/, Ιούνιος, 2024)

Figure 8–142: Excerpt from the Health Safety and Protection Map against Covid-19 Infection

8.15.3 Anthropogenic Accidents/Disasters

8.15.3.1 Road Transport Accident Risks

The risks from road accidents concern the road traffic in part of the study area (the Project's onshore facilities), which increases during the summer months. The road network in the area is in relatively good condition; therefore, the likelihood of a serious road accident is low and is significantly related to the driving behavior of the users.

8.15.3.2 Risks of Accidents from Maritime Transport

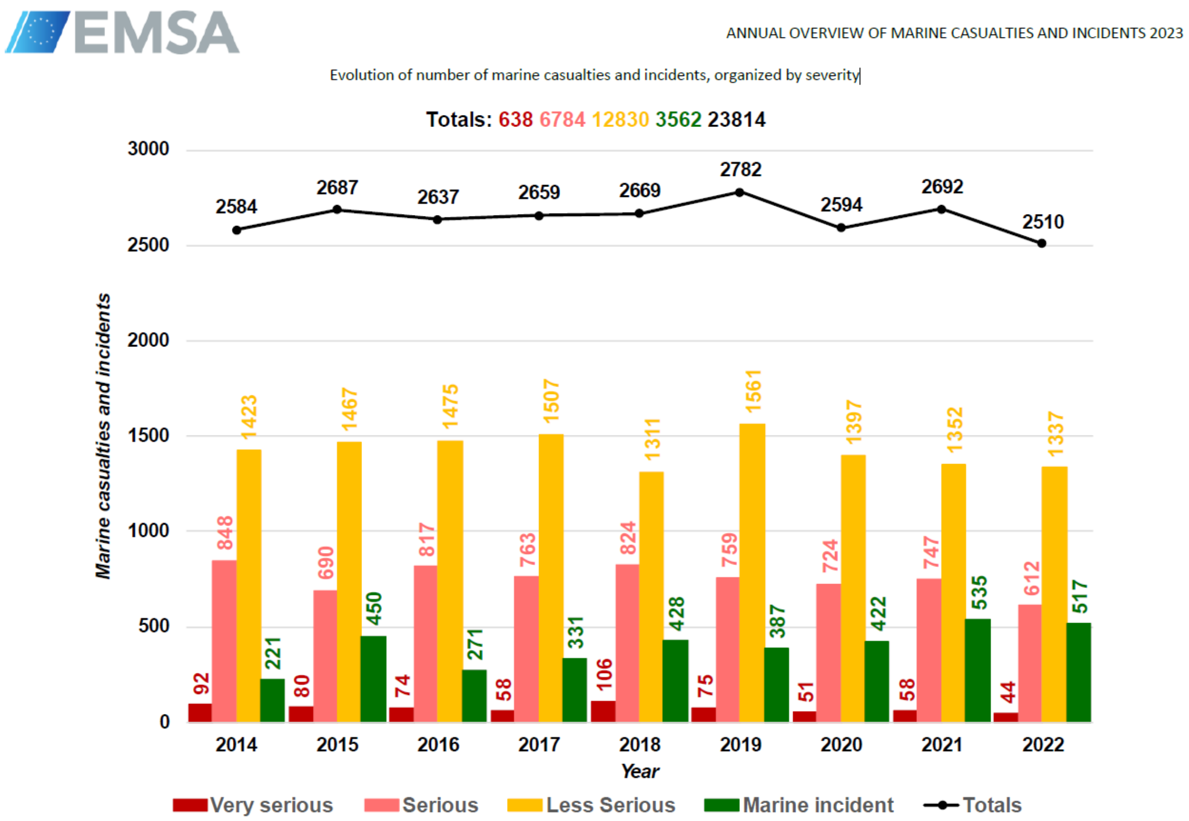
Maritime transport is of strategic importance for the economy of both the country and the EU, as well as for connections between cities or member states. Shipping operational activities are based on fundamental principles and regulations, namely harmonized national rules grounded in international conventions and resolutions issued by the International Maritime Organization (IMO).

In recent years, the IMO has adopted regulations aimed at preventing marine accidents, limiting their adverse consequences, and, consequently, increasing safety in international maritime transport.

According to IMO Resolution A.849 of 27 November 1997 on the adoption of the Code for the Investigation of Marine Casualties and Incidents (Casualty Investigation Code), a "marine casualty" is defined as "any incident or sequence of incidents at sea which has resulted in loss of life, total actual loss, material damage to the ship, grounding or the ship's inability (disablement) to navigate, the ship's involvement in a collision, material damage to the ship's marine external infrastructure, severe environmental damage, or the potential to cause severe environmental damage" (IMO, 2008).

The level of maritime safety in EU waters is currently very high; however, according to the annual Marine Casualty and Incident Report published by the European Maritime Safety Agency (EMSA) for 2023, the total number of marine accidents in 2022 exceeded 2,000 (EMSA, 2023).

The following **Figure** presents the trend in the number of marine accidents and incidents according to their severity.



(Source: Annual Marine Casualty and Incident Report, EMSA, June 2023)

Figure 8–143: Number of Marine Accidents and Incidents in the EU by Severity for the Years 2014–2022

The total number of the aforementioned marine accidents and incidents during the period from 2014 to 2022 was 23,814, with an annual average of 2,646 accidents.

The main risks arising in maritime transport are:

- **Possible collision or grounding of vessels with the platforms**
- **Possible anchoring that compromises the integrity of the pipelines**
- **Accidental leakage of chemicals, liquids, or solid waste**

8.15.3.3 Risks of Accidents/Disasters from Failures of Existing Technical Works or Other Anthropogenic Activities

In the immediate area of the Project, **the Prinos Offshore Development project and the Sigma onshore industrial unit** are located, as described below.

According to the valid Environmental Terms Approval Decision (ΑΕΠΟ) ΔΙΠΑ/8413/24.04.2018 (ΑΔΑ: ΨΓΛ14653Π8-Ζ79), the **Prinos Offshore Development project** concerns the existing offshore oil and natural gas extraction facilities located in the Gulf of Kavala, in the Northeastern Aegean, and its expansion with two new platforms, one of which is planned for the long term. The total production capacity is 27,000 barrels/day of stabilized crude oil.

The Sigma onshore industrial unit includes facilities for the desalination, dehydration, stabilization, and desulfurization of the produced crude oil; the conversion of produced sour gas into sweet gas; the production of liquid and solid sulfur; as well as the necessary facilities for the safe storage and handling of the produced crude oil, natural gas, and sulfur.

Throughout the operation of both the Sigma onshore industrial unit and the Prinos Offshore Development project, no significant accidents have been recorded, due to the technical soundness of these installations and the comprehensiveness of the Health, Safety, and Environmental (HSE) Plans and Procedures implemented by Energean. However, the proposed project interacts directly with elements of the Prinos offshore development project and the Sigma onshore industrial unit. Therefore, there is a theoretical possibility of risk from accidents or disasters arising from failures of existing technical works or other anthropogenic activities.

8.15.3.4 Sabotage, Vandalism, and Other Illegal Activities

Sabotage (vandalism, arson, etc.) is a potential cause of serious accidents and disasters in the study area, with arson being of particular concern. However, to date, no such incidents have been recorded in the study area, and the likelihood of their occurrence is considered extremely low, mainly due to the security procedures implemented by Energean.

CONTENTS

TABLES

9 ENVIRONMENTAL AND SOCIAL SCOPING OF THE ESIA

9.1 INTRODUCTION

The objective of the current Environmental and Social Scoping of the ESIA is to identify the Environmental Parameters that need to be further analyzed during the evaluation and assessment of potential environmental and social impacts. The purpose of this process is:

- To identify the main environmental issues and potential impacts associated with each of the activities and the corresponding phases of the project's life cycle.
- To share this information and the specific project details with the relevant recognized stakeholders, in order to ensure that the identified issues reflect the true nature of these issues and, if additional issues arise, to include them in the assessment conducted within the framework of the ESIA.

It is noted that although the implementation of object delimitation within the framework of the preparation of the EIA is not mandatory according to the contents prescribed by national legislation, in this case, its preparation and inclusion in the present ESIA was deemed useful for reasons mentioned below.

Initially, it is important to emphasize that the existing national legislative framework initially defines the control process and clearly delineates the requirements within the context of ESIA through:

- The classification of all projects and activities according to type/capacity/served population/etc. (control procedure), with the Ministerial Decision MEEN/DEL/17185/1069 (Government Gazette B 841/24.02.2022), as amended by MEEN/DEL/53510/3616 (Government Gazette B 3327/19.05.2023) and in force,
- Of the definition of detailed specifications for all categories/classes of projects and activities with the Ministerial Decision 170225/2014.
- The specification of specific requirements in cases where the project falls within protected areas or falls under specific Directives (Integrated Pollution Prevention and Control - IPPC, Offshore Activities Directive, etc.) and the definition of accompanying/supporting studies required to be carried out within the framework of the ESIA.

It is noted that the Greek legislative framework is fully harmonized with all relevant EU Directives and therefore the provisions set out by the aforementioned legislative acts are in full agreement with EU policies. Specifically, regarding the provisions of Article 5(2) of Directive 97/11/EC, which requires the Member State (MS) to implement a procedure whereby the project owner can seek the opinion of the competent authorities on the information to be submitted within the framework of the ESIA procedure. This procedure has been defined by Article 2 of Law 4014/2011, where the object delimitation report (specifically the **Preliminary Environmental Requirements Determination – PERD**) is part of a "**voluntary procedure.**" Additionally, the specifications for the object delimitation report have been set out in Annex 1 of Ministerial Decision 170225/2014 for cases where the project owner wishes to follow it.

Although the voluntary process of the aforementioned delimitation report was chosen not to be followed, Energean decided to include it within the framework of the present ESIA in order to:

- It is in accordance with international best practices and **the Performance Requirements (PR)** of the **European Bank for Reconstruction and Development (EBRD)**,
- Recognizes the environmental and social impacts that may be associated with the Project, which should be examined in more detail in the ESIA,
- informs and consults with stakeholders and discusses with them:
  - The basic information (including the environmental and social issues of the existing facilities related to the construction and operation of the proposed project) and the company's history in the area over the past three decades,
  - The company's plans for further development,
  - The relevant legislative requirements as derived from national law, EU legislation, and EBRD standards,
  - The methodology for evaluating the ESIA,
  - The specialized studies that are to be conducted within the framework of the ESIA, as well as the overall planning of the new scheduled developments.

In the following **Sections**, the main environmental and social impacts are examined, regarding their significance and the mitigation measures required to avoid, minimize, address or restore the impacts of these effects.

9.2 IDENTIFICATION OF KEY ENVIROMENTAL AND SOCIAL IMPACTS

9.2.1 General Information

In the following **Sections**, the scoping of the ESIA is presented, both within the framework of the normal/routine activities of the project (routine activities) during the construction and operation of the project, and within the framework of unforeseen incidents and accidents. The methodology used included the following steps:

1 Identification of the distinct project for each phase of the project life cycle (construction, operation, decommissioning), which could potentially interact with the abiotic and biotic components of the natural environment, as well as with the anthropogenic environment.

2 Identification of the potential receptors present in the project area. The recipients were identified in the abiotic and biotic physical environment, as well as in the anthropogenic environment, taking into account both marine and terrestrial recipients.

3 Preparation of a **Table**, in which the activities of the project (on the vertical axis) are listed in relation to the potentially affected receptors (on the horizontal axis).

4 The study team of the present ESIA, in collaboration with the technical managers and scientific staff of Energean, prepared a matrix of facility activities that occur during the construction phase, the operational phase, and the decommissioning phase, where each was systematically evaluated for potential interactions with receptors. The interactions were classified as **"out of bounds"** (no interaction or negligible interaction) and **"in-bounds interactions"** (clear negative, positive, or mixed interaction).

5 The interactions of the activities that were deemed **"out of scope"** for further evaluation are analyzed in this Chapter.

6 For the **"within-object interactions"**, the detailed description, analysis, and evaluation of the potential impacts are provided in the relevant **Chapter 11.**

7 Discussion with the stakeholders of a similar (simplified) **Table** in order to ensure their participation in the process (as further described in the SEP**, Annex 17-4**).

9.2.2 Summary Presentation of the Content Delineation of the ESIA

The **Tables (matrices)** developed within the framework of defining the content of this ESIA are presented below by phase of the project's life cycle (construction, operation, decommissioning), while the justification for the "off-limits" activities is presented in the following **Section** by environmental parameter.

Table 1 - Screening Table – Interactions during the Construction Phase of the Project

Φάση Κατασκευής																																									
Project Activity/Element		Marine Environment											Terrestrial Environment															Anthropogenic Environment													
		Abiotic Environmental Parameters					Biotic Environmental Parameters						Abiotic Environmental Parameters										Biotic Environmental Parameters									Socio-economic Environment							Technical Infrastructure & Services		
		Morphological characteristics of seabed	Qualitative characteristics of seabed	Geological formations	Qualitative characteristics of seawater & adjacent water bodies	**Underwater noise and Vibrations**	Marine habitats	**Marine mammals**	Marine turtles	Ichthyofauna	**Avifauna**	**Protected areas**	Climate, Microclimate & Bioclimate	Κλιματική αλλαγή	Morphological Characteristics of Soil	Topological Characteristics	Qualitative Characteristics of Soil	Geological & Tectonic Characteristics	Quality & Quantity Characteristics of Surface & Groundwater	Air Quality	Aerial noise and vibrations	Electromagnetic Radiation	Terrestrial Habitats	**Terrestrial Mammals**	**Amphibians and Reptiles**	Forests & Forested Areas	Protected Areas	Spatial Planning and Land Uses	Structure and Function of Anthropogenic Environment – Social Cohesion	Cultural Heritage	Intangible Cultural Heritage	Demographic & Sociographic Characteristics	Agriculture / Livestock Farming	Fisheries / Aquaculture	Tourism	Other Economic Activities	Employment / Workforce	Community Health & Safety	Maritime Transport / Traffic	Other Transport Infrastructure	Environmental Infrastructure Systems
Human, Material and Natural Resources	Mobilization (recruitment, employment, involvement) of labor force																																								
	Supply chain and procurement issues regarding the construction materials, resources and services required for the implementation of the project																																								
Onshore installations (CO_2 reception and management infrastructure and equipment, onshore section of the CO_2 pipeline)	Geotechnical surveys and data collection works at the installation sites of the project's onshore infrastructure																																								
	Soil preparation for the equipment foundation, earthworks for the siting of the new onshore infrastructure and installations																																								
	Concrete works and placement of concrete with a thickness of 0.5 m for the construction of base foundation slabs																																								
	Installation of the final section of the onshore pipelines (placement, welding), which will be installed on the ground on the new foundations, without protective coverings																																								

	Φάση Κατασκευής																																							
	Marine Environment											Terrestrial Environment															Anthropogenic Environment													
	Abiotic Environmental Parameters					Biotic Environmental Parameters						Abiotic Environmental Parameters										Biotic Environmental Parameters																		
																															Socio-economic Environment							Technical Infrastructure & Services		
Project Activity/Element	Morphological characteristics of seabed	Qualitative characteristics of seabed	Geological formations	Qualitative characteristics of seawater & adjacent water bodies	**Underwater noise and Vibrations**	Marine habitats	**Marine mammals**	Marine turtles	Ichthyofauna	**Avifauna**	**Protected areas**	Climate, Microclimate & Bioclimate	Κλιματική αλλαγή	Morphological Characteristics of Soil	Topological Characteristics	Qualitative Characteristics of Soil	Geological & Tectonic Characteristics	Quality & Quantity Characteristics of Surface & Groundwater	Air Quality	Aerial noise and vibrations	Electromagnetic Radiation	Terrestrial Habitats	**Terrestrial Mammals**	**Amphibians and Reptiles**	Forests & Forested Areas	Protected Areas	Spatial Planning and Land Uses	Structure and Function of Anthropogenic Environment – Social Cohesion	Cultural Heritage	Intangible Cultural Heritage	Demographic & Sociographic Characteristics	Agriculture / Livestock Farming	Fisheries / Aquaculture	Tourism	Other Economic Activities	Employment / Workforce	Community Health & Safety	Maritime Transport / Traffic	Other Transport Infrastructure	Environmental Infrastructure Systems
Works and activities for the installation and testing of the electrical interconnection and the related equipment. .																																								
Movement of heavy vehicles, construction machinery, vehicles and transport trucks, as well as support vehicles during construction.																																								
Temporary storage/deposit of structural/construction materials and surplus excavation materials.																																								
Use of water resources during construction: • Sprinkling of construction site areas: approximately 10–20 m³/day for each main construction area. • Personnel living needs: approximately 60 l/day per worker.																																								
Generation, management and disposal of waste from construction works of the onshore facilities of the project.																																								
Traffic – Daily vehicle movement related to the construction of the onshore facilities (including worker transportation and support vehicle movements).																																								

Φάση Κατασκευής																																									
Project Activity/Element		Marine Environment											Terrestrial Environment															Anthropogenic Environment													
		Abiotic Environmental Parameters					Biotic Environmental Parameters						Abiotic Environmental Parameters										Biotic Environmental Parameters									Socio-economic Environment							Technical Infrastructure & Services		
		Morphological characteristics of seabed	Qualitative characteristics of seabed	Geological formations	Qualitative characteristics of seawater & adjacent water bodies	**Underwater noise and Vibrations**	Marine habitats	**Marine mammals**	Marine turtles	Ichthyofauna	**Avifauna**	**Protected areas**	Climate, Microclimate & Bioclimate	Κλιματική αλλαγή	Morphological Characteristics of Soil	Topological Characteristics	Qualitative Characteristics of Soil	Geological & Tectonic Characteristics	Quality & Quantity Characteristics of Surface & Groundwater	Air Quality	Aerial noise and vibrations	Electromagnetic Radiation	Terrestrial Habitats	**Terrestrial Mammals**	**Amphibians and Reptiles**	Forests & Forested Areas	Protected Areas	Spatial Planning and Land Uses	Structure and Function of Anthropogenic Environment – Social Cohesion	Cultural Heritage	Intangible Cultural Heritage	Demographic & Sociographic Characteristics	Agriculture / Livestock Farming	Fisheries / Aquaculture	Tourism	Other Economic Activities	Employment / Workforce	Community Health & Safety	Maritime Transport / Traffic	Other Transport Infrastructure	Environmental Infrastructure Systems
	Water discharge – The water present in the trenches or excavations will be removed using appropriate systems (pumps or drainage wells) and will be discharged into nearby water bodies (after their characterization).																																								
Offshore CO_2 Transport Pipeline	**Phase 1** Geophysical Survey A small-type vessel (length 15 m) will be used, equipped for seabed scanning, to provide basic data along the pipeline corridor. Geotechnical Survey Following the processing of the geophysical survey results, soil samples will be taken using a drilling rig and a piston corer (Box-corer), which will be sent to laboratories for analysis.																																								
	Phase 2 Works for pipeline approach to the shore (placement of the specific pipeline section in a trench approximately 500 m long and 3 m deep).																																								
	Phase 3 E Installation of a 20 km long subsea pipeline (using the S-lay method) from a special pipe-laying vessel, along with two auxiliary anchor/tug vessels.																																								
	Phase 4																																								

Φάση Κατασκευής

Project Activity/Element		Marine Environment											Terrestrial Environment															Anthropogenic Environment													
		Abiotic Environmental Parameters					Biotic Environmental Parameters						Abiotic Environmental Parameters										Biotic Environmental Parameters									Socio-economic Environment							Technical Infrastructure & Services		
		Morphological characteristics of seabed	Qualitative characteristics of seabed	Geological formations	Qualitative characteristics of seawater & adjacent water bodies	Underwater noise and Vibrations	Marine habitats	Marine mammals	Marine turtles	Ichthyofauna	Avifauna	Protected areas	Climate, Microclimate & Bioclimate	Κλιματική αλλαγή	Morphological Characteristics of Soil	Topological Characteristics	Qualitative Characteristics of Soil	Geological & Tectonic Characteristics	Quality & Quantity Characteristics of Surface & Groundwater	Air Quality	Aerial noise and vibrations	Electromagnetic Radiation	Terrestrial Habitats	Terrestrial Mammals	Amphibians and Reptiles	Forests & Forested Areas	Protected Areas	Spatial Planning and Land Uses	Structure and Function of Anthropogenic Environment – Social Cohesion	Cultural Heritage	Intangible Cultural Heritage	Demographic & Sociographic Characteristics	Agriculture / Livestock Farming	Fisheries / Aquaculture	Tourism	Other Economic Activities	Employment / Workforce	Community Health & Safety	Maritime Transport / Traffic	Other Transport Infrastructure	Environmental Infrastructure Systems
	Installation of riser pipeline at the Vity exit and connection works. After the installation, the pipeline will be connected to the riser at the existing Vity exit..																																								
	Phase 5																																								
	Backfilling of trench and pipeline protection, commissioning. After the installation of the pipeline and the relevant connections, the pipeline will be buried along its entire length. Upon completion of the construction works, the pipeline will be emptied of water using a series of pumps to dry it, and any residual moisture will be removed using chemicals (monoethylene glycol – MEG), so that it is completely dry and suitable for commissioning.																																								
	Marine traffic- Daily vessel movements for the operation of the CO_2 transport pipelines (including the transfer of crews, support vessel movements, etc.).																																								
	Marine traffic – Definition of exclusion zones due to the CO_2 transport pipeline installation works (and associated works/activities).																																								

Φάση Κατασκευής

Project Activity/Element		Marine Environment											Terrestrial Environment															Anthropogenic Environment													
		Abiotic Environmental Parameters					Biotic Environmental Parameters						Abiotic Environmental Parameters										Biotic Environmental Parameters									Socio-economic Environment							Technical Infrastructure & Services		
		Morphological characteristics of seabed	Qualitative characteristics of seabed	Geological formations	Qualitative characteristics of seawater & adjacent water bodies	Underwater noise and Vibrations	Marine habitats	Marine mammals	Marine turtles	Ichthyofauna	Avifauna	Protected areas	Climate, Microclimate & Bioclimate	Κλιματική αλλαγή	Morphological Characteristics of Soil	Topological Characteristics	Qualitative Characteristics of Soil	Geological & Tectonic Characteristics	Quality & Quantity Characteristics of Surface & Groundwater	Air Quality	Aerial noise and vibrations	Electromagnetic Radiation	Terrestrial Habitats	Terrestrial Mammals	Amphibians and Reptiles	Forests & Forested Areas	Protected Areas	Spatial Planning and Land Uses	Structure and Function of Anthropogenic Environment – Social Cohesion	Cultural Heritage	Intangible Cultural Heritage	Demographic & Sociographic Characteristics	Agriculture / Livestock Farming	Fisheries / Aquaculture	Tourism	Other Economic Activities	Employment / Workforce	Community Health & Safety	Maritime Transport / Traffic	Other Transport Infrastructure	Environmental Infrastructure Systems
	Operation of the pipeline laying vessel (accommodating 200 persons). Generation of waste / discharges.																																								
Offshore installations (excluding the Offshore CO_2 transmission pipeline)	**Preparation of the suspended injection well** A permanent mechanical plug (bridge plug) will be placed at a predetermined depth inside the production tubing following the killing of the well.																																								
	The protective production tubing 9 5/8″ will be retrieved up to approximately 1200 m, in order to create sufficient space for annular distribution. Above the cut protective tubing 9 5/8″, a mechanical plug will be installed. The Christmas tree and the remaining components of the head above the 9 5/8″ protective tubing will be removed.																																								
	Well drilling Drilling of 4 wells to a depth of approximately 3,700 m (2 wells will be used as CO_2 injection wells and 2 as water production wells for the relative pressure balance of the reservoir).																																								

Φάση Κατασκευής																																									
Project Activity/Element		Marine Environment											Terrestrial Environment															Anthropogenic Environment													
		Abiotic Environmental Parameters					Biotic Environmental Parameters						Abiotic Environmental Parameters										Biotic Environmental Parameters									Socio-economic Environment							Technical Infrastructure & Services		
		Morphological characteristics of seabed	Qualitative characteristics of seabed	Geological formations	Qualitative characteristics of seawater & adjacent water bodies	**Underwater noise and Vibrations**	Marine habitats	**Marine mammals**	Marine turtles	Ichthyofauna	**Avifauna**	**Protected areas**	Climate, Microclimate & Bioclimate	Κλιματική αλλαγή	Morphological Characteristics of Soil	Topological Characteristics	Qualitative Characteristics of Soil	Geological & Tectonic Characteristics	Quality & Quantity Characteristics of Surface & Groundwater	Air Quality	Aerial noise and vibrations	Electromagnetic Radiation	Terrestrial Habitats	**Terrestrial Mammals**	**Amphibians and Reptiles**	Forests & Forested Areas	Protected Areas	Spatial Planning and Land Uses	Structure and Function of Anthropogenic Environment – Social Cohesion	Cultural Heritage	Intangible Cultural Heritage	Demographic & Sociographic Characteristics	Agriculture / Livestock Farming	Fisheries / Aquaculture	Tourism	Other Economic Activities	Employment / Workforce	Community Health & Safety	Maritime Transport / Traffic	Other Transport Infrastructure	Environmental Infrastructure Systems
	All four new wells will be constructed with drilling units of the TDS (Top Drive system) type and will be directed using a combination of mud motors and rotary steerable systems.																																								
	Completion of the drilling																																								
	The casing will be cemented with a 200 m cement column above the base of the previous casing and along the entire length of the open geological formation.																																								
	Waste - Production, management, and disposal of drilling waste (drilling mud and cuttings).																																								
	During the drilling of the 16-inch diameter section down to a depth of 2,200 m, a drilling fluid will be used consisting of seawater/brine. The cuttings from this section will be discharged to the bottom of the sea. Below this depth, the drilling fluid will be returned to the surface where the mud and cuttings will be separated and processed.																																								
	Marine traffic - Daily vessel movements for the implementation of drilling operations (including the transport of personnel and movements of support vessels).																																								

Φάση Κατασκευής																																									
	Project Activity/Element	Marine Environment											Terrestrial Environment															Anthropogenic Environment													
		Abiotic Environmental Parameters					Biotic Environmental Parameters						Abiotic Environmental Parameters										Biotic Environmental Parameters									Socio-economic Environment							Technical Infrastructure & Services		
		Morphological characteristics of seabed	Qualitative characteristics of seabed	Geological formations	Qualitative characteristics of seawater & adjacent water bodies	**Underwater noise and Vibrations**	Marine habitats	**Marine mammals**	Marine turtles	Ichthyofauna	**Avifauna**	**Protected areas**	Climate, Microclimate & Bioclimate	Κλιματική αλλαγή	Morphological Characteristics of Soil	Topological Characteristics	Qualitative Characteristics of Soil	Geological & Tectonic Characteristics	Quality & Quantity Characteristics of Surface & Groundwater	Air Quality	Aerial noise and vibrations	Electromagnetic Radiation	Terrestrial Habitats	**Terrestrial Mammals**	**Amphibians and Reptiles**	Forests & Forested Areas	Protected Areas	Spatial Planning and Land Uses	Structure and Function of Anthropogenic Environment – Social Cohesion	Cultural Heritage	Intangible Cultural Heritage	Demographic & Sociographic Characteristics	Agriculture / Livestock Farming	Fisheries / Aquaculture	Tourism	Other Economic Activities	Employment / Workforce	Community Health & Safety	Maritime Transport / Traffic	Other Transport Infrastructure	Environmental Infrastructure Systems
	Marine traffic – Designation of exclusion zones due to drilling operations.																																								
	Unexpected incidents (structural failures, equipment malfunctions, and accidents during pipeline installation and facility construction).																																								

LEGEND
Outside limits – No interaction
Outside limits – Negligible interaction
Within limits – Clear negative interaction
Within limits – Clear positive interaction
Within limits – Clear mixed interaction

Table 2 - Interaction Delimitation Table – Project Operation Phase

Operation Phase																																									
Project Activity / Element | Marine Environment		Marine Environment											Terrestrial Environment															Ανθρωπογενές Περιβάλλον													
		Abiotic Environmental Parameters					Biotic Environmental Parameters						Abiotic Environmental Parameters										Biotic Environmental Parameters									Socio-economic Environment							Technical Infrastructure & Services		
		Morphological characteristics of seabed	Qualitative characteristics of seabed	Geological formations	Qualitative characteristics of marine and coastal waters	Subsea roads and Pipelines	Marine habitats	**Marine mammals**	Sea Turtles	Ichthyofauna	**Avifauna**	**Protected areas**	Climate, microclimate & bioclimate	Climate change	Morphological soil characteristics	Topological characteristics	Qualitative soil characteristics	Geological & technical soil characteristics	Qualitative & quantitative characteristics of surface & groundwater	Air quality	Aerial noise and vibrations	Electromagnetic radiation	Terrestrial Ecosystems	**Terrestrial Mammals**	**Amphibians and Reptiles**	Forests & woodland areas	Protected areas	Spatial planning and land use	Structure & function of the human environment – Social cohesion	Cultural Heritage	Intangible Cultural Heritage	Demographic & population characteristics	Agriculture / Livestock farming	Fisheries / Aquaculture	Tourism	Other economic activities	Employment / Workforce	Public Health & Community Safety	Maritime Transport / Traffic	Other Transport Infrastructure	Environmental Infrastructure Systems
Physical Presence and Operation of the Project	Physical presence and siting of terrestrial infrastructure of the project																																								
	Physical presence and siting of offshore infrastructure of the project																																								
Human, Material and Natural Resources	Mobilization (recruitment, employment, involvement) of workforce																																								
	Supply chain and procurement issues of required materials, resources and services related to the operation of the project																																								
	Consumption of energy, fuels and materials																																								
Physical presence and siting of terrestrial infrastructure of the project	**CO_2 delivery via pipeline (bulk processing)** CO_2 from remote producers will enter the facility through a **terrestrial pipeline.**																																								
	CO_2 delivery via containers (CO_2 parcels) CO_2 loads from pilot projects will be transported to the Sigma terminal by truck using ISO freight containers with pressurized tanks, insulated to minimize losses.																																								

Operation Phase

Project Activity / Element | Marine Environment		Marine Environment											Terrestrial Environment															Ανθρωπογενές Περιβάλλον													
		Abiotic Environmental Parameters					Biotic Environmental Parameters						Abiotic Environmental Parameters										Biotic Environmental Parameters									Socio-economic Environment							Technical Infrastructure & Services		
		Morphological characteristics of seabed	Qualitative characteristics of seabed	Geological formations	Qualitative characteristics of marine and coastal waters	Subsea roads and Pipelines	Marine habitats	**Marine mammals**	Sea Turtles	Ichthyofauna	**Avifauna**	**Protected areas**	Climate, microclimate & bioclimate	Climate change	Morphological soil characteristics	Topological characteristics	Qualitative soil characteristics	Geological & technical soil characteristics	Qualitative & quantitative characteristics of surface & groundwater	Air quality	Aerial noise and vibrations	Electromagnetic radiation	Terrestrial Ecosystems	**Terrestrial Mammals**	**Amphibians and Reptiles**	Forests & woodland areas	Protected areas	Spatial planning and land use	Structure & function of the human environment – Social cohesion	Cultural Heritage	Intangible Cultural Heritage	Demographic & population characteristics	Agriculture / Livestock farming	Fisheries / Aquaculture	Tourism	Other economic activities	Employment / Workforce	Public Health & Community Safety	Maritime Transport / Traffic	Other Transport Infrastructure	Environmental Infrastructure Systems
Transport of CO_2 to the offshore Prinos storage facilities	CO_2 is supplied under appropriate conditions for injection and routed to the wellhead, from where it is discharged to the Prinos complex via a 12–16" pipeline, 20 km in length.																																								
Transport of CO_2 to the offshore Prinos storage facilities	As for the CO_2 parcels, the transport vessel connects to the platform piping via a flexible hose system. From there, the CO_2 loads undergo further processing to meet the proper specifications/conditions for injection into the reservoir.																																								
CO_2 Injection	The main processing equipment on the Beta platform will include a pumping and heating station to meet the required injection conditions, installed on the open deck of the platform.																																								
CO_2 Injection	CO_2 injection will target reservoirs B and C with two injection wells during the period 2025–2035 and will then expand to the entire reservoir until the end of the project.																																								

Operation Phase																																									
		Marine Environment											Terrestrial Environment															Ανθρωπογενές Περιβάλλον													
		Abiotic Environmental Parameters					Biotic Environmental Parameters						Abiotic Environmental Parameters										Biotic Environmental Parameters									Socio-economic Environment							Technical Infrastructure & Services		
Project Activity / Element | Marine Environment		Morphological characteristics of seabed	Qualitative characteristics of seabed	Geological formations	Qualitative characteristics of marine and coastal waters	Subsea roads and Pipelines	Marine habitats	**Marine mammals**	Sea Turtles	Ichthyofauna	**Avifauna**	**Protected areas**	Climate, microclimate & bioclimate	Climate change	Morphological soil characteristics	Topological characteristics	Qualitative soil characteristics	Geological & technical soil characteristics	Qualitative & quantitative characteristics of surface & groundwater	Air quality	Aerial noise and vibrations	Electromagnetic radiation	Terrestrial Ecosystems	**Terrestrial Mammals**	**Amphibians and Reptiles**	Forests & woodland areas	Protected areas	Spatial planning and land use	Structure & function of the human environment – Social cohesion	Cultural Heritage	Intangible Cultural Heritage	Demographic & population characteristics	Agriculture / Livestock farming	Fisheries / Aquaculture	Tourism	Other economic activities	Employment / Workforce	Public Health & Community Safety	Maritime Transport / Traffic	Other Transport Infrastructure	Environmental Infrastructure Systems
Water Production	The two water production wells on the Beta platform will be equipped with electric submersible pumps (ESP) and will extract water from the reservoir. They will operate with a production rate of up to 7,500 bwpd each during the period 2025–2031, and the water production will gradually increase up to 97,000 bwpd per well by 2031 and until the end of the project.																																								
Maintenance and Rehabilitation Activities of Installations and Equipment	Maintenance and rehabilitation activities of onshore installations and equipment																																								
	Maintenance and rehabilitation activities of offshore installations and equipment																																								
Waste	Π Production, management and disposal of waste from the operation of the onshore and offshore project installations.																																								
Marine Traffic	Daily vessel movements due to the operation of the project (including the transport of personnel and the movements of support vessels).																																								
	Designation of exclusion zones due to project operation.																																								

LEGEND
Out of bounds – No interaction
Out of bounds – Negligible interaction
Within bounds – Clear negative interaction
Within bounds – Clear positive interaction
Within bounds – Clear mixed interaction

Table 3 - Interaction Delimitation Table – Decommissioning/Shutdown Phase of the Project

Operational Cessation / Decommissioning Phase																																									
Project Activity / Element		Marine Environment											Terrestrial Environment															Anthropogenic Environment													
		Abiotic Environmental Parameters					Biotic Environmental Parameters						Abiotic Environmental Parameters										Biotic Environmental Parameters									Socio-economic Environment							Technical Infrastructure & Services		
		Morphological characteristics of seabed	Qualitative characteristics of seabed	Geological formations	Physical characteristics of marine and adjacent waters	Submarine noise and vibrations	Marine habitats	**Marine mammals**	Sea turtles	**Ichthyofauna**	**Avifauna**	Protected areas	Climate, microclimate & bioclimate	Climate change	Morphological characteristics of soil	Topological characteristics	Qualitative characteristics of soil	Geological & tectonic characteristics	Qualitative & quantitative characteristics of surface & underground waters	Air quality	Aerial noise and vibrations	Electromagnetic radiation	Terrestrial habitats	**Terrestrial mammals**	**Amphibians and reptiles**	Forests & forested areas	Protected areas	Spatial Planning and Land Use	Structure and functions of the anthropogenic environment – Social	Cultural Heritage	Intangible cultural heritage	Demographic & social characteristics	Agriculture / livestock farming	Fisheries / aquaculture	Tourism	Other economic activities	Employment / Workforce	Health & community safety	Maritime Transport / Traffic	Other Transport Infrastructure	Environmental Infrastructure Systems
Human, Material, and Natural Resources	Mobilization (recruitment, employment, engagement) of workforce																																								
	Supply chain issues and procurement of required materials, resources, and services related to the decommissioning / dismantling of the project																																								
	Consumption of energy, fuels, and materials																																								
Dismantling of Onshore Installations – Decommissioning of Onshore Project Installations	Dismantling of equipment and removal of installations																																								
	Removal of concrete and foundation slabs, as well as earthworks for the restoration of the onshore area of the Project																																								
	Movement of heavy vehicles, construction machinery, and transport trucks, as well as support vehicles during the decommissioning / dismantling phase of the project, including emissions:																																								
	• Dust (PM10, PM2.5)																																								
	• Gaseous pollutants (CO, VOC και NOx).																																								
	• Noise																																								
	Generation of solid and liquid waste.																																								

		Operational Cessation / Decommissioning Phase																																							
Project Activity / Element		Marine Environment											Terrestrial Environment															Anthropogenic Environment													
		Abiotic Environmental Parameters					Biotic Environmental Parameters						Abiotic Environmental Parameters										Biotic Environmental Parameters																		
																																Socio-economic Environment							Technical Infrastructure & Services		
		Morphological characteristics of seabed	Qualitative characteristics of seabed	Geological formations	Physical characteristics of marine and adjacent waters	Submarine noise and vibrations	Marine habitats	**Marine mammals**	Sea turtles	**Ichthyofauna**	**Avifauna**	Protected areas	Climate, microclimate & bioclimate	Climate change	Morphological characteristics of soil	Topological characteristics	Qualitative characteristics of soil	Geological & tectonic characteristics	Qualitative & quantitative characteristics of surface & underground waters	Air quality	Aerial noise and vibrations	Electromagnetic radiation	Terrestrial habitats	**Terrestrial mammals**	**Amphibians and reptiles**	Forests & forested areas	Protected areas	Spatial Planning and Land Use	Structure and functions of the anthropogenic environment – Social	Cultural Heritage	Intangible cultural heritage	Demographic & social characteristics	Agriculture / livestock farming	Fisheries / aquaculture	Tourism	Other economic activities	Employment / Workforce	Health & community safety	Maritime Transport / Traffic	Other Transport Infrastructure	Environmental Infrastructure Systems
	Traffic – Daily movement of vehicles related to the shutdown/decommissioning of the project (including worker transportation and support vehicle movements).																																								
	The pipelines within the onshore section of the CO_2 transport system will be decommissioned, cleaned, and purged with nitrogen to ensure safety, in accordance with international guidelines and best practices.																																								
	The infrastructure will be isolated from the offshore pipeline using a sealed flange and will be demolished.																																								
	Restoration of the onshore extension of the installation area of the Project.																																								
Cessation of Operation / Decommissioning of Offshore CO_2 Transmission Pipelines	The offshore booster pipeline will be depressurized, cleaned using standard pigging procedures, and then inerted with nitrogen. Subsequently, the pipeline will be disconnected from the offshore platform, sealed with a welded cap or flange, and left in place, in accordance with international standards.																																								

Operational Cessation / Decommissioning Phase

Project Activity / Element		Marine Environment											Terrestrial Environment															Anthropogenic Environment													
		Abiotic Environmental Parameters					Biotic Environmental Parameters						Abiotic Environmental Parameters										Biotic Environmental Parameters									Socio-economic Environment							Technical Infrastructure & Services		
		Morphological characteristics of seabed	Qualitative characteristics of seabed	Geological formations	Physical characteristics of marine and adiacent waters	Submarine noise and vibrations	Marine habitats	**Marine mammals**	Sea turtles	**Ichthyofauna**	**Avifauna**	Protected areas	Climate, microclimate & bioclimate	Climate change	Morphological characteristics of soil	Topological characteristics	Qualitative characteristics of soil	Geological & tectonic characteristics	Qualitative & quantitative characteristics of surface & underground waters	Air quality	Aerial noise and vibrations	Electromagnetic radiation	Terrestrial habitats	**Terrestrial mammals**	**Amphibians and reptiles**	Forests & forested areas	Protected areas	Spatial Planning and Land Use	Structure and functions of the anthropogenic environment – Social	Cultural Heritage	Intangible cultural heritage	Demographic & social characteristics	Agriculture / livestock farming	Fisheries / aquaculture	Tourism	Other economic activities	Employment / Workforce	Health & community safety	Maritime Transport / Traffic	Other Transport Infrastructure	Environmental Infrastructure Systems
	The pipelines from the top of the booster pipeline to the wellhead will be depressurized and filled with nitrogen to inert the system. The pipelines will be disconnected from the wellheads, sealed, and left in place.																																								
	Marine traffic – Daily movement of vessels for the implementation of decommissioning works of the offshore pipelines (including the transport of personnel and support vessel movements).																																								
	Marine traffic – Definition of exclusion zones due to the execution of offshore pipeline decommissioning works.																																								
Παύση Cessation of Operation / Decommissioning of Offshore Installations (excluding the Offshore CO_2 Transport Pipeline)	**Primary plug** – If cement is used as a plug, a cement column of at least 30 m is required to form a permanent barrier. Where possible, cement plugs of 152 m are installed to exceed the 30 m minimum.																																								
	Secondary plug – A combined minimum of 60 m of cement is required to form a secondary barrier. Where feasible, 244 m of cement is installed to exceed this 60 m minimum.																																								
	Dismantling of equipment and removal of installations																																								

Project Activity / Element	Operational Cessation / Decommissioning Phase																																							
	Marine Environment											Terrestrial Environment															Anthropogenic Environment													
	Abiotic Environmental Parameters					Biotic Environmental Parameters						Abiotic Environmental Parameters										Biotic Environmental Parameters									Socio-economic Environment							Technical Infrastructure & Services		
	Morphological characteristics of seabed	Qualitative characteristics of seabed	Geological formations	Physical characteristics of marine and adjacent waters	Submarine noise and vibrations	Marine habitats	**Marine mammals**	Sea turtles	**Ichthyofauna**	**Avifauna**	Protected areas	Climate, microclimate & bioclimate	Climate change	Morphological characteristics of soil	Topological characteristics	Qualitative characteristics of soil	Geological & tectonic characteristics	Qualitative & quantitative characteristics of surface & underground waters	Air quality	Aerial noise and vibrations	Electromagnetic radiation	Terrestrial habitats	**Terrestrial mammals**	**Amphibians and reptiles**	Forests & forested areas	Protected areas	Spatial Planning and Land Use	Structure and functions of the anthropogenic environment – Social cohesion	Cultural Heritage	Intangible cultural heritage	Demographic & social characteristics	Agriculture / livestock farming	Fisheries / aquaculture	Tourism	Other economic activities	Employment / Workforce	Health & community safety	Maritime Transport / Traffic	Other Transport Infrastructure	Environmental Infrastructure Systems
Generation of solid and liquid waste																																								
Marine traffic – Daily vessel movements for the execution of offshore decommissioning works (including the transport of personnel and the movement of support vessels).																																								
Marine traffic – Designation of exclusion zones due to the implementation of offshore decommissioning works.																																								

LEGEND
Outside boundaries – No interaction
Outside boundaries – Negligible interaction
Within boundaries – Clear negative interaction
Within boundaries – Clear positive interaction
Within boundaries – Clear mixed interaction

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FIGURES

10 ASSESSSMENT AND EVALUATION OF ENVIRONMENTAL IMPACTS

10.1 IMPACT ASSESSMENT AND EVALUATION METHODOLOGY

10.1.1 General Information

In this **Chapter**, the potentially significant impacts that the project may have on the natural and anthropogenic environment of the study area are assessed and evaluated, including the use of natural resources, the emission of pollutants, the creation of nuisances, and the disposal of generated waste. The impacts being examined concern all the abiotic and biotic parameters that shape the natural environment (atmosphere, soil, water, flora, fauna, noise, traffic, landscape, etc.), land use planning, and land uses, as well as the other socio-economic characteristics of the study area.

The assessment and evaluation of P&S impacts mainly focus on the characteristics of potentially significant impacts (likelihood of occurrence, extent, intensity, cumulative/synergistic action, etc.) of all activities and individual elements of the project, based on the project design data, supporting studies, the existing environmental conditions (see **Chapter 8**) and the results of the computational models (atmosphere, noise, etc.) used to simulate the potential impacts on various **Environmental Parameters.**

<u>Within the framework of the present, the potential impacts are examined:</u>

i. For the construction, operation, and decommissioning/cessation of operations phases of the project under study (Normal / Usual Project Activities),

ii. Regarding the vulnerability of the project to the risks of serious accidents or disasters related to the project (Non-Normal Operation of the Project), according to JMD 1915/2018,

iii. Regarding the project's resilience to climate change, that is, its ability to cope with and adapt to the expected climate risks, according to the National Climate Law (Law No. 4936/Goverment Gazette 105A/27-05-2023),

As analysed in **Chapter 6.4.2**, the proposed projects will be constructed <u>within a total duration of approximately 12 months.</u>

However, as discussed in **Paragraph '6.3.1 Project Operation and Management Description'**, <u>some elements of the proposed project are either already existing and operational (within the framework of the company's activities in the broader study area), or they are already licensed and in the implementation phase.</u> More specifically, these are the following:

- The existing Beta platform (which has slots for 12 wells and is connected to the Delta processing platform). Modifications will be made to the Beta platform to include the necessary CO2 injection facilities. It will be equipped with a lift, the corresponding collection pipeline, equipment for processing CO2 loads, and the auxiliary facilities may also be upgraded to accommodate the new activities. As part of the proposed project, two CO2 injection wells and two water production wells will be drilled. The new wells will be diverted using the existing wells on the Beta platform. Before the diversion, the existing wells will be sealed and abandoned. In the two water wells, Electric Submersible Pumps (ESP) will operate to produce the required water, which will then be managed at the existing processing facility on the Delta platform. The additions/modifications of equipment on the Beta platform will be summarized as follows:

  - Pipelines for connecting the new CO2 pipeline to a temporary connection point to the well.
  - Pipelines related to the required starting heater.
  - Pipe connections to the "Christmas tree" and the injection wellhead.
  - Safety valves and shutdown systems.
  - Electrical interconnection and equipment for monitoring and communication with ground control stations.
  - Pipelines from the water production wells and connection pipelines to the existing water treatment facility on the Delta platform via the existing bridge.

- The modification of Delta platform will involve a comprehensive upgrade of the auxiliary facilities, the treatment and disposal unit of the produced water, and the control and safety systems, so that the water produced for reservoir pressure management purposes will be treated using the existing facilities. This comprehensive approach optimizes resource use while simultaneously enhancing the operational performance of the platform and environmental management.
- The land facilities of the project will be located within the boundaries of the existing Sigma land industrial unit.

Additionally, as previously mentioned, within the framework of this ESIA, the proposed project, which constitutes **Phase 1** of the overall Project, is being examined [the operation of the facility is planned to be developed in two distinct phases (Phase 1 and Phase 2)]. Therefore, in the subsequent stages of the program's maturation, the next stages of the overall project's development will follow, in which the proposed interventions (within the framework of the present) will be used as part of the broader and integrated overall storage infrastructure (which will be licensed within the framework of a new standalone ESIA).

After the completion of the entire CO2 storage project, the phase of **decommissioning** will follow, which will concern all the infrastructures. However, since specific elements of the project are either already existing and operational (within the framework of other activities of the company in the broader study area), or are already licensed and in the implementation phase, the analysis of the potential impacts from their decommissioning will be the subject of studies related to the company's activities on a case-by-case basis (within the framework of which they were designed, licensed, implemented, and will be maintained). Therefore, although the potential impacts from the cessation of operations of the examined project and the decommissioning of its infrastructure **will be the subject of this ESIA**, in some cases they will be further specified within the framework of the relevant studies that will be prepared (or have already been prepared) as part of the subsequent full development of the activities of the proposed overall CO2 storage project/program or within the framework of the company's other activities in the broader study area.

10.1.2 Assessment of Potential Significant Impacts from Normal / Routine Project Activities

The assessment and evaluation of the potentially significant impacts from the construction of the proposed project were carried out based on the following steps:

- Step 1: Identification and evaluation of the Significant Environmental Parameters (SEPs or Valued Receptors-VRs) of the natural and anthropogenic environment of the study area.
- Step 2: EAssessment and evaluation of the Potential Significant Impacts from the usual activities of the construction and operation phases of the examined Project.

10.1.2.1 Recognition and Evaluation of Significant Environmental Aspects

The process of **Environmental and Social Impact Assessment (ESIA)** initially requires the distinction of parameters of the natural and anthropogenic environment receiving the impacts, into significant or noteworthy elements defined as **Significant Environmental Parameters (SEPs)**. As an SEP, <u>any element of the natural and anthropogenic environment is characterized as significant by the parties involved in the evaluation, licensing, and implementation process of the project under study (project proponent, competent authorities and services, consultants, other parties directly or indirectly involved or affected by the implementation of the project, etc.).</u>

The SPEs are categorized considering their environmental value, as derived from the data presented in **Chapter 8** of the Current State of the Environment and - where possible - their sensitivity to the Project's activities.

Based on the above, the SPEs are categorized as **Low, Medium, and High Importance.** The significance of each SPE is considered as weight in the final assessment of impacts during the ESIA process, as described in **Section 10.1.2.2.** In this way, <u>the same impact is ultimately assessed as more significant in a High Importance Environmental Parameter compared to a Low Importance Environmental Parameter.</u>

In the next stage of the ESIA process, the significance of each VEC is correlated with the inherent significance of the corresponding potential impacts on it, leading to the comprehensive final assessment and evaluation of the expected environmental and social impacts. Based on the assessment of the current environmental conditions of the study area (see **Chapter 8**), the identified SPAs and their corresponding assessment are presented in the following **Table.**

Table 1 - Identification and Assessment of Key Environmental Parameters in the Study Area

Significant Environmental Parameter (SEP)			Assessment	«Next Record»Significant Environmental Parameter (SEP)
«Next Record»Significant Environmental Parameter (SEP)	Climatic and Bioclimatic Characteristics		No projects or activities with significant impacts on climate, microclimate, or bioclimate are identified in the study area (impacts related to the climate crisis are examined in the next SEP). Although the proposed project does not have significant effects on climate, microclimate, or bioclimate, it involves CO_2 storage and is therefore indirectly related to potential impacts on climate, microclimate, and bioclimate, so this KEP at this stage of the program is assessed as **Moderate**.	«Next Record»Significant Environmental Parameter (SEP)
			Air pollutant emissions in the broader area are at measurable levels, mainly due to industrial and energy installations in the region, such as Energean facilities, Hellenic Petroleum facilities, activities in the Port of Philippos B, and traffic emissions (Egnatia Odos, secondary roads, etc.). These emissions significantly affect local climate conditions. The proposed CO_2 storage project produces CO_2 both locally and from remote sources. Since it removes CO_2 from the atmosphere, it does not contribute to climate change. In fact, the project supports local, regional, national, and international climate goals by enabling the decarbonization of CO_2-intensive activities. Therefore, its contribution to total emissions reduction and achieving net-zero targets by 2050, as well as offsetting hard-to-abate emissions, makes the project a key tool against climate change. This SEP is assessed as **High**.	«Next Record»Significant Environmental Parameter (SEP)
	Morphological and Topological Characteristics		The land section of the project is located on terrestrial land with mild slopes. The morphology of the coastal zone of the immediate study area is characterized by extensive sandy beaches with lagoons, coastal lakes, and land strips. However, the land allocation of the terrestrial part of the project is located **within the boundaries of the Sigma industrial facility**, in an area already shaped by long-term anthropogenic activities. Therefore, the overall morphology of the area is heavily modified by anthropogenic activities and does not exhibit any particular geological formations or features of interest.	«Next Record»Significant Environmental Parameter (SEP)

Significant Environmental Parameter (SEP)			Assessment	«Next Record»Significant Environmental Parameter (SEP)
			With regard to the offshore installations of the project, the average depth of the Gulf of Kavala is estimated at approximately 32 m, with a maximum depth of around 60 m found in the basin west of Thasos. According to the Bathymetric Map of the Hellenic Military Geographical Service (HMGS), the depth at existing and future platforms in the wider project area ranges between 28–49 m. Although bathymetry is constantly changing due to sediment transported by small rivers, as well as by the main river system—the Nestos River and its delta—the slopes of the seabed in the area designated for pipeline routing are mild. Therefore, this Significant Environmental Parameter (SEP) is assessed as **Low** in significance.	
			According to Map P2.δ of the Assessment and Revision of the Regional Spatial Planning and Sustainable Development Framework of the Region of Eastern Macedonia and Thrace, regarding the landscape, the area of the terrestrial installations of the Project falls within a zone of particularly valued and designated landscape. However, near the offshore installations of the Project, there is an Internationally Important Area (IA), the Nestos Zone, as well as Thasos Island, which is classified as a Nationally Important Area (NA). Overall, the coastal and marine area of the proposed project, due to its natural character and the visual features of the landscape, demonstrates valuable attributes. However, the image of the landscape in the area of the project is influenced by the industrial zone, in which the terrestrial facilities of the Project are located, partially mitigating the human presence and commercial activity. Therefore, according to the above and the two-fold analysis presented in the relevant **section** of **Chapter 8** of the Kavala Study, the landscape of the study area may be characterized as of moderate value and interest in terms of its aesthetic quality, which is observed to be diminished due to human interventions and activities. As a result, this SEP is assessed as of **Moderate** importance.	«Next Record»Significant Environmental Parameter (SEP)
	Geological, tectonic and soil characteristics		Prinos is a small extensional basin within a broader system of Neogene basins that extends from Northern Greece, southern Bulgaria, and North Macedonia to eastern Albania, forming the Southern Balkans extension system. In the chronostratigraphic column of the Prinos Basin, three main and clearly defined series are distinguished:	«Next Record»Significant Environmental Parameter (SEP)

Significant Environmental Parameter (SEP)			Assessment	«Next Record»Significant Environmental Parameter (SEP)
			Pre-evaporitic series: This includes a variety of rock types deposited in distinct sub-environments. The oldest stratigraphic unit (pre-Prinos Group) is characterized by alternating lagoonal, shelf, and terrestrial environments, indicating sedimentation strongly influenced by the interplay between sea-level fluctuations and tectonics. The younger parts of the sequence (Prinos Group) are represented by a series of stacked/sand-dominated high- to very high-energy turbidite flows, interbedded with mud-dominated flows of low to very low energy. Evaporitic series: The evaporitic sequence is characterized by alternating layers of salt and conglomerates. The total thickness of this sequence reaches approximately 800 meters. In the northern part, the evaporites laterally transition into thick anhydrites and limestones interbedded with marl-rich conglomerates. Anhydrite and dolomite layers are often intercalated with claystones that contain post-diagenetic anhydrite nodules. Post-evaporitic sequence: The post-evaporitic sequence dates to the Pliocene–Quaternary and consists of marine sands, silts, and clays. Toward its upper section, it transitions into a prograding deltaic sequence fed by the paleo-Nestos River. In shallower intervals, it is once again interbedded with marine conglomeratic sediments. The geology/geomorphology of the immediate terrestrial study area is currently not subject to significant alterations from geodynamic processes or anthropogenic interventions—or a combination thereof—such as slope instability, creep, landslides, or human activities including borrow pits, quarrying, waste dumping, embankments, etc. Moreover, no significant or protected geological formations are present in the area. The proven productive reservoirs in the Prinos field are located at the top of the Pre-evaporitic sequence and mainly consist of turbidites (channel and distal fan turbidites), which were formed during rapid subsidence of the basin in the Miocene. These are typically found at depths ranging from 2,490 m to 2,790 m TVDSS in the Prinos field area. The Epsilon reservoir is located approximately 4.5 km west-northwest of the Prinos reservoir. It is an anticlinal structure with faulting, covering an area of approximately 4 km^2, and is separated from the Prinos field by a structural low (saddle point) to the east. Additionally, Energean's technical team has conducted a series of specialized studies and 3D subsurface simulations to evaluate the potential for CO_2 storage in the basin underlying the Prinos structures. These simulations also identify a sealing caprock at the top of the structure, structural boundaries defined by bounding faults, and the volume of the basin. Furthermore, the technical team is developing and implementing scenarios regarding the estimated volume of CO_2 to be stored, potential CO_2 sources, the CO_2 transportation network, and associated synergies.	

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			Therefore, based on the above, as well as the more detailed descriptions provided in the relevant **Sections of Chapters 4 and 8**, this SEP (Significant Environmental Parameter) is assessed as **Low** significance.	
			According to the applicable Seismic Code, EAK 2000, and the Seismic Hazard Zoning Map, as revised by Joint Ministerial Decision Δ17α/115/9/ΦΝ275 (Government Gazette 1154/B/12-8-2003), the study area belongs to Seismic Hazard Zone I. According to the EAK, the horizontal ground seismic acceleration is $A = \alpha \times g$, where α is the ground acceleration expressed as a fraction of gravitational acceleration. In this case, for Zone I, the horizontal ground seismic acceleration is **$A = 0.16$**. Although the Prinos basin is a tectonically stable area (as required for CO_2 storage sites in terms of tectonic (seismic) activity), since theoretically, CO_2 storage projects in semi-depleted fields can, under certain conditions, affect the tectonics of the area (the vulnerability of the project to phenomena related to the tectonics of the area is examined in **Section 10.13**), this SEP is assessed as of **Moderate significance**.	«Next Record»Significant Environmental Parameter (SEP)
			According to the Soil Association Map of Greece by the National Committee Against Desertification and the Agricultural University of Athens, the area of the project's onshore installations is located on soils of the Cambisols (CM) and Regosols (RG) types. Furthermore, according to the geomorphological map of the Ministry of Environment and Energy (ΥΠΕΝ), the soils in the study area are primarily characterized as alluvium. Alluvium or alluvial deposits are accumulations of clay, sand, gravel, and other detrital material transported and deposited by water flow in a fluvial environment. Three types of alluvial deposits typically serve as parent materials for soil formation: alluvial fans, floodplains, and river deltas. Overall, the condition (in terms of both quantity and quality) of the soil resources in the immediate area of the project is assessed as degraded, as it constitutes part of the existing Sigma onshore installation. The area affected by the project is relatively limited and has already been altered due to anthropogenic interventions, which are expected to be restored following the completion of the program. However, since the overall condition (quantitative and qualitative) of the soil resources in the immediate project area is considered degraded (being part of the existing Sigma onshore installation), this SEP assessed as of **Low** significance.	«Next Record»Significant Environmental Parameter (SEP)
			As part of the Environmental Monitoring Program (EMP) of the offshore installations at Prinos, analyses of seabed samples were conducted in November 2023. Reviewing the sampling stations collectively and	«Next Record»Significant

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			comparing the results of the laboratory analyses with those from October 2015 (Environmental and Social Impact Assessment of the "Prinos Offshore Development Project", 2015) and July 2021 ("Monitoring Program Report" – hereinafter referred to as MPR, 2020), it was found that there were no changes in the concentration levels of Polycyclic Aromatic Hydrocarbons (PAHs). Specifically, in all repeated samples from the aforementioned sampling stations, the detected values were below the laboratory's detection limit (<0.020 mg/kg), as well as below the EU threshold values for good environmental status of the marine environment. Additionally, the aforementioned measurements included an examination of the trace element distribution of metal concentrations in the seabed sediments. The study of trace metal concentration distribution in sediments is important in the context of environmental pollution. Sediments exhibit less temporal variability and are therefore preferably used as monitoring tools for assessing pollution. Heavy metals enter the coastal environment from various sources, both natural and anthropogenic, such as the discharge of domestic wastewater and industrial effluents. Variations in metal concentrations may reflect the mixing of sediments from different origins and pollution from a multitude of different sources. As part of the EMP, in all repeated samples from the aforementioned sampling stations, the detected values were below the EU threshold values for good environmental status of the marine environment. Therefore, this SEP is assessed as being of **Moderate significance**.	Environmental Parameter (SEP)
	Waters		Within the project study area, the river water body *Asprochoma* R. (EL1106R0009010092N), with a total length of 17.21 km, is recorded. It is classified as having Moderate ecological status and Good chemical status (Overall Moderate status). It is located west of the onshore installations of the Project, at a distance of approximately ~1.7 km. Additionally, within the project study area, the transitional water body *Lower Nestos Estuary of the Wider Keramoti Area* (EL1207T0001N), with a total area of 7.7 km^2, is also identified. Although the proposed project is located at a significant distance from important surface water receptors, its implementation could, under certain conditions, cause indirect impacts on surface water bodies in the study area. Therefore, this SEP is assessed as being of **Moderate** significance.	«Next Record»Significant Environmental Parameter (SEP)

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			With regard to the quality of the coastal water systems in the wider area of the Project, the LDK study team conducted seawater sampling in November 2023 at six (6) locations within the Kavala Gulf, as part of the 2023 Annual Environmental Monitoring Report (EMR 2023), which concerns the implementation of the environmental monitoring program of the Prinos Offshore Development, in accordance with the requirements of Environmental Terms Approval Decision (ETAD) 8413/24.04.2018/YPEN. Regarding PAH concentrations, in all repeated seawater samples, including those from the Reference Station, the values were below the detection limit (<0.005 mg/L), as well as below both the EU and national lower threshold values for good environmental status of the marine environment (Annex I of Joint Ministerial Decision H.P. 51354/2641/E103/2010, Ministerial Decision 170766/2016). Similar concentrations were recorded during the 2021 sampling (within the framework of EMR 2020), where PAH concentrations in the seawater samples were also below the detection limit. Therefore, no indications of degradation of the marine environment in the area under examination due to PAHs from the operation of the Project are observed. Consistent results were recorded in the measurements conducted on the repeated seawater samples at all depths, as concentrations of ammonia (NH_3), phosphates (PO_4^{3-}), nitrites (NO_2^-), and nitrates (NO_3^-) varied at similar levels across all repeated samples, including those from the Reference Station, and were comparable to concentrations recorded in seawater samplings conducted over the last 30 years in Greece, particularly in the Northern Aegean, according to Souvermezoglou et al. (2014). In conclusion, as confirmed by the above data and those included in the 1st Revision of the River Basin Management Plans (RBMPs) for the Thrace and Eastern Macedonia Water Districts, the ecological status and chemical status of the surface waters examined are assessed as "good." However, since the implementation and operation of the proposed project could potentially cause adverse impacts on the coastal and marine waters within the study area, this SEP is assessed as being of **Moderate** significance.	«Next Record»Significant Environmental Parameter (SEP)
			The project study area falls within the boundaries of the following three (3) groundwater bodies: • Groundwater Body of Nestos Delta (EL1200060) • Groundwater Body of Orei Basin (EL1200070) • Groundwater Body of Symvolo – Kavala (EL1100130) The onshore installations fall entirely within the Groundwater Body of the Nestos Delta. The Nestos Delta GWB (EL1200060) constitutes an alluvial aquifer system and has an area of 555.11 km². The waters of the GWB mainly cover irrigation needs, as well as secondary domestic, livestock, and	«Next Record»Significant Environmental Parameter (SEP)

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			industrial demands. In terms of protected areas, the Nestos River and Delta, along with associated terrestrial ecosystems – protected areas, are related to SPA GR1150010 (Nestos Delta and Keramoti-Eastern Area Lagoons and Coastal Zone) and SPA GR1150001 (Nestos Delta and Keramoti and Thasos Island Lagoons). It should be noted that the GWB partially belongs (its eastern section) to the area designated as a nitrate vulnerable zone (plains east and west of Lake Vistonida), according to JMD 190126/2013 (Government Gazette 983B'/23-04-2013) (RBMP SEA WD 12, 2017). According to the 1st Revision of the RBMPs for the Water Districts of Thrace and Eastern Macedonia, the quantitative status of the Nestos Delta GWB is good, while its chemical status is poor (local exceedances of trace elements such as As and Al). As the implementation of the proposed project may cause adverse impacts on the groundwater bodies of the study area, this SEP is assessed as being of **Moderate significance**.	
	Atmospheric Environment		According to data from the National Air Pollution Monitoring Network (NAPMN) and the Annual Air Quality Report (2022), it is <u>estimated that the concentrations of gaseous pollutants in the wider area of the Project remain at low levels relative to the established regulatory limits</u>. As part of the Annual Monitoring Report for the Prinos Offshore Development Project (2021), continuous monitoring of H_2S and explosive mixture gaseous emissions was conducted throughout the year via installed sensors, for the purpose of ensuring personnel safety at the facilities. No exceedances in H_2S or explosive mixture gas concentrations were recorded. Potential deterioration in air quality in the wider area of the Project may arise from various industrial installations in the region, including Energean's industrial and extraction activities (onshore and offshore facilities), the Hellenic Fertilizers and Chemicals ELFE S.A., the operations at the Philippos II port, as well as the ports of Kavala and Keramoti, and vehicular traffic (Egnatia Motorway, secondary connecting roads, and the urban road network of Kavala). Additionally, it is noted that dispersion conditions are considered satisfactory given the location of the study area (coastal and offshore zone) and the prevailing climatic conditions, and thus, high concentrations of gaseous pollutants are not observed in the examined area. Therefore, this SEP is assessed as being of **Low** significance.	«Next Record»Significant Environmental Parameter (SEP)
	Acoustic environment and emissions		The current state of the acoustic environment in the wider area of the project is considered moderate, given the industrial character of the onshore part of the study area. The main noise sources in the area include industrial noise from facilities operating in the region (Energean Oil and Gas, Hellenic Fertilizers and	«Next Record»Significant

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	of vibrations and radiation		Chemicals ELFE S.A., quarrying), noise from activities at the commercial port of Philippos B, vehicle traffic on the area's road network – including heavy vehicles due to industrial activities – noise from maritime traffic, and noise from typical urban activities within settlements in the region. The operation of the offshore existing facilities located in the study area is continuous and, as such, no significant fluctuations in the noise levels produced are observed. As part of the Annual Monitoring Report for the Prinos Offshore Development Project, noise measurements were conducted at seven (7) locations within the Kavala Gulf, following Directive 2002/49/EC of the European Parliament in September 2021. At none of the sampling points did the Lden index value exceed 50 dB. In addition, considering that the underwater noise in the offshore study area is mainly associated with vessel traffic and existing offshore drilling platforms, the frequency of noise sources is characterized as moderate. Therefore, this SEP is assessed as being of **Moderate** significance (the evaluation of potential impacts on the underwater soundscape, primarily regarding its effect on underwater fauna, is examined in a dedicated SEP).	Environmental Parameter (SEP)
			No significant vibration emissions are recorded within the study area, due to the absence of related activities that would constitute a noteworthy source of vibrations. Within the project's area of influence, but at a significant distance from it, sensitive receptors are identified (e.g., residential uses). However, since the project does not generate significant vibration emissions, these sensitive receptors are not expected to be affected. Therefore, this SEP is assessed as being of **Moderate** significance (the assessment of the underwater noise status and its impact on the underwater fauna is examined in a dedicated subsequent SEP).	«Next Record»Significant Environmental Parameter (SEP)
			No significant emissions of ionizing or non-ionizing radiation are recorded within the study area. As the proposed project is in no way related to radiation emissions, this SEP is assessed as being of **Low** significance.	«Next Record»Significant Environmental Parameter (SEP)
«Next Record»Significant	Terrestrial Habitat		The onshore installations of the proposed Project are located outside the protected areas of the Natura 2000 Network, within the existing extent of the SIGMA industrial complex, in a zone classified as industrial and commercial, according to the Corine Land Cover (CLC 2018) database of the European Programme.	«Next Record»Significant Environmental Parameter (SEP)

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			Although the proposed project is not expected to occupy a large area of terrestrial habitats, it is important to note that amphibians found on the coastal area in front of the onshore SIGMA installations constitute significant habitats for terrestrial mammals and reptiles. However, it is noted that the limited section of the amphibian zone to be crossed by the pipeline will be restored to its original condition after the completion of construction works. Therefore, this SEP is assessed as being of **Moderate** significance.	
			The terrestrial mammals recorded in the wider area of the project include the European hedgehog (*Erinaceus roumanicus*), the mole (*Talpa caeca* and *Talpa europaea*), the golden jackal (*Canis aureus*), the red fox (*Vulpes vulpes*), the beech marten (*Martes foina*), the Eurasian otter (*Lutra lutra*), and the wildcat (*Felis silvestris*). The otter and the wildcat are species of high ecological interest but are located far from the project area, whereas the golden jackal moves within the area of the Project, including in front of the SIGMA onshore installations. Given that the project's onshore installations occupy space within the industrial zone of SIGMA, which is clearly demarcated from the surrounding habitats, no presence of terrestrial mammals is recorded in this already exploited area. Exceptionally, in the limited amphibian zone to be crossed by the pipeline, presence of the golden jackal (*Canis aureus*) has been recorded. Therefore, this SEP is assessed as being of **Low** significance.	«Next Record»Significant Environmental Parameter (SEP)
			The onshore installations of the proposed Project are located outside the protected areas of the Natura 2000 Network, within the existing extent of the SIGMA industrial complex, in a zone classified as industrial and commercial, according to the Corine Land Cover (CLC 2018) database of the European Programme. In the area, two (2) amphibian species and fifteen (15) reptile species are recorded. These amphibians and reptiles are mainly found in springs, ditches, and sand dunes. The Greek tortoise (*Testudo graeca*) appears in high densities in the sand dunes east of the Project's onshore installations, while the ditches and irrigation canals constitute important habitats for the Balkan terrapin (*Mauremys rivulata*). Finally, the extensive sand dunes in the area are suitable for the nesting of loggerhead sea turtles (*Caretta caretta*). Considering that the Project’s onshore installations are located within the SIGMA industrial complex and that the limited section of the sand dunes where the pipeline will be installed will be restored to its previous condition, this SEP is assessed as being of **Moderate** significance.	«Next Record»Significant Environmental Parameter (SEP)

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	Marine Habitat		According to field surveys conducted in 2023, 2021, and 2015 in the wider area of the project, areas of soft sandy seabed with occasional dense vegetation of the seagrass *Cymodocea nodosa* were recorded, as well as unvegetated areas. *Posidonia oceanica* meadows were not observed in the eastern part of the onshore installations, but according to the available estimates (Panayotidis et al. 2022; Torouzelis et al. 2018), their potential presence in front of the onshore installations is not excluded. As for the substrate of the offshore facilities, it is characterized as muddy. The substrate is therefore considered less diverse and rich in terms of ecosystems. Taking the above into account, this SEP is assessed as being of **Low** significance.	«Next Record»Significant Environmental Parameter (SEP)
			The study area of the proposed Project falls within ACCOBAMS Zone 9 in the Northeastern Mediterranean (Thracian Sea) and within the Important Marine Mammal Area “Northern Coast and Islands of the Thracian Sea.” It also falls within the protected Natura 2000 area, SCI & SPA GR1150014 “Marine Area of Kavala – Thasos.” Species recorded in the area include the Bottlenose Dolphin (*Tursiops truncatus*), the Common Dolphin (*Delphinus delphis*), the Harbour Porpoise (*Phocoena phocoena*), and the Mediterranean monk seal (*Monachus monachus*). Considering that the offshore part of the Project (primarily the offshore CO_2 transport pipeline section) is being developed within protected areas, this SEP is assessed as being of **High** significance.	«Next Record»Significant Environmental Parameter (SEP)
			Based on data from the NGO Archelon, which monitors sea turtles in the study area over the past four years (2020–2023), 81 sea turtle strandings have been recorded within the SCI & SPA GR1150014 area, which includes the proposed Project. According to the “National Action Plan for the sea turtle (*Caretta caretta*) in Greece,” the area is not included among nesting zones. Although the presence of *Posidonia* meadows in the area is limited, the condition of the marine environment and the habitats identified in the marine zone appear suitable for foraging by sea turtles, particularly the loggerhead turtle, which primarily feeds on animal organisms. Taking the above into account, the environmental parameter related to sea turtles and their habitats in the project area is assessed as being of **Moderate** significance.	«Next Record»Significant Environmental Parameter (SEP)

Significant Environmental Parameter (SEP)			Assessment	«Next Record»Significant Environmental Parameter (SEP)
			The study area of the proposed Project falls within the protected area Natura 2000 GR1150014 “Marine Area of Kavala – Thasos.” Within this Natura area, ichthyofauna populations are present, including the protected species twait shad (*Alosa fallax*). However, on the one hand, the intervention area within the marine zone is relatively limited and, on the other hand, offshore facilities are already present in that area. Furthermore, during the construction phase, ichthyofauna populations have the ability to relocate to adjacent areas with similar ecological characteristics, which are abundant in the wider study area. Taking the above into account, this SEP is assessed as being of **Moderate** significance.	«Next Record»Significant Environmental Parameter (SEP)
	Avifauna		The study area falls within the SCI & SPA GR1150014 “Marine Area of Kavala – Thasos,” SPA GR1150001 “Nestos Delta and Keramoti Lagoons and Thasopoula Island,” and SCI GR1150010 “Nestos Delta and Keramoti Lagoons – Wider Area,” all part of the Natura 2000 Network. The marine part of the project area is included in the Important Bird Area (IBA) coded GR250 and named “Kavala Gulf and Marine Area of Thasos,” while also within the study area lies the IBA coded GR012 under the name “Nestos Delta and Coastal Lagoons.” In GR1150014, the protected species *Phalacrocorax aristotelis desmarestii* and *Puffinus yelkouan* are recorded. Considering that the offshore section of the Project is being developed within the aforementioned protected areas, this SEP is assessed as being of **High** significance.	«Next Record»Significant Environmental Parameter (SEP)
	National System of Protected Areas		The proposed Project is located <u>within the protected area Natura 2000 SCI & SPA GR1150014 “Marine Area of Kavala – Thasos</u>.” Additionally, the following Natura 2000 network areas are located in the wider region: • SCI GR1150010 “Nestos Delta and Keramoti Lagoons – Wider Area” • SPA GR1150001 “Nestos Delta and Keramoti Lagoons and Thasopoula Island” • SPA GR1150012 “Thasos (Mount Ypsario and coastal zone)” Within the study area of the Project lies <u>part of the National Park of Eastern Macedonia – Thrace, as well as its Peripheral Zone.</u>	«Next Record»Significant Environmental Parameter (SEP)

Significant Environmental Parameter (SEP)			Assessment	«Next Record»Significant Environmental Parameter (SEP)
			The study area of the project does not include a designated Wildlife Refuge (as per paragraph 3 of Article 6 of Law 3937/2011). The nearest Wildlife Refuge to the project area is K854 – "Kastene Dag of the Oreino Municipality," located approximately 4.8 km from the onshore section of the project. Therefore, this SEP is assessed as being of **High** significance.	
			According to Decision No. 385085/31-10-2022 of the Secretary General of Forests of the Ministry of Environment and Energy (Government Gazette 777/D/7-11-2022), the Forest Maps of the Regional Units of Kavala and Thasos were ratified. The onshore installations are located within areas classified with the code: AA: Other form – land cover shown in older aerial photographs, and PA: Finalized acts and characterization decisions – non-forested, which are not subject to the restrictions of forestry legislation. Therefore, this SEP is assessed as being of **Low** significance.	«Next Record»Significant Environmental Parameter (SEP)
			The nearest Landscape of Outstanding Natural Beauty (LONB) to the onshore installations of the Project is the non-designated LONB named "Aesthetic Forest of Amygdalona Kavala," with code AT4011109, located approximately 5.6 km west of the installations. In the immediate vicinity of the project, within the boundaries of the Municipality of Nestos, lies a Ramsar Wetland, which is also included in the Montreux Record. This wetland, named "**Nestos Delta and Adjacent Lagoons,**" with a total area of 21,930 ha, was included in the Ramsar Convention in 1975. The marine area of the project is part of the Important Bird Area (IBA) coded GR250 and named "Kavala Gulf and Marine Area of Thasos," while near this area lies IBA GR016 named "Thasos Island and Islets." The study area falls within Zone 9 of ACCOBAMS in the Northeastern Mediterranean (Thracian Sea). The study area also falls within the Important Marine Mammal Area named "Northern Coast and Islands of the Thracian Sea," with a total area of 5,441 km². Given the above, this SEP is assessed as being of High significance.	«Next Record»Significant Environmental Parameter (SEP)

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«Next Record»Significant Environmental Parameter (SEP)	**Spatial Planning and Land Use**		As documented in Chapter 5 of this report, <u>the proposed project does not conflict with the directions, priorities, and choices of Spatial Planning at the National, Regional, and Sectoral levels, and it demonstrates compatibility and compliance with the institutionalized spatial and urban planning constraints, as reflected in the designated land uses of the study area.</u> Considering the fact that all coastal and offshore installations of the proposed project will be developed either at locations with existing facilities or at locations already subject to restrictions due to the presence of the offshore hydrocarbon extraction project in Prinos, this SEP is assessed as being of **Low** significance.	«Next Record»Significant Environmental Parameter (SEP)
	Structure and Functions of the Anthropogenic Environment		The project facilities are located in the Region of Eastern Macedonia and Thrace, in the Regional Unit of Kavala, which comprises the Regional Units (RUs) of Kavala and Thasos, within the Municipal Unit of Kavala of the Municipality of Kavala. The municipalities of the RUs of Kavala and Thasos have coastlines, and the main settlements are coastal or near the sea. The most populous municipality in the prefecture is Kavala. The main characteristics of the Municipality of Kavala are as follows: • It represents the classical example of a municipality structured around a large urban center and its surrounding areas. • Most of its area is coastal but also includes a significant mountainous section. • It consists of a radial settlement network with one central hub and six satellite settlements. • The city of Kavala is the administrative center serving all residents of the Kavala Regional Unit. • It is a center for academic education and research. • It possesses a full range of urban and social infrastructure and services. Kavala is the capital of the Regional Unit of Kavala. It is an important port and commercial center in northern Greece. It is also the seat of the Holy Metropolis of Philippi, Neapolis, and Thasos, and it hosts a significant portion of the cultural assets of the Regional Unit. The population of Kavala comprises a mix of urban and rural communities, with the city of Kavala being the main urban center, while the surrounding areas include smaller towns and villages. The region's economy is diversified and demonstrates multi-faceted development, with the tertiary sector and administration playing significant roles. At the same time, the area functions as a hub for the rural hinterland, featuring an international freight port located outside the urban fabric, adjacent to an industrial zone. Additionally, an	«Next Record»Significant Environmental Parameter (SEP)

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			urban port operates near the city center, serving recreational uses and acting as a cruise passenger entry point. Therefore, based on the above, this SEP is assessed as being of **Moderate** significance.	
	Cultural Heritage		As analyzed in **Chapter 8**, within the study area there are sites of archaeological/cultural interest; however, they are located at a distance from the footprint of the proposed project (distance ≥1 km), and thus, no restrictions arise with regard to the implementation of the project. No sites or findings of cultural or archaeological interest are identified within the footprint of the project. The marine area of the Gulf of Kavala, where all offshore installations (existing and new) are located, has been thoroughly investigated and there are no indications of significant underwater archaeological findings. Over time, the shallow waters and the type of seabed do not allow the preservation of any potential remains. It is also noted that all coastal and offshore installations of the proposed project will be developed at locations with existing facilities. Therefore, this SEP is assessed as being of **Low** significance.	**«Next Record»Significant Environmental Parameter (SEP)**
	Socio – economic environment		According to the Hellenic Statistical Authority, the Region of Eastern Macedonia and Thrace has a permanent population of 562,201 inhabitants, making it the 6th most populous region in the country. The permanent population decreased by 7.6% during the period 2011–2021. At the RU level, a greater decrease was observed in the RU of Kavala compared to the RU of Thasos (-7% and -4.8% respectively). The region's population tends to be older, and the ratio of elderly persons requiring support to working-age individuals indicates strong age dependency, with the dependency index reaching 0.367 in 2019—a value higher than the national average (0.346). The Regional GDP and the RUs followed the national pattern of the Greek economic crisis. Regional GDP recovered after the end of the pandemic, reaching €8.12 billion in 2022, corresponding to 3.93% of the National GDP (8th among the Regions). At the RU level, in 2018, the RUs of Kavala and Thasos accounted for 27% of the Region's GDP. The Region of Eastern Macedonia and Thrace has long demonstrated economic specialization in the agricultural sector, with the share of Gross Value Added (GVA) being nearly double the national level, showing significant interconnection of the primary sector with the other two productive sectors (manufacturing and tourism). The fisheries and aquaculture sector are also particularly dynamic, showing growth across all RUs of the Region. Fish farming and shellfish farming units are mainly found in the wetlands of the coastal front, with fewer units located in inland waters. The coastal fisheries sector is also a significant productive sector for	**«Next Record»Significant Environmental Parameter (SEP)**

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			the Region, with a presence in all RUs that have a coastal front. According to the results of the 2022 Survey on Marine Fishing with Motorized Vessels, the largest quantities of catches in the country were recorded in the fishing area: Strymonian and Kavala Gulfs, coasts of Thasos Island, and Thracian Sea—16,299.2 tons and 25.0% of the national total. The GVA of the secondary sector in the regional economy was approximately 19% in 2017. The sector shows significant dependence on the primary sector, as it mainly involves the utilization of agricultural production and mineral–mining resources, as well as the processing of other raw materials. The tertiary sector absorbs the largest share of employment. The tourism sector shows upward trends, and the revenues of the Region of Eastern Macedonia and Thrace from tourism in 2022 accounted for 2% (€508 million) of the country's total tourism revenue, while the direct contribution of tourism to the Region's GDP amounted to 6%. The Region increased its human resources in the accommodation and food services sectors by 2.0% during the period 2010–2019, one of the highest rates in the country. In 2023, Kavala airport recorded a 19% increase in arrivals, and on the island of Thasos, ferry traffic increased by 17%. Regarding the economically active population in the Region of Eastern Macedonia and Thrace, the rate for 2023 stands at 50.1%, ranking the Region 5th from the bottom among the 13 Regions. The successive crises negatively affected unemployment levels in the Region. Despite the recovery, unemployment rates in the Region remain higher than the national average and significantly higher than the EU average. Comparatively, the unemployment pattern in the RU of Kavala followed that of the less agricultural areas. That is, while areas with greater involvement in agricultural production experienced a smaller increase in unemployment during the crisis, as the country emerged from the crisis after 2015–2016, areas with greater participation in the secondary and tertiary sectors saw a more significant decline in unemployment. Given the importance of sectors such as fisheries and tourism to the regional and local economy, and the recent pressures on the labor market due to successive crises, this SEP is assessed as being of **High** significance.	
	Social Infrastructure		The Health Unit of Kavala has the following infrastructure: The General Hospital (GH) of Kavala, which provides primary care – regular and afternoon outpatient clinics – and secondary care.	**«Next Record»Significant Environmental Parameter (SEP)**

Significant Environmental Parameter (SEP)			Assessment	«Next Record»Significant Environmental Parameter (SEP)
			Under the operational responsibility of the GH are the Physical Medicine and Rehabilitation Center (KE.F.I.AP.) of Chrysoupoli and the Mental Health Center of Kavala. Under the hospital's responsibility, and within the framework of the community operational program "Psychargos Phase A", aimed at the integration and reintegration of individuals with mental illness into the labor market, a residential facility operates with ten residents. Also under the administration of the General Hospital of Kavala are the Health Centers of the Prefecture, along with their regional clinics. Tertiary health care is provided primarily through the University Hospital of Alexandroupoli or the University and other specialized hospitals in Thessaloniki, the rest of Greece, or abroad. Regarding the transport of patients or injured individuals to health care facilities, this is handled by the National Emergency Aid Center (EKAB). EKAB is part of the National Health System. In cases of emergency, accidents, or incidents, first aid is provided by the health care facilities until the injured are able to access more specialized care from general hospitals or larger health centers, if required. According to a recent report by IOBE, Eastern Macedonia and Thrace is among the regions where self-reported problems of access to health services (unmet medical needs due to cost, geographical distance, or waiting lists) are particularly high, reaching 11.7% in 2022. Given the reported pressure on access to health services, this SEP is assessed as being of **High** significance.	
	Technical Infrastructure		In the immediate study area, no technical infrastructure has been identified that would be vulnerable to potential impacts from the implementation and operation of the proposed project. Moreover, due to the scale and nature of the project (no significant quantities of waste are generated, no appreciable amounts of energy are required, etc.), it does not appear that the networks and technical infrastructure of the wider study area will be significantly burdened. Therefore, this SEP is assessed as being of **Low** significance.	«Next Record»Significant Environmental Parameter (SEP)

10.1.2.2 Assessment of Environmental and Social Impacts

The final assessment of each potential impact results from the interaction between the nature of each impact (type, significance, and magnitude) and the importance of the respective Valued Environmental Receptor (**Table** 10-1). Consequently, the overall identification and evaluation of each potential impact depends on the intrinsic significance of the impact, the sensitivity, and the quality of the environment, as described in the following **Sections**.

10.1.2.2.1 Calculation of the Significance of Impacts

The calculation of the significance of each impact is based on the **Conesa method** (Conesa, 2010), which was refined and adapted by the LDK study team so as, on the one hand, to align with international guidelines, the corresponding national and EU legislation, as well as internationally recognized best available practices, and on the other hand, to ensure the highest possible level of functionality in accordance with the technical parameters of the project under assessment and the environmental characteristics of the study area.

According to this method, the assessment of the significance of a project's or activity's impact on an environmental parameter results from evaluating the probability of occurrence of the project's/activity's effect, in conjunction with specific variables, including, among others, the intensity of the intervention, the extent, and the duration of the resulting effect.

The significance of the impacts is assessed based on the qualitative outcome caused by each effect, which in turn is defined as the ratio by which the environmental impact is measured according to the degree of intensity of the generated change and the classification of the effect. This classification is based on qualitative criteria such **as intensity (IN), extent (EX), moment of occurrence (MO), duration (PE), reversibility (RV), synergy (SI), accumulation (AC), type of effect (EF), periodicity (PR), and mitigation (MC).**

Within the context of this **Chapter**, the probability of occurrence is not included among the qualitative criteria for determining the significance of the impact, as the impacts from the routine activities of the project are considered to be certain or nearly certain to occur. Impacts with a lower probability of occurrence concern emergency events / accidents, which are assessed using a different methodology based on the probability of occurrence of the potential hazards and their consequences (see **Chapter 10.1.3).**

In the following **Table**, the qualitative evaluation criteria for calculating the significance of each impact are presented.

Table 2 - Qualitative Assessment Criteria for the Environmental and Social Impacts of the Project

Nature: Defines the character of the impact, which may be Positive or Negative. **Positive:** An impact considered to represent an improvement to the baseline or introduces a positive change. **Negative:** An impact considered to represent a deterioration from the baseline or introduces an undesirable factor.

<table>
<tr><td colspan="2">Intensity (IN):</td></tr>
<tr><td>Natural Environment (Biotic and Abiotic): Intensity may be assessed in relation to the sensitivity of the receptor (e.g. habitats, species or biocommunities, waters, soil, etc.). In detail:
• Negligible: The impact on the environment is not detectable.
• Minor:
▪ The impact affects the environment in such a way that natural functions and processes are not significantly adversely affected (in case of a negative impact).
▪ The impact affects the environment in such a way that natural functions improve to a minor degree (in case of a positive impact).
• Moderate:
▪ When the affected environmental parameter is altered, natural functions and processes continue, albeit in a modified form (in case of a negative impact).
▪ When the affected environmental parameter is altered, yet natural functions and processes are significantly improved (in case of a positive impact).
• High:
▪ When natural functions or environmental parameters are altered to such an extent that they may cease or become temporarily or permanently degraded (in case of a negative impact).
▪ When natural functions or environmental parameters are significantly upgraded in relation to their existing condition (in case of a positive impact).
• Critical:
▪ When natural functions or environmental parameters are altered to such an extent that they may cease or become irreversibly degraded (in case of a negative impact).
▪ When natural functions or environmental parameters are substantially upgraded in relation to their existing condition (in case of a positive impact).

Where deemed necessary, national and/or international standards are used as a benchmark for assessing the impact. Specialised studies should contribute to quantifying the magnitude of impacts with corresponding substantiated justification.</td>
<td>Anthropogenic & Socio-economic Environment: The intensity may be assessed in terms of the ability of the individuals/communities affected by the Project to cope with or adapt to the negative changes caused by the Project (in the case of a negative impact), or the extent to which their quality of life/well-being will be enhanced as a result of the socio-economic benefits (in the case of a positive impact). Specifically:

• Negligible: No perceptible change in the quality of life of the affected individuals/communities is recorded.
• Low:
▪ The affected individuals/communities can cope with/adapt to the negative impacts with relative ease and maintain their pre-impact quality of life/well-being (in the case of a negative impact).
▪ The affected individuals/communities will marginally benefit from the proposed activity and experience a relatively small improvement in their quality of life/well-being (in the case of a positive impact).
• Medium:
▪ The affected individuals/communities can cope with/adapt to the negative impacts with some difficulty and maintain their pre-impact livelihoods, but only with some degree of support to mitigate the impacts (in the case of a negative impact).
▪ The quality of life/well-being of the affected individuals/communities improves moderately as a result of the positive impacts.
• High:
▪ The affected individuals/communities can cope with/adapt to the negative impacts with significant difficulty and maintain their pre-impact livelihoods only with full support for impact mitigation (in the case of a negative impact).
▪ The quality of life/well-being of the affected individuals/communities improves significantly as a result of the positive impacts.
• Critical:
▪ The affected individuals/communities will not be able to cope with/adapt to the negative changes and will not be able to maintain their pre-impact quality of life/well-being (in the case of a negative impact).
▪ The quality of life/well-being of the individuals will improve remarkably because of the positive impacts.</td></tr>
<tr><td colspan="2">Extent (EX):</td></tr>
</table>

The area of influence affected by the impact, including the project footprint and its immediate surrounding area. In detail:

- Within the Project Footprint:
  The impact is confined to a specific location within the boundaries of the project footprint.
- Local:
  The impact affects a limited geographical area surrounding the boundaries of the Project.
- Regional/National:
  The impact affects significant environmental resources at a regional or national level or is experienced on a regional/national scale (based on administrative boundaries, habitat/ecosystem type, etc.).
- International/Transboundary:
  The impact affects significant environmental resources at an international/transboundary level or is experienced on an international/transboundary scale.
- Critical:
  The impact (whether local or not) affects a critical area.

Moment of Occurrence (MO):
The time interval between the start of Project implementation and the manifestation of the impact on the environmental receptor under consideration.

- Immediate:
  The impact occurs simultaneously with the commencement of Project implementation (or within a very short time thereafter).
- Short-term:
  The impact occurs within one year from the start of Project implementation.
- Medium-term:
  The impact occurs between 2 and 10 years from the start of Project implementation.
- Long-term:
  The impact requires more than 10 years from the start of Project implementation to manifest.

Duration (PE):
The estimated duration of the impact, from the moment it manifests until the return to the pre-intervention condition, either through natural means or through the implementation of appropriate/targeted measures. In detail:

- Brief:
  The impact is expected to be of very short duration and intermittent/occasional. Its duration is practically negligible.
- Temporary:
  The impact lasts less than 1 year.
- Short-lived:
  The impact lasts from 1 to 10 years.
- Long-lived:
  The impact lasts from 11 to 25 years.

- Permanent:
  The impact lasts more than 25 years.

Reversibility (RV):
The ability of the receptor of the corresponding environmental parameter affected by the project/activity to recover through natural means and without human intervention. Impacts are characterised as reversible if the affected receptor can return to its original condition within a time period of less than 25 years.
In detail, reversibility may be:

- Short-term:
  When reversal occurs within 1 year.
- Medium-term:
  When reversal occurs within 2–10 years.
- Long-term:
  When reversal occurs within 11–15 years.

If the affected receptor cannot return to its pre-intervention condition without human intervention within a period of 15 years, the impact is considered irreversible by natural means.

Synergy (SI):
The phenomenon whereby the impact caused by an activity acts synergistically with the impacts of other activities—provided they are implemented simultaneously—leading to greater impacts (in terms of type, intensity, duration, extent, etc.) compared to the individual effect of each activity.

In detail, the impact may be:

- Non-synergistic:
  The impact of an activity is isolated, without any synergistic interaction.
- Synergistic:
  The impact of the activity may act synergistically with the impacts of other activities, if implemented simultaneously, resulting in greater impacts compared to the individual action of each activity.
- Highly synergistic:
  The impact of the activity may act synergistically with the impacts of other activities, if implemented simultaneously, resulting in significantly greater impacts compared to the individual action of each activity.

Accumulation (AC):
The progressive increase in the scale of the impact on the receptor of the corresponding environmental parameter when the impact persists over time.

In detail, the impact may be:

- Standalone (non-cumulative):
  The effect of the impact is isolated and does not cause additional cumulative impacts.
- Cumulative:
  The effect of the impact progressively increases due to the absence of means for elimination/minimisation when the activity causing the impact continues over an extended period. Additionally, cumulative impacts also arise from the aggregated effect of the activity on a receptor when it is added to other past, present, and future activities, regardless of the responsible party for those activities.

Effect (EF):
The cause-effect relationship, also known as the consequence of an activity.

In detail, the effect of an impact may be:

- Direct:
  The impact resulting from a direct interaction between a planned activity of the project and the receptor of a corresponding environmental parameter (e.g. between the occupation of an area and the pre-existing habitats, or between the discharge of effluents and the quality of the receiving water).
- Indirect:
  The impact resulting from other activities that are triggered as a secondary consequence of the Project (e.g. internal migration due to employment opportunities that generates demand for resources).

Periodicity (PR):
The manifestation of an impact or the repetition of a phenomenon either irregularly or according to a specific and defined pattern.

In detail, the impact may manifest as:

- Irregular and discontinuous:
  The impact occurs unpredictably and is repeated occasionally without following a specific or clear pattern.
- Continuous:
  The impact occurs in a steady and uninterrupted manner, which does not change significantly over time.
- Periodic:
  The impact occurs according to a specific and defined pattern, in a cyclical and recurring manner.

Restoration (MC):
The potential for full or partial restoration/recovery of the affected environmental parameter/receptor or process due to the Project, through the implementation of corrective measures.

In detail, the impact on the receptor may be:

- Immediately restorable:
  The recovery/restoration of the receptor to its original condition is achieved through the implementation of corrective measures during the implementation of the proposed interventions or immediately upon their completion.
- Short-term restorable:
  The recovery/restoration of the receptor to its original condition is achieved through the implementation of corrective measures within 1 year.
- Medium-term restorable:
  The recovery/restoration of the receptor to its original condition is achieved through the implementation of corrective measures within 2–10 years.

- Long-term restorable:
  The recovery/restoration of the receptor to its original condition is achieved through the implementation of corrective measures within 11–15 years.
- Partially restorable:
  The impact is partially reversible through the implementation of corrective measures.
- Compensable/offsettable:
  The impact is irreversible through corrective measures but is subject to compensation/offsetting.
- Non-restorable:
  The impact is irreversible through the implementation of corrective measures, or the restoration period exceeds 15 years.

The significance of the impact is quantified by matching the corresponding numerical values to the evaluation criteria of the above **Table**, according to the Scoring Table (**Table 10 3**) provided below.

Table 3 - Scoring of Qualitative Assessment Criteria

Qualitative Impact Criteria	Qualitative Assessment Criteria	Value
Nature (S)	Positive	+1
	Negative	-1
Intensity (IN)	Negligible	1
	Minor	2
	Moderate	4
	High	8
	Critical	12
Extent (EX)	Within Project Site	1
	Local	2
	Regional/National	4
	International/Transboundary	8
	Critical	+4*
Time of Occurrence (MO)	Long-term	1
	Medium-term	2
	Short-term	3
	Immediate	4
Duration (PE)	Brief	1
	Temporary	1
	Short-lived	2
	Long-lived	3

Qualitative Impact Criteria	Qualitative Assessment Criteria	Value
	Permanent	4
Reversibility (RV)	Short-term	1
	Medium-term	2
	Long-term	3
	Irreversible	4
Synergy (SI)	Non-synergistic	1
	Synergistic	2
	Highly synergistic	4
Accumulation (AC)	Standalone (non-cumulative)	1
	Cumulative	4
Effect (EF)	Indirect	1
	Direct	4
Periodicity (PR)	Irregular and discontinuous	1
	Periodic	2
	Continuous	4
Restoration (MC)	Immediately restorable	1
	Short-term restoration	2
	Medium-term restoration	3
	Long-term restoration	4
	Compensable / Partially restorable	4
	Non-restorable	8
* For impacts occurring in critical areas, the value of 4 is added to the corresponding score for the extent of the impact.		

(Source: Conesa, 2010, as adapted by the LDK study team)

The following equation, which results from the weighting of the above criteria, is used to calculate the quantified value of the impact significance, Im:

$$Im = S * (3 * IN + 2 * EX + MO + PE + RV + SI + EF + PR + MC + AC)$$

Where, the Im prices range from 13 to 100.

As previously mentioned, in the present methodology the probability of occurrence is not included among the criteria for determining the significance of the impact, since the impacts from the routine activities of the project are considered to be certain or almost certain to occur. Therefore, the probability of occurrence is not included as a factor in the above equation, as it is de facto assigned a value of 1.

The quantified value of the significance of each impact is an absolute value (Im), which constitutes the **Magnitude of the Impact.**

10.1.2.2.2 Evaluation of Environmental and Social Impacts

As already stated, the Magnitude of the impact is the quantified value of the significance of each impact and, as such, indicates which of the potential impacts of the proposed project are relevant and potentially significant. However, since the absolute value of the magnitude of the impact (Im) can only be used for comparative consideration among the potential impacts, according to the Conesa method the correspondence of Im values has been standardized into categories, which are distinguished based on specific numerical thresholds and constitute clearly defined classes characterizing the significance of the impacts. The following presents the **classification classes** of impact significance, which are defined by the corresponding ranges of Im values, according to the Conesa method (as adapted by the LDK study team).

Table 4 - Significance characterization classes of each impact magnitude value (Im)

Range of Im values	Significance characterization classes of each impact
$Im \leq 20$	Negligible
$21 \leq Im \leq 40$	Low
$41 \leq Im \leq 60$	Moderate
$61 \leq Im \leq 85$	High
$Im > 85$	Very High

(Source: Conesa, 2010, as adapted by the LDK study team)

The classification of the significance of each impact is used in combination with the evaluation of the Valued Environmental Receptors (see **Section 10.1.2.1**), in order to determine the **Final Assessment** of each impact, which is characterized as **Negligible, Low, Moderate, Major** or **Critical** according to the Conesa method (Conesa, 2010), as adapted by the LDK study team (**Table** 10-5).

Table 5 - The matrix for determining the final assessment of each environmental and social impact

		Impact Significance Classification				
		Negligible	Minor	Moderate	High	Very high
SEP Significance	Low	Negligible	Negligible	Minor	Moderate	Significant
	Moderate	Negligible	Minor	Moderate	Significant	Critical
	High	Minor	Moderate	Significant	Critical	Critical

(Source: Conesa, 2010, as adapted by the LDK study team)

The above impact significance categories correspond to the definitions presented in the following **Table.**

Table 6 - Definition of the Significance of Environmental and Social Impacts (SEP)

Critical	Impacts above an acceptable threshold, resulting in permanent loss of environmental quality without the possibility of restoration, regardless of the application of preventive or corrective measures. These impacts are non-reversible. Therefore, it is an unacceptable impact, as it corresponds to a severe effect that is not subject to mitigation. Alternative locations for the implementation of the project/activity should be sought. Otherwise, implementation should be cancelled.
Significant	Impacts that require extensive and intensive preventive or corrective measures for the receptor to return to its original state. Even with such measures, the restoration period is medium- to long-term.
Moderate	Impacts that do not require extensive and intensive measures for the receptor to return to its original state, or the degree of disturbance is not great, possibly short-term, and recovery is short- to medium-term. In some cases, these impacts are subject to mitigation and require specific corrective actions where applicable, without extensive efforts.
Minor	Impacts that cause detectable but not significant changes to the condition of the receptors. They may require mild or no mitigation measures. In some cases, even without the implementation of corrective actions, such minor impacts are of short duration and tend to subside naturally or through simple and limited measures.
Negligible	Impacts that can be reversed naturally or immediately cease when the activity ends and do not require preventive or corrective measures. Negligible impacts are considered reversible, short-term, and without the need for corrective intervention.
Positive	Impacts that result in an improvement in the quality/condition of the receptor.

(Source: Conesa, 2010, as adapted by the LDK study team)

10.1.2.3 Residual Impacts

Residual impacts are those that persist following the implementation of preventive and/or corrective measures. Where mitigation measures are proposed, the significance of these impacts is re-evaluated under the assumption that the proposed measures will eliminate or reduce their significance. This re-evaluation is conducted for the impacts categorized as **Moderate, Major**, and **Critical** prior to the implementation of mitigation measures (see **Section 10.1.2.3**).

10.1.3 Assessment of Potentially Significant Impacts Arising from the Vulnerability of the Project to Risks of Accidents or Disasters Related to the Project (Emergency Conditions / Unplanned Events)

10.1.3.1 Introduction

According to paragraph 3 of Article 5 of Joint Ministerial Decision (JMD) 48416/2037/E.103/2011 (Government Gazette 2516/B/7.11.2011) "Measures and conditions for the geological storage of carbon dioxide… – Amendment of JMD No. 29457/1511/2005 (B΄ 992), Presidential Decree 51/2007 (A΄ 54), and Presidential Decree 148/2009 (A΄ 190), in compliance with the provisions of Directive 2009/31/EC of the European Parliament and of the Council of 23 April 2009 on the geological storage of carbon dioxide and amending Council Directive 85/337/EEC, and Directives 2000/60/EC, 2001/80/EC, 2004/35/EC, 2008/1/EC of the European Parliament and of the Council and Regulation (EC) No. 1013/2006", a geological formation is selected as a storage site only if, under the proposed conditions of use, there is no significant risk of leakage, nor significant risk to the environment or human health.

The risk assessment was carried out as part of the application submitted by EnEarth to HHRM S.A. (Hellenic Hydrocarbon and Energy Resources Management Company S.A.) on 30.06.2024 (Ref. No. 22781/HHRM), in order to determine the suitability of the geological formation as a CO_2 storage site, based on Article 173 of Law 4964/2022, and follows the contents specified for Phase 3.3 of the assessment of the proposed storage complex under Annex I of JMD 48416/2037/E.103/2011.

The risk assessment includes, among others, the following:

i. **Hazard identification** through the investigation of potential leakage events from the storage complex. This includes, among others:
a) the possible leakage pathways;
b) the potential magnitude of leakage events along identical leakage paths (flow rates);
c) the critical parameters influencing potential leakage;
d) the secondary effects of CO_2 storage, including displaced formation fluids and new substances potentially formed as a result of CO_2 storage;
e) any other factors that may pose a hazard to human health or the environment (e.g., physical structures associated with the project).

ii. Exposure assessment — based on environmental characteristics, the distribution and activities of the human population above the storage complex, and the behavior and fate of CO_2 leaking through possible pathways.

iii. Effect assessment — based on the sensitivity of specific species, communities, or habitats linked to potential leakage events (item i).

iv. Hazard characterization — assessment of the safety and integrity of the site, both short-term and long-term, including the evaluation of leakage risk under the proposed conditions of use and of worst-case impacts on the environment and human health.

10.1.3.2 Methodology

To achieve a comprehensive overview of the Project's risks within the present context, the hazard potential is assessed for each component (facilities, wells, storage site). Deviations from standard operating procedures and conditions (pressure, temperature, flow rates) are thoroughly examined, as they could pose risks and affect the safety, integrity, and reliability of both the infrastructure and the hydrocarbons of the reservoir.

The risks associated with the CO_2 handling facilities do not differ from those routinely addressed in the existing oil and gas production facilities of Prinos, which include multiple pipelines and equipment through which hazardous gases (e.g., H_2S) flow. The identified risks for both the Prinos facilities and the wells are examined using a **Qualitative Risk Assessment (QRA)** method, in accordance with the company's policy and procedures for identifying and assessing relevant risks, based on ISO 17776:2000 and in alignment with the guidance of the competent authorities and the EU.

Probability, using a scale from A to E (E = highest probability), and **severity**, using a scale from 1 to 5 (5 = highest severity), are the assessment criteria that lead to the **final overall risk level** (**Table** 10-7).

For subsurface-related risks, a comprehensive risk assessment was carried out using the bowtie analysis method to estimate the probability and potential quantities of leakage through various potential leakage pathways. Based on the failure probability of each protection barrier, the bowtie analysis included a **Semi-Quantitative Risk Assessment (SQRA)** to estimate the leakage probability for each different pathway. The estimation of leakage percentages and flow rates, expressed as a percentage (%) of the total injected CO_2 mass, was conducted according to the guidelines of the UK Department of Energy and Climate Change report (2012), which states that leakage rates along escape pathways such as faults or wells can be estimated based on the total injected CO_2 mass.

It is important to note that, although the Semi-Quantitative Risk Assessment (SQRA) yields numerical values, these are entirely based on the judgment of subject matter experts, due to limited data availability for long-term geological CO_2 storage. Therefore, the SQRA results should be considered only as indicative values for comparing relative risks rather than for deriving absolute values.

Considering the early design stage of the CO_2 Storage Project in Prinos, the risk assessment study also aims to propose mitigation or prevention measures to be implemented in future stages of the Project.

Table 7 - Risk Assessment Matrix According to ISO 17776:2000

Severity	Consequences				Probability				
	People	Facility	Environment	Reputation	A	B	C	D	E
					Has never occurred in the hydrocarbon exploration and production industry	Has occurred in the hydrocarbon E&P industry	Has occurred in Energean and frequently in the E&P industry	Has occurred many times in the E&P industry or once or more per year in Energean or on-site	Occurs often in the E&P industry or multiple times per year in Energean or on-site
					Increasing Probability →				
1 Negligible	First aid provision	Negligible damage Production loss ≤ 1 hour Repair/Loss cost < $1 million	Negligible impact Restoration < 15 days and cost < $1 million	Negligible impact Negligible local community interest					
2 Minor	Medical treatment provision Restricted ability to work	Minor damage Production loss 1 hour – 4 days απώλειας $1 εκ. - $6 εκ.	Minor impact Restoration in 15 days – 1 month & κόστος $1 εκ. - $6 εκ.	Limited impacts Minor local interest		LOW		MODERATE	
3 Moderate	Loss of workdays	Local damage	Local impact	Significant impacts					

Severity	Consequences				Probability				
	People	Facility	Environment	Reputation	A	B	C	D	E
					Has never occurred in the hydrocarbon exploration and production industry	Has occurred in the hydrocarbon E&P industry	Has occurred in Energean and frequently in the E&P industry	Has occurred many times in the E&P industry or once or more per year in Energean or on-site	Occurs often in the E&P industry or multiple times per year in Energean or on-site
					Increasing Probability →				
		Production loss of 4–7 days Repair/loss cost: $6 million – $12.5 million.	Restoration within 1–12 months & cost $6 million – $12.5 million	Moderate public interest – Local TV/newspapers					
4 Critical	Loss of life or permanent/partial disability	Major damage Production loss: 7–28 days Repair/loss cost: $12.5 million – $100 million	Major impacts Restoration: 12–24 months Cost: $12.5 million – $100 million .	Major national-level consequences Interest at the national level – National TV/newspapers				HIGH	
5 Catastrophic	Multiple fatalities, permanent disabilities	Extensive damage Production loss > 28	Extensive impacts Restoration in >18 months	Major international-level impacts International-					

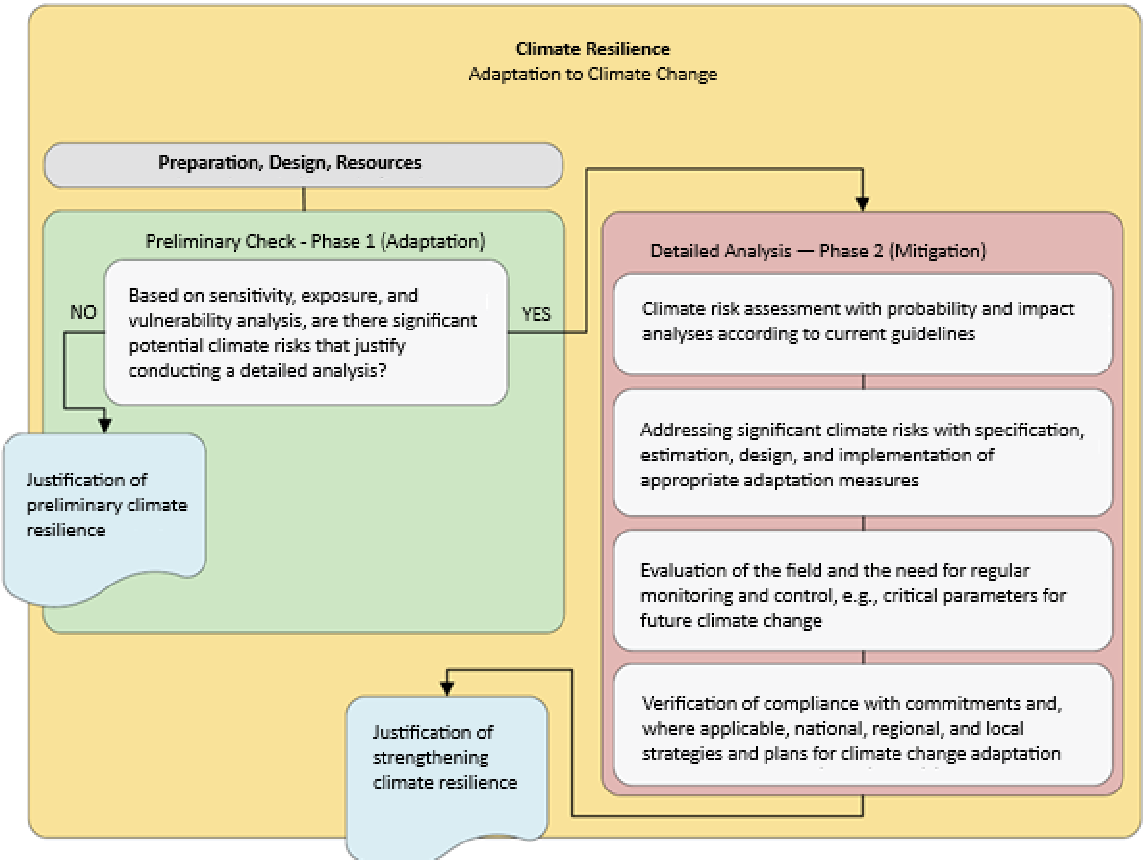
Severity	Consequences				Probability				
	People	Facility	Environment	Reputation	A	B	C	D	E
					Has never occurred in the hydrocarbon exploration and production industry	Has occurred in the hydrocarbon E&P industry	Has occurred in Energean and frequently in the E&P industry	Has occurred many times in the E&P industry or once or more per year in Energean or on-site	Occurs often in the E&P industry or multiple times per year in Energean or on-site
					Increasing Probability →				
		days Repair/loss cost > $100 million	& cost >$100 million	level interest International TV/newspapers					

10.1.4 Impacts from Expected Climate-related Hazards

10.1.4.1 Introduction

This **Section** presents the methodology for documenting the **project's resilience to climate chan**ge, i.e., its ability to withstand and adapt to expected climate-related hazards.

For the purposes of this **Section**, the basis for analyzing the project's resilience to climate change is the procedure set out in the European Commission document entitled *"Technical guidance on the climate proofing of infrastructure in the period 2021–2027"* (2021/C 373/01), hereinafter referred to as the **"Technical Guidance",** which is summarized in the following **Diagram**.



(Source: "Technical guidance on the climate proofing of infrastructure in the period 2021–2027" (2021/C 373/01)

Diagram 10–1: Overview of the climate adaptation process for enhancing climate resilience

Overall, the assessment of infrastructure projects' adaptation to climate change consists of two phases, where the first phase is the **pre-screening**, which may indicate the need for a **detailed analysis** (second phase).

During the pre-screening, a vulnerability analysis of the Project to climate change is carried out. The outcome of the vulnerability analysis determines whether a detailed analysis is required. If so, the detailed analysis includes a **risk assessment** of each **significant hazard source** identified in the **vulnerability analysis**. Within the risk assessment, each hazard source—now considered an **inherent risk**—is evaluated with respect to its **level of significance**. For significant inherent risks, climate change **adaptation measures** must be considered in order to reduce each such risk to an **acceptable level of residual risk**.

10.1.4.2 Pre-screening

10.1.4.2.1 General Information

The pre-screening phase includes the **analysis of the Project's vulnerability** to climate change. The vulnerability analysis is divided into three steps and includes the implementation of the following methodological stages:

1. **Sensitivity** analysis,
2. Analysis of current and future **exposure**,
3. A combination of the two for the **vulnerability** assessment.

For the analysis of sensitivity, exposure, and vulnerability, the National Coordination Authority of the Ministry of Development and Investments, in collaboration with the JASPERS team (Joint Assistance to Support Projects in European Regions) and with the support of the Ministries of Environment and Energy (MEE) and Infrastructure and Transport (**MIT**), has developed a methodology for assessing the climate resilience of infrastructure projects with an expected operational life of at least 5 years (paragraph 2.i of Article 73 of Regulation (EU) 2021/1060). This methodology, along with the relevant adapted computational tools (e.g., an Excel-based tool developed by the General Secretariat for Public Investments & NSRF and available on the **National Information Web Hub for Climate Change Adaptation – AdaptivGreece Hub**[1], developed under the LIFE-IP AdaptInGR project, www.adaptivegreece.gr), is applied in the following **Sections** to conduct the **vulnerability analysis** of the Project to climate change.

10.1.4.2.2 Sensitivity Analysis

The objective of the sensitivity analysis is to identify the **hazard sources** for the specific type of infrastructure, based on its design and operational characteristics, **regardless of its siting location.** In other words, sensitivity relates to the type of project and its operating mode. Important elements for the sensitivity analysis of an infrastructure include its design characteristics, as referenced in the relevant technical design studies of the infrastructure and the environmental impact assessment, where such is foreseen.

A **hazard** is defined as the potential occurrence of a natural or anthropogenic event or trend that may cause loss of life, injury, or other health impacts, as well as damage to or loss of assets, infrastructure, livelihoods, service provision, ecosystems, and environmental resources.

Lists of potential hazards are available in relevant literature and in the corresponding methodological documents, all of which share the common characteristic of being non-exhaustive. The applicability of each list must be evaluated in relation to a specific project, infrastructure, or location. A relatively extensive list of hazard sources is published in the EU Taxonomy Regulation. This list distinguishes between chronic hazards and extreme events (acute hazards) and classifies them into four categories:

- Hazard sources related to temperature (thermal stress, wildfires, etc.)
- Hazard sources related to wind (storms, hurricanes, etc.)
- Hazard sources related to water (sea level rise, droughts, floods, etc.)
- Hazard sources related to soil (coastal erosion, landslides, etc.)

Another list of potential hazards is provided in the JASPERS working document.

Many hazard sources appear in both of the above-mentioned lists. Additionally, some of the hazard sources may not be applicable to Greece due to its geographical location, such as those related to the thawing of permafrost.

In addition to the above lists, hazard sources identified in the Regional Climate Change Adaptation Plans (PeSPKA)—developed by the 13 Regions of the country based on the National Strategy for Climate Change Adaptation (ESPKA)are also used. Within the context of the present Study, the **Hazard Source Table** used results from the combination of all the aforementioned sources (see following **Table**).

Specifically, the sensitivity analysis for the assessed project, based on the computational tool developed by the General Secretariat for Public Investments & NSRF, is summarized in the following **Table**. In each sensitivity field of the assessed project, the corresponding classification (Low, Moderate, High) is filled in for each implementation and operation parameter of the project (Construction, Operation, Products/Services, Integration into the area), from the combination of which the overall sensitivity of the assessed project is derived.

Table 8 - Sensitivity Analysis for the Proposed Project

Source of Risk	Sensitivity				
	Construction	Operation	Products/Services	Presence in the Area	Total Sensitivity
Heatwave					
Cold spell					
Frost (Number of days with T<0)					
Forest fire					
Hurricane, Severe Storms, Tornadoes					
Storm (including snowstorms, sandstorms)					
Tornadoes / Gusty Winds					
Drought					
Extreme precipitation (rain, hail, snow/ice)					
Flooding (in coastal areas, rivers, due to rainfall, groundwater rise)					
Soil erosion / Land degradation					
Subsidence					
Change in mean air temperature					
Urban heat island					
Thermal stress					
Temperature variability					
Solar radiation variability					
Wind pattern variability					
Variability in type and pattern of extreme precipitation (rain, hail, snow/ice)					
Variability between surface and groundwater					
Change in mean water temperature in water bodies					
Ocean acidification / salinity					
Saline water intrusion, salinization of surface & groundwater					
Sea level rise					

Source of Risk	Sensitivity				
	Construction	Operation	Products/Services	Presence in the Area	Total Sensitivity
Availability and overexploitation of water resources					
Coastal erosion					
Soil degradation, change in salinity content, desertification					
Changes in the duration of cultivation periods					

10.1.4.2.3 Exposure Analysis

The objective of the exposure analysis is to identify the **hazard sources** for the intended geographical location of the infrastructure (or for alternative locations), both for the immediate and the long-term future, **regardless of its type.**

For the exposure analysis process, the **Hazard Source Table** selected for the project's sensitivity analysis will also be used.

Specifically, the exposure analysis for the project under assessment, according to the data presented in **Chapter 8** of the present document and the computational tool developed by the General Secretariat for Public Investments & NSRF, is summarized in the following **Table**. In each exposure field of the project under assessment, the corresponding classification (Low, Moderate, High) is provided for present and future conditions (Existing conditions, Future conditions), from the combination of which the overall sensitivity of the project under assessment is derived.

Table 9 - Exposure analysis for the examined project

Risk Source	Exposure		
	Existing conditions	Future conditions	Total Exposure
Heatwave			
Cold spell			
Frost (Number of days with T<0)			
Δασική πυρκαγιά			
Hurricane, Severe Storms, Tornadoes			
Storm (including snowstorms, sandstorms)			
Tornadoes / Gusty Winds			
Drought			
Extreme precipitation (rain, hail, snow/ice)			
Flooding (in coastal areas, rivers, due to rainfall, groundwater rise)			
Soil erosion / Land degradation			
Subsidence			
Change in mean air temperature			
Urban heat island			
Thermal stress			
Temperature variability			
Solar radiation variability			
Wind pattern variability			
Variability in type and pattern of extreme precipitation (rain, hail, snow/ice)			
Variability between surface and groundwater			
Change in mean water temperature in water bodies			
Ocean acidification / salinity			
Saline water intrusion, salinization of surface & groundwater			
Sea level rise			

Risk Source	Exposure		
	Existing conditions	Future conditions	Total Exposure
Availability and overexploitation of water resources			
Coastal erosion			
Soil degradation, change in salinity content, desertification			
Changes in the duration of cultivation periods			

10.1.4.2.4 Vulnerability Analysis

The vulnerability analysis combines the exposure and sensitivity analyses in order to determine which hazard sources are related to the specific infrastructure, **in terms of both its type and geographical location.** It serves as the basis for deciding whether the analysis should proceed to the second stage of detailed assessment.

For the analysis of sensitivity and exposure, a three-level assessment scale has been defined (Low, Moderate, High), which indicates the vulnerability level for each climate-related hazard (Low, Moderate, High).

In cases where the same hazard source is related to both sensitivity and exposure, the infrastructure's vulnerability to that hazard source results from the combination of the two.

Vulnerability = Combination {Sensitivity, Exposure}

If the vulnerability analysis justifiably concludes that the infrastructure does not exhibit vulnerability to any hazard source, then no further **risk analysis** is required, and the assessment of the infrastructure's adaptation to climate change is considered complete.

However, if moderate or high levels of vulnerability arise for certain hazard sources, a detailed **risk assessment** must be carried out for each of them.

Specifically, the vulnerability analysis for the assessed project, based on the computational tool developed by the General Secretariat for Public Investments & NSRF, is summarized in the following **Table**. In each field of sensitivity and exposure of the assessed project, the corresponding classification is provided based on the previous **Tables** (Low, Moderate, High), and the resulting vulnerability classification is determined for each hazard source.

Table 10 - Vulnerability analysis for the examined project

Risk Source	Sensitivity	Exposure	Vulnerability
Heatwave			
Cold spell			
Frost (Number of days with T<0)			
Δασική πυρκαγιά			
Hurricane, Severe Storms, Tornadoes			
Storm (including snowstorms, sandstorms)			
Tornadoes / Gusty Winds			
Drought			
Extreme precipitation (rain, hail, snow/ice)			
Flooding (in coastal areas, rivers, due to rainfall, groundwater rise)			
Soil erosion / Land degradation			
Subsidence			
Change in mean air temperature			
Urban heat island			
Thermal stress			
Temperature variability			
Solar radiation variability			
Wind pattern variability			
Variability in type and pattern of extreme precipitation (rain, hail, snow/ice)			
Variability between surface and groundwater			
Change in mean water temperature in water bodies			
Ocean acidification / salinity			
Saline water intrusion, salinization of surface & groundwater			
Sea level rise			
Availability and overexploitation of water resources			
Coastal erosion			
Soil degradation, change in salinity content, desertification			
Changes in the duration of cultivation periods			

Based on the above analysis, moderate or high levels of vulnerability may emerge for certain hazard sources. Consequently, a **detailed risk assessment** will be carried out for each of them within the scope of the following **Section.**

10.1.4.3 Detailed Analysis

10.1.4.3.1 General Analysis

The detailed analysis includes the following steps:

- Risk analysis.
- Measures to enhance climate change adaptation / Monitoring plan.

10.1.4.3.2 Risk Analysis

The risk analysis is conducted for climate-related hazards identified in the vulnerability analysis as moderate or high.

The risk assessment consists of the combination of the **probability** of occurrence of each hazard source, as identified in the pre-screening stage of the vulnerability analysis, and the **expected severity** of the impacts of that hazard source.

There are various approaches to describing the probability of occurrence of a hazard source. However, it is important at the beginning of the analysis to define the scale that will be used and to clearly explain how the probability of occurrence is assessed and what each rating level corresponds to. The selected scale should be relevant to the specific characteristics of the project, and the same scale must be used throughout the analysis. According to the Technical Guidance, the probability of occurrence of any specific hazard event may be described using qualitative or quantitative terms. Each probability category must include a description — for example, if a category such as "likely" is used for a hazard, it must be defined clearly.

As for the impact analysis of the potential hazard sources, the Technical Guidance emphasizes the need to consider not only direct impacts, but also possible secondary, indirect, or synergistic impacts. The analysis may need to account for the adaptive capacity of the broader system within which the infrastructure operates. According to the Technical Guidance, *adaptive capacity* is the ability of systems, institutions, people, and other living organisms to adjust to potential harm, to take advantage of opportunities, or to respond to consequences.

The **severity or magnitude** of the impacts must be assessed using a scoring scale for each hazard source. Again, it is important that the selected methodology includes the scale to be used for determining severity or magnitude, and that it explains clearly what each score level means. The selected scale should be relevant to the characteristics of the project. Each score category must include a description — for example, if the term **"catastrophic"** is used for the project, it must be clearly defined.

Impacts may generally relate to physical assets and activities, health and safety, environmental and social impacts (including those on vulnerable populations), economic impacts, etc.

Within the context of this Report, a five-level assessment scale is used for both the probability of occurrence and the severity or magnitude of impacts, as presented in the relevant **Table** below. In this **Table**, each level of the scale is clearly explained and tailored to the specific characteristics of the infrastructure.

To perform the risk analysis, a quantitative scale has been defined for the probability of hazard occurrence and for the magnitude/severity of impacts, in accordance with the provisions of the Assessment Framework for Climate Resilience of Infrastructure Projects. The **Tables** that follow present the probability scale calibration for hazard occurrence in a tourism facility and the magnitude/severity scale calibration for impacts in a tourism facility, respectively.

Table 11 - Probability scale rating for the occurrence of hazard sources in building infrastructure

Scale	Rating	Description
Unlikely	1	5% probability of occurrence over the estimated lifespan of the unit
Rare	2	20% probability of occurrence over the estimated lifespan of the unit
Moderate	3	50% probability of occurrence over the estimated lifespan of the unit
Likely	4	80% probability of occurrence over the estimated lifespan of the unit
Almost Certain	5	95% probability of occurrence over the estimated lifespan of the unit

Table 12 - Rating scale for the magnitude/severity of impacts on building infrastructure

Scale	Rating	Description
Negligible	1	Minimal impact that can be absorbed by routine operations
Of Minor Importance	2	Adverse event affecting the normal functioning of the infrastructure, leading to localized impacts
Moderate	3	A serious event requiring additional management actions and resulting in moderate impacts
Significant	4	A critical event requiring urgent action, resulting in significant, extensive, and long-term impacts
Catastrophic	5	A catastrophic event potentially leading to disruption of operations or structural/network failure, causing major damage and widespread impacts

Having assessed the probability of occurrence and the expected magnitude of the impacts of each hazard source, the significance level of each potential risk constitutes the **inherent risk** and can be determined by combining the two above factors.

Inherent Risk = Probability of Occurance x Impact

Thus, the result of the risk assessment can be summarized in a **Table** that presents the probability of occurrence and the severity or magnitude of the impacts of the key hazard sources. The Table reflects the hazard sources that have been examined and identifies those for which the combination of probability of occurrence and impact severity requires the implementation of actions (adaptation measures), as shown in the following **Table.**

The risk/inherent risk scale is then defined for each score in the form of a significance scale. The different significance levels (negligible, low, moderate, significant, very significant) are represented using a color palette, where green indicates negligible significance and red indicates maximum significance — i.e., the highest inherent risk.

Table 13 - Risk Level Rating Scale

Impact / Severity	Probability	Rare	Unlikely	Moderate	Likely	Almost Certain
		1	2	3	4	5
Negligible	1	1	2	3	4	5
Of Minor Importance	2	2	4	6	8	10
Moderate	3	3	6	9	12	15
Significant	4	4	8	12	16	20
Catastrophic	5	5	10	15	20	25

Table 14 - Interpretation of Inherent Risk Score Scale

Score Range	Risk Level	Description
1-3	Negligible	No risk mitigation measures required.
4-6	Low	Risk reduction measures depend on project-specific circumstances.
7-10	Moderate	Risk reduction measures may be necessary depending on project context.
11-19	Significant	Risk reduction measures are recommended.
20-25	Very Significant	Risk reduction measures are mandatory.

Based on the above analysis, moderate or high levels of vulnerability may arise for certain hazard sources. Consequently, **a detailed risk assessment** will be carried out for each of them.

10.1.4.3.3 Measures to Enhance Climate Change Adaptation and Residual Risk

For moderate and significant inherent risks, additional adaptation measures must be considered in order to achieve the greatest possible reduction of **residual risk**. Therefore, in this specific case, adaptation measures are considered for all cases with at least moderate inherent risk, since lower risks (negligible and low) fall outside the scope of the risk assessment.

10.2 ASSESSMENT OF POTENTIALLY SIGNIFICANT IMPACTS FROM THE REGULAR / ROUTINE ACTIVITIES OF THE PROJECT

10.2.1 Impacts Related to the Climatic and Bioclimatic Characteristics

The following sections examine the likelihood of the occurrence of potential adverse impacts on the climatic and bioclimatic characteristics of the area, as a result of the construction, operation, and decommissioning of the Project under assessment.

10.2.1.1 Construction Phase

This **Section** examines the likelihood of potential adverse impacts on the climatic and bioclimatic characteristics of the area, as a result of the construction phase of the Project under assessment.

<u>Due to the nature and scale of the implementation works, the construction of the proposed Project is not expected to cause any change in the climatic and bioclimatic characteristics of the study area, nor any alteration in wind direction, upward or downward airflows, temperature, or thermal capacity of the area.</u>

With regard to greenhouse gas (GHG) emissions, the construction of the Project is estimated to have no significant environmental impact. **Greenhouse gases** mainly include water vapor, carbon dioxide, methane, and hydrofluorocarbons. Therefore, the potential impacts on the climatic and bioclimatic characteristics of the study area from the Project include:

- GHG emissions from the construction of the onshore facilities.
- GHG emissions from the construction of the CO_2 transmission pipeline.
- GHG emissions from the operation of the drilling rig during the drilling works.

As in the case of the calculation of air pollutant emissions, the greenhouse gas emissions of the construction phase, discussed in **Chapter 6 (Section "6.4.7 Atmospheric Emissions")**, are examined in the following sections with respect to emissions from the construction works of the proposed Project, divided into three separate parts. Specifically, the construction of onshore facilities, the drilling works, and the construction of the CO_2 transmission pipeline are examined separately. A key factor justifying this separate calculation of air and GHG emissions is the time sequencing of the activities: the onshore facility works are expected to precede both the bulk of the drilling work and the major part of the pipeline installation.

Accordingly, it was assessed that the separation of air and GHG emissions between the onshore facility works, the construction of the CO_2 transmission pipeline, and the drilling operations would result in a more rational estimation of their respective magnitudes, due to variations in the nature of the works (areal development vs. linear interventions and point-source works, respectively) and the potential temporal lag between them.

The quantities of GHG emissions, as calculated in **Section 6.4.7.4 "Greenhouse Gas Emissions"**, are summarized below, and the related impacts are assessed.

GHG Emissions from the Construction of the Onshore Facilities

The activities that cause impacts during the construction of the onshore facilities, based on the content scope of the ESIA (**Chapter 9**), are the following:

- Site preparation for equipment foundations, earthworks for the siting of new onshore infrastructure and installations.
- Concrete works and placement of 0.5 m thick concrete for the construction of base foundation slabs.
- Installation of the final segment of onshore pipelines (placement, welding), which will be installed on the ground atop the new foundations, without protective coverings.
- Works and activities for the installation and testing of the electrical interconnection and related equipment.
- Operation of heavy vehicles, construction machinery, transportation trucks and support vehicles during construction, which emit:
  - Particulate matter (PM10, PM2,5).
  - Air pollutants (CO, VOC και NOx).
  - GHGs.
-
- Temporary disposal/storage of construction materials and surplus excavation materials.
- Traffic – Daily movement of vehicles related to the construction of the onshore facilities (including worker transportation and movements of support vehicles).

The total greenhouse gas (GHG) emissions during the construction works of the onshore facilities, based on the indicative construction schedule (**Section 6.4.2**), were calculated in the **Tables** of **Section *"6.4.7.4 Greenhouse Gas Emissions"***. Accordingly, <u>total emissions from the transportation of workers and heavy vehicles to and from the project site, as well as from the operation of construction machinery, are estimated at approximately **61 t CO_2e**.</u>

Given that the expected quantities of GHG emissions during <u>the implementation phase of the site preparation works, and the construction of the onshore facilities</u> are considered particularly limited, the significance of the associated impacts is expected to be <u>negative, of negligible intensity, localized, direct in terms of timing, temporary in duration, with short-term reversibility, synergistic, cumulative, direct in terms of effect, periodic, and immediately restorable. In terms of their Final Assessment, these impacts are evaluated as **Moderate**.</u> As the Final Assessment classifies these impacts as **Moderate**, this study proposes prevention / mitigation / management measures so that such impacts are reduced to at least Minor.

<u>Following the implementation of the relevant measures proposed in **Chapter 11** of the present study, the residual impacts are ultimately assessed as **Minor**, and therefore, the project is deemed compatible with the environmental protection objectives, which constitute prerequisites of this study.</u>

GHG Emissions from the Construction of the CO_2 Transmission

The activities that generate impacts during the construction of the CO_2 transmission pipeline, based on the scoping of the ESIA content (**Chapter 9**), are the following:

- Phase 1: Geophysical Survey – A small vessel (15 m in length) equipped for seabed scanning will be used to provide essential data within the pipeline corridor.
- Phase 1: Geotechnical Survey – Following the processing of geophysical survey results, soil samples will be collected using a grab sampler and a core sampler (BoX-corer), which will be sent to laboratories for analysis.
- Phase 2: Shore Approach Works – Installation of the corresponding segment of the pipeline within a trench approximately 500 meters in length and 3 meters in depth to enable connection to shore.
- Phase 3: Installation of the Subsea Pipeline – Laying of a 20 km subsea pipeline using the S-lay method from a specialized pipe-laying vessel, accompanied by two support vessels (supply/tugboats).
- Phase 5: Trench Backfilling and Pipeline Protection, Commissioning – After installation of the pipeline and its associated connections, the pipeline will be buried along its entire length for protection.
- Marine Traffic – Emissions generated from the daily movement of vessels involved in the installation of the CO_2 transmission pipelines, including personnel transport and support vessel operations.

The total greenhouse gas (GHG) emissions and criteria air pollutants of concern (COPC) based on the estimated fuel consumption during the construction works, according to the indicative construction schedule (**Section 6.4.2**), were calculated in the Tables **of Section "6.4.7.4 Greenhouse Gas Emissions".**

For the emission calculations, default emission factors were applied for Marine Gas Oil fuel, as provided by the European Environment Agency's emission inventory guidebook (EMEP/EEA 2023, *EMEP/EEA air pollutant emission inventory guidebook*, *Technical guidance to prepare national emission inventories*, https://www.eea.europa.eu/publications/emep-eea-guidebook-2023). Based on the fuel consumption calculated in **Section 6.4.5.3.2**, the total CO_2 emissions for the entire construction period of the CO_2 transmission pipeline are estimated at **6,467.33 tons of CO_2e.**

The expected quantities of emissions from the construction of the CO2 transport pipeline are estimated to be relatively limited but measurable, and therefore, in terms of their significance, these specific impacts are assessed as negative, of medium intensity, localized, immediate in terms of their occurrence, temporary in duration, short-term reversible, synergistic, cumulative, direct in terms of their effect, periodic, and immediately restorable. Regarding their Final Assessment, these impacts are evaluated as **Moderate**. Since, in their Final Assessment, these impacts are evaluated as **Moderate,** within the framework of this study, measures for prevention/mitigation/management are proposed so that these impacts become at least Minor. Following the implementation of the relevant measures proposed in **Chapter 11** of this document, the residual impacts are ultimately assessed as **Minor** and therefore the project is compatible with the environmental protection objectives that are prerequisites of this study.

GHG Emissions from Drilling Activities

The activities that cause impacts during drilling operations, based on the P&K content delimitation of the ESIA (**Chapter 9**), are as follows:

ι δραστηριότητες που προκαλούν επιπτώσεις κατά τη διάρκεια της των γεωτρητικών εργασιών, βάσει και της Π&Κ οριοθέτησης περιεχομένου της ΜΠΕ (**Κεφάλαιο 9**) είναι οι ακόλουθες:

- Preparation of the existing start-up well.
  - A permanent mechanical bridge plug will be installed at a predetermined depth inside the production casing after the well is killed.
- Drilling of wells
  - Drilling of 4 wells to a depth of approximately 3,700 m (2 wells will be used as CO2 injection wells and 2 as water production wells for the relative pressure maintenance of the reservoir).
  - All four new wells will be constructed with a TDS (Top Drive System) drilling unit and will be directed using a combination of mud motors and rotary drilling assemblies.
- Completion of drilling
  - Η προστατευτική σωλήνωση κάθε γεώτρησης θα τσιμεντωθεί με στήλη τσιμέντου 200 m, πάνω από την βάση της προηγούμενης προστατευτικής σωλήνωσης και σε όλο το μήκος του ανοιχτού γεωλογικού σχηματισμού.
- Marine traffic
  - Emissions caused by the daily movement of ships during drilling operations (including the transportation of workers and the movements of support vessels), which create:
  - *Air pollutants (CO, VOC, and NOx) and GHG.*

The total greenhouse gas emissions (GHG) based on the estimated fuel consumption during the works according to the indicative construction schedule (**Section 6.4.2)** were calculated in the relevant Tables of Section **6.4.7.4 Greenhouse Gas Emissions.**

O The following **Table** summarizes the calculation of CO2 emissions from the construction activities of the Project.

Table 15 - Calculation of CO_2 emissions from the construction works of the Project

Construction Activities	CO_2 Emissions (tn)
Transportation of workers and heavy vehicles to and from the project site, operation of construction machinery	61,0

Construction Activities	CO_2 Emissions (tn)
Operation of drilling equipment [1]	69.626,1
Construction of CO_2 pipeline using the construction vessel and auxiliary ships	6.467,3
Total CO_2 emissions during construction	**76.154,4**

The expected quantities of atmospheric emissions from the implementation of drilling activities are estimated to be relatively limited and therefore, in terms of their significance, these specific impacts are assessed as negative, of medium intensity, localized, immediate in terms of their occurrence, temporary in duration, short-term reversible, synergistic, cumulative, direct in terms of their effect, continuous, and immediately restorable. Regarding their Final Assessment, these impacts are evaluated as **Moderate**.

As for their Final Evaluation, these impacts are assessed as **Moderate**, within the framework of this study, measures for prevention/mitigation/management are proposed so that these impacts become at least Minor. Following the implementation of the relevant measures proposed in **Chapter 11** of this report, the residual impacts are ultimately assessed as **Minor** and therefore the project is compatible with the environmental protection objectives that are prerequisites of this study.

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation	Final Evaluation of Residual Impact.
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)				
Emissions of GHG from construction of onshore facilities	Climate / Climate change	-	1	2	4	1	1	2	4	2	1	4	26	Minor	High	Moderate	Minor
Emissions of GHG from CO_2 pipeline construction	Climate / Climate change	-	4	2	4	1	1	2	4	2	1	4	35	Minor	High	Moderate	Minor
Emissions of Emissions from geotechnical works from	Climate / Climate change	-	4	2	4	1	1	2	4	4	1	4	37	Minor	High	Moderate	Minor

[1] *It is considered that the drilling equipment will operate **20 days per month over a period of 8 months**, in accordance with the construction schedule of the Project.*

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation	Final Evaluation of Residual Impact.
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)				
geotechnical works																	

10.2.1.2 Operation Phase

In this **Section,** the likelihood of potential adverse impacts on the climatic and bioclimatic characteristics of the area, as a result of the operation of the examined project, is examined.

The activities that cause impacts during the operation of the examined project, based on the P&K content delineation of the EIA (**Chapter 9**), are as follows:

Transport of CO2 to the Prinos offshore storage facilities

According to the calculations presented in **Section 6.5.6.3**, the fuel consumption for the supply vessel is estimated to be **1,300 t** for the entire duration of the Project. For the above fuel consumption, the total GHG emissions for the entire duration of the Project are estimated to **be 4,195.37 tn CO2e** (including emissions from the transportation of workers and the movements of support vessels).

The expected quantities of GHG emissions from the transportation of CO2 to the offshore storage facilities in Prinos are estimated to be relatively limited but measurable, and therefore, in terms of their significance, these specific impacts are assessed as negative, of medium intensity, localized, immediate in terms of their occurrence, long-term, of short-term reversibility, synergistic, cumulative, direct in terms of their effect, periodic, and immediately remediable. Regarding their Final Assessment, these impacts are evaluated as **Moderate.** Since, in their Final Evaluation, the aforementioned impacts are assessed as **Moderate**, within the framework of this study, measures for prevention/mitigation/management are proposed so that these impacts become at least Minor. After the implementation of the relevant measures proposed in **Chapter 11** of this report, the residual impacts are ultimately assessed as **Minor** and therefore the project is compatible with the environmental protection objectives that are prerequisites of this study.

CO_2 Injection and Water Extraction

The main processing equipment on the Beta platform will include a pumping and heating station for the required injection conditions, installed on the open deck of the platform.

- The two water production wells on the Beta platform will be equipped with electric submersible pumps (ESP) and will extract water from the reservoir. For the extraction of produced water from the water wells on the Beta platform, two Electric Submersible Pumps (ESP) with a power of approximately 0.5 to 1 MW each are planned. According to the calculations presented in Section 6.5.6.3, the annual operation of the pumping and heating station requires a total energy of 9,344 MWh, while the operation of the two pumps in the water production wells requires a total energy of 13,140 MWh. According to the emission factor of the remaining energy mix, as published by the DAPEEP, the annual GHG emissions from the operation of the above equipment will be approximately 9,823.0 tn CO2e.
- ΔΑΠΕΕΠ

The expected quantities of emissions from the injection of CO2 and the extraction of water are estimated to be relatively limited but measurable, and therefore, in terms of their significance, these specific impacts are assessed as negative, of medium intensity, localized, immediate in terms of their occurrence, long-lasting, of short-term reversibility, synergistic, cumulative, direct in terms of their effect, continuous, and immediately restorable. Regarding their Final Assessment, these impacts are evaluated as **Moderate**. As for their Final Evaluation, these impacts are assessed as **Moderate,** within the framework of this study, measures for prevention/mitigation/management are proposed so that these impacts become at least Minor. Following the implementation of the relevant measures proposed in **Chapter 11** of this report, the residual impacts are ultimately assessed as **Minor** and therefore the project is compatible with the environmental protection objectives that are prerequisites of this study.

Maintenance and repair activities for infrastructure and equipment

Given the scale and nature of the project, the expected quantities of CO2e emissions from maintenance and repair activities of infrastructure and equipment are estimated to be particularly limited but calculable. Therefore, in terms of their significance, these specific impacts are assessed as negative, low-intensity, localized to the project area, immediate in terms of their occurrence, long-lasting, short-term reversible, synergistic, cumulative, direct in terms of their effect, periodic, and directly restorable. Regarding their Final Assessment, these impacts are evaluated as **Moderate.** As for their Final Evaluation, these impacts are assessed as **Moderate**, within the framework of the present study, measures for prevention/mitigation/management are proposed so that these impacts become at least Minor. Following the implementation of the relevant measures proposed in **Chapter 11** of this report, the residual impacts are ultimately assessed as **Minor** and therefore the project is compatible with the environmental protection objectives that are prerequisites of this study.

Marine Traffic

The daily movement of ships due to the operation of the Project (including the transportation of workers and the movements of support vessels) results in emissions of air pollutants (CO, VOC, and NOx) and PM. Based on the fuel consumption anticipated for the movements of the vessels, the total CO2e emissions for the entire duration of the Project are estimated at **4,195.37 tn CO2e** (including the CO2e emissions from the supply vessels), as calculated in **Section 6.5.6.3.**

Given the scale and nature of the project, the expected quantities of atmospheric emissions from the daily movement of ships due to the operation of the project (including the transportation of workers and the movements of support ships) are estimated to be particularly limited but quantifiable. Therefore, in terms of their significance, these specific impacts are assessed as negative, low-intensity, local, immediate in terms of their occurrence period, long-term, short-term reversible, synergistic, cumulative, direct in terms of their effect, periodic, and directly restorable. Regarding their Final Assessment, these impacts are evaluated as Moderate. Regarding their Final Assessment, these impacts are evaluated as **Moderate.** Since, in their Final Evaluation, these impacts are assessed as **Moderate,** within the framework of this study, measures for prevention/mitigation/management are proposed so that these impacts become at least Minor. Following the implementation of the relevant measures proposed in **Chapter 11** of this report, the residual impacts are ultimately assessed as **Minor** and therefore the project is compatible with the environmental protection objectives that are prerequisites of this study.

Physical presence and operation of the Project

The proposed Project constitutes a CO2 storage unit. The operation of the proposed Project involves significant **CO2 storage**, as the related CO2 emissions are **negative** and are considered **stable** and equal to **869,175 tn CO2 eq per year** (calculations in **Section 4.5.2**), since in the current Phase of the project (1) the storage of **1,000,000 tn CO2 eq/year** is anticipated (from which the related CO2 emissions arising from the aforementioned activities are deducted).

The proposed CO2 storage project in Prinos is expected to play a significant role in achieving national greenhouse gas emission reduction targets, as well as to strongly contribute to meeting the country's commitments/obligations regarding international treaties and agreements on emission reduction and achieving climate neutrality, as it is the first such initiative in Greece and the Eastern Mediterranean for CO2 storage. Therefore, the impact on the local socio-economic conditions from the implementation of the proposed project is assessed as **strongly positive**.

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Importance	Final Impact Evaluation	Final Residual Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Moment of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Recoverability)	AC (Accumulation)	Im (Impact Magnitude)				
Emissions of GHGs from the transport of CO_2 to the offshore	Climate / Climate change	-	4	2	4	3	1	2	4	2	1	4	37	Minor	High	Moderate	Minor

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Importance	Final Impact Evaluation	Final Residual Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Moment of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Recoverability)	AC (Accumulation)	Im (Impact Magnitude)				
storage facilities of Prinos																	
Emissions of GHGs from the injection of CO_2	Climate / Climate change	-	4	2	4	3	1	2	4	4	1	4	39	Minor	High	Moderate	Minor
Emissions of GHGs from water pumping	Climate / Climate change	-	4	2	4	3	1	2	4	4	1	4	39	Minor	High	Moderate	Minor
Emissions of GHGs from maintenance and repair activities of infrastructure and equipment	Climate / Climate change	-	2	1	4	3	1	2	4	2	1	4	29	Minor	High	Moderate	Minor
Emissions of GHGs from the daily movement of vessels due to Project operation (including worker transport and support vessel movements)	Climate / Climate change	-	2	2	4	3	1	2	4	2	1	4	31	Minor	High	Moderate	Minor
CO_2 storage from Project operation	Climate / Climate change	+	12	8	4	4	3	2	4	4	4	4	81	Positive	High	Positive	Positive

10.2.1.3 Phase of Decommissioning/Uninstallation

In this **Section,** the likelihood of potential adverse impacts on the climatic and bioclimatic characteristics of the area, as a result of the cessation of operation and the decommissioning of the examined Project, is examined.
The activities that cause impacts during the cessation of operation and the decommissioning of the examined project, based on the P&K content delimitation of the ESIA (**Chapter 9**), are as follows:

Dismantling of Land Facilities – Restoration of the Land Area of the Project Installation

As part of the dismantling of the land facilities and the restoration of the land area of the project installation, the following activities with potential adverse impacts are foreseen:

- Removal of concrete and foundation slabs, as well as earthworks for the restoration of the land area of the Project installation.
- Movement of heavy vehicles, construction machinery, transport vehicles and trucks, as well as support vehicles during the shutdown/decommissioning of the project, which emit gaseous pollutants (CO, VOC, and NOx) and GHG.
- Traffic - Daily movement of vehicles related to the shutdown / decommissioning of the Project (including the transportation of workers and the movements of support vehicles).
- The pipelines within the onshore section of the CO2 transport pipeline system will be depressurized, cleaned, and purged with nitrogen to secure them in accordance with international guidelines and best practices. The infrastructure will be isolated from the offshore pipeline with a sealed flange and will be demolished.

The expected quantities of GHG emissions during the phase of <u>dismantling the land-based facilities and restoring the land area of the project's installation are estimated to be limited in significance</u>, and the related impacts will, in any case, be consistent with those anticipated for the construction phase of the project (possibly even milder, as the phase of dismantling the land-based facilities and restoring the land area of the project's installation generally lasts significantly shorter than the construction phase). Therefore, these specific impacts are expected to be <u>negative, of negligible intensity, localized, immediate in terms of their occurrence period, temporary in duration, short-term reversible, synergistic, cumulative, direct in their effect, periodic, and immediately remediable. Regarding their Final Assessment, these impacts are evaluated as **Moderate**.</u> As for their Final Assessment, these impacts are evaluated as **Moderate**; within the framework of this study, measures for prevention/mitigation/management are proposed so that these impacts become at least Minor. Following the implementation of the relevant measures proposed in **Chapter 11** of this report, the residual impacts are ultimately assessed as **Minor** and therefore the project is compatible with the environmental protection objectives that are prerequisites of this study.

Suspension of operation / decommissioning of offshore CO2 transportation pipeline

As part of the decommissioning of the offshore CO2 transport pipeline, the following activities with potential adverse impacts are planned:

- The offshore pipeline and riser will be depressurized, cleaned with standard pigging operations, and decommissioned by the introduction of nitrogen. Subsequently, the pipeline will be isolated from the offshore platform, sealed with welded caps or flanges, and left in place in accordance with international standards.
- Maritime traffic - Emissions caused by the implementation of the decommissioning activities of offshore facilities (including the transportation of workers and the movements of support vessels), which generate air pollutants (CO, VOC, and NOx) and GHGs.

The expected quantities of emissions during the phase of implementing the decommissioning / dismantling of offshore CO2 transport pipelines are estimated to be limited in significance; therefore, these specific impacts are expected to be negative, negligible in intensity, localized, immediate in terms of their occurrence, temporary in duration, short-term reversible, synergistic, cumulative, direct in their effect, periodic, and immediately restorable. Regarding their Final Assessment, these impacts are evaluated as **Moderate**. Since in their Final Evaluation, these impacts are assessed as **Moderate,** within the framework of the present study, measures for prevention/mitigation/management are proposed so that these impacts become at least Minor. After the implementation of the relevant measures proposed in **Chapter 11** of this report, the residual impacts are ultimately assessed as **Minor** and therefore the project is compatible with the environmental protection objectives that are prerequisites of this study.

Shutdown / Decommissioning of offshore facilities (except for the offshore CO2 transport pipeline)

As part of the decommissioning of the offshore facilities (excluding the offshore CO2 transportation pipeline), the following activities with potential adverse impacts are anticipated:

- Placement of barriers
  - Primary barrier - If cement is used as a barrier, a cement column of at least 30 m is required to form a permanent barrier. Where possible, 152 m cement plugs are placed to over-cover these 30 m of cement
  - Secondary barrier - A combined plug of at least 60 m of cement is required to form a secondary barrier. Where possible, 244 m of cement is placed to exceed these 60 m of cement.
- Dismantling of equipment and decommissioning of facilities
- Marine traffic - Emissions caused by the implementation of the decommissioning activities of offshore facilities (including the transportation of workers and the movements of support vessels), which create air pollutants (CO, VOC, and NOx) and GHGs.

The expected quantities of GHG emissions during the phase of implementing the cessation/decommissioning activities of the offshore facilities (excluding the offshore CO2 transport pipeline) are estimated to be limited in significance. Therefore, these specific impacts are expected to be negative, of low intensity, localized, immediate in terms of their occurrence, temporary in duration, short-term reversible, synergistic, cumulative, direct in their effect, periodic, and immediately restorable. Regarding their Final Assessment, these impacts are evaluated as **Moderate**. As for their Final Assessment, these impacts are evaluated as **Moderate**; within the framework of this study, measures for prevention/mitigation/management are proposed so that these impacts are reduced to at least Minor. After the implementation of the relevant measures proposed in **Chapter 11** of this report, the residual impacts are ultimately assessed as **Minor** and therefore the project is compatible with the environmental protection objectives that are prerequisites of this study.

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation	Final Residual Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Moment of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Recoverability)	AC (Accumulation)	Im (Impact Magnitude)				
GHG emissions from Decommissioning of Onshore Facilities – Restoration of Onshore Installation Area of the Project	Climate / Climate change	-	1	2	4	1	1	2	4	2	1	4	26	Minor	High	Moderate	Minor
GHG emissions from Cessation of Operations / Inactivity of Offshore CO_2 Transport Pipeline	Climate / Climate change	-	1	2	4	1	1	2	4	2	1	4	26	Minor	High	Moderate	Minor
GHG emissions from Cessation of Operations / Decommissioning of offshore facilities (disconnection from the Offshore CO_2 Transport Pipeline)	Climate / Climate change	-	2	2	4	1	1	2	4	2	1	4	29	Minor	High	Moderate	Minor

10.2.2 Impacts on Morphological and Topological Characteristics

In the following paragraphs, the likelihood of potential adverse impacts on the morphological and topological characteristics of the area as a result of the construction, operation, and cessation/decommissioning of the examined project will be examined.

10.2.2.1 Construction Phase

In this **Section**, the likelihood of potential adverse impacts on the morphological and topological characteristics of the area, as a result of the construction of the examined project, is examined.

Construction of the land facilities

Morphology of the land area

As previously mentioned, the land portion of the project is located on an area with gentle slopes. The morphology of the coastal zone of the immediate study area is characterized by extensive sandy beaches with lakes, lagoons, and strips of land. However, the site for the land-based portion of the project is located within the boundaries of the SIGMA industrial facility, in an area that has been shaped by the long-term implementation of anthropogenic activities. Therefore, the overall morphology of the land area designated for the terrestrial facilities is heavily shaped by anthropogenic activities and does not exhibit steep slopes, elevations, or interesting features. The activities that may potentially impact the morphology of the study area during the construction of the land facilities, based on the P&K delineation of the content of the EIA (**Chapter 9**), are as follows:

- Preparation of the ground for the foundation of the equipment, earthworks for the placement of the new land-based infrastructures and facilities.
- Concrete pouring and placement of 0.5 m thick concrete for the construction of base foundation slabs.
- Installation of the final section of land pipelines (placement, welding), which will be installed in the ground on the new foundations, without protective covers.
- Temporary deposition/storage of structural/construction materials and surplus excavation materials.

In the case of constructing the land facilities, limited **morphological alterations** are expected from the excavations and backfilling associated with the earthworks for shaping the site of the land facilities of the Project and the implementation of the facilities themselves. More specifically, the excavation area will be limited to the points where the bases of the land equipment will be placed, and it is estimated to be approximately 50 m^2.

Additionally, the interventions of the terrestrial facilities of the proposed Project will result in particularly limited quantities of surplus materials and will require relatively limited quantities of raw materials. Specifically, from the site preparation works of the proposed project, it is expected that the following will arise/ be required:

- Especially limited volume of surplus excavation materials (~200 m3), which will be part of the Project's development
- Relatively limited total volume of materials required for the land facilities site preparation works: Approximately 350 tons of concrete and 50 tons of carbon steel pipes and protective steel casings are required, for example.

Therefore, the impact on the morphology of the area from the implementation of the land facilities of the project will be negative, of negligible intensity, within the project occupation area, simultaneous with the construction works, temporary in duration, medium-term reversible, non-synergistic, non-cumulative, direct in terms of its effect, continuous, and short-term recoverable. Therefore, in terms of their Final Evaluation, these impacts are assessed as **Negligible**.

Landscape

According to Map P2.d of the Evaluation and Revision of the Spatial Planning and Sustainable Development Framework of the Region of Eastern Macedonia and Thrace for the Landscape, the area of the terrestrial facilities of the Project falls within a zone of particularly degraded landscape. The activities that may potentially cause impacts on the landscape of the study area during the construction of the land facilities, based on the P&K delineation of the content of the EIA (**Chapter 9**), are as follows:

- Preparation of the ground for the foundation of the equipment, earthworks for the placement of the new land-based infrastructures and facilities.
- Concrete pouring and placement of 0.5 m thick concrete for the construction of base foundation slabs.
- Installation of the final section of land pipelines (placement, welding), which will be installed in the ground on the new foundations, without protective covers.
- Movement of heavy vehicles, construction machinery, transport vehicles and trucks, as well as support vehicles during construction.
- Temporary deposition/storage of structural/construction materials and surplus excavation materials.
- Production, management, and disposal of waste from the construction activities of the project's land facilities.
- Traffic - Daily movement of vehicles related to the construction of the land facilities (including the transportation of workers and the movements of support vehicles).

During the construction phase, some temporary change in the **aesthetics of the landscape** in the immediate area of the Project is expected. The earthworks, the movement and parking of machinery, the piles of construction materials, and the construction site facilities will affect the landscape, which, however, is already a developed industrial area with long-term use. The unorganized and uncontrolled development of the works, the unorganized deposition of construction materials and surplus excavation materials, as well as the scattered placement of construction site machinery, can also burden the landscape.

Finally, it is noted that the upcoming changes from the project under study do not conflict with the provisions of the European Landscape Convention (Law 3827/2010, Government Gazette 30/A/2010), as no landscapes or specific landscape policies have been recognized to date in the study area, in accordance with the provisions of the Convention.

The project under consideration involves small-scale land interventions, which are located within an existing industrial facility that, according to Map P2.d of the Evaluation and Revision of the Spatial Planning and

Sustainable Development Framework of the Region of Eastern Macedonia and Thrace for the Landscape, falls within a **zone of particularly degraded landscape**. Considering the characteristics of the project (**Chapter 6**) in conjunction with the existing condition of the area where the proposed project will be located (as described in the relevant paragraph of **Chapter 8**), it is estimated that the construction of the proposed Project will be acceptable for the aesthetics of the area.

The impact on the landscape of the area from the deposits of the required materials for the development of the land-based facilities will be limited. Beyond the limited quantity of temporary deposits, it is important to note that their management will be carried out according to the best available practices for landscape and soil protection. Therefore, the already small potential impacts are expected to be further minimized and thus be considered as overall negligible.

More specifically, the impact on the landscape of the area is estimated as negative, of negligible intensity, local, simultaneous with the construction works, temporary in duration, medium-term reversible, synergistic, non-cumulative, direct in terms of its effect, continuous, and short-term restorable. Therefore, in terms of their Final Assessment, these impacts are evaluated as **Mino**r.

The aforementioned negative impacts can be prevented and addressed to a significant extent by taking measures and implementing proper construction practices, as discussed in **Chapter 11.**

Construction of the CO_2 transport pipeline

Morphology of the seabed

The activities that may potentially impact the morphology of the seabed during the construction of the CO2 transport pipeline, based on the P&K content delimitation of the ESIA (**Chapter 9**), are as follows:

- Phase 1 - Geotechnical Survey: After processing the results of the geophysical survey, soil samples will be taken with a grab and a box-corer, which will be sent to laboratories for analysis.
- Phase 2: Works for the approach of the pipeline to the shore (placement of the specific section of the pipeline in a trench approximately 500 m long and 3 m deep).
- Phase 3: Installation of a 20 km subsea pipeline (using the S-lay method) by a specialized pipelaying vessel, along with 2 support supply/tug vessels.
- Phase 4 - Installation of the riser pipe on platform Beta, connection works.
- Phase 5: Trench closure and pipeline protection, commissioning. After the installation of the pipeline and the related connections, the pipeline will be buried along its entire length.

The estimated excavation area for the land section of the pipeline is 500 m long, with an area of 200 m^2 and a depth of 3 m.

The 20 km CO_2 pipeline will be installed by a specialized pipelay and trenching vessel. After the installation of the pipeline and the connections, the pipeline will need to be buried along its entire length. Tools that can be used for trenching are as follows:

- The pipeline burial plow excavator, driven by a support vessel, passes over the pipeline axis and creates the trench.
- Launch sled, supported by a specialized vessel, with high-pressure jets passing over the pipeline axis and forming the trench as it is dragged along the pipeline.
- Hydroskimmer, supported by a special vessel, uses an underwater fan to remove the soil beneath the pipeline and form the trench.

It may be necessary to perform multiple passes to achieve the desired pipeline burial depth (from 1.5 to 2 m TOP), depending on the soil conditions. Due to the nature of the seabed and the very strong bottom currents in the area, the pipeline trench will naturally backfill without the need for additional works. In locations where post-lay trenching is not feasible due to accessibility constraints or proximity to other structures or the platform, the exposed sections of the pipeline will be covered with a concrete mattress for additional protection

The anticipated impact on seabed morphology from <u>the construction of the CO_2 transport pipeline</u> is considered relatively limited but notable; therefore, the significance of this impact is assessed as <u>negative, of moderate intensity, within the pipeline's footprint, concurrent with construction works, of temporary duration, medium-term reversible, non-synergistic, non-cumulative, direct in nature, continuous, and short-</u>

term restorable. In terms of Final Evaluation, these impacts are assessed as **Negligible**.

Landscape

The activities that may cause impacts on the landscape of the study area during the construction phase of the CO_2 transport pipeline, based on the content delimitation of the ESIA (**Chapter 9**), are the following:

- Phase 2: Works for the pipeline's landfall (placement of the specific pipeline section in a trench approximately 500 m long and 3 m deep)
- Phase 3: Installation of a 20 km long subsea pipeline (using the S-lay method) by a dedicated pipelay vessel, accompanied by 2 support/supply/tug vessels.
- Marine traffic – Daily vessel movements for the installation of the CO_2 transport pipelines (including the transport of workers and the movement of support vessels).
- Όπως προαναφέρθηκε, Η εκτιμώμενη περιοχή εκσκαφής για το χερσαίο τμήμα του αγωγού είναι μήκους 500 m επιφάνειας 200 m^2 και βάθους 3 m.

As previously mentioned, the estimated excavation area for the onshore section of the pipeline is 500 m long, with a surface area of 200 m^2 and a depth of 3 m.

Additionally, the 20 km long CO_2 pipeline will be installed by a specialized pipelay and trenching vessel. After pipeline installation and tie-ins, the pipeline must be buried along its entire length. The trenching tools that can be used include:

- A pipeline burial plough, guided by a support vessel, passes over the pipeline alignment and creates the trench.
- A jet sled, supported by a specialized vessel, equipped with high-pressure water jets that pass over the pipeline alignment and create the trench as it is dragged along the route.
- A hydro-trencher, supported by a specialized vessel, uses an underwater fan to remove the soil beneath the pipeline and form the trench.
-
- Multiple passes may be required to achieve the desired burial depth (from 1.5 to 2 m TOP), depending on seabed conditions. However, as is evident, during the installation works of the CO_2 transport pipeline, an increase in suspended solids concentrations and, consequently, turbidity is expected, as a result of seabed excavation, which will lead to associated negative impacts on the seascape of the area.

Based on the project design data presented in **Section 6**, the expected impact on the marine landscape from the construction of the CO_2 transport pipeline is considered relatively limited but notable. Therefore, the significance of this impact is assessed as negative, of moderate intensity, local, concurrent with construction works, of temporary duration, medium-term reversible, synergistic, non-cumulative, direct in nature, continuous, and short-term restorable. In terms of Final Evaluation, these impacts are assessed as **Minor**.

Drilling Works

Seabed Morphology

During the drilling of the 16-inch diameter section down to a depth of 2,200 m, a drilling mud based on seawater/lime will be used. The cuttings from this section, estimated at 1,140 m³, will not contain hazardous substances and will be deposited on the seabed. The potential impact of this activity consists of locally confined changes to the seabed characteristics within an area of approximately 600 m². The seabed morphology will be altered but is expected to gradually return to its previous state over the following 5–10 years.

The anticipated impact on seabed morphology from the drilling works is long-term reversible yet notable. Therefore, in terms of significance, this impact is assessed as negative, of moderate intensity, local, concurrent with construction activities, temporary, long-term reversible, non-synergistic, direct, continuous, medium-term restorable, and non-cumulative. In terms of Final Evaluation, these impacts are assessed as **Minor.**

Landscape

The activities that may cause impacts on the landscape of the study area during the drilling works, based on the content delimitation of the ESIA (**Chapter 9**), are the following:

- Drilling operations
  - Drilling of 4 wells to a depth of approximately 3,700 m (2 wells will be used as CO_2 injection wells and 2 as water production wells for the corresponding pressure balancing of the reservoir).
  - All four new wells will be constructed using a TDS (Top Drive System) drilling unit and will be guided using a combination of mud motors and rotary drilling assemblies.
- Waste – Generation, management and disposal of extractive waste (drilling mud and cuttings)
  - During the drilling of the 16-inch diameter section down to a depth of 2,200 m, a drilling mud based on seawater/lime will be used. The cuttings from this section will be deposited on the seabed. Below this depth, the drilling fluids return to the surface where the cuttings are removed, and the mud is treated.

As already mentioned, during the drilling works, an increase in the concentration of suspended solids and consequently turbidity is expected, due to seabed excavation, with related negative impacts on the marine landscape of the area.

Based on the design data of the examined project, as presented in **Section 6**, the anticipated impact on the seascape from the drilling works is considered relatively limited but notable. Therefore, in terms of significance, this impact is assessed as negative, of moderate intensity, local, concurrent with construction works, temporary, long-term reversible, non-synergistic, direct, continuous, medium-term restorable, and non-cumulative. In terms of Final Evaluation, these impacts are assessed as **Minor**.

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Construction of onshore installations	Morphology of terrestrial area	-	1	1	4	1	2	1	4	4	1	1	23	Minor	Low	Negligible
Construction of onshore installations	Landscape	-	1	2	4	1	2	2	4	4	1	1	26	Minor	Moderate	Minor
Construction of the CO_2 transport pipeline	Morphology of the seabed	-	4	1	4	1	2	1	4	4	1	1	32	Minor	Low	Negligible
Construction of the CO_2 transport pipeline	Landscape	-	4	2	4	1	2	2	4	4	1	1	35	Minor	Moderate	Minor
Geotechnical works	Morphology of the seabed	-	4	2	4	1	3	1	4	4	1	1	35	Minor	Low	Negligible
Geotechnical works	Landscape	-	4	2	4	1	2	2	4	4	1	1	35	Minor	Moderate	Minor

10.2.2.2 Operation Phase

This **section** examines the likelihood of potential adverse impacts on the morphological and landscape characteristics of the area, as a result of the operation of the proposed project.

The activities causing impacts during the operation phase of the examined project, based on the content delimitation of the ESIA (**Chapter 9**), are the following:

Physical Presence – Operation of Onshore Facilities

Morphology of the Onshore Area

As previously mentioned, the onshore section of the project is sited in an area with gentle slopes. The siting area for the onshore component of the project lies within the boundaries of the SIGMA industrial facility, in a location already modified due to long-standing human activities. Therefore, the overall morphology of the onshore facilities' siting area is heavily shaped by anthropogenic interventions and does not present any elevations or features of interest.

During the operation phase, the morphology of the soil in the immediate vicinity of the proposed onshore facilities will remain as it was shaped during the construction phase, causing corresponding impacts in the long term.

Therefore, the impact on the morphology of the area from the operation of the project's onshore facilities will be negative, of negligible intensity, within the project's footprint, permanent, medium-term reversible, non-synergistic, non-cumulative, direct, continuous, and short-term restorable. As such, in terms of Final Evaluation, these impacts are assessed as **Negligible**.

Lanscape

Regarding the impact on the landscape of the area, during the operation phase the project's onshore facilities will visually constitute part of the SIGMA site and the broader industrial zone of the area, which is characterized by strong human presence and industrial/commercial activity. Due to the limited size of the proposed onshore facilities, the burden on the landscape will be extremely limited.

Therefore, the impact on the landscape of the area from the operation of the project's onshore facilities will be negative, of negligible intensity, local, concurrent with construction works, permanent, medium-term reversible, synergistic, non-cumulative, direct, continuous, and short-term restorable. As such, in terms of Final Evaluation, these impacts are assessed as **Minor**.

Physical Presence – Operation of Offshore Facilities

Seabed Morphology

After the completion of the construction period, the morphology of the seabed in the immediate area of the offshore section of the CO_2 subsea pipeline and in the area of the wells will return to its original condition, since the pipeline trench will be naturally backfilled (without additional works, as previously mentioned), while in the area of the wells, the deposited materials will disperse and the seabed morphology will gradually return to its prior state over the next 5–10 years. Therefore, no further impact on the morphological characteristics of the seabed is expected from the physical presence and operation of the offshore facilities of the proposed Project. As such, the potential impacts on the seabed morphology from the operation of the proposed Project are considered **Neutral**.

Landscape

After the completion of the construction period, the landscape in the immediate area of the offshore section of the pipeline will not be altered, as the CO_2 subsea pipeline will not be visible, and the well area will be located on existing platforms that have been operating in the area for many years and are effectively integrated into its landscape. Therefore, no further impact on the landscape characteristics of the study area is expected from the physical presence and operation of the offshore facilities of the proposed Project. As such, the potential impacts on the landscape from the operation of the proposed Project are considered **Neutral**.

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Physical presence – Operation of onshore installations	Morphology of terrestrial area	-	1	1	4	4	2	1	4	4	1	1	26	Minor	Low	Negligible
Physical presence – Operation of onshore installations	Landscape	-	1	2	4	4	2	2	4	4	1	1	29	Minor	Moderate	Minor

10.2.2.3 Decommissioning Phase

This **section** examines the likelihood of potential adverse impacts on the morphological and landscape characteristics of the area, as a result of the decommissioning and dismantling of the proposed Project.

The activities causing impacts on the morphological and landscape characteristics of the area during the decommissioning and dismantling phase of the examined project, based on the content delimitation of the ESIA (**Chapter 9**), are the following:

Dismantling of Onshore Facilities – Restoration of the Onshore Project Area

Morphology of the Onshore Area

The following activities are considered:

- Removal of concrete and foundation slabs, as well as earthworks for the restoration of the onshore installation area of the Project.

During the dismantling of the onshore facilities of the Project, negative impacts on the area's morphology are expected, which are estimated to be limited in significance and generally comparable to those anticipated during the construction phase (potentially even milder, as the dismantling and restoration phase typically lasts significantly less than the construction phase).nTherefore, the impact on the area's morphology from the dismantling works is assessed as <u>negative, of negligible intensity, within the project footprint, concurrent with construction activities, temporary, medium-term reversible, non-synergistic, non-cumulative, direct, continuous, and short-term restorable. Accordingly, in terms of Final Evaluation, these impacts are assessed as **Negligible.**</u>

On the other hand, during the decommissioning and dismantling phase of the examined Project, restoration works are expected to be implemented that will restore the morphology of the study area to its previous state (or potentially to an even better condition, if the pre-existing condition was significantly degraded). Therefore<u>**, positive impacts on the area's morphology** are expected as a result of the restoration of the affected onshore zone.</u>

Landscape

As part of the dismantling of the onshore facilities and the restoration of the onshore installation area of the Project, the following activities are foreseen, with potential adverse effects:

- Disassembly of equipment and dismantling of installations
- Removal of concrete and foundation slabs, as well as earthworks for the restoration of the onshore installation area of the Project
- Generation of solid and liquid waste

During the dismantling of the onshore facilities and the restoration of the onshore installation area, limited quantities of surplus materials, concrete, pipeline materials made of carbon steel, protective steel casing, and other metallic equipment will arise. The earthworks, movement and parking of machinery, and the temporary storage of dismantled materials will have an impact on the landscape, although the area is already a shaped industrial site with long-standing use. Unorganized and uncontrolled execution of works and material storage could further burden the landscape.

However, based on the project design and the existing management framework of the SIGMA industrial unit, the handling of the above materials will be carried out in accordance with the best available practices, prioritizing reuse, followed by recycling, and finally the safe disposal of materials that cannot be reused or recycled.

As a result, the already minor potential impacts are expected to be further minimized and are therefore assessed overall as negligible. Specifically, the impact on the landscape of the area from the dismantling of onshore facilities is assessed as negative, of negligible intensity, local, concurrent with construction works, temporary, medium-term reversible, synergistic, non-cumulative, direct, continuous, and short-term restorable. Accordingly, in terms of Final Evaluation, these impacts are assessed as **Minor**.

On the other hand, during the decommissioning and dismantling phase of the examined Project, restoration works are expected to be implemented that will restore the landscape of the study area to its former state (or potentially to an even better condition, if the pre-existing condition was significantly degraded). Therefore, **positive impacts** on the landscape are expected as a result of the restoration of the affected onshore area.

Decommissioning of Offshore Facilities

The offshore CO_2 pipeline and the riser will be depressurized, cleaned through standard pigging operations, and inerted by the introduction of nitrogen. Subsequently, the pipeline will be disconnected from the offshore platform, sealed with welded caps or flanges, and left in place, in accordance with international standards. The disassembly of equipment and the dismantling of the injection and water production well facilities will not affect the morphology of the seabed in the area.

Therefore, no further impact on the morphological characteristics of the seabed or on the landscape of the area is expected from the implementation of the decommissioning works of the offshore facilities.

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Dismantling of Onshore Installations	Morphology of onshore area	-	1	2	4	1	2	2	4	4	1	1	26	Minor	Low	Negligible

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Restoration of onshore area of the Project installation	Morphology of onshore area	+	2	2	4	4	1	2	4	4	1	1	31	Positive	Low	Positive
Dismantling of Onshore Installations	Landscape	-	1	1	4	1	2	1	4	4	1	1	23	Minor	Moderate	Minor
Restoration of onshore area of the Project installation	Landscape	+	2	2	4	4	1	2	4	4	1	1	31	Positive	Moderate	Positive

10.2.3 Impacts Related to Geological, Tectonic and Soil Characteristics

The following sections examine the potential occurrence of adverse impacts on the geological, tectonic, and soil characteristics of the area as a result of the construction, operation, and decommissioning of the proposed Project.

10.2.3.1 Construction Phase

This **section** examines the potential occurrence of adverse impacts on the geological, tectonic, and soil characteristics of the area as a result of the construction of the proposed Project.

Construction of onshore facilities

Geological and tectonic characteristics

The activities that may cause impacts on the geological and tectonic characteristics of the study area during the construction of the onshore facilities, based on the scoping and content delimitation of the ESIA (**Chapter 9**), are the following:

- Site preparation for equipment foundations, earthworks for the siting of new onshore infrastructure and installations.
- Concreting works and placement of 0.5 m thick concrete for the construction of foundation slabs.
- Installation of the final section of onshore pipelines (placement, welding), which will be installed above ground on the new foundations, without protective covers.

During the construction phase of the onshore facilities, interventions will be carried out that may have potential impacts on the geological characteristics within the Project's footprint, as small-scale excavation, shaping, and backfilling works will be required. More specifically, excavation areas will be limited to the locations where the bases of the onshore equipment will be placed, within an already developed industrial site of the SIGMA facilities and are estimated at approximately 50 m^2. These activities will result in a relatively small volume of excavated materials and, therefore, are not expected to cause alteration or significant disruption of the surface of the bedrock. Ground displacements will not be large-scale and ultimately the geomorphology and geology are not expected to be notably altered from their current state, due to the excavation and backfilling works that will be performed as part of the proposed interventions. However, in the area where the onshore facilities are to be installed, limited local impacts will be recorded, although, as mentioned above, the interventions are very limited in extent and will take place within an industrial facility already formed by long-term intensive anthropogenic activities.

The construction of the onshore facilities is not expected to alter any unique or rare geological formations. Moreover, there are no special geological features in the project area, such as springs, caves, etc., and therefore no such features are expected to be affected or destroyed.

With regard to the tectonic characteristics of the study area, the project site does not present any ground instability issues (as derived from the analysis of geology, soil, and tectonics of the study area described in **Chapter 8**), and therefore, during the construction phase and due to the nature and scale of the project, no additional unstable ground conditions are expected to occur. In any case, appropriate measures will be taken during the execution of the works, where required (see **Chapter 11**).

In addition, with respect to the tectonic characteristics of the study area, these are not expected to be affected in any way, since, by their nature, the interventions are superficial and, by definition, cannot alter the tectonic features of the study area.

Therefore, the impacts on the geological characteristics of the area due to the construction of the onshore facilities will be negative, of negligible intensity, within the footprint of the Project, concurrent with construction works, of temporary duration, reversible in the medium term, non-synergistic, non-cumulative, direct in terms of their effect, continuous, and restorable in the short term. Accordingly, in terms of their Final Evaluation, these impacts on the geological characteristics of the area are assessed as **Negligible.**

Similarly, the impacts on the tectonic characteristics of the area due to the construction of the onshore facilities are assessed as **Neutral.**

Soil Characteristics

The activities that may cause impacts on the soil characteristics of the study area during the construction of the onshore facilities, based on the scoping and content delimitation of the ESIA (**Chapter 9**), are the following:

- Site preparation for the foundation of the equipment, earthworks for the placement of new onshore infrastructures and facilities.

- Movement of heavy vehicles, construction machinery, transport trucks, and support vehicles during construction.
- Temporary deposition/storage of construction materials and surplus excavation materials.
- Generation, management, and disposal of waste from the construction works of the onshore facilities of the project.

During the construction phase of the onshore facilities, interventions will be carried out with potential impacts on the soil characteristics in the footprint of the Project, as small-scale excavation, shaping, and backfilling activities will be required. Specifically, the excavation area will be limited to the locations where the foundations of the onshore equipment will be placed, within the already developed industrial site of the SIGMA facilities and is estimated to cover approximately 50 m^2. These earthworks will result in a relatively small volume of excavated material, and therefore, no significant alteration or displacement of soil resources is expected. Ground displacement will be limited in scale, and ultimately, geomorphology is not expected to be significantly altered from its current state due to the excavations and backfills carried out as part of the proposed interventions. However, local impacts on the qualitative characteristics of the soil will be recorded in the area where the onshore facilities are installed, although, as previously mentioned, the interventions are particularly limited and take place within an industrial facility already shaped by long-term and intensive anthropogenic activities.

Soil compaction and reduction of porosity will occur during construction activities that require heavy machinery, especially if carried out when the soils are wet. Ground displacement will be limited, as the volume of excavated material will be reused within the shaping of the facilities' site.

Therefore, due to the occupation of land surfaces (although not natural but rather shaped and ultimately degraded by long-term anthropogenic activities), <u>negative impacts are expected from the onshore facilities of the project, of low intensity, localized at the project site, concurrent with construction works, of temporary duration, reversible in the medium term, synergistic, non-cumulative, continuous, and immediately restorable. Hence, in terms of their Final Evaluation, these impacts are considered **Negligible.**</u>

Moreover, it should be noted that no degradation of soil quality is expected in the surrounding areas of the intervention zone (e.g., in terms of structure, fertility, etc.), as no long-term deposition of materials in the form of stockpiles is foreseen outside the construction site and the delimited project area. However, during the deposition of excavation materials, due to general surface disturbance and deposition of loose soil masses, localized increase in soil erosion is possible. This impact is clearly limited in extent and duration (until the completion of the works) and is significantly reversible after the implementation of appropriate measures. Thus, provided that the bulk of the earthworks takes place during the dry season, when rainfall is minimal, the erosion risk for exposed surfaces will be very low. Consequently, soil erosion from the works, with the application of appropriate measures (such as those proposed in Chapter 11, including, among others, coverage of temporary deposits) and correct scheduling of earthworks, will be **negligible**. Therefore, **neutral impacts** are expected from the temporary deposition of surplus excavation materials.

Additionally, during the construction phase of the project, there is a theoretical possibility of soil pollution due to runoff from road surfaces and the ground surface of the project site (fuels, lubricants from vehicle movement, etc.). However, this impact is **negligible**, due to the extremely low additional traffic load required for the implementation of the proposed onshore facilities. Furthermore, the site's ground surface will include all necessary technical provisions, so that any runoff will be collected before reaching any water or soil receptor. Therefore, **neutral impacts** are expected from such runoff.

During excavation, due to disturbance of the surface, localized increases in soil erosion are likely. This impact, again, is of limited extent and duration (until completion of the works) and is significantly reversible after implementation of appropriate measures. If the majority of earthworks are carried out during the dry season, when rainfall is minimal, the erosion risk will be very low. Thus, negligible soil erosion is expected, and the corresponding environmental impacts are **neutral**.

Soil pollution may potentially occur due to traffic accidents, as is also the case with the existing road network under current conditions in the study area. In such a case, toxic materials may come into contact with the soil. The following steps for soil remediation would involve removal of the contaminated soil layer and handling by a specialized entity. Therefore, traffic activities under this Project require preventive measures, essentially involving implementation of all safety regulations and the best available practices governing transport operations (as described in the relevant paragraphs of **Chapter 11**). However, due to the small volume and limited area of the works for the onshore facilities, and provided best practices and safety protocols are followed, the corresponding environmental impacts are expected to be **neutral**.

Soil pollution could also result from potential direct emissions of liquid or solid waste residues from earthmoving machinery due to accidents or poor management practices. These include lubricants, grease, and fuels, which may partially infiltrate and remain in the soil. Also, disposal of concrete residues may affect the soil pH. Based on experience from similar or even larger-scale projects, such emissions are not considered significant, especially if appropriate good practice measures are taken for both the regular operation of the site and accident prevention. Therefore, the potential impacts from such emissions are assessed as **neutral**.

Accordingly, <u>the construction works of the proposed Project are expected to cause some degradation of the qualitative soil characteristics within the footprint of the onshore facilities. However, with the implementation of appropriate measures and proper scheduling of earthworks, these impacts are not considered significant.</u> Likewise, with the application of suitable preventive/remedial measures, the impacts on the soil quality characteristics of the areas adjacent to the project site are expected to be minimal.Συνεπώς,

Thus, the impacts on the soil characteristics of the area due to the construction of the onshore facilities are expected to be <u>negative, of low intensity, localized, concurrent with construction, temporary, medium-term reversible, synergistic, non-cumulative, continuous, and immediately restorable. Therefore, in terms of their Final Evaluation, these impacts are assessed as **Negligible**</u>.

Construction of the CO_2 Transport Pipeline

Sediment Quality and Structure of the Seabed

The activities that may result in impacts on the seabed characteristics of the study area during the construction of the CO_2 transport pipeline, based on the scoping and content delimitation of the ESIA (**Chapter 9**), include the following:

- Phase 1 – Geotechnical Investigation: Following the processing of the results of the geophysical survey, soil samples will be collected using a grab sampler and a core sampler (Box-corer), which will then be sent to laboratories for analysis.
- Phase 2 – Shore Approach Works: Installation of the pipeline section nearshore into a trench approximately 500 m long and 3 m deep.
- Phase 3 – Installation of the Offshore Pipeline: Placement of the 20 km long subsea pipeline (using the S-lay method) from a specialized pipelay vessel, assisted by two supply/tug support vessels.
- Phase 5 – Trench Backfilling and Pipeline Protection, Commissioning: After pipeline installation and connection works, the entire pipeline will be buried for protection.

The estimated excavation area for the onshore section of the pipeline is 500 m in length, covering a surface area of approximately 200 m^2, and with a depth of 3 m.

The 20 km long CO_2 pipeline will be installed by a specialized pipelay and trenching vessel. Following installation and connection, the pipeline will be buried along its entire length to protect it from trawl fishing activities in the area. In the nearshore section (first 500 m), the burial depth from the top of the pipeline will be 2 m, while in the offshore section, the burial depth will range from 1 to 1.5 m. However, multiple trenching passes may be required to achieve the desired burial depth, depending on the seabed characteristics. Due to the nature of the soil and the strong bottom currents in the area, the trench is expected to naturally backfill over time, without requiring additional intervention.

Therefore, regarding seabed characteristics, adverse impacts arise from surface disturbance and sediment dispersion caused by the pipeline placement on the seabed and by trenching activities at the shore approach area. However, due to the limited volume of excavations (indicatively, offshore trench depth of 1–1.5 m) and the short duration of these activities, the anticipated negative impacts are not expected to be significant. Thus, the impacts on the structure and quality of seabed sediments due to the construction of the CO_2 transport pipeline are expected to be negative, of moderate intensity, local, concurrent with construction works, temporary, medium-term reversible, non-synergistic, non-cumulative, continuous, and immediately restorable. Therefore, in terms of their Final Evaluation, these impacts on the geological characteristics of the area are assessed as **Minor.**

During the placement works of the offshore section of the CO_2 pipeline, no impacts on the geological features or induction of geological hazards are expected, as the activities take place at shallow depths within the seabed (1 to 1.5 m) and avoid locations with potential geological risks (e.g., unstable submarine slopes, liquefied sediments, steep rocky seabed, or tectonically deformed salt formations).

Furthermore, as for the tectonic characteristics of the study area, no impact is expected, as the interventions are superficial by nature (with excavation depths of 1 to 1.5 m in the offshore section) and, by definition, cannot alter the tectonic characteristics of the study area.

Drilling Activities

Sediment Quality and Structure of the Seabed

The activities that may result in impacts on the sediment quality and structure of the seabed within the study area during the construction of the offshore installations (excluding the CO_2 transport pipeline), based on the scoping and content delimitation of the ESIA (**Chapter 9**), include the following:

- Waste – Generation, management and disposal of extractive waste (drilling mud and cuttings). During the drilling of the 16-inch diameter section down to a depth of 2,200 m, a seawater/lime-based drilling mud will be used. The cuttings from this section will be discharged onto the seabed. Below this depth, the drilling fluids will return to the surface, where the cuttings will be removed and the mud will be processed.

During the drilling of the 16-inch diameter section of the wells down to a depth of 2,200 m, a seawater/lime-based drilling mud will be used. The cuttings from this section, estimated at approximately 1,140 m^3 in volume, will not contain hazardous substances and will be discharged onto the seabed. The potential impact from this activity is a locally limited alteration in the quality and structure of the seabed sediments.

Therefore, the impacts on the structure and quality of seabed sediments resulting from the drilling activities will be negative, of moderate intensity, localized, concurrent with construction activities, temporary, medium-term reversible, non-synergistic, non-cumulative, continuous, and immediately restorable. Consequently, in terms of their Final Evaluation, these impacts on the sediment quality and structure of the seabed are assessed as **Minor.**

Subsea Geological Formations

The activities that may cause impacts on the subsea geological formations of the study area during the construction of the CO_2 transport pipeline, based on the scoping and content delimitation of the ESIA (**Chapter 9**), are the following:

- Preparation of the existing kickoff well. A permanent mechanical barrier (bridge plug) will be placed at a predetermined depth inside the production casing following the well-killing procedure.
- Drilling of wells. Drilling of four wells to an approximate depth of 3,700 m (two wells will be used as CO_2 injection wells and two as water production wells to enable reservoir pressure balancing). All four new

wellbores will be drilled using a Top Drive System (TDS) drilling unit and will be steered using a combination of mud motors and rotary drilling assemblies.

The drilling operations within the framework of the proposed project include the construction of two new CO_2 injection wells and two water production wells, which are expected to have adverse impacts on the geological formations they will penetrate. Based on technical studies (as referenced in **Section 4.1.1 – Project Feasibility**) carried out to assess the suitability of the area for the siting of the proposed project and to define its technical parameters, it has been determined that the area's geology is appropriate for implementing the proposed project. Furthermore, it is documented that no significant geological formations are present in the project area that would be adversely affected by the planned drilling operations.

In a typical CO_2 storage project well, approximately 650 m^3 of cuttings are generated; therefore, for the four-well drilling program, an estimated 2,700 m^3 of solid waste will be produced. The drilling operations for the Project generate small volumes of residues, as all scheduled wells are of small diameter and lateral drilling design.

Consequently, the impacts on the subsea geological formations from the drilling activities will be negative, of moderate intensity, local, concurrent with construction activities, temporary, medium-term reversible, non-synergistic, non-cumulative, continuous, and immediately restorable. Therefore, in terms of their Final Evaluation, these impacts on the qualitative characteristics and structure of the seabed in the area are assessed as **Negligible.**

Tectonics

As has also been substantiated by the company's existing extractive activities in the study area, the implementation of the proposed drilling works (which share similar characteristics with the existing wells in the company's hydrocarbons exploitation project) is not expected to result in any impacts on the tectonic structure of the study area, and such impacts are therefore assessed as **Neutral**.

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Construction of onshore installations	Geological characteristics	-	1	1	4	1	2	1	4	4	1	1	23	Minor	Low	Negligible

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Construction of onshore installations	Soil characteristics	-	2	1	4	1	2	2	4	4	1	1	27	Minor	Low	Negligible
Construction of the CO_2 transport pipeline	Seabed quality characteristics and structure	-	4	2	4	1	2	1	4	4	1	1	34	Minor	Moderate	Minor
Drilling works	Seabed quality characteristics and structure	-	4	2	4	1	2	1	4	4	1	1	34	Minor	Moderate	Minor
Drilling works	Geological characteristics and subsea geological formations	-	4	2	4	1	2	1	4	4	1	1	34	Minor	Low	Negligible

10.2.3.2 Operation Phase

The following sections examine the potential occurrence of adverse impacts on the geological, tectonic, and soil characteristics of the study area as a result of the operation of the proposed project.

Qualitative and quantitative soil characteristics

The activities that may potentially affect the qualitative and quantitative characteristics of the soil in the study area during the operation of the onshore and offshore facilities of the project, based on the content delimitation defined by the Guidelines for Environmental Impact Assessment (**Chapter 9**), are as follows:

- Physical presence and spatial layout of the project's onshore infrastructure.
- Waste: Generation, management, and disposal of waste from the operation of the onshore and offshore project facilities.

The physical presence and spatial layout of the project's onshore infrastructure results in land surface occupation (although the land is not natural but rather developed and ultimately degraded by intensive and long-term human activities). Therefore, negative impacts are expected, of low intensity, localised within the project area, concurrent with construction works, long-lasting, medium-term reversible, synergistic, non-cumulative, continuous, and immediately restorable. Accordingly, in terms of their Final Evaluation, these impacts are assessed as **Negligible**.

The activities during the operation phase of the proposed project will generally result in the generation of relatively limited quantities of waste, corresponding to the relatively small scale of the project. More specifically, as previously mentioned, the following are expected to result from the proposed project:

- Municipal solid waste
- It is estimated that the project will generate both hazardous and non-hazardous municipal solid waste (MSW), as well as certain additional waste streams subject to alternative management (EPR schemes). The categories of waste that may be generated during the operation of the project, based on the European Waste Catalogue (EWC) (Decision 2001/118/EC, as amended and in force), are presented in Table 6-45 (Section 6.5.5.1.1 Municipal Solid Waste). The estimated annual amount of MSW during the project's operation, as well as the average daily quantities generated, are presented in Table 6-46. The management method for the municipal waste streams, based on current legislative requirements, is included in the overall Waste Management Plan of the Project, as presented in Annex 17.3.
- Produced water from the designed wells. The produced water will be directed to the Prinos Delta platform where it will be separated and treated using existing systems and then discharged to the sea. Stormwater on the platforms, which may potentially contain hydrocarbons, will be collected by the closed drainage system through curbed areas. To minimise such quantities, the surface of the curbed areas has been reduced and sheltered from rainfall, wherever feasible.
- Hazardous and non-hazardous waste from the operation and maintenance of the underground CO_2 storage facility. Given the early design stage of the Project, it is not currently possible to precisely

estimate the types and quantities of hazardous and non-hazardous waste that may be generated. However, it can be noted that hazardous waste is already produced at the Prinos Delta platform from existing facilities during general maintenance operations, which occur for 15 days every 30 months. Hazardous waste produced during the cleaning of tanks V-101 A/B, V-107, and V-102 from the water treatment process on the Delta platform consists of oil sludge (mixtures of heavy hydrocarbons primarily containing asphaltenes), rags, absorbent materials, etc. Hazardous and non-hazardous waste may also result from the CO_2 treatment process. The categories of waste likely to be produced from the operation and maintenance of the underground storage facility, based on the European Waste Catalogue (EWC), are presented in Table 6-48 (Section 6.5.5.2 Solid Waste from Operation/Maintenance of the Facility).

Regarding potential soil impacts from the generated waste, it should be noted that the quantities are relatively limited. In addition to the limited quantities, it is important to highlight that waste management will be conducted according to the Best Available Techniques (BAT) for soil protection and in accordance with current legislative requirements, as included in the overall **Waste Management Plan** of the Project, presented in **Annex 16.3.**

Furthermore, it should be noted that the total waste expected from the operation of the proposed project is already being generated by the company's existing facilities in the area (in different quantities and proportions). These quantities have been effectively managed for several decades without significant impacts on the soil quality in the study area. This demonstrates the adequacy and effectiveness of the Waste **Management Plan** currently applied at the existing facilities, which has been considered in the design of the corresponding Plan for the proposed project.

Therefore, given that the collection, storage, transport, and disposal of waste will be carried out based on best available techniques for soil protection and the requirements of applicable legislation, as included in the overall **Waste Management Plan** of the Project, the related impacts on the qualitative characteristics of the soil in the study area during the operation of the onshore and offshore project facilities are assessed as **Neutral**.

Seabed Quality Characteristics

O The activities that may potentially impact the quality characteristics of the seabed in the study area during the operation of the onshore and offshore facilities of the project, based on the content delimitation defined by the Guidelines for Environmental Impact Assessment (**Chapter 9**), are the following:

- Waste: Generation, management, and disposal of waste from the operation of the onshore and offshore project facilities.

Similarly to the case of impacts on the quality characteristics of the soil in the study area and based on the analysis presented in the previous **section**, given that the collection, storage, transport, and disposal of waste will be carried out in accordance with the best available techniques for soil protection and the requirements of applicable legislation, as included in the overall **Waste Management Plan** of the Project, the associated impacts on the quality characteristics of the seabed in the study area during the operation of the onshore and offshore facilities are assessed as **Neutral**.

Geological Formations

Οι δραστηριότητες που ενδεχομένως προκαλούν επιπτώσεις στους γεωλογικούς σχηματισμούς της περιοχής μελέτης κατά τη διάρκεια λειτουργίας των χερσαίων και των υπεράκτιων εγκαταστάσεων του έργου, βάσει και της Π&Κ οριοθέτησης περιεχομένου της ΜΠΕ (**Κεφάλαιο 9**) είναι οι ακόλουθες:

- Injection CO_2
- The main processing equipment on Beta platform will include a pumping and heating station for achieving the required injection conditions, installed on the open deck of the platform.
- CO_2 injection will initially target reservoirs B and C through two injection wells during the period 2025–2035 and will subsequently expand to the entire reservoir by the end of the project.

From a technical standpoint, the company has carried out a series of studies and analyses to assess the viability of the Project. Among others, a **Geochemical Study** has been developed to evaluate the geochemical reaction of CO_2 with the minerals of the rocks and the formation fluids. This study demonstrated that the expected geochemical alterations will be minimal due to the characteristics of the geological formations in the study area. Therefore, CO_2 injection is not expected to cause impacts on the rock minerals or the formation fluids, and accordingly, the related impacts on the geological formations of the study area during the operation of the onshore and offshore facilities are assessed as **Neutral**.

Tectonics

Regarding the **operation of the wells** and the storage of CO_2, it is noted that **theoretically**, the injection of CO_2 into geological formations can increase the pressure within the rock formations, potentially inducing seismic events. A higher injection rate may increase pore pressure and the risk of induced seismicity. In the case of the Project under consideration, the risk of induced seismicity is minimal, provided that operations are conducted in accordance with the planned injection rate and within the framework of safe operational conditions.

From a technical perspective, the company has carried out a series of studies and analyses to assess the feasibility of the Project. Specifically, to date, the following studies, among others, have been conducted:

- Subsurface/Storage Site Studies, aiming to investigate and simulate the subsurface in relation to the Prinos storage field. These studies examined the following aspects: CO_2 storage and permanent sequestration, storage constraints, injection strategies, water production, and profiles (water, CO_2, water and hydrocarbon transport, etc.). The initial Subsurface/Storage Site Studies, completed in December 2022, were conducted in three phases, evaluating different aspects of the Project:
  - Phase I – Preliminary Risk Assessment: The storage field was evaluated based on modeling of CO_2 plume migration within the basin. Furthermore, potential leakage of CO_2 through faults was analyzed, and the relative risk of CO_2 leakage was assessed. Preliminary leakage scenarios were examined and evaluated, total CO_2 storage volumes were calculated, and an initial risk inventory was compiled.
  - Phase II – Characterization of the Storage Site & Complex: Static models were developed for the CO_2 storage site and the storage complex.
  - Phase III – Dynamic Simulation and Scenario Development: Various CO_2 storage development scenarios were designed. 3D and 4D geomechanical models were simulated, and the maximum injection pressure was defined to avoid CO_2 leakage risks. A complete risk inventory was established regarding the subsurface and the storage field.
- Geochemical study was conducted to assess the interaction between CO_2 and the minerals of the host rocks and fluids of the geological formation, which demonstrated that the expected geochemical changes will be minimal due to the characteristics of the geological formations in the study area.
- A study on the integrity of legacy wells was completed to determine the likelihood of those wells providing potential pathways for CO_2 leakage.
- The Energean technical team has carried out a series of specialized studies and 3D subsurface simulations to evaluate CO_2 storage within the geological structures beneath the Prinos reservoir, including the underlying aquifer. These simulations also confirmed the presence of an impermeable caprock, the structural boundaries defined by bounding faults and geological closures, and the volume of the aquifer.
- The Energean technical team is further developing and applying scenario analyses related to the projected CO_2 volumes to be stored, potential CO_2 sources, the CO_2 transportation network, and

associated synergies. During the first half of 2024, an additional set of subsurface studies was completed, which further matured the Project and helped to identify and mitigate key project risks.

As part of the above studies, simulations were conducted—among others—regarding the tectonic conditions in the area and the overall suitability (and safety) of the site for the siting of the proposed project. These simulations demonstrated that the Prinos Basin is a tectonically stable area, as required for CO_2 storage sites in terms of tectonic (seismic) activity. Furthermore, they confirmed that the potential impacts of the project on the tectonic regime of the area are negligible, provided that the project operates within the prescribed injection rate and under safe operational conditions.

Although the likelihood of an impact on the tectonic characteristics of the area during the operation of the new CO_2 injection wells is very low and essentially negligible, provided that the project functions safely, it is nonetheless a theoretically existing risk. Therefore, in terms of significance, this impact is assessed as negative, of moderate intensity, local, immediate in timing, long-term, reversible in the short term, non-synergistic, non-cumulative, with a direct effect, discontinuous and immediately reversible. Consequently, in terms of Final Evaluation, this impact is classified as **Minor**.

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Physical presence – Operation of onshore installations	Soil characteristics	-	2	1	4	3	2	2	4	4	1	1	29	Minor	Low	Negligible
Physical presence and operation of installations – CO_2 injection into geological formations	Tectonics	-	4	2	4	3	2	2	4	1	1	1	34	Minor	Moderate	Minor

10.2.3.3 Decommissioning Phase

The following sections assess the likelihood of potential adverse impacts on the geological, tectonic, and soil characteristics of the area as a result of the decommissioning and dismantling of the proposed Project.

Dismantling of Onshore Facilities – Restoration of the Onshore Project Site

Soil Quality Characteristics

The activities that may potentially impact the soil quality characteristics of the study area during the dismantling of the onshore facilities and the restoration of the onshore project site, in accordance with the Scope and Content Determination of the EIA (**Chapter 9**), are as follows:

- Generation of solid and liquid waste.
- Restoration of the onshore project area.

The dismantling activities of the onshore facilities of the proposed project are generally expected to result in the generation of relatively limited quantities of waste, corresponding to the overall limited scale of the project. During the dismantling and restoration works of the onshore area of the project, small quantities of surplus materials, concrete, pipeline materials made of carbon steel, protective steel casing, and other metallic equipment will be produced. These materials will be managed according to best available practices, prioritizing reuse, followed by recycling, and finally safe disposal of any non-reusable and non-recyclable materials.

In addition to the relatively limited quantities, it is important to note that their management will follow best available practices for soil protection and the applicable legislative requirements, as included in the Project's Integrated **Waste Management Plan**, presented in **Annex 16.3.**

Therefore, considering that the collection, storage, removal, and disposal of waste will be implemented in accordance with best available practices and legal requirements for soil protection, as outlined in the Project's Integrated **Waste Management Plan**, it is assessed that the related impacts on the soil quality characteristics of the study area during the dismantling phase of the onshore and offshore facilities will be negative, of negligible intensity, local, concurrent with decommissioning works, temporary, short-term reversible, synergistic, non-cumulative, direct in their effect, continuous, and short-term restorable. Consequently, in terms of Final Evaluation, these impacts on the soil characteristics of the area are assessed as **Negligible**.

On the contrary, during the decommissioning and dismantling phase of the proposed Project, restoration works are expected to be implemented, aiming to return the soil of the study area to its original condition (or to an even improved state, if the pre-intervention condition was significantly degraded). As such, **positive impacts** on the soil characteristics of the area are expected from the restoration of the onshore intervention area.

Decommissioning of Offshore CO_2 Transfer Pipelines

Seabed Quality Characteristics

The activities that may potentially affect the seabed quality characteristics of the study area during the decommissioning of the offshore CO_2 transfer pipelines of the project, based on the Scope and Content Determination of the EIA (**Chapter 9**), are the following:

- The offshore pipeline and riser will be depressurized, cleaned using standard pigging operations, and then inerted with nitrogen. Subsequently, the pipeline will be disconnected from the offshore platform, sealed with welded caps or flanges, and left in place in accordance with international standards.

Given that, on one hand, the offshore CO_2 pipeline is buried (at a depth of approximately 1.5 m), and on the other hand, the seabed surface has been restored to its original condition (due to the presence of strong marine currents that have backfilled the pipeline trenches and restored the previous state of the seabed surface), the decision (in accordance with international standards) to seal and leave the CO_2 transfer pipeline in place is considered the best option, as it will not cause significant impacts on the seabed. Nevertheless, the presence of the pipeline within the seabed constitutes a minor, yet existing, impact. Therefore, the impacts will be negative, of negligible intensity, within the project footprint, permanent, non-reversible, non-synergistic, non-cumulative, direct in effect, continuous, and non-restorable. As such, in terms of Final Evaluation, the impacts are assessed as **Minor.**

Decommissioning of Offshore Installations (excluding the offshore CO_2 transfer pipeline)

Seabed Quality Characteristics

The activities that may potentially affect the seabed quality characteristics of the study area during the decommissioning of the offshore installations (excluding the offshore CO_2 transfer pipeline), based on the Scope and Content Determination of the ESIA (**Chapter 9**), are the following:

- Disassembly of equipment and dismantling of installations (not including the existing offshore platforms, which were constructed and are operated under the Environmental Terms Approval [AEPO] for the Prinos Offshore Production Installations, and their decommissioning is covered by the relevant ESIA).
- Generation of solid and liquid waste.

The dismantling activities of the offshore equipment of the proposed project are generally expected to result in the generation of relatively limited quantities of waste, corresponding to the relatively small scale of the project. During the dismantling of the offshore installations of the project, limited quantities of surplus materials will arise, including carbon steel pipeline materials, protective steel casing, and other metallic equipment. These materials will be managed according to best available practices, prioritizing reuse, followed by recycling, and finally the safe disposal of materials that cannot be reused or recycled.

In addition to their relatively limited quantity, it is important to note that the management of these materials will follow best available practices for the protection of the seabed and the applicable legislative requirements, as outlined in the Project's Integrated **Waste Management Plan**, presented in **Annex 16.3**.

Therefore, since the collection, storage, removal, and disposal of waste will be carried out in accordance with best available practices and legislative requirements for seabed protection, as included in the Project's Integrated **Waste Management Plan**, the associated impacts on the seabed quality characteristics of the study area during the decommissioning of the offshore facilities are expected to be negative, of negligible intensity, within the project footprint, concurrent with the works, temporary, short-term reversible, synergistic, non-cumulative, direct in effect, continuous, and short-term restorable. As such, in terms of Final Evaluation, these impacts are assessed as **Minor**.

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Generation of solid and liquid waste during decommissioning	Soil characteristics	-	1	2	4	1	2	2	4	4	1	1	26	Minor	Low	Negligible
Restoration of the onshore project site	Soil characteristics	+	2	2	4	4	1	2	4	4	1	1	31	Positive	Low	Positive
Cessation of Operation / Decommissioning of offshore CO_2 transport pipelines	Seabed structure and quality characteristics	-	1	2	4	4	4	1	4	4	8	1	37	Minor	Moderate	Minor
Cessation of operation / Decommissioning of offshore installations (excluding the offshore CO_2 transport pipeline)	Seabed structure and quality characteristics	-	1	2	4	1	2	2	4	4	1	1	26	Minor	Moderate	Minor

10.2.4 Impacts on the Natural Biotic Environment

The following sections assess the potential occurrence of adverse impacts on the natural biotic environment of the area resulting from the construction, operation, and decommissioning of the proposed project.

10.2.4.1 Construction Phase

10.2.4.1.1.1 Terrestrial Habitat

10.2.4.1.1.2 Terrestrial Habitats

Construction of Onshore Facilities and CO_2 Transport Pipeline

The activities that cause impacts on terrestrial habitats during the construction of the CO_2 transport pipeline, based on the Scope and Content Determination of the EIA (**Chapter 9**), are the following:

- Phase 2: Works for bringing the pipeline ashore (installation of this pipeline section in a trench approximately 500 m long and 3 m deep).
-
- It should be noted that the installation of the other onshore facilities of the project will not cause impacts on terrestrial habitats, as they are located within the boundaries of an existing industrial area, without natural vegetation or natural habitat types. The impact of the construction works for the CO_2 transport pipeline on terrestrial habitat types are described in detail in Section 2 of the Project's MEoA (Special Ecological Assessment Study).

The onshore facilities of the proposed Project are located outside protected areas of the Natura 2000 Network. They are situated within the existing area of the SIGMA industrial site, which, according to the Corine Land Cover (CLC 2018) database of the European Programme, is classified as industrial and commercial zones.

The section of the CO_2 pipeline to be installed on the coast, in front of the SIGMA onshore facilities, in a trench approximately 500 m long, 5 m wide, and 3 m deep, is expected to have impacts on coastal sand dunes, which are found in the area. Specifically, during the trenching operations to bring the pipeline ashore, using equipment typical for dredging operations of port works, the structure of the sand dunes, the flora presents in them—such as the species *Silene grisebachii*—and the significant populations of terrestrial turtles that use the area for foraging and reproduction, will be affected.

Considering that the excavated material will be kept on the side of the trench for subsequent backfilling to fully cover the pipeline in its final configuration, it is expected that suitable conditions will be reestablished for the regeneration of dune vegetation.

Consequently, the impacts are expected to be negative, of low intensity, localized, concurrent with the construction phase, of immediate onset, temporary, short-term reversible, synergistic, of direct impact, continuous, short-term restorable, and non-cumulative. Therefore, in terms of Final Evaluation, these impacts are assessed as **Minor**.

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Construction of the CO_2 transport pipeline	Terrestrial Habitats	-	2	2	4	1	1	2	4	4	2	1	29	Minor	Moderate	Minor

10.2.4.1.1.3 Terrestrial Mammals

Construction of onshore facilities and CO_2 transmission pipeline

The activities that may cause impacts during the construction phase of the CO_2 transmission pipeline, based on the structure and content outline of the EIA (**Chapter 9**), are the following:

- Phase 2: Works for the landfall of the pipeline (installation of the relevant section of the pipeline in a trench approximately 500 m long and 3 m deep).

It should be noted that the installation of the remaining onshore facilities of the project does not cause impacts on terrestrial mammals, as they are sited within the boundaries of an existing industrial area, which lacks natural vegetation and systematic or occasional presence of terrestrial mammal species. The onshore facilities of the proposed project are located outside protected areas of the Natura 2000 Network. They are sited within the existing SIGMA plant area, in a zone classified by the Corine Land Cover database (CLC 2018) as industrial and commercial land.

It should be noted that the potential impacts on terrestrial mammal species resulting from the project construction are described in detail in **Section 2** of the project's Appropriate Assessment Report (**MEoA**).

As stated in **Chapter 8** of this EIA, terrestrial mammals recorded in the wider area of the project include the northern, white-breasted hedgehog (Erinaceus roumanicus), the blind mole (Talpa caeca or Talpa europaea), the golden jackal (Canis aureus), the red fox (Vulpes vulpes), the beech marten (Martes foina), the otter (Lutra lutra), and the wildcat (Felis silvestris).

Taking into account that the existing facilities already cause disturbance to the jackals, it is estimated that during the landfall works of the pipeline they will temporarily avoid the area (relocating to nearby areas with similar ecological conditions, which are abundant adjacent to the project site), but are not expected to be permanently displaced.

Therefore, <u>the impacts are expected to be negative, of negligible intensity, local in extent, concurrent with construction activities, of immediate onset, temporary in duration, short-term, synergistic, of direct effect,</u>

continuous, immediately reversible, and non-cumulative. Accordingly, in terms of Final Evaluation, the above impacts are overall assessed as **Negligible**.

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Construction of the onshore section of the CO_2 transport pipeline	Terrestrial Mammals	-	1	2	4	1	1	2	4	4	1	1	25	Minor	Low	Negligible

10.2.4.1.1.4 Amphibians and Reptiles

Construction of onshore facilities and CO_2 transport pipeline

The activities that may generate impacts during the construction of the CO_2 transport pipeline, based on the content boundaries defined in the EIS (**Chapter 9**), are as follows:

- Phase 2: Works for the coastal approach of the pipeline (placement of this section of the pipeline in a trench approximately 500 m long and 3 m deep).
- It is noted that the installation of the other onshore facilities of the project will not have any impact on amphibians and reptiles, as these are located within an existing industrial zone with no natural vegetation and no (systematic) presence of amphibians and reptile individuals.

The impacts potentially arising from the construction of the Project on amphibian and reptile species are described in detail in **Section 2** of the **Project's Specific Ecological Assessment (SEA).**

The onshore facilities of the proposed Project are located outside the Natura 2000 network protected areas. They lie within the existing premises of the SIGMA plant in a zone classified according to the European Corine Land Cover (CLC 2018) database, as industrial and commercial.

The section of the CO_2 transport pipeline to be installed at the coastline, in front of the SIGMA onshore facilities, will be placed in a trench approximately 500 m long, 5 m wide, and 3 m deep. Specifically, during the coastal approach works for the pipeline, which will involve excavation using equipment typically employed in dredging operations for port infrastructure, impacts are expected on reptile species present in the terrestrial dune zone. Indicatively, terrestrial tortoises, which maintain a significant population in the area, may be injured or crushed by heavy construction vehicles.

Given that the coastal pipeline construction and installation works will last for a short period and that the dune area will be restored to its previous condition, the impacts are expected to be negative, of negligible intensity, direct, localized, concurrent with construction works, of temporary duration, short-term reversibility, synergistic, non-cumulative, of direct effect, continuous, and immediately reversible. Accordingly, in terms of Final Evaluation, the above impacts are assessed as **Minor.**

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Construction of the onshore section of the CO_2 transport pipeline	Amphibians and Reptiles	-	1	2	4	1	1	2	4	4	1	1	25	Minor	Moderate	Minor

10.2.4.1.2 Marine Habitat

10.2.4.1.2.1 Marine Habitats

Construction of the CO_2 transport pipeline

The activities that are expected to generate impacts during the construction phase of the CO_2 transport pipeline, based on the Content Scoping of the EIA Study (**Chapter 9**), are the following:

- Phase 2: Shore approach works for the pipeline (placement of the pipeline section in a trench approximately 500 m long, 5 m wide, and 3 m deep).
- Phase 3: Installation of the subsea pipeline (20 km) using the S-lay method by a dedicated pipeline-laying vessel, accompanied by 2 support/supply/tugboats.
- Phase 5: Trench closure and pipeline protection, commissioning. After installation of the pipeline and related connections, the pipeline will be buried along its entire length.

The installation of the project will have direct negative impacts on marine habitats and benthic organisms due to the permanent occupation of seabed areas by project components; however, these areas are of very limited spatial extent. Additionally, it is estimated that, in the long term, the permanently occupied areas may be partially recolonized by local marine organisms.

In the coastal section, the presence of *Posidonia oceanica* meadows is possible, while in the remaining offshore section, the seabed is expected to consist of soft sediment without vegetation. The presence of any subsea vegetation may be investigated during the geotechnical/geophysical survey that will take place in Phase A using a specially equipped sonar vessel.

In conclusion, the impacts on marine habitats during construction are <u>negative, of low intensity, local in nature, concurrent with the construction works, direct, permanent, short-term reversible, non-synergistic, direct in their effect, continuous, short-term restorable, and non-cumulative. Therefore, with regard to their Final Assessment, these impacts are assessed as **Minor.**</u>

Οι δραστηριότητες που προκαλούν επιπτώσεις κατά τη διάρκεια της των γεωτρητικών εργασιών, βάσει και της Π&Κ οριοθέτησης περιεχομένου της ΜΠΕ (**Κεφάλαιο 9**) είναι οι ακόλουθες:

Drilling Works

- The activities that are expected to generate impacts during drilling works, based on the Content Scoping of the EIA Study (Chapter 9), are the following:
  - Drilling of wells:
    - Drilling of 4 wells to a depth of approximately 3,700 m (2 wells will be used as CO_2 injection wells and 2 as water production wells for pressure balancing of the reservoir).
    - The four (4) new wells will be drilled using a Top Drive System (TDS) rig, employing a combination of mud motors and rotary drilling assemblies.

- Waste – Generation, management, and disposal of extractive wastes (drilling mud and cuttings).

During the drilling operations, water turbidity levels are expected to increase, which may negatively affect water quality and transparency, thus impacting marine ecosystems and species that depend on them. Furthermore, the physical disturbance of the seabed due to excavation is expected to affect the benthic communities in the project area. Additionally, the discharge of extractive wastes such as drilling mud and cuttings may impact marine ecosystem biodiversity. These wastes may cover the seabed, causing alteration or destruction of benthic habitats and organisms living therein. However, upon completion of the drilling operations, the natural recovery of the marine ecosystems is expected, with water quality returning to normal levels and benthic ecosystems being restored. Accordingly, these impacts are negative, of low intensity, local in extent, immediate in occurrence, temporary, short-term reversible, synergistic, direct in their effect, continuous, short-term restorable, and non-cumulative. Therefore, with regard to their Final Assessment, these impacts are assessed as **Minor**.

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Construction of the CO_2 transport pipeline	Marine habitats	-	2	2	4	4	1	1	4	4	2	1	31	Minor	Low	Negligible
Geotechnical works	Marine habitats	-	2	2	4	1	1	2	4	4	2	1	29	Minor	Low	Negligible

10.2.4.1.2.2 Marine Mammals

Construction of the CO_2 transmission pipeline

O The activities that may cause impacts during the construction of the CO_2 transmission pipeline, based on the ToR (**Chapter 9** of the ESIA), are the following:

- Phase 1: Geophysical Survey – A small vessel (approx. 15 m in length) equipped with seabed scanning equipment will be used to provide baseline data along the pipeline corridor.
- Phase 1: Geotechnical Survey – Following the processing of the geophysical survey results, soil samples will be collected using grab samplers and core samplers (Box-corer) and sent to laboratories for analysis.
- Phase 3: Installation of a 20 km subsea pipeline (using the S-lay method) by a specialized pipe-laying vessel, supported by two supply/tugboats.

- Phase 5: Backfilling of trench and pipeline protection, commissioning. After pipeline installation and connection works, the pipeline will be buried along its entire length.
- Marine traffic – Daily vessel movements for pipeline installation (including worker transfers and movements of support vessels).
- Marine traffic – Emissions generated by the daily vessel movements for pipeline installation (including worker transport and support vessel activity).

As analyzed in **Chapter 8.8.8**, the study area lies within the boundaries of the Natura 2000 site GR1150014 "Marine Area of Kavala - Thasos", within Zone 9 of the ACCOBAMS Agreement in the Northeastern Mediterranean (Thracian Sea), and within the Important Marine Mammal Area (IMMA) entitled "Northern Coast and Islands of the Thracian Sea". A detailed assessment of the impacts of the CO_2 pipeline construction works on the protected species of the aforementioned areas is provided in **Section 2** of the Project's **AA report.**

The construction activities, including the subsea pipeline installation using the S-lay method, may cause disturbance to marine mammals. Despite the existing level of tolerance to noise due to regular maritime activity in the Gulf of Kavala, continuous underwater noise from the pipe-laying process may have impacts, as marine mammals rely on sound for communication, mate-finding, foraging, predator avoidance, and navigation. Exposure to anthropogenic noise may result in adverse effects, such as injury, hearing loss, avoidance behavior, communication masking, and in some cases, strandings and mortality.

The installation of the subsea pipeline, trenching, and hydrotesting may also disturb marine mammals by locally increasing turbidity levels. The resuspended sediment could reduce light availability for primary producers and indirectly affect feeding. However, <u>considering the limited duration of construction works, these impacts are expected to be localized and of negligible consequence to the species.</u>

In addition, vessel movements during pipeline installation may also affect marine mammals, as collisions could occur in some instances. Unlike other species (e.g., sea turtles), marine mammals are highly mobile and possess acute sensory perception. Cetaceans, in particular, should be able to detect a vessel in time and move out of its path, provided early detection occurs. <u>Considering that the pipe-laying vessel and the two (2) support tugboats move very slowly to ensure accurate pipeline placement on the seabed, marine mammals are expected to be able to detect the vessels in time and leave the area until works are completed.</u>

In conclusion, the installation of the subsea pipeline will increase underwater noise levels, turbidity, and marine traffic, causing temporary behavioral and physiological disturbances to marine mammals, leading them to avoid the area during construction works. Therefore, the impacts are expected to be <u>negative, of low intensity, local in extent, of immediate onset, temporary, short-term reversible, synergistic, direct, periodic, immediately restorable, and non-cumulative. In terms of their Final Assessment, these impacts are classified as **Moderate**</u>. As such, in the context of the present study, preventive/mitigation/management measures are proposed in order to reduce these impacts to at least Minor. Following the implementation of the relevant measures proposed in **Chapter 11** of this study, the residual impacts are ultimately assessed as **Minor**, and the project is therefore considered compatible with the environmental protection objectives that are prerequisites of this study.

Drilling Operations

The activities causing impacts during the drilling operations, based on the content delimitation defined in **Chapter 9** of the EIA, are the following:

- Drilling of wells:
  - Drilling of four (4) wells to an approximate depth of 3,700 m (2 wells will be used for CO_2 injection and 2 for water production for reservoir pressure balancing).
  - The four (4) new wells will be constructed using a Top Drive System (TDS) drilling unit and will be directionally drilled using a combination of mud motors and rotary steerable systems.
- Marine traffic: Daily vessel movements related to the execution of drilling operations (including transportation of personnel and support vessel movements).
- Waste – Generation, management, and disposal of extractive waste (drilling mud and cuttings).

Detailed impacts that may result from the drilling activities and related maritime traffic on the protected marine mammal species are presented in **Section 2** of the Project's **MEIA**.

According to the **Detailed Project Design Description (Chapter 6)**, natural sea noise levels as a result of wind and wave action may range from 90 dB re 1μPa under calm conditions with low wind, to 110 dB re 1μPa under windier conditions. Shell Australia conducted a detailed study in 1998 comparing noise levels of a stationary rig with those during active drilling. Noise levels from a supply vessel serving the rig were also measured and compared (R. McCauley, 1998, "Underwater noise emissions from the drill rig Ocean General, tugs, fishing vessels and natural sources in the Timor Sea, Australia"). Noise levels during both drilling and non-drilling phases (generator operation, human activity) were similar. At a distance of 125 m from the rig, noise levels of 117 dB were recorded. During offloading activities by support vessels, noise levels reached 134 dB. Therefore, although the jack-up rig will introduce increased noise levels above background, these are not expected to exceed noise levels from other vessels operating in the area, including those serving existing platforms.

Anthropogenic underwater noise generated during drilling will be higher than natural background levels. The increased noise may alter marine mammal behavior, interfere with acoustic communication, cause temporary or permanent hearing loss, and damage tissues. Marine mammals may temporarily abandon the area, affecting migration routes and feeding grounds. However, none of the marine mammal species present in the area breed within the project zone, and the temporary disturbance is not expected to have significant effects.

Furthermore, daily vessel traffic for drilling operations (including personnel transport and support vessels) may also cause temporary disturbance to marine mammals. In some cases, collisions may occur, potentially causing injury or death. While marine mammals in the area are likely accustomed to high levels of vessel traffic in the Gulf of Kavala, implementing measures to control vessel speed is necessary to minimize disturbance and risk.

The generation, management, and disposal of extractive waste such as drilling mud and cuttings may also affect the marine environment and, consequently, marine mammals. However, due to the small diameter and lateral reach of the four wells, only small volumes of waste will be produced. These may have localized and short-term impacts on marine mammals, as species are expected to temporarily avoid the area.

Therefore, the impacts are expected to be negative, of low intensity, local in extent, of immediate onset, temporary in duration, reversible in the short term, synergistic, with direct effect, periodic, rapidly restorable, and non-cumulative. In terms of Final Evaluation, these impacts are assessed as **Moderate**. Since these impacts are assessed as **Moderate**, this study proposes prevention/mitigation/management measures so that they may be reduced to at least Minor. Following the implementation of the relevant measures proposed in **Chapter 11**, the residual impacts are ultimately assessed as **Minor**, and the project is therefore compatible with the environmental protection objectives that are prerequisites of this study.

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation	Final Residual Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)				
Construction of the CO_2 transmission pipeline	Marine Mammals	-	2	2	4	1	1	2	4	2	1	1	26	Minor	High	Moderate	Minor
Drilling activities	Marine Mammals	-	2	2	4	1	1	2	4	2	1	1	26	Minor	High	Moderate	Minor

10.2.4.1.2.3 Sea Turtles

The activities that may cause impacts during the construction of the CO_2 transport pipeline, based on the content delimitation of the EIA (**Chapter 9**), are the following:

- Phase 1: Geophysical Survey – A small vessel (15 m in length) equipped with seabed scanning equipment will be used to provide baseline data within the pipeline corridor.
- Phase 1: Geotechnical Survey – Following processing of the geophysical survey results, seabed samples will be collected using a grab sampler and a box corer, which will be sent to laboratories for analysis.
- Phase 3: Installation of a 20 km subsea pipeline (using the S-lay method) by a dedicated pipe-laying vessel, supported by two supply/tug vessels.
- Phase 5: Trench backfilling and pipeline protection, commissioning. After the pipeline and related connections are installed, the pipeline will be buried along its entire length.

- Marine traffic – Daily vessel movements for the installation of the CO_2 transport pipeline (including worker transportation and support vessel operations).
- Marine traffic – Emissions caused by the daily movement of vessels for the installation of the CO_2 transport pipeline (including worker transportation and support vessel operations).

The impacts that may be caused to sea turtles during the construction of the CO_2 pipeline are detailed in **Section 2** of the Project's **MEIA.**

Phases 1, 3, and 4 of the construction and installation of the CO_2 transport pipeline are expected to cause temporary disturbance to sea turtles in the area. Specifically, the noise generated may disrupt natural behaviors such as foraging and reproduction. However, it should be noted that no nesting activity has been recorded in the project area, only the presence of foraging individuals.

Additionally, construction activities and modifications to the seabed that may result from pipeline installation could affect ecosystems, vegetation types, and benthic species that serve as food sources for sea turtles. The daily movement of vessels during construction may also disturb sea turtles, as they are often injured or killed by vessel propellers. Due to their size and limited ability to evade quickly, sea turtles are at greater risk of collision, which can lead to asphyxiation.

However, considering that the pipe-laying vessel and the two supply/tug vessels move very slowly to ensure precise placement of the pipeline on the seabed, sea turtles are expected to detect the vessels in time and to avoid the area until works are completed.

In conclusion, the impacts are expected to be negative, low in intensity, local in extent, immediate in onset, temporary, short-term reversible, synergistic, direct in effect, continuous, rapidly restorable, and non-cumulative. As for their Final Evaluation, these impacts are assessed as **Minor**.

Drilling Activities

The activities that cause impacts during the drilling phase, based on the content delineation in the ESIA (**Chapter 9**), are the following:

- Drilling of wells:
  - Drilling of four (4) wells to a depth of approximately 3,700 m (2 wells will be used for CO_2 injection and 2 wells for water production to balance the reservoir pressure).
  - All four (4) new boreholes will be constructed using a TDS (Top Drive System) drilling rig and will be directionally drilled using a combination of mud motors and rotary drilling assemblies.
- Marine traffic: Daily vessel movements for the implementation of the drilling operations (including the transport of personnel and support vessel movements).
- Waste: Generation, management and disposal of extractive waste (drilling mud and cuttings).

The impacts that may arise from the drilling activities and associated marine traffic on sea turtles are presented in detail in **Section 2** of the Project's **AEIA.**

Noise from the drilling operations, similarly to the construction of the CO_2 pipeline, may cause disturbance to the sea turtles observed in the area of the Kavala Gulf. Specifically, the elevated noise levels are expected to disrupt their natural behaviours, such as foraging and reproduction. However, it is noted that no nesting activity has been recorded within the Project study area. Sea turtles use a wide area for foraging, and therefore a small zone of increased noise over a limited period is unlikely to result in any significant impact on sea turtles.

Daily vessel traffic for the installation of the pipelines increases the risk of collisions with sea turtles, which may be injured or killed by vessel propellers. However, considering that marine traffic in the wider Kavala Gulf area is intense, sea turtles in the region are likely already accustomed to the presence and activity of vessels.

The generation, management and disposal of extractive waste such as drilling mud and cuttings may affect the marine environment and, consequently, sea turtles. The disposal of such waste could cause pollution that may impact the turtles' foraging areas. However, due to the small diameter and lateral drilling of the four wells, only small volumes of waste will be produced, which may have localized and short-term impacts, as the species are expected to temporarily avoid the area.

In conclusion, the impacts are expected to be <u>negative, low in intensity, local in extent, immediate in onset, temporary, short-term reversible, synergistic, direct in effect, continuous, rapidly restorable, and non-cumulative. As for their Final Evaluation, these impacts are assessed as **Minor.**</u>

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Construction of the CO_2 transmission pipeline	Sea turtles	-	2	2	4	1	1	2	4	4	1	1	28	Minor	Moderate	Minor
Drilling activities	Sea turtles	-	2	2	4	1	1	2	4	4	1	1	28	Minor	Moderate	Minor

10.2.4.1.2.4 Fish Fauna

Construction of the CO_2 Transmission Pipeline

The activities that may cause impacts during the construction of the CO_2 transmission pipeline, according to the scoping and content delineation of the ESIA (**Chapter 9**), are as follows:

- Phase 2: Shore approach works for the pipeline (installation of this specific pipeline segment in a trench approximately 500 m in length, 5 m in width, and 3 m in depth).
- Phase 3: Installation of a 20 km subsea pipeline (using the S-lay method) by a dedicated pipelay vessel, assisted by 2 support/supply tugboats.άση 3: Εγκατάσταση υποθαλάσσιου αγωγού μήκους 20 km (με τη μέθοδο S-lay) από ειδικό σκάφος τοποθέτησης αγωγών, μαζί με 2 υποστηρικτικά πλοία ανεφοδιασμού/ρυμουλκά.
- Phase 5: Trench backfilling and pipeline protection, commissioning. After installation of the pipeline and associated connections, the pipeline will be buried along its entire length.

As detailed in **Chapter 8.8.8**, the study area lies within the Natura 2000 protected area GR1150014 "Marine Area of Kavala – Thasos". The specific impacts that may be caused by the construction works of the CO_2 transmission pipeline on the protected species *Alosa fallax* of the GR1150014 area are described in detail in **Section 2** of the Project's **AEIA.**

The pipeline will be buried along its entire length to protect it from bottom trawling activities in the area. In the coastal section (first 500 m), the burial depth from the top of the pipeline will be 2 m, while in the offshore section, the burial depth will range from 1 to 1.5 m. During Phase 3, the pipeline will be installed by a dedicated pipelay and trenching vessel. Following the installation and connections (Phase 5), the pipeline must be fully buried. Multiple passes may be required to reach the target burial depth (1.5 to 2 m TOP), depending on soil conditions. Due to the nature of the seabed and the strong bottom currents in the area, the trench is expected to naturally backfill, requiring no further intervention.

Activities during Phases 2 and 5 are expected to increase particle suspension and turbidity in the water. Elevated turbidity may hinder fish species in detecting food, as many fish rely on vision to locate prey. It may also impact spawning areas—particularly for species that deposit eggs on specific benthic habitats—and may impair respiration due to gill damage.

During the construction activities, noise levels in the area are expected to rise. Continuous noise can cause stress in fish, affecting their growth, health, and behaviour. Fish, cephalopods, and other mobile marine invertebrates use underwater sound for communication, predator avoidance, navigation, and foraging (Carroll et al., 2016).

Considering that the construction works are of limited duration (up to 6 months) and spatially confined, the impacts are expected to be negative, low in intensity, localized, direct and concurrent with the construction period, temporary, short-term reversible, synergistic, direct in effect, continuous, short-term restorable, and non-cumulative. In terms of Final Evaluation, these impacts are assessed as **Minor**.

Drilling Activities

The activities that may cause impacts during drilling operations, according to the scoping and content delineation of the EIA (**Chapter 9**), are as follows:

- Drilling operations:
    - Drilling of 4 wells to a depth of approximately 3,700 m (2 wells will be used for CO_2 injection and 2 for water production to maintain reservoir pressure balance).
    - All four (4) new boreholes will be constructed using a TDS-type (Top Drive System) drilling unit and will be directionally drilled using a combination of mud motors and rotary drilling assemblies.
- Waste – Generation, management, and disposal of extractive waste (drilling mud and cuttings).

The detailed impacts that may arise from drilling operations and marine traffic on the protected fish species of the GR1150014 area are analyzed in **Section 2** of the Project's **AEIA.**

During drilling of the 16-inch diameter section of the wells down to a depth of 2,200 m, seawater/lime-based drilling mud will be used. The drill cuttings from this section, estimated at 1,140 m^3 in volume, will not contain hazardous substances and will be discharged on the seabed. The potential impact on fish fauna is associated with increased turbidity. Similar to the impacts expected during the construction of the subsea CO_2 pipeline, drilling operations are anticipated to disturb the fish population. Specifically, behavioral changes in fish are expected due to the noise generated by the drilling rig. Continuous noise may cause stress in fish, affecting their growth, health, behavior, and presence in the area.

Turbidity generated may affect spawning grounds, particularly for species that deposit their eggs on specific seabed areas, as well as gill function, making respiration more difficult and increasing the energy cost for survival.

Taking the above into consideration, the impacts are expected to be negative, low in intensity, localized, immediate in appearance, temporary, short-term reversible, synergistic, direct in effect, continuous, immediately restorable, and non-cumulative. In terms of final evaluation, these impacts are assessed as **Minor.**

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Construction of the CO_2 transmission pipeline	Ichthyofauna	-	2	2	4	1	1	2	4	4	2	1	29	Minor	Moderate	Minor

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Geotechnical works	Ichthyofauna	-	2	2	4	1	1	2	4	4	1	4	28	Minor	Moderate	Minor

10.2.4.1.3 Avifauna

Construction of the CO_2 transmission pipeline

The activities causing impacts during the construction of the CO_2 transmission pipeline, as defined by the scoping and content delineation of the EIA (Chapter 9), are as follows:

- Phase 2: Shoreline approach works (installation of the onshore segment of the pipeline in a trench approximately 500 m long, 5 m wide and 3 m deep).
- Phase 3: Installation of a 20 km subsea pipeline (S-lay method) by a specialized pipelay vessel, supported by 2 supply/tugboats.
- Phase 5: Trench backfilling and pipeline protection, commissioning. Upon installation of the pipeline and associated connections, the pipeline will be buried along its entire length.
- Marine traffic: Daily vessel movement for the installation of the CO_2 transmission pipeline (including crew transport and movement of support vessels).

With regard to the impacts of the project construction activities on avifauna species, a detailed description is provided in **Section 2** of the **AEIA.**

As stated in **Chapter 8**, the study area falls within the Natura 2000 sites SPA & SAC GR1150014 "Marine Area of Kavala – Thasos", SPA GR1150001 "Nestos Delta and Keramoti Lagoons and Thasopoula Islet", and SAC GR1150010 "Nestos Delta and Keramoti Lagoons – Wider Area". The marine project area also overlaps with the Important Bird Area (IBA) GR250 "Kavala Gulf and Thasos Marine Area", and the study area includes IBA GR012 "Nestos Delta and Coastal Lagoons".

The activities during the construction of the CO_2 pipeline are expected to affect avifauna. According to AEIA data, project activities are expected to cause short-term and spatially limited impacts on species populations due to temporary disturbance and habitat degradation during construction works.

Specifically, the Mediterranean Shag (*Phalacrocorax aristotelis desmarestii*) and the Yelkouan Shearwater (*Puffinus yelkouan*) are expected to be disturbed due to vessel movements and pipeline installation activities. The Shag, known to be highly displaced by intensive marine traffic, will likely avoid the area temporarily until construction is complete, while degradation of its foraging habitat due to increased turbidity and sediment resuspension may briefly reduce food availability. Similar effects are expected for the Yelkouan Shearwater, though to a lesser extent, as it forages in the upper water column and generally avoids human activity.

Wader species, such as *Charadrius alexandrinus*, *Charadrius dubius*, and *Haematopus ostralegus*, which breed on the dunes and coast in front of the SIGMA land facilities, will be temporarily affected by the loss and degradation of their habitats due to construction of the pipeline's onshore section. Disturbance and displacement will be short-term, and population recovery will depend on habitat restoration after the completion of work.

Ciconiiformes and Phoenicopteriformes species, foraging outside the boundaries of GR1150001, will experience negligible indirect and temporary impacts. These include temporary degradation of foraging habitats due to construction works and disturbance from human presence. The temporary loss or degradation of these habitats will be confined to the duration of the works and the subsequent site restoration. Species such as storks feeding at the mouths of drainage ditches and small artificial ponds will be temporarily displaced from the work area.

Laridae species, such as *Sterna hirundo*, *Ichthyaetus melanocephalus*, *Chroicocephalus ridibundus*, *Hydrocoloeus minutus*, *Thalasseus sandvicensis*, and *Chroicocephalus genei*, will be affected by degradation of a small portion of their foraging habitat in the coastal zone. These impacts will primarily result from increased turbidity and the remobilization of pollutants in sediments during work. Disturbance due to construction activities will have negligible effects, as the affected area is small and impacts are temporary.

In conclusion during the construction phase of the CO_2 transmission pipeline, the impacts are expected to be negative, minor in significance, local, immediate in onset, temporary, short-term reversible, synergistic, direct, continuous, short-term restorable, and self-contained. In terms of their Final Evaluation, these impacts are assessed as **Moderate.** Given that the Final Evaluation of these impacts is **Moderate**, the present study proposes preventive/mitigation/management measures so that the aforementioned impacts are reduced to at least Minor. Following the implementation of the relevant measures proposed in **Chapter 11** of this study, the residual impacts are ultimately assessed as **Minor**, and thus the project is compatible with the environmental protection objectives that constitute prerequisites of the present study.

Συμπερασματικά, κατά τη διάρκεια της κατασκευής του αγωγού μεταφοράς CO_2 οι επιπτώσεις αναμένεται να είναι αρνητικές, μικρής σημασίας, τοπικές, άμεσης εμφάνισης, προσωρινές, βραχυπρόθεσμα αναστρέψιμες, συνεργιστικές, άμεσης επίδρασης, συνεχείς, βραχυπρόθεσμα αποκαταστάσιμες και αυτοτελείς. Ως προς την τελική αξιολόγηση τους, οι εν λόγω επιπτώσεις αξιολογούνται ως **Μέτριες.** Καθώς ως προς την Τελική Αξιολόγηση τους, οι εν λόγω επιπτώσεις αξιολογούνται ως **Μέτριες**, στα πλαίσια της παρούσας προτείνονται μέτρα πρόληψης/μετριασμού/αντιμετώπισης έτσι ώστε οι εν λόγω επιπτώσεις να καταστούν τουλάχιστον μικρές. Έπειτα από την εφαρμογή των σχετικών μέτρων που προτείνονται στο **Κεφάλαιο 11** της παρούσας, οι υπολειμματικές επιπτώσεις τελικώς αξιολογούνται ως **Μικρές** και συνεπώς το έργο είναι συμβατό με τους στόχους προστασίας του περιβάλλοντος που αποτελούν προαπαιτούμενα της παρούσας μελέτης.

Drilling Operations

The activities that cause impacts during the drilling operations, based on the definition and content delimitation of the EIA (Chapter 9), are as follows:

- Well drilling:
  - Drilling of four (4) wells to a depth of approximately 3,700 m (two wells will be used as CO_2 injection wells and two as water production wells, for pressure balancing within the reservoir).
  - All four (4) new wells will be constructed using a Top Drive System (TDS) drilling unit and will be steered using a combination of mud motors and rotary drilling assemblies.
- Marine Traffic : daily vessel movements for the implementation of the drilling operations (including the transportation of personnel and movement of support vessels).
- Waste - Generation, management, and disposal of extractive waste (drilling mud and cuttings).

By analogy with the issues analyzed in the previous Section, similar and corresponding impacts are expected during the drilling operations.

In conclusion, during the drilling operations, the impacts are expected to be negative, of minor significance, local, of immediate onset, temporary, reversible in the short term, synergistic, of direct impact, continuous, short-term restorable, and discrete. In terms of their Final Assessment, these impacts are classified as **Moderate.** Since, based on the Final Assessment, these impacts are considered **Moderate**, measures for prevention/mitigation/management are proposed within the present study, so that these impacts can be reduced to at least Minor. Following the implementation of the relevant measures proposed in **Chapter 11** of this study, the residual impacts are ultimately assessed as **Minor,** and therefore, the project is compatible with the environmental protection objectives that constitute prerequisites of the present study.

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation	Final Residual Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)				
Construction of the CO_2 transmission pipeline	Avifauna	-	2	2	4	1	1	2	4	4	2	1	29	Minor	High	Moderate	Minor
Geotechnical works	Avifauna	-	2	2	4	1	1	2	4	4	2	1	29	Minor	High	Moderate	Minor

10.2.4.1.4 Impacts on the Areas of the National System of Protected Areas

The Project under assessment is located within the Natura 2000 protected area SCI & SPA GR1150014 "Marine Area of Kavala – Thasos." In the wider region, the following Natura 2000 sites are identified: SCI GR1150010 "Nestos Delta and Keramoti Lagoons – Wider Area," SPA GR1150001 "Nestos Delta and Keramoti Lagoons and Thasopoula Islet," and SPA GR1150012 "Thasos (Mount Ypsario and Coastal Zone)."

The activities that may cause impacts on the Areas of the National System of Protected Areas during the construction phase of the project, based on the C&V delineation of the ESIA content (**Chapter 9**), are as follows:

- Offshore CO2 transportation pipeline
- Phase 1
  - *Geophysical Survey.* A small vessel (15 m in length) equipped for seabed scanning will be used to provide essential data along the pipeline corridor.
  - *Geotechnical Survey.* After processing the results of the geophysical survey, sediment samples will be collected using a grab sampler and a box corer and sent to laboratories for analysis.
- Phase 3
  - *Installation of the subsea pipeline* (20 km long, using the S-lay method) by a dedicated pipelay vessel, supported by two supply/tug boats.
- Offshore installations (excluding the offshore CO_2 transportation pipeline)
- Drilling operations:
  - Drilling of four wells to a depth of approximately 3,700 m (two wells will be used for CO_2 injection and two for water production for reservoir pressure balancing).
  - All four new boreholes will be constructed using a Top Drive System (TDS) drilling unit and will be steered using a combination of mud motors and rotary drilling assemblies.
- <u>Marine traffic</u> – Establishment of access exclusion zones due to the drilling operations.

The potential impacts arising from project components during the construction phase are detailed in **Section 2**, titled *"Appropriate Assessment of Project Impacts (Normal Operation)"* of the Project's **AA** Report.

Based on the analysis of the AA Report and the information presented above regarding the parameters of the biotic environment that constitute the protected assets of these Protected Areas, the following impacts are identified:

- During the construction of the CO_2 transportation pipeline, the impacts on the Areas of the National System of Protected Areas are expected to be <u>negative, of minor significance, local, of immediate onset, temporary, short-term reversible, synergistic, of direct impact, continuous, short-term restorable, and discrete. In terms of their Final Assessment, these impacts are evaluated as Moderate.</u> As the Final Assessment rates these impacts as Moderate, prevention/mitigation/management measures are proposed within this study to reduce these impacts to at least Minor.

After implementing the relevant measures proposed in Chapter 11 of this study, the residual impacts are ultimately assessed as Minor, and therefore, the project is compatible with the environmental protection objectives which are prerequisites of the present study.

- Similarly, during the drilling operations, the impacts on the Areas of the National System of Protected Areas are expected to be negative, of minor significance, local, of immediate onset, temporary, short-term reversible, synergistic, of direct impact, continuous, short-term restorable, and discrete. In terms of their Final Assessment, these impacts are evaluated as Moderate. As the Final Assessment rates these impacts as Moderate, prevention/mitigation/management measures are proposed within this study to reduce these impacts to at least Minor. After implementing the relevant measures proposed in Chapter 11 of this study, the residual impacts are ultimately assessed as Minor, and therefore, the project is compatible with the environmental protection objectives which are prerequisites of the present study.
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Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation	Final Residual Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)				
Construction of the CO_2 transmission pipeline	Areas of the National Protected Areas System	-	2	2	4	1	1	2	4	4	2	1	29	Minor	High	Moderate	Minor
Geotechnical works	Areas of the National Protected Areas System	-	2	2	4	1	1	2	4	4	2	1	29	Minor	High	Moderate	Minor

10.2.4.1.5 Forests and Woodland Areas

According to **Chapter 8**, the terrestrial installations of the project are not located within forested areas and, therefore, are not subject to the provisions of forest legislation. Specifically, based on the ratified Forest Maps, the areas designated for the terrestrial installations of the project bear the classification codes "PA" (Final decisions and rulings of non-forest character).

It is also noted that the terrestrial installations of the project will be constructed within the existing area of the SIGMA plant, in a zone characterized according to the Corine Land Cover (CLC 2018) database as industrial and commercial. Additionally, the section of the pipeline to be laid along the shoreline will be constructed in a trench 5 meters wide and 3 meters deep.

Therefore, no impacts on forests or woodland areas are anticipated during the construction phase of the project.

10.2.4.1.6 Other Important Natural Areas

The nearest Landscape of Outstanding Natural Beauty (LONB) to the terrestrial installations of the Project is the non-designated LONB named "Aesthetic Forest of Amygdaleonas, Kavala" with code AT4011109, located approximately 5.6 km west of the project site.

In the immediate vicinity of the project, within the boundaries of the Municipality of Nestos, there is one (1) Ramsar Wetland, which is also included in the Montreux Record. This wetland, named **"Nestos Delta and adjacent lagoons"**, with a total area of 21,930 ha, was designated under the Ramsar Convention in 1975.

The marine area of the project is located within the Important Bird Area (IBA) with code GR250 and name "Kavala Gulf and Thasos marine area", while nearby lies the area with code GR016 and name "Island of Thasos and Xironisi".

The study area falls within Zone 9 of ACCOBAMS in the Northeastern Mediterranean (Thracian Sea).

The study area is also located within the Important Marine Mammal Area (IMMA) named "Northern Coast and Islands of the Thracian Sea" with a total area of 5,441 km².

The activities that may potentially cause impacts on these Important Natural Areas during the construction phase of the project, based on the P&K content delineation of the EIA (**Chapter 9**), are the following:

- Offshore CO_2 Transmission Pipeline
- Phase 1:
  - Geophysical Survey. A small-type vessel (15 m in length) equipped with seabed scanning equipment will be used to collect baseline data within the pipeline corridor.
  - Geotechnical Survey. Following processing of the geophysical survey results, soil samples will be taken using a grab sampler and box corer, which will then be sent to laboratories for analysis.
- Phase 3:
  - Installation of the 20 km offshore pipeline (via the S-lay method) from a specialized pipe-laying vessel, accompanied by two (2) support/supply/tug vessels.
- Offshore Installations (excluding the Offshore CO_2 pipeline)
- Drilling Activities
  - Drilling of four (4) wells to a depth of approximately 3,700 m (two wells will serve as CO_2 injection wells and two as water production wells to balance the reservoir pressure).
  - All four (4) new wells will be constructed using a TDS (Top Drive System) drilling unit and will be steered using a combination of mud motors and rotary steerable systems.
- Marine Traffic – Establishment of exclusion zones due to drilling operations.

Based on the analysis presented in the project's AA Report (MEoA), and the previously mentioned biotic environment components that are the conservation targets of these Important Natural Areas, the following impacts arise:

- During the construction phase of the CO_2 transmission pipeline, the impacts on the Important Natural Areas are expected to be negative, of minor significance, local in scale, immediate in onset, temporary, short-term reversible, synergistic, of direct effect, continuous, short-term restorable, and discrete. Regarding their final evaluation, these impacts are assessed as Moderate. Given that the final assessment categorizes these impacts as Moderate, mitigation/prevention/remediation measures are proposed within the current report in order to reduce them to at least Minor. Following the implementation of the relevant measures, as proposed in Chapter 11 of the present report, the residual impacts are ultimately assessed as Minor. Consequently, the Project is considered compatible with the environmental protection objectives that constitute prerequisites of this study.
- Similarly, during the drilling operations, the impacts on the Important Natural Areas are expected to be negative, of minor significance, local in scale, immediate in onset, temporary, short-term reversible, synergistic, of direct effect, continuous, short-term restorable, and discrete. Regarding their final evaluation, these impacts are assessed as Moderate. Given that the final assessment categorizes these impacts as Moderate, mitigation/prevention/remediation measures are proposed within the current report in order to reduce them to at least Minor. Following the implementation of the relevant measures, as proposed in Chapter 11 of the present report, the residual impacts are ultimately assessed as Minor. Consequently, the Project is considered compatible with the environmental protection objectives that constitute prerequisites of the present study.

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation	Final Residual Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)				
Construction of the CO_2 transmission pipeline	Areas of the National Protected Areas System	-	2	2	4	1	1	2	4	4	2	1	29	Minor	High	Moderate	Minor
Geotechnical works	Areas of the National Protected Areas System	-	2	2	4	1	1	2	4	4	2	1	29	Minor	High	Moderate	Minor

10.2.4.2 Operation Phase

10.2.4.2.1 Terrestrial Habitat

10.2.4.2.1.1 Terrestrial Habitat Types

In the following paragraphs, the potential occurrence of adverse impacts on terrestrial habitat types, as a result of the operation of the Project under assessment, is examined. The impacts that may be caused by the operation of the Project on terrestrial habitat types are presented in detail in **Section 2** of the Project's **Appropriate Assessment (AA)**.

The operation of the **onshore facilities** for the reception of bulk CO_2 from the onshore pipeline and the handling of CO_2 loads for transfer to the offshore facilities does not have any significant impact on the terrestrial habitat types. However, in relation to the sand dunes observed on the coast in front of the SIGMA onshore installation, at the location where part of the pipeline will be installed, the impacts are expected to be negligible in the event that the pipeline is not covered and the appropriate conditions are not formed for the development of the dune flora *Silene grisebachii*.

In conclusion, the impacts that may arise during the operation phase of the Project are expected to be of negligible magnitude, local, of short-term occurrence, short-lived, short-term reversible, synergistic, of direct effect, continuous, short-term restorable, and self-contained. In terms of their final assessment, these impacts are evaluated as **Minor.**

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Transport of CO_2 to the offshore storage facilities of Prinos *(pipeline section to be installed at the coast)*	Terrestrial habitats	-	1	2	3	2	1	2	4	4	2	1	26	Minor	Moderate	Minor

10.2.4.2.1.2 Terrestrial Mammals

The following paragraphs examine the probability of potential adverse impacts on terrestrial mammals found in the area, as a result of the operation of the examined Project.

Considering that no excavation works will be carried out during the operational phase of the Project, no impacts on the terrestrial mammals of the area are expected. The absence of excavation works ensures that there will be no changes to the soil or local vegetation that could affect the shelters or movement paths of terrestrial mammals.

More specifically, the stability of soil conditions and vegetation ensures that the habitats and paths of mammals will not be disturbed. Species such as the European hedgehog (Erinaceus roumanicus), the blind mole (Talpa caeca or Talpa europaea), the jackal (Canis aureus), the fox (Vulpes vulpes), and the beech marten (Martes foina), which are found in the area, will continue to use their natural habitats without facing further pressures from the Project.

Consequently, the impacts on terrestrial mammals from the operation of the examined project are evaluated as **Neutral**.

10.2.4.2.1.3 Amphibians and Reptiles

In the following paragraphs, the possibility of potential adverse effects on terrestrial mammals found in the area as a result of the operation of the proposed Project is examined.

Taking into account that no earthworks will be carried out during the operation of the Project, no impacts on the amphibians and reptiles of the area are expected. The preservation of the dune zone and the restoration of natural vegetation will contribute to maintaining ecological balance and protecting these species.

Moreover, maintaining the isolation of the dune zone without significant human presence can make the area suitable for use by sea turtles for nesting, thus supporting the sustainable development of the area.

Therefore, the impacts on amphibians and reptiles from the operation of the examined project are assessed as **Neutral**.

10.2.4.2.2 Marine Habitat

10.2.4.2.2.1 Marine Habitats

In the following paragraphs, the likelihood of potential adverse effects on the marine habitats of the area, as a result of the operation of the proposed Project, is examined. The activities that cause impacts on marine habitats as a result of the operation of the proposed Project, based on the P&K delineation of the content of the ESIA (**Chapter 9**), are as follows:

- Water extraction. The two water production wells on the Beta platform will be equipped with electric submersible pumps (ESP) and will extract water from the reservoir. They will operate with a production of up to 7500 bwpd each during the period 2025-2031, and the water production will gradually increase to 97000 bwpd per well by 2031 and by the end of the project.
- Waste. Production, management, and disposal of waste from the operation of the onshore and offshore facilities of the project.
- Marine traffic. Definition of access exclusion zones due to the operation of the project.

Pumping water from the reservoir and discharging the treated water into the marine environment

The extraction of water from the two wells on the Beta platform and the discharge of the treated water into the sea may locally degrade marine habitats. It is expected that the treated water will meet quality standards before its discharge into the environment; however, differences in temperature between the discharged water and the marine environment, as well as a large local discharge flow, may locally degrade the quality of the marine habitat. It is estimated that the substrate in the broader area of the offshore facilities of the Project is muddy and devoid of vegetation.

Therefore, the impacts on the marine habitats of the area are assessed as negative, of negligible intensity, local extent, immediate occurrence, permanent, short-term reversible, non-synergistic, direct effect, continuous, mid-term recoverable, and self-contained. Regarding their final assessment, these impacts are evaluated as **Negligible.**

Definition of access exclusion zones due to the operation of the project

The maintenance of the no-anchoring and fishing zone and its limited extension during the operation of the Project will have positive impacts on marine habitats. The reduction of fishing pressure will allow for the restoration of fish stocks and the protection of marine phanerogams. Additionally, protection from ship anchors will ensure the structure and function of sensitive marine ecosystems, enhancing the environmental health and sustainability of the area.

Therefore, during the operational phase of the project, **positive** impacts on the marine habitats of the area are also expected.

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Water abstraction from the reservoir and discharge of the treated water into the marine environment during project operation	Marine habitats	-	1	2	4	4	1	1	4	4	3	1	29	Minor	Low	Negligible
Establishment / maintenance of an anchoring and fishing exclusion zone during project operation	Marine habitats	+	4	4	4	4	1	2	4	4	4	1	44	Positive	Low	Positive

10.2.4.2.2.2 Marine Mammals

In the following paragraphs, the likelihood of potential adverse effects on marine mammals as a result of the operation of the examined Project is examined.

The detailed impacts that may be caused by the operation of the Project on protected marine mammal species are outlined in detail in **Section 2** of the Project's **ESIA**.

The activities that cause impacts on marine mammals as a result of the operation of the proposed Project, based on the P&K content delimitation of the ESIA (**Chapter 9**), are as follows:

- Water extraction. The two water production wells on the Beta platform will be equipped with electric submersible pumps (ESP) and will extract water from the reservoir. They will operate with a production of up to 7500 bwpd each during the period 2025-2031, and the water production will gradually increase to 97000 bwpd per well by 2031 and by the end of the project.
- Waste. Production, management, and disposal of waste from the operation of the onshore and offshore facilities of the project.
- Marine traffic. Definition of access exclusion zones due to the operation of the project.

Pumping water from the reservoir and discharging the treated water into the marine environment

The water production wells on platform Beta will be equipped with electric pumps, which will extract water from the reservoir. The produced water from the storage project will undergo the same treatment as the current operation through oil separators on the Delta platform. The properly treated water will be discharged into the sea. Exposure to anthropogenic noise can cause adverse effects on marine mammals, such as injuries, acoustic damage, avoidance behaviors, communication masking, and, in some cases, strandings and death.

The underwater noise generated by the operation of the pumps may cause temporary behavioral disturbances in marine mammals, potentially leading them to avoid the immediate area of the pumps where the underwater noise is intensely produced. This displacement may also be indirectly due to the displacement of fish that are a food source for marine mammals. However, **according to the data from the ESIA, the possibility of displacement of the marine mammals Phocoena phocoena and Tursiops truncatus is considered unlikely.** Therefore, the impacts are assessed as negligible intensity, local extent, immediate occurrence, permanent, short-term reversible, synergistic, immediate effect, periodic, directly recoverable, and non-cumulative. Regarding their final assessment, these impacts are evaluated as **Moderate.** Since in their Final Evaluation, these impacts are assessed as **Moderate,** within the framework of the present study, measures for prevention/mitigation/management are proposed so that these impacts become at least Minor. After the implementation of the relevant measures proposed in **Chapter 11** of this report, the residual impacts are ultimately assessed as **Minor** and therefore the project is compatible with the environmental protection objectives that are prerequisites of this study.

Definition of access exclusion zones due to the operation of the project

The existing anchoring and fishing prohibition zone, which is slightly expanded, has positive effects on marine mammals. Specifically, the reduction of fishing pressure and the restoration of fish stocks will create safer and more food-rich habitats for marine mammals, thus contributing to the improvement of their health and well-being in the area.

Therefore, during the operational phase of the project, **positive** impacts on the marine mammals in the area are also expected.

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation	Final Residual Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)				
Water abstraction from the reservoir and discharge of the treated water into the marine environment during the operation of the Project	Marine Mammals	-	1	2	4	4	1	2	4	2	1	1	26	Minor	High	Moderate	Minor
Establishment / maintenance of anchoring and fishing exclusion zone during the operation of the Project	Marine Mammals	+	4	4	4	4	1	2	4	4	4	1	44	Positive	High	Positive	Positive

10.2.4.2.2.3 Sea Turtles

In the following paragraphs, the likelihood of potential adverse effects on sea turtles as a result of the physical presence and operation of the examined Project is examined.

The detailed impacts that may be caused by the operation of the Project on sea turtle species are presented in detail in **Section 2** of the Project's **ESIA.**

The activities that cause impacts on marine mammals as a result of the operation of the proposed Project, based on the P&K content delimitation of the ESIA (**Chapter 9**), are as follows:

- Water extraction. The two water production wells on the Beta platform will be equipped with electric submersible pumps (ESP) and will extract water from the reservoir. They will operate with a production of up to 7500 bwpd each during the period 2025-2031, and the water production will gradually increase to 97000 bwpd per well by 2031 and by the end of the project.

- Waste. Production, management, and disposal of waste from the operation of the onshore and offshore facilities of the project.
- Marine traffic. Daily movement of vessels due to the operation of the project (including the transportation of workers and the movements of support vessels).
- Maritime traffic. Definition of exclusion zones due to the operation of the project.

Pumping water from the reservoir and discharging the treated water into the marine environment

The water production wells on the Beta platform will be equipped with electric pumps, which will extract water from the reservoir. The produced water from the storage project is expected to undergo the same treatment as in the current operation, through oil separators on the Delta platform. The appropriately treated water will discharge into the sea. However, the treatment that will be required will be further investigated after the collection and analysis of water samples from the aquifer at the storage facility. Sea turtles have auditory abilities and can perceive sounds in the water. Therefore, the underwater noise from the pumps is likely to disrupt their natural behavior and use of the area. It is noted that the area is extensive and no reproduction has been observed, only the presence of individuals for foraging. It is estimated that sea turtles are likely to avoid the immediate area where the underwater noise from the water pumping from the reservoir is most intense. Therefore, the impacts are expected to be of negligible intensity, local extent, immediate occurrence, permanent, short-term reversible, synergistic, immediate effect, periodic, directly restorable, and non-cumulative. Regarding their final assessment, these impacts are evaluated as **Minor.**

Daily movement of vessels due to the operation of the project (including the transportation of workers and the movement of support vessels)

The daily movement of vessels due to the operation of the project (including the transportation of workers and the movements of support vessels) may cause disturbance to the sea turtles found in the area. The noise from the boat engines can affect them, causing them to move away from feeding areas and disrupting their migration routes. Additionally, turtles, due to their size and inability to move quickly, are at greater risk of entanglement with boats, which can cause asphyxiation. However, considering that maritime traffic in the broader area of Kavala Bay is intense and that the speed of all vessels will not exceed 20 knots, the risk of collision and entanglement of sea turtles with the vessels is minimized. Therefore, the impacts are assessed as low intensity, local extent, immediate occurrence, permanent, short-term reversible, synergistic, immediate effect, periodic, directly restorable, and non-cumulative. Regarding their final assessment, these impacts are evaluated as **Minor.**

Definition of access exclusion zones due to the operation of the project

The maintenance of the existing anchoring and fishing prohibition zone and its limited extension during the operation of the project has positive effects on sea turtles. Specifically, the reduction of fishing pressure and the restoration of fish stocks will create safer and more food-rich habitats for sea turtles, thereby contributing to the improvement of their health and well-being in the area. The exclusion zone already exists due to the presence and operation of existing underwater pipelines and platforms. Consequently, a maintenance and limited increase of the positive impact is expected due to the restriction of fishing and maritime traffic in the area.

Therefore, during the operational phase of the project, positive impacts on the sea turtles in the area are also expected.

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Water abstraction from the reservoir and discharge of the treated water into the marine environment during the operation of the Project	Sea turtles	-	1	2	4	4	1	2	4	2	1	1	26	Minor	Moderate	Minor
Daily vessel traffic due to the operation of the Project (including worker transportation and support vessel movements)	Sea turtles	-	2	2	4	4	1	2	4	2	1	1	29	Minor	Moderate	Minor
Establishment / maintenance of anchoring and fishing exclusion zone during the operation of the Project	Sea turtles	+	4	4	4	4	1	2	4	4	4	1	44	Positive	Moderate	Positive

10.2.4.2.2.4 Fish Fauna

In the following paragraphs, the likelihood of potential adverse effects on the ichthyofauna, as a result of the physical presence and operation of the examined Project, is examined.

The detailed impacts that may be caused by the operation of the Project on protected fish species are presented in detail in **Section 2** of the Project's **ESIA.**

The activities that cause impacts during the operation of the examined project, based on the P&K content delimitation of the EIA (**Chapter 9**), are as follows:

- Water extraction. The two water production wells on the Beta platform will be equipped with electric submersible pumps (ESP) and will extract water from the reservoir. They will operate with a production of up to 7500 bwpd each during the period 2025-2031, and the water production will gradually increase to 97000 bwpd per well by 2031 and by the end of the project.

- Waste. Production, management, and disposal of waste from the operation of the onshore and offshore facilities of the project.
- Marine traffic. Definition of exclusion zones due to the operation of the project.

Pumping water from the reservoir and discharging the treated water into the marine environment

The water production wells on the Beta platform will be equipped with electric pumps, which will extract water from the reservoir. It is expected that the produced water from the storage project will undergo the same treatment as the current operation through oil separators on the Delta platform. The appropriately treated water will be discharged into the sea. However, the treatment that will be required will be further investigated after the collection and analysis of groundwater samples at the storage facility.

From the underwater noise of the pumps, the following are expected: (a) behavioral changes: The continuous noise from the pumps may cause fish to avoid the area. (b) Communication and Reproduction: The noise may affect communication between fish, which is important for reproduction. Reduced communication can lead to lower fertilization rates and reproductive success. (C) Effects on physiology: Continuous noise can cause stress in fish, with potential consequences for their health and development. Stress can also affect their immune response, making them more vulnerable to diseases.

The discharge of water is expected to affect the fish population as it is likely that there will be (a) temperature changes: if the treated water has a different temperature from the seawater, it may create temperature zones that could affect the behavior and distribution of fish (b) changes in the ecosystem: the discharge of large quantities of water may affect the structure and function of marine ecosystems, impacting the habitats of fish and other marine organisms. Overall, the negative impact during the operational phase is expected to be localized in the area of the Beta and Delta platforms and for this reason of minor significance, considering that the fish will move to areas with lower disturbance. According to the distribution maps of the 4th national report on the implementation of Directive 92/43/EEC (10 x 10 km grid areas), the distribution of the species Allosa fallax, which is a protected object of the SPA & SAC GR115014, does not fall within the project area. In conclusion, the impacts are expected to be negative, of low intensity, local extent, short-term occurrence, permanent duration, short-term reversibility, synergistic, immediate effect, continuous frequency, directly restorable, and non-cumulative. Regarding their final assessment, these impacts are evaluated as **Minor.**

Definition of access exclusion zones due to the operation of the project

The designation of access exclusion zones for the operation of the project, concerning marine fish fauna, is expected to have a positive impact. Specifically, these areas will be protected from fishing and other human activities, providing safe havens for reproduction and growth, as well as reducing stress on fish species.

Therefore, during the operational phase of the project, positive impacts on the area's fish fauna are also expected.

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Water abstraction from the reservoir and discharge of the treated water into the marine environment during project operation	Ichthyofauna	-	2	2	3	4	1	2	4	4	1	1	30	Minor	Moderat	Minor
Establishment / maintenance of an anchoring and fishing exclusion zone during project operation	Ichthyofauna	+	4	4	4	4	1	2	4	4	4	1	44	Positive	Moderate	Positive

10.2.4.2.3 Birdlife

In the following paragraphs, the possibility of potential adverse effects on the avifauna, as a result of the physical presence and operation of the examined Project, is examined.

The detailed impacts that may be caused by the operation of the Project on protected bird species are presented in detail in **Section 2** of the Project's **ESIA.**

The activities that cause impacts during the operation of the examined project, based on the P&K content delimitation of the ESIA (**Chapter 9),** are as follows:

- Water extraction. The two water production wells on the Beta platform will be equipped with electric submersible pumps (ESP) and will extract water from the reservoir. They will operate with a production of up to 7500 bwpd each during the period 2025-2031, and the water production will gradually increase to 97000 bwpd per well by 2031 and by the end of the project.
- Waste. Production, management, and disposal of waste from the operation of the onshore and offshore facilities of the project.
- Marine traffic. Definition of exclusion zones due to the operation of the project.

Pumping water from the reservoir and discharging the treated water into the marine environment

The water production wells on the Beta platform will be equipped with electric pumps, which will extract water from the reservoir. It is expected that the produced water from the storage project will undergo the same treatment as the current operation through oil separators on the Delta platform. The appropriately treated water will discharge into the sea. However, the treatment that will be required will be further investigated after the collection and analysis of groundwater samples at the storage facility.

The discharge of treated water is likely to be related to (a) temperature changes: if the treated water has a different temperature from the seawater, it may create thermal zones that could affect the behavior and distribution of fish, (b) changes in the ecosystem: the discharge of large quantities of water may affect the structure and function of marine ecosystems, impacting the habitats of fish and other marine organisms.

Considering that the bird species found in the area use it for foraging, disturbance and degradation of their foraging area are expected during the operation of the project. However, the works are spatially localized to a particularly small section of the species' habitat in the area, and therefore the overall impact is expected to be negligible. Therefore, the overall impacts are negative, of low intensity, localized in scope, short-term in occurrence, permanent in duration, short-term reversible, synergistic, immediate in effect, continuous in frequency, directly restorable, and non-cumulative. Regarding their final assessment, these impacts are evaluated as **Moderate.** Since in their Final Evaluation, these impacts are assessed as **Moderate**, within the framework of the present study, measures for prevention/mitigation/management are proposed so that these impacts become at least Minor. After the implementation of the relevant measures proposed in **Chapter 11** of this report, the residual impacts are ultimately assessed as **Minor** and therefore the project is compatible with the environmental protection objectives that are prerequisites of this study.

Definition of access exclusion zones due to the operation of the project

The designation of access exclusion zones for the operation of the project, concerning the habitat of the avifauna, is expected to have a positive impact. Specifically, these areas will be protected from fishing and other human activities, providing safe havens for the reproduction and development of fish species, and consequently leading to an increase in local fish stocks.

Therefore, during the operational phase of the project, positive impacts on the area's avifauna are also expected.

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation	Final Residual Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)				
Water abstraction from the reservoir and discharge of the treated water into the marine environment during project operation	Avifauna	-	2	2	3	4	1	2	4	4	1	1	30	Minor	High	Moderate	Minor

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation	Final Residual Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)				
Marine traffic: Establishment of exclusion zones due to project operation	Avifauna	+	4	4	3	4	1	2	4	4	4	1	43	Positive	High	Positive	Positive

10.2.4.2.4 Areas of the National System of Protected Areas

As previously mentioned, the examined Project is located within the protected area Natura 2000 SCI & SPA GR1150014 "Thassos Kavala Marine Area." In the broader area, the Natura 2000 sites GR1150010 "Nestos Delta and Keramoti Lagoons – Wider Area," GR1150001 "Nestos Delta and Keramoti Lagoons and Thasopoula Island," and GR1150012 "Thasos (Mount Ipsario and Coastal Zone)" are located.

The activities that may potentially cause impacts on the Areas of the National Protected Areas System during the operation of the project, based on the P&K delineation of the content of the ESIA (**Chapter 9**), are as follows:

- Water extraction. The two water production wells on the Beta platform will be equipped with electric submersible pumps (ESP) and will extract water from the reservoir. They will operate with a production of up to 7500 bwpd each during the period 2025-2031, and the water production will gradually increase to 97000 bwpd per well by 2031 and by the end of the project.
- Waste. Production, management, and disposal of waste from the operation of the onshore and offshore facilities of the project.
- Marine traffic. Daily boat traffic due to the operation of the project (including the transportation of workers and the movements of support vessels).
- Marine traffic. Definition of access exclusion zones due to the operation of the project.

The impacts that may arise from the aspects of the project during the operational phase are described in detail in **Section 2,** titled "Due Diligence Impact Assessment of the Project (normal operation)," of the Project's **ESIA.**

Based on the analysis of the project's ESIA, as well as the aforementioned parameters of the biotic environment that constitute the protected objects of the respective Protected Areas, the following impacts on them are identified:

- From the activities of water extraction from the reservoir and the discharge of treated water into the marine environment, negative impacts of low intensity, local extent, immediate occurrence, permanent duration, short-term reversibility, synergistic, direct effect, continuous frequency, immediately recoverable, and non-cumulative are expected to arise. Regarding their final assessment, these impacts are evaluated as Moderate. Since in their Final Evaluation, these impacts are assessed as Moderate, within the framework of this study, measures for prevention/mitigation/management are proposed so that these impacts become at least Minor. Following the implementation of the relevant measures proposed in Chapter 11 of this report, the residual impacts are ultimately assessed as Minor and therefore the project is compatible with the environmental protection objectives that are prerequisites of this study.

- Correspondingly, from the daily movement of vessels due to the operation of the project (including the transportation of workers and the movement of support vessels), the impacts on the Areas of the National Protected Areas System are expected to be negative, of low intensity, local extent, immediate occurrence, permanent duration, short-term reversibility, synergistic, direct effect, continuous frequency, immediately restorable, and non-cumulative. Regarding their final assessment, these impacts are evaluated as Moderate. As for their Final Evaluation, these impacts are assessed as Moderate; within the framework of this study, prevention/mitigation/management measures are proposed so that these impacts become at least Minor. Following the implementation of the relevant measures proposed in Chapter 11 of this document, the residual impacts are ultimately assessed as Minor and therefore the project is compatible with the environmental protection objectives that are prerequisites of this study.
- The designation of access exclusion zones due to the operation of the project is expected to have Positive impacts on the Areas of the National Protected Areas System.

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation	Final Residual Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)				
Water abstraction activities from the reservoir and discharge of treated water into the marine environment	Areas of the National Protected Areas System	-	2	2	4	4	1	2	4	4	1	1	31	Minor	High	Moderate	Minor
Daily vessel movements due to project operation (including transport of personnel and movements of support vessels)	Areas of the National Protected Areas System	-	2	2	4	4	1	2	4	4	1	1	31	Minor	High	Moderate	Minor
Marine traffic: Establishment of exclusion zones due to project operation	Areas of the National Protected Areas System	+	4	4	4	4	1	2	4	4	4	1	44	Positive	High	Positive	Positive

10.2.4.2.5 Forests and Forested Areas

According to Chapter 8, the land-based facilities of the project are not developed on forested areas and therefore are not located in sites subject to the provisions of forestry legislation. Specifically, according to the ratification of the Forest Maps, the areas designated for the land facilities of the project bear the codes PA (Final acts and classification decisions – non-forested).

It is also noted that the land-based facilities of the project will be constructed within the existing area of the SIGMA plant, in a region which is classified according to the database of the European Corine Land Cover (CLC 2018) program as industrial and commercial. Additionally, the section of the pipeline that will be installed on the shore will be constructed in a trench 5 meters wide and 3 meters deep.

Therefore, **no impacts on forests and forested areas are expected during the operational phase of the project.**

10.2.4.2.6 Other Significant Natural Areas

As previously mentioned, the nearest Area of Particular Natural Beauty (APNB) to the land facilities of the Project is the non-designated APNB named "Aesthetic Forest of Amygdaleona Kavala" with code AT4011109, located approximately 5.6 km to the west of them.

In the immediate area of the project, within the boundaries of the Municipality of Nestos, there is one (1) Ramsar Wetland, which is also included in the Montreux Record. The aforementioned wetland, named **"Nestos Delta and adjacent lagoons",** with a total area of 21,930 ha, joined the Ramsar Convention in 1975.

The marine area of the project is included in the Important Bird Area (IBA) with code GR250 and the name "Kavala Bay and Thasos Marine Area", while nearby is the area with code GR016 and the name "Thasos Island and Xironisi".

H The study area falls within the boundaries of Zone 9 of Accobams in the Northeastern Mediterranean (Thracian Sea).

The study area falls within the Important Area for Marine Mammals named "Northern Coast and Islands of the Thracian Sea" with a total area of 5441 km^2.

The activities that may potentially cause impacts on the aforementioned Significant Natural Areas during the operation of the project, based on the P&K content delineation of the EIA (**Chapter 9**), are as follows:

- Water extraction. The two water production wells on the Beta platform will be equipped with electric submersible pumps (ESP) and will extract water from the reservoir. They will operate with a production of up to 7500 bwpd each during the period 2025-2031, and the water production will gradually increase to 97000 bwpd per well by 2031 and by the end of the project.
- Waste. Production, management, and disposal of waste from the operation of the onshore and offshore facilities of the project.

- Marine traffic. Daily movement of vessels due to the operation of the project (including the transportation of workers and the movements of support vessels).
- Maritime traffic. Definition of access exclusion zones due to the operation of the project.

Based on the analysis of the EIA of the project, as well as the aforementioned parameters of the biotic environment that constitute the protected objects of the said Protected Areas, the following impacts on them are identified:

- From the activities of water extraction from the reservoir and the discharge of treated water into the marine environment, negative impacts are expected to arise that are of low intensity, local extent, immediate occurrence, permanent duration, short-term reversibility, synergistic, immediate effect, continuous frequency, directly restorable, and non-cumulative. Regarding their final assessment, these impacts are evaluated as Moderate. Since in their Final Evaluation, these impacts are assessed as Moderate, within the framework of this study, measures for prevention/mitigation/management are proposed so that these impacts are reduced to at least Minor. After the implementation of the relevant measures proposed in Chapter 11 of this report, the residual impacts are ultimately assessed as Minor and therefore the project is compatible with the environmental protection objectives that are prerequisites of this study.
- Correspondingly, from the daily movement of vessels due to the operation of the project (including the transportation of workers and the movements of support vessels), the impacts on Significant Natural Areas are expected to be negative, of low intensity, local extent, immediate occurrence, permanent duration, short-term reversibility, synergistic, direct effect, continuous frequency, immediately restorable, and non-cumulative. Regarding their final assessmentYW, these impacts are assessed as Moderate. Since, in their Final Evaluation, these impacts are assessed as Moderate, within the framework of this study, measures for prevention/mitigation/management are proposed so that these impacts become at least Minor. After the implementation of the relevant measures proposed in Chapter 11 of this report, the residual impacts are ultimately assessed as Minor and therefore the project is compatible with the environmental protection objectives that are prerequisites of this study.
- The designation of access exclusion zones due to the operation of the project is expected to have Positive impacts on Significant Natural Areas.

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation	Final Residual Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)				
Water abstraction activities from the reservoir and discharge of the treated water into the marine environment	Other Important Natural Areas	-	2	2	4	4	1	2	4	4	1	1	31	Minor	High	Moderate	Minor

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation	Final Residual Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)				
Daily vessel traffic due to the operation of the Project (including worker transport and support vessel movements)	Other Important Natural Areas	-	2	2	4	4	1	2	4	4	1	1	31	Minor	High	Moderate	Minor
Marine traffic: Designation of exclusion zones due to the operation of the Project	Other Important Natural Areas	+	4	4	4	4	1	2	4	4	4	1	44	Positive	High	Positive	Positive

10.2.4.3 Phase of Shutdown/Uninstallation

10.2.4.3.1 Terrestrial Habitat

10.2.4.3.1.1 Terrestrial Habitats

The non-removal of the pipeline and the absence of earthworks will ensure that there will be no change to the terrestrial habitats, including the dune area in front of the SIGMA land facilities. Maintaining the existing situation will contribute to preserving the ecological balance and the ongoing protection of the area's natural habitats.

Therefore, <u>the impacts on terrestrial natural habitats from the decommissioning phase of the examined project are assessed as **Neutral.**</u>

10.2.4.3.1.2 Terrestrial Mammals

Taking into account that during the phase of operational suspension and restoration of the Project, no earthworks will be carried out, no impacts on the terrestrial mammals of the area are expected. Additionally, the absence of noise during these phases ensures that terrestrial mammals will not be affected by anthropogenic activities. The preservation of the dune zone and the restoration of natural vegetation will contribute to maintaining ecological balance and protecting these species, providing a stable and quiet environment for their survival.

Therefore, <u>the impacts on terrestrial mammals from the phase of operational cessation / decommissioning of the examined project are assessed as **Neutral.**</u>

10.2.4.3.1.3 Amphibians and Reptiles

Considering that during the phase of suspension and restoration of the Project, no earthworks will be carried out, no impacts are expected on the amphibians and reptiles of the area. The preservation of the dune zone and the restoration of natural vegetation will contribute to maintaining ecological balance and protecting these species.

Therefore, the impacts on amphibians and reptiles from the phase of cessation of operation / decommissioning of the examined project are assessed as **Neutral.**

10.2.4.3.2 Marine Habitat

10.2.4.3.2.1 Marine Habitat Types

The following paragraphs examine the potential occurrence of adverse impacts on the marine habitat types of the area, as a result of the decommissioning and dismantling phase of the Project under assessment.

No decommissioning works are foreseen for the offshore CO_2 transportation pipeline; consequently, impacts on the marine habitat types pertain only to the area where dismantling activities will take place at the existing Delta and Beta platforms. In this area, a direct effect on marine habitats of highly localized nature is expected. The substrate in this area is anticipated to be muddy and devoid of vegetation.

Therefore, the impacts are expected to be negative, of negligible magnitude, local in extent, of immediate onset, temporary in duration, short-term reversible, non-synergistic, of direct effect, periodic, short-term restorable, and non-cumulative. In terms of their final assessment, these impacts are evaluated as **Negligible**.

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Decommissioning / Dismantling of offshore installations excluding the offshore CO_2 transport pipeline	Marine habitats	-	1	2	4	1	1	1	4	2	2	1	23	Minor	Low	Negligible

10.2.4.3.2.2 Marine Mammals

The following paragraphs assess the potential occurrence of adverse impacts on marine mammals in the area, as a result of the decommissioning and dismantling phase of the Project under assessment.

The activities that may cause impacts on the protected marine mammal species during the decommissioning and dismantling phase of the project, based on the content structure outlined in **Chapter 9** of the ESIA, are the following:

- Decommissioning / Dismantling of offshore installations (excluding the offshore CO_2 transportation pipeline): disassembly of equipment and removal of installations.

The impacts that may arise from project-related aspects during the decommissioning and dismantling phase are described in detail in **Section 2**, titled *"Appropriate Assessment of Project Impacts (normal operation)"*, of the Project's **AA** Report.

The dismantling of offshore installations, excluding the offshore CO_2 transportation pipeline which will remain in place, may generate elevated noise levels near the activity location. These could potentially disturb marine mammal species present in the area. As mentioned in the assessment of impacts during the construction and operation phases, marine mammals are sensitive to underwater noise, which may temporarily alter their behavior—such as causing them to avoid the area—or interfere with their communication. Indirect impacts may also occur due to the potential displacement of fish species that constitute a food source for marine mammals. However, it should be noted that the noise levels are not expected to exceed those of typical marine activities in the area.

The impact is expected to be local and short-term, since the subsea pipeline will not be removed, and dismantling operations will only take place in the area of the offshore platforms Delta and Beta.

Consequently, the impacts are expected to be negative, of negligible magnitude, local in extent, of immediate onset, temporary in duration, short-term reversible, synergistic, of direct effect, periodic, short-term restorable, and non-cumulative. In terms of their final assessment, these impacts are evaluated as **Moderate**. As such, within the current report, mitigation/prevention/remediation measures are proposed so that these impacts are reduced to at least **Minor**. Following the implementation of the relevant measures proposed in Chapter 11 of this report, the residual impacts are ultimately assessed as **Minor**, and therefore the project is compatible with the environmental protection objectives that constitute prerequisites of this study.

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation	Final Residual Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)				
Decommissioning / Dismantling of offshore installations excluding the offshore CO_2 transport pipeline	Marine Mammals	-	1	2	4	1	1	2	4	2	2	1	24	Minor	High	Moderate	Minor

10.2.4.3.2.3 Sea Turtles

The following sections assess the potential occurrence of adverse impacts on sea turtles in the area as a result of the decommissioning and dismantling phase of the proposed Project.

The activities that may potentially cause impacts on the protected species of sea turtles during the decommissioning and dismantling phase, according to the Content Definition and Delimitation Framework (**Chapter 9**) of the ESIA, are the following:

- Decommissioning / Dismantling of offshore facilities (excluding the offshore CO_2 transmission pipeline). Disassembly of equipment and removal of installations.

The potential impacts arising from these aspects of the Project during the decommissioning and dismantling phase are described in detail in **Section 2**, entitled "Appropriate Assessment of the Project Impacts (Normal Operation)", of the **HRA** Report.

The dismantling of the offshore facilities —excluding the offshore CO_2 pipeline which will remain in place— may cause increased noise levels near the work area, which may disturb sea turtles. As previously noted, sea turtles are sensitive to underwater noise, which can temporarily alter their behavior, such as displacing them from the area. However, it is worth noting that noise levels are **not expected to exceed those of typical marine operations** in the area.

Consequently, <u>the impacts are expected to be adverse, of negligible magnitude, of local extent, of immediate onset, of temporary duration, reversible in the short term, synergistic, of direct impact, periodic, short-term restorable, and non-cumulative. In terms of final assessment, these impacts are evaluated as **Minor**.</u>

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Decommissioning / Dismantling of offshore installations excluding the offshore CO_2 transport pipeline	Sea Turtles	-	1	2	4	1	1	2	4	2	2	1	24	Minor	Moderate	Minor

10.2.4.3.2.4 Fish Fauna

The following sections assess the potential occurrence of adverse impacts on the fish fauna of the area, as a result of the decommissioning and dismantling phase of the proposed Project.

The activities that may potentially cause impacts on the fish fauna during the decommissioning and dismantling phase, according to the Content Definition and Delimitation Framework (**Chapter 9**) of the ESIA, are the following:

- Decommissioning / Dismantling of offshore facilities (excluding the offshore CO_2 transmission pipeline). Disassembly of equipment and removal of installations.

The impacts that may arise from these aspects of the Project during the decommissioning and dismantling phase are described in detail in **Section 2**, entitled *"Appropriate Assessment of the Project Impacts (Normal Operation)"*, of the **HRA** Report.

The dismantling of the offshore facilities —excluding the offshore CO_2 pipeline which will remain in place— may result in increased underwater noise levels in proximity to the work areas, which could disturb fish fauna. As previously mentioned, (see **Chapter 10.5.1.2.4**), fish species are sensitive to underwater noise, which may temporarily alter their behavior, such as causing them to temporarily vacate the area, interfere with their communication, and affect their development. However, it is worth noting that noise levels are not expected to exceed those of current marine activities in the area.

During the pipeline decommissioning and dismantling works, water turbidity levels may also increase. Elevated turbidity can affect feeding behavior, as many fish species rely on vision to locate their prey, and can also interfere with respiration, as suspended particles may impair gill function.

Nevertheless, the impact is expected to be local and short-term in nature, as the offshore pipeline will not be removed, and the decommissioning works will only take place at the offshore platforms Delta and Beta.

Therefore, <u>the impacts are expected to be adverse, of low magnitude, of local extent, of immediate onset, of temporary duration, reversible in the short term, synergistic, of direct impact, periodic, short-term restorable and non-cumulative. In terms of final assessment, these impacts are evaluated as **Minor.**</u>

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Decommissioning / Dismantling of offshore installations excluding the offshore CO_2 transport pipeline	Ichthyofauna	-	2	2	4	1	1	2	4	2	2	1	27	Minor	Moderate	Minor

10.2.4.3.2.5 Avifauna

The following sections assess the potential occurrence of adverse impacts on the avifauna of the area as a result of the decommissioning and dismantling phase of the proposed Project.

The activities that may potentially cause impacts on the avifauna of the area during the decommissioning and dismantling phase, according to the Content Definition and Delimitation Framework (**Chapter 9**) of the ESIA, are the following:

- Decommissioning / Dismantling of offshore installations (excluding the offshore CO_2 transmission pipeline). Disassembly of equipment and removal of installations.

The impacts that may arise from these aspects of the Project during the decommissioning and dismantling phase are described in detail in **Section 2**, entitled *"Appropriate Assessment of the Project Impacts (Normal Operation)"* of the **HRA** Report.

The dismantling of offshore installations, excluding the offshore CO_2 pipeline which will remain in place, is expected to result in impacts on avifauna species in the area such as *Phalacrocorax aristotelis desmarestii* and *Puffinus yelkouan*. Given that the offshore pipeline will remain buried and no excavation or removal works will be performed, impacts are anticipated only from the decommissioning activities at the offshore platforms (Beta and Delta). These impacts are expected to be very localized and limited, as they will not broadly affect the habitats of avifauna species. They may cause localized changes to habitat structure, but such effects will be temporary in nature. Marine traffic associated with the decommissioning and dismantling of offshore installations may cause additional disturbance to bird species. The presence of vessels and related activities may temporarily displace birds from the area. However, these impacts are expected to be short-term and limited to the duration of the works, with bird species returning once activities are completed and disturbance has ceased.

In conclusion, the impacts on avifauna are expected to be adverse, of negligible magnitude, local in extent, of immediate onset, of temporary duration, short-term reversible, synergistic, of direct impact, periodic, short-term restorable and non-cumulative. In terms of final assessment, these impacts are evaluated as **Moderate.** As these impacts are assessed as **Moderate** in the final evaluation, appropriate mitigation/prevention/remediation measures are proposed within the present report to reduce the significance of these impacts to at least Minor. Following the implementation of the relevant measures proposed in **Chapter 11** of this report, the residual impacts are ultimately assessed as **Minor,** and therefore the Project is considered compatible with the environmental protection objectives required by this study.

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation	Final Residual Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)				
Decommissioning / Dismantling of offshore installations (excluding the offshore CO_2 transport pipeline)	Avifauna	-	1	2	4	1	1	2	4	2	4	1	24	Minor	High	Moderate	Minor

10.2.4.3.3 Areas of the National System of Protected Areas

As previously mentioned, the proposed Project is located within the Natura 2000 protected area SCI & SPA GR1150014 “Marine Area of Kavala–Thasos”. In the broader surrounding area, the following Natura 2000 sites are also present: SCI GR1150010 “Nestos Delta and Keramoti Lagoons – Wider Area”, SPA GR1150001 “Nestos Delta and Keramoti Lagoons and Thasopoula Islet”, and SPA GR1150012 “Thasos (Mount Ypsario and Coastal Zone)”.

The activities that may potentially cause impacts on the Areas of the National System of Protected Areas during the decommissioning and dismantling phase of the Project, based on the Content Delimitation Framework of the ESIA (**Chapter 9**), are the following:

- Decommissioning / Dismantling of offshore installations (excluding the offshore CO_2 transmission pipeline). Disassembly of equipment and removal of infrastructure.

The impacts that may arise from these aspects of the Project during the decommissioning and dismantling phase are described in detail in **Section 2**, titled *“Appropriate Assessment of the Project Impacts (Normal Operation)”*, of the **HRA** Report.

Based on the analysis included in the HRA Report and the considerations previously stated regarding the biotic environment parameters that represent the conservation objectives of these Protected Areas, it is concluded that the impacts on the Areas of the National System of Protected Areas during the decommissioning and dismantling phase are expected to be adverse, of negligible intensity, local in extent, of immediate onset, temporary in duration, short-term reversible, synergistic, of direct impact, periodic, short-term restorable and non-cumulative. In terms of final assessment, these impacts are evaluated as Moderate. As these impacts are assessed as Moderate in the final evaluation, appropriate prevention/mitigation/remediation measures are proposed within the present report to reduce the significance of these impacts to at least Minor. Following the implementation of the relevant measures proposed in Chapter 11 of this report, the residual impacts are ultimately assessed as Minor, and therefore the Project is considered compatible with the environmental protection objectives required by this study.

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation	Final Residual Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)				
Decommissioning / Dismantling of offshore installations (excluding the offshore CO_2 transport pipeline)	Areas of the National System of Protected Areas	-	1	2	4	1	1	2	4	2	2	1	24	Minor	High	Moderate	Minor

10.2.4.3.4 Forests and Forested Areas

According to **Chapter 8**, the Project's onshore installations are not developed within forested areas and, therefore, are not located in zones subject to the provisions of forest legislation. Specifically, according to the ratified Forest Maps, the areas where the Project's onshore installations are sited are designated with the code "PA" (Final acts and decisions of land classification – non-forested).

It is also noted that the Project's onshore installations will be constructed within the existing premises of the SIGMA facility, in an area that is classified according to the European Corine Land Cover database (CLC 2018) as industrial and commercial land. Furthermore, the section of the pipeline to be installed along the shoreline will be constructed in a trench of 5 meters width and 3 meters depth.

Therefore, <u>no impacts are expected on forests or forested areas during the decommissioning and dismantling phase of the Project.</u>

10.2.4.3.5 Other Important Natural Areas

As previously mentioned, the closest Landscape of Particular Natural Beauty (LPNB) to the Project's onshore installations is the non-designated LPNB named "Aesthetic Forest of Amygdaleonas, Kavala" with code AT4011109, located approximately 5.6 km west of the installations.

<u>In the immediate vicinity of the Project, within the boundaries of the Municipality of Nestos, lies one (1) Ramsar Wetland</u>, which is also included in the Montreux Record. This wetland, named **"Nestos Delta and adjacent lagoons"**, with a total area of 21,930 ha, joined the Ramsar Convention in 1975.

The Project's marine area falls within the Important Bird Area (IBA) coded GR250, named "Kavala Gulf and Marine Area of Thasos", while nearby is also IBA GR016 "Thasos Island and Xironisi Islet".

The study area lies within Zone 9 of ACCOBAMS in the Northeastern Mediterranean (Thracian Sea).

It also lies within the **Important Marine Mammal Area (IMMA)** named "Northern Coast and Islands of the Thracian Sea", with a total area of 5,441 km².

The activities that may potentially cause impacts on these **Important Natural Areas** during the decommissioning and dismantling phase of the Project, based on the Content Delimitation Framework of the ESIA (**Chapter 9**), are the following:

- Decommissioning / Dismantling of offshore installations (excluding the offshore CO_2 transmission pipeline). Disassembly of equipment and removal of infrastructur

Based on the analysis of the HRA Report and the parameters of the biotic environment that constitute the conservation features of the above-mentioned protected areas, it is concluded that the impacts on these Important Natural Areas during the decommissioning and dismantling phase are expected to be: adverse, of negligible intensity, local in extent, immediate in onset, temporary in duration, short-term reversible, synergistic, of direct impact, periodic, short-term restorable, and non-cumulative. In terms of final assessment, these impacts are evaluated as **Moderate.** As these impacts are assessed as **Moderate** in the final evaluation, appropriate prevention/mitigation/remediation measures are proposed within the present report to reduce the significance of these impacts to at least Minor. Following the implementation of the relevant measures proposed in **Chapter 11** of this report, the residual impacts are ultimately assessed as **Minor**, and therefore the Project is considered compatible with the environmental protection objectives required by this study.

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation	Final Residual Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)				
Decommissioning / Dismantling of offshore installations (excluding the offshore CO_2 transport pipeline)	Other Important Natural Areas	-	1	2	4	1	1	2	4	2	2	1	24	Minor	High	Moderate	Minor

10.2.5 Impacts on the Human Environment

10.2.5.1 Spatial Planning – Land Uses

10.2.5.1.1 Construction Phase

As stated in **Chapter 5** of this report, the Project under assessment does not conflict with the directions, priorities, and choices of Spatial Planning at the National, Regional, or Sectoral level. It is also compatible and compliant with the legally established spatial and urban planning restrictions, as reflected in the designated land uses of the study area.

More specifically, the Project aims to mitigate the effects of climate change through the storage of carbon dioxide and does not conflict with the goals set by the General Spatial Planning and Sustainable Development Framework (GSPFSD) for the same purpose.

With regard to the provisions and directions of the Special Spatial Planning and Sustainable Development Frameworks (SSPFSD) established to date — and which may relate to the activities and facilities of the Project — as noted in **Chapter 5**, the Project does not contradict the directions of the SSPFSD for Industry, and although it is not directly related to the SSPFSD for Renewable Energy Sources (RES) (since it is not a RES project), it indirectly contributes to achieving the objectives of this specific framework (e.g. tackling climate change). Furthermore, it does not affect the projections or planning of the framework in any way.

Regarding the Special Spatial Planning and Sustainable Development Framework for Aquaculture (SSPFSD-A), which identifies and categorizes areas suitable for aquaculture development (AZAs), part of the Project falls within AZA B14 "Agiasma – Keramoti – Erasmio" (fish farming, shellfish farming, other aquatic organisms) and is located 10.6 km away from AZA B13 "Nea Iraklitsa – Nea Peramos", as illustrated in the following **Figure**. These AZAs are classified as Category B, i.e., aquaculture development areas with scope for further development.

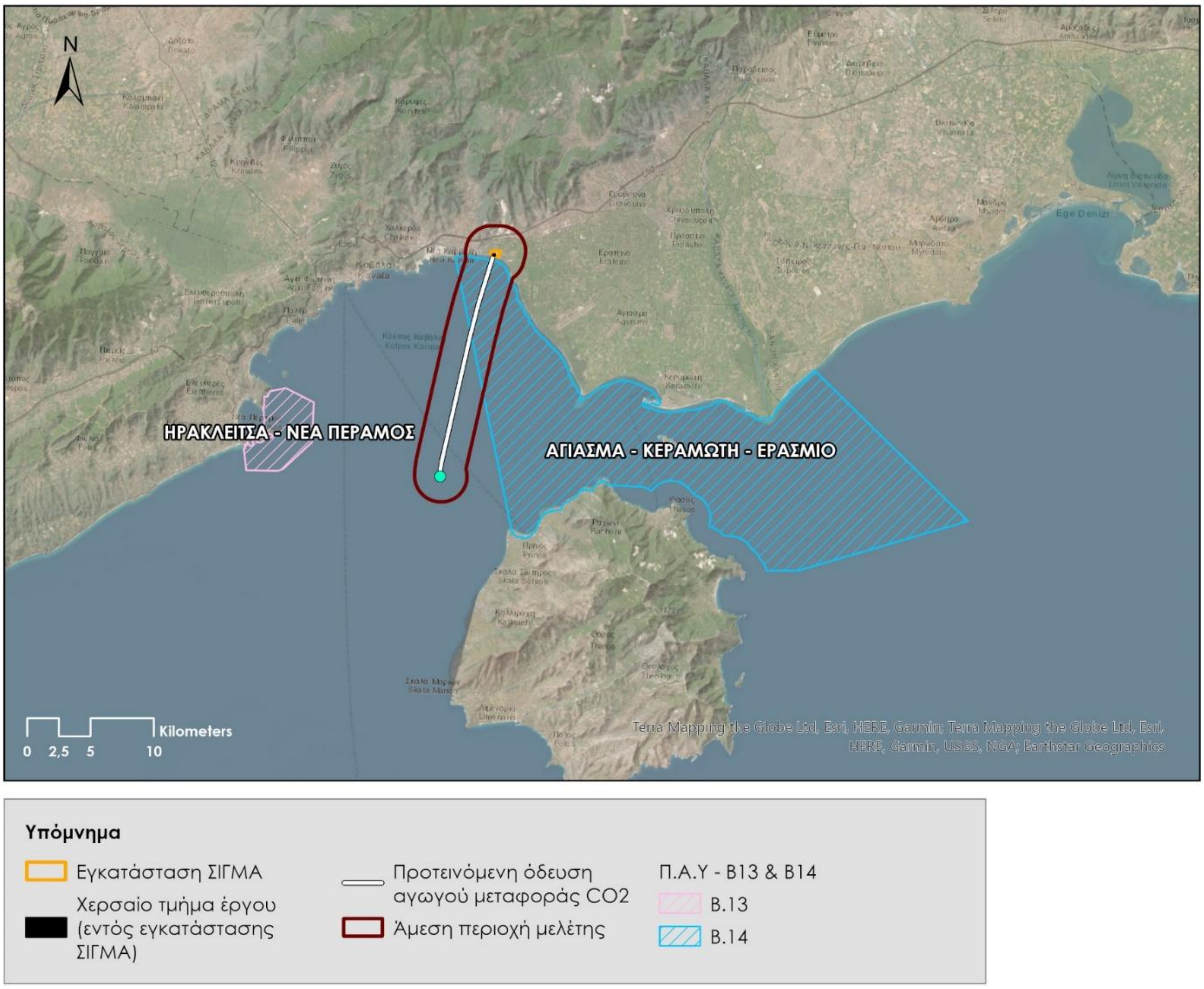


Figure 10-1. Aquaculture Development Areas (ADAs)

(Source: 1st Revision of ESIA, own processing by the study team)

According to the following Figure, for the existing project which is already environmentally permitted (Decision No. οικ 8413 / 24-04-18, ADA: ΨΓΛ14653Π8-Ζ79 titled "Approval of environmental terms for the Prinos Offshore Development Project"), a zone has been defined within the AZA (between the red lines), through which pipelines pass, where mooring and any form of fishing are prohibited._Given that the proposed CO_2 transport pipeline will pass through this designated zone, which has already been established, it is not expected to further impact the existing uses of the AZA.

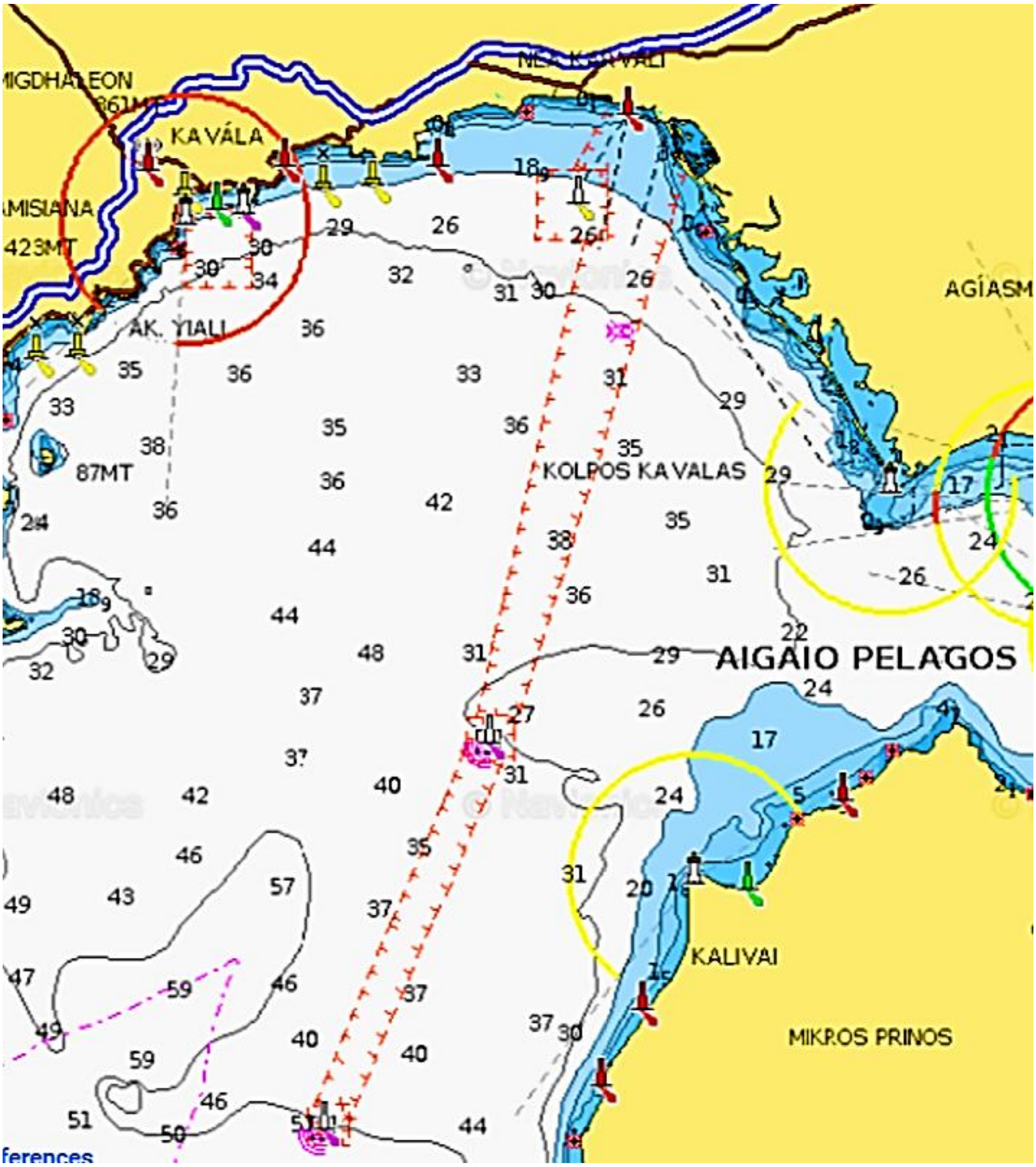


Figure 10-2. Existing zone of mooring and fishing prohibition in the project area

(Source: Navionics, https://webapp.navionics.com/#boating@9&key=wzlxFqnitC)

With regard to the onshore facilities of the proposed project, as analyzed in Chapter 5, there is no conflict with the provisions of the statutory land use regime in force in the wider area of the project. According to the General Urban Plan (GUP) of the Municipality of Kavala (Government Gazette 69/AAP/11-03-2013), the area of the project's onshore facilities falls within a "Zone of Organised Development of Productive Activities (ZODPA) of the Secondary Sector."

As regards the offshore installations, at national level, no maritime uses have been designated, with the exception of the Special Framework for Spatial Planning and Sustainable Development for Aquaculture (SFSP&SD-A). In the absence of a formal Marine Spatial Plan and corresponding Marine Land Use Regulations, spatial planning in the marine area of the proposed project is governed by the existing marine spatial planning framework, i.e. the relevant applicable Special and Regional Spatial Planning Frameworks, which concern specific economic sectors, including aquaculture.

The main uses that may be developed in the marine area are as follows:

- Fishing
- Aquaculture
- Navigation and maritime transport
- Military uses and activities
- Research and protection of the marine ecosystem & underwater antiquities
- Renewable energy generation
- Extraction of hydrocarbons and aggregates
- Tourism / Recreation

As previously mentioned, for the existing project that is already environmentally permitted (Decision Ref. No. οικ 8413 / 24-04-18, ADA: ΨΓΛ14653Π8-Ζ79, entitled “Approval of environmental terms for the Prinos Offshore Development Project”), a maritime zone has been designated within which pipelines run, where mooring and all forms of fishing are prohibited. The proposed CO_2 pipeline will run within the aforementioned designated zone, and the definition of the proposed new exclusion zone will be consolidated with the existing one, which will be slightly extended. Consequently, the existing balance with other maritime uses is not expected to be disrupted.

Considering the fact that all coastal and offshore facilities of the proposed project will be developed at locations with existing infrastructure or where restrictions already apply due to the presence of the Prinos offshore hydrocarbon extraction project, land patterns (or maritime uses and activities) are not expected to change, nor will the project lead to displacement of local residents or changes in local land ownership and use.

With regard to uses in the marine area, the exclusion zone represents a small portion of the overall marine area, does not obstruct major navigation routes, does not limit access to ports, popular coastal areas, or areas used for tourism-related activities (e.g. diving), and does not restrict the sustainable use of marine resources. In conclusion, the impacts on existing maritime uses during the construction phase are expected to remain limited. Therefore, the potential impacts are assessed as negative, of negligible intensity, confined to the project’s footprint, direct, of temporary duration (construction phase), of short-term reversibility, non-synergistic, non-cumulative, continuous, and readily reversible.

Accordingly, with regard to the Final Assessment, the impacts on spatial planning and land uses are evaluated as **Negligible.**

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Offshore CO_2 transmission pipeline: Designation of exclusion zones due to CO_2 transmission pipeline installation works (and related works/activities).	Marine uses	-	1	1	4	1	1	1	4	4	1	1	22	Minor	Low	Negligible
Offshore facilities (excluding the offshore CO_2 transmission pipeline): Designation of exclusion zones due to geotechnical works.	Marine uses	-	1	1	4	1	1	1	4	4	1	1	22	Minor	Low	Negligible

10.2.5.1.2Operation Phase

Similarly to the construction phase, the proposed project does not conflict with the directions, priorities, and choices of Spatial Planning at the National, Regional, Local, and Sectoral levels, and it is fully compatible and compliant with the institutional spatial and urban planning restrictions, as reflected in the designated land uses of the study area.

Furthermore, considering that all coastal and offshore facilities of the proposed project will operate in locations with existing infrastructure or where restrictions are already in place due to the presence of the Prinos offshore hydrocarbon extraction project, no changes are expected in land use patterns, nor is the Project anticipated to result in displacement of local residents or changes in local ownership or land use.

As for uses in the marine space, the exclusion zone represents a small portion of the overall marine area. It does not obstruct key navigation routes, does not restrict access to ports, popular coastal areas, or areas used for tourism activities (e.g. diving), and does not limit the sustainable use of marine resources.

In conclusion, the impacts on existing maritime uses during the operation phase are expected to remain limited. Therefore, the potential impacts are assessed as negative, of negligible intensity, confined to the project's footprint, direct, of long-term duration (operation phase), of short-term reversibility, non-synergistic, non-cumulative, continuous and readily reversible.

Accordingly, with regard to the Final Assessment, the impacts on spatial planning and land uses are evaluated as **Negligible.**

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Physical presence and siting of the marine infrastructure of the project	Marine uses	-	1	1	4	3	1	1	4	4	1	1	24	Minor	Low	Negligible
Marine traffic: Designation of access exclusion zones due to the operation of the project.	Marine uses	-	1	1	4	3	1	1	4	4	1	1	24	Minor	Low	Negligible

10.2.5.1.3 Decommissioning and Cessation Phase

During the decommissioning phase, no changes are expected in land use patterns, nor are the activities anticipated to result in displacement of local residents or changes in local ownership or land use. Regarding uses in the marine space, the exclusion zone — which will be slightly extended — will continue to represent a small portion of the overall marine area and, for the most part, will cover locations where restrictions are already in place due to the existing Prinos offshore hydrocarbon extraction project. Navigation routes will not be obstructed, access to ports, popular coastal areas, or areas used for tourism activities (e.g. diving) will not be limited, and the sustainable use of marine resources will not be restricted.

In conclusion, the impacts on existing maritime uses during the decommissioning phase are expected to remain limited. Therefore, <u>the potential impacts are assessed as negative, of negligible intensity, within the project footprint, direct, of temporary duration (decommissioning phase), of short-term reversibility, non-synergistic, non-cumulative, continuous and readily reversible.</u> υμπερασματικά, οι επιπτώσεις σε υφιστάμενες θαλάσσιες χρήσεις στην φάση παύσης λειτουργίας/απεγκατάστασης αναμένεται να παραμείνουν περιορισμένες. Ως εκ τούτου, <u>οι δυνητικές επιπτώσεις εκτιμώνται ως αρνητικές, αμελητέας έντασης, εντός της έκτασης κατάληψης του Έργου, άμεσες, προσωρινής διάρκειας (φάση απεγκατάστασης), βραχυπρόθεσμης αναστρεψιμότητα, μη συνεργιστικές, μη σωρευτικές, συνεχείς και άμεσα αποκαταστάσιμες.</u>

υνεπώς, <u>ως προς την Τελική Αξιολόγηση τους, οι επιπτώσεις στον χωροταξικό σχεδιασμό και τις χρήσεις γης αξιολογούνται ως **Αμελητέες**.</u>

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Decommissioning / Dismantling of offshore CO_2 transport pipelines: Designation of access exclusion zones due to the implementation of the dismantling works of the offshore pipelines.	Marine uses	-	1	1	4	1	1	1	4	4	1	1	22	Minor	Low	Negligible
Decommissioning / Dismantling of offshore facilities (excluding the offshore CO_2 transport pipeline): Designation of access exclusion zones due to the implementation of the dismantling works of the offshore facilities.	Marine uses	-	1	1	4	1	1	1	4	4	1	1	22	Minor	Low	Negligible

10.2.5.2 Structure and Functions of the Human Environment

10.2.5.2.1 Construction Phase

CO_2 storage projects may create divisions within communities, especially when divergent views exist regarding the potential benefits and risks. Some community members may view carbon storage as a positive step in addressing climate change and generating employment opportunities, while others may express concerns about environmental or other risks. Considering the industrial tradition of the area and the longstanding presence of the project operator, in combination with transparent information-sharing processes and the participation of local communities, public trust—vital to social cohesion—is expected to be maintained. It is also important to note that the planned investment, which includes the proposed project, has not raised objections or opposition from local stakeholders or residents and is, in general, perceived positively. In any case, the implementation of the **Stakeholder Engagement Plan**, including the establishment of a **Grievance Mechanism (GM)**, will play a key role in building strong, constructive, and flexible relationships with stakeholders and in fostering mutual understanding through the active involvement of individuals, groups, and organizations in the Project.

The establishment of exclusion zones is not expected to disrupt social cohesion, as these zones coincide with existing ones and are primarily located in areas where restrictions are already in effect due to the existing offshore hydrocarbon extraction project in Prinos.

Furthermore, during the construction phase, the Project is not expected to alter the identity of the community. Jobs related to the offshore workforce, which is traditionally a recognized sector in the area, will be maintained, and the workforce is expected to be sourced from the wider study area or not significantly differ from the surrounding population. As such, the risk of diminished cohesion and conflict is considered low. In addition to preserving the existing structure and established functions of the human environment, positive impacts are also expected in areas such as employment and the local economy—issues that will be further analyzed in the respective section addressing socio-economic impacts.

Ensuring that the social benefits of CO_2 storage projects, such as employment opportunities and economic development, are distributed fairly within the community—including consideration of the needs of vulnerable groups—can also contribute to enhancing social cohesion.

Construction activities may generate some complaints due to minor disturbances caused by noise, dust, traffic, and the presence of machinery; however, these are expected to be of limited intensity and scope, of relatively short duration, and temporary in nature, and will subside upon completion of the works. Therefore, based on the Final Assessment, these impacts are evaluated as **Negligible.**

Finally, the implementation of the proposed project will trigger the application of Corporate Social Responsibility (CSR) actions in consultation with local authorities and based on the assessment of local needs (e.g. investments in education, healthcare, etc.), which are expected to generate positive secondary outcomes, strengthening overall community welfare and cohesion. Therefore, these impacts are evaluated as Positive.

<u>In conclusion, during the construction phase, the proposed project is not expected to bring about significant changes in the functions of the human environment in the area. Based on the results of the environmental impact assessment in this section of the ESIA, it is assessed that the proposed project **will not lead to any significant adverse changes** in the functions of the human environment and the social cohesion of the area, and on the contrary, is expected to contribute **positively** to them.</u>

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Movement of heavy vehicles, construction machinery, transport trucks, and support vehicles	Structure and Functions of the Human Environment	-	1	1	4	1	1	1	4	2	1	1	20	Negligible	Moderate	Negligible

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
during construction, emitting: • Particulate matter (PM10, PM2.5) • Gaseous pollutants (CO, VOC, and NOx) • Noise																
Mobilization / Engagement (recruitment, employment, involvement) of workforce	Disruption and Operations of the Human Environment	+	4	2	4	2	1	1	1	4	2	1	32	Positive	Moderate	Positive
Implementation of Corporate Social Responsibility (CSR) actions	Disruption and Operations of the Human Environment	+	4	4	4	3	1	2	4	4	1	4	43	Positive	Moderate	Positive

10.2.5.2.20Operation Phase

During the operation phase of the project, the processes of transparent information dissemination and local community engagement are expected to continue to ensure the maintenance of public trust, which is of paramount importance for social cohesion.

The establishment of access exclusion zones is not expected to disrupt social cohesion, as these zones overlap with existing ones and are mainly located in areas where restrictions are already in place due to the offshore hydrocarbon extraction project in Prinos. In any case, the implementation of the **Stakeholder Engagement Plan,** including the establishment of a **Grievance Mechanism (GM)**, will play a key role in building strong, constructive, and flexible relationships with stakeholders and in fostering mutual understanding through the active participation of individuals, groups, and organizations in the Project.

Furthermore, as in the construction phase, the Project is not expected to alter the identity of the community during its operation phase. Jobs related to the offshore workforce sector traditionally known in the region—will be maintained, and the workforce is expected to come from the broader study area or not significantly differ from the local population. As such, the risk of diminished cohesion or conflict is considered low.

Positive impacts on the functions of the human environment in areas such as employment and the local economy will continue and are analyzed in detail in the relevant section addressing socio-economic impacts.

The implementation of Corporate Social Responsibility (CSR) actions, in coordination with local authorities and based on an assessment of local needs (e.g. investment in education, healthcare, etc.), is also expected to generate positive secondary effects, enhancing overall community well-being and cohesion.

In conclusion, the operation of the proposed project is **not expected to result in adverse changes** to the functions of the human environment or the social cohesion of the area; on the contrary, it is expected to contribute **positively** to them.

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Mobilization / Engagement (recruitment, employment, involvement) of workforce	Disruption and Operations of the Human Environment	+	4	2	4	3	3	1	1	4	1	1	34	Positive	Moderate	Positive
Implementation of Corporate Social Responsibility (CSR) actions	Disruption and Operations of the Human Environment	+	4	4	4	3	1	2	4	4	1	4	43	Positive	Moderate	Positive

10.2.5.2.3 Decommissioning and Cessation Phase

During the decommissioning phase of the project, no changes to the identity of the community are expected. The employment positions of the workforce active in the offshore section of the area will be maintained, and the workforce is expected to originate from the broader study area or not significantly differ from the local population. As such, the risk of reduced cohesion or social conflict is considered low.

Positive impacts on the functions of the human environment, particularly in areas such as employment and the local economy—topics which will be analyzed in detail in the relevant section addressing socio-economic impacts—are also expected during the decommissioning phase.

However, upon completion of the decommissioning phase, the current workforce will be required to seek alternative employment, which may result in secondary adverse impacts on social cohesion. The significance of this impact is assessed as negative, of moderate intensity, local, direct, of short-term reversibility and recoverability, indirect and non-synergistic. Therefore, in terms of its Final Evaluation, this impact is assessed as **Minor**.

The proposed measures for the workforce, as described in **Chapter 11**, in combination with the implementation of the **Stakeholder Engagement Plan,** including the establishment of a **Grievance Mechanism (GM)** through which complaints or concerns may be addressed, will ensure the prevention and mitigation of potential impacts related to the aforementioned issue during the decommissioning phase.

Decommissioning activities may lead to some complaints regarding minor disturbances caused by noise, dust, increased traffic, and the presence of machinery. However, these are expected to be of limited intensity and scale, relatively short duration, and temporary in nature, and will be reversed once works are completed. Consequently, in terms of Final Evaluation, these impacts are assessed as **Negligible**.

The establishment of access exclusion zones is not expected to disrupt social cohesion, as they will coincide with existing ones and will primarily be located in areas already subject to restrictions due to the offshore hydrocarbon extraction project in Prinos.

Considering the results of the environmental impact assessment conducted in this section of the ESIA, it is estimated that during the **decommissioning phase, the proposed Project will not cause significant adverse changes** to the functions of the human environment or to the social cohesion of the area. On the contrary, it is expected to make **positive** contributions to these aspects.

However, after the Project's cessation of operation, **secondary adverse impacts** may occur, which are assessed as **Minor** in the Final Evaluation.

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Movement of heavy vehicles, construction machinery, transport and freight vehicles, as well as support vehicles during construction, which emit: • Dust (PM10, PM2.5). • Gaseous pollutants (CO, VOC, and NOx). • Noise.	Disruption and Operations of the Human Environment	-	1	1	4	1	1	1	4	2	1	1	20	Negligible	Moderate	Negligible
Decommissioning: Mobilization / Engagement (recruitment, employment, involvement) of workforce	Disruption and Operations of the Human Environment	+	4	2	4	2	1	1	1	4	2	1	32	Positive	Moderate	Positive
Operation Termination:	Disruption and Operations of	-	4	2	4	2	1	1	1	4	2	1	32	Minor	Moderate	Minor

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Cessation of workforce activities	the Human Environment															

10.2.5.3 Cultural Heritage – Underwater Cultural Heritage

10.2.5.3.1 Construction Phase

As stated in **Section 8.10.3 "Cultural Heritage"**, the marine area of the Kavala Gulf—where all offshore installations (existing and new) are located—has been thoroughly investigated, and <u>no evidence of significant underwater archaeological findings has been identified.</u> Over time, the shallow waters and seabed type are not conducive to the preservation of potential remains.

Within the Project's study area (2 km radius from the Drilling Site), the following archaeological sites and monuments are identified:

- The terrestrial archaeological site "Nea Karvali, Kavala", which has been designated by Ministerial Decision No. YA 21220, Official Gazette: 527/B/24-08-1967. This site is located at a distance of 1.15 km from the Project's terrestrial area.
- The listed monument "Remains of the ancient city of Akontisma, Nea Karvali, Kavala", also designated by Ministerial Decision No. YA 21220, Official Gazette: 527/B/24-08-1967, and located 1 km from the Project's terrestrial area.

As can be deduced from the above, within and in the vicinity of the Project's area of influence, no sites of cultural interest are identified, as the nearest of them is located approximately 1 km away from the Project's terrestrial area.

It is further noted that all offshore and coastal installations of the proposed Project will be developed in locations with pre-existing infrastructure. No visible archaeological elements have been identified within the terrestrial footprint of the proposed Project, a fact confirmed during the site inspection carried out for this study, during which an extensive survey of the area was performed.

Moreover, no traditional settlements or settlements protected due to their specific urban, aesthetic, historical, folkloric, or architectural character are located in the immediate study area.

Consequently, construction works are not expected to affect the cultural and archaeological environment of the area in any way and are therefore assessed as <u>Neutral.</u>

In any case, construction works will be carried out in accordance with the applicable national regulatory framework (Law 3028/2002 as amended and in force, Law 4858/2021 as amended and in force) and the opinions of the competent authorities. The competent Archaeological Services of the Region will be notified, and construction works will be conducted in the presence of specialized personnel from the relevant Ephorates of Antiquities, ensuring the integrity of cultural heritage. In the event of discoveries deemed as potential cultural heritage (or paleontological) objects, features, or sites, construction activities shall be halted, and the applicable chance finds procedure will be followed, in accordance with Greek legislation, EU regulations, and best practices, such as EBRD's Performance Requirement 8 (PR8) on Cultural Heritage. Construction activities will resume only after implementation of the approved avoidance, minimization, or mitigation and protection measures.

10.2.5.3.2 Operation Phase

No impacts are expected.

10.2.5.3.3 Decommissioning Phase

No impacts are expected.

10.2.5.4 Socio-Economic Environment

10.2.5.4.1 Construction Phase

10.2.5.4.1.1 Fisheries / Aquaculture

As stated in **Section 8.10.4.2.1** ***Key Economic Indicators and Productive Structure***, the fisheries and aquaculture sector are particularly dynamic in the area.

The following **Figures** illustrate the existing zone subject to specific restrictions related to fishing and/or vessel anchoring and/or passage, as well as the location of fish farms and aquaculture units within the Project's study area. The proposed zone with special restrictions is aligned with the existing one, involving a minor expansion of its area.

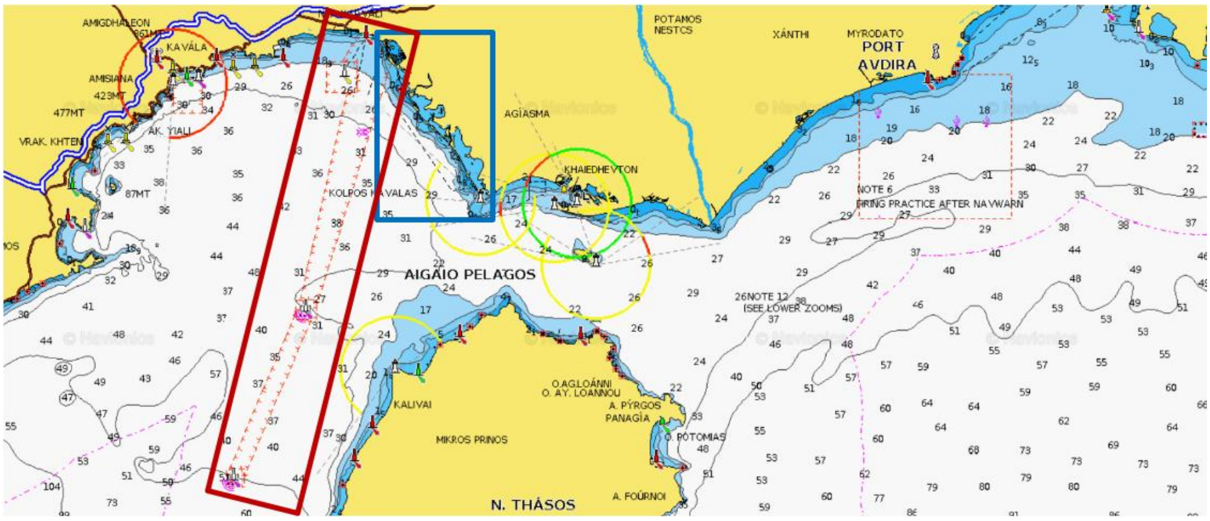


Figure 10-3. Exclusion zone and locations of Fish Farms and Aquaculture Facilities

(Source: Navionics, https://webapp.navionics.com/#boating@9&key=wzlxFqnitC, own processing by the study team)

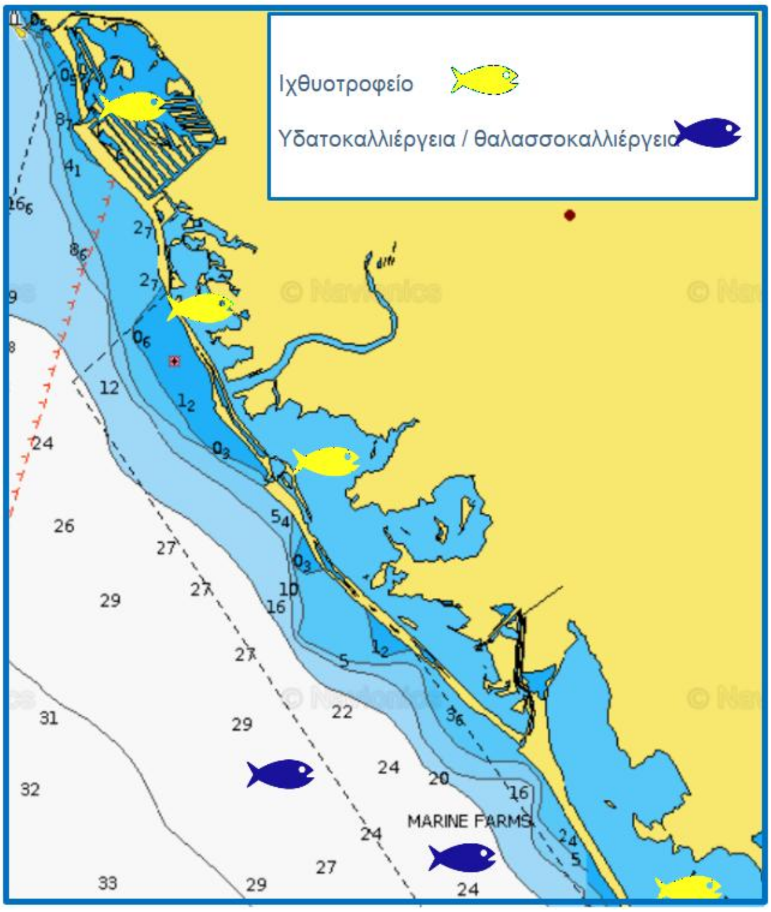


Figure 10-4. Fish Farms and Aquaculture near the Project Area

(Source: Navionics, https://webapp.navionics.com/#boating@9&key=wzlxFqnitC, own processing by the study team)

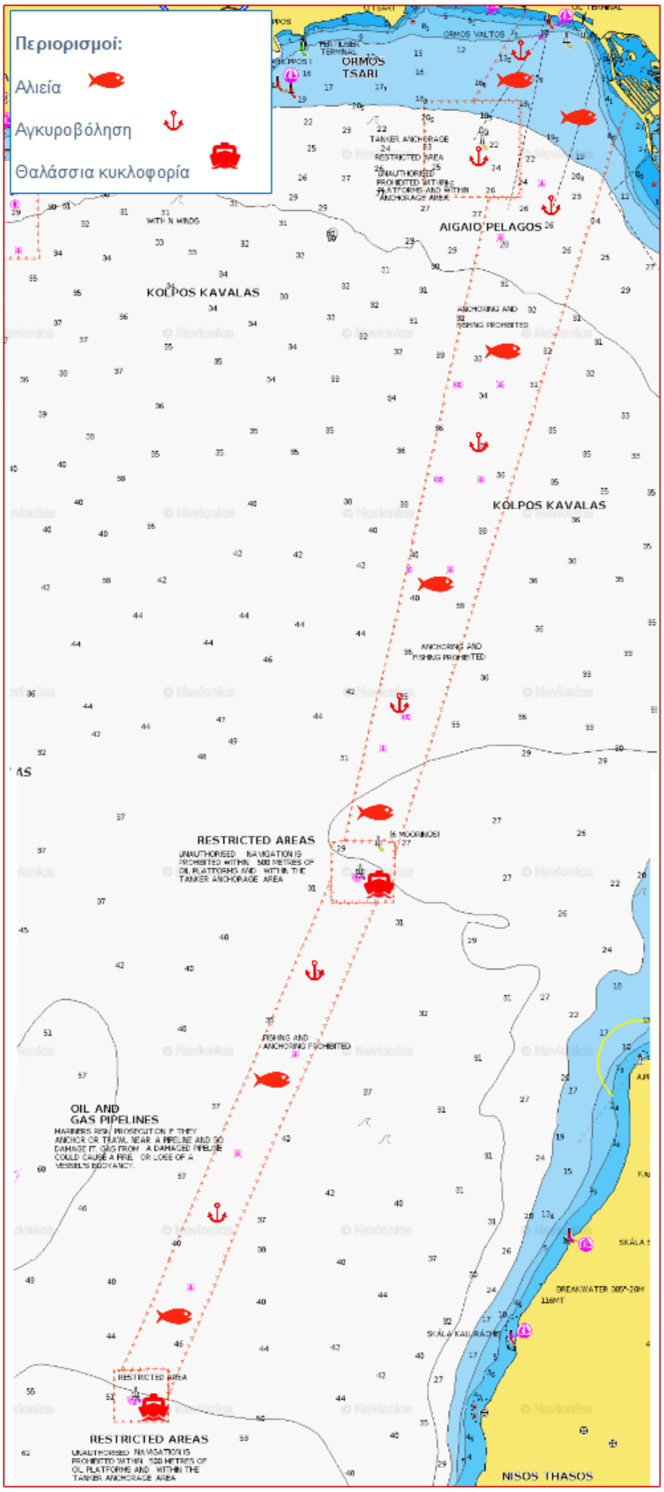


Figure 10-5. Zone with special restrictions on fishing and/or passage and/or anchoring of vessels

(Source: Navionics, https://webapp.navionics.com/#boating@9&key=wzlxFqnitC, own processing by the study team)

As analyzed in **Chapter 10.2.5.1 *Spatial Planning – Land Uses***, for the existing environmentally licensed project (Ref. No. 8413 / 24-04-18, ADA: ΨΓΛ14653Π8-Ζ79 entitled "Approval of Environmental Terms for the Prinos Offshore Development Project"), an exclusion zone is defined within an Aquaculture Area of Organized Development (PAOAD) classified as Category B, i.e., areas designated for aquaculture development with room for further expansion, within which anchoring and all forms of fishing are prohibited. The proposed pipeline will pass within this designated exclusion zone and is not expected to significantly affect the uses of the PAOAD.

The proposed exclusion zones are aligned with the existing ones, involving only a minor expansion and remaining limited to a small section of the total marine area. Given that the proposed exclusion zone predominantly overlaps with areas already subject to restrictions due to the existing offshore hydrocarbon extraction project at Prinos, no significant reduction in the available fishing areas for fishermen is anticipated.

Potential adverse impacts on fish fauna during the construction phase could indirectly affect the fisheries sector. However, according to the findings of the **Special Ecological Assessment Study (SEAS)** and **Chapter 10.2.4** of the ESIA, no changes are expected that could affect fishing activities. The impacts on fish fauna are confined within a 500-meter zone on either side of the existing infrastructures (where fishing is already restricted), mainly due to turbidity and noise during the construction works. Since the impact is localized and limited to a short distance from the pipeline installation operations, no effects are expected on fishing activities taking place beyond 500 meters from the Project.

In conclusion, during the construction phase, considering the environmental impact assessments of the present EIS section and the SEAS, it is estimated that the construction phase of the proposed Project will have **neutral** effects on the viability of the fisheries and aquaculture sectors, and therefore on the communities in the area that depend on these sectors.

10.2.5.4.1.2 Tourism

The Regional Units of Kavala and Thasos are among the most popular tourist destinations in the Region of Eastern Macedonia and Thrace.

Given that all coastal and offshore facilities of the proposed Project will be developed at locations where existing installations are already in place—constituting a long-established industrial site—no changes to the natural landscape of the region's tourist destinations are expected.

The access exclusion zones remain confined to a small portion of the overall marine area and are located in areas already subject to restrictions due to the existing offshore hydrocarbon extraction project at Prinos. Therefore, no restrictions on existing tourism activities (e.g., water sports, diving, underwater tours, yachting, etc.) are anticipated.

Bathing water quality also affects the attractiveness of a tourist destination. As shown in the Bathing Water Profile Register of Greece (https://bathingwaterprofiles.gr/map) and stated in Chapter **8.5.2 *Bathing Waters***, the water quality at bathing beaches located near the area is rated as "excellent," except for Rapsani 1 and Rapsani 2, which are rated as "sufficient." The following **Figure** presents the bathing waters located in the wider area of the Project, as well as the location of the beaches whose water quality was not rated as "excellent."

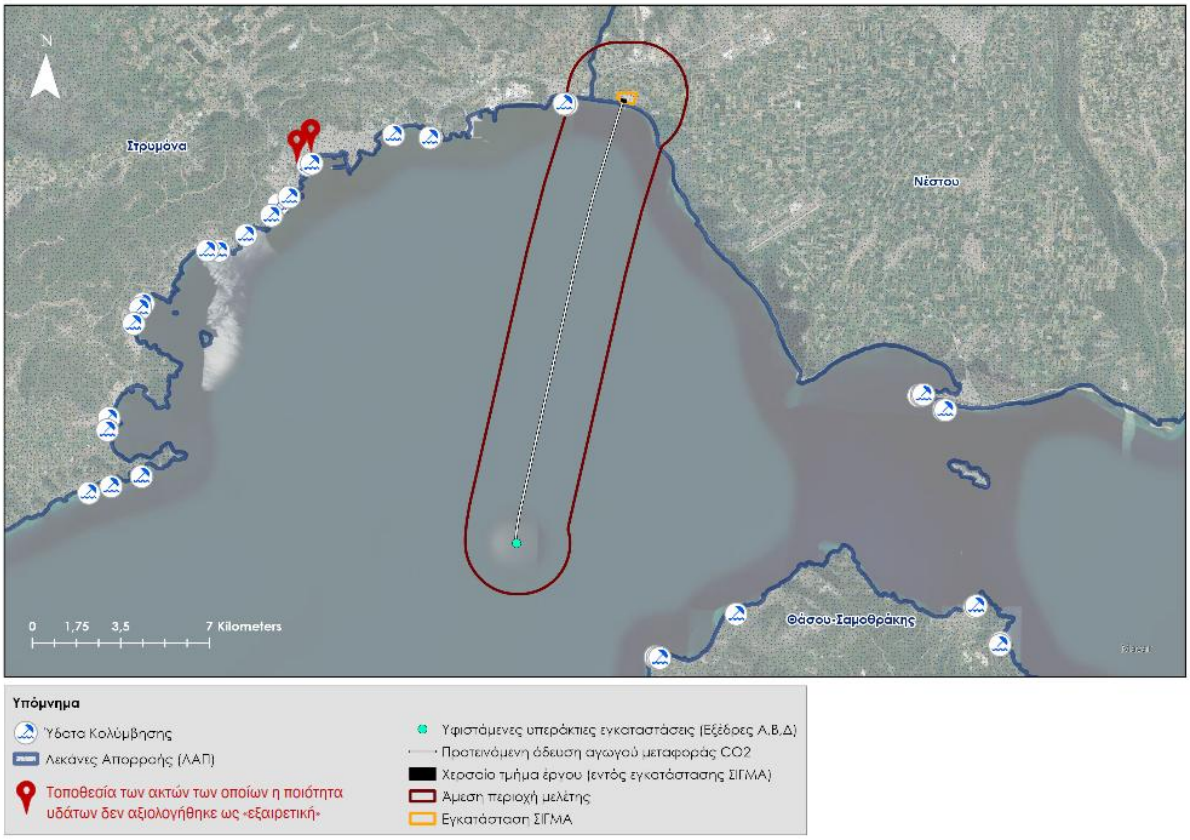


Figure 10-6. Bathing waters near the Project area

(Source: https://bathingwaterprofiles.gr own processing by the study team)

The "Blue Flag" Programme is an initiative of the international organization FEE (Foundation for Environmental Education), which is represented in Greece by the Hellenic Society for the Protection of Nature (HSPN). The Hellenic Society for the Protection of Nature collaborates with the Ministry of Environment and Energy (YPEN) to facilitate the participation of interested coastal management bodies in the international voluntary "Blue Flag" Programme. In 2024, a total of 15 beaches in the Regional Units of Kavala and Thasos were awarded the Blue Flag distinction.

The Blue Flag-awarded beaches are presented in the **Figure** below.

Figure 10-7. List of awarded beaches 2024 for the Regional Units of Kavala and Thasos

Municipality of Pangaio:
10. Nea Iraklitsa, 11. Nea Peramos, 12. Ammolofos, 13. Sarakina, 14. Ofrinio/Touzla

Municipality of Kavala:
15. Perigiali, 16. Batis, 17. Tosca/Tosca Beach

Municipality of Nestos:
18. Ammoglossa Keramoti/Ammos Beach, 19. Ammoglossa Keramoti/Paralia Beach

Municipality of Thasos:
20. Thasos Town/Limanaki, 21. Makryammos, 22. Chrysi Ammoudia/Golden Beach Camping, 23. Pefkari 2/Alexandra Beach, 24. Prinos Dasylio 2/Ilio Mare Beach Thasos Town/Limanaki

(Source: https://www.blueflag.gr/)

As stated in **Chapter 10.2.9** ***Impacts on Water***, the potential impacts from the construction phase on water quality, which could lead to a decrease in the attractiveness of bathing waters, are assessed as short-term reversible, readily restorable, and overall **Minor**. Therefore, no significant adverse secondary effects on tourism or reduced income in this productive sector are expected.

Construction activities may generate noise and air pollution, affecting the overall experience of tourists. As stated in **Chapter 10.2.6** ***Impacts on Air Quality*** **of this Study,** the impacts from anticipated air pollutant emissions during the construction of the onshore facilities, the CO_2 transport pipeline, and the drilling operations are assessed as localized, of limited duration, and overall Minor. Similarly, according to the **noise and vibration** impact assessment presented in **Chapter 10.2.7**, the expected noise emissions during the construction of the onshore facilities, the CO_2 transport pipeline, and the drilling operations are also assessed as localized, of limited duration, and overall **Minor**.

The **Figures** below present the tourist accommodations located closest to the Project area and those located nearest to the site where the onshore construction activities will take place.

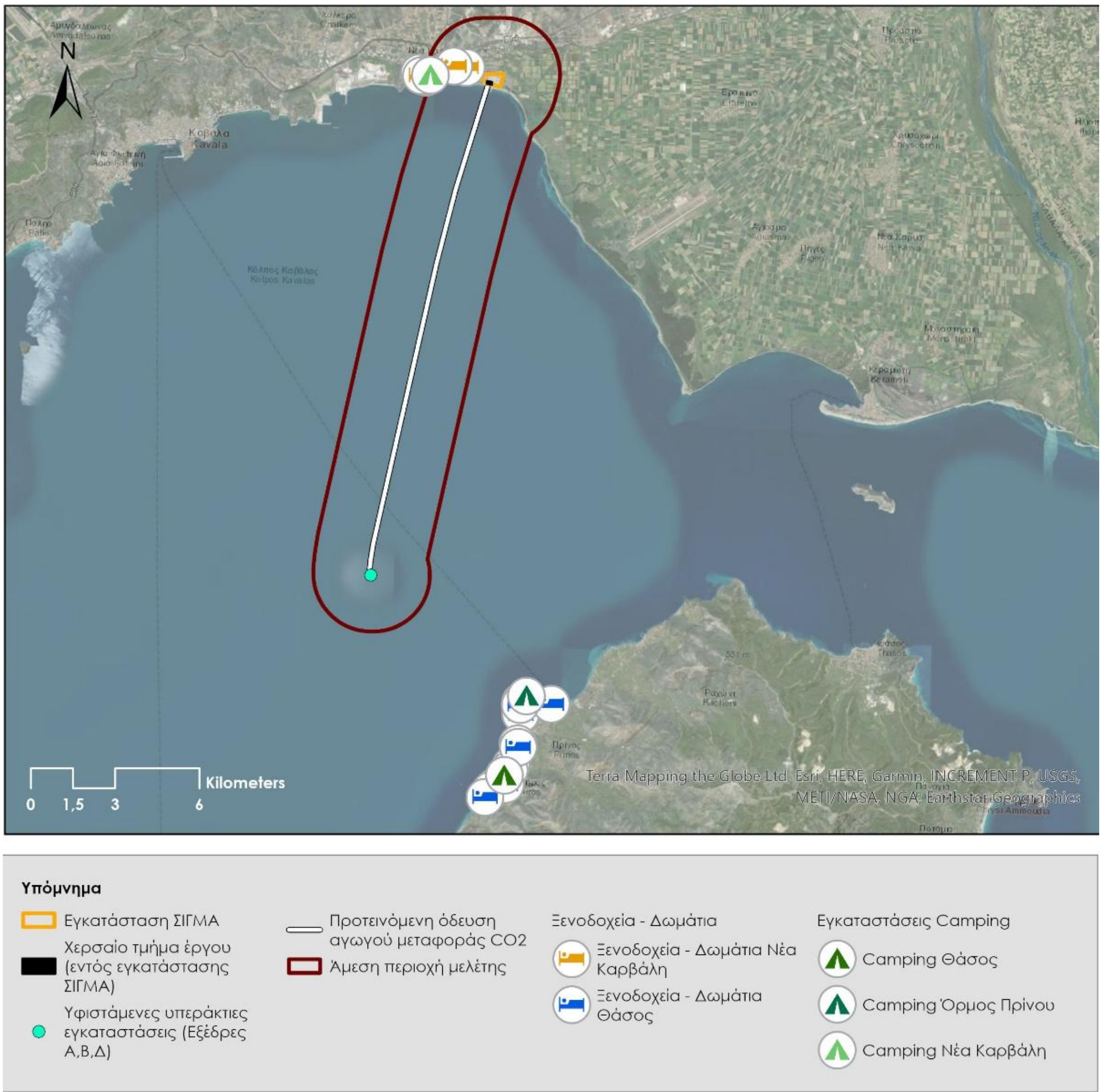


Figure10-8. Tourist accommodation near the Project study area

(Source: https://www.booking.com/, own processing by the study team)

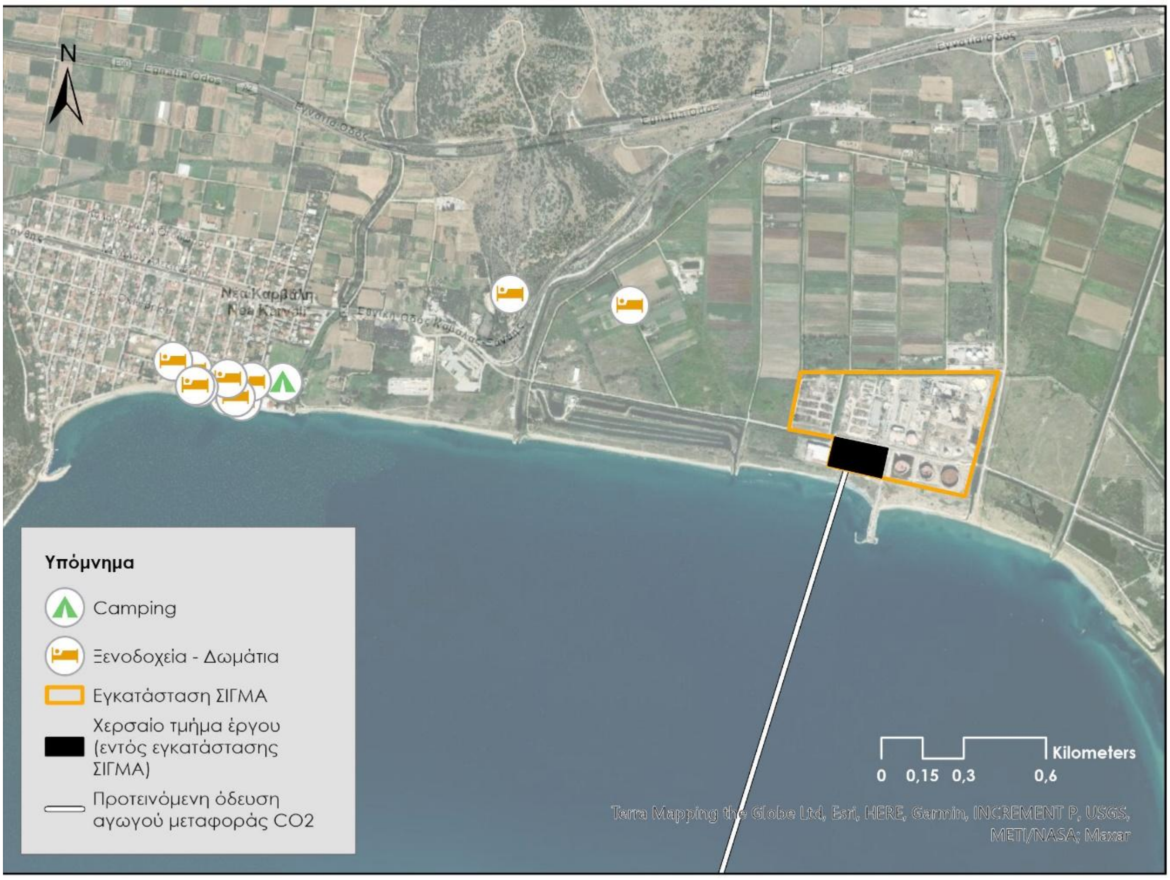


Figure 10-9. Tourist accommodation near the area where the Project's onshore construction works will take place

(Source: https://www.booking.com/, own processing by the study team)

The **table** below shows the distance between the closest tourist accommodation and the areas where construction works will take place (both onshore and offshore).

Table 16 - Distance between the nearest tourist accommodation and the areas where construction works will take place

Type of accommodation	Areas where construction works will take place	Distance (km)
1 Hotel	SIGMA Facilities	0.7
Rented rooms	SIGMA Facilities	1
Camping Facilities	SIGMA Facilities	2
1 Hotel	Exedra B	6.8
Camping Facilities	Exedra B	7

Considering the distance from the construction sites and the impact assessment for air emissions and noise, the secondary potential impact from the construction works in the onshore area are assessed as negative, negligible in intensity, localised, short-term, temporary, of short-term reversibility, non-synergistic, indirect, intermittent, immediately reversible, and non-cumulative. In the Final Evaluation, these impacts are assessed as **Minor.**

However, given the very limited number of businesses located nearby, the above-mentioned impacts are not expected to cause any noticeable negative effects on the tourism sector in the area.

In any case, the proposed mitigation measures described in **Chapter 11**, which will ensure the minimisation of anticipated negative impacts from noise and air pollutant emissions, in combination with the implementation of the **Stakeholder Engagement Plan**—including the establishment of a Grievance Mechanism (GM) for the lodging of complaints or grievances—will ensure the prevention and mitigation of potential impacts during the construction phase.

In conclusion, during the construction phase, considering the results of the Environmental Impact Assessment of this section of the ESIA, the proposed Project **is not expected to cause significant adverse changes** to the viability of the tourism sector and, consequently, to the communities in the area that depend on this sector.

10.2.5.4.1.3 Other Economic Activities

The construction phase is expected to result in increased demand and economic activity in related sectors of the supply chain, such as suppliers of construction materials, construction companies, equipment suppliers, and service providers, thus stimulating the local economy.

The increased employment during the construction phase will also have a corresponding impact on local businesses. The supply of goods and services to support workers' daily needs from the local market is expected to boost economic activity and increase revenues for local enterprises.

As part of the implementation of the Project, structural and construction materials from the local market will be required (e.g., concrete, aggregates, etc.), as well as construction equipment (e.g., cranes, bulldozers, scaffolding, etc.), and goods and services to support workers' daily needs (e.g., food products, accommodation services, etc.).

Therefore, the impact on economic activities in the area—other than fisheries/aquaculture and tourism—from the construction phase of the proposed Project is assessed as **Positive.**

10.2.5.4.1.4 Employment and Workforce

During the construction phase, employment is expected to increase, as local contractors will be hired to contribute to the construction works, thereby supporting the local economy. Specifically, the types of workers likely to be employed during the construction phase of the proposed Project include engineers, geologists/geophysicists, surveyors, consultants, machine operators, technicians, drivers, material handlers, security personnel, labourers, etc. It is also worth noting that workers involved in the construction of the CO_2 Storage Facility may acquire valuable skills and experience that are transferable to other projects or sectors, potentially leading to long-term employment opportunities. Accordingly, the impact on employment and the workforce is assessed as Positive.

Additionally, as previously mentioned, the construction phase stimulates demand in related supply chain sectors, such as manufacturing, transport, and services. Suppliers of structural and construction materials, machinery, and other necessary equipment experience increased activity, contributing positively to employment and overall economic growth in the Regional Unit of Kavala.

The need for legal, financial, and consulting services during the design and construction phases also contributes to employment in these sectors.

In total, it is estimated that more than 200 people (both direct and indirect employment) will be engaged in the drilling and construction activities (engineers, HSE advisors, logistics supervisors, coordinators, base port crew, drilling unit crew, process monitoring personnel, etc.). Additional personnel will be employed through local subcontractors (general labourers, welders, metalworkers, ground crew, etc.), as well as for services related to equipment and facility rentals (cranes, bulldozers, scaffolding, etc.), logistics services, port and transport services, etc.

The increased employment and economic activity during the construction phase will have a corresponding impact on local businesses such as retail trade, hospitality services, etc. The employment and income generated in the local economy as a result of consumption by directly and indirectly employed workers can therefore lead to additional job creation in related sectors.

Depending on the needs and orientation of the local community, additional sources of growth, employment, and income are expected to be created. Based on international experience, as well as the experience from the company's operations to date in Kavala, for every direct job created, approximately three additional jobs are generated in a local community hosting facilities similar to those of the proposed Project, which include offshore infrastructure.

Based on the above, the overall impact on employment and the workforce from the construction phase of the proposed Project is assessed as **Positive**.

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Construction of onshore facilities – Emissions, air pollutants and noise	Tourism	-	1	2	3	1	1	1	1	1	1	1	17	Negligible	High	Minor

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Mobilization / engagement (recruitment, employment, engagement) of workforce	Other economic activities	+	4	2	4	2	2	1	1	4	3	1	34	Positive	High	Positive
Supply chain and procurement issues of required construction materials, resources, and services related to the implementation of the project	Other economic activities	+	8	2	4	2	2	1	4	4	3	1	49	Positive	High	Positive
Mobilization / engagement (recruitment, employment, engagement) of workforce	Employment and workforce	+	8	2	4	2	2	1	4	4	3	1	49	Positive	High	Positive
Supply chain and procurement issues of required construction materials, resources, and services related to the implementation of the project	Employment and workforce	+	8	2	4	2	2	1	4	4	3	1	49	Positive	High	Positive

10.2.5.4.2Operational Phase

10.2.5.4.2.1 Fisheries / Aquaculture

Regarding the exclusion zone, as in the construction phase, it overlaps with the existing one, is mostly located in areas already subject to restrictions due to the offshore hydrocarbon extraction activities at Prinos and constitutes a small part of the total marine area. Therefore, it is not expected to significantly affect the use of the Aquaculture Spatial Planning Area (ASPA) or restrict the sustainable use of marine resources in fishing areas for fishermen.

According to the **Special Ecological Assessment Study (SEAS)** and **Chapter 10.2.4** of the ESIA, the impact on fish fauna is expected to be localised, mainly in the vicinity of Platforms Beta and Delta (where special fishing restrictions are already in place), and for this reason is assessed as Minor, considering that fish are expected to move to areas with lower disturbance. Therefore, fishing activities are not expected to be negatively affected. On the contrary, the establishment of exclusion zones is expected to have a positive impact on marine fauna. Specifically, these protected areas from fishing and other human activities offer safe havens for reproduction and development, as well as a reduction of stress for fish species, enhancing fish stocks in the sea and creating secondary **positive** effects for fisheries.

In conclusion, during the operational phase, the proposed Project **is not expected to cause adverse changes to the fisheries and aquaculture sectors** and, consequently, to the communities in the area that depend on them. On the contrary, positive secondary effects are expected in terms of fish availability for commercial fishing. Accordingly, in the Final Evaluation, the impacts are assessed as **Positive**.

10.2.5.4.2.2 Tourism

The access exclusion zones cover a small part of the total marine area and overlap with existing ones. They are mostly located in areas where restrictions are already in place due to the existing offshore hydrocarbon extraction facilities at Prinos and therefore **are not expected to limit tourist activities** (e.g., water sports, diving, underwater excursions, yachting, etc.).

As stated in **Chapter 10.2.9 "Impacts on Water",** potential impacts during the operational phase on water quality are solely associated with offshore facilities (excluding the offshore CO_2 transport pipeline) and are assessed as localised, short-term, immediately reversible, and overall **Minor.**

Taking into account the impact assessment for water, as well as the distance between the facilities and the bathing beaches, the secondary potential impacts on tourism are assessed as negative, negligible in intensity, localised, short-term, temporary, of short-term reversibility, non-synergistic, indirect, intermittent, immediately reversible, and non-cumulative. In the Final Evaluation, these impacts are assessed as **Minor**.

The Waste Management Plan and the proposed mitigation measures described in **Chapter 11**—which ensure the minimisation of expected adverse impacts—combined with the implementation of the **Stakeholder Engagement Plan**, including the establishment of a **Grievance Mechanism (GM)** for managing complaints or concerns, will safeguard against potential impacts during the operational phase.

Similar to the construction phase, the operation of the proposed Project may result in noise and air pollution, affecting the overall experience of tourists. Considering the location of the nearest accommodation facilities, secondary impacts may arise from air emissions and noise during the CO_2 reception process. As stated in **Chapter 10.2.6 "Impacts on Air Quality"** of this ESIA, emissions from CO_2 reception are estimated to be relatively limited but non-negligible and are assessed as Minor in the Final Evaluation. According to the **noise and vibration** assessment presented in Chapter 10.2.7, expected noise emissions from CO_2 reception are also assessed as **Minor**.

Considering the impact assessment for air emissions and noise, the secondary potential impacts from CO_2 reception in the onshore area are assessed as negative, negligible in intensity, localised, short-term, temporary, of short-term reversibility, non-synergistic, indirect, intermittent, immediately reversible, and non-cumulative. In the Final Evaluation, these impacts are also assessed as **Minor**.

However, given the very limited number of businesses in the nearby area, **the above-mentioned impacts are not expected to result in noticeable adverse effects on the tourism sector** of the region.

In any case, the mitigation measures proposed in **Chapter 11**, which will ensure the minimisation of expected negative impacts from noise and air emissions, in combination with the implementation of the **Stakeholder Engagement Plan**—including the **Grievance Mechanism**, will ensure the prevention and mitigation of potential impacts during the operational phase.

In conclusion, during the operational phase, and considering the results of the environmental impact assessment of this EIA section, the proposed Project **is not expected to cause significant adverse changes** to the viability of the tourism sector and, consequently, to the communities in the area that depend on it.

10.2.5.4.2.3 Other Economic Activities

The operational phase will continue to support demand in various sectors of the supply chain such as manufacturing, transportation, and services.

The presence of a permanent workforce is also expected to contribute to the local economy through spending on housing, food, transport, and other services.

Therefore, the impact on economic activities in the area—other than fisheries/aquaculture and tourism—during the operational phase of the proposed Project is assessed as **Positive**.

10.2.5.4.2.4 Employment and Workforce

The operation of the proposed Project requires a permanent workforce to manage daily operations, including plant operators, maintenance technicians, engineers, specialised safety personnel, administrative staff, etc. The employment positions during the operational phase—mainly technical and administrative staff of EnEarth—exceed 45, are stable and long-term, and often require specialised skills. Additionally, Energean will provide technical support to EnEarth through its own personnel, which will continue to be employed at the existing facilities.

The operational phase will continue to support employment in various sectors of the supply chain such as manufacturing, transportation, and services.

The contribution to the local economy by the permanent workforce, through expenditures on housing, food, transportation, and other services, can lead to the creation of additional jobs in local businesses.

Overall, the impact on employment and the workforce from the operational phase of the proposed Project is assessed as **Positive**.

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Marine traffic – Establishment of exclusion zones due to project operation.	Fishing / Aquaculture – local fish populations	+	2	2	2	3	3	2	1	4	2	4	31	Positive	High	Positive
Project operation – Offshore installations (excluding the offshore CO_2 transport pipeline)	Tourism	-	1	2	3	1	1	1	1	1	1	1	17	Negligible	High	Minor
Air pollutant and noise emissions during CO_2 delivery	Tourism	-	1	2	3	1	1	1	1	1	1	1	17	Negligible	High	Minor
Mobilization / Engagement (recruitment, employment, engagement) of workforce	Other economic activities	+	4	2	4	3	3	1	1	4	4	1	37	Positive	High	Positive
Supply chain and procurement issues of required materials, resources, and services related to project operation	Other economic activities	+	8	2	4	3	3	1	4	4	4	1	52	Positive	High	Positive
Mobilization / Engagement (recruitment, employment, engagement) of workforce	Employment and workforce	+	8	2	4	3	3	1	4	4	4	1	52	Positive	High	Positive
Supply chain and procurement issues of required materials, resources, and services related to project operation	Employment and workforce	+	4	2	4	3	3	1	4	4	4	1	40	Positive	High	Positive

10.2.5.4.3 Decommissioning / Cessation of Operations Phase

10.2.5.4.3.1 Fisheries / Aquaculture

As in the construction phase, the exclusion zone represents a small portion of the total marine area and does not restrict the sustainable use of marine resources.

ΣAccording to the Special Ecological Assessment Study (SEAS) and Chapter 10.2.4 of the ESIA, no changes are expected that could negatively affect fisheries. Impacts on marine fauna are confined within a 500 m buffer zone around the existing infrastructure (where special fishing restrictions are already in place for most of this area) due to turbidity and noise associated with the decommissioning and removal works of the pipeline. As the impact is localised, at a short distance from the decommissioning works, there will be no impact on fishing activities that occur beyond 500 m from the works.

Furthermore, the establishment of exclusion zones during the offshore pipeline decommissioning works—particularly through the restriction of fishing vessels and suspension of fishing within these zones—is expected to have **positive effects** on marine fauna. Specifically, the suspension of fishing activities in the exclusion zones may lead to a local increase in fish stocks and thus generate **positive outcomes** for fisheries.

The reduction in fishing pressure will allow for the restoration of fish populations, enhancing their reproduction and development. Additionally, the creation of these protected zones will promote increased biodiversity and improve the structure of marine ecosystems.

In conclusion, the impacts on fisheries and aquaculture during the decommissioning phase are overall assessed as **Positive.**

10.2.5.4.3.2 Tourism

The access exclusion zones overlap with existing ones and are mostly located in areas already subject to restrictions due to the offshore hydrocarbon extraction project at Prinos. They are confined to a small part of the total marine area and **are therefore not expected to limit tourism-related activities** (e.g., water sports, diving, underwater tours, yachting, etc.).

As stated in **Chapter 10.2.9 "Impacts on Water"**, the potential impacts of the decommissioning phase on water quality—which could affect the attractiveness of bathing areas—are assessed as short-term reversible, immediately restorable, and overall **acceptable**. Therefore, significant negative secondary impacts on tourism or reduced income in this productive sector are not expected.

The decommissioning of the proposed Project may cause noise and air pollution, affecting the overall tourist experience. Considering the location of the nearest accommodations, secondary impacts may arise from air pollutant emissions and noise during the dismantling of onshore facilities and restoration of the onshore project area. As stated in **Chapter 10.2.6 "Air Quality Impacts" and Chapter 10.2.7 "Noise and Vibration Impacts"** of this Study, the expected emissions of air pollutants and noise during the dismantling and restoration works are estimated to be limited and Minor in the Final Evaluation.

Considering the assessment of air emissions and noise, the secondary potential impacts are assessed as negative, of negligible intensity, localised, short-term, of temporary duration, with short-term reversibility, non-synergistic, indirect, intermittent, immediately reversible, and non-cumulative. In the Final Evaluation, these impacts are assessed as **Minor.**

However, given the very limited number of businesses in close proximity, the above-mentioned impacts are not expected to result in noticeable negative effects on the local tourism sector.

In any case, the mitigation measures described in Chapter 11 aim to minimise the expected adverse impacts from noise and air emissions—combined with the implementation of the Stakeholder Engagement Plan, including the establishment of a **Grievance Mechanism (GM)** to handle complaints or concerns, will ensure the prevention and mitigation of potential impacts during the decommissioning phase.

In conclusion, during the decommissioning / cessation of operations phase, and considering the results of the environmental impact assessment in this section of the ESIA, the proposed Project **is not expected to bring about significant adverse changes** to the viability of the tourism sector or to the communities in the area that rely on it.

10.2.5.4.3.3 Other Economic Activities

The decommissioning phase is expected to lead to increased economic activity similar to that of the construction phase. An economic boost is expected in relevant sectors of the supply chain such as construction companies, equipment suppliers, logistics providers, underwater operations contractors, waste management and recycling companies, etc.

Increased employment will have a positive impact on local businesses. The procurement of goods and services to support the workforce from the local market is expected to lead to increased economic activity and higher revenues for local enterprises.

Therefore, the impact on economic activities in the area—other than fisheries/aquaculture and tourism—during the decommissioning phase of the proposed Project is assessed as **Positive.**

10.2.5.4.3.4 Employment and Workforce

During the decommissioning phase, specialised personnel will be required, such as engineers, equipment operators, technicians, drivers, safety personnel, laborers, etc.

The decommissioning phase is also expected to boost demand for businesses providing support services, such as waste management and transport.

The increased activity during the decommissioning phase may further benefit local businesses providing goods and services to workers, such as accommodation, food, and retail.

Accordingly, **positive** impacts are expected on employment and the local economy during the decommissioning phase.

However, after the completion of the decommissioning phase, the existing workforce will need to seek alternative employment. The significance of this impact is assessed as Negative, moderate intensity, local, direct, short-lived, of short-term reversibility, irregular, non-cumulative, and non-synergistic. In the Final Evaluation, these impacts are assessed as **Moderate.** Therefore, within the scope of this ESIA, prevention / mitigation / response measures are proposed to reduce these impacts to at least Minor. Following the implementation of the relevant measures outlined in **Chapter 11**, residual impacts are ultimately assessed as **Minor**, and the Project is therefore deemed compatible with the environmental protection objectives required by this Study.

Mitigation measures to address this impact include internal redeployment (identifying other projects within the company where the affected employees' skills can be utilised), cross-training (offering training programmes to equip employees with skills for other positions within the company or sector), and outplacement services (providing job search assistance in collaboration with recruitment agencies, offering resume writing support, interview coaching, etc., to enhance employment opportunities). A key mitigation measure is the implementation of the Stakeholder Engagement Plan, to foster open and transparent communication with stakeholders regarding the decommissioning process, timelines, and potential impacts. Regular updates and meetings with employees and community members can help manage expectations, build trust, and mitigate potential adverse impacts.

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation	Final Residual Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)				
Cessation of Operation / Decommissioning of offshore installations (excluding the offshore CO_2 transport pipeline) Marine traffic – Establishment of exclusion zones due to the implementation of the decommissioning works of offshore installations.	Fishing / Aquaculture	+	2	2	2	2	1	2	1	2	1	4	25	Positive	High	Positive	Positive
Atmospheric emissions and noise during dismantling of onshore installations – restoration of the onshore project area	Tourism	-	1	2	3	1	1	1	1	1	1	1	17	Negligible	High	Minor	Minor
Mobilization / Engagement (recruitment, employment, engagement) of workforce	Other economic activities	+	4	2	4	1	1	1	1	4	2	1	31	Positive	HIgh	Positive	Positive
Supply chain and procurement issues of required materials, resources, and services related to the cessation of	Other economic activities	+	8	4	4	1	1	1	4	4	2	1	50	Positive	High	Positive	Positive

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation	Final Residual Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)				
operation / decommissioning of the project.																	
Decommissioning: Mobilization / Engagement (recruitment, employment, engagement) of workforce	Employment and workforce	+	4	2	4	1	1	1	4	4	2	1	34	Positive	High	Positive	Positive
Decommissioning: Supply chain and procurement issues of required construction materials, resources and services related to the implementation of the project.	Employment and workforce	+	8	2	4	1	1	1	4	4	2	1	46	Positive	High	Positive	Positive
Cessation of Operation: Interruption of workforce activities	Employment and workforce	-	4	2	4	2	1	1	4	1	2	1	32	Minor	High	Moderate	Minor

10.2.5.5 Health and Safety

10.2.5.5.1 Construction Phase

10.2.5.5.1.1 Occupational Health and Safety (OHS)

Achieving a safe and healthy working environment constitutes a key aspect of socio-economic well-being and progress in a modern and well-governed society, while also contributing decisively to the promotion of economic growth and employment, through the assurance of quality and productivity at work.

The risk of injuries during construction activities is possible and arises, among others, from the presence of construction machinery and equipment (indicatively: cranes, bulldozers, scaffolding, etc.), working at heights, emissions of dust, potentially high levels of noise, etc.

Greek legislation on OHS is fully harmonized with the relevant EU framework, through the transposition of both the Framework Directive 89/391/EEC and the specific Directives deriving from it. The core of the relevant legal framework in Greece, which includes a multitude of individual pieces of legislation (mainly in the form of Presidential Decrees) for general and specific occupational hazards or workplaces, is the Code of Laws on Occupational Health and Safety (CLOHS) ratified by Article One of Law 3850/2010 (Government Gazette A' 84), in which, among others, the legal principle of the employer's sole responsibility is established, and the basic obligations of employers and employees are described, along with the relevant institutional bodies for protection and prevention services (safety technician, occupational physician, Committee for Health & Safety of Workers, etc.).

The Project Developer must, among other things, have in place a Health and Safety Plan (HSP), which constitutes a legal obligation (Presidential Decree 305/1996, Article 3), and covers all construction activities. The HSP is a comprehensive study that includes the measures that must be taken, as well as all other elements that must be implemented in order to improve working conditions and prevent occupational accidents and diseases. Among other things, the HSP describes and clarifies the rules to be applied in the work areas, as well as specific measures for activities involving particular safety and health risks for workers, according to Annex II of Article 12 of P.D. 305/1996. The HSP also incorporates risk prevention in all phases of the Project and includes the Occupational Risk Assessment (ORA), the potential risks of each task, and the proposed measures for preventing or controlling those risks.

The ORA is conducted by a qualified individual, such as the safety technician, and must include:

- Identification and documentation of existing occupational health and safety risks as well as those that may emerge. (Indicatively mentioned: risks from machinery and equipment, fire hazards, electric shock, explosion, falls, risks from exposure to harmful agents [physical, chemical, biological], risks from work organization, violence and harassment at work, psychosocial risks).
- Qualitative and, where necessary, quantitative determination of the harmful agents (physical, chemical, biological).
- Preventive measures are already in place and/or proposed to be taken for risk control and worker protection.

A Health and Safety File (HSF) must also be developed in compliance with national legislation (P.D. 305/1996, Article 3), and in accordance with the best practices such as PR4 of the EBRD, which compiles all elements of the HSP. It includes the Project Log, guidelines, and useful information on OHS matters that must be considered during any future work throughout the lifecycle of the project.

Both the HSP and HSF must be updated in accordance with the progress of the works and, in any case, must contain accurate and up-to-date information. The appointment of a Health and Safety Coordinator is a legal obligation (P.D. 305/1996, Article 3) for any construction site where multiple crews are working simultaneously. The Health and Safety Coordinator coordinates the activities of the project participants in order to integrate the General Principles of Accident Prevention in all phases of the project and provides services in line with applicable legislation, specifically P.D. 305/1996. The Health and Safety Coordinator is responsible for revising the HSP and HSF during the project's execution.

The employment of a Safety Technician is also legally mandatory (Law 3850/2010, Article 8) for all companies involved in technical/construction projects. The Safety Technician is one of the key actors in improving working conditions in the project and provides their services according to the provisions of the legislation, specifically P.D. 17/1996 and P.D. 294/1988, as codified by Law 3850/2010.

In the context of supervising and improving working conditions:

- The Safety Technician regularly inspects workplaces with respect to occupational health and safety and reports to the employer any omission of health and safety measures. Upon identifying any omission, they propose corrective measures and supervise the implementation of those measures.
- The Safety Technician must supervise the correct use of personal protective equipment.
- They are obliged to investigate the causes of work-related accidents, analyze and evaluate the results of their investigations, and propose measures to prevent similar accidents, which are recorded in the special log of the Safety Technician's suggestions kept by the company.
- The Safety Technician exercises supervisory roles during fire drills and emergency exercises conducted in the company to assess readiness in case of accidents.
- They inform and guide employees in the prevention of occupational hazards associated with their work and ensure compliance with health and safety rules within the company.
- The Safety Technician participates in the design and implementation of training programs for employees on health and safety issues.
- The Safety Technician must cooperate with the Occupational Physician by conducting joint inspections of the work areas.
- The Safety Technician is obligated to maintain business confidentiality.

The Occupational Physician is another institutional role established by law for monitoring the health of workers (Law 3850/2010 as amended by Law 4808/2021). Their duties are advisory, and they provide recommendations and guidance to the employer, employees, and their representatives regarding measures that should be taken for the physical and mental health of workers.

In the context of health supervision:

- The Occupational Physician conducts medical assessments of workers related to their job position, ensures the conduct of medical examinations and environmental measurements of the workplace, maintains a medical file for each worker, and issues a certificate of fitness for the specific work.
- The Occupational Physician supervises the implementation of worker health protection measures, regularly inspects work areas, and proposes corrective actions when deficiencies are observed, while explaining the importance of proper use of personal protective equipment.
- In line with their duties, they investigate the causes of occupational diseases, analyze and evaluate their findings, and propose preventive measures. The Occupational Physician notifies, through the company, the Labour Inspectorate of any work-related illnesses.
- Regarding compliance with health and safety rules, the Occupational Physician is responsible for informing employees about the risks associated with their work and prevention methods, including risks of violence and harassment, including sexual harassment.

- If the company lacks the appropriate infrastructure, they are obliged to refer workers for specific supplementary medical examinations, at the employer's expense, to private entities or competent units of insurance bodies or the National Health System (NHS).
- In the event of an accident, violence, or sudden illness, they provide emergency care and conduct vaccination programs for employees under the direction of the regional public health authority.
- The Occupational Physician is required to maintain medical and business confidentiality.
- The Occupational Physician must cooperate with the Safety Technician by conducting joint inspections of work areas.

With respect to the prevention and management of violence and harassment in the workplace (including gender-based violence and harassment), Greece has adopted a multifaceted approach that includes a strong legislative framework, institutional mechanisms, reporting and support mechanisms, as well as awareness-raising actions to promote a culture of zero tolerance.

According to the law, every employer, regardless of the number of employees, as well as those who exercise managerial authority or represent the employer, are obliged to take specific measures for the prevention and management of violence and harassment at work, to demonstrate zero tolerance for such incidents or behaviors when receiving and handling relevant complaints, and to provide accessible forms of information and training on risks, prevention, protection, and the obligations of involved parties (Articles 5–8, Law 4808/2021). For private sector companies employing more than twenty (20) people, the obligations of Articles 9, 10, and 11 of Law 4808/2021 also apply, including the adoption of policies for the prevention and combating of workplace violence and harassment, as well as for the internal management of related complaints, in accordance with Ministerial Decision 82063/2021 (Government Gazette B' 5059/01-11-2021), which includes a sample policy template. In case of violation by the employer of Articles 5 to 11 of Part II of Law 4808/2021, either through onsite inspection or labour dispute, the Labour Inspectors for Occupational Health and Safety or the Labour Relations Inspectors impose the administrative penalties provided for in Ministerial Decision 80016/2022 (Government Gazette B' 4629/01-09-2022).

The existing institutional mechanisms include the Labour Inspectorate (SEPE), responsible for monitoring and enforcing all labour laws, and the Ombudsman, responsible for handling complaints concerning discrimination and harassment in the workplace and providing additional avenues for redress.

It is also noted that construction activities must be carried out in accordance with national legislation, including the laws applicable to the specific sector of economic activity, such as Presidential Decree 778/1980 (as amended and in force) on safety measures during building construction works, Presidential Decree 1073/1981 (as amended and in force) on safety measures in construction sites of buildings and any type of civil engineering works, Law 4144/1983 (as amended and in force) on addressing violations in Social Security and the labour market, and Ministerial Decision 130646/1996 on the safety measures logbook.

EnEarth is part of the Energean Group. Energean implements a "Health & Safety Management System" through which relevant indicators are systematically monitored so that any necessary corrective actions are taken. These indicators include, among others, man-hours worked, the number and frequency of accidents.

Indicatively, 0.47 lost time hours per 1 million man-hours due to workplace accidents have been recorded, while specifically in Greece, the facilities in Prinos and Nea Karvali, as well as the Athens offices, are certified according to ISO 45001, the first global international standard for occupational health and safety.

In 2022, more than 650 drills were conducted, and nearly 14,000 hours of training were offered to employees and contractors across the Energean Group. In 2023, focused on the World Day for Safety and Health at Work (celebrated internationally on April 28), we carried out a series of innovative and critical training courses for the safety sector in workplaces such as the offshore complex of Prinos and the onshore facilities in Nea Karvali.

Specifically, 68 employees at the onshore and offshore facilities in Kavala were trained and certified in safe working at height and height rescue techniques in collaboration with Active Point, one of the most specialized companies in Greece and abroad in training staff and workers for such activities.

Additionally, 48 employees were trained and certified in confined space work and rescue techniques in collaboration with Dräger, one of the most established companies in the field of safety solutions and services globally. Notably, the Fire Department of Kavala and Energean contractors in Kavala were also invited and participated with staff and observers in this training.

The Energean Group also implements a "Stop Work Policy" whereby any individual, regardless of position, seniority, or specialty, has the right and duty to issue a "Stop Work Order" whenever any person, asset, or environment is at risk. A "Code of Ethics" is also implemented, which is linked to various policies such as the "Health, Safety, Environmental & Social Responsibility Policy", the "Equal Opportunities Policy", the "Diversity and Inclusion Policy", to ensure the avoidance of discrimination, violence, exclusion, or harassment.

Finally, considering standards set by European and National legislation and the nature of work for personnel in the subject project, measures such as frequent and regular breaks during each shift have been foreseen.

With full implementation of the legal provisions, the significance of the impact is assessed as negative, of negligible magnitude, in the project area, temporary, short-term reversibility, irregular, non-cumulative, and non-synergistic. In terms of the Final Evaluation, the said impact is assessed as **Minor.**

With the implementation of the above-mentioned policies, i**t is estimated that there will be no adverse effects** on occupational health and safety.

10.2.5.5.1.2 Public Health

Modern perceptions and approaches to Public Health consistently focus on the determinants of health and the 17 Sustainable Development Goals (SDGs) of the United Nations (UN). The determinants of health and well-being can be classified into the following categories:

- Socioeconomic and Demographic Determinants (employment/unemployment, income, gender, age, education, living conditions, etc.).

- Environmental Determinants (natural and built environment, access to clean water, air and soil quality, noise levels, etc.).
- Health Services (quality, accessibility, overall health expenditures, etc.).
- Behavioral Determinants (nutrition, physical activity, substance use, psychological factors, health literacy, etc.).
- Genetic Determinants (heredity plays a role in determining life expectancy, health status, and the likelihood of developing certain diseases).

Taking into account the findings of the environmental impact assessment of the current section of the Environmental Impact Study (EIS), the correlation with the above health determinants is evaluated. The term **"correlation"** refers to the potential for a health determinant to be affected by the impacts, as assessed in this study, and therefore, the potential triggering of secondary health impacts. Determinants assessed as **not being connected** to the proposed Project will **not be evaluated** in the following sections. The correlation assessment is presented in the table below:

Πίνακας 10-1: Συσχέτιση μεταξύ του έργου και των προσδιοριστών υγείας

Health Determinant	Correlation
Environmental Determinants	
Air quality	Uncertain correlation
Water quality	Uncertain correlation
Soil quality	Uncertain correlation
Acoustic environment quality	Uncertain correlation
Ecological elements	Uncertain correlation
Demographic Determinants	
Demographic indicators (permanent population, age distribution, life expectancy/aging)	No correlation
Socio-economic Determinants	
Income from productive sectors	Uncertain correlation
Employment	Uncertain correlation
Education	Unclear correlation
Behavioral Determinants	
Smoking	No correlation
Dietary habits	No correlation
Alcohol consumption	No correlation
Physical activity	No correlation
Εγγραμματοσύνη υγείας	No correlation
Health Services	
Health expenditures	Unclear correlation

Health Determinant	Correlation
Population coverage for health care	No correlation
Number of hospital beds	No correlation
Number of doctors/nursing staff	No correlation
Genetic determinants	No correlation

Each health determinant can be associated with potential hazards and possible health outcomes. The pathway of potential health outcomes followed for each selected health determinant (either with a certain or uncertain correlation), in cases **of uncontrolled exposure to potential hazards,** is described in the following **Figures.**

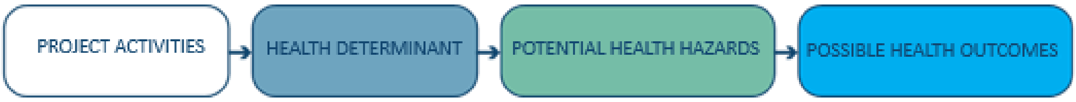


Figure10-10. Pathway — project activity / possible health outcomes

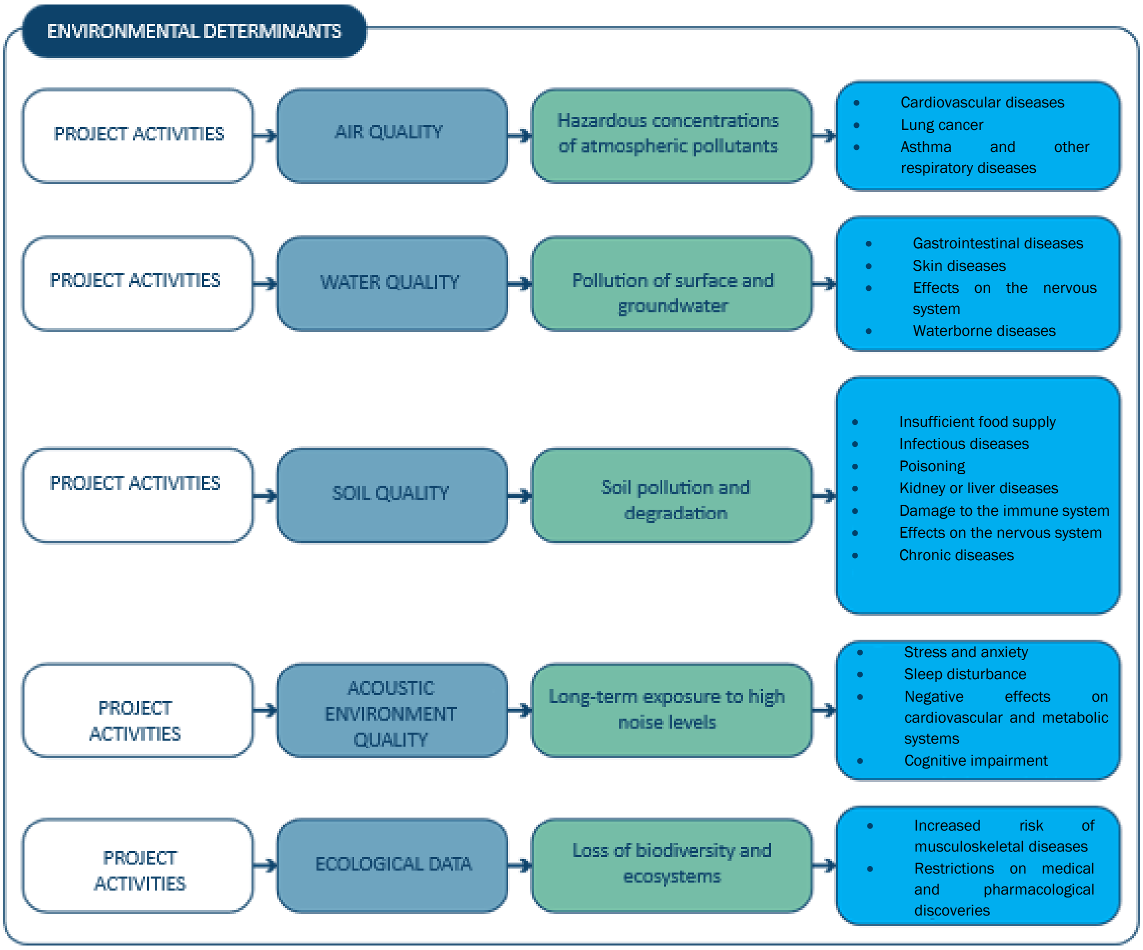


Figure 10-11. Pathway for Environmental Determinants

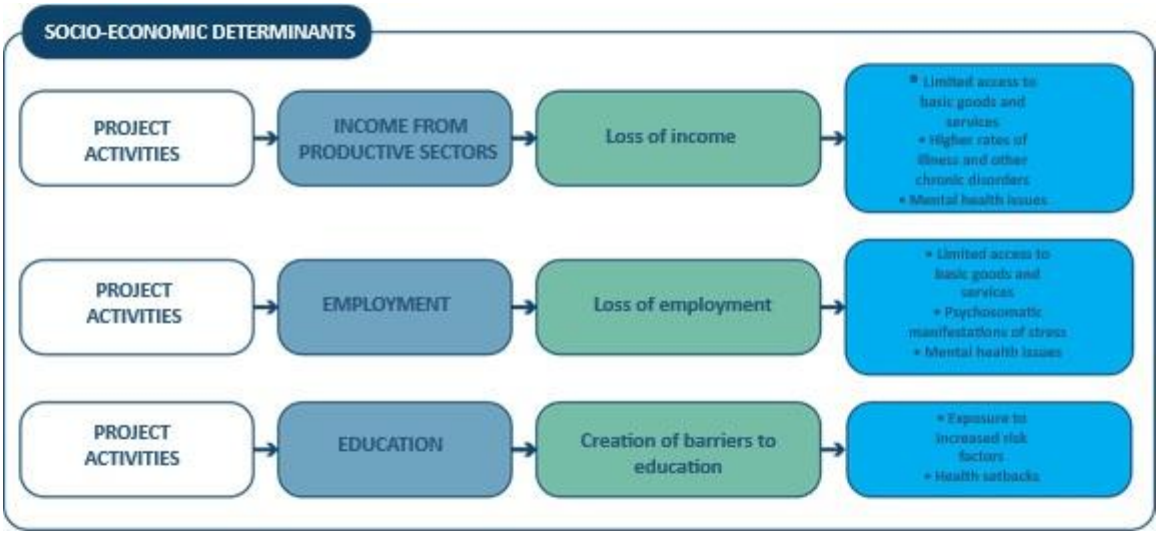


Figure 10–12: Pathway for Socio-Economic Determinants

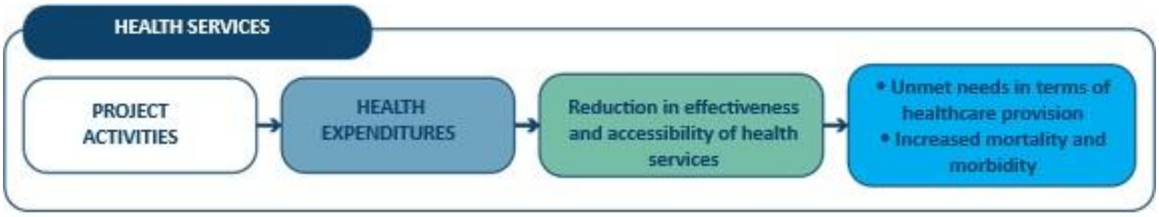


Figure 10–13: Pathway for Behavioral Risk Factors

The following **sections** examine the extent to which project activities, as defined in the Environmental and Social Scoping of the EIA (**Chapter 9**), may lead to the aforementioned potential health hazards/outcomes.

A summary of the results of the impact assessment on the selected health determinants according to the ESIA is presented below

- Air quality impacts from the construction phase activities were assessed as negative, of low to medium intensity, local in extent, short-term in duration, and overall negligible. Consequently, exceedances of the thresholds set by Greek legislation and the specifications of international organizations are not expected. In conclusion, hazardous concentrations of air pollutants that could cause significant adverse effects on public health are not anticipated.
- Water quality impacts from construction activities were assessed as negative, of low to medium intensity, local in extent, short-term in duration, and overall minor. In conclusion, no pollution of surface or groundwater is expected that could result in significant adverse effects on public health.
- Soil quality impacts during the construction phase were assessed as negative, of negligible to low intensity, limited extent, short duration, and overall negligible to minor. Therefore, degradation of soil

quality that could result in significant adverse effects on public health is not expected during the construction phase.

- Noise impacts from construction activities were assessed as negative, of low to moderate intensity, local extent, short-term, and overall minor. Therefore, long-term exposure to high noise levels that could have adverse public health effects is not expected.
- Impacts on the natural biotic environment during construction were assessed as negative, of negligible to low intensity, local extent, temporary in duration, and overall negligible to moderate. For those impacts assessed as moderate, after implementation of the mitigation measures proposed in Chapter 11, residual impacts are ultimately assessed as minor. In conclusion, no loss of biodiversity or ecosystems is expected that could lead to secondary effects on public health.
- Impacts on productive economic sectors of the area during construction are not expected to result in significant disruptions to fisheries, aquaculture, or tourism that would cause loss of income. On the contrary, the increase in local economic activity due to the project is expected to lead to increased income for parts of the local population. In conclusion, the impact of the project on this health determinant is assessed as positive.
- Activities during construction are also expected to have a positive impact on employment, and therefore the effect on this health determinant is considered positive.
- Regarding education and health expenditures, it is noted that implementation of the proposed project will trigger Corporate Social Responsibility (CSR) actions, in consultation with local authorities and based on the assessment of local needs (investments in education, health, etc.), which may result in positive effects on these specific determinants.
  It should also be noted that the overall project may serve as an opportunity for academic institutions in the region to propose or participate in new research programs, as has occurred in the past in Kavala, where institutions have actively collaborated with the hydrocarbon exploitation company.
  Opportunities could also arise for student internships, lifelong learning initiatives, laboratory equipment provision, scholarships, etc., which would positively affect the education-related health determinant

Based on the above, <u>during the construction phase, environmental health determinants are not expected to be affected in ways that could lead to adverse public health effects. Socio-economic determinants will be positively affected, and there may be a marginal positive effect on health expenditure. Therefore, the overall impact on public health during the construction phase of the proposed project is assessed as **Positive.**</u>

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Construction works	Occupational health and safety	-	1	1	4	1	1	1	4	1	1	1	19	Negligible	High	Minor

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Construction activities	Public Health	+	2	2	2	2	1	1	1	4	2	1	24	Positive	High	Positive

10.2.5.5.2 Operational Phase

10.2.5.5.2.1 Occupational Health and Safety

The risk of occupational injuries during the operational phase of the Project is considered possible and may arise from the handling of chemicals, maintenance work, or work at heights.

With the full implementation of legal provisions, the significance of the impact is assessed as negative, of negligible intensity, within the Project area, temporary, with short-term reversibility, irregular, non-cumulative, and non-synergistic. The Final Impact Assessment classifies the impact as **Minor.**

With the application of the policies outlined above, **no adverse effects on occupational health and safety are expected.**

10.2.5.5.2.2 Public Health

A summary of the ESIA assessment results concerning the selected health determinants is presented below:

- Air quality impacts from operational activities were assessed as negative, of low to medium intensity, local in extent, and of short to long-term duration. Overall, the impacts were assessed as negligible. Therefore, exceedances of the thresholds set by Greek legislation and international standards are not anticipated. In conclusion, hazardous concentrations of atmospheric pollutants that could lead to significant adverse effects on public health are not expected. It is also worth noting that CO_2 storage projects can reduce atmospheric emissions, which may indirectly lead to lower rates of asthma, bronchitis, heart disease, and other respiratory and cardiovascular conditions. Furthermore, reduced CO_2 emissions contribute to mitigating climate change, helping to reduce the frequency of extreme weather events such as heatwaves, which are associated with heatstroke, dehydration, and the exacerbation of chronic illnesses. In summary, the overall impact of the project on this specific health determinant is expected to be positive.
- Water quality impacts during the operational phase were assessed as negative, of negligible to low intensity, local in extent, and overall minor. Consequently, no pollution of surface or groundwater is expected that could lead to significant adverse effects on public health.

- No soil pollution is expected from activities during the operational phase. Therefore, no related adverse public health effects are anticipated.
- Noise impacts during the operation of the Project were assessed as negative, of low to medium intensity, local in extent, and periodic in nature. Overall, the impacts were assessed as minor. Therefore, no long-term exposure to high noise levels is expected that could result in adverse public health effects.
- Impacts on the natural biotic environment from activities during the operational phase are not expected to lead to biodiversity loss or ecosystem degradation. Healthy ecosystems provide services and resources that are essential to human health. The contribution of CO_2 storage projects to climate change mitigation also helps maintain ecosystems and the services they provide. In conclusion, positive effects on public health are anticipated.
- During the operational phase, no significant changes in fisheries, aquaculture, or tourism are expected that could result in income loss. On the contrary, the increased local economic activity resulting from the Project is expected to lead to income growth for part of the community. In conclusion, the impact of the Project on the productive economic sectors of the area and this specific health determinant is expected to be positive.
- Employment impacts from operational activities are positive, and therefore the impact on this specific health determinant is expected to be positive.
- Regarding education and healthcare spending, as in the construction phase (CSR initiatives and opportunities in the education sector), the Project is expected to have positive impacts on these specific determinants. It is also worth noting that CO_2 storage projects, by reducing air pollutant emissions—and therefore reducing pollution-related diseases and climate-related health effects—may lead to a decrease in the overall burden on healthcare systems, potentially reducing healthcare costs and improving individuals' quality of life. In conclusion, the overall impact of the Project on the "healthcare services" determinant—and therefore on public health—is expected to be positive.

Based on the above, during the operational phase of the Project, environmental health determinants are not expected to be affected in ways that could cause adverse effects on public health. On the contrary, **positive impacts** are expected on socio-economic determinants, healthcare costs, and selected environmental determinants. Therefore, the overall public health impact from the operational phase of the proposed Project is assessed as **Positive.**

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Operation works	Occupational health and safety	-	1	1	4	1	1	1	4	1	1	1	19	Negligible	High	Minor

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Operation activities	Public health	+	4	4	2	3	3	1	1	4	4	1	39	Positive	High	Positive

10.2.5.5.3 Decommissioning / Cessation of Operations Phase

10.2.5.5.3.1 Occupational Health and Safety

The risks are similar to those identified during the construction phase.

With the full implementation of the legal provisions, the significance of the impact is assessed as negative, of negligible intensity, within the Project area, temporary, with short-term reversibility, irregular, non-cumulative, and non-synergistic. In terms of its Final Assessment, the impact is rated as **Minor.** With the implementation of the aforementioned policies, no adverse effects on occupational health and safety are expected.

10.2.5.5.3.2 Public Health

A summary of the ESIA findings regarding the selected health determinants is presented below:

- Air quality impacts during the decommissioning/cessation of operations phase were assessed as negative, of negligible to moderate intensity, local in extent, periodic and temporary in duration, and overall Minor. Therefore, exceedances of the thresholds set by Greek legislation and international standards are not expected. In conclusion, hazardous concentrations of atmospheric pollutants that could cause significant adverse effects on public health are not anticipated.
- Water quality impacts from activities during decommissioning/cessation of operations were assessed as positive in relation to the dismantling of the Project and the restoration of the allocated site. Any negative impacts are assessed as being of negligible to low intensity, limited in extent and duration, and overall Minor. In conclusion, no surface or groundwater pollution is expected that could result in significant adverse effects on public health.
- Soil impacts from decommissioning/cessation activities are expected to be positive with respect to the restoration of the Project's land area. Any negative impacts are assessed as limited in intensity, extent, and duration, and overall Negligible to Minor. Therefore, no related adverse effects on public health are anticipated.
- Noise impacts from decommissioning/cessation activities were assessed as positive in terms of the Project's removal and restoration of the terrestrial intervention area. Any negative impacts are assessed as periodic, of limited intensity, extent, and duration, and overall Minor. Therefore, no long-term exposure to high noise levels is expected that could result in adverse public health effects.
- Impacts on the natural biotic environment from decommissioning/cessation activities are not expected to lead to loss of biodiversity or ecosystems that would result in public health impacts.
- Impacts on the productive sectors of the local economy during decommissioning/cessation are not expected to cause significant changes in fishing, aquaculture, or tourism that would lead to income loss. On the contrary, increased local economic activity during the decommissioning phase is expected to lead to increased income for part of the community. In conclusion, the impact of the Project on this specific health determinant is expected to be positive.

- Employment impacts from decommissioning activities are assessed as positive. However, following the completion of the decommissioning phase, the existing workforce will need to seek alternative employment. This impact is assessed as negative, of moderate intensity, local, and of limited duration. Nonetheless, the implementation of measures described in Chapter 11 of the ESIA will minimize the impact, which is ultimately assessed as Minor. Therefore, no significant adverse impact on this health determinant is expected.
- With regard to education and healthcare expenditure, similar to previous phases (Corporate Social Responsibility actions and opportunities in the education sector), the Project is expected to have positive effects on these specific determinants.

Based on the above, during the decommissioning/cessation of operations phase, environmental health determinants are not expected to be affected in ways that could result in adverse effects on public health. Socio-economic determinants are expected to be mostly positively affected, with a potential marginal positive effect overall. Therefore, the overall public health impact from the decommissioning/cessation of operations phase of the proposed Project is assessed as **Positive**.

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Decommissioning works	Occupational health and safety	-	1	1	4	1	1	1	4	1	1	1	19	Negligible	High	Minor
Decommissioning activities	Public health	+	2	2	2	2	1	1	1	4	2	1	24	Positive	High	Positive

10.2.5.6 Impacts on Technical Infrastructure

The following sections assess the likelihood of potential adverse impacts on the technical infrastructure of the area as a result of the construction, operation, and decommissioning/cessation of operations phases of the proposed Project.

10.2.5.6.1 Construction Phase

10.2.5.6.1.1 Maritime Transport / Traffic

The paragraphs below assess the likelihood of potential adverse impacts on the region's maritime transport as a result of implementing the proposed Project.

Based on the Environmental and Social Content Scoping of the ESIA (**Chapter 9**), the Project activities that may impact maritime transport in the area are as follows :

- Offshore CO_2 Transmission Pipeline
  - Maritime traffic – Daily vessel movement for the installation of CO_2 transmission pipelines (including crew transport and support vessel movements).
  - Maritime traffic – Designation of access exclusion zones due to the pipeline installation works (and related activities).
- Offshore installations (excluding the offshore CO_2 transmission pipeline):
  - Maritime traffic – Daily vessel movement for the implementation of drilling operations (including crew transport and support vessel movements).
  - Maritime traffic – Designation of access exclusion zones due to drilling operations.

For the construction of the offshore components of the proposed Project, daily vessel movements will be required for the installation of the CO_2 transmission pipelines and other offshore facilities (including the transportation of personnel and the movements of support vessels). However, it is estimated that the daily vessel traffic will not significantly increase the maritime traffic load of the area, given that, due to the limited volume and the nature of the construction activities, only a small number of construction and support vessels will be required to operate on a daily basis. The vast majority of these activities will take place within the existing maritime traffic restriction zone. Therefore, due to the limited required increase in daily vessel movements for the installation of the CO_2 transmission pipelines and the other offshore facilities, impacts are expected to be characterized as negative, of negligible intensity, local, concurrent with construction works, temporary, short-term reversible, synergistic, of direct effect, continuous, immediately remediable, and non-cumulative. With respect to their final evaluation, these impacts are assessed as **Negligible.**

In addition, regarding maritime traffic, access exclusion zones will be designated due to the installation works of the CO_2 transmission pipelines (and related works/activities), as well as due to the drilling activities. In any case, according to the existing project that has received environmental permitting (Ref. οικ 8413 / 24-04-18, ADA: ΨΓΛ14653Π8-Ζ79, entitled “Approval of Environmental Terms for the Prinos Offshore Development Project”), a 500 m exclusion zone has already been established on either side of the offshore facilities (platforms, submarine pipelines and cables), within which anchoring and all forms of fishing are already prohibited. The designated exclusion zones of the Project will be merged with the existing one, which will be slightly extended; therefore, no significant additional impacts are expected on maritime transport of passenger and commercial vessels, as the area is already restricted due to the existing Prinos activities. Consequently, the impacts on the maritime transport/traffic sector from the maintenance and use of the marine access exclusion zone are characterized as negative, of negligible intensity, local, concurrent with the construction works, temporary, short-term reversible, synergistic, of direct effect, continuous, immediately remediable, and non-cumulative. With respect to their final evaluation, these impacts are assessed as **Negligible**.

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Installation of CO_2 transport pipelines and other offshore facilities (including the transport of personnel and movements of support vessels)	Maritime Transport / Traffic	-	1	2	4	1	1	2	4	4	1	1	25	Minor	Low	Negligible
Maintenance and use of the marine exclusion zone	Maritime Transport / Traffic	-	1	2	4	1	1	2	4	4	1	1	25	Minor	Low	Negligible

10.2.5.6.1.2 Other Transport Infrastructure

The following paragraphs examine the potential occurrence of adverse impacts on the other transport infrastructure in the area as a result of the implementation of the proposed Project.

The activities that cause impacts on the area's land transport infrastructure, as a result of the implementation of the proposed Project and based on the Environmental and Social Scoping Content of the ESIA (**Chapter 9**), are the following:

- Land facilities (CO_2 reception and management infrastructure and equipment, onshore section of the CO_2 pipeline)
    - Movement of heavy vehicles, construction machinery, transport trucks, and support vehicles during the construction phase.
    - Generation, management, and disposal of waste from the construction works of the land facilities of the Project.
    - Traffic – Daily movement of vehicles related to the construction of the land facilities (including the transportation of personnel and the movement of support vehicles)

Regarding the movement on the road network of heavy vehicles, construction machinery, vehicles, and waste transport trucks, a slight increase in traffic load in the wider area is expected due to the implementation of the construction works of the proposed Project (see construction site composition, required construction materials and waste generation in the relevant **Sections** of **Chapter 6**).

Therefore, the impacts on the road transport/traffic sector from the implementation of the construction works of the proposed Project are characterized as negative, of negligible intensity, local, concurrent with the construction activities, temporary, short-term reversible, synergistic, of direct effect, continuous, immediately remediable, and non-cumulative. With respect to their final evaluation, these impacts are assessed as **Negligible.**

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Movement on the road network of heavy vehicles, construction machinery, and waste transport trucks due to the implementation of the construction works of the proposed projec	Road Network / Transport / Traffic	-	1	2	4	1	1	2	4	4	1	1	25	Minor	Low	Negligible

10.2.5.6.1.3 Environmental Infrastructure Systems

The following paragraphs examine the potential occurrence of adverse impacts on the environmental infrastructure systems of the area as a result of the implementation of the proposed Project.

The activities that cause impacts on the environmental infrastructure systems of the area, as a result of the implementation of the proposed Project and based on the Environmental and Social Scoping Content of the ESIA (**Chapter 9**), are the following:

- Land facilities (CO_2 reception and management infrastructure and equipment, onshore section of the CO_2 pipeline):
  - Generation, management, and disposal of waste from the construction works of the land facilities of the Project.
- Offshore CO_2 transport pipeline:
  - Operation of the pipe-laying vessel (accommodating 200 people), generation of waste/wastewater.
- Offshore installations (excluding the offshore CO_2 transmission pipeline)
  - Waste – Generation, management, and disposal of extractive waste (drilling mud and cuttings).

  During the drilling of the 16-inch diameter section down to a depth of 2,200 m, a drilling fluid based on seawater/lime will be used. The cuttings from this section will be deposited on the seabed. Below this depth, the drilling fluids return to the surface where the cuttings are removed, and the fluid is treated.

Based on the description of the construction activities of the examined Project, as detailed in **Chapter 6** of this document, the following arise:

- The water requirements during the construction phase will be mainly covered by seawater (or desalinated water using own means) or bottled water. Small quantities of approximately 100 m^3 for the concrete curing process will be covered by the network of the onshore SIGMA facilities.
- The energy requirements during the construction phase will be covered by diesel generators and will not burden the existing energy system.
- During the construction phase at the onshore project site, domestic wastewater will be generated from the residence of the workers (~10 people). It is estimated that the flow of domestic wastewater will be equal to the potable water consumption of the workers, i.e., 0.2 m^3/day at peak. The personnel will be served by the infrastructure of the existing SIGMA facilities, while alternatively chemical toilets may be used within the site, which will be regularly emptied and maintained by a licensed company under the responsibility of the contractor. In total, the liquid waste produced by workers during the construction phase (3 months, 60 working days) amounts to approximately 12 m^3. Additional household-type wastewater from the platform complex is collected and stored in dedicated tanks located on each platform. The tanks are periodically emptied into the barge or the support vessel tank. The tank content is transported via the barge to the onshore facilities for biological treatment. Lastly, wastewater from the vessel crews is treated onboard and does not burden the onshore biological treatment systems. From the above, it follows that the load on the onshore treatment systems is not significant due to the small number of workers.
- Regarding solid waste from construction, it is estimated that both non-hazardous and hazardous Municipal Solid Waste (MSW) will be generated, as well as certain other waste streams subject to alternative management (AMS). The MSW production corresponding to the daily simultaneous presence of 188 workers is presented below. Recyclables will be delivered to alternative management bodies, while the remaining waste will be directed to the local landfill (XYTA) of Kavala.

AA Production		Mixed	Recyclable	Total	Unit
Total Production (14 months)	AA Production (tn)	14,19	6,85	**21,04**	tn
	AA Production (m³)	54,57	32,22	**86,79**	m³

Other liquid waste expected to be generated on the vessel during the construction of the CO_2 pipeline includes **bilge water** and **ballast water**.

- The water from the engine room may contain grease and/or oils (bilge water). Bilge water will be managed in accordance with Annex I of MARPOL 73/78 (Regulations for the Prevention of Pollution by Oil) and its relevant amendments. The treatment equipment (bilge water separator) will comply with the IMO Guidelines and Specifications for Pollution Prevention Equipment for Machinery Space Bilges of Ships, IMO Resolution MEP.107(49).
- The discharge of ballast water used to stabilize ships at sea is subject to the requirements of Annex I of MARPOL 73/78 and the International Convention for the Control and Management of Ships' Ballast Water and Sediments (Ballast Water Management – BWM). The treatment equipment (ballast water treatment system) onboard will comply with the D-2 standard concerning the treatment of ballast water.

The **integrated management of C&DW** generated from the construction and excavation works of the Project will be carried out in accordance with JMD 36259/1757/E103/2010 (Government Gazette 1312/B/24.08.2010) "Measures, conditions, and program for the alternative management of construction and demolition waste (C&DW)" and the relevant provisions of Law 4819/2021, as amended and in force. It is estimated that the Project will generate C&DW subject to alternative management (AMS) and other hazardous and non-hazardous waste, such as structural residues (e.g., concrete, metals, packaging materials, etc.) and surplus materials from the site preparation and construction activities.

According to initial estimates, the surplus excavation materials from the site formation works of the Project amount to approximately 200 m³. Excavations will be limited to the absolutely necessary, while reuse of surplus materials will be prioritized for backfilling needs as part of the construction. Other C&DW will be estimated at a later design stage when the Waste Management Plan is specified. In any case, it is noted that the management of C&DW in the Project area is carried out according to the provisions of JMD 36259/1757/E103/2010 through the following Alternative Management Systems (based on data from the Hellenic Recycling Agency (EOAN), https://www.eoan.gr):

- AMS "Northern Greece Aggregates Recycling S.A.", trading as "AN.A.V.E. S.A."
- AMS "Central Macedonia C&DW Recycling S.A.", trading as "ANA.KEM."
- AMS "Central Greece Recycling System Ltd.", trading as "S.AN.K.E. Ltd."
- AMS "PEDMEDE ECO Limited Liability Company", trading as "PEDMEDE ECO L.L.C

The extractive waste generated, hazardous and non-hazardous, from the drilling works mainly consists of drill cuttings and drilling mud. The total volume of cuttings (4 drillings) is estimated at **2,691 m³.** In each drilling, the cuttings from 350 m to 2,200 m depth, due to the biodegradable mud, may be disposed of on the seabed. Below approximately 2,200 m, the drilling fluids return to the surface, where the cuttings are removed and the mud is treated. The management of extractive waste is carried out in accordance with JMD 39624/2209/E103 (Government Gazette B/2076/25.9.2009).

Based on the above, the construction works of the proposed installations do not impose significant burdens on water and energy needs. However, they do cause a temporary load (maximum 14 months) on environmental infrastructure (MSW, wastewater).

Therefore, based on the above analysis, it is concluded that the anticipated adverse potential impacts from the construction of the Project are limited to the collection, transport, disposal, and management systems of liquid and solid waste. Nevertheless, due to the relatively limited waste quantities and the limited duration of the Project implementation, these impacts are characterized as negative, of negligible intensity, local, concurrent with construction works, temporary, short-term reversible, synergistic, of direct impact, continuous, immediately remediable, and non-cumulative. Regarding their final assessment, these impacts are evaluated as **Negligible**.

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Production of liquid and solid waste due to the implementation of construction works	Waste collection, transport, disposal and management systems for liquid and solid waste	-	1	2	4	1	1	2	4	4	1	1	25	Minor	Low	Negligible

10.2.5.6.2 Operation

10.2.5.6.2.1 Maritime Transport / Traffic

The following paragraphs examine the potential occurrence of adverse effects on the maritime transport of the area as a result of the operation of the proposed Project.

The activities that cause impacts on the maritime transport of the area, as a result of the operation of the proposed Project, based on the ToR-defined content of the ESIA (Chapter 9), are the following:

- Maritime traffic
  - Daily vessel movement due to the operation of the project (including personnel transport and support vessel movements).
  - Definition of exclusion zones due to the operation of the project.

The operation of the offshore components of the proposed project will require vessel movements for the execution of scheduled routes transporting CO_2 isobox containers, transporting personnel, and support vessel movements. Nevertheless, it is estimated that the daily vessel traffic will not significantly increase the maritime traffic load of the area, since due to the limited volume of CO_2 transported via isobox containers and the operational requirements of the project, only a few routes will be required on a daily basis by a small number of transport and auxiliary vessels, the overwhelming majority of which will be executed within the existing maritime traffic restriction zone. Therefore, due to the limited increase in daily vessel traffic required for the operation of the project, the resulting impacts are characterized as <u>negative, of low intensity, local, of immediate onset, long-term, short-term reversible, synergistic, of direct impact, continuous, immediately remediable, and non-cumulative. As to their final assessment, these impacts are evaluated as **Negligible.**</u>

Additionally, with regard to maritime traffic, exclusion zones are defined due to the existence and operation of the project. In any case, according to the existing project that has been environmentally permitted (Ref. No. οικ 8413 / 24-04-18, ADA: ΨΓΛ14653Π8-Ζ79 titled "Approval of environmental terms for the Offshore Development Project of Prinos"), a 500 m zone is already designated on either side of the offshore facilities (platforms, subsea pipelines and cables) in which mooring and any form of fishing is prohibited. The exclusion zones defined for the Project overlap with the existing zone, which is slightly extended; therefore, no significant additional impacts are expected on maritime transport of passenger and commercial vessels, since the area is already restricted due to existing Prinos activities. Consequently, the impacts on the maritime transport / traffic sector due to the maintenance and use of the maritime exclusion zone are characterized as <u>negative, of low intensity, local, of immediate onset, long-term, short-term reversible, synergistic, of direct impact, continuous, immediately remediable, and non-cumulative. As to their final assessment, these impacts are evaluated as **Negligible.**</u>

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Daily vessel movements due to project operation (including the transport of personnel and the movement of support vessels)	Marine Transport / Traffic	-	2	2	4	3	1	2	4	4	1	1	30	Minor	Low	Negligible
Maintenance and use of the marine exclusion zone	Marine Transport / Traffic	-	2	2	4	3	1	2	4	4	1	1	30	Minor	Low	Negligible

10.2.5.6.2.2 Other Transport Infrastructure

The following paragraphs examine the potential occurrence of adverse effects on other transport infrastructure in the area as a result of the operation of the proposed Project.

The activities that cause impacts on the maritime transport of the area, as a result of the operation of the proposed Project, based on the ToR-defined content of the ESIA (**Chapter 9**), are the following:

- Physical presence and spatial positioning of the Project's onshore infrastructure
  - Receipt of CO_2 with containers (CO_2 parcels). The CO_2 cargoes from pilot projects will be transported to the dock of the Sigma facility by ISO freight trucks with pressure vessels, insulated to minimize losses.

With regard to the road network, an increase in traffic load may be caused by the freight trucks transporting the CO_2 containers, by the vehicles of the personnel, as well as by the waste transport trucks. Since the PATHE highway is located at a short distance (~1 km) from the onshore facilities of the Project and main roads are selected for transport, combined with the small number of routes (~20) required to transport ~400 tn of CO_2, no significant burden is expected on the local road network, which in any case is not considered to be particularly congested. Lastly, it is noted that during the operation phase, approximately 40 people are employed, a particularly small number to cause any traffic issues in the area.

In conclusion, <u>the impacts on the road network of the area due to the operation of the proposed Project are characterized as negative, of negligible intensity, local, of immediate onset, long-term, short-term reversible, synergistic, of direct impact, continuous, immediately remediable, and non-cumulative. As to their final assessment, these impacts are evaluated as **Negligible.**</u>

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Road network loading due to the operation of the project	Road Network / Transport / Traffic	-	1	2	4	3	1	2	4	4	1	1	27	Minor	Low	Negligible

10.2.5.6.2.3 Environmental Infrastructure Systems

The following paragraphs examine the potential occurrence of adverse effects on the environmental infrastructure systems in the area as a result of the operation of the proposed Project.

The activities that cause impacts on the environmental infrastructure systems of the area, as a result of the operation of the proposed Project, based on the ToR-defined content of the ESIA (**Chapter 9**), are the following:

- Waste
  - Generation, management and disposal of waste from the operation of the onshore and offshore facilities of the project.

Based on the description of the operational activities of the proposed project, as detailed **in Chapter 6** of this report, the following arise:

- During the operational phase of the CO_2 storage facilities, no requirement for fresh water is expected, except for the living needs of the personnel, in line with the current operation of the facilities.
- Regarding the needs of the new facilities, no increase in energy demand is expected for the onshore installations, as no processing of the CO_2 cargo or the pipeline-delivered quantity is foreseen.
- In the new offshore facilities during the operational phase, power will be required for the processing of CO_2 at the Beta platform, in order to achieve the appropriate injection conditions (P, T). Based on initial estimations concerning the anticipated energy consumption for CO_2 compression, as well as for the bulk CO_2 heating during start-up, the power demand is estimated at the level of 1.6 MW. Approximately 99% of this power demand is attributed to the operation of the electric heater required during start-up, used to prevent low temperatures in the piping and the formation of hydrates/ice near the well area. For pumping the produced water from the water wells at the Beta platform, two Electric Submersible Pumps (ESPs) are foreseen, each with a capacity of approximately 0.5 to 1 MW. Power supply will be provided to the pumps via power cables fed by Variable Speed Drives (VSDs) located in the electrical room of the Beta platform. The next development phases will require the installation of additional water wells and corresponding submersible pumps and transmission systems, with a corresponding increase in power requirements. From the onshore installations, electric power is provided to the Delta platform via 20 km long subsea cables (2 x 3C-120 mm^2, 20 kV), which in the current state provide power of up to ~ 4 MW. Future needs will be similarly met from the SIGMA onshore facilities, which include a 150 kV High Voltage (HV) Substation within the premises, for connecting the project's facilities to the HEDNO grid, which will be expanded with an additional Transformer Bay.
- It is estimated that the Project will generate both non-hazardous and hazardous Municipal Solid Waste (MSW), as well as certain other waste streams subject to alternative management (EPR schemes).

AA Production	Mixed	Recyclable	Total	Unit
AA Production (tn)	14,19	6,85	**21,04**	tn
AA Production (m^3)	54,57	32,22	**86,79**	m^3

- The water produced from the planned wells is transferred to the Prinos Delta platform where it is separated and treated through the existing systems and then discharged into the sea. Stormwater on the platforms, which may potentially contain hydrocarbons, enters the closed drainage system through the bunded areas. To minimize these quantities, the size of the bunded areas has been minimized and protected from rainfall where possible.

- It is estimated that during the operation and maintenance of the underground CO_2 storage facility, non-hazardous and hazardous waste will be generated. The management of the aforementioned hazardous and non-hazardous waste, as well as of other potentially generated waste during the operation and maintenance phase of the facility, will be carried out in accordance with the applicable legislation. The generated waste will be collected separately by type in containers suitable for their safe temporary storage at the Project site, in compliance with safety and environmental protection regulations, and their management will be carried out by licensed waste collection, transportation and management contractors. The hazardous waste such as rags, absorbent materials, etc., related to the current project and originating from the shared use of the water separation system on the Delta platform, e.g. water separator V-102, are already included in the existing operation of the Delta platform.

It is noted that the increased energy demand requirements will be covered by the SIGMA facilities and, therefore, by the HEDNO grid, without causing any adverse impact due to, on one hand, the limited energy needs for the operation of the Project and, on the other hand, the availability of the relevant grid and HV substation facilities, which, with minor interventions, can meet the needs of the proposed Project.

Consequently, based on the above analysis, it is concluded that the anticipated adverse potential impacts from the construction of the project are limited to the systems for collection, transportation, disposal and management of liquid and solid waste. However, due to the relatively limited amounts of waste produced, the said impacts are characterized as negative, of negligible intensity, local, of immediate onset, long-term, short-term reversible, synergistic, of direct impact, continuous, immediately remediable and non-cumulative. In terms of their final evaluation, these impacts are assessed as **Negligible.**

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Generation of liquid and solid waste due to the operation of the project	Systems for the collection, transport, disposal, and management of liquid and solid waste	-	2	2	4	3	1	2	4	4	1	1	30	Minor	Low	Negligible

10.2.5.6.3 Phase of Decommissioning / Dismantling

10.2.5.6.3.1 Maritime Transport / Traffic

The following paragraphs assess the likelihood of potential adverse impacts on the maritime transport of the area, as a result of the decommissioning / dismantling phase of the proposed Project.

The activities causing impacts on the maritime transport of the area, as a result of the decommissioning / dismantling phase of the proposed Project, based on the ToR content demarcation of the EIA (Chapter 9), are the following:

- Decommissioning / Dismantling of the offshore CO_2 transfer pipelines
  - Maritime traffic - Daily vessel movements to carry out the dismantling works of the offshore pipelines (including personnel transportation and support vessels movements).
  - Maritime traffic - Designation of exclusion zones due to the execution of the dismantling works of the offshore pipelines.
- Decommissioning / Dismantling of the offshore installations (excluding the offshore CO_2 transfer pipeline)
  - Maritime traffic - Daily vessel movements to carry out the dismantling work of the offshore installations (including personnel transportation and support vessels movements).
  - Maritime traffic - Designation of exclusion zones due to the execution of the dismantling works of the offshore installations.

For the dismantling of the offshore parts of the proposed Project, daily vessel movements will be required (including personnel transportation and support vessels movements). However, it is estimated that the daily vessel traffic will not significantly increase the maritime traffic load in the area, since due to the limited volume and nature of the dismantling works, only a few daily trips will be needed by a small number of construction and auxiliary vessels, the vast majority of which will be carried out within the existing restricted maritime traffic zone. Therefore, due to the limited increase in daily vessel traffic required for the dismantling of the offshore installations, the impacts are expected to be negative, of negligible intensity, local, concurrent with the construction works, temporary, short-term reversible, synergistic, of direct impact, continuous, immediately remediable and non-cumulative. In terms of their final evaluation, these impacts are assessed as **Negligible.**

Additionally, regarding maritime traffic, exclusion zones are designated due to the dismantling works of the offshore installations of the Project (and related works/activities). In any case, according to the existing environmentally permitted project (Decision Ref. 8413 / 24-04-18, ADA: ΨΓΛ14653Π8-Ζ79 with subject "Approval of environmental terms for the Offshore Development of Prinos project") a 500 m zone on each side of the offshore installations (platforms, subsea pipelines and cables) is already defined, within which anchoring and all forms of fishing are prohibited. The designated exclusion zones of the Project are offset against the existing zone, which is slightly extended, therefore no significant additional impacts are expected on passenger and commercial ship traffic, since the entire area is already limited by the existing Prinos activities. In conclusion, the impacts on maritime transport / traffic from the maintenance and use of the marine exclusion zone are characterized as negative, of negligible intensity, local, concurrent with the construction works, temporary, short-term reversible, synergistic, of direct impact, continuous, immediately remediable and non-cumulative. In terms of their final evaluation, these impacts are assessed as **Negligible.**

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Decommissioning of offshore installations (including the transport of workers and movements of support vessels)	Marine Transport / Traffic	-	1	2	4	1	1	2	4	4	1	1	25	Minor	Low	Negligible
Maintenance and use of the marine exclusion zone	Marine Transport / Traffic	-	1	2	4	1	1	2	4	4	1	1	25	Minor	Low	Negligible

10.2.5.6.3.2 Other Transport Infrastructure

The following paragraphs examine the potential occurrence of adverse impacts on the remaining transport infrastructure of the area, as a result of the decommissioning phase of the Project under assessment.

The activities that cause impacts on the maritime transport of the area, as a result of the decommissioning phase of the Project under assessment, based on the ToR content demarcation of the EIA (Chapter 9) are the following:

- Dismantling of Onshore Facilities – Restoration of the Project's Onshore installation area.
  - Traffic of heavy vehicles, construction machinery, trucks and transport vehicles, as well as support vehicles during the decommissioning / dismantling phase of the project.
  - Traffic – Daily movement of vehicles related to the decommissioning / dismantling phase of the project (including transportation of personnel and movement of support vehicles).

Regarding road network traffic of heavy vehicles, construction machinery, trucks and waste transport vehicles, a slight increase in the traffic load of the wider area is expected due to the execution of the dismantling works of the Project under assessment (see construction site layout, waste generation in the relevant Sections of Chapter 6).

Consequently, the impacts on road transport / traffic from the execution of the dismantling works of the proposed project are characterized as negative, of negligible intensity, local, concurrent with construction activities, temporary, short-term reversible, synergistic, of direct impact, continuous, immediately remediable and non-cumulative. In terms of their final evaluation, these impacts are assessed as **Negligible.**

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Movement on the road network of heavy vehicles, construction machinery, vehicles and waste transport trucks due to the implementation of the project's decommissioning works	Road Network / Transport / Traffic	-	1	2	4	1	1	2	4	4	1	1	25	Minor	Low	Negligible

10.2.5.6.3.3 Environmental Infrastructure Systems

In the following paragraphs, the likelihood of potential adverse impacts on the environmental infrastructure systems of the area, as a result of the operational cessation/decommissioning phase of the examined Project, is examined.

The activities that cause impacts on the environmental infrastructure systems of the area, as a result of the operation cessation/decommissioning phase of the examined Project, based on the P&K content delineation of the ESIA (**Chapter 9**), are as follows:

- Demolition of Land-Based Facilities – Restoration of the Land Area of the Project Installation.
  - Production of solid and liquid waste.
- Shutdown / Decommissioning of offshore facilities (excluding the offshore CO2 transportation pipeline).
  - Production of solid and liquid waste.

Based on the description of the operational activities of the examined project, as detailed in Chapter 6 of this document, the most significant source of waste during the decommissioning and dismantling phase is the removable equipment. Priority in its management will be given to reuse, followed by recycling, and finally the safe disposal of non-reusable and non-recyclable materials. Specifically, the quantity of metallic waste (which is expected to be the largest in volume) that will require management will depend to a large extent on the determination of the decommissioning method (i.e., deep-water disposal or towing to shore for dismantling).

A specific type of waste stream during decommissioning comes from the growth of marine organic matter on the support pipes. The organic matter is preferably removed with a water jet in the marine area and not on land during the decommissioning phase, considering the environmental impact of the activity. The quantities of organic matter should be calculated when the exact cessation time of the Project's operation is known.

The usual specific categories of waste are also expected, such as metal scrap, batteries, electrical and electronic equipment (EEE), however, these cannot be determined at this stage in terms of their quantities.

The generated waste will be collected separately by type in containers suitable for their safe temporary storage at the Project in accordance with safety and environmental protection regulations, and its management will be carried out by licensed waste collection, transportation, and management entities.

Therefore, based on the above analysis, it appears that the expected adverse potential impacts during the phase of cessation of operation/decommissioning of the examined project are limited to the systems of collection, transportation, disposal, and management of liquid and solid waste. However, due to the relatively limited quantities of waste produced, these impacts are characterized as negative, negligible in intensity, local, simultaneous with construction activities, temporary, short-term reversible, synergistic, of immediate effect, continuous, directly restorable, and non-cumulative. Regarding their final assessment, these impacts are evaluated as **Negligible.**

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Production of liquid and solid waste due to the project's decommissioning works	Systems for the collection, transport, disposal and management of liquid and solid waste	-	1	2	4	1	1	2	4	4	1	1	25	Minor	Low	Negligible

10.2.6 Effects on Air Quality

In the following paragraphs, the likelihood of potential adverse effects on the air quality of the area, as a result of the construction, operation, and cessation of operation/decommissioning of the examined Project, is examined.

10.2.6.1 Construction Phase

In the following paragraphs, the likelihood of potential adverse effects on the air quality of the area, as a result of the implementation of the examined Project, is examined.

More specifically, in the following paragraphs, the emissions of air pollutants from the construction activities of the proposed project are examined in three separate sections. More specifically, the construction works of the land facilities, the drilling operations, and the construction of the CO2 transport pipeline are examined separately. A particularly important factor for the separate calculation of greenhouse gas emissions for the above activities is the fact that the land facility works will precede the main volume of drilling operations and a significant volume of CO2 transport pipeline installation.

Similarly, it was estimated that the separation of greenhouse gas emissions from the land-based facility development works, the construction of the CO2 transport pipeline, and the drilling activities will lead to a more rational estimation of their magnitudes, due to the differences observed in the characteristics of the works (area project versus linear intervention and point works, respectively), different dispersion conditions of the pollutants (coastal environment, offshore environment), and the potential time lag between them.

Subsequently, pollutant emissions are summarized as calculated in the relevant 'Section 6.4.7 Atmospheric Emissions' and the related impacts are evaluated.

Pollutant emissions from the construction of land facilities

The activities that have impacted on the air quality of the area during the construction of the land facilities, based on the P&K content delineation of the ESIA (**Chapter 9**), are as follows:

- Preparation of the ground for the foundation of the equipment, earthworks for the placement of the new land-based infrastructures and facilities.
- Concrete pouring and placement of 0.5 m thick concrete for the construction of base foundation slabs.
- Installation of the final section of land pipelines (placement, welding), which will be installed in the ground on the new foundations, without protective covers.
- Movement of heavy vehicles, construction machinery, transport vehicles and trucks, as well as support vehicles during construction, which emit:
    - Dust (PM10, PM2.5).
    - Gaseous pollutants (CO, VOC, and NOx).
    - GHGs
- Temporary deposition/storage of structural/construction materials and surplus excavation materials.
- Traffic - Daily movement of vehicles related to the construction of the land facilities (including the transportation of workers and the movements of support vehicles).

The atmospheric emissions during the construction of the land facilities based on the indicative construction schedule (Section 6.4.2) were calculated in the **Tables** of **Section 6.4.7.3 Atmospheric emissions from the construction of the land facilities.**

The following table presents the total estimated emissions of CO, HC, NOX, SO2, TSP from the operation of construction machinery within the work site and from the movements of heavy vehicles to and from the Sigma facilities during the construction phase overall and on the peak day, according to the assumptions provided above.

Table 3. Total emissions of air pollutants (CO, HC, NOX, SO_2, TSP) from construction machinery and heavy vehicles during the construction phase of the Project

	CO	HC	NO_X	SO_2	TSP	Unit
Machinery	745,0	258,5	380,1	91,2	212,9	kg
Heavy vehicles	9,98	2,70	4,94	1,40	1,20	kg
Total	**755,0**	**261,2**	**385,0**	**92,6**	**214,1**	**kg**
Daily Emissions	**12,6**	**4,4**	**6,4**	**1,5**	**3,6**	**kg/d**

As the expected quantities of air pollutant emissions during the implementation phase of the project site development works are estimated to be particularly limited, in terms of their significance, these specific impacts are expected to be negative, of negligible intensity, immediate, localized, concurrent with construction activities, temporary, short-term reversible, synergistic, cumulative, periodic, and immediately restorable. Regarding their Final Assessment, these impacts are evaluated as **Negligible.**

Emissions Pollutant emissions from the construction of land facilities

The activities that have impacted on the air quality of the area during the construction of the CO2 transport pipeline, based on the P&K content delimitation of the ESIA (**Chapter 9**), are as follows:

- Phase 1: Geophysical Survey - A small-type vessel (15 m in length) will be used with equipment to scan the seabed, to provide essential data within the pipeline corridor.
- Phase 2. Works for the approach of the pipeline to the shore (placement of this specific section of the pipeline in a trench approximately 500 m long and 3 m deep).
- Phase 3: Installation of a 20 km subsea pipeline (using the S-lay method) by a specialized pipelaying vessel, along with 2 support supply/tug vessels.
- Maritime traffic - Emissions caused by the daily movement of ships for the installation of CO2 transport pipelines (including the transportation of workers and the movements of support ships), which create:
    - Gaseous pollutants (CO, VOC, and NOx).

The total greenhouse gas emissions based on the estimated fuel consumption during the works according to the indicative construction schedule (Section 6.4.2) were calculated in the Tables of Section 6.4.7.2

Atmospheric emissions from the construction of the CO2 pipeline. For the calculation of emissions, the standard emission factors for Marine Gas Oil fuel from the European Environment Agency's air pollutant emission inventory guidebook (EMEP/EEA 2023, EMEP/EEA air pollutant emission inventory guidebook, Technical guidance to prepare national emission inventories, https://www.eea.europa.eu/publications/emep-eea-guidebook-2023) were used.

The expected quantities of pollutant emissions from the construction of the CO2 transport pipeline are estimated to be relatively limited but measurable (Table 6 29 Estimated Pollutant Emissions during the Construction of the CO2 Pipeline) and therefore, in terms of their significance, these specific impacts are assessed as negative, of medium intensity, direct, localized, simultaneous with construction activities, temporary, short-term reversible, synergistic, cumulative, periodic, and immediately restorable. Regarding their Final Assessment, these impacts are evaluated as **Negligible.**

Emissions of gaseous pollutants from Drilling Operations

The activities that impact the air quality of the area during drilling operations, based on the P&K content delineation of the EIA (Chapter 9), are as follows:

- Drilling of wells
  - Drilling of 4 wells to a depth of approximately 3,700 m (2 wells will be used as CO2 injection wells and 2 as water production wells for the relative pressure maintenance of the reservoir).
  - All four new wells will be constructed with a TDS-type drilling unit and will be directed using a combination of mud motors and rotary drilling assemblies.
- Completion of drilling
  - The protective casing of each well will be cemented with a 200 m cement column, above the base of the previous protective casing and along the entire length of the open geological formation.
- Marine traffic
  - Emissions caused by the daily movement of ships during drilling operations (including the transportation of workers and the movements of support vessels), which create air pollutants (CO, VOC, and NOx) and GHGs.

Emissions into the atmosphere will be produced by the Jack-up type drilling rig and the support vessels during drilling operations. Given the relatively limited emissions (the relevant calculations are provided in **Section 6.4.7.1**) and the distance from the receptors, these emissions are not considered to significantly contribute to the degradation of air quality.

The emissions of gaseous pollutants based on the estimated fuel consumption during the operations according to the indicative construction schedule (**Section 6.4.2**) were calculated in the **Tables** of **Section 6.4.7.1 Atmospheric Emissions from Drilling Operations.**

The expected quantities of air pollutant emissions from the implementation of drilling activities are estimated to be relatively limited, and therefore, in terms of their significance, these specific impacts are assessed as <u>negative, of medium intensity, immediate, localized, concurrent with construction activities, temporary, short-term reversible, synergistic, cumulative, continuous, and directly restorable. Regarding their Final Assessment, these impacts are evaluated as **Negligible.**</u>

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Air pollutant emissions from the construction of onshore facilities	Atmospheric environment	-	1	2	4	1	1	2	4	2	1	4	26	Minor	Low	Negligible

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Air pollutant emissions from the construction of the CO_2 transfer pipeline	Atmospheric environment	-	4	2	4	1	1	2	4	2	1	4	35	Minor	Low	Negligible
Air pollutant emissions from drilling activities	Atmospheric environment	-	4	2	4	1	1	2	4	4	1	4	37	Minor	Low	Negligible

10.2.6.2 Operation Phase

In the following paragraphs, the likelihood of potential adverse effects on the air quality of the area, as a result of the operation of the examined Project, is examined.

The emissions into the atmosphere during the operation of the Project will mainly result from the operation of trucks transporting CO2 loads, the operation of cranes, the operation of refueling vessels, as well as the processing of the loads and bulk flow of CO2 (heating and pumping).

The activities that cause impacts on the air quality of the area during the operation of the project, based on the P&K content delimitation of the EIA (Chapter 9), are as follows:

- Transport of CO2 to the Prinos storage facilities
  - Receipt of CO2 with containers (CO2 parcels) The CO2 shipments from pilot projects will be transported to the Sigma facility's dock with ISO container trucks with pressure vessels, insulated to minimize losses.
  - CO2 is provided under suitable conditions for injection and routed to the head, from which it is extracted to the Prinos complex via a 12-16" pipeline, 20 km long.
- CO2 Injection
  - The main processing equipment on the Beta platform will include a pumping and heating station for the required injection conditions, installed on the open deck of the platform.
  - CO2 injection will target reservoirs B and C with two injection wells during the 2025-2035 period and will then be extended to the entire reservoir by the end of the project.
- Water production
  - The two water production wells on the Beta platform will be equipped with electric submersible pumps (ESP) and will extract water from the reservoir. They will operate with a production of up to 7500 bwpd each during the period 2025-2031, and the water production will gradually increase to 97000 bwpd per well by 2031 and by the end of the project.

- Δ Maintenance and repair activities for infrastructure and equipment
  - Activities for the maintenance and repair of offshore infrastructure and equipment
- Marine Traffic
  - Daily movement of vessels due to the operation of the project (including the transportation of workers and the movements of support vessels).

Atmospheric emissions during the receipt of CO2 and the transportation of CO2 to the Prinos offshore storage facilities

The typical emissions of air pollutants from transport trucks include pollutants such as carbon dioxide (CO2), nitrogen oxides (NOx), particulate matter (PM), volatile organic compounds (VOCs), sulfur dioxide (SO2), and carbon monoxide (CO). These emissions result from the use of fuel in truck engines. The emissions of gaseous pollutants from the operation of cranes result from the use of fuels in their engines, similar to trucks.

The above pollutant emissions were calculated in **Section 6.5.6.1 Atmospheric emissions during CO2 reception.**

The expected quantities of pollutant emissions from CO2 reception are estimated to be relatively limited but calculable, and therefore, in terms of their significance, these specific impacts are assessed as <u>negative, of medium intensity, direct, localized, long-term, of short-term reversibility, synergistic, cumulative, periodic, and immediately remediable. Regarding their Final Assessment, these impacts are evaluated as **Negligible.**</u>

Atmospheric emissions during handling – treatment for CO2 injection and water extractions

Atmospheric emissions during handling – treatment for CO2 injection and water extraction The main processing equipment on the Beta platform will include a pumping and heating station for the required injection conditions, installed on the open deck of the platform. The two water production wells on the Beta platform will be equipped with electric submersible pumps (ESP) and will extract water from the reservoir. For the extraction of produced water from the water wells on the Beta platform, two Electric Submersible Pumps (ESP) with a power of approximately 0.5 to 1 MW each are planned.

A power of approximately 1.6 MW is required for CO2 processing to achieve the appropriate injection conditions (P, T). This power demand includes the requirements for the compression/pumping of CO2 loads, as well as the heating of bulk CO2 during startup. This power demand is mainly due to the operation of the electric heater required during startup, as a means to avoid low temperatures in the pipeline and the formation of hydrates/salts in the area near the well. The required daily energy for 16 hours of operation (2 shifts) amounts to 1.6 MW x 16h/d = 25.6 MWh, while the annual energy is **9,344 MWh.**

Additionally, for the extraction of the produced water from the water wells on the Beta platform, two Electric Submersible Pumps (ESP) with a power of approximately 0.5 to 1 MW each are planned. The power supply will be provided to the pumps through supply cables fed by variable speed drive (VSD) systems within the electrical station of the Beta platform. Assuming 24-hour operation of the pumps, considering an average power rating of 0.75 MW, the annual energy required for each pump is equal to 0.75 MW x 24hr/d x 365 d = 6,570 MWh. Therefore, the total energy required for the operation of the two pumps is equal to **13,140 MWh.**

The pollutant emissions during the transportation – processing for CO2 injection and water pumping are presented in **Section 6.5.6.2 Atmospheric emissions during transportation – processing for CO2 injection.**

The expected quantities of pollutant emissions from the transportation – processing for CO2 injection are estimated to be relatively limited but calculable, and therefore, in terms of their significance, these specific impacts are assessed as negative, of medium intensity, direct, localized, long-term, short-term reversible, synergistic, cumulative, continuous, and immediately remediable. Regarding their Final Assessment, these impacts are evaluated as **Negligible.**

Maintenance and repair activities of infrastructure and equipment

Given the scale and nature of the project, the expected quantities of air pollutant emissions from maintenance and repair activities of infrastructure and equipment are estimated to be particularly limited but measurable. Therefore, in terms of their significance, these specific impacts are assessed as negative, low-intensity, direct, localized, temporary, short-term reversible, synergistic, cumulative, discontinuous, and immediately restorable. Regarding their Final Assessment, these impacts are evaluated as **Negligible.**

Marine Traffic

The daily movement of ships due to the operation of the Project (including the transportation of workers and the movements of support ships) results in emissions of air pollutants (CO, VOC, and NOx) and GHG.

Given the scale and nature of the project, the expected quantities of CO2 emissions from the daily movement of ships due to the operation of the project (including the transportation of workers and the movements of support ships) are estimated to be particularly limited but quantifiable. Therefore, in terms of their significance, these specific impacts are assessed as negative, low-intensity, direct, localized, long-term, short-term reversible, synergistic, cumulative, periodic, and directly remediable. Regarding their Final Assessment, these impacts are evaluated as **Negligible.**

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Atmospheric emissions during CO_2 reception and transport to the offshore storage facilities in Prinos	Atmospheric environment	-	4	2	4	3	1	2	4	2	1	4	37	Minor	Low	Negligible
Air pollutants from CO_2 injection	Atmospheric environment	-	4	2	4	3	1	2	4	4	1	4	39	Minor	Low	Negligible
Air pollutants from water abstraction	Atmospheric environment	-	4	2	4	3	1	2	4	4	1	4	39	Minor	Low	Negligible
Air pollutants from maintenance and repair activities of infrastructure and equipment	Atmospheric environment	-	2	2	4	1	1	2	4	1	1	4	28	Minor	Low	Negligible
Air pollutants from the daily movement of vessels due to Project operation (including the transport of workers and support vessel movements)	Atmospheric environment	-	4	2	4	3	1	2	4	2	1	4	37	Minor	Low	Negligible

10.2.6.3 Decommissioning Phase

The following paragraphs examine the potential occurrence of adverse impacts on the air quality of the area, as a result of the decommissioning phase of the Project under assessment.

The activities that impact the air quality of the area during the operation of the Project, based on the ToR content demarcation of the ESIA (**Chapter 9**), are the following:

- Dismantling of Onshore Facilities – Restoration of the Project's Onshore installation area
    - Dismantling of equipment and deconstruction of facilities
    - Removal of concrete and foundation slabs, as well as earthworks for the restoration of the Project's onshore installation area
    - Traffic of heavy vehicles, construction machinery, trucks and transport vehicles, as well as support vehicles during the decommissioning / dismantling phase of the project, which emit gaseous pollutants
    - Traffic – Daily movement of vehicles related to the decommissioning / dismantling of the project (including transportation of personnel and support vehicle movements)

- Restoration of the Project's onshore installation area
- Decommissioning / Dismantling of the offshore CO2 transport pipelines
  - Marine traffic – Daily movement of vessels for carrying out the dismantling works of the offshore pipelines (including the transportation of personnel and movement of support vessels)
- Decommissioning / Dismantling of the offshore installations (excluding the offshore CO2 transport pipeline)
  - Marine traffic – Daily movement of vessels for carrying out the dismantling works of the offshore installations (including the transportation of personnel and movement of support vessels)

Dismantling of Onshore Facilities – Restoration of the Project's Onshore installation area

The anticipated amounts of air pollutant emissions during the implementation of the dismantling works of the onshore facilities and the restoration of the Project's onshore installation area are estimated to be limited in significance, and the related impacts will in any case be similar to those foreseen for the construction phase of the project (potentially milder, as the dismantling phase of the onshore facilities and the restoration of the onshore installation area generally lasts significantly less than the construction phase). Therefore, these impacts are expected to be <u>negative, of negligible intensity, direct, localized, concurrent with construction activities, of temporary duration, short-term reversible, synergistic, cumulative, periodic and immediately remediable. In terms of their Final Evaluation, these impacts are assessed as **Negligible.**</u>

Decommissioning / Shutdown of the offshore CO2 transport pipeline

The anticipated amounts of air pollutant emissions during the implementation of the decommissioning / dismantling works of the offshore CO2 transport pipelines are estimated to be limited in significance. Therefore, these impacts are expected to be <u>negative, of negligible intensity, direct, localized, concurrent with construction activities, of temporary duration, short-term reversible, synergistic, cumulative, periodic and immediately remediable. In terms of their Final Evaluation, these impacts are assessed as **Negligible.**</u>

Decommissioning / Dismantling of offshore installations (excluding the offshore CO2 transport pipeline)

The anticipated amounts of air pollutant emissions during the implementation of the decommissioning / dismantling works of the offshore installations (excluding the offshore CO2 transport pipeline) are estimated to be limited in significance. Therefore, these impacts are expected to be negative, of medium intensity, direct, localized, concurrent with construction activities, of temporary duration, short-term reversible, synergistic, cumulative, continuous and immediately remediable. In terms of their Final Evaluation, these impacts are assessed as **Negligible.**

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Air pollutants from the removal of Onshore Installations – Decommissioning / Cessation of the onshore area installations of the Project	Atmospheric environment	-	1	2	4	1	1	2	4	2	1	4	26	Minor	Low	Negligible
Decommissioning / Cessation of offshore CO_2 transport pipeline	Atmospheric environment	-	1	2	4	1	1	2	4	2	1	4	26	Minor	Low	Negligible
Decommissioning / Cessation of offshore installations (excluding the offshore CO_2 transport pipeline)	Atmospheric environment	-	4	2	4	1	1	2	4	2	1	4	35	Minor	Low	Negligible

10.2.7 Impacts from Noise or Vibrations

The following paragraphs examine the potential occurrence of adverse impacts from noise and vibration emissions as a result of the construction, operation, and decommissioning phase of the Project under assessment.

It is important to note that the assessment of underwater noise status and its impact on marine fauna is examined in the relevant paragraphs of **Section 10.2.4.**

10.2.7.1 Construction Phase

The following paragraphs examine the noise emissions from the construction works of the proposed Project in three separate segments. Specifically, the construction works of the onshore facilities, the drilling operations, and the construction of the CO_2 transport pipeline are examined individually. A particularly important factor for the separate calculation of noise emissions for the above activities is the fact that the onshore facility works will precede the main volume of drilling operations and a significant portion of the CO_2 pipeline installation.

Accordingly, it was estimated that the separation of noise emissions from the onshore facility development works, the CO_2 transport pipeline construction, and the drilling operations would lead to a more rational estimation of their magnitudes, due to the differences observed in the nature of the works (areal versus linear or point interventions, works in onshore versus offshore environments, respectively), as well as the potential time lag between them.

Underwater Noise and Vibrations

Noise and vibration emissions from the construction of the CO_2 transport pipeline

The activities causing impacts during the construction of the CO_2 transport pipeline, based on the ToR content demarcation of the ESIA (**Chapter 9**), are the following:

- Phase 2. Works for the shoreline approach of the pipeline (placement of this section of the pipeline into a trench approximately 500 m long and 3 m deep)
- Phase 3. Installation of the subsea pipeline of 20 km length (using the S-lay method) from a dedicated pipeline-laying vessel, along with two support supply/tug vessels
- Maritime traffic – Daily movement of vessels for the installation of the CO_2 transport pipelines (including transportation of personnel and movement of support vessels)

During the construction phase of the CO_2 transport pipeline, the construction vessel and support vessels will generate underwater noise. The main sources of underwater noise are categorized as follows:

- Propellers and thrusters: Noise from propellers and thrusters is mainly caused by cavitation around the propellers during vessel movement or operation of thrusters to maintain/stabilize vessel position during supply activities (OSPAR 2009, Richardson et al., 1995). Underwater noise generated by propellers and thrusters includes:
  - Relatively broadband acoustic signals with free-field source levels of about 160–175 dB (re 1 μPa), produced by small vessels (length up to 50 m), although emissions depend heavily on vessel speed and operational parameters
  - Typical broadband source levels ranging from 165–180 dB (re 1 μPa) from more complex propulsion systems, typically including azimuthal thrusters on tugboats, crew vessels, supply vessels, and many research vessels (length 50–100 m)
  - Relatively strong and mostly low-frequency noise (with strongest energy usually concentrated at frequencies below several hundred Hz), with broadband source levels around 180–190 dB (re 1 μPa) from large vessels (length > 100 m)
- Engines and electromechanical equipment: Engine noise often dominates when vessels are stationary or moving at low speeds. The main sources of mechanical noise include large mechanical equipment, such as major power generation units (diesel engines or gas turbines), compressors, and pumps. Mechanical noise is typically low-frequency and tonal in nature.

However, the limited implementation duration of the Project (based on the indicative construction schedule – **Section 6.4.2**) and the relatively low volume of works required for the construction of the CO_2 transport pipeline (estimated excavation area for the onshore section is 500 m in length, 200 m² surface area, and 3 m depth; the offshore section is 20 km long and 1–1.5 m deep), render the anticipated noise emissions from the pipeline construction relatively limited. Therefore, in terms of their significance, these impacts are assessed as negative, of minor intensity, localized, concurrent with construction works, of temporary duration, short-term reversible, synergistic, non-cumulative, periodic, and immediately remediable. As for their Final Evaluation, these impacts are assessed as **Minor.**

Noise and vibration emissions from Drilling Operations

The activities causing impacts during the construction of offshore installations (excluding the offshore CO_2 transport pipeline), based on the ToR content demarcation of the EIA (Chapter 9), are the following:

- Preparation of the existing starter well.
  - A permanent mechanical barrier (bridge plug) will be installed at a predetermined depth inside the production casing after the well has been killed.
- Drilling operations
  - Drilling of 4 wells to a depth of approximately 3,700 m (2 wells will be used as CO_2 injection wells and 2 as water production wells for reservoir pressure balancing)
  - All four new wells will be constructed using a Top Drive System (TDS) drilling rig and will be directionally drilled using a combination of mud motors and rotary drilling assemblies.
  - Maritime traffic – Daily movement of vessels for carrying out drilling operations (including transportation of personnel and movement of support vessels)

Natural background noise levels at sea, resulting from wind and wave action, may range from 90 dBA at 1 μPa under very calm conditions with low wind, to 110 dB at 1 μPa under windy conditions. Some drilling phases could generate noise levels that exceed the aforementioned natural background levels. Shell Australia conducted an analytical study in 1998, comparing the noise levels of a rig under static conditions versus during drilling. Noise levels from a supply vessel servicing the rig were also measured and compared to rig noise (R. McCauley, 1998, "Underwater Noise Emissions Measured from the Ocean General Drilling Rig, Tugboats, Fishing Vessels, and Natural Sources in the Timor Sea, Australia"). Noise levels during drilling and non-drilling periods (e.g. generator operation, human activity) were found to be similar. A noise level of 117 dB was recorded at 125 m from the rig. During loading operations from support vessels, noise levels reached 134 dB.

Therefore, although the Jack-up drilling rig will introduce elevated noise levels above the natural background, this level is not expected to be significantly higher than the noise produced by other marine vessels in the area, including those servicing the existing platforms.

Accordingly, from the implementation of offshore installations (excluding the offshore CO_2 transport pipeline) and the drilling operations, the following impacts are expected:

- The anticipated underwater noise emissions are estimated to be relatively limited and, therefore, in terms of their significance, these impacts are assessed as negative, of medium intensity, direct, localized, concurrent with construction works, of temporary duration, short-term reversible, synergistic, non-cumulative, periodic, and immediately remediable. In terms of their Final Evaluation, these impacts are assessed as Minor.
- The anticipated vibrations are estimated to be relatively limited and, therefore, in terms of their significance, these impacts are assessed as negative, of minor intensity, concurrent with construction

works, localized, of temporary duration, short-term reversible, synergistic, non-cumulative, periodic, and immediately remediable. In terms of their Final Evaluation, these impacts are assessed as Minor.

Airborne Noise and Vibrations

Noise and vibration emissions from the construction of onshore facilities

The activities that cause impacts during the construction of the onshore facilities, based on the ToR content demarcation of the ESIA (**Chapter 9**), are as follows:

- Ground preparation for equipment foundations, earthworks for the siting of the new onshore infrastructure and facilities.
- Concrete works and placement of 0.5 m thick concrete for the construction of base foundation slabs
- Movement of heavy vehicles, construction machinery, vehicles and transport trucks, as well as support vehicles during construction.
- Traffic – Daily vehicle movement related to the construction of the onshore facilities (including transportation of workers and movements of support vehicles)

The airborne noise emissions during the construction works of the onshore facilities, based on the indicative construction schedule (**Section 6.4.2**), were calculated in the **tables of Section 6.4.8.3**. From these calculations it is derived that:

- The combined level of the LAeq (12-hour) index for the given construction site scenario and for 100% operational time is estimated to be 67 dB(A) at an average distance of 50 m from the construction activities and 60 dB(A) at an average distance of 100 m.
- The combined level of the LAeq (12-hour) index of emitted noise from the traffic of heavy vehicles outside the construction site, for the given scenario and for 100% operational time, is estimated to be 58 dB(A) at an average distance of 50 m from the vehicle.

During the construction phase, vibrations may be generated during excavation works and the movement of heavy vehicles. In the case of the onshore facilities of the Project, due to the absence of extensive (in depth and area) earthworks, the vibration levels and their duration are not expected to be significant and, in any case, will remain below the threshold of human perception.

Therefore, since the anticipated noise emissions during the construction phase of the Project's onshore facilities are estimated to be limited in significance, these impacts are expected to be negative, of minor intensity, localized, concurrent with construction works, of temporary duration, short-term reversible, synergistic, direct, periodic, immediately remediable, and non-cumulative. As for their Final Evaluation, these impacts are assessed as **Minor.**

Noise and vibration emissions from the construction of the CO_2 transport pipeline

The activities that cause impacts during the construction of the CO_2 transport pipeline, based on the ToR content demarcation of the ESIA (**Chapter 9**), are as follows:

- Phase 2. Works for the shoreline approach of the pipeline (placement of this pipeline segment into a trench approximately 500 m long and 3 m deep).
- Phase 3. Installation of the subsea pipeline of 20 km length (using the S-lay method) by a dedicated pipeline-laying vessel, together with 2 support supply/tug vessels.
- Maritime traffic – Daily movement of vessels for the installation of the CO_2 transport pipelines (including transportation of personnel and movements of support vessels).
- Operation of the pipeline-laying vessel (hosting 200 people). Waste/wastewater generation.

However, given the limited implementation period of the Project (based on the indicative construction schedule – Section 6.4.2), and the relatively limited volume of construction works for the CO_2 transport pipeline (the estimated excavation area for the onshore section of the pipeline is 500 m in length, 200 m^2 in surface area, and 3 m in depth, while the offshore section is 20 km long and 1–1.5 m in depth), the expected airborne noise emissions from the construction of the CO_2 transport pipeline are considered relatively limited. Therefore, in terms of their significance, these impacts are assessed as negative, of medium intensity, localized, concurrent with construction works, of temporary duration, short-term reversible, synergistic, non-cumulative, periodic, and immediately remediable. As for their Final Evaluation, these impacts are assessed as **Minor.**

Noise and vibration emissions from the Drilling Works

The activities that cause impacts during the drilling operations, based on the ToR content demarcation of the ESIA (**Chapter 9**), are as follows:

- Drilling of wells - Drilling of 4 wells to a depth of approximately 3,700 m (2 wells will be used as CO_2 injection wells and 2 as water production wells for the corresponding pressure balancing of the reservoir) All four new boreholes will be constructed using a TDS (Top Drive System) drilling unit and will be steered using a combination of mud motors and rotary drilling assemblies.
- Marine traffic – Daily movement of vessels for the execution of drilling operations (including the transportation of workers and the movements of support vessels)

However, given the limited implementation period of the proposed Project (based on the indicative construction schedule – **Section 6.4.2**), and the relatively limited scope of the drilling works, the expected airborne noise emissions from the drilling operations are considered relatively limited. Therefore, in terms of their significance, these impacts are assessed as negative, of medium intensity, localized, concurrent with construction works, of temporary duration, short-term reversible, synergistic, non-cumulative, periodic, and immediately remediable.

As for their Final Evaluation, these impacts are assessed as **Minor**.

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Construction of the CO_2 transport pipeline	Underwater Noise	-	2	2	4	1	1	2	4	2	1	1	26	Minor	Moderate	Minor
Drilling works	Underwater Noise	-	4	2	4	1	1	2	4	2	1	1	32	Minor	Moderate	Minor
Drilling works	Vibrations	-	2	2	4	1	1	2	4	2	1	1	26	Minor	Moderate	Minor
Construction of the onshore installations	Acoustic Environment	-	2	2	4	1	1	2	4	2	1	1	26	Minor	Moderate	Minor
Construction of the CO_2 transport pipeline	Acoustic Environment	-	4	2	4	1	1	2	4	2	1	1	32	Minor	Moderate	Minor
Drilling works	Acoustic Environment	-	4	2	4	1	1	2	4	2	1	1	32	Minor	Moderate	Minor

10.2.7.2 Operation Phase

The following paragraphs examine the potential for adverse impacts due to noise or vibration emissions resulting from the operation of the proposed Project.

Underwater noise and vibrations

The activities causing impacts from underwater noise and vibration emissions during the operation of the proposed Project, based on the ToR content demarcation of the ESIA (**Chapter 9**), are as follows:

- Physical presence and spatial positioning of the onshore infrastructures of the Project.
- CO_2 με containers (CO_2 parcels):
  - The CO_2 loads from pilot projects will be transported to the Sigma facility jetty with ISO container trucks equipped with pressure vessels, insulated to minimize losses
- CO_2 transport to the offshore storage facilities of Prinos:
  - As regards the CO_2 loads, the transport vessel will connect to the pipeline on the platform via a flexible hose system. From there, the CO_2 parcels will undergo further processing to meet the required specifications/conditions for injection into the well.
- CO_2 injection:
  - The main processing equipment on the Beta platform will include a pumping and heating station to meet the required injection conditions, installed on the open deck of the platform.
  - CO_2 injection will target Reservoirs B and C with two injection wells during the period 2025–2035 and will subsequently expand to the entire reservoir until the end of the project.
- Water production:
  - The two water production wells on the Beta platform will be equipped with Electric Submersible Pumps (ESP) and will extract water from the reservoir. They will operate at up to 7,500 bwpd each during the period 2025–2031, and water production will gradually increase up to 97,000 bwpd per well by 2031 and through the end of the project.
- Marine traffic:
  - Daily vessel movement due to the operation of the project (including worker transportation and movements of support vessels).

During the operation phase, limited vibrations may occur. Vibrations may result from the operation of rotating machinery such as pumps. Although operational vibrations are generally less intense than those generated by construction activities, they may pose risks to surrounding infrastructure or sensitive equipment. However, <u>due to the operational characteristics and equipment of the proposed Project, potential vibration emissions are expected to be extremely limited and in any case below the threshold of perception. Therefore, the related impacts are assessed as **Neutral**.</u>

Noise emissions during operation arise mainly from the continuous operation of machinery and equipment on the platforms (pumps, electric heaters), and secondarily from the operation of vessels transporting CO_2 and personnel. Although noise emissions from operation are continuous, their prevention and mitigation is feasible through design modifications of the equipment, installation of sound insulation in noisy parts of the facilities, and regular maintenance practices.

Accordingly, in terms of underwater noise emissions from the operation of the proposed Project, the following impacts are expected:

- The anticipated underwater noise emissions during the operation phase of the proposed Project (CO_2 reception with containers (CO_2 parcels), CO_2 transport to the offshore storage facilities of Prinos, CO_2 injection and water production) are considered relatively limited in terms of significance and therefore these impacts are expected to be negative, of low intensity, localized, of immediate occurrence, permanent, short-term reversible, synergistic, of direct effect, periodic, immediately remediable, and non-cumulative. In terms of Final Evaluation, these impacts are assessed as Minor.
- Similarly, the expected underwater noise emissions from marine traffic during the operation phase of the proposed Project are considered limited in terms of significance and therefore these impacts are expected to be negative, of moderate intensity, localized, of immediate occurrence, permanent, short-term reversible, synergistic, of direct effect, periodic, immediately remediable, and non-cumulative. In terms of Final Evaluation, these impacts are assessed as Minor.

Airborne noise

The activities causing impacts from airborne noise and vibration emissions during the operation of the proposed Project, based on the ToR content demarcation of the ESIA (**Chapter 9**), are as follows:

- Physical presence and spatial positioning of the onshore infrastructures of the Project
- CO_2 reception with containers (CO_2 parcels):
  - The CO_2 loads from pilot projects will be transported to the Sigma facility jetty with ISO container trucks equipped with pressure vessels, insulated to minimize losses.
- CO_2 transport to the offshore storage facilities of Prinos:
  - As regards the CO_2 loads, the transport vessel will connect to the pipeline on the platform via a flexible hose system. From there, the CO_2 parcels will undergo further processing to meet the required specifications/conditions for injection into the well.
- CO_2 injection:
  - The main processing equipment on the Beta platform will include a pumping and heating station to meet the required injection conditions, installed on the open deck of the platform.
  - CO_2 injection will target Reservoirs B and C with two injection wells during the period 2025–2035 and will subsequently expand to the entire reservoir until the end of the project.
- Water production:
  - The two water production wells on the Beta platform will be equipped with Electric Submersible Pumps (ESP) and will extract water from the reservoir. They will operate at up to 7,500 bwpd each during the period 2025–2031, and water production will gradually increase up to 97,000 bwpd per well by 2031 and through the end of the project.
- Marine traffic:
  - Daily vessel movement due to the operation of the project (including worker transportation and movements of support vessels)

As mentioned above, operational noise emissions arise mainly from the continuous operation of machinery and equipment on the platforms (pumps, electric heaters), and secondarily from the operation of vessels transporting CO_2 cargo and personnel. Although noise emissions from operation are continuous, their prevention and mitigation is feasible through design modifications of the equipment, installation of sound insulation in noisy parts of the facilities, and regular equipment maintenance practices.

Accordingly, in terms of airborne noise emissions from the operation of the proposed project, the following impacts are expected:

- The anticipated airborne noise emissions during the operation phase of the proposed project (CO_2 reception with containers (CO_2 parcels), CO_2 transport to the offshore storage facilities of Prinos, CO_2 injection and water production) are considered relatively limited in terms of significance and therefore these impacts are expected to be <u>negative, of low intensity, localized, of immediate occurrence,</u>

permanent, short-term reversible, synergistic, of direct effect, periodic, immediately remediable, and non-cumulative. In terms of Final Evaluation, these impacts are assessed as Minor.

- Similarly, the anticipated airborne noise emissions from marine traffic during the operation phase of the proposed project are considered limited in terms of significance and therefore these impacts are expected to be negative, of moderate intensity, localized, of immediate occurrence, permanent, short-term reversible, synergistic, of direct effect, periodic, immediately remediable, and non-cumulative. In terms of Final Evaluation, these impacts are assessed as Minor.

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
• Reception of CO_2 in containers (CO_2 parcels) • Transport of CO_2 to the offshore storage facilities of Prinos • CO_2 injection • Water abstraction	Underwater noise	-	2	2	4	4	1	2	4	2	1	1	29	Minor	Moderate	Minor
Marine traffic	Underwater noise	-	4	2	4	4	1	2	4	2	1	1	35	Minor	Moderate	Minor
• Reception of CO_2 in containers (CO_2 parcels) • Transport of CO_2 to the offshore storage	Acoustic Environment	-	2	2	4	4	1	2	4	2	1	1	29	Minor	Moderate	Minor

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
facilities of Prinos • CO_2 injection • Water abstraction																
Marine traffic	Acoustic Environment	-	4	2	4	4	1	2	4	2	1	1	35	Minor	Moderate	Minor

10.2.7.3 Decommissioning Phase

The following paragraphs examine the potential for adverse impacts resulting from noise or vibration emissions during the decommissioning phase of the proposed Project.

Underwater noise and vibrations

The activities that may cause impacts due to underwater noise and vibration emissions during the decommissioning phase of the Project, based on the content delineation of the ESIA (**Chapter 9**), are the following:

- Decommissioning of offshore CO_2 transportation pipelines.
    - The offshore pipeline and riser will be depressurized, cleaned using standard pigging operations and subsequently inerted with nitrogen. Then, the pipeline will be isolated from the offshore platform, sealed with welded caps or flanges, and remain in place, in accordance with international standards.
    - The pipelines from the riser top to the wellheads will be depressurized and filled with nitrogen to inert the system. The pipelines will be disconnected from the wellheads, sealed, and left in place.
    - Marine traffic – Daily vessel movements for carrying out the decommissioning of offshore pipelines (including personnel transportation and movements of support vessels).
- Decommissioning of offshore installations (excluding the offshore CO_2 transportation pipeline).
    - Dismantling of equipment and removal of installations.
    - Marine traffic – Daily vessel movements for carrying out the decommissioning of offshore installations (including personnel transportation and movements of support vessels).

During the decommissioning phase, **vibrations** may occur during excavation works and the movement of heavy vehicles. However, in the case of the Project's onshore facilities, due to the absence of extensive (in depth and area) earthworks, vibration levels and their duration are not expected to be significant and will, in any case, remain below perceptible thresholds. As a result, the related impacts are assessed as ***Neutral*.**

In addition, on one hand, the limited duration of the decommissioning activities of the Project's offshore facilities, and on the other, the fact that a large part of the installations will remain in the area even after project completion (e.g., the CO_2 transportation pipeline will be isolated and remain within the seabed), render the expected underwater noise emissions from the decommissioning of the offshore installations relatively limited. Therefore, in terms of significance, these impacts are assessed as *negative, negligible in intensity, local in extent, concurrent with the decommissioning activities, of temporary duration, of short-term reversibility, synergistic, non-cumulative, periodic and immediately restorable*. As for their overall evaluation, these impacts are assessed as ***Minor*.**

Similarly, the limited duration of the decommissioning activities of the Project's offshore facilities and the fact that a large part of the infrastructure will remain in place after the project's operation (e.g., the CO_2 transportation pipeline will be isolated and remain within the seabed), render the expected underwater noise emissions from marine transport (of personnel and decommissioning materials) relatively limited. Therefore, in terms of significance, these impacts are assessed as *negative, low in intensity, local in extent, concurrent with the decommissioning activities, of temporary duration, of short-term reversibility, synergistic, non-cumulative, periodic and immediately restorable*. As for their overall evaluation, these impacts are assessed as ***Minor*.**

Airborne noise

The activities that may cause impacts due to noise emissions during the decommissioning phase of the Project, based on the content delineation of the ESIA (**Chapter 9**), are the following:

- Removal of Onshore Installations – Restoration of the Project's Onshore Installation Area
  - Dismantling of equipment and removal of installations.
  - Removal of concrete and foundation slabs, along with earthworks for the restoration of the Project's onshore installation area.
  - Movement of heavy vehicles, construction machinery, transport trucks, as well as support vehicles during the Project's decommissioning.
  - Traffic – Daily vehicle movements associated with the Project's decommissioning (including personnel transportation and movements of support vehicles).
  - Restoration of the Project's onshore installation area.
- Decommissioning of offshore CO_2 transportation pipelines.
  - The offshore pipeline and riser will be depressurized, cleaned using standard pigging operations and subsequently inerted with nitrogen. Then, the pipeline will be isolated from the offshore

platform, sealed with welded caps or flanges, and remain in place, in accordance with international standards.
  - The pipelines from the riser top to the wellheads will be depressurized and filled with nitrogen to inert the system. The pipelines will be disconnected from the wellheads, sealed, and left in place.
  - Marine traffic – Daily vessel movements for carrying out the decommissioning of offshore pipelines (including personnel transportation and movements of support vessels).
- Decommissioning of offshore installations (excluding the offshore CO_2 transportation pipeline)
  - Dismantling of equipment and removal of installations.
  - Marine traffic – Daily vessel movements for carrying out the decommissioning of offshore installations (including personnel transportation and movements of support vessels).

Overall, the expected noise emissions during the decommissioning phase of the Project's onshore installations are estimated to be limited in significance, as the onshore facilities are limited in extent, duration, and infrastructure volume to be removed. Therefore, these impacts are expected to be *negative, low in intensity, local in extent, concurrent with the decommissioning activities, of temporary duration, of short-term reversibility, synergistic, non-cumulative, periodic and immediately restorable*. As for their overall evaluation, these impacts are assessed as ***Minor.***

Furthermore, on one hand, the limited duration of the decommissioning of the Project's onshore facilities, and on the other, the relatively small volume of materials to be removed from the Project area after dismantling of installations and equipment, render the expected airborne noise emissions from road transport (of personnel and decommissioning materials) relatively limited. Therefore, in terms of significance, these impacts are assessed as negative, negligible in intensity, local in extent, concurrent with the decommissioning activities, of temporary duration, of short-term reversibility, synergistic, non-cumulative, periodic and immediately restorable. As for their overall evaluation, these impacts are assessed as **Minor.**

Likewise, on one hand, the limited duration of the decommissioning of the Project's offshore facilities, and on the other, the fact that a large part of the infrastructure will remain in place after the project's completion (e.g., the CO_2 transportation pipeline will be isolated and remain within the seabed), render the expected airborne noise emissions from the decommissioning of offshore installations relatively limited. Therefore, in terms of significance, these impacts are assessed as *negative, low in intensity, local in extent, concurrent with the decommissioning activities, of temporary duration, of short-term reversibility, synergistic, non-cumulative, periodic and immediately restorable*. As for their overall evaluation, these impacts are assessed as ***Minor.***

Additionally, on one hand, the limited duration of the decommissioning of the Project's offshore facilities, and on the other, the fact that a large part of the infrastructure will remain in place after the project's completion (e.g., the CO_2 transportation pipeline will be isolated and remain within the seabed), render the expected airborne noise emissions from marine transport (of personnel and decommissioning materials) relatively limited. Therefore, in terms of significance, these impacts are assessed as *negative, negligible in* *intensity, local in extent, concurrent with the decommissioning activities, of temporary duration, of short-term reversibility, synergistic, non-cumulative, periodic and immediately restorable*. As for their overall evaluation, these impacts are assessed as ***Minor***.

In contrast, during the decommissioning phase of the proposed Project, restoration works are expected to be carried out which will restore the acoustic environment of the study area to its previous state (or even improve it, if the pre-existing conditions were significantly degraded). Therefore, from the decommissioning of the proposed Project and the restoration of the terrestrial intervention area, ***positive impacts* are expected on the acoustic environment of the area.**

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Disassembly and dismantling of offshore facilities	Underwater Noise	-	1	2	4	1	1	2	4	2	1	1	23	Minor	Moderate	Minor
Marine movements and transport (personnel, equipment, and materials) within the scope of the decommissioning/dismantling of the offshore facilities of the examined Project	Underwater Noise	-	2	2	4	1	1	2	4	2	1	1	26	Minor	Moderate	Minor
Disassembly and dismantling of onshore facilities	Acoustic Environment	-	2	2	4	1	1	2	4	2	1	1	26	Minor	Moderate	Minor
Road movements and transport (personnel, equipment, and materials) within the scope of the decommissioning/dismantling of the onshore facilities of the examined Project and restoration of the terrestrial intervention area	Acoustic Environment	-	1	2	4	1	1	2	4	2	1	1	23	Minor	Moderate	Minor
Disassembly and dismantling of offshore facilities	Acoustic Environment	-	2	2	4	1	1	2	4	2	1	1	26	Minor	Moderate	Minor
Marine movements and transport (personnel, equipment, and materials) within the scope of the decommissioning/dismantling of the offshore facilities of the examined Project	Acoustic Environment	-	1	2	4	1	1	2	4	2	1	1	23	Minor	Moderate	Minor
Decommissioning/cessation of the examined Project and restoration of the terrestrial intervention area	Acoustic Environment	+	2	2	4	4	1	2	4	4	1	1	31	Positive	Moderate	Positive

10.2.8 Impacts Related to Electromagnetic Fields

10.2.8.1 Construction Phase

No emissions of electromagnetic radiation are expected during the construction works, as no permanent installations or machinery emitting continuous radiation will be used.

Regarding the Naturally Occurring Radioactive Material (NORM) associated with the Prinos formations, most of the drill cuttings historically produced from Prinos drilling operations exhibit radioactivity levels comparable to background levels.

10.2.8.2 Operation Phase

No emissions of electromagnetic radiation or radioactivity are expected during the operation phase of the Project.

10.2.8.3 Decommissioning Phase

No emissions of electromagnetic radiation or radioactivity are expected during the decommissioning phase of the Project.

10.2.9 Impacts on Water

The following paragraphs examine the likelihood of potential adverse impacts on water resources as a result of the construction, operation and decommissioning/abandonment phases of the Project under consideration.

10.2.9.1 Construction Phase

The following paragraphs examine the likelihood of potential adverse impacts on the water resources of the area as a result of the implementation of the Project under consideration.

Qualitative characteristics of marine & coastal waters

The activities causing impacts on the qualitative characteristics of the marine & coastal waters of the area during the construction phase of the Project, based also on the scoping of the ESIA content (**Chapter 9**), are the following:

- Land-based facilities (infrastructure and equipment for CO2 capture and management, onshore section of the CO2 pipeline).
  - Land preparation for the equipment foundations, earthworks for the siting of new land-based infrastructure and facilities.
  - Concreting works and placement of 0.5 m thick concrete for the construction of foundation slabs.
  - Installation of the final section of onshore pipelines (placement, welding), which will be installed on the ground on the new foundations, without protective covers.
  - Temporary deposition/storage of structural/construction materials and surplus excavation materials.
  - Water discharge – Water present in trenches or excavations will be removed with appropriate systems (pumps or sumps) and discharged into water bodies located in the Project area (following their classification).
- Offshore CO2 transmission pipeline
  - Phase 2. Works for pipeline landfall (placement of this specific pipeline section in a trench of approximately 500 m length and 3 m depth).
  - Phase 5. Trench backfilling and pipeline protection, commissioning.
  - After the installation of the pipeline and the related connections, the pipeline will be buried along its entire length.
  - After the completion of construction works, the pipeline will be emptied of water using a series of pumps from onshore, and the residual moisture will be removed with the use of chemicals (monoethylene glycol – MEG), so that it is completely dry and suitable for operation.
  - <u>Marine traffic</u> – Daily movement of vessels for the installation of the CO2 transmission pipelines (including the transportation of workers and the movement of support vessels.

- Offshore facilities (excluding the Offshore CO2 transmission pipeline)
  - Drilling of wells
  - Drilling of 4 wells up to a depth of approximately 3,700 m (2 wells will be used as CO2 injection wells and 2 as water production wells to maintain the reservoir pressure balance).
  - All four new wellbores will be drilled using a Top Drive System (TDS) drilling unit and will be steered with a combination of mud motors and rotary steerable systems.
  - Waste – Generation, management and disposal of extractive waste (drilling mud and cuttings).
  - During the drilling of the 16-inch diameter section down to a depth of 2,200 m, a drilling fluid consisting of seawater/lime slurry will be used. The cuttings from this section will be deposited on the seabed. Below this depth, the drilling fluids will return to the surface where the cuttings will be removed, and the slurry will be treated.

Based on the description of the Project construction activities, as analytically presented in **Chapter 6** of the present Study, the following arise:

Land-based facilities

- Generation, management and disposal of liquid waste from the construction works of the Project's land-based facilities. As already mentioned in Chapter 6, the existing Sigma facilities will be used for staff servicing, while alternatively, chemical toilets may be used within the construction site, which will be regularly emptied and maintained by a licensed company under the responsibility of the Project's contractor. Overall, the liquid waste generated by workers during the construction phase (3 months, 60 working days) is estimated at approximately 12 m^3.
- In the context of the construction works, impacts on water may be caused by runoff from material piles and stockpiles, concrete runoff, the generation of liquid waste from used lubricating oils from machinery – fuel leaks. The activities that will take place at the construction site areas pose potential pollution threats to the aquatic environment of the area. Any possible leaks or accidental discharges of used lubricants from heavy vehicles, trucks, machines, as well as washing of the machinery and equipment of the construction sites, are pollution sources that must be addressed.

In addition, dust generation, which will be surface enriched with adsorbed pollutants (exhaust gases, fuels, oils, etc.), may be carried along with stormwater to the coastal waters during heavy rainfall. To minimize such impacts of the proposed Project construction on the surface waters of the area, a series of measures will be taken through the implementation of the Project's Waste Management Plan as well as good construction site practices, combined with their monitoring under the Environmental Monitoring and Control Program.

Offshore CO_2 transport pipeline

- In Phase 2 of the project "Works for the pipeline's approach to the shore (placement of this pipeline segment in a trench approximately 500 m long and 3 m deep)", water present in the excavations or trenches will be removed using appropriate systems (pumps or sumps) and will be discharged into the coastal WS "Eastern Kavala Gulf" EL1207C0001N of the project area. The water discharged into the coastal water system is not expected to have any impact, as it is of a similar nature, being water removed from the coastal zone and not mixed with any type of waste. In any case, a quality check will be performed prior to discharge to verify its good quality.

- In Phase 3 of the project (Installation of 20 km subsea pipeline – using the S-lay method) from a specialized pipe-laying vessel, together with 2 supply/tug support vessels, there is a possibility of increased turbidity affecting water quality. During excavation, water turbidity levels will rise, which may impact water quality and transparency, negatively affecting marine ecosystems and species that depend on them. Furthermore, the physical disturbance of the seabed caused by the excavation is expected to affect the benthic communities in the project area.

    Sediment pollution levels in the area are estimated to be low; therefore, no spread of pollution into the water column or the seabed is expected.
- In Phase 5 of the project (Trench closure and pipeline protection, commissioning). Upon completion of construction works, the pipeline will be emptied of water using a series of land-based pumps, and any residual moisture will be removed using chemicals (monoethylene glycol – MEG), ensuring the pipeline is completely dry and suitable for commissioning.
- Pipeline hydrotest. Once the pipeline is installed, it will be filled with chemically treated water and subjected to hydrotesting. The chemically treated water volume for the pipeline ranges between 1,400 m^3 and 2,500 m^3 for the 20 km length, with potential IDs of 12–14. This water will remain in the pipeline until the hydrotest is completed. Environmentally friendly chemicals will be used. Specifically, approved biocides and corrosion inhibitors will be used to meet the requirements of applicable national and EU legislation and comply with international marine protection conventions (e.g., Barcelona Convention). The substances used for the above purposes must be selected from the "OSPAR List of Substances Used and Discharged Offshore which Are Considered to Pose Little or No Risk to the Environment (PLONOR)" in its most recent version. It is noted, however, that substances listed in the "OSPAR List of Substances of Possible Concern (LSPC)" are not permitted for use.
- During the pipeline construction phase, domestic wastewater will be produced onboard from workers' daily activities. The flow of domestic wastewater is estimated to be equal to the water consumption for daily use (~30 m^3/day), which will be treated in a biological treatment system onboard. Other liquid waste expected to be produced onboard during pipeline construction includes bilge water and ballast water. Bilge water, which may contain grease and/or oil, will be managed in accordance with Annex I of MARPOL 73/78 (Regulations for the Prevention of Pollution by Oil) and its relevant amendments. The treatment equipment (bilge water separator) will comply with the IMO Guidelines and Specifications for Pollution Prevention Equipment for Machinery Space Bilges of Ships (IMO Resolution MEPC.107(49)). The discharge of ballast water used to stabilize vessels at sea is subject to the requirements of Annex I of MARPOL 73/78 and the International Convention for the Control and Management of Ships' Ballast Water and Sediments (Ballast Water Management – BWM). The ballast water treatment system onboard will comply with Standard D-2, regarding the treatment of ballast water. In general, in order to prevent pollution from vessels, all measures specified in the relevant Guidelines (Chapter 11) must be taken, in coordination with the competent Port Authority.

Offshore installations (excluding the Offshore CO_2 transport pipeline)

- Waste – Generation, management and disposal of extractive waste (drilling mud and cuttings). The primary section of the well will be 16 inches and drilled from approximately 350 m down to 2,200 m. Given that no hydrocarbon traces have ever been detected at these depths in the area, the cuttings from this section will be deposited on the seafloor, while below approximately 2,200 m, the drilling fluids will return to the surface, where cuttings will be removed and the mud processed. Given the quality of the cuttings, their disposal on the seabed will not cause pollution of the water quality. However, this activity will increase turbidity. As previously stated, sediments are clean, free of hydrocarbons, and have low heavy metal and trace element content. Therefore, any potential contaminants will disperse over a wide area but are unlikely to be detectable against the existing conditions of the aquatic environment due to already low (below any threshold) concentration levels. Moreover, the volume of cuttings on the sea floor (400 MT) is not considered significant.
- During well drilling, domestic wastewater will be produced from workers' daily activities. The flow of such wastewater is expected to be equivalent to the water consumption for daily needs, as calculated in Chapter 6. Domestic-type sewage from the platform complex will be collected and stored in special tanks located on each platform. These tanks are periodically emptied into a barge or the tank of a support vessel. The tank's contents are transported via the barge to onshore facilities for biological treatment. Therefore, as already stated, the waste produced will be managed in accordance with the applicable legislation and the project's WMP and will not affect the surface or groundwater of the study area.

Based on the above, the following adverse impacts are assessed with regard to the qualitative characteristics of the marine & coastal waters in the area:

- From the implementation of the onshore facilities of the project, adverse impacts are expected, assessed as negative, of low intensity, limited to the project area, concurrent with the construction works, temporary, reversible in the short term, synergistic, with direct effect, continuous, readily restorable, and non-cumulative. In terms of final assessment, these impacts are evaluated as Minor.
- From the implementation of the offshore CO_2 transport pipeline, adverse impacts are expected, assessed as negative, of moderate intensity, local, concurrent with the construction works, temporary, reversible in the short term, synergistic, with direct effect, continuous, readily restorable, and non-cumulative. In terms of final assessment, these impacts are evaluated as Minor.
- From the implementation of the offshore installations (excluding the offshore CO_2 transport pipeline), adverse impacts are expected, assessed as negative, of moderate intensity, local, concurrent with the construction works, temporary, reversible in the short term, synergistic, with direct effect, continuous, readily restorable, and non-cumulative. In terms of final assessment, these impacts are evaluated as Minor.

Qualitative & quantitative characteristics of surface & groundwater

The activities that cause impacts on the qualitative & quantitative characteristics of the surface & groundwater in the area during the construction phase of the project, based on the scope and content defined in the Scoping and Content Definition (**Chapter 9** of the ESIA), are the following:

- Onshore facilities (CO_2 reception and handling infrastructure and equipment, onshore section of the CO_2 pipeline)
  - Site preparation for equipment foundation, earthworks for the siting of the new onshore infrastructure and facilities
  - Concrete works and placement of 0.5 m thick concrete for the construction of foundation base slabs
  - Temporary deposition/storage of structural/construction materials and surplus excavation materials
  - Use of water resources during construction
  - Generation, management and disposal of waste from construction works of the onshore facilities of the project
  - Water discharge – Water present in excavations or trenches will be removed using appropriate systems (pumps or sumps) and discharged into water bodies located in the project area (following their characterization)
- Offshore CO_2 transport pipeline
  - Marine traffic – Daily vessel movement for the installation of the CO_2 transport pipelines (including the transport of personnel and the movement of support vessels)
- Offshore installations (excluding the Offshore CO_2 transport pipeline)
  - Marine traffic – Daily vessel movement for the execution of drilling works (including the transport of personnel and the movement of support vessels)

Based on the description of the construction activities of the proposed project, as described in detail in **Chapter 6** of this report, the following are concluded:

- Use of water resources during construction:
  - Worksite wetting: The water needs for concrete curing and tool washing are limited to approximately 100 m^3, which will be covered by the water supply network of the Sigma facilities. The required water for the wetting of materials and soil surfaces, approximately 200 m^3, may be covered using seawater through the use of mobile pumps or tankers under the responsibility of the project operator.
  - Personnel needs for the construction of the onshore facilities of the project: for workers' living needs, a total of 12 m^3 will be required during the construction phase (3 months, 60 working days). These needs will be met by the water supply network of the Sigma facilities and by bottled water supplies.

Most of the above activities involve the consumption of bottled water and the use of seawater. The quantities used from the Sigma facility's water supply network are very small, resulting in no significant demand for abstracted quantity from surface or groundwater bodies.

- To meet the water needs of the personnel for the construction of the offshore CO_2 transport pipeline, a total of 900 m³ is required during the construction phase (assuming approximately 30 working days during which 200 workers will stay onboard daily). Drinking and utility water needs will be covered by a seawater treatment system (Vacuum Vapour Compression) with an estimated capacity of 50 m³/day, which the vessel will be equipped with, and by bottled water supplies.
- Personnel water needs for the drilling works are estimated at ~4,000 m³ (of which approximately 200 m³ will be drinking water). Bottled water will be used for drinking purposes, so this activity also does not result in increased abstraction from surface or groundwater bodies.
- Water consumption for the drilling of one well is estimated at approximately 3,200 m³ and may reach 3,700 m³, so the water use for all four wells is estimated at 10,000 m³. For this purpose, seawater will be used.

Therefore, based on the above, it is assessed that no adverse impacts will be recorded on the qualitative characteristics of surface and groundwater in the study area, while the following adverse impacts on the quantitative characteristics of the water resources in the area are expected:

- From the implementation of the onshore facilities of the project, adverse impacts are expected, assessed as negative, of negligible intensity, local, concurrent with the construction works, temporary, reversible in the short term, synergistic, with direct effect, continuous, readily restorable, and non-cumulative. In terms of final assessment, these impacts are evaluated as Minor.
- From the implementation of the offshore CO_2 transport pipeline, adverse impacts are expected, assessed as negative, of low intensity, local, concurrent with the construction works, temporary, reversible in the short term, synergistic, with direct effect, continuous, readily restorable, and non-cumulative. In terms of final assessment, these impacts are evaluated as Minor.
- From the implementation of the offshore installations (excluding the offshore CO_2 transport pipeline), adverse impacts are expected, assessed as negative, of moderate intensity, local, concurrent with the construction works, temporary, reversible in the short term, synergistic, with direct effect, continuous, readily restorable, and non-cumulative. In terms of final assessment, these impacts are evaluated as Minor.

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Construction work for onshore installations	Quality characteristics of seawater and coastal waters	-	2	1	4	1	1	2	4	4	1	1	26	Minor	Moderate	Minor
Construction works for CO_2 subsea pipeline	Quality characteristics of seawater and coastal waters	-	4	2	4	1	1	2	4	4	1	1	34	Minor	Moderate	Minor
Construction works for offshore facilities (excluding the offshore CO_2 transport pipeline)	Quality characteristics of seawater and coastal waters	-	4	2	4	1	1	2	4	4	1	1	34	Minor	Moderate	Minor
Construction work for onshore installations	Quality characteristics of the region's water resources	-	1	2	4	1	1	2	4	4	1	1	25	Minor	Moderate	Minor
Construction works for CO_2 subsea pipeline	Quality characteristics of the region's water resources	-	2	2	4	1	1	2	4	4	1	1	28	Minor	Moderate	Minor
Construction works for offshore facilities (excluding the offshore CO_2 transport pipeline)	Quality characteristics of the region's water resources	-	4	2	4	1	1	2	4	4	1	1	34	Minor	Moderate	Minor

10.2.9.2 Operational Phase

The following paragraphs examine the likelihood of potential adverse impacts on the water resources of the area as a result of the operational phase of the proposed Project.

Qualitative characteristics of marine & coastal waters

The activities that cause impacts on the qualitative characteristics of marine & coastal waters in the area during the operational phase of the project, based on the scope and content defined in the Scoping and Content Definition (**Chapter 9** of the ESIA), are the following:

- CO_2 injection. The main processing equipment on Beta platform will include a pumping and heating station for the required injection conditions, installed on the open deck of the platform.
  - CO_2 injection will target Reservoirs B and C with two injection wells during the period 2025–2035 and will subsequently expand to the entire reservoir by the end of the project.
- Water production. The two water production wells on Beta platform will be equipped with electric submersible pumps (ESP) and will extract water from the reservoir. They will operate with a production of up to 7500 bwpd each during the period 2025–2031 and water production will gradually increase to 97000 bwpd per well by 2031 and until the end of the project.
- Maintenance and repair activities of infrastructure and equipment
  - Maintenance and repair activities of onshore infrastructure and equipment.
- Waste. Generation, management and disposal of waste from the operation of the onshore and offshore facilities of the project.
- Marine traffic. Daily vessel movements due to the operation of the project (including the transport of personnel and movements of support vessels).

Based on the description of the project's operational activities, as described in detail in Chapter 6 of this report, the following are concluded:

Offshore CO_2 transport pipeline

From the maintenance and repair activities of offshore infrastructure and equipment, and more specifically from the periodic inspection of the pipeline (every 5 years), no significant impacts are expected on the aquatic environment, provided that best available practices are followed (indicatively: ensuring that the materials used in the construction and maintenance of the project (coatings, insulation, linings, etc.) do not contain substances listed in the Supreme Chemical Council Decision 1100/91/91 (OGG B' 1008/12−12−1991) and Ministerial Decisions 475/2002/03 (B' 208/2003) and 121/2003/03 (B' 1045/2003), as in force, such as mercury, arsenic and organotin compounds, as well as other chemical substances considered hazardous under the applicable legislation on hazardous substances and for which restrictions on their marketing and use apply with respect to the marine and aquatic environment), and also in accordance with the provisions of the Project's Environmental Management Plan and the respective Environmental Monitoring Programme.

Offshore installations (excluding the Offshore CO_2 transport pipeline)

- Generation, management and disposal of waste from the operation of the offshore facilities of the project.
    - The two water production wells on Beta platform will be equipped with electric submersible pumps (ESP) and will extract water from the reservoir. They will operate with a production of up to 7500 bwpd each during the period 2025–2031 and water production will gradually increase to 97000 bwpd per well by 2031 and until the end of the project. The water produced from these wells will be routed to the Delta platform of Prinos, where it will be separated and treated in the existing systems and then discharged into the sea. The treated seawater will meet quality and salinity standards, since any uncontrolled discharge may be associated with: (a) temperature changes: if the treated water has a different temperature from the surrounding seawater, it may create thermal zones that can affect fish behavior and distribution (b) ecosystem alterations: the discharge of large volumes of water may impact the structure and function of marine ecosystems, affecting fish habitats and other marine organisms. However, no significant impacts are expected from these activities on the aquatic environment, provided that the best available practices are followed, as well as the provisions of the Project's Environmental Management Plan and the respective Environmental Monitoring Programme.
    - Water from the platform surfaces (wash water and rainwater) will be directed to the closed drainage system through the bunded areas and then discharged in accordance with the International Convention for the Prevention of Pollution from Ships (MARPOL). To minimize these volumes, the size of the bunded areas has been minimized and protected from rainfall where possible. As above, no significant impacts are expected from these activities on the aquatic environment, provided that the best available practices are followed, as well as the provisions of the Project's Environmental Management Plan and the respective Environmental Monitoring Programme.
    - Hazardous waste generated from the cleaning of tanks V-101 A/B, V-107, and V-102 from water treatment operations on the Delta platform consists of oily sludge (mixtures of heavy hydrocarbons containing mainly asphaltenes), rags, absorbent materials, etc. The generated waste will be separately collected by type in suitable containers for safe temporary storage at the Project site, in accordance with safety and environmental protection regulations, and will be managed by licensed collection, transport, and waste management entities. However, these are already included in the existing operations of the Delta platform, so no deterioration of water quality is expected from this activity. In any case, the Waste Management Plan will be implemented in combination with the proposed measures of Chapter 11.
    - The daily vessel movements due to the project's operation (including the transport of personnel and movements of support vessels) are not expected to have significant impacts on the qualitative characteristics of marine and coastal waters, given their low transport volume and limited number,

especially following the implementation of best available practices and the provisions of the Project's Environmental Management Plan and the respective Environmental Monitoring Programme.

Therefore, based on the above, the following adverse impacts are expected regarding the qualitative characteristics of the marine & coastal waters of the area:

- From the operation of the offshore CO_2 transport pipeline, adverse impacts are expected, of negligible intensity, local, immediate occurrence, long-term, reversible in the short term, synergistic, with direct effect, periodic, readily restorable, and non-cumulative. In terms of final assessment, these impacts are evaluated as Minor.
- From the operation of the offshore installations (excluding the offshore CO_2 transport pipeline), adverse impacts are expected, of low intensity, local, immediate occurrence, long-term, reversible in the short term, synergistic, with direct effect, continuous, readily restorable, and non-cumulative. In terms of final assessment, these impacts are evaluated as Minor.

Qualitative & quantitative characteristics of surface & groundwater

The activities that cause impacts on the qualitative & quantitative characteristics of surface & groundwater in the area during the operational phase of the project, based on the Scoping and Content Definition of the ESIA (**Chapter 9**), are the following:

- Human, material, and natural resources
  - Consumption of energy, fuels, and materials
- Waste. Generation, management and disposal of waste from the operation of the onshore and offshore facilities of the project.

During the operational phase of the CO_2 storage facilities, no freshwater use is required, except for personnel accommodation purposes, which remains at levels similar to those of the currently operating facilities. Similarly, during the operational phase of the CO_2 storage facilities, the production of wastewater is expected, also remaining at levels comparable to the current operation of the existing facilities.

Therefore, during the operational phase of the project, limited impacts on the quantity of water resources are expected, as only small amounts of water will be required for personnel accommodation needs. In contrast, no adverse impacts on the quality of water resources are anticipated, given the application of best available practices regarding the collection and disposal of liquid waste, as foreseen in the Project's Waste Management Plan (WMP). As a result, in terms of their significance, the impacts on the quantitative characteristics of the water resources are assessed as adverse, of low intensity, direct, localised, immediate in occurrence, long-term, reversible in the short term, synergistic, non-cumulative, continuous and readily restorable. In terms of their final evaluation, these impacts are considered **Minor.**

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Maintenance of offshore CO_2 transport pipeline	Quality characteristics of seawater and coastal waters	-	1	2	4	3	1	2	4	2	1	1	25	Minor	Moderate	Minor
Operation of offshore facilities	Quality characteristics of seawater and coastal waters	-	2	2	4	3	1	2	4	4	1	1	30	Minor	Moderate	Minor
Operation of the project	Quantitative characteristics of water resources	-	2	2	4	3	1	2	4	4	1	1	30	Minor	Moderate	Minor

10.2.9.3 Decommissioning Phase / Dismantling

The following paragraphs examine the likelihood of potential adverse impacts on the water resources of the area, as a result of the decommissioning/dismantling phase of the Project under assessment.

Qualitative characteristics of marine & coastal waters

The activities that cause impacts on the qualitative characteristics of marine & coastal waters in the area during the decommissioning/dismantling phase of the project, based on the Scoping and Content Definition of the ESIA (**Chapter 9**), are the following:

- Dismantling of Onshore Facilities – Restoration of the Onshore Project Site
  - Dismantling of equipment and removal of installations
  - Movement of heavy vehicles, construction machinery, transport trucks and support vehicles during the decommissioning/dismantling of the project, which emit:
  - Restoration of the onshore project area
- Decommissioning / Dismantling of offshore CO_2 transmission pipelines
  - The offshore pipeline and riser will be depressurised, cleaned using standard pigging operations and then inerted by injecting nitrogen. The pipeline will then be disconnected from the offshore platform, sealed with welded caps or flanges and left in place, in accordance with international standards.
  - The flowlines from the top of the riser to the wellheads will be depressurised and filled with nitrogen to inert the system. The flowlines will be disconnected from the wellheads, capped, and left in place.
  - Marine traffic – Daily vessel movements for the implementation of the dismantling works of the offshore pipelines (including transport of personnel and support vessel operations).
- Decommissioning / Dismantling of offshore facilities (excluding the offshore CO_2 transmission pipeline)
  - Dismantling of equipment and removal of installations.
  - Generation of solid and liquid waste.
  - Marine traffic – Daily vessel movements for the implementation of the dismantling works of the offshore installations (including transport of personnel and support vessel operations).

Based on the description of the construction activities of the Project under assessment, as analysed in Chapter 6 of this document, the following arise:

Χερσαίες εγκαταστάσεις

- Generation, management and disposal of liquid waste from the dismantling works of the project's onshore facilities. As already mentioned in Chapter 6, the existing SIGMA facilities will be used to accommodate personnel, while alternatively, chemical toilets may be used within the construction site, which will be regularly emptied and maintained by a licensed company under the responsibility of the project's contractor.
- Within the framework of the dismantling works of the project's onshore facilities, impacts on water may be caused by runoff from stockpiles and materials, the generation of liquid waste from used mineral oils from machinery, and fuel leaks. Activities taking place within the construction site constitute potential pollution threats to the aquatic environment of the area. Any potential leaks or accidental discharges of used mineral oils from heavy vehicles, trucks, engines, as well as the washing of machinery and equipment on site, represent pollution sources that must be addressed.
- In addition, dust generation, which will be superficially loaded with adsorbed pollutants (exhaust gases, gasoline, oil, etc.), may be carried away to coastal waters in the event of heavy rainfall. In order to minimise these impacts on surface water from the proposed project's construction activities, a number of measures will be implemented, including the application of the Project's Waste Management Plan as well as best construction site practices, in combination with monitoring measures under the Environmental Monitoring and Control Programme.

Offshore CO_2 transmission pipeline

The offshore CO_2 pipeline and riser will be depressurised, cleaned using standard pigging operations, and inerted by injecting nitrogen. The pipeline will then be disconnected from the offshore platform, sealed with welded caps or flanges, and left in place, in accordance with international standards.

As evidenced from the above, the volume of the required works is particularly limited and, therefore, both the use of equipment and vessels for the dismantling works and the resulting waste generation with potential adverse effects on the qualitative characteristics of marine & coastal waters in the area will also be limited.

Offshore installations (excluding the Offshore CO_2 transmission pipeline)

- The activities during the dismantling of the offshore equipment of the proposed project will generally result in the generation of relatively limited amounts of waste, as a consequence of the relatively limited scale of the project. During the dismantling of the offshore installations of the Project, limited quantities of surplus materials will be generated, including carbon steel piping, protective steel casings, and other metallic equipment. In addition, waste will be generated from the operation of the vessels and equipment required for the dismantling of the offshore equipment of the proposed project. The management of the above materials will follow the best available practices, with priority given to reuse, followed by recycling, and finally safe disposal of non-reusable and non-recyclable materials.
- Beyond their relatively limited quantity, it is important to highlight that their management will follow the best available practices for soil protection and the requirements of applicable legislation, as outlined in the overall Waste Management Plan of the Project, which is presented in Annex 16.3.
- During the dismantling phase of the offshore equipment, domestic wastewater will be generated from the accommodation of workers. It is estimated that the amount of domestic wastewater will be equal to the freshwater consumption for the accommodation of workers, as calculated in Chapter 6. Domestic-type wastewater from the platform complexes is collected and stored in special tanks located on each platform. These tanks are periodically emptied into a barge or into the tank of the support vessel. The tank contents are then transferred via the barge to the onshore facilities for biological treatment.

Based on the above, the following impacts on the qualitative characteristics of marine & coastal waters in the area are assessed:

- From the decommissioning and dismantling of the project's onshore installations, adverse impacts are expected, which are assessed as of negligible intensity, limited to the project area, concurrent with the dismantling works, temporary, reversible in the short term, synergistic, of direct effect, continuous, readily restorable, and non-cumulative. In terms of their final evaluation, these impacts are assessed as Minor.
- On the contrary, during the decommissioning and dismantling phase of the Project under assessment, restoration works of the onshore project site are expected to be implemented, which will restore the water conditions of the study area to their previous state (or even to improved condition, if the pre-intervention state was significantly degraded). Therefore, <u>positive impacts on the waters of the area are expected from the restoration of the onshore intervention area.</u>
- From the decommissioning of the offshore CO_2 transmission pipeline, adverse impacts are expected, which are assessed as of negligible intensity, local, concurrent with the construction works, temporary, reversible in the short term, synergistic, of direct effect, continuous, readily restorable, and non-cumulative. In terms of their final evaluation, these impacts are assessed as Minor.
- From the decommissioning and dismantling of the offs<u>hore installations (excluding the offshore CO_2 transmission pipeline)</u>, adverse impacts are expected, which are assessed as of low intensity, local, concurrent with the construction works, temporary, reversible in the short term, synergistic, of direct

effect, continuous, readily restorable, and non-cumulative. In terms of their final evaluation, these impacts are assessed as Minor.

Qualitative & quantitative characteristics of surface & groundwater

The activities that generate impacts on the qualitative and quantitative characteristics of surface and groundwater in the area during the decommissioning/removal phase of the project, based on the Scope and Content delimitation of the ESIA (**Chapter 9**), are as follows:

- Human, material, and natural resources
  - Consumption of energy, fuels, and materials
- Removal of Onshore Installations – Restoration of the onshore project site
  - Operation of heavy vehicles, construction machinery, transport vehicles and trucks, as well as support vehicles during the decommissioning/removal phase of the project, which emit:
  - Generation of solid and liquid waste.
  - Restoration of the onshore area of the Project site.

Regarding the use of water resources during the decommissioning/removal phase of the project, this is expected to be at very limited levels, as the required quantities are even lower than those of the construction phase (as described in the corresponding section above), due to the smaller volume and shorter duration of the necessary works.

Furthermore, similarly to the construction phase of the project, the existing infrastructure of the Sigma facilities will be used for the accommodation of personnel. Alternatively, chemical toilets may be installed within the construction site, which will be regularly emptied and maintained by a licensed company under the responsibility of the contractor.

As part of the dismantling **works**, impacts on water may arise from the runoff of material piles and stockpiles, as well as from the production of liquid waste originating from used mineral oils from machinery – fuel leaks. The activities hosted in the construction areas represent potential pollution threats to the local aquatic environment. Any leaks or accidental discharges of used mineral oils from heavy vehicles, trucks, and machinery, as well as washing of construction machinery and equipment, are sources of pollution that must be addressed.

In addition, the production of dust, which may be surface contaminated with adsorbed pollutants (exhaust gases, gasoline, oils, etc.), could, in the event of heavy rainfall, be carried by stormwater runoff toward coastal waters. In order to minimise such impacts from the dismantling works of the proposed project on surface waters in the area, a number of measures will be implemented through the application of the Project's Waste Management Plan, as well as proper construction site practices, combined with their monitoring within the framework of the Environmental Monitoring and Control Program.

Therefore, during the decommissioning/removal phase of the project, limited impacts on the quantity of water resources are expected, since only small quantities of water will be required for the accommodation of project personnel. On the other hand, no adverse impacts are expected on the quality of water resources, given the implementation of the best available practices regarding the collection and disposal of liquid waste, as foreseen in the Project's WMP. As a result, in terms of their significance, the impacts on the quantitative characteristics of water resources are assessed as adverse, of low intensity, local, concurrent with the construction works, temporary, reversible in the short term, synergistic, of direct effect, continuous, readily restorable, and non-cumulative. In terms of their final assessment, these impacts are evaluated as **Minor.**

Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)			
Decommissioning/cessation of the onshore facilities of the project	Quality characteristics of seawater and coastal waters	-	1	1	4	1	1	2	4	4	1	1	23	Minor	Moderate	Minor
Decommissioning of the onshore facilities of the project and restoration of their designated area	Quality characteristics of seawater, coastal, surface and groundwater	+	2	2	4	4	1	2	4	4	1	1	31	Positive	Moderate	Positive
Cessation of the subsea CO_2 pipeline	Quality characteristics of seawater and coastal waters	-	1	1	4	1	1	2	4	4	1	1	23	Minor	Moderate	Minor
Decommissioning/cessation of offshore facilities (excluding the offshore CO_2 transport pipeline)	Quality characteristics of seawater and coastal waters	-	2	2	4	1	1	2	4	4	1	1	26	Minor	Moderate	Minor
Cessation and decommissioning works of the onshore project facilities	Quantitative characteristics of the area's water resources	-	2	2	4	1	1	2	4	4	1	1	26	Minor	Moderate	Minor

10.3 SUMMARY OF IMPACTS FROM THE NORMAL / ROUTINE OPERATION OF THE PROJECT

A summary presentation of the impacts during the implementation phase of the proposed project, in matrix form, is provided in the following Tables.

Table 10-4. Summary of characteristics, significance, magnitude, and Final Assessment of impacts on the individual environmental parameters during the Construction Phase of the proposed project

Construction - Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation	Final Residual Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)				
CLIMATIC AND BIOCLIMATIC CHARACTERISTICS																	
GHG emissions from the construction of onshore facilities	Climate / Climate change	-	1	2	4	1	1	2	4	2	1	4	26	Minor	High	Moderate	Minor
GHG emissions from the construction of the CO_2 transport pipeline	Climate / Climate change	-	4	2	4	1	1	2	4	2	1	4	35	Minor	High	Moderate	Minor
GHG emissions from drilling operations	Climate / Climate change	-	4	2	4	1	1	2	4	4	1	4	37	Minor	High	Moderate	Minor
MORPHOLOGICAL AND TOPOGRAPHICAL CHARACTERISTICS																	
Construction of onshore facilities	Morphology of onshore area	-	1	1	4	1	2	1	4	4	1	1	23	Minor	Low	Negligible	Negligible
Construction of onshore facilities	Landscape	-	1	2	4	1	2	2	4	4	1	1	26	Minor	Moderate	Minor	Minor
Construction of the CO_2 transport pipeline	Morphology of the seabed	-	4	1	4	1	2	1	4	4	1	1	32	Minor	Low	Negligible	Negligible

Construction - Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation	Final Residual Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)				
Construction of the CO_2 transport pipeline	Landscape	-	4	2	4	1	2	2	4	4	1	1	35	Minor	Moderate	Minor	Minor
Drilling works	Morphology of the seabed	-	4	2	4	1	3	1	4	4	1	1	35	Minor	Low	Negligible	Negligible
Drilling works	Landscape	-	4	2	4	1	2	2	4	4	1	1	35	Minor	Moderate	Minor	Minor
GEOLOGICAL, TECTONIC AND SOIL CHARACTERISTICS																	
Construction of onshore installations	Geological characteristics	-	1	1	4	1	2	1	4	4	1	1	23	Minor	Low	Negligible	Negligible
Construction of onshore installations	Soil characteristics	-	2	1	4	1	2	2	4	4	1	1	27	Minor	Low	Negligible	Negligible
Construction of the CO_2 transport pipeline	Quality characteristics and structure of the seabed	-	4	2	4	1	2	1	4	4	1	1	34	Minor	Moderate	Minor	Minor
Drilling works	Quality characteristics and structure of the seabed	-	4	2	4	1	2	1	4	4	1	1	34	Minor	Moderate	Minor	Minor
Drilling activities	Geological characteristics and	-	4	2	4	1	2	1	4	4	1	1	34	Minor	Low	Negligible	Negligible

Construction - Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation	Final Residual Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)				
	subsea geological formations																
NATURAL BIOTIC ENVIRONMENT																	
Construction of the CO_2 transport pipeline	Terrestrial Habitats	-	2	2	4	1	1	2	4	4	2	1	29	Minor	Moderate	Minor	Minor
Construction of the onshore section of the CO_2 transport pipeline	Terrestrial Mammals	-	1	2	4	1	1	2	4	4	1	1	25	Minor	Low	Negligible	Negligible
Construction of the onshore section of the CO_2 transport pipeline	Amphibians and Reptiles	-	1	2	4	1	1	2	4	4	1	1	25	Minor	Moderate	Minor	Minor
Construction of the onshore section of the CO_2 transport pipeline	Marine Habitats	-	2	2	4	4	1	1	4	4	2	1	31	Minor	Low	Negligible	Negligible
Drilling activities	Marine Habitats	-	2	2	4	1	1	2	4	4	2	1	29	Minor	Low	Negligible	Negligible
Construction of the onshore section of the CO_2 transport pipeline	Marine Mammals	-	2	2	4	1	1	2	4	2	1	1	26	Minor	High	Moderate	Minor
Drilling activities	Marine Mammals	-	2	2	4	1	1	2	4	2	1	1	26	Minor	High	Moderate	Minor

Construction - Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation	Final Residual Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)				
Construction of the CO_2 transport pipeline	Marine turtles	-	2	2	4	1	1	2	4	4	1	1	28	Minor	Moderate	Minor	Minor
Drilling activities	Marine turtles	-	2	2	4	1	1	2	4	4	1	1	28	Minor	Moderate	Minor	Minor
Construction of the CO_2 transport pipeline	Ichthyofauna	-	2	2	4	1	1	2	4	4	2	1	29	Minor	Moderate	Minor	Minor
Γεωτρητικές εργασίες	Ichthyofauna	-	2	2	4	1	1	2	4	4	1	4	28	Minor	Moderate	Minor	Minor
Construction of the CO_2 transport pipeline	Avifauna	-	2	2	4	1	1	2	4	4	2	1	29	Minor	High	Moderate	Minor
Drilling activities	Avifauna	-	2	2	4	1	1	2	4	4	2	1	29	Minor	High	Moderate	Minor
Construction of the CO_2 transport pipeline	Areas of the National System of Protected Areas	-	2	2	4	1	1	2	4	4	2	1	29	Minor	High	Moderate	Minor
Drilling activities	Areas of the National System of Protected Areas	-	2	2	4	1	1	2	4	4	2	1	29	Minor	High	Moderate	Minor
Κατασκευή του αγωγού μεταφοράς CO2	Other Important Natural Areas.	-	2	2	4	1	1	2	4	4	2	1	29	Minor	High	Moderate	Minor

Construction - Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation	Final Residual Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)				
Γεωτρητικές εργασίες	Other Important Natural Areas.	-	2	2	4	1	1	2	4	4	2	1	29	Minor	High	Moderate	Minor
ANTHROPOGENIC ENVIRONMENT																	
Offshore CO_2 transportation pipeline: Definition of exclusion zones for marine users due to CO_2 pipeline installation works (including associated activities/operations).	Marine uses	-	1	1	4	1	1	1	4	4	1	1	22	Minor	Low	Negligible	Negligible
Offshore facilities (excluding the offshore CO_2 transportation pipeline): Definition of exclusion zones for marine users due to geotechnical works	Marine uses	-	1	1	4	1	1	1	4	4	1	1	22	Minor	Low	Negligible	Negligible
Movement of heavy vehicles, construction machinery, and transport/support trucks during construction, which emit: • Dust (PM10, PM2.5) • Air pollutants (CO, VOC, and NOx) • Noise	Disruption and Functions of the Anthropogenic Environment	-	1	1	4	1	1	1	4	2	1	1	20	Negligible	Moderate	Negligible	Negligible

Construction - Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation	Final Residual Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)				
Mobilization / Engagement (recruitment, employment, involvement) of workforce	Disruption and Functions of the Anthropogenic Environment	+	4	2	4	2	1	1	1	4	2	1	32	Positive	Moderate	Positive	Positive
Implementation of Corporate Social Responsibility (CSR) Actions	Disruption and Functions of the Anthropogenic Environment	+	4	4	4	3	1	2	4	4	1	4	43	Positive	Moderate	Positive	Positive
Construction of onshore facilities – Emissions of air pollutants and noise	Tourism	-	1	2	3	1	1	1	1	1	1	1	17	Negligible	High	Minor	Minor
Mobilization / Engagement (recruitment, employment, involvement) of workforce	Other economic activities	+	4	2	4	2	2	1	1	4	3	1	34	Positive	High	Positive	Positive
Supply chain and procurement issues concerning the required construction materials, resources, and services for the implementation of the Project.	Other economic activities	+	8	2	4	2	2	1	4	4	3	1	49	Positive	High	Positive	Positive
Mobilization (recruitment, employment, engagement) of the labor force	Employment and workforce	+	8	2	4	2	2	1	4	4	3	1	49	Positive	High	Positive	Positive
Supply chain and procurement issues concerning the required construction materials, resources,	Employment and workforce	+	8	2	4	2	2	1	4	4	3	1	49	Positive	High	Positive	Positive

Construction - Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation	Final Residual Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)				
and services for the implementation of the Project																	
Construction work	Occupational health and safety	-	1	1	4	1	1	1	4	1	1	1	19	Negligible	High	Minor	Minor
Construction-related activities	Public Health	+	2	2	2	2	1	1	1	4	2	1	24	Positive	High	Positive	Positive
TECHNICAL INFRASTRUCTURE																	
Installation of CO_2 transport pipelines and other offshore installations (including the transport of workers and support vessel movements)	Maritime Transport / Traffic	-	1	2	4	1	1	2	4	4	1	1	25	Minor	Low	Negligible	Negligible
Preservation and use of the marine zone – access restriction	Marine Transport / Traffic	-	1	2	4	1	1	2	4	4	1	1	25	Minor	Low	Negligible	Negligible
Traffic on the road network of heavy vehicles, construction machinery, vehicles and trucks transporting waste due to the implementation of construction works of the examined project	Road Network / Transport / Traffic	-	1	2	4	1	1	2	4	4	1	1	25	Minor	Low	Negligible	Negligible
Generation of liquid and solid waste due to the implementation of construction works	Waste collection, transfer, disposal and management	-	1	2	4	1	1	2	4	4	1	1	25	Minor	Low	Negligible	Negligible

Construction - Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation	Final Residual Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)				
	systems for liquid and solid waste																
AIR QUALITY																	
Air pollutant emissions from the construction of onshore installations	Atmospheric environment	-	1	2	4	1	1	2	4	2	1	4	26	Minor	Low	Negligible	Negligible
Air pollutant emissions from the operation of the CO_2 transport system	Atmospheric environment	-	4	2	4	1	1	2	4	2	1	4	35	Minor	Low	Negligible	Negligible
Air pollutant emissions from drilling works	Atmospheric environment	-	4	2	4	1	1	2	4	4	1	4	37	Minor	Low	Negligible	Negligible
ACOUSTIC ENVIRONMENT																	
Construction of the CO_2 transport pipeline	Underwater Noise	-	2	2	4	1	1	2	4	2	1	1	26	Minor	Moderate	Minor	Minor
Drilling works	Underwater Noise	-	4	2	4	1	1	2	4	2	1	1	32	Minor	Moderate	Minor	Minor
Drilling works	Vibrations	-	2	2	4	1	1	2	4	2	1	1	26	Minor	Moderate	Minor	Minor
Construction of onshore installations	Acoustic environment	-	2	2	4	1	1	2	4	2	1	1	26	Minor	Moderate	Minor	Minor

Construction - Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation	Final Residual Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)				
Construction of the CO_2 transport pipeline	Acoustic environment	-	4	2	4	1	1	2	4	2	1	1	32	Minor	Moderate	Minor	Minor
Drilling works	Acoustic environment	-	4	2	4	1	1	2	4	2	1	1	32	Minor	Moderate	Minor	Minor
WATERS																	
Construction works of onshore installations	Quality characteristics of marine and coastal waters	-	2	1	4	1	1	2	4	4	1	1	26	Minor	Moderate	Minor	Minor
Construction works of the CO_2 subsea pipeline	Quality characteristics of marine and coastal waters	-	4	2	4	1	1	2	4	4	1	1	34	Minor	Moderate	Minor	Minor
Construction works of offshore installations (excluding the offshore CO_2 transport pipeline)	Quality characteristics of marine and coastal waters	-	4	2	4	1	1	2	4	4	1	1	34	Minor	Moderate	Minor	Minor
Construction works of onshore installations	Quantitative characteristics of the region's water resources	-	1	2	4	1	1	2	4	4	1	1	25	Minor	Moderate	Minor	Minor
Construction works of the CO_2 subsea pipeline	Quantitative characteristics of the region's water resources	-	2	2	4	1	1	2	4	4	1	1	28	Minor	Moderate	Minor	Minor

Construction - Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation	Final Residual Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)				
Construction works of offshore installations (excluding the offshore CO_2 transport pipeline)	Quantitative characteristics of the region's water resources	-	4	2	4	1	1	2	4	4	1	1	34	Minor	Moderate	Minor	Minor

Table 10-5. Summary of characteristics, significance, magnitude, and Final Assessment of impacts on the individual environmental parameters during the Operation Phase of the proposed project

Operation - Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation	Final Residual Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)				
CLIMATIC AND BIOCLAMATIC CHARACTERISTICS																	
GHG emissions from the transport of CO_2 to the offshore storage installations in Prinos	Climate / Climate change	-	4	2	4	3	1	2	4	2	1	4	37	Minor	High	Moderate	Minor
GHG emissions from CO_2 injection	Climate / Climate change	-	4	2	4	3	1	2	4	4	1	4	39	Minor	High	Moderate	Minor
GHG emissions from water abstraction	Climate / Climate change	-	4	2	4	3	1	2	4	4	1	4	39	Minor	High	Moderate	Minor
GHG emissions from maintenance activities and infrastructure/equipment servicing	Climate / Climate change	-	2	1	4	3	1	2	4	2	1	4	29	Minor	High	Moderate	Minor
GHG emissions from the daily movement of vessels due to the Project's operation (including worker transport and support vessel movements)	Climate / Climate change	-	2	2	4	3	1	2	4	2	1	4	31	Minor	High	Moderate	Minor
CO_2 storage from the operation of the Project	Climate / Climate change	+	12	8	4	4	3	2	4	4	4	4	81	Positive	High	Positive	Positive

Operation - Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation	Final Residual Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)				
MORPHOLOGICAL AND TOPOLOGICAL CHARACTERISTCS																	
Physical presence – Operation of onshore installations	Morphology of the onshore area	-	1	1	4	4	2	1	4	4	1	1	26	Minor	Low	Negligible	Negligible
Physical presence – Operation of onshore installations	Landscape	-	1	2	4	4	2	2	4	4	1	1	29	Minor	Moderate	Minor	Minor
GEOLOGICAL, TECTONIC AND SOIL CHARACTERISTICS																	
Physical presence – Operation of onshore installations	Soil characteristics	-	2	1	4	3	2	2	4	4	1	1	29	Minor	Low	Negligible	Negligible
Physical presence and operation of installations – CO_2 injection into geological formations	Tectonic	-	4	2	4	3	2	2	4	1	1	1	34	Minor	Moderate	Minor	Minor
NATURAL BIOTIC ENVIRONMENT																	
CO_2 transport to the offshore storage installations in Prinos (pipeline segment to be installed onshore)	Terrestrial habitats	-	1	2	3	2	1	2	4	4	2	1	26	Minor	Moderate	Minor	Minor
Water abstraction from the reservoir and discharge of treated water into the marine environment during project operation	Marine habitats	-	1	2	4	4	1	1	4	4	3	1	29	Minor	Low	Negligible	Negligible

Operation - Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation	Final Residual Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)				
Designation / maintenance of an anchoring and fishing exclusion zone during the operation of the Project.	Marine habitats	+	4	4	4	4	1	2	4	4	4	1	44	Positive	Low	Positive	Positive
Water abstraction from the reservoir and discharge of treated water into the marine environment during the operation of the Project	Marine mammals	-	1	2	4	4	1	2	4	2	1	1	26	Minor	High	Moderate	Minor
Designation / maintenance of an anchoring and fishing exclusion zone during the operation of the Project	Marine mammals	+	4	4	4	4	1	2	4	4	4	1	44	Positive	High	Positive	Positive
Water abstraction from the reservoir and discharge of treated water into the marine environment during the operation of the Project	Sea turtles	-	1	2	4	4	1	2	4	2	1	1	26	Minor	Moderate	Minor	Minor
Daily vessel movement due to Project operation (including transport of workers and movements of support vessels)	Sea turtles	-	2	2	4	4	1	2	4	2	1	1	29	Minor	Moderate	Minor	Minor
Designation / maintenance of an anchoring and fishing exclusion zone during the operation of the Project	Sea turtles	+	4	4	4	4	1	2	4	4	4	1	44	Positive	Moderate	Positive	Positive

Operation - Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation	Final Residual Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)				
Water abstraction from the reservoir and discharge of the treated water into the marine environment during the operation of the Project.	Icthyofauna	-	2	2	3	4	1	2	4	4	1	1	30	Minor	Moderate	Minor	Minor
Designation / maintenance of an anchoring and fishing exclusion zone during the operation of the Project	Ichthyofauna	+	4	4	4	4	1	2	4	4	4	1	44	Positive	Moderate	Positive	Positive
Water abstraction from the reservoir and discharge of treated water into the marine environment during the operation of the Project	Avifauna	-	2	2	3	4	1	2	4	4	1	1	30	Minor	High	Moderate	Minor
Marine traffic: Designation of zones with restricted access due to the operation of the Project	Avifauna	+	4	4	3	4	1	2	4	4	4	1	43	Positive	High	Positive	Positive
Water abstraction and discharge activities in the marine environment from the reservoir and discharge of treated water	Areas of the National System of Protected Areas	-	2	2	4	4	1	2	4	4	1	1	31	Minor	High	Moderate	Minor
Daily vessel movement due to the operation of the Project (including worker transport and movements of support vessels)	Areas of the National System of Protected Areas	-	2	2	4	4	1	2	4	4	1	1	31	Minor	High	Moderate	Minor

Operation - Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation	Final Residual Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)				
Marine traffic: Designation of exclusion zones due to the operation of the Project.	Areas of the National System of Protected Areas	+	4	4	4	4	1	2	4	4	4	1	44	Positive	High	Positive	Positive
Water abstraction from the reservoir and discharge of treated water into the marine environment	Other Important Natural Areas	-	2	2	4	4	1	2	4	4	1	1	31	Minor	High	Moderate	Minor
Daily vessel movement due to the operation of the Project (including transport of workers and movements of support vessels)	Other Important Natural Areas	-	2	2	4	4	1	2	4	4	1	1	31	Minor	High	Moderate	Minor
Marine traffic: Designation of exclusion zones due to the operation of the Project	Other Important Natural Areas	+	4	4	4	4	1	2	4	4	4	1	44	Positive	High	Positive	Positive
ANTHROPOGENIC ENVIRONMENT																	
Physical presence and spatial allocation of the Project's marine infrastructure	Marine uses	-	1	1	4	3	1	1	4	4	1	1	24	Minor	Low	Negligible	Negligible
Marine traffic: Designation of exclusion zones due to the operation of the Project	Marine uses	-	1	1	4	3	1	1	4	4	1	1	24	Minor	Low	Negligible	Negligible
Mobilization / Engagement (recruitment, employment, engagement) of workforce	Structure and Operations of the Human Environment	+	4	2	4	3	3	1	1	4	1	1	34	Positive	Moderate	Positive	Positive

Operation - Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation	Final Residual Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)				
Implementation of Corporate Social Responsibility (CSR) Actions	Structure and Operations of the Human Environment	+	4	4	4	3	1	2	4	4	1	4	43	Positive	Moderate	Positive	Positive
Marine traffic – Designation of exclusion zones due to the operation of the Project	Fisheries / Aquaculture – local fish populations	+	2	2	2	3	3	2	1	4	2	4	31	Positive	High	Positive	Positive
Operation of the Project – Offshore installations (excluding the offshore CO_2 transport pipeline)	Tourism	-	1	2	3	1	1	1	1	1	1	1	17	Negligible	High	Minor	Minor
Emissions of atmospheric pollutants and noise during CO_2 unloading	Tourism	-	1	2	3	1	1	1	1	1	1	1	17	Negligible	High	Minor	Minor
Mobilization / Engagement of workforce (recruitment, employment, involvement)	Other economic activities	+	4	2	4	3	3	1	1	4	4	1	37	Positive	High	Positive	Positive
Supply chain issues and procurement of necessary materials, products, and services related to Project operation.	Other economic activities	+	8	2	4	3	3	1	4	4	4	1	52	Positive	High	Positive	Positive
Mobilization / Engagement of workforce (recruitment, employment, involvement)	Employment and workforce	+	8	2	4	3	3	1	4	4	4	1	52	Positive	High	Positive	Positive

Operation - Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation	Final Residual Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)				
Supply chain issues and procurement of necessary materials, products, and services related to Project operation	Employment and workforce	+	4	2	4	3	3	1	4	4	4	1	40	Positive	High	Positive	Positive
Operation works	Occupational health and safety	-	1	1	4	1	1	1	4	1	1	1	19	Negligible	High	Minor	Minor
Operation activities	Public health	+	4	4	2	3	3	1	1	4	4	1	39	Positive	High	Positive	Positive
TECHNICAL INFRASTRUCTURE																	
Daily vessel movement due to the operation of the Project (including transport of workers and movements of support vessels)	Maritime Transport / Traffic	-	2	2	4	3	1	2	4	4	1	1	30	Minor	Low	Negligible	Negligible
Use and maintenance of the marine exclusion zone	Maritime Transport / Traffic	-	2	2	4	3	1	2	4	4	1	1	30	Minor	Low	Negligible	Negligible
Road network load due to Project operation	Road Network / Transport / Traffic	-	1	2	4	3	1	2	4	4	1	1	27	Minor	Low	Negligible	Negligible
Generation of liquid and solid waste due to Project operation	Systems for the collection, transfer, disposal and management of liquid and solid waste	-	2	2	4	3	1	2	4	4	1	1	30	Minor	Low	Negligible	Negligible

Operation - Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation	Final Residual Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)				
AIR QUALITY																	
Atmospheric emissions during the reception of CO_2 and its transport to the offshore storage installations in Prinos	Atmospheric Environment	-	4	2	4	3	1	2	4	2	1	4	37	Minor	Low	Negligible	Negligible
Gaseous emissions from CO_2 injection	Atmospheric Environment	-	4	2	4	3	1	2	4	4	1	4	39	Minor	Low	Negligible	Negligible
Gaseous emissions from water abstraction	Atmospheric Environment	-	4	2	4	3	1	2	4	4	1	4	39	Minor	Low	Negligible	Negligible
Gaseous emissions from infrastructure and equipment maintenance and repair activities	Atmospheric Environment	-	2	2	4	1	1	2	4	1	1	4	28	Minor	Low	Negligible	Negligible
Gaseous emissions from the daily movement of vessels due to the operation of the Project (including the transport of workers and movements of support vessels)	Atmospheric Environment	-	4	2	4	3	1	2	4	2	1	4	37	Minor	Low	Negligible	Negligible
ACOUSTIC ENVIRONMENT																	
• Reception of CO_2 in containers (CO_2 parcels)	Underwater Noise	-	2	2	4	4	1	2	4	2	1	1	29	Minor	Moderate	Minor	Minor

Operation - Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation	Final Residual Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)				
• Transport of CO_2 to the offshore storage installations in Prinos • CO_2 injection • Water abstraction																	
Θαλάσσια κυκλοφορία	Underwater Noise	-	4	2	4	4	1	2	4	2	1	1	35	Minor	Moderate	Minor	Minor
• Reception of CO_2 in containers (CO_2 parcels) • Transport of CO_2 to the offshore storage installations in Prinos • CO_2 injection • Water abstraction	Acoustic environment	-	2	2	4	4	1	2	4	2	1	1	29	Minor	Moderate	Minor	Minor
Marine traffic	Acoustic environment	-	4	2	4	4	1	2	4	2	1	1	35	Minor	Moderate	Minor	Minor

Operation - Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation	Final Residual Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)				
WATERS																	
Maintenance of the offshore CO_2 transport pipeline	Quality characteristics of marine and coastal waters	-	1	2	4	3	1	2	4	2	1	1	25	Minor	Moderate	Minor	Minor
Operation of offshore installations	Quality characteristics of marine and coastal waters	-	2	2	4	3	1	2	4	4	1	1	30	Minor	Moderate	Minor	Minor
Project operation	Quantitative characteristics of water resources	-	2	2	4	3	1	2	4	4	1	1	30	Minor	Moderate	Minor	Minor

Table 10-6. Summary of characteristics, significance, magnitude, and Final Assessment of impacts on the individual environmental parameters during the Decommissioning/Shutdown Phase of the proposed project

SHUTDOWN / DECOMMISSIONING – Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation	Final Residual Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)				
CLIMATIC AND BIOCLIMATIC CHARACTERISTICS																	
Emissions of GHGs from the dismantling of onshore installations – Restoration of the onshore Project site	Climate / Climate change	-	1	2	4	1	1	2	4	2	1	4	26	Minor	High	Moderate	Minor
Emissions of GHGs from the Shutdown / Decommissioning of the offshore CO_2 transport pipeline	Climate / Climate change	-	1	2	4	1	1	2	4	2	1	4	26	Minor	High	Moderate	Minor
Emissions of GHGs from the Shutdown / Decommissioning of the offshore installations (excluding the offshore CO_2 transport pipeline)	Climate / Climate change	-	2	2	4	1	1	2	4	2	1	4	29	Minor	High	Moderate	Minor
MORPHOLOGICAL AND TOPOLOGICAL CHARACTERISTICS																	
Dismantling of onshore installations	Morphology of the onshore area	-	1	2	4	1	2	2	4	4	1	1	26	Minor	Low	Negligible	Negligible
Restoration of the onshore Project site	Morphology of the onshore area	+	2	2	4	4	1	2	4	4	1	1	31	Positive	Low	Positive	Positive

SHUTDOWN / DECOMMISSIONING – Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation	Final Residual Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)				
Dismantling of onshore installations	Landscape	-	1	1	4	1	2	1	4	4	1	1	23	Minor	Moderate	Minor	Minor
Restoration of the onshore Project site	Landscape	+	2	2	4	4	1	2	4	4	1	1	31	Positive	Moderate	Positive	Positive
GEOLOGICAL, TECTONIC AND SOIL CHARACTERISTICS																	
Generation of solid and liquid waste during decommissioning	Soil characteristics	-	1	2	4	1	2	2	4	4	1	1	26	Minor	Low	Negligible	Negligible
Restoration of the onshore Project site	Soil characteristics	+	2	2	4	4	1	2	4	4	1	1	31	Positive	Low	Positive	Positive
Shutdown / Decommissioning of offshore CO_2 transport pipelines	Quality characteristics and structure of the seabed	-	1	2	4	4	4	1	4	4	8	1	37	Minor	Moderate	Minor	Minor
Shutdown / Decommissioning of offshore installations (excluding the offshore CO_2 transport pipeline)	Quality characteristics and structure of the seabed	-	1	2	4	1	2	2	4	4	1	1	26	Minor	Moderate	Minor	Minor
NATURAL BIOTIC ENVIRONMENT																	
Shutdown / Decommissioning of offshore installations (excluding the offshore CO_2 transport pipeline)	Marine habitats	-	1	2	4	1	1	1	4	2	2	1	23	Minor	Low	Negligible	Negligible

SHUTDOWN / DECOMMISSIONING – Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation	Final Residual Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)				
Shutdown / Decommissioning of offshore installations (excluding the offshore CO_2 transport pipeline)	Marine Mammals	-	1	2	4	1	1	2	4	2	2	1	24	Minor	High	Moderate	Minor
Shutdown / Decommissioning of offshore installations (excluding the offshore CO_2 transport pipeline)	Se Turtles	-	1	2	4	1	1	2	4	2	2	1	24	Minor	Moderate	Minor	Minor
Shutdown / Decommissioning of offshore installations (excluding the offshore CO_2 transport pipeline)	Ichthyofauna	-	2	2	4	1	1	2	4	2	2	1	27	Minor	Moderate	Minor	Minor
Shutdown / Decommissioning of offshore installations (excluding the offshore CO_2 transport pipeline)	Avifauna	-	1	2	4	1	1	2	4	2	4	1	24	Minor	High	Moderate	Minor
Shutdown / Decommissioning of offshore installations (excluding the offshore CO_2 transport pipeline)	National System of Protected Areas	-	1	2	4	1	1	2	4	2	2	1	24	Minor	High	Moderate	Minor
Shutdown / Decommissioning of offshore installations (excluding the offshore CO_2 transport pipeline)	Other Important Natural Areas	-	1	2	4	1	1	2	4	2	2	1	24	Minor	High	Moderate	Minor
ΑΝΘΡΩΠΟΓΕΝΕΣ ΠΕΡΙΒΑΛΛΟΝ																	

SHUTDOWN / DECOMMISSIONING – Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation	Final Residual Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)				
Shutdown / Decommissioning of offshore CO_2 transport pipelines: Designation of exclusion zones due to the implementation of the decommissioning works of the offshore pipelines	Marine Uses	-	1	1	4	1	1	1	4	4	1	1	22	Minor	Low	Negligible	Negligible
Shutdown / Decommissioning of offshore installations (excluding the offshore CO_2 transport pipeline): Designation of exclusion zones due to the implementation of the decommissioning works of the offshore installations	Marine Uses	-	1	1	4	1	1	1	4	4	1	1	22	Minor	Low	Negligible	Negligible
Movement of heavy vehicles, construction machinery, and trucks, as well as supporting vehicles during construction, which emit: – Noise – Particulate Matter (PM10, PM2.5) – Air pollutants (CO, VOC, and NOx)	Structure and Functions of the Human Environment	-	1	1	4	1	1	1	4	2	1	1	20	Negligible	Moderate	Negligible	Negligible
Shutdown / Decommissioning of the offshore installations (excluding the offshore CO_2 transport pipeline):	Fishing / Aquaculture	+	2	2	2	2	1	2	1	2	1	4	25	Positive	High	Positive	Positive

SHUTDOWN / DECOMMISSIONING – Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation	Final Residual Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)				
Marine traffic – Designation of exclusion zones due to the implementation of decommissioning operations of the offshore installations.																	
Emissions of atmospheric pollutants and noise during the removal of onshore installations – restoration of the onshore project area	Tourism	-	1	2	3	1	1	1	1	1	1	1	17	Negligible	High	Minor	Minor
Mobilization / Engagement (recruitment, employment, engagement) of workforce	Other economic activities	+	4	2	4	1	1	1	1	4	2	1	31	Positive	High	Positive	Positive
Supply chain issues and procurement of required materials, products, and services related to the shutdown / decommissioning of the project	Other economic activities	+	8	4	4	1	1	1	4	4	2	1	50	Positive	High	Positive	Positive
Decommissioning: Mobilization / Engagement (recruitment, employment, engagement) of workforce	Employment and workforce	+	4	2	4	1	1	1	4	4	2	1	34	Positive	High	Positive	Positive
Decommissioning: Supply chain issues and procurement of required construction materials, products, and services related to the project's implementation	Employment and workforce	+	8	2	4	1	1	1	4	4	2	1	46	Positive	High	Positive	Positive

SHUTDOWN / DECOMMISSIONING – Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation	Final Residual Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)				
Cessation of Operations: Termination of workforce activities	Employment and workforce	-	4	2	4	2	1	1	4	1	2	1	32	Minor	High	Moderate	Minor
Decommissioning works	Occupational health and safety	-	1	1	4	1	1	1	4	1	1	1	19	Negligible	High	Minor	Minor
Decommissioning activities	Public health	+	2	2	2	2	1	1	1	4	2	1	24	Positive	High	Positive	Positive
TECHNICAL INFRASTRUCTURE																	
Decommissioning of offshore installations (including the transportation / transfer of personnel and the movement of support vessels)	Marine Transport / Traffic	-	1	2	4	1	1	2	4	4	1	1	25	Minor	Low	Negligible	Negligible
Preservation and use of marine exclusion zone	Marine Transport / Traffic	-	1	2	4	1	1	2	4	4	1	1	25	Minor	Low	Negligible	Negligible
Movement on the road network of heavy vehicles, construction machinery, and trucks for transporting waste due to the implementation of decommissioning works	Road Network / Transport / Traffic	-	1	2	4	1	1	2	4	4	1	1	25	Minor	Low	Negligible	Negligible

SHUTDOWN / DECOMMISSIONING – Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation	Final Residual Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)				
Generation of liquid and solid waste due to decommissioning works of the Project	Systems for collection, transport, disposal and management of liquid and solid waste	-	1	2	4	1	1	2	4	4	1	1	25	Minor	Low	Negligible	Negligible
AIR QUALITY																	
Gaseous emissions from the removal of terrestrial installations – Restoration of the terrestrial area of the Project	Atmospheric Environment	-	1	2	4	1	1	2	4	2	1	4	26	Minor	Low	Negligible	Negligible
Cessation of Operations / Decommissioning of offshore CO_2 transmission pipeline	Atmospheric Environment	-	1	2	4	1	1	2	4	2	1	4	26	Minor	Low	Negligible	Negligible
Cessation of Operations / Decommissioning of offshore installations (excluding the offshore CO_2 transmission pipeline)	Atmospheric Environment	-	4	2	4	1	1	2	4	2	1	4	35	Minor	Low	Negligible	Negligible
ΑΚΟΥΣΤΙΚΟ ΠΕΡΙΒΑΛΛΟΝ																	
Dismantling of equipment and decommissioning of offshore installations	Underwater Noise	-	1	2	4	1	1	2	4	2	1	1	23	Minor	Moderate	Minor	Minor
Marine movements and transfers (personnel, equipment, and materials) as part of the	Underwater Noise	-	2	2	4	1	1	2	4	2	1	1	26	Minor	Moderate	Minor	Minor

SHUTDOWN / DECOMMISSIONING – Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation	Final Residual Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)				
decommissioning works of the offshore installations of the proposed Project.																	
Dismantling and removal of onshore installation equipment	Acoustic environment	-	2	2	4	1	1	2	4	2	1	1	26	Minor	Moderate	Minor	Minor
Road movements and transfers (personnel, equipment, and materials) within the framework of decommissioning works of the proposed Project and restoration of the onshore intervention area	Acoustic environment	-	1	2	4	1	1	2	4	2	1	1	23	Minor	Moderate	Minor	Minor
Dismantling and removal of offshore installation equipment	Acoustic environment	-	2	2	4	1	1	2	4	2	1	1	26	Minor	Moderate	Minor	Minor
Marine movements and transfers (personnel, equipment, and materials) within the framework of decommissioning works of offshore installations of the proposed Project	Acoustic environment	-	1	2	4	1	1	2	4	2	1	1	23	Minor	Moderate	Minor	Minor
Decommissioning of the proposed Project and restoration of the onshore intervention area	Acoustic environment	+	2	2	4	4	1	2	4	4	1	1	31	Positive	Moderate	Positive	Positive
WATERS																	

SHUTDOWN / DECOMMISSIONING – Activity	Receptor	Impact Magnitude												Impact Significance	SEP Significance	Final Impact Evaluation	Final Residual Impact Evaluation
		S (Nature)	IN (Intensity)	EX (Extent)	MO (Time of occurrence)	PE (Duration)	RV (Reversibility)	SI (Synergy)	EF (Effect)	PR (Periodicity)	MC (Restoration)	AC (Accumulation)	Im (Impact Magnitude)				
Cessation of operations and decommissioning of the Project's onshore installations	Quality characteristics of marine and coastal waters	-	1	1	4	1	1	2	4	4	1	1	23	Minor	Moderate	Minor	Minor
Decommissioning of the Project's onshore installations and restoration of their spatial configuration	Quality characteristics of marine, coastal, surface, and groundwater	+	2	2	4	4	1	2	4	4	1	1	31	Positive	Moderate	Positive	Positive
Cessation of operations of the CO_2 subsea pipeline	Quality characteristics of marine and coastal waters	-	1	1	4	1	1	2	4	4	1	1	23	Minor	Moderate	Minor	Minor
Cessation of operations and decommissioning of offshore installations (excluding the offshore CO_2 transport pipeline)	Quality characteristics of marine and coastal waters	-	2	2	4	1	1	2	4	4	1	1	26	Minor	Moderate	Minor	Minor
Cessation of operations and decommissioning of the Project's onshore installations	Quantitative characteristics of the region's water resources	-	2	2	4	1	1	2	4	4	1	1	26	Minor	Moderate	Minor	Minor

As shown in the **Table** above, during the **Construction Phase** of the project, negligible and minor negative impacts are expected (and in any case compatible with the environmental protection objectives) on the following environmental parameters:

- Climatic and bioclimatic characteristics (minor impacts)
- Morphological and landscape characteristics (negligible to minor impacts)
- Geological, tectonic and soil characteristics (negligible to minor impacts)
- Natural - biotic environment (negligible to minor impacts)
- Anthropogenic environment (negligible to minor impacts)
- Technical infrastructure (negligible impacts)
- Air quality (negligible impacts)
- Acoustic environment and vibrations (minor impacts)
- Waters (minor impacts)

It is important to note that the Final Evaluations of the impacts from the routine activities during the implementation phase of the proposed project did not exceed the rating of **"Minor"**, with the exception of the following, which were evaluated as **"Moderate"** as follows:

- Impacts on climate/climate change from greenhouse gas emissions resulting from the construction of the onshore facilities, the construction of the CO_2 transmission pipeline, and the drilling operations.
- Impacts on the natural biotic environment from the construction activities of the CO_2 transmission pipeline and the drilling operations.

For the impacts that were evaluated as **"Moderate"**, following the implementation of the relevant mitigation measures proposed in **Chapter 11** of this Study, the residual impacts are ultimately assessed as **"Minor"**, and therefore the project is compatible with the environmental protection objectives that are prerequisites of the present study.

Positive impacts are expected on the anthropogenic environment from the mobilization (employment, recruitment, involvement) of workforce, as well as from supply chain and procurement issues related to the necessary construction materials, resources and services for the project's implementation, and from the implementation of Corporate Social Responsibility Actions.

A summary presentation of the evaluation results is provided in the following Figure.

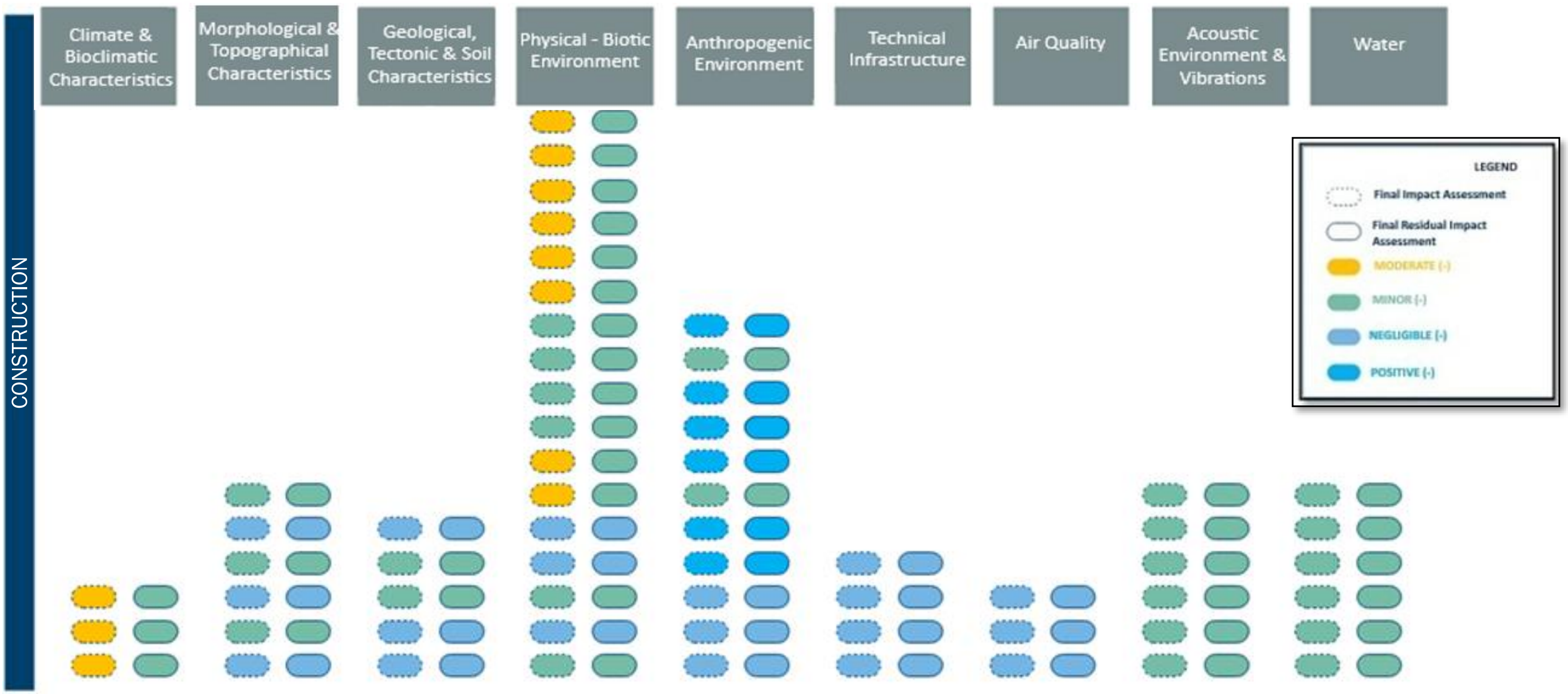


Figure 10-14. Summary presentation of impact assessment results for the construction phase

As shown in the **Table** above, during the **Operation Phase** of the project, negligible and minor negative impacts are expected (and in any case compatible with the environmental protection objectives) on the following environmental parameters:

- Morphological and landscape characteristics (negligible and minor impacts)
- Geological, tectonic and soil characteristics (negligible and minor impacts)
- Natural - biotic environment (negligible and minor impacts)
- Anthropogenic environment (negligible and minor impacts)
- Technical infrastructure (negligible impacts)
- Air quality (negligible impacts)
- Acoustic environment and vibrations (minor impacts)
- Waters (minor impacts)

It is important to note that the Final Evaluations of the impacts during the routine activities of the project implementation phase did not exceed the **"Minor"** rating, with the exception of the following, which were assessed as **"Moderate":**

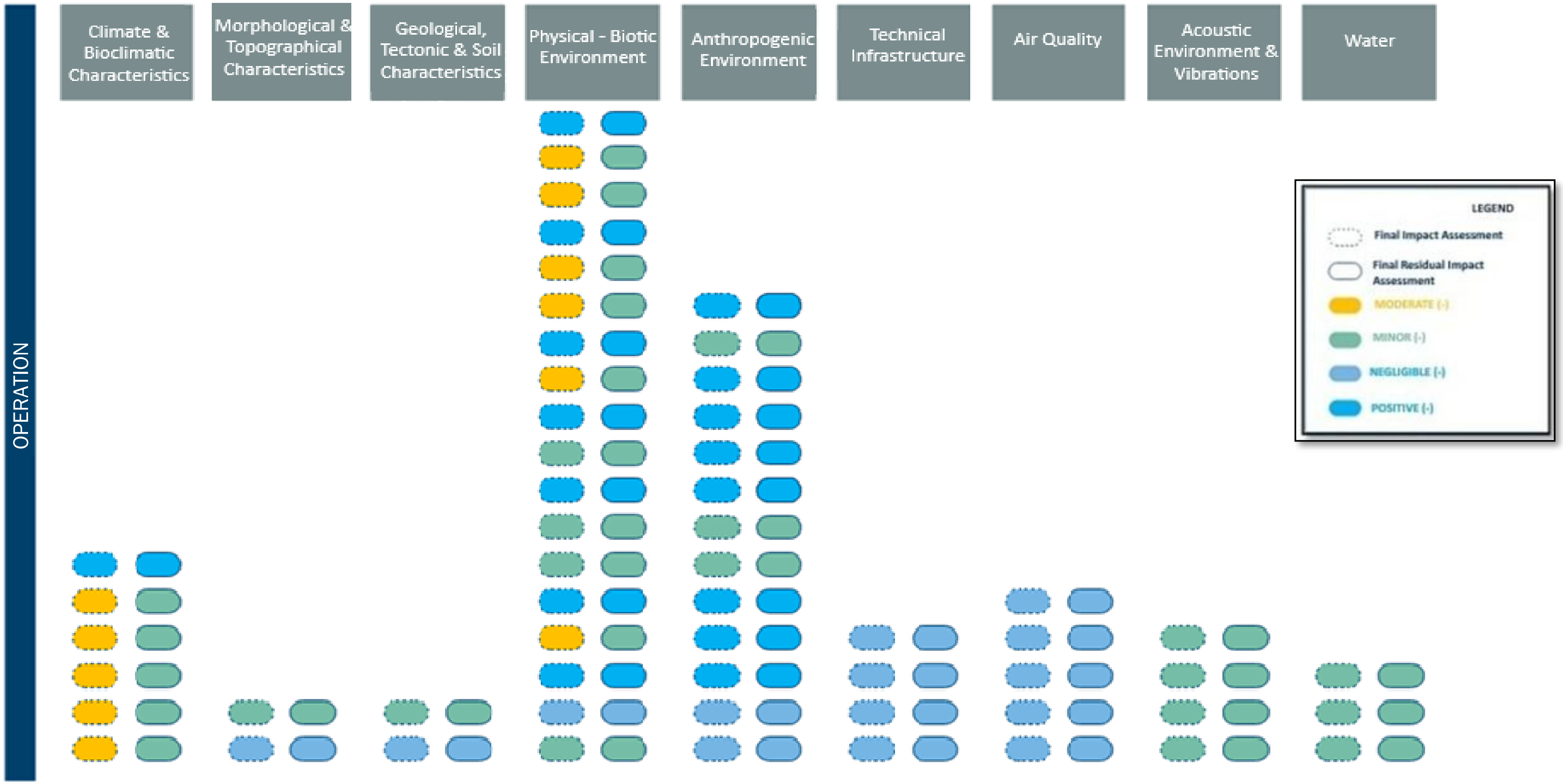
- Impacts on climate and climate change from GHG emissions due to the CO_2 transportation to the offshore storage facilities of Prinos, CO_2 injection, water abstraction, maintenance and repair activities of infrastructure and equipment, and daily ship movements related to the operation of the project (including the transport of personnel and movements of support vessels).
- Impacts on the biotic environment from water abstraction from the reservoir and discharge of treated water into the marine environment during the operation of the project, as well as from the daily movement of vessels related to the project's operation (including the transport of personnel and movements of support vessels).

For the impacts assessed as "Moderate", following the implementation of the relevant measures proposed in Chapter 11 of this Study, the residual impacts are ultimately assessed as "Minor". Therefore, the project is compatible with the environmental protection objectives that constitute prerequisites of the present study.

Positive impacts are expected on the following environmental parameters:

- Climate and climate change due to CO_2 storage during the project's operation
- Natural – biotic environment due to the designation/maintenance of a no-anchoring and no-fishing zone.
- Anthropogenic environment, mainly through the mobilisation (recruitment, employment, involvement) of workforce, issues related to supply chain and procurement of necessary resources and services concerning the project's operation, and the implementation of Corporate Social Responsibility Actions.

A summary of the evaluation results is presented in the following **Figure**.



10–15: Summary of Impact Assessment Results for the Operation Phase

As shown in the **Table** above, during the **Decommissioning Phase** of the project, negligible and minor negative impacts are expected (and in any case compatible with the environmental protection objectives) on the following environmental parameters:

- Geological, tectonic and soil characteristics (negligible and minor impacts).
- Natural - biotic environment (negligible and minor impacts).
- Anthropogenic environment (negligible and minor impacts).
- Technical infrastructure (negligible impacts).
- Air quality (negligible impacts).
- Acoustic environment and vibrations (minor impacts).
- Waters (minor impacts)**ορφολογικά** και Τοπιολογικά Χαρακτηριστικά (αμελητέες και μικρές επιπτώσεις).

It is important to note that the Final Evaluations of the impacts during the routine activities of the project implementation phase did not exceed the **"Minor"** classification, with the exception of the following, which were assessed as **"Moderate"** as follows:

- Impacts on climate and climate change from GHG emissions due to the dismantling and decommissioning of the Project's facilities / deactivation of the offshore CO_2 transmission pipeline.
- Impacts on the biotic environment from the dismantling and decommissioning of the Project's facilities.
- Impacts on employment and the workforce due to the termination of operations

For the impacts assessed as **"Moderate"**, following the implementation of the relevant measures proposed in Chapter 11 of this Study, the residual impacts are ultimately assessed as **"Minor"**. Therefore, the project is compatible with the environmental protection objectives that constitute prerequisites of the present study.

Positive impacts are expected on the following environmental parameters:πιπτώσεις αναμένονται στις ακόλουθες περιβαλλοντικές παραμέτρους:

- Morphological and landscape characteristics from the restoration of the Project's onshore installation area.
- Soil characteristics from the restoration of the Project's onshore installation area.
- Anthropogenic environment, mainly through the mobilisation (recruitment, employment, involvement) of workforce, issues related to the supply chain and procurement of required resources and services concerning the decommissioning of the project.
- Acoustic environment and vibrations from the decommissioning of the onshore installations of the project and the restoration of their location area.
- Water from the decommissioning of the onshore installations of the project and the restoration of their location area.

A summary of the evaluation results is presented in the following **Figure.**

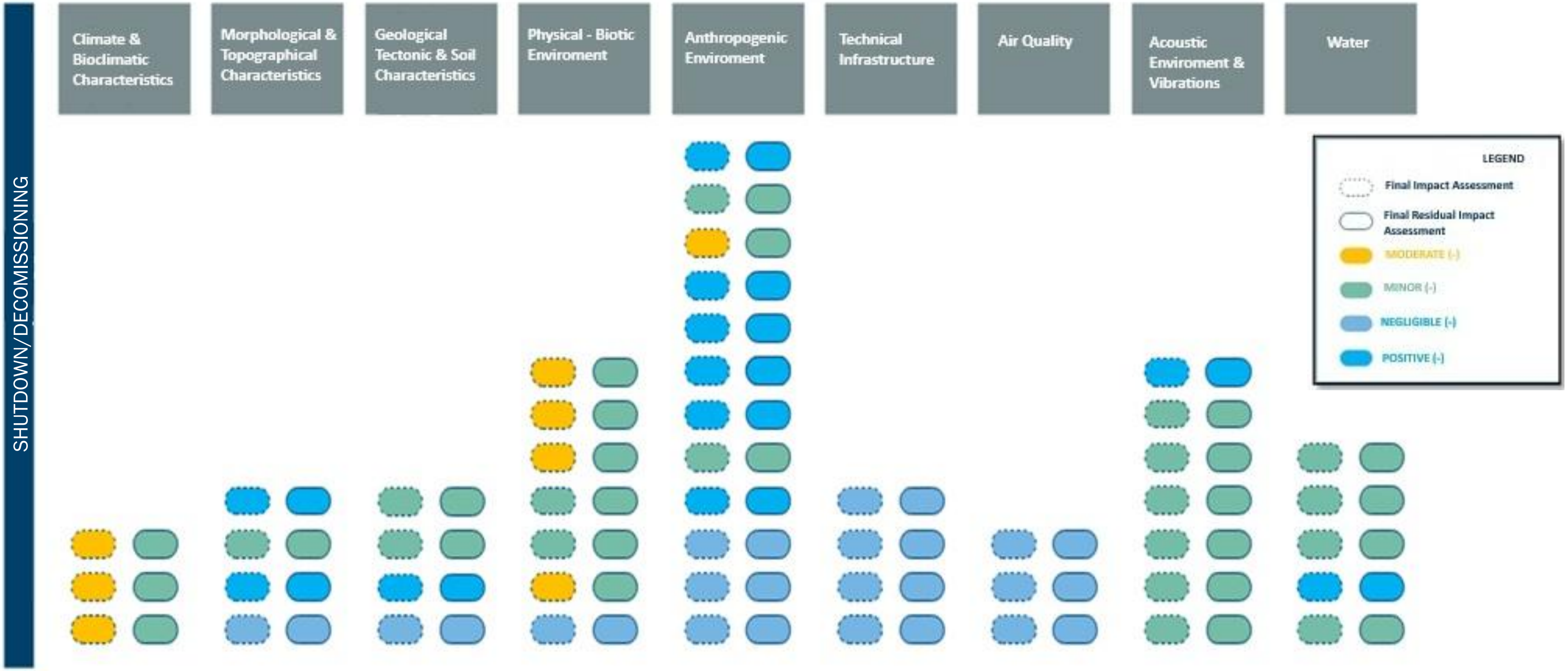


Figure 10–16: Summary of Impact Assessment Results for the Decommissioning Phase

10.4 IMPACTS ARISING FROM THE PROJECT'S VULNERABILITY TO MAJOR ACCIDENTS OR DISASTERS RELATED TO THE PROJECT

The purpose of this chapter is to assess the potential impacts arising from the vulnerability of the Project under study to risks of major accidents or disasters, in accordance with the requirements of JMD 1915/2018.

10.4.1 Hazard Assessment

10.4.1.1 Potential Leakage Pathways

10.4.1.1.1 Potential Leakage Pathways in CO_2 Storage Projects

The potential leakage pathways in any CO_2 storage site and complex include:

- Leakage through legacy wells: Legacy wells are exposed to high pressures and high concentrations of injected CO_2.
- Leakage through the overburden: Potential leakage pathways depend on the extent and thickness of the overburden, including phase changes or degradation. Assessment of potential leakage through the overburden requires mapping using seismic and well data. Finally, potential leakage may result from geochemical degradation of the overburden quality, including changes in permeability along fault and fracture zones. This process depends on the geochemistry of each layer and possible interactions between CO_2 and the geological formation and the fluids it contains.
- Leakage through faults and fractures: This leakage mechanism depends on the fracturing of the overburden and the increase in pressure at the storage site. It may also be associated with microseismicity induced by fracturing. This CO_2 leakage mechanism may occur through natural (pre-existing) faults and/or fractures. Obviously, not all faults are potential leakage pathways, as some of them are closed or sealed. The probability of leakage through faults depends on the distribution of faults/fractures, their characteristics, and their geomechanical response. This potential CO_2 leakage mechanism could occur through fault reactivation, resulting from increased reservoir pressure or natural seismicity.
- Lateral leakage through deeper structural features: This potential CO_2 leakage mechanism occurs through a deeper structural feature in the event that the reservoir is overfilled. It depends on the storage site structure and the management of its capacity during injection through monitoring and operational strategy.
- Lateral migration: Refers to storage sites without structural closure and mainly concerns sites that rely on residual trapping in the formation pores. This potential leakage mechanism refers to CO_2 migration beyond the lateral boundary of the site and the storage complex (e.g., via upward migration) and depends on the existing phases, rock types, and permeability of the formation.

10.4.1.1.2 Potential CO_2 Leakage Pathways in the Project under Assessment

O The potential CO_2 leakage pathways in the subsurface beyond the predetermined field and the Prinos storage complex are described below. Three main categories have been identified: two potential leakage pathways related to the subsurface—vertical and lateral—and a third potential leakage pathway associated with existing wells. This assessment of migration pathways outside the predefined storage complex aims at identifying potential leakage pathways to be targeted in the Monitoring Plan.

There are also potential leakages that may occur in the surface infrastructure, mainly related to potential pipeline leaks, which are described below.

10.4.1.1.2.1 Potential Vertical Leakage Pathways in the Prinos Subsurface

There are five potential leakage pathways related to the subsurface and characterized as vertical:

V1: Refers to CO_2 leakage along a (theoretically reactivated) NE-SW fault, known as Fault 17, located on the western flank of the Prinos anticline structure, in the syncline between the Prinos and Epsilon structures. This leakage pathway is shown in **Figure 10-19**.

V2: Refers to CO_2 leakage along the northeastern boundary fault separating Prinos from North Prinos (**Figure 10-18** and **Figure 10-20**).

V3: Refers to CO_2 leakage along the NW-SE fault (dipping to the SW) that overlays the Prinos structure (**Figure 10-19, Figure 10-20, Figure 10-21, Figure 10-22**).

V4: Refers to CO_2 leakage along the NW-SE fault (dipping to the NE) – the southern bounding fault of Prinos (**Figure 10-19, Figure 10-20, Figure 10-22**).

V5: Refers to CO_2 leakage through the overburden via the primary seal and the secondary sealing system.

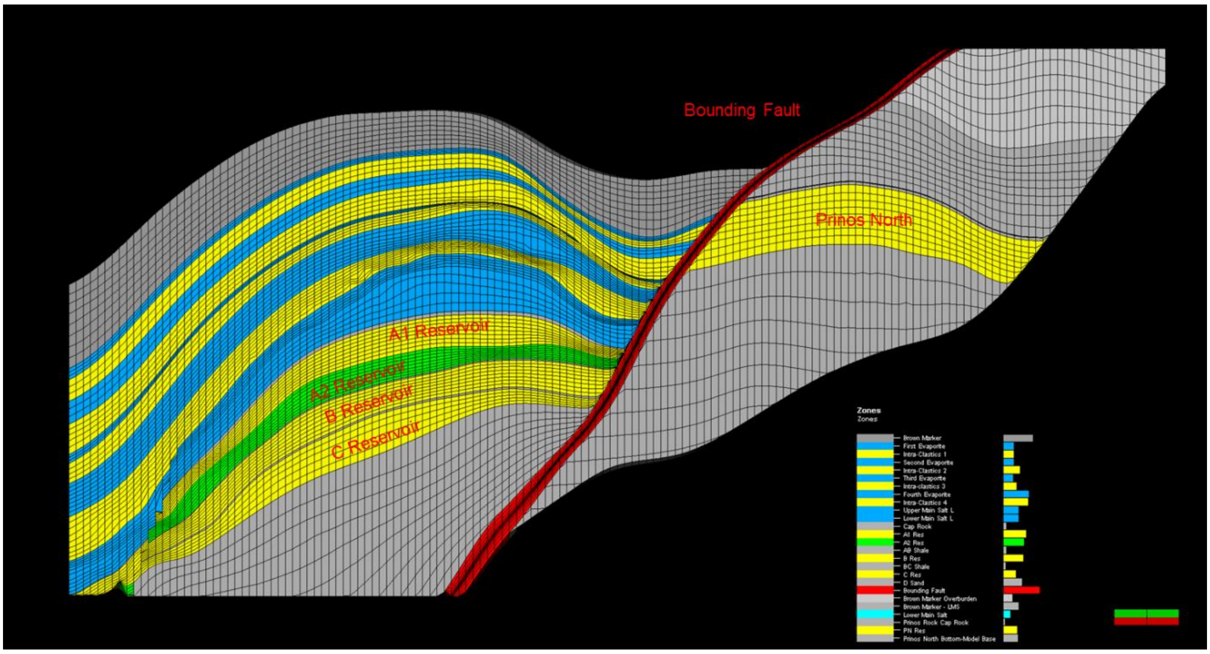


Figure 10-17. Depiction of the fault separating Prinos from North Prinos

10.4.1.1.2.2 Potential Lateral Leakage Pathways in the Prinos Subsurface

There are three potential leakage pathways related to the subsurface that are characterized as lateral:

L1: Refers to CO_2 leakage through lateral migration toward deeper parts of the structure on its western side and eventually to CO_2 migration through the syncline (leakage point) into the Epsilon structure. This leakage pathway is shown in **Figure 10-19.**

L2: Refers to CO_2 leakage through the northeastern boundary fault of Prinos (vertical leakage path – V2) into North Prinos. This leakage pathway is shown in **Figure 10-21.**

L3: A Refers to CO_2 leakage along the NW–SE fault (dipping to the SW) (vertical leakage path – V4) and migration of the plume within the clastic sedimentary zones (beneath the Messinian evaporites) toward the southwest within the Prinos basin. This leakage pathway is also shown in **Figure 10-21.**

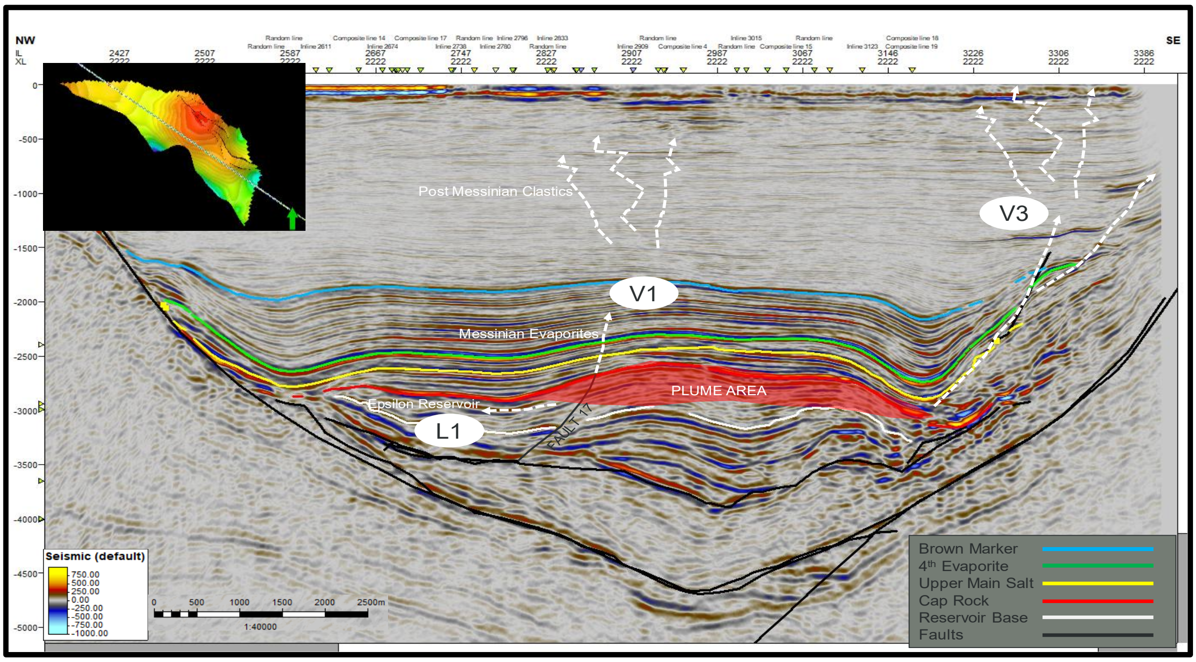


Figure 10-18. Seismic section along NW-SE direction showing possible lateral leakage pathways L1 and vertical pathways V1 and V3

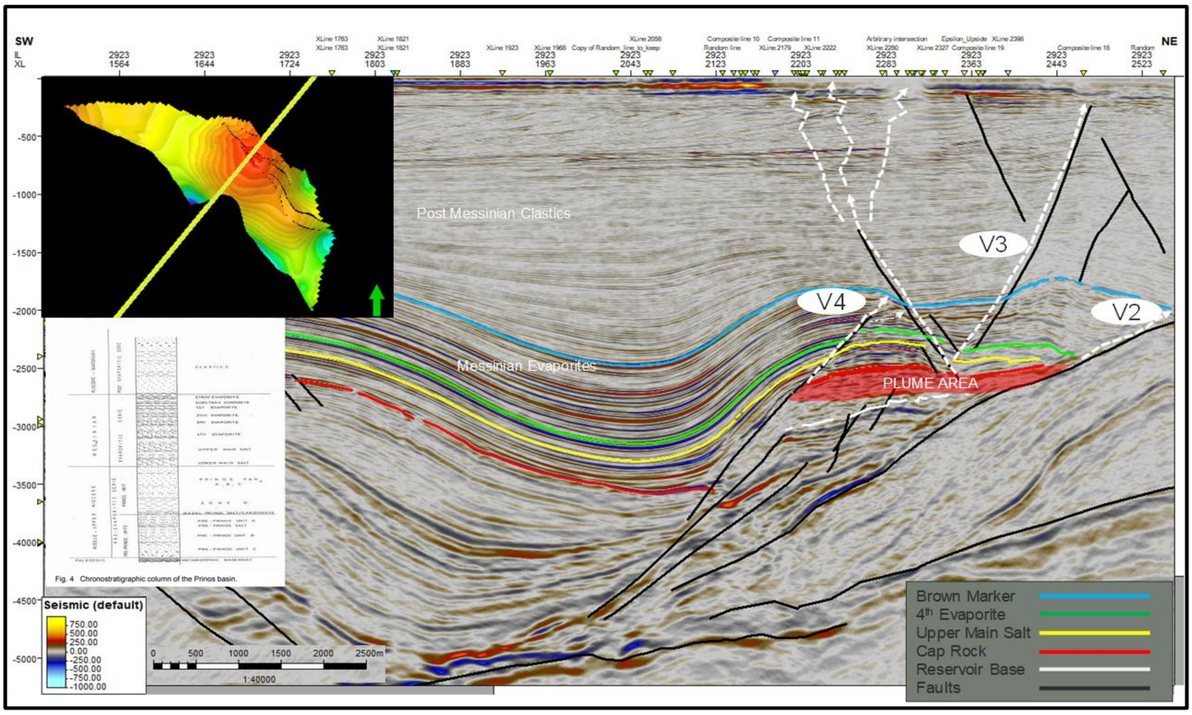


Figure 10-19. Seismic section along SW-NE direction showing the possible vertical leakage pathways V2, V3, and V4

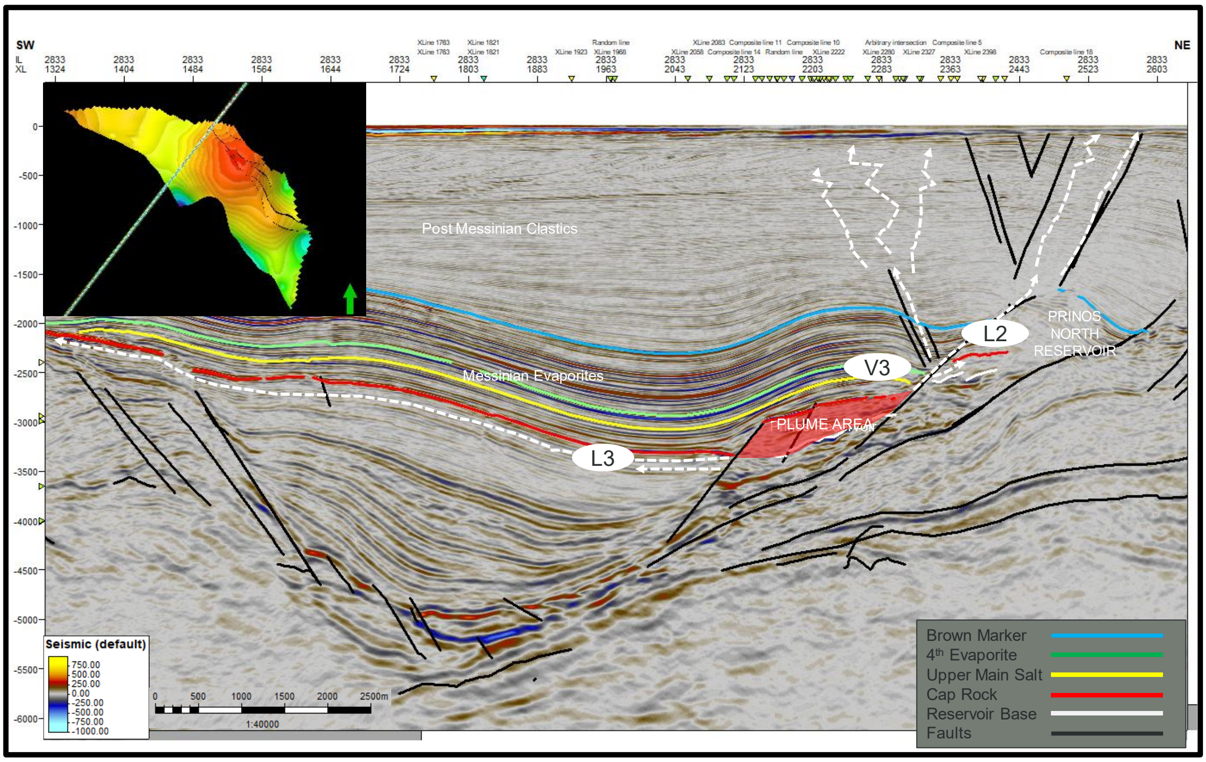


Figure 10-20. Seismic section along SW-NE direction showing the possible lateral leakage pathways L2, L3, and the vertical pathway V3

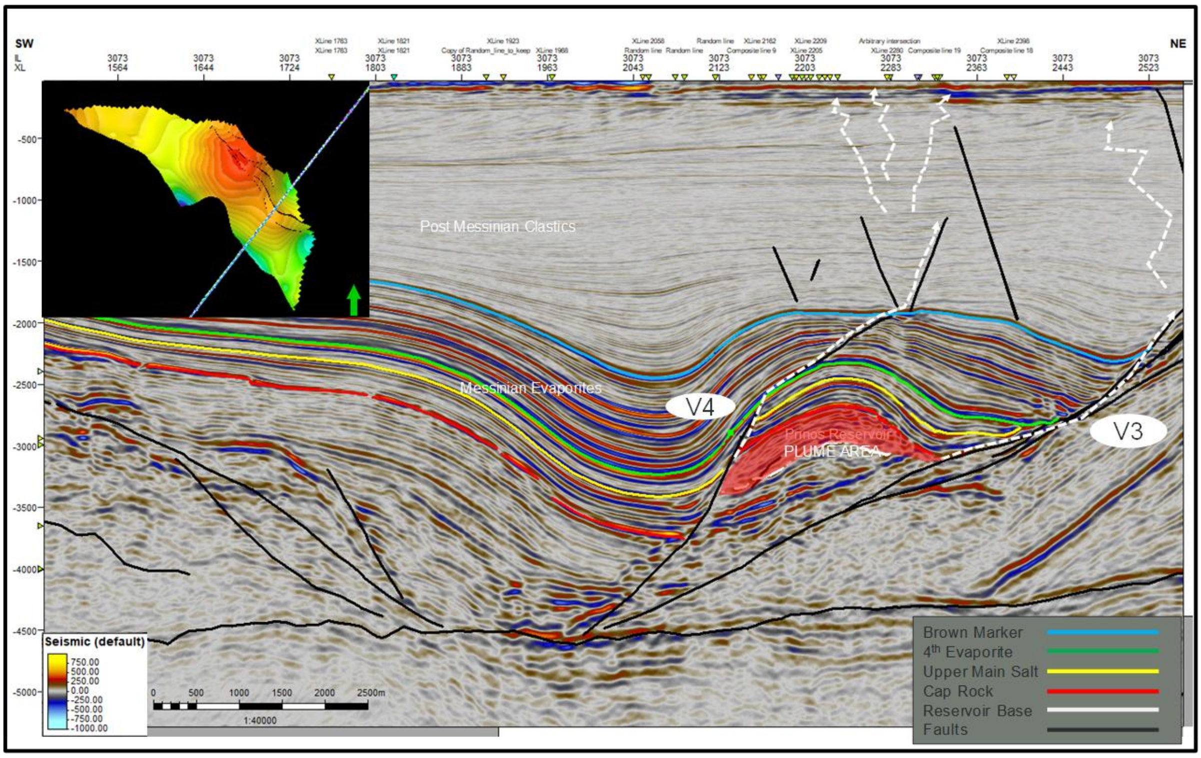


Figure 10-21. Seismic section along SW-NE direction located towards the south showing the possible vertical leakage pathways V3 and V4

10.4.1.1.2.3 Potential Leakage Pathways Through Old Prinos Wells

Potential CO_2 leakage pathways from the designated Prinos storage complex could include existing old wells that are exposed to high pressures and high CO_2 concentrations.

Wells provide a conduit between the onshore CO_2 processing facilities and the reservoir where the CO_2 is intended to be stored. As such, they are typically long and constructed using specialized techniques. Once constructed, leak detection and remediation efforts are typically limited to locations where well leakage into permeable formations, the seabed, or the atmosphere is considered likely.

Upon completion of the integrity assessment of the existing old wells, a study has been conducted which outlines in detail the risks and resulting outcomes associated with the wells as potential artificial leakage pathways within the CO_2 storage complex of Prinos throughout the Project's lifetime, and which indicates that the risks are low-level and/or can be adequately managed.

Prinos wells as potential leakage pathways

Following the assessment of leakage pathways based on the Offshore Energies UK (OEUK) guidelines for well decommissioning in CO_2 storage, the following conclusions were drawn:

i. Inadequate barriers: Of the 76 wells from the Prinos platform complex, 29 have acceptable barriers (low risk), 7 are outside the structure, 28 are considered tolerable (medium risk), and 12 are considered unacceptable (high risk). Of the 28 tolerable medium-risk wells, 2 have been identified as requiring additional monitoring. The 12 high-risk wells (16% of total wells) lack appropriate barriers according to current industry practices for long-term CO_2 storage containment.

ii. Barrier depth: 17 of the 29 old wells with acceptable barriers were abandoned with the base of their internal primary barrier placed along the evaporitic sequence and therefore along an impermeable formation. However, permeable layers have been identified within the evaporitic sequence beneath the base of these internal barriers. Over time, protective casing strings are expected to corrode, exposing the sandstones to the CO_2 plume. This implies a risk of CO_2 plume entry into these permeable zones, which, however, are likely to act as secondary containment units.

iii. Portland cement: All existing old wells were constructed using Portland cement. Although Portland cement was not specifically designed for high CO_2 concentrations, it can be concluded that its use in the construction and abandonment of the old wells does not constitute a significant leakage risk, provided that best practices were followed and good isolation was achieved.

iv. Existing active Prinos production wells: Some wells at the Alpha and Beta Prinos platforms will continue producing from Reservoir A during the early years of the Project, while CO_2 injection will take place in the underlying Reservoirs B and C. As these were constructed using standard carbon steel materials, there is a risk of accelerated corrosion of these wells if they come into contact with the CO_2 plume, potentially compromising their integrity and causing leakage from the storage site.

v. Existing active Prinos production wells: Some wells at the Alpha and Beta Prinos platforms will continue producing from Reservoir A during the early years of the Project, while CO_2 injection will take place in the underlying Reservoirs B and C. As these were constructed using standard carbon steel materials, there is a risk of accelerated corrosion of these wells if they come into contact with the CO_2 plume, potentially compromising their integrity and causing leakage from the storage site.

10.4.1.1.2.4 The CO_2 Pipeline as a Potential Leakage Pathway

Potential CO_2 leakage pathways can be identified along the pipeline through various exposure mechanisms. High pressures, high CO_2 concentrations containing **impurities**, combined with accidental damage from external activities and operational incidents, are among the leakage mechanisms that must be managed and mitigated to ensure the safe transportation of CO_2 to the offshore Prinos facilities.

The high arrival pressure of CO_2 from both sources—i.e., via the onshore CO_2 pipeline (102 barg) and trucked CO_2 loads (60–80 barg)—combined with the risk of overpressure due to equipment failure, pipeline blockage from impurity buildup, or operational errors, could result in pipeline rupture or explosion and subsequent CO_2 release into the atmosphere. Furthermore, pipeline corrosion over time may increase the likelihood of leaks, while mechanical failures such as material fatigue or welding defects may also contribute to corrosion phenomena, creating vulnerable points in the pipeline that could fail under high-pressure conditions.

Accidental damage from external activities, such as construction works or natural events, poses additional threats to the structural integrity of the pipeline, potentially causing physical damage and leading to leaks. Moreover, incidents during CO_2 unloading and loading operations—particularly during crane lifting or pipe transfer—represent another possible exposure mechanism, which, when combined with inadequate operational procedures, material incompatibility, and insufficient maintenance, may lead to the dropping of CO_2 loads, resulting in high-pressure CO_2 release and occupational accidents, posing risks to personnel safety and integrity (injuries).

10.4.1.2 Critical Parameters Affecting Leakage

The main parameter influencing potential leakage is reservoir pressure. The maximum pressure for safe CO_2 storage is limited by several factors. The maximum reservoir pressure that the formation can withstand before failure is calculated as part of a geomechanical study. Reservoir pressure also depends on the integrity of abandoned wells.

Another important parameter influencing potential leakage is reservoir temperature. Injecting cold CO_2 cools the warm reservoir, affecting the integrity of the rocks accordingly.

10.4.1.3 Secondary Effects of CO_2 Storage

The main phenomena in the well area due to injection, including geochemical and thermal effects, relate to the potential formation and development of a dry-out zone and brine evaporation due to high injection rates. This may increase the likelihood of salt precipitation, which can adversely affect permeability near the well. Moreover, the injection of cold CO_2 into warmer formations could trigger Joule-Thomson effects, potentially leading to the formation of CO_2 hydrates. High injection rates, combined with a sharp increase in pressure and temperature from the wellbore outward, may also induce hydrothermal geomechanical changes. Based on simulation results, there is no significant risk of hydrate formation near the wellbore, as the Joule-Thomson effect is minimal due to the relatively high pre-injection pressure and temperature. The reservoir temperature evolution can be divided into three zones: a zone up to 50–75 m, depending solely on injection temperature, a transitional zone with a radius of 200–250 m, where temperature begins returning to reservoir conditions, the far-field zone, where temperature remains at reservoir values.

A dry-out zone of up to 50 m is formed, where water fully evaporates and precipitated salt blocks the pores, depending on the initial salinity of the brine, while salt precipitation phenomena are observed in a zone with a radius of 100 m. This dry-out zone is likely to exhibit reduced permeability, affecting injection capacity, with a flow resistance factor of up to 1.4, indicating a permeability reduction of up to 30% within the 50 m radius.

10.4.1.4 Other Factors Hazardous to Human Health or the Environment

CO_2 storage sites, if not designed according to safety specifications, can pose risks to human health beyond leakage pathways and secondary containment issues. The following paragraphs present these hazards and their classification.

10.4.1.4.1 Induced Seismicity

Risk	CO_2 injection into geological formations may increase pressure within the rock formations, potentially causing seismic events.
Health impacts	Induced seismicity may cause ground shaking, which in turn can lead to structural damage to existing infrastructures. This could potentially result in injury or death in cases of partial or total collapse of structures, falling objects/debris, etc.
Risk analysis	The characterization of induced seismicity risk from human activities at the Prinos reservoir includes the evaluation of geological, operational, and environmental parameters that define the probability and impact of seismic events
Geological parameters	Faults • Presence of faults in the area • Fault characteristics (orientation, length, slip rate) • Stress field and orientation relative to faults
	Rock properties • Lithology: type of rocks (e.g., shale, sandstone, granite).

	• Permeability and porosity: Higher permeability can lead to easier fluid migration. • Mechanical properties: Strength and elasticity of the rocks.
Operational parameters	Injection and production • Injection volume and rate: Higher injection rates may increase pore pressure and the risk of seismicity. • Injection depth: Injection is more likely to occur near seismic zones at greater depths. • Production rate: Higher production rates may also affect the underground stress field.
	Fluid properties • Different types of fluids (water, CO_2, liquid waste) have different impacts. • Temperature and chemical composition: Hot fluids or those chemically reacting with formations can influence risk.
Environmental parameters	Seismicity historical data • Previous seismic events: Areas with a history of induced seismicity are more sensitive. • Older seismic activity in the area.
	Surface activity • Population density: Higher risk in densely populated areas. • Proximity to dams, power plants, and other critical infrastructure.
Risk classification	Based on the above analysis, the risk of induced seismicity can be qualitatively characterized as **low**, according to the following findings:
Geological parameters	No significant faults, stable lithology, and low permeability.
Operational parameters	Low injection rate, deep injection depth, stable production rates.
Environmental parameters	No historical seismicity, low background seismicity, remote location with sparse population.
Monitoring	Continuous monitoring of seismic activity, controlled injection rates.

10.4.1.4.2 Groundwater Pollution

Risk	CO_2 can cause changes in the chemical composition of groundwater by dissolving minerals from rocks or through reactions with pollutants present in the storage site formations.
Health impacts	Contaminated groundwater can pose serious health risks if used for drinking, irrigation, or other purposes. Potential pollutants include heavy metals and other toxic substances that may cause a range of health problems, from gastrointestinal issues to long-term chronic diseases.

Risk analysis	The characterization of the risk of groundwater contamination in the Prinos reservoir includes the evaluation of geological, operational, and environmental parameters. The objective is to assess the potential pathways and the likelihood of migration of CO_2 or other pollutants into the underground water resources.
Geological parameters	Faults • Presence and density of faults in the area, which act as pathways for CO_2 migration • Fault activity: Active faults carry a higher risk
	Integrity of the overlying formation • Quality of the seal and capacity of the overlying formation to prevent CO_2 migration • Thickness and lateral extent adequacy of the overlying formation • Low permeability of the overlying formation is crucial for effective sealing
	Reservoir properties • Porosity and permeability: High porosity and permeability are necessary for CO_2 storage, but adequate management is required to avoid risks • Trapping mechanisms: Structural (anticlines, faults) or stratigraphic trapping mechanisms must be reliable
Operational parameters	Injection practices • Injection pressure must be controlled to avoid fracturing the overlying rock • Injection rates: High rates may increase the risk of overpressure • Well integrity: Wells must be properly cemented and maintained to prevent leakage
	Monitoring and verification • Baseline condition (quality) of groundwater prior to CO_2 injection • Continuous monitoring of pressure, CO_2 plume movement, and groundwater quality
Environmental parameters	Proximity to groundwater resources • Distance from aquifer: Greater distances reduce the risk of contamination. • Hydraulic connection between the storage site and freshwater aquifers.
	Marine environment • Intrusion of seawater: Interaction between the injected CO_2 and seawater could affect marine ecosystems. • Pressure conditions in the marine environment.
Risk classification	Based on the above analysis, the risk of groundwater contamination at the storage site can be qualitatively classified as **low**, supported by the following conclusions:
Geological parameters	High quality, thick, continuous overlying rock with low permeability. Few faults in the area.

Operational parameters	Controlled injection pressure and rate. Operation of monitoring systems
Environmental parameters	Significant distance from groundwater resources. Low hydraulic connectivity with freshwater zones. Stable pressure conditions in the marine environment.
Monitoring	Studies of baseline conditions and monitoring of groundwater.

10.4.1.4.3 Equipment Failure

Risk	The infrastructure required for the transport and injection of CO_2, such as pipelines, wells, and compressors, may fail due to corrosion, mechanical damage, or operational errors.
Health Impacts	Failures may lead to CO_2 leakage at the surface, which can cause asphyxiation in humans and animals, as high concentrations of CO_2 can displace oxygen.
Risk Analysis	The characterization of surface infrastructure failure risk includes the evaluation of parameters related to the integrity and reliability of the infrastructure, environmental conditions, and operational practices.
Infrastructure Integrity	Structural design and materials • Adherence to design standards and best practices in infrastructure design. • Use of high-quality materials resistant to corrosion and mechanical stresses. • Inspection of aging and condition (wear) of the infrastructure.
	Maintenance and inspections • Implementation of a regular maintenance program. • Frequent inspections to identify wear, corrosion, and other issues. • Repair protocols: Effective and timely repair procedures.
Environmental Parameters	Seismic Activity • Assessment of seismicity in the area and potential impacts on the infrastructure. • Monitoring for possible underground movements that could affect infrastructure stability.
	Marine Environment • Risk of corrosion due to exposure to seawater. • Evaluation of the potential impact of marine organisms on infrastructure. • Frequency and intensity of storms, waves, and other weather conditions.
Operational parameters	Injection and production operations • Injection pressure and rate within operational limits. • Operational stress on the infrastructure. • Impact of potential operational changes on operating procedures.

	Emergency response • Emergency response plans for infrastructure failures. • Regular training and emergency drills for personnel.
Human factors	Personnel Training • Skill levels: adequately trained and experienced personnel. • Human error: likelihood and impact of human error.
	Administrative practices • Safety culture within the organization. • Compliance with regulatory requirements and industry best practices.
Risk Classification	Based on the above analysis, the risk of surface infrastructure failure can be qualitatively classified as **moderate**, in accordance with the following, mainly due to the marine environment and the aging of the infrastructure:
Infrastructure Integrity	Well-maintained infrastructure, good quality materials, regular maintenance with occasional minor issues.
Environmental Parameters	Moderate corrosion potential Rare and mild storms Low seismic activity
Operational Parameters	Operational practices within safe limits Established emergency response plans
Human Factors	Adequately trained personnel Strong safety culture Strict compliance with legislation
Monitoring	Regular maintenance Use of corrosion-resistant materials Implementation of robust safety protocols

10.4.1.4.4 Impacts on Soil and Vegetation

Risk	CO_2 leakage may affect soil chemistry and disrupt vegetation growth by altering pH levels and nutrient availability.
Health impacts	Changes in soil and vegetation can affect local agriculture and food supply, with potential impacts on human health through reduced food quality and availability.
Risk analysis	The characterization of the risk of impacts on soil and vegetation includes assessing the likelihood of CO_2 leakage and its effects on the marine environment, which may indirectly affect nearby coastal ecosystems. Even if direct impacts on soil and vegetation are less relevant in offshore areas, broader ecological effects must be considered.
Geological parameters	Integrity of the reservoir • Quality (integrity and permeability) of the overlying formation to prevent CO_2 leakage.

	• Presence and activity of faults in the area, which act as CO_2 migration pathways. • Geomechanical conditions favorable for CO_2 trapping.
	Barriers and containment • Secondary containment: Presence of secondary barriers providing additional containment. • Potential pathways for CO_2 migration to the seabed.
Operational parameters	Injection practices • Injection pressure and rate within safety limits to avoid fracturing the overlying rock. • Continuous monitoring of the CO_2 plume and pressure within the reservoir. • Integrity of injections and monitoring wells.
	Leak detection • Use of sensors and technology to detect CO_2 leakage at the seabed. • Geochemical monitoring: Analysis of water chemistry to detect potential changes indicating CO_2 leakage.
Environmental parameters	Marine ecosystem • Benthic ecology: Impacts on benthic organisms and habitats. • Water chemistry: Changes in pH and carbon chemistry due to CO_2 dissolution. • Marine flora and fauna: Effects on marine life, especially species sensitive to CO_2 level changes
	Coastal ecosystems • Potential impact of CO_2 emissions on the coastal environment due to proximity to the shoreline. • Effects on coastal vegetation. • Changes in soil chemistry in coastal zones due to changes in seawater.
Human factors	Monitoring and response • Defined response plans for detected leakage incidents. • Training and awareness: Ensuring staff training to detect and respond to leakage events.
	Regulatory compliance • Regulations and standards: Compliance with environmental regulations and industrial standards. • Stakeholder engagement: Interaction with local communities and interested parties regarding potential risks and mitigation measures.
Risk classification	Based on the above analysis, the risk of impacts on soil and vegetation can be qualitatively classified as **low**, according to the following findings:

Geological parameters	High-quality overlying rock. Few faults in the area. Favorable geomechanical conditions
Operational parameters	Controlled injection practices Operation of monitoring systems Integrity of wells
Environmental parameters	Minor impact on the marine ecosystem Significant distance from the shoreline Stable conditions in the marine environment
Human factors	Comprehensive CO_2 leakage response plans Strict compliance with legislation Adequate stakeholder participation
Monitoring	Monitoring of soil and vegetation Comprehensive CO_2 leakage response plans

10.4.1.4.5 Operational Accidents

Risk	Causes such as human error, equipment failure, or natural disasters may cause accidents during construction, operation, and maintenance of the CO_2 storage site.
Health impacts	Accidents may result in injuries or fatalities of workers and nearby residents. The release of CO_2 or other hazardous substances during an accident may create immediate health risks through suffocation or contact.
Risk analysis	The characterization of the risk of operational accidents includes evaluation of parameters related to infrastructure design and maintenance, operational practices, environmental conditions, and human factors.
Infrastructure Integrity	Structural design and materials • Compliance with design standards and best practices. • Use of materials resistant to corrosion, pressure, and marine conditions. • Inspection of aging and condition (wear) of infrastructure.
	Maintenance and inspections • Implementation of regular maintenance programs. • Frequent inspections to detect wear, corrosion, and potential failures. • Repair protocols: Effective and timely repair procedures.
Operational parameters	Injection and production operations • Injection pressure and rate within operational limits. • Compliance with standard operating procedures (**SOPs**). • Equipment reliability: Regular testing and maintenance of critical equipment.
	Emergency response

	• Emergency response plans for various scenarios. • Regular emergency training and drills for personnel. • Availability and operational readiness of safety equipment.
Environmental parameters	Seismic Activity • Assessment of seismicity in the area and potential impacts on infrastructure. • Monitoring for possible underground movements that could affect infrastructure stability.
	Marine Environment • Weather and marine conditions: Impacts of storms, waves, and other weather conditions. • Corrosion risk due to exposure to seawater. • Assessment of potential impacts of marine organisms on infrastructure.
Human factors	Personnel Training • Skill levels: adequately trained and experienced personnel. • Human error: likelihood and impact of human error.
	Administrative practices • Safety culture within the organization. • Compliance with regulatory requirements and industry best practices.
Risk Classification	Based on the above analysis, the risk of operational accidents can be qualitatively classified as **low**, according to the following conclusions:
Infrastructure Integrity	Well-maintained infrastructure with minor occasional issues and good quality materials.
Operational parameters	Operational practices within safe limits. Established emergency response plans. Reliable equipment.
Environmental parameters	Mild and stable marine conditions. Moderate corrosion potential. Low seismic activity.
Human factors	Adequately trained personnel. Strong safety culture. Strict compliance with legislation.
Mitigation	Worker safety training. Emergency response planning and regular drills.

10.4.2 Exposure and Effects Assessment

10.4.2.1 General Information

To achieve a comprehensive overview of the Project's risks, hazard assessment is conducted for each section (facilities, wells, storage site). Deviations from standard operating procedures and conditions (pressure, temperature, flow rates) that could create hazards and affect the safety, integrity and reliability of both the infrastructure and the hydrocarbons in the reservoir are thoroughly examined.

10.4.2.2 Facility Risk Assessment

The risk assessment related to the facilities mainly concerns the following:

- Bulk CO2 transportation to the Prinos complex via the 12–16" offshore pipeline
- CO2 unloading from trucks
- Compression of the CO2 loads to achieve injection-suitable pressure
- Loading of CO2 loads onto supply vessels / barges for offshore transport
- Processing of CO2 loads on the supply vessel / barge or the platform
- Connection of the transfer hose from the vessel to the platform for direct injection

The main operational hazards at the facilities include:

- CO2 leakage due to pipeline rupture
- Pipeline blockage
- Hydraulic shock in the pipeline
- Connection failures during loading/unloading
- Pressure drops and accidents during unloading

Partial or total pipeline rupture is a significant risk associated with the Project. Considering the high inlet pressures of bulk CO2 (102 barg) and truck-delivered CO2 loads (60–80 barg), overpressure caused by equipment failure or operational errors must be prevented and mitigated to avoid consequences such as CO2 leakage, asphyxiation hazards, high repair costs and operational downtime. Key preventive measures include designing the pipeline with pressure relief systems and automated pressure control systems. The design should also include appropriate safety margins.

Overpressure may also result from pipeline blockages, which can arise from hydrate formation or other solid deposits, or contaminants accumulating along the pipeline. Key preventive actions include ensuring CO2 purity according to specified standards, frequent pigging (cleaning) of the pipeline, and monitoring pipeline condition and flow.

Pipeline **corrosion** due to impurities or environmental conditions, mechanical failure (material fatigue or welding defects), and accidental damage from external activities are other major causes of CO2 leakage.

These pose significant hazards to both human health and the environment (soil and air pollution). Corrosion-resistant materials, protective coatings, and reduced welded joints during pipeline construction can significantly prevent leakage. Additionally, the installation of new and upgrading of existing monitoring equipment, including leak detection systems, is vital as part of the monitoring plan under development.

Another risk concerns accidents during CO2 load transfer operations, which may occur:

- during crane lifting from trucks onto the deck of the transport vessel.
- onshore near the compression station.
- during offloading via hose systems on the platform deck.

Inadequate maintenance of cranes and other lifting or transport equipment, mechanical failures, improper connection/disconnection procedures, material incompatibilities, and connector degradation can result in CO2 load drops (crane lifting or hose connection/disconnection accidents), causing high-pressure CO2 releases, structural damage and serious personnel injuries. Therefore, it is necessary to ensure the equipment meets the required lifting specifications, undergoes frequent maintenance, inspection, and that transport procedures and road transport plan are followed.

In addition to the aforementioned risks, internal pipeline roughness, accumulation of ice or corrosive impurities/contaminants, and temperature variations during transport (e.g. at start-up) can also lead to pressure drops along the pipeline, causing operational delays and increased energy consumption to achieve the required injection pressure. To prevent pressure drops, proper pipeline design based on flow assurance studies is required, as well as pressure monitoring throughout the CO2 transport system and mitigation of low temperatures via start-up equipment.

Natural hazards and adverse environmental conditions (strong winds, rain, extreme temperatures) may affect operations by causing injection delays or shutdowns, leading to downtime, low performance, risks such as fires, explosions, and personnel injuries. To account for this unpredictable risk, equipment and pipeline design must consider extreme weather conditions to prevent such incidents.

Table 10-7 summarizes the risks identified in relation to the facilities of the proposed CO2 storage Project in Prinos and their respective potential impacts.

Table 10-7. Risks related to the Project's installations and their potential impacts

AA	Risk Description	Potential Impacts	Initial Risk
1	CO_2 leakage due to pipeline corrosion, due to deposits/contaminants in the CO_2 stream or environmental conditions	• CO_2 escape to the atmosphere – greenhouse gas emissions • Risks to human health • Environmental damage (soil and/or water pollution)	C3

AA	Risk Description	Potential Impacts	Initial Risk
2	CO_2 leakage due to mechanical damage (e.g., poor welding, material wear)	• CO_2 escape to the atmosphere – greenhouse gas emissions • Risks to human health • Environmental damage (soil and/or water pollution)	C3
3	CO_2 leakage due to accidental damage from external causes (e.g., construction works)	• CO_2 escape to the atmosphere – greenhouse gas emissions • Risks to human health • Environmental damage (soil and/or water pollution)	C3
4	Partial/total rupture of pipeline due to overpressure, equipment failure, or operational errors	• Large-scale CO_2 leakage causing risks to human and animal safety (risk of asphyxiation) • Significant environmental pollution • High repair costs and operational downtime	C4
5	Partial/total rupture of pipeline due to significant corrosion or material defects leading to structural failure	• Large-scale CO_2 leakage causing risks to human and animal safety (risk of asphyxiation) • Significant environmental pollution • High repair costs and operational downtime	C4
6	Pipeline blockage due to formation of hydrates or other solid deposits inside the pipeline	• Disruption of CO_2 flow leading to inadequate operation. • Possible pressure increase resulting in risk of leaks or explosions. • Increased maintenance and cleaning costs.	C2
7	Pipeline blockage due to accumulation of deposits/contaminants or pollutants in the CO_2 stream	• Disruption of CO_2 flow leading to inadequate operation. • Possible pressure increase resulting in risk of leaks or explosions. • Increased maintenance and cleaning costs.	C2

AA	Risk Description	Potential Impacts	Initial Risk
8	Hydraulic shock in the pipeline due to rapid valve closure or compressor failure combined with poor design, lack of safety margin, or protection mechanisms against high pressure	Probability of pipeline damage due to pressure spikes	B2
9		Increased wear on pipeline components causing failures	B2
10	Accidents during CO_2 cargo unloading (lifting errors) due to mechanical failure of crane/other lifting equipment or insufficient maintenance	Drop of CO_2 cargo, potential structural damage to containers	C3
11		Risk of rupture of container or high-pressure CO_2 leakage	C4
12	Accidents during CO_2 cargo unloading (lifting errors) due to mechanical failure of crane/other lifting equipment or insufficient maintenance	Serious injury or death to personnel and infrastructure damage	C4
13	Failures during connection (flexible connection/disconnection of pipes) due to inappropriate connection/disconnection procedures	Risk of CO_2 leakage at connection points, safety and environmental hazards	D3
14	Failures during connection (flexible connection/disconnection of pipes) due to material incompatibility or degradation of connectors and sealing elements	Operational delays and increased repair costs	D2
15		Increased risk of equipment damage and injury	D3
16	CO_2 pressure drop in pipes and pipelines (flow/pump) due to friction losses and resistance from pipe roughness	Reduced injection rate if pressure is below optimum	B2
17	CO_2 pressure drop in pipes and pipelines (flow/pump) due to ice buildup or corrosion products in pipes or pipelines	Probability of demand for additional compression to offset pressure drop, resulting in increased energy consumption and increased OPEX	B2
18	CO_2 pressure drop in pipes and pipelines (bulk / cargo) due to friction losses and resistance caused by the roughness of the pipeline's internal surface	Operational delays leading to reduced efficiency	B2
19	CO_2 pressure drop in pipes and pipelines (bulk/cargo) during transport due to temperature variations (freezing) in winter, causing formation of ice and frost on the exterior of pipes/pipelines	• Probability of requiring additional compression to compensate for the pressure drop, resulting in higher energy consumption and OPEX. • Operational delays leading to reduced efficiency.	B2

AA	Risk Description	Potential Impacts	Initial Risk
20	CO_2 leakage after an accident (overturn or object drop) on cargo	• CO_2 escape to the atmosphere – greenhouse gas emissions • Risks to human health • Environmental damage (soil and/or water pollution)	C2
21	Partial/total rupture of pipeline due to fishing/trawling	• CO_2 escape to the atmosphere – greenhouse gas emissions • Risks to human health • Environmental damage (soil and/or water pollution)	D4
22	Rupture of lifting pipe due to collision with vessel on quay	• Safety risks including asphyxiation and extreme cold caused by rapid decompression of compressed CO_2 • Ecosystem risks including marine oxygen depletion • Operational downtime due to leaks and secondary damage to other equipment	C2
23	Losses due to quay collapse	Rupture of wells, pipeline, lifting pipe	B2
24	Natural risks due to weather conditions (strong winds, rain, extreme temperatures) that may affect installations	Equipment failures and risks to personnel	C3
25	Freezing/formation of dry ice CO_2 due to low temperatures during injection	Equipment failures and risks to personnel	B2
26	High temperatures due to heat from compression	• Personnel injury • Exceeding design temperature (multiple outlet pipes, pipeline, multiple injection wells	C2
27	Wave action / adverse environmental conditions	Operational delays or need for disconnection / injection shutdown	D2
28	Parallel operation of Sigma and Prinos installations, interaction with the operation of the CO_2 storage Project	Probability of delays due to poor coordination	B1

To ensure safe operation, beyond preventive design, it is important to establish a mitigation framework to reduce the impacts of the identified risks. Immediate mitigation actions will include the clean-up and repair of damaged pipelines and/or equipment to minimize health and environmental impacts, the review and update of operational procedures, as well as the frequent maintenance and inspection following the incident to prevent recurrence. Backup equipment should be available, along with emergency shutdown systems. Finally, medical assistance should be provided to personnel to mitigate the health impacts of the risks.

Overall, the estimated residual risk after implementing the proposed risk control and mitigation measures is significantly reduced to the ALARP level (As-Low-As-Reasonably-Practicable), as presented in the following risk assessment tables. All the described risks, which initially ranged between B1–D4 (Table 10-8), are considered low-level after the application of corrective actions and are classified between A1–B3 (**Table** 10-9).

Table 10-8. Risk levels associated with the operation of the CO_2 storage facilities of Prinos

Severity Level (1-5)	Likelihood (A-E)				
	A	B	C	D	E
1		1			
2		8	5	2	
3			5	2	
4			4	1	
5					

Table 10-9. Residual risk levels during the operation of the CO_2 storage facilities of Prinos

Severity Level (1-5)	Likelihood (A-E)				
	A	B	C	D	E
1	1	3			
2	9	6			
3		9			
4					
5					

10.4.2.3 Well Risk Assessment

The assessment of risks related to well integrity covers the following scope:

- Abandoned inaccessible wells.
- Accessible wells.

10.4.2.3.1 Future Wells for the Project

It should be noted that the quantification of well leakage is of limited accuracy due to the large number of variables per well (input data to simulation models) and the lack of data on the probabilities of well equipment failure. However, an assessment has been carried out focusing primarily on the integrity of the wells in order to determine the condition of the existing infrastructure, which contributed to identifying potential leakage pathways.

10.4.2.3.1.1 Abandoned Inaccessible Wells

The well integrity assessment identified twelve abandoned wells as being of higher risk due to the placement of permanent barriers that could lead to lateral leakage into permeable formations and potentially create a leakage pathway to the surface over time.

The twelve wells are currently considered to retain the existing reservoir pressure, and there is no indication of integrity issues. Risks are not expected until reservoir pressure significantly increases due to CO_2 injection. Additional monitoring or remediation will be required for these twelve wells in order to reduce risk to an **ALARP (As-Low-As-Reasonably-Practicable)** level. The control measures will be finalized during the final design phase.

One of the initial offshore exploration and appraisal wells, P-6, lacks data to verify its "as-abandoned" condition; therefore, additional monitoring is proposed where the wellhead location is known and situated on the seabed. The selection of monitoring technology will be finalized in the final design phase.

10.4.2.3.1.2 Sandstone Layers in the Evaporite Formations

Seventeen wells have been abandoned where the base of the internal barrier is positioned along the evaporitic sequence, and therefore along an impermeable formation. However, permeable layers have been identified within the evaporitic sequence below the base of these internal barriers. Over time, the protective casing could corrode, exposing the sandstones to CO_2. This implies a risk of CO_2 plume entry into these permeable zones. A study is currently underway to confirm whether the evaporitic sand layers are suitable as a secondary containment reservoir and not considered leakage pathways.

10.4.2.3.1.3 Portland Cement

Portland cement was used in the construction of the abandoned wells, which is not necessarily intended for high CO_2 concentrations. Consequently, there is a risk of cement degradation, which in turn could create a leakage pathway.

According to extensive research, the impact of CO_2 on Portland cement is extremely slow and limited to 0–10 m over 10,000 years, provided that good installation practices are followed. The well-integrity analysis has assessed the risks related to cement barriers. Additionally, an independent geological study has confirmed that the salt formations within the evaporitic sequence will flow around the poorly cemented casing, thereby reducing the need for Portland cement in certain wells.

10.4.2.3.1.4 Accessible Wells

Certain wells on the Prinos Alpha and Beta platforms will continue to produce from the reservoir A layers during the injection of CO_2 into the B and C reservoirs. As these were constructed with conventional carbon steel materials, there is a risk of potential accelerated corrosion if they come into contact with CO_2, which would cause integrity issues and potential leakage from the storage reservoir. However, reservoir modelling can simulate CO_2 migration within the various reservoir layers and predict when the CO_2 plume will reach

each well. Prior to this "CO_2 breakthrough", the wells will be abandoned to prevent the occurrence of integrity issues. Furthermore, fluid sampling under the monitoring program can confirm CO_2 concentrations during oil production.

10.4.2.3.1.5 Construction and Abandonment of New Wells

The construction of new CO_2 injection wells could potentially pose a leakage risk. During CO_2 injection, a significant temperature drop occurs near the well, which could affect well construction, causing contraction and potentially annular micro-fractures. The quality of the cement in the annulus of the cemented casing and production tubing will be verified via logging. In addition, the creep and sealing properties of the salts in the evaporitic formation will help to seal the annulus, minimizing micro-fractures as potential leakage pathways.

10.4.2.3.1.6 Well Risk Assessment

Prinos is a mature reservoir, and geological risks are well understood. The well designs have evolved over the years to establish a robust design that could also be suitable for CO_2 storage. During the design phase, the abandonment program will define the steps that could be applied to abandon the wells if required.

Table 10-10 summarizes the risks identified in relation to the wells of the proposed CO_2 storage project in Prinos and the potential impacts.

Table 10-10. Risks related to the Project's wells and their potential impacts

AA	Περιγραφή κινδύνου	Πιθανές επιπτώσεις	Αρχικός Κίνδυνος
1	Poor condition of abandoned wells. After integrity analysis of 12 wells, deemed unsuitable based on their condition	Leakage of CO_2 / petroleum / water through wells into formation layers or to surface	C4
2	Drilling of intervening wells. Failure of intervening wells and inability to place seals at greater depths in high-risk wells	Leakage of CO_2 / petroleum / water through wells into formation layers or to surface	C4
3	Abandoned non-compliant wells – 28 abandoned wells not abandoned according to modern industrial standards (e.g., cementing)	Leakage of CO_2 / petroleum / water through wells into formation layers or to surface	C4
4	Abandoned old inaccessible wells – Seventeen wells have been abandoned where the base of their internal seal is placed along the evaporitic sequence, and consequently, the well has been abandoned at depths within impermeable formations. However, permeable layers exist within the evaporitic sequence beneath the bases of these internal seals. Over time, the casings could corrode, exposing the sandstones to CO_2.	Leakage of CO_2 / petroleum / water through wells into formation layers – secondary storage accumulation	C4

AA	Περιγραφή κινδύνου	Πιθανές επιπτώσεις	Αρχικός Κίνδυνος
5	Use of Portland cement in the construction and abandonment process of (abandoned) wells. Portland cement may react with the carbonic acid of the CO_2 plume.	Leakage of CO_2 / petroleum / water through wells into formation layers – secondary containment reservoir	C3
6	No data available for exploratory well P-6, thus the condition "abandoned" is unknown	Leakage of CO_2 / petroleum / water through wells into formation layers or to surface	C3
7	Non-compliant wells at Alpha and Beta platforms that remain active, not designed for exposure to acidic CO_2/water mixture	Leakage of CO_2 / petroleum / water through wells into formation layers or to surface	C3
8	New water production wells have potential for ESP pump damage	Reduction in CO_2 storage capacity	C2
9	New injection wells are not constructed for CO_2 supply to storage	Leakage of CO_2 / petroleum / water through wells into formation layers or to surface	C4
10	CO_2 well abandonment	Leakage of CO_2 / petroleum / water through wells into formation layers or to surface	C4

The correct selection of materials to avoid accelerated corrosion is a key prerequisite for a successful CO_2 well.

Overall, the estimated residual risk after the implementation of the proposed risk mitigation control measures is significantly reduced to the ALARP level (As-Low-As-Reasonably-Practicable), as presented in the following risk assessment tables. All the described risks, which initially ranged between C2–C4 (**Table 10-26**), are, after the application of corrective measures, considered to be of low to moderate level and are classified between A3–B4 (**Table** 10-27).

Table 10-11. Risk levels associated with the wells of the Prinos CO_2 storage Project

Severity Level (1-5)	Probability (A-E)				
	A	B	C	D	E
1					
2			1		
3			3		
4			6		
5					

Table 10-12. Residual risk levels associated with the wells of the Prinos CO_2 storage Project

Severity Level (1-5)	Probability (A-E)				
	A	B	C	D	E
1		1			

Severity Level (1-5)	Probability (A-E)				
	A	B	C	D	E
2					
3	1	3			
4	1	4			
5					

10.4.2.4 Storage Site Risk Assessment

The risk assessment related to potential subsurface leakage pathways from the Prinos storage complex covers the following aspects:

- Vertical faults
- Lateral faults

10.4.2.4.1 Vertical Leakage Pathways

Five (5) potential leakage pathways have been identified along which CO_2 may vertically escape beyond the boundaries of the storage complex. The leakage pathways related to the storage site are:

- Leakage pathway #V1: Along the (active) NE–SW trending Fault 17.
- Leakage pathway #V2: Along the fault (which also constitutes the boundary of the site) trending NE toward North Prinos.
- Leakage pathway #V3: Along the NW–SE trending fault (dipping to the SW).
- Leakage pathway #V4: Along the NW–SE trending fault (dipping to the NE) – Southern fault bounding Prinos.
- Leakage pathway #V5: Through the overburden formation, via the primary seal and the secondary sealing system.

10.4.2.4.2 Lateral Leakage Pathways

Three (3) potential leakage pathways have been identified along which CO_2 may laterally escape beyond the boundaries of the storage complex, i.e., outside the Prinos reservoir. The leakage pathways related to the storage site are:

- Leakage pathway #L1: Via lateral movement towards deeper parts of the structure on its western side and ultimately the migration of CO_2 through the saddle (leakage point) into the Epsilon structure.

- Leakage pathway #L2: Along the fault (which also constitutes the boundary of the site) trending NE toward North Prinos.

- Leakage pathway #L3: Along the NW–SE trending fault (dipping to the SW).

10.4.2.4.3 Storage Site Risk Assessment

The Risk **Assessment Matrix** (**Figure** 10-22) shows that **leakage pathway #L1** (down-dip pathway displaced toward an anticline and into Epsilon) is the only subsurface leakage pathway that raises concern compared to other potential subsurface leakage pathways, as it could affect the future hydrocarbon development of the Epsilon field. This means that the Monitoring Plan in relation to subsurface leakage risks should focus exclusively on monitoring and preparing corrective actions in the event that CO_2 leaks into the Epsilon structure.

	Small ≤ 10 t/day	Medium ≤ 100 t/day	Large ≤ 1000 t/day	Catastrophic > 1000 t/day
Short (≤ 1 year)			V2	V1 V3 V4
Medium (≤ 10 years)			L1 L2 L3	
Long (≤ 100 years)		V5		
Extended (< 1000 years)				

			Consequence (Release Rate & Duration Combined)				
			Very Small < 0.01%	Small < 0.1%	Medium < 1%	Large < 10%	Catastrophic > 10%
Likelihood	Very Remote	≤ 1.00E-6		V5			
Likelihood	Remote	≤ 1.00E-5				V4	
Likelihood	Highly unlikely	≤ 1.00E-4			V2 L2	V1 V3	
Likelihood	Unlikely	≤ 1.00E-3			L3		
Likelihood	Possible	≤ 1.00E-2			L1		
Likelihood	Probable	≤ 0.1					
Likelihood	Likely	≤ 1					

Σχήμα 10-1: Πίνακες αξιολόγησης επικινδυνότητας τόπου αποθήκευσης

10.4.3 Hazard Characterization – Geographical Extent of Potential Risks

Onshore Project Facilities

With regard to accident scenarios, based on the Impact Modeling Study for the risk assessment related to CO_2 leakage from the onshore facilities of the CO_2 storage unit in Prinos, the likelihood of an accident was identified at three locations within the facility, specifically at the following points:

- At the CO_2 onshore pipeline reception manifold
- At the bulk CO_2 cargo reception point

- At the CO_2 vessel reception point

The corresponding impact extent curves resulting from a major CO_2 leak at each of the aforementioned points (based on the worst-case scenario in each case) are presented in the following **Figures.**

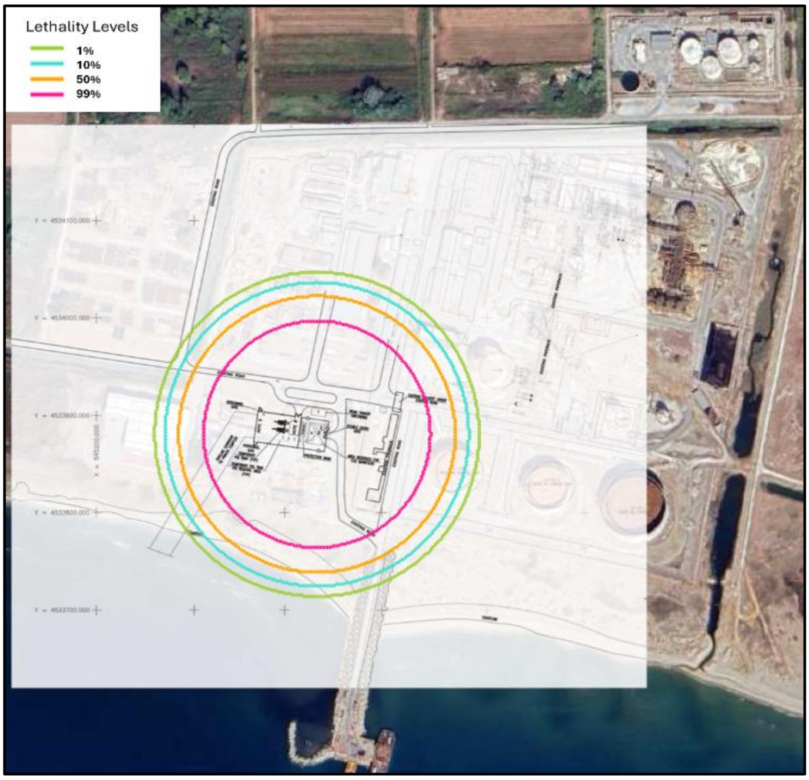


Figure 10-23. Impact curve due to CO_2 leakage at the receiving manifold of the onshore CO_2 pipeline in the worst-case accident scenario (Scenario FCO2, conditions F2)

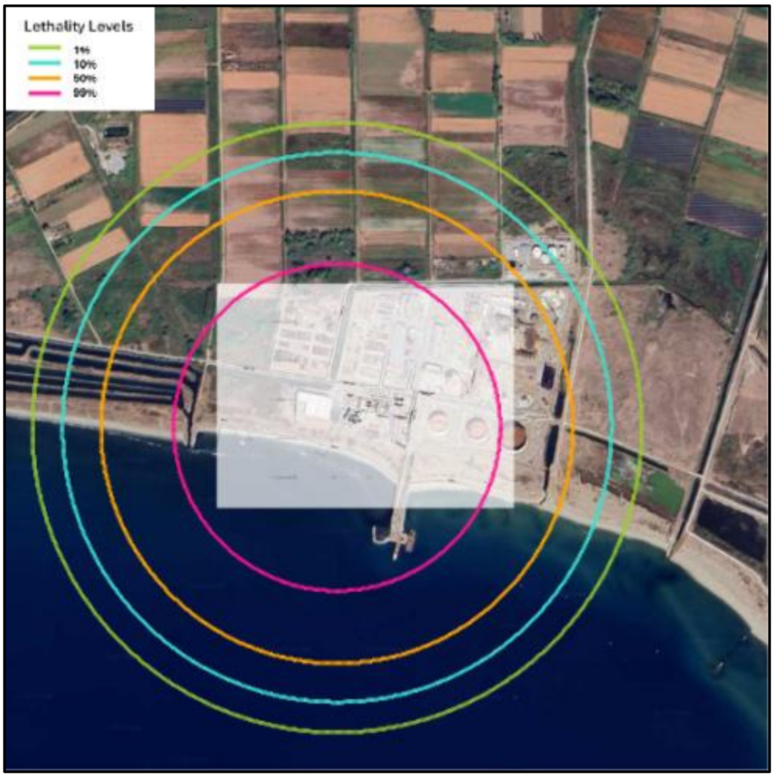


Figure 10-24. Impact curve due to CO_2 leakage at the receiving point of bulk CO_2 loads in the worst-case accident scenario (Scenario FC02, conditions F2)

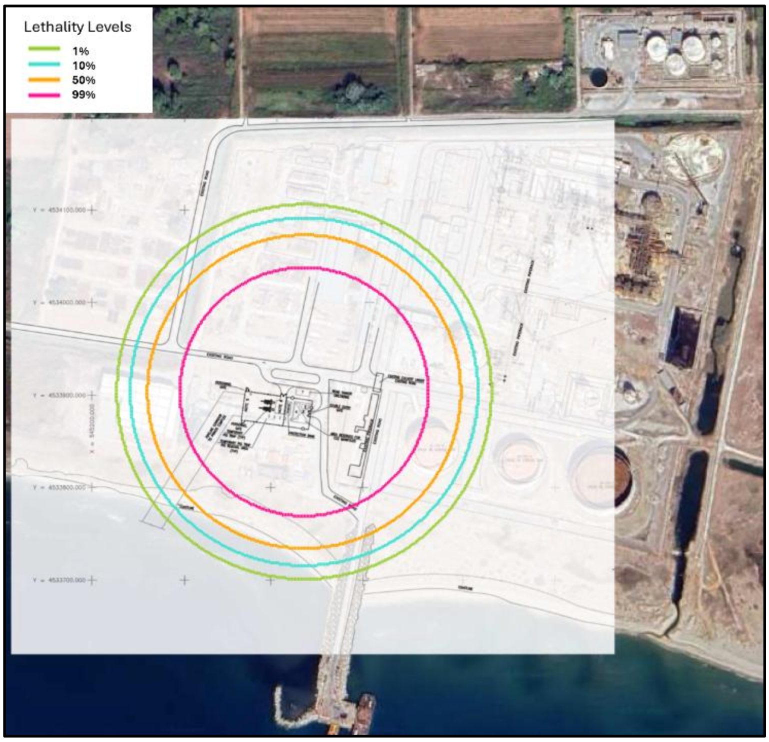


Figure 10-25. Impact curve due to CO_2 leakage at the receiving point of CO_2 containers in the worst-case accident scenario (FC03 scenario - D5)

Based on the Impact Modeling Study conducted to assess the risks associated with CO_2 leakage from the onshore facilities of the CO_2 storage unit in Prinos, it was found that, under the worst-case accident scenario at these facilities (Scenario FC02, F2 weather conditions, **Figure 10–24**), the maximum hazard distance for 1% lethality in the **onshore environment** is estimated at 782 m. This could result from a major CO_2 leak from the pipeline. Therefore, the geographical distribution of the results from these simulations indicates that **even in the worst-case accident scenario at the onshore facilities of the project, sensitive receptors of the natural and human environment (such as settlements, individual residences outside the project area, or other public facilities) cannot be affected.**

In contrast, the impacts of a potential accident on the project's onshore facilities would concern risks to the personnel employed in the Project, who, however, will be adequately prepared to take immediate action in emergency situations (e.g., gas discharge shutdown), in accordance with the Project's **Health and Safety Management Plans**, as defined by law and outlined in the relevant **sections** of **Chapter 11.**

Subsea CO_2 Transmission Pipeline

The impact modeling for the risk assessment related to potential CO_2 leakage from the project's subsea CO_2 transmission pipeline shows that any potential subsea leaks would form a bubble cone reaching the sea surface, as illustrated in the following **Figure.**

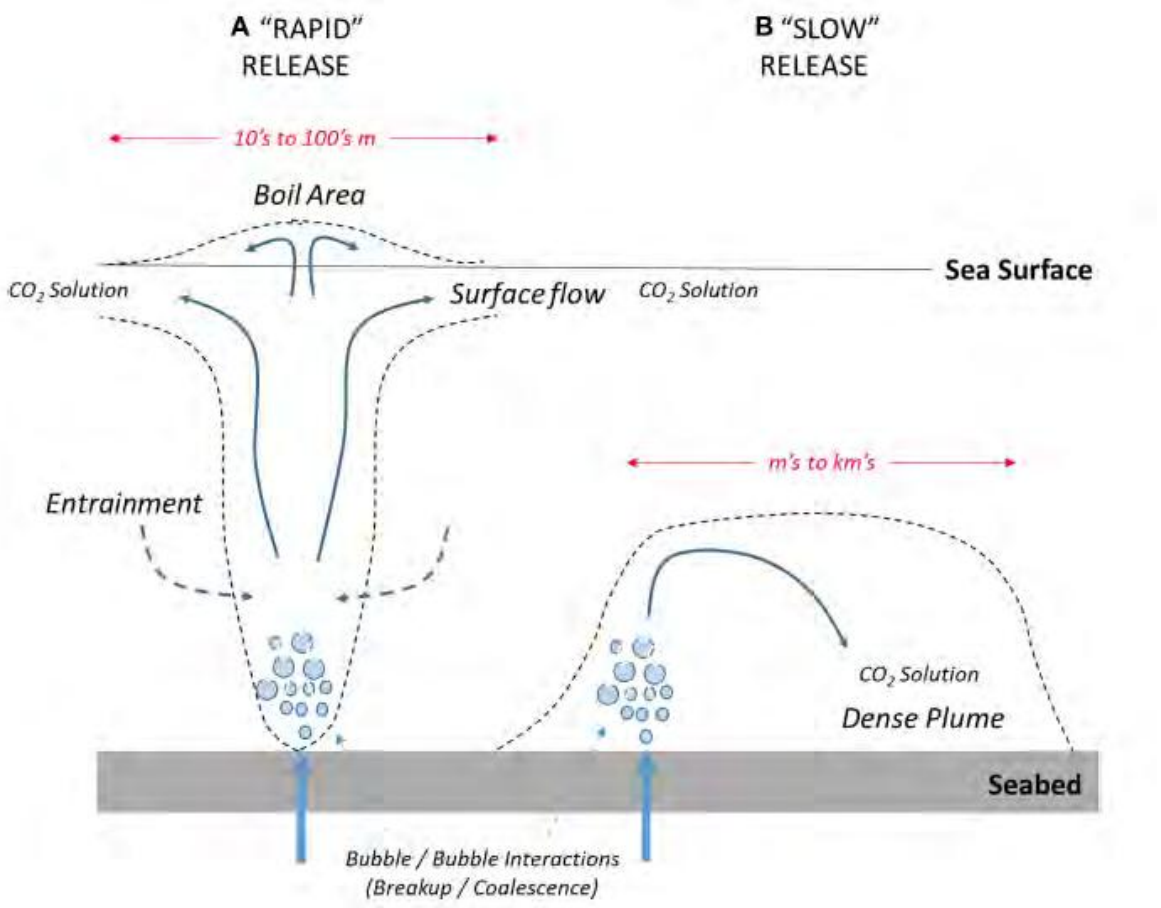


Figure 10-26. Simulation models of CO_2 leakage behavior. (A) A "fast" CO_2 leak where CO_2 reaches the surface of the water column as a gas (from Chen et al., 2005). (B) A "slow" CO_2 leak where CO_2 dissolves in the sea before reaching the surface (from Dewar et al., 2

The diameter of the plume at the sea surface is estimated to be 20% of the depth at the release point. The average sea depth in the Prinos area is approximately 40 meters. Therefore, under the worst-case scenario, the diameter of the surface plume will reach 8 m. In the case of this specific project, the release rate simulation was carried out using the Phast v9 software for each pipeline hole size, to calculate the leakage rate feeding the generated cloud.

The simulation results indicated that at sea level, the maximum distance at which the CO_2 concentration corresponds to the 1% lethality threshold is approximately 1 km in the direction of the prevailing wind (for subsea pipeline rupture under scenario FC08). During the initial stages of the release (t = <60 s), a high plume is predicted that may exceed the deck level of the platform for a short period of time; however, the downwind distances at these elevations are limited. As the pipeline depressurizes, the plume height decreases significantly and disperses over long distances in the direction of the wind. The dispersion plume height remains below 2 m above sea level at downwind distances greater than ~100 m, which means that the risk to personnel on vessels is reduced in these scenarios, as is the risk of potential adverse impacts on the natural environment.

<u>It should be noted that with the implementation of preventive measures (as required by legislation and foreseen in the health and safety plans that will apply during the implementation and operation of the project), this scenario becomes extremely rare.</u>

Offshore Facilities

With regard to the **offshore facilities**, the simulation results demonstrate that hazard distances related to the defined lethality levels are limited to the immediate surroundings of the Beta platform. The maximum hazard distance for 1% lethality is estimated at 80 m at the deck elevation of the Beta platform, resulting from a leak due to rupture in the CO_2 pipeline (scenario FC04, following **Figure**), which also represents the worst-case scenario.

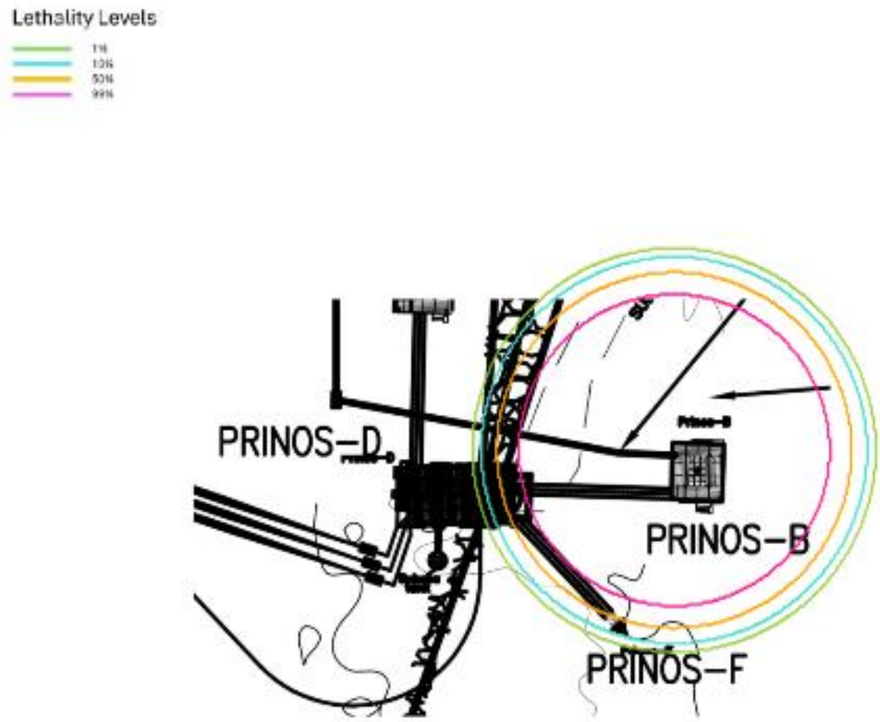


Figure 10-27. Impact curve due to CO_2 pipeline rupture – Scenario FC04, conditions F2 – Deck level

However, only the aforementioned rupture scenario FC04 may affect the adjacent Delta platform at the elevation of its decks. Given that CO_2 is heavier than air, a release above the surface tends to move downward toward sea level, and a subsea release remains close to the surface and disperses, potentially posing a risk to support vessels.

Similarly to the case of the subsea pipeline examined above, the simulation results showed that at sea level, the maximum distance corresponding to a 1% CO_2 lethality threshold is approximately 1 km in the direction of the prevailing wind. During the initial stages of the release (t = <60 s), a high plume is expected that may exceed the deck levels of the platform for a short period of time; however, the downwind distances at these elevations are limited. As the pipeline depressurizes, the plume height decreases significantly and disperses over significant distances in the wind direction. The dispersion plume height remains below 2 m above the sea surface at downwind distances greater than ~100 m, which means that the risk to vessel personnel is reduced in these scenarios, and likewise the risk of potential adverse effects on the natural environment is also reduced.

<u>It is noted that with the implementation of preventive measures (as required by legislation and foreseen in the health and safety plans applicable during the implementation and operation phases of the project), this scenario becomes extremely rare.</u>

10.4.4 Recommendations and Proposed Preventive Measures

Regarding the <u>facilities</u> of the CO_2 storage project, the main risks include pipeline rupture, blockages, corrosion, and accidents during unloading operations. Mitigation measures include pressure relief systems, regular cleaning of pipelines and equipment, use of corrosion-resistant materials, and intensive monitoring. These measures aim to reduce operational delays and health risks.

The well integrity assessment covers abandoned, active, and future CO_2 storage <u>wells</u>. Risks include potential leakage due to well-worn components, particularly in old wells. High-risk wells will undergo dedicated monitoring or remediation. Productive wells will be abandoned before or during CO_2 injection and prior to the CO_2 plume reaching any active well. New wells will be designed using appropriate materials to prevent leakage.

The risk assessment of the <u>storage site</u> identifies as "likely" the potential for CO_2 to migrate through the main Prinos block via the structural anticline toward the Epsilon field (leakage pathway #L1). The Epsilon field is planned for development in the next five years. New wells that will penetrate the Epsilon structure are expected to provide additional pressure data to confirm the aquifer model with regard to pressure development in the Prinos and Epsilon fields. This could be considered part of the Prinos monitoring plan.

A dedicated integrity assessment of the abandoned wells in Prinos, North Prinos, and Epsilon should incorporate the findings of the subsurface leakage risk assessment. At present, it is assumed that wells that may present leakage in Prinos and North Prinos act as scaling factors that only affect the likelihood of leakage pathways V1, V2, V3, and L2.

The abandoned wells in Epsilon are considered secure in terms of integrity. Additionally, assuming that oil is present in Epsilon, it would act as a barrier to any potential brine or CO_2 leakage from abandoned wells, leading to the conclusion that no scaling factor affects leakage pathway #L1. It is recommended to quantify the leakage risks of abandoned wells that will not undergo intervention or be used for monitoring prior to injection, in order to more accurately determine the Probability and Severity of Consequences of a potential seabed leak.

In conclusion, the risk assessment study has identified environmental and safety hazards through detailed assessments and proposes mitigation measures to ensure a low-risk operating framework. The risk assessment will be updated as the Project progresses to incorporate new information and improve mitigation strategies.

Detailed proposed risk prevention and mitigation measures are presented in **Chapter 11.**

10.4.5 Summary of Potential and Cumulative (P&C) Impacts Resulting from the Vulnerability of the Project to Major Accidents or Disasters Related to the Project

The results of the assessment of the potential and cumulative (P&C) impacts arising from accidents and/or disasters associated with the operation of the Project are summarized below, in accordance with the methodology outlined in Section 11.1.3 and the analysis conducted in the preceding sections.

10.4.5.1 General Information

According to the hazard studies and simulations carried out as part of the present project, it is estimated that the toxic effects of CO_2 that could potentially result in adverse P&C impacts in the event of a major accident related to the project or a disaster extend to:

- ~780 m from the CO_2 reception point of the onshore pipeline (or approximately 300–350 m from the boundaries of the Sigma industrial facility), in areas including adjacent crops, the nearby fish farm, and the pier, but not reaching residential or public facilities.
- ~1000 m above the sea surface and a few meters radially within the sea from a point of the subsea CO_2 transport pipeline that may rupture or from the location of the offshore installations.

Furthermore, according to data collected over several years by Energean, it is demonstrated that <u>the depleted hydrocarbon fields and related structures have a proven storage capacity, a verified impermeable cap rock to prevent potential leakage of stored fluids, a defined pore volume suitable for CO_2 storage, and are located in tectonically stable regions.</u> It is additionally noted that the Prinos basin is a **tectonically stable area**, as required for CO_2 storage sites with respect to tectonic (seismic) activity. Consequently, <u>the scenario of CO_2 leakage from the reservoir itself during the operation of the Project (whose impacts would be largely catastrophic) is considered unlikely.</u> Regarding a potential pipeline leak, this can be prevented through regular inspection using an intelligent pigging tool that measures pipeline wall thickness (every 5 years or in other system shutdown events) and the planned monitoring system (**Annex 16.2**). In any case, the consequences depend on the quantity and duration of the leakage.

10.4.5.2 Impact on Morphological and Soil Characteristics

Increased concentrations of CO_2 may cause soil erosion and surface subsidence due to the rise in soil acidity. Furthermore, increased acidity in water may dissolve carbonate materials on the seabed, leading to changes in morphology and sediment stability. Erosion may result in sediment destabilization and subsequent transport, altering seabed topography. Rapid depressurization, however, may create a type of “crater” that could cause physical damage to the seabed. Nevertheless, even if such impacts occur, they will be confined to the limited area previously estimated and are therefore not considered significant.

10.4.5.3 Impact on Morphological and Soil Characteristics

Increased concentrations of CO_2 may cause soil erosion and surface subsidence due to the rise in soil acidity.

Furthermore, increased acidity in water may dissolve carbonate materials on the seabed, leading to changes in morphology and sediment stability. Erosion may result in sediment destabilization and subsequent transport, altering seabed topography.

Rapid depressurization, however, may create a type of "crater" that could cause physical damage to the seabed.

Nevertheless, even if such impacts occur, they will be confined to the limited area previously estimated and are therefore not considered significant.

10.4.5.4 Impact on Geological and Tectonic Characteristics

CO_2 leakage may cause erosion of rocks beneath the seafloor, creating fractures and cavernous structures that could destabilize the geological formation of the area. In regions with carbonate rocks, soil erosion may occur. In areas of high seismicity, CO_2 leakage may trigger or exacerbate geological tremors, increasing the risk of subsea earthquakes.

However, according to the deliverables for the Exploration Permit submitted by Energean in November 2023, it was found that CO_2 is already present in these reservoirs and has existed there for millions of years (at least since the time of oil charge). Therefore, it is concluded that the natural presence of CO_2 in the reservoir suggests that high degrees of reactivity between the injected CO_2 and reservoir rocks may be unlikely.

Chlorite, which is known to react with CO_2, is identified in the Epsilon reservoir from wells EL-1-ST1, EL-2, and EL-3 (with a total average of 1.7%) but appears negligible in the Prinos reservoir (well PB-14) (with a total average of 0.06%). No distinct chlorite was observed in the point-counting data, indicating that chlorite is located within rock fragments and therefore not highly reactive (as it has relatively low exposed surface area).

The Epsilon wells EL-1-ST1, EL-2, and EL-3 contain more smectite/illite than the Prinos well (PB-14). The Epsilon wells contain less "illite and mica" than the Prinos well. Smectite (may absorb or react with CO_2 if it is Mg-, Fe-, or Ca-bearing) has a smectite/illite ratio of about 20–25% (i.e., secondary). It is noted that dioctahedral smectite is much more common in sandstones than trioctahedral smectite, but trioctahedral smectite is significantly more reactive to CO_2, as it contains divalent Fe and Mg that can form carbonate minerals such as magnesite and siderite.

10.4.5.5 Impact on the Aquatic Environment

The addition of a large quantity of CO_2 to the sea lowers its pH, making it more acidic. Due to the increase in atmospheric CO_2 and its absorption by the oceans, the average surface ocean pH has decreased by 0.1 (Humphreys et al., 2020), a phenomenon referred to as ocean acidification.

In the event of a CO_2 leak from an offshore carbon storage development, the CO_2 would enter the sea either as a gas or dissolved in the porewater of the sediments. Gaseous CO_2 will dissolve into the seawater and/or escape into the atmosphere, depending on the initial conditions of the leak.

In case of a CO_2 leak, in addition to the aforementioned pH reduction, the following are also expected:

- Increased dissolution of $CaCO_3$.
- Lower carbonate saturation in seawater, which negatively affects the structure of organisms with calcareous shells.
- Changes in microbial communities in the sediments, in both species composition and respiratory activity, which also affects the biogeochemical cycling of carbon and other elements.
- Alteration of the activity and bioavailability of various chemical elements, not only those essential to marine organisms (e.g. Ca, Mn, and nutrients such as Si and Fe), but also those with toxic biological effects (e.g. heavy metals).
- Reduced efficiency of phosphorus burial in marine sediments, which contributes to increased phosphorus concentrations in the water column and enhances eutrophication phenomena, especially in shallow areas.
- Various authors have used different pH change thresholds to describe various degrees of ecological impact. However, a general consensus is as follows:
  - <0.01 No detectable or negligible disturbance, with no ecological significance.
  - <0.1 Possibly negligible or minimal impact, disturbance lower than natural variability.
  - 0.1 to 0.3 Disturbance on the order of natural variability, with possible minor impacts without systemic significance.
  - 0.3 to 0.4 Certain species and processes are significantly impacted.
  - 0.4 Broader and significant to severe impacts are anticipated.
  - 1.0 Substantially harmful impact.

Nevertheless, even in the event of such impacts, they will be confined to the limited area previously estimated and are therefore not considered significant.

10.4.5.6 Impact on the Atmospheric Environment

CO_2 leakage may affect air quality at a local level, negatively impacting the health of residents near the leakage area. However, in any case, the potential impacts will not be worse than the baseline scenario (i.e., non-implementation of the project) and therefore are not considered to result in adverse effects.

10.4.5.7 Impact on the Acoustic Environment

No significant impacts on the acoustic environment or on underwater noise are anticipated. However, an extremely significant CO_2 leak could generate gas bubbles rising to the surface of the water. The movement of these bubbles may generate noise that disrupts underwater ecosystems, as bubbles may also alter the way sound propagates and reflects in the water, affecting the acoustic communication of marine organisms. In such cases, however, organisms are primarily at risk from the acidification of the water.

10.4.5.8 Impact on the Biotic Environment

Impact on Marine Life – Phytoplankton and Microbes

Plankton and microbial communities may be affected by changes in the carbonate system. Previous studies examining the effects of controlled CO_2 leakage on microbial communities have identified changes in the relative abundance of both major and minor bacterial taxonomic groups (Tait et al., 2015). The impact of increased pCO_2 on phytoplankton is complex (Sommer et al., 2015; Wells et al., 2015). Some phytoplankton species are poor absorbers of dissolved inorganic carbon (DIC), and while the response to increased pCO_2 may vary between groups and species, it is likely to lead to seasonal changes in phytoplankton community structure (Mackey et al., 2015; Bach & Taucher, 2019). Some harmful species may increase toxin production under elevated DIC conditions, which could pose a potential risk to fish in the area surrounding a CO_2 leak (Riebesell et al., 2018).

Nevertheless, even in the event of such impacts, they would be confined to the limited area previously estimated and are therefore not considered significant.

Impact on Marine Life – Zooplankton

Corrosive conditions related to elevated CO_2 are likely to have a significant impact on zooplankton calcifying species. Short-term exposure to extreme acidification conditions is sufficient to cause substantial shell damage and mortality in marine gastropods (Bednaršek et al., 2014; Gardner et al., 2018) and in commercially significant bivalve larvae (Wijsman et al., 2019), resulting in reduced recruitment (Parker et al., 2013).

Nevertheless, even in the event of such impacts, they would be confined to the limited area previously estimated and are therefore not considered significant.

Impact on Marine Life – Benthic Organisms

Benthic organisms, including some related to commercial fishing activities, are likely to experience mortality under extreme acidification scenarios near a leak zone, whereas mortality would be reduced for organisms capable of moving away from the leakage area. The QICS project (Quantifying and Monitoring Potential Ecosystem Impacts of Geological Carbon Storage) (e.g., Blackford et al., 2014) reported rapid recovery of the seabed community once a small-scale leak ceased. However, impacts on coral habitats and rhodolith beds (maërl) and bivalve reefs may cause long-term damage with potential recovery on a decadal scale.

Impact on Marine Life – Marine Mammals and Seabirds

Marine mammals and seabirds may be indirectly affected by CO_2 leakage through disruption of the food chain.

10.4.5.9 Impact on the Man-made Environment

Based on the Impact Modeling Study conducted to assess risks associated with CO_2 leakage from the Prinos carbon storage facilities, it was found that the maximum risk distance for 1% fatality in **the terrestrial environment** is estimated at 782 m, which could result from a large leak from the CO_2 pipeline. These findings indicate that land-based leaks cannot affect settlements, individual dwellings outside the project area, or other public facilities. They concern risks to the workforce employed during the operation phase of the Project, which is however properly trained to take immediate measures in emergency situations (e.g. gas feed cut-off).

With regard to the **offshore installations**, results indicate that the risk distances from the defined fatality thresholds are limited to the immediate vicinity of the Beta platform. The maximum risk distance for 1% fatality is estimated at 80 m at the deck level of the Beta platform, arising from a CO_2 pipeline rupture (scenario FC04, ***Error! Reference source not found***.). However, only the aforementioned rupture scenario FC04 may affect the adjacent Delta platform at the elevation of its decks. Given that CO_2 is heavier than air, a leak occurring above sea level tends to move downward toward the sea surface, while a subsea leak remains near the surface and disperses, potentially posing a hazard to support vessels.

At sea level, the maximum downwind distance where the concentration corresponds to a 1% fatality level is approximately 1 km for the subsea pipeline rupture scenario (FC08). In the initial stages of the leak ($t \leq 60$ s), a high plume is expected that may exceed the platform deck levels for a short period of time, but the downwind distances at those elevations remain limited. As the pipeline depressurizes, the plume height decreases significantly and disperses over considerable distances downwind. The dispersion plume height is less than 2 m above the sea surface for downwind distances greater than ~100 m, which means that the risk to vessel personnel is reduced in these scenarios. However, with the implementation of preventive measures (e.g. pipeline inspection), this scenario becomes extremely rare.

As regards fishing activities, the fishing industry can generally relocate to other areas without adverse effects provided that the fish fauna is able to move away from the affected field. However, the nearest fish farm may potentially suffer damage. Tourism is not expected to be affected since the impacts are local in nature and extend into a zone outside the project area. Additionally, no impacts on cultural heritage are anticipated, as such sites are located at a significant distance from the project area (>2 km).

10.4.5.10 Impact on the Socio-economic Environment

In the event of a leakage accident affecting fish stocks, the local economy—which to some extent depends on this activity—is also expected to be affected.

10.4.5.11 Impact on Technical Infrastructure

No impacts on technical infrastructure are expected from carbon dioxide leakage.

10.5 IMPACTS FROM ANTICIPATED CLIMATE RISKS

The following **sections** provide a detailed assessment of the impacts of anticipated climate risks on the proposed project and examine its vulnerability to these risks in particular, as well as to phenomena related to climate change in general, in accordance with the methodology presented in **Section 10.4.1.**

10.5.1 Sensitivity Analysis

The purpose of the sensitivity analysis is to identify the **sources of hazard** for this specific type of infrastructure, based on its construction and operational characteristics, **independently of its siting location**. That is, sensitivity pertains to the type of project and its mode of operation.

A **hazard** is defined as the potential occurrence of a natural or anthropogenic event or trend that may cause loss of life, injury or other health impacts, as well as damage or loss to assets, infrastructure, livelihoods, service provision, ecosystems, and environmental resources.

Specifically, the sensitivity analysis for the project under assessment, in accordance with the computational tool developed by the General Secretariat for Public Investments & NSRF, is summarized in the following **table (Hazard Source Table).**

Table 10-13. Sensitivity analysis for the project under consideration

Source of Risk	Sensitivity				
	Construction	Operation	Products / Services	Inclusion in area	Total Sensitivity
Heatwave	Low	Low	Low	Low	Low
Cold wave	Low	Low	Low	Low	Low
Frost (Number of days with Tmin < 0)	Low	Low	Low	Low	Low
Forest fire	High	High	High	Moderate	High
Cyclone, Severe Storms, Typhoons	Moderate	Moderate	Moderate	Low	Moderate
Storms (including snowstorms, dust storms)	Low	Low	Low	Low	Low
Tornadoes/Twisters, Winds	Moderate	Moderate	Moderate	Low	Moderate
Drought	Low	Low	Low	Low	Low
Severe precipitation (rain, hail, snow/ice)	Low	Low	Low	Low	Low
Floods (in coastal areas, rivers, due to rain, groundwater)	Moderate	Moderate	Moderate	Moderate	Moderate
Landslide/Soil erosion	Low	Low	Low	Low	Low

Source of Risk	Sensitivity				
	Construction	Operation	Products / Services	Inclusion in area	Total Sensitivity
Subsidence	Low	Low	Low	Low	Low
Change in average air temperature	Low	Low	Low	Low	Low
Urban heat island	Low	Low	Low	Low	Low
Thermal stress	Low	Low	Low	Low	Low
Variability of temperature	Low	Low	Low	Low	Low
Change in solar radiation	Low	Low	Low	Low	Low
Change in characteristics of winds	Low	Low	Low	Low	Low
Change in characteristics and types of precipitation (rain, hail, snow/ice)	Low	Low	Low	Low	Low
Variability of precipitation or hydrological variability	Low	Low	Low	Low	Low
Change in average temperature of water bodies	Low	Low	Low	Low	Low
Oxygenation/salinity of seawater	Low	Low	Low	Low	Low
Saltwater intrusion, contamination of surface and groundwater	Low	Low	Low	Low	Low
Sea level rise	High	High	High	Low	High
Availability and stress of water resources	Low	Low	Low	Low	Low
Coastal erosion	Low	Low	Low	Low	Low
Soil degradation, change in salt content, desertification	Low	Low	Low	Low	Low
Changes in duration of growing seasons	Low	Low	Low	Low	Low

10.5.2 Exposure Analysis

The purpose of the exposure analysis is to identify the **sources of hazard** for the anticipated geographical location of the infrastructure (or for the alternative locations), both for the near and the distant future, **regardless of the type of infrastructure.**

For the exposure analysis process, the same **Hazard Source Table** used in the sensitivity analysis of the project will be applied.

More specifically, the exposure analysis for the project under assessment, in accordance with the computational tool developed by the General Secretariat for Public Investments & NSRF, is summarized in the following **table.**

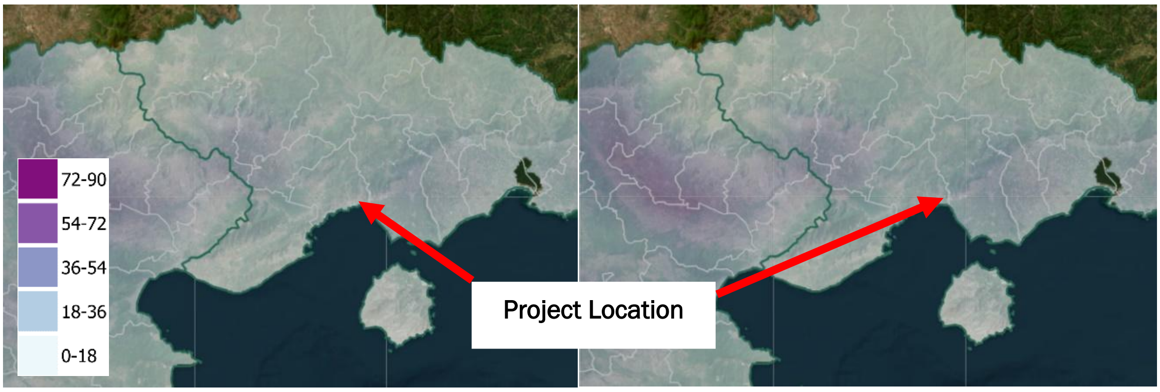
Table 10–14: Exposure Analysis for the Project Under Consideration

Source of Risk	Exposure		
	Current Conditions	Future Conditions	Overall Exposure
Heatwave	Low	Moderate	Moderate
Cold wave	Low	Moderate	Moderate
Frost (Number of days with Tmin ≤0°C)	Low	Low	Low
Forest fire	Low	Low	Low
Cyclone, Severe Storms, Hurricane	Low	Low	Low
Storm (including snowstorms, dust storms)	Low	Low	Low
Tornadoes/Twisters, Winds	Low	Low	Low
Drought	Low	Moderate	Moderate
Severe precipitation (rain, hail, snow/ice)	Low	Moderate	Moderate
Flooding (in coastal areas, rivers, due to rainfall, groundwater)	Moderate	Moderate	Moderate
Landslide/ / Soil erosion	Low	Low	Low
Subsidence	Low	Low	Low
Change in average air temperature	Low	Low	Low
Urban heat island	Low	Low	Low
Heat stress	Low	Low	Low
Variability of temperature	Low	Low	Low
Change in solar radiation	Low	Low	Low
Change in wind characteristics of winds	Low	Low	Low
Change in precipitation characteristics and types of	Low	Low	Low

Source of Risk	Exposure		
	Current Conditions	Future Conditions	Overall Exposure
precipitation (rain, hail, snow/ice)			
Variability of precipitation or hydrological variability	Low	Low	Low
Change in average temperature of water bodies	Low	Low	Low
Oxygenation/salinity of seawater	Low	Low	Low
Saltwater intrusion, salinization of surface and& groundwater	Low	Low	Low
Sea level rise	Low	Low	Low
Availability and stress on water resources	Low	Low	Low
Coastal erosion	Low	Low	Low
Soil degradation, change in salt content, desertification	Low	Low	Low
Changes in duration of crop seasons	Low	Low	Low

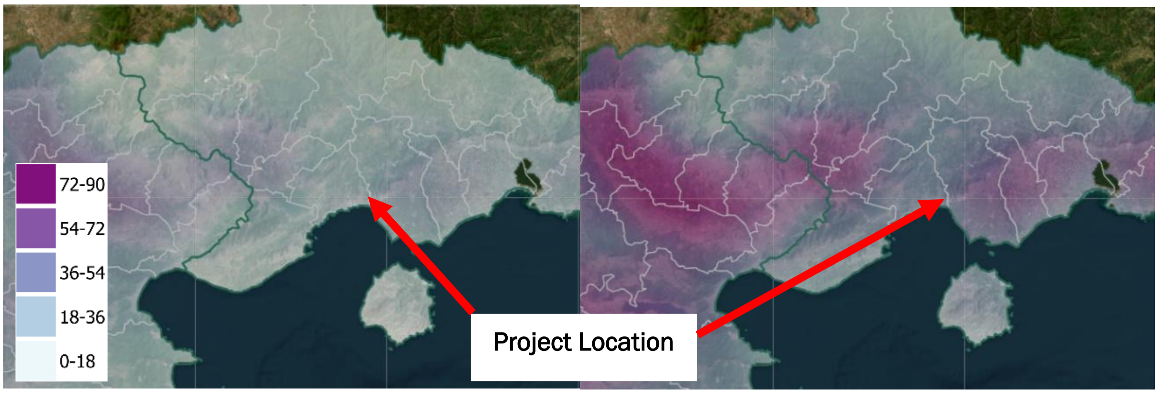
More specifically, the exposure analysis for the project under assessment, as applied in the **Climate Change Adaptation and Resilience Analysis of the Project,** is as follows:

- Regarding the Hazard Source **"Heatwave"**, the exposure of the project under assessment was evaluated as moderate, as also indicated by the trend of the index *"Number of days with TX > 35°C – very hot days"*, as presented for the area in the following **Figures.**



(Source: https://geo.adaptivegreecehub.gr/)

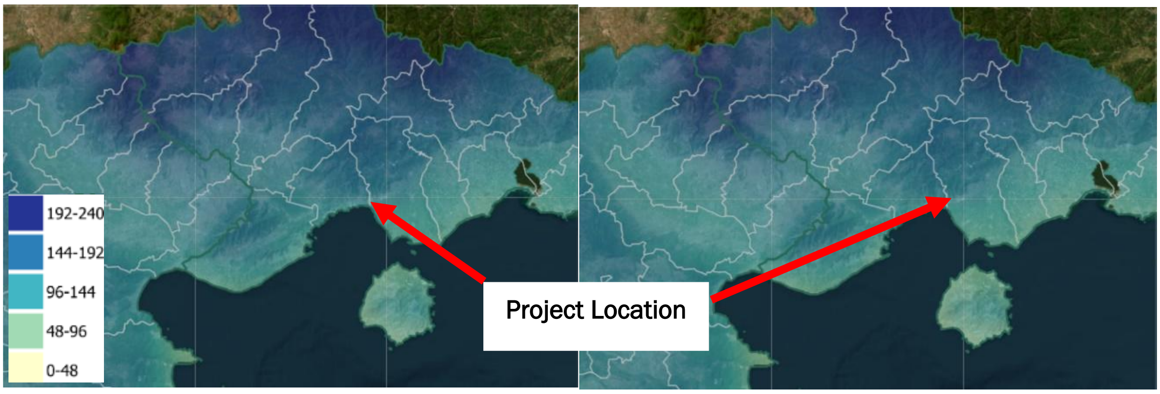
Figure 10–2: Number of days with TX > 35°C – very hot days in the near future (2031-2060) (left: RCP 4.5 scenario and right: RCP 8.5 scenario)



(Source: https://geo.adaptivegreecehub.gr/)

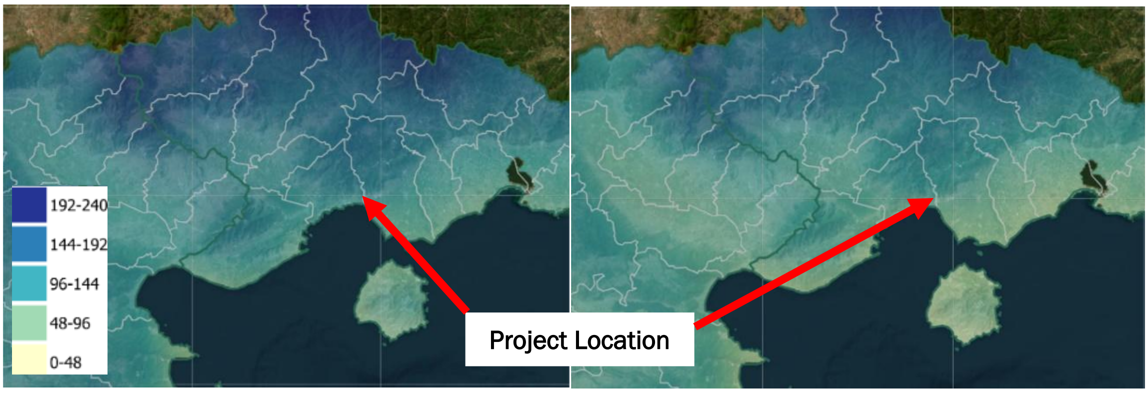
Figure 10–3: Number of days with TX > 35°C – very hot days in the distant future (2071-2100) (left: RCP 4.5 scenario and right: RCP 8.5 scenario)

- Regarding the Hazard Source **"Cold wave"**, the exposure of the project under assessment was evaluated as **moderate**, as also indicated by the trend of the index *"Number of days with strong heating demand (days with TG <10 °C)"* in the near future (2031–2060) and in the distant future (2071–2100), under scenarios RCP 4.5 and RCP 8.5.



(Source: https://geo.adaptivegreecehub.gr/)

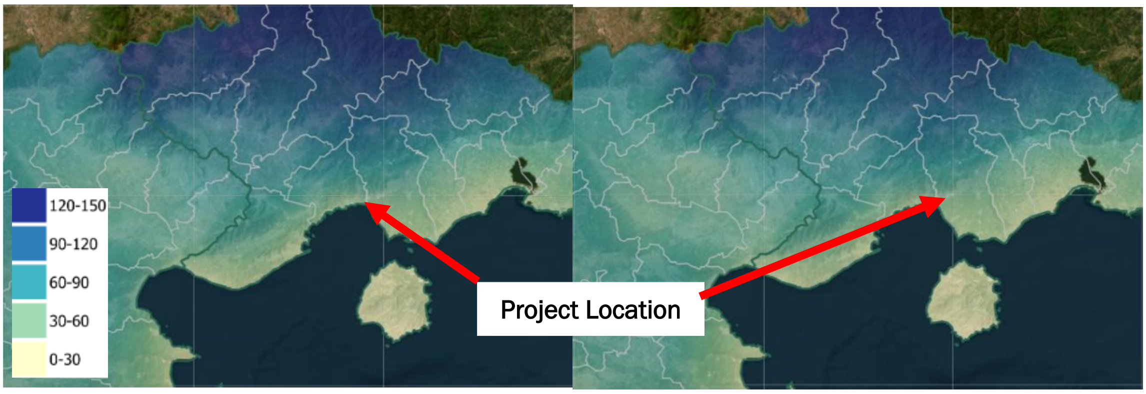
Figure 10–4: Number of days with TG < 10 °C – in the near future (2031-2060) (left: RCP 4.5 scenario and right: RCP 8.5 scenario)



(Source: https://geo.adaptivegreecehub.gr/)

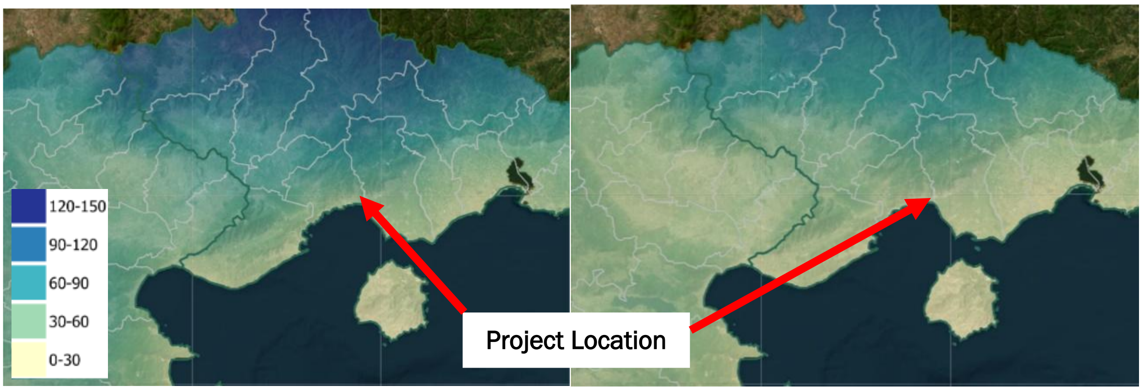
Figure 10–5: Number of days with TG < 10 °C in the distant future (2071-2100) (left: RCP 4.5 scenario and right: RCP 8.5 scenario)

- Regarding the Hazard Source **"Frost"**, the exposure of the project under assessment was evaluated as **low**, as also indicated by the trend of the index *"Number of days with TN < 0 °C – nighttime frost"* in the near future (2031–2060) and in the distant future (2071–2100), under scenarios RCP 4.5 and RCP 8.5.



(Source: https://geo.adaptivegreecehub.gr/)

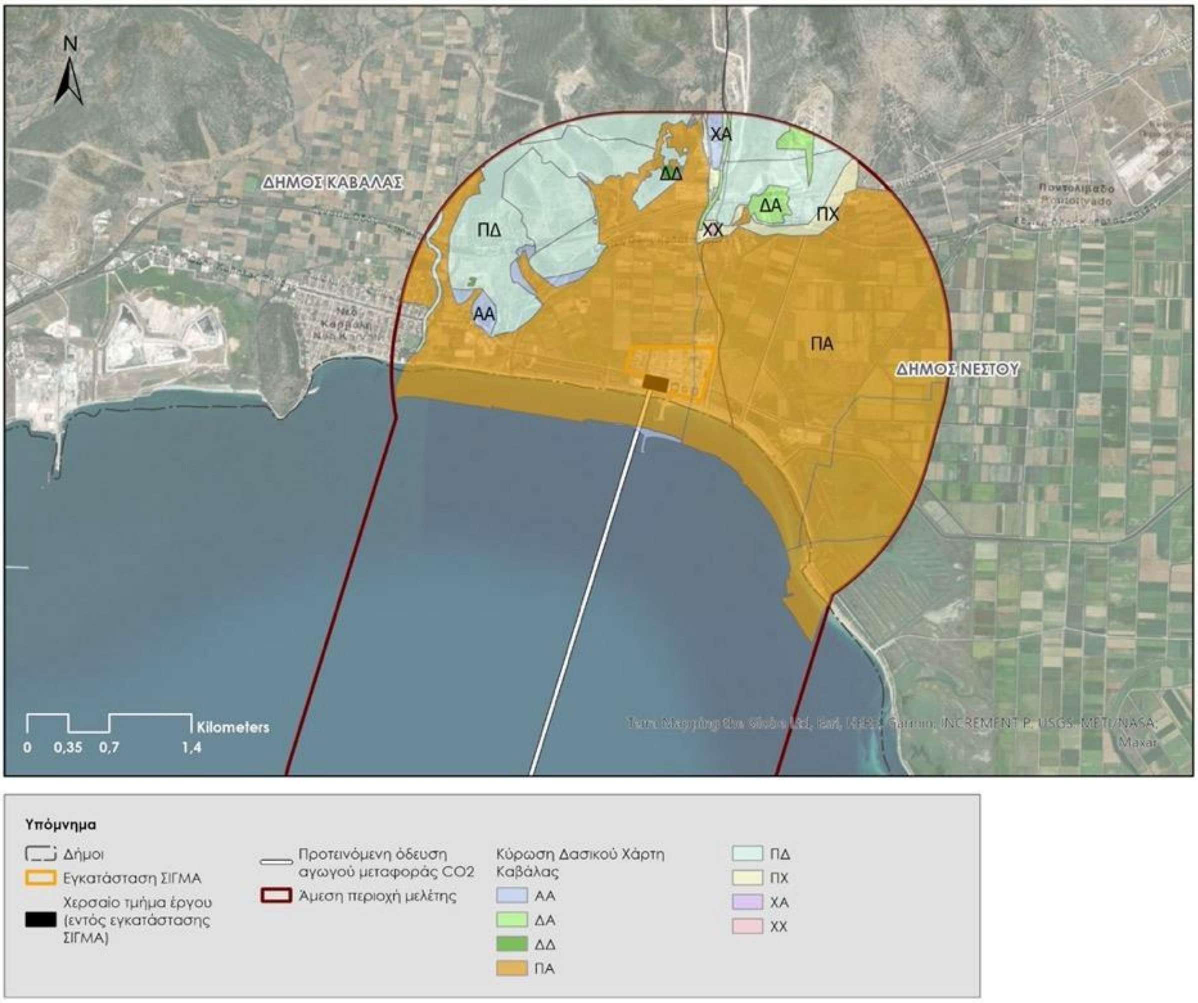
Figure 10–6: Number of days with TN < 0°C in the near future (2031-2060) (left: RCP 4.5 scenario and right: RCP 8.5 scenario)



(Source: https://geo.adaptivegreecehub.gr/)

Figure 10–7: Number of days with TN < 0°C in the distant future (2071-2100) (left: RCP 4.5 scenario and right: RCP 8.5 scenario)

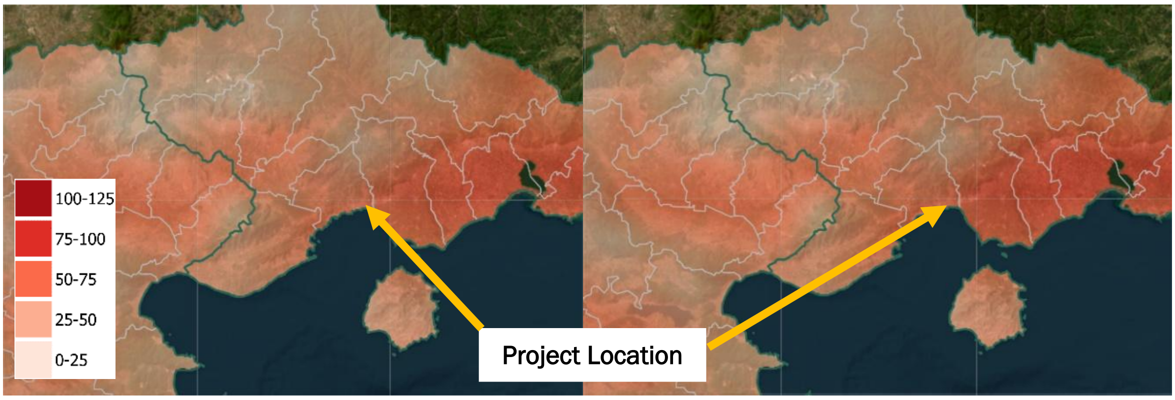
- Regarding the Hazard Source **"Forest Fire"**, the exposure of the project under assessment was evaluated as **Low**, as the project itself is not entirely located within a forest or forested area. Furthermore, as illustrated in the officially ratified forest map of the area (following **Figure**), the surroundings of the project are predominantly comprised of agricultural and non-forested lands. The next **figure** shows a map excerpt, indicating vegetation categories classified as forest or generally forested areas under paragraphs 1, 2, 3, 4, and 5 of Article 3 of Law 998/1979 (Government Gazette A' 289), as applicable, as well as areas not governed by forest legislation.



(Source: Κύρωση Δασικού Χάρτη Καβάλας 2022, επεξεργασία από ομάδα μελέτης)

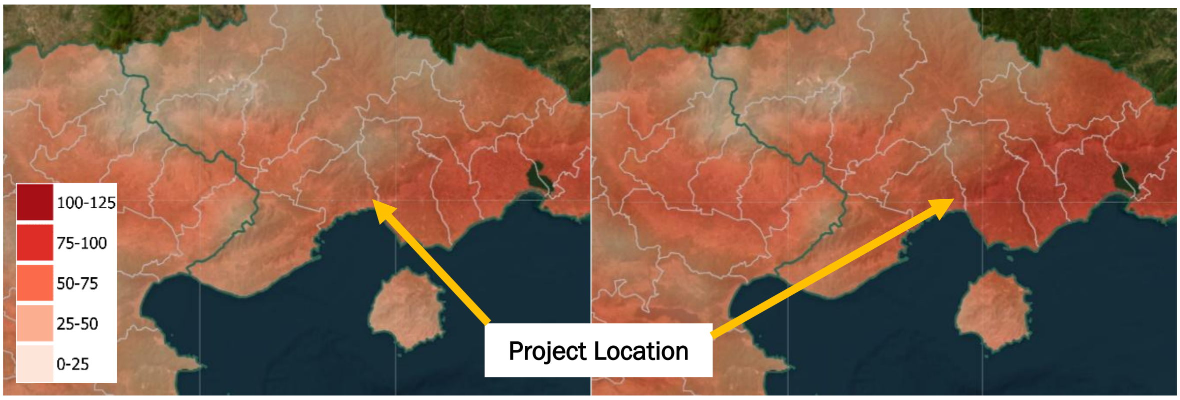
Figure 10–8: Forest character of land areas in the wider project area

Although the project area demonstrates a measurable future **risk of forest fire**, as also illustrated in the following **Figures, there are no forest areas within the study area that would facilitate the spread of such fires.** Therefore, taking all parameters into account, the exposure of the project under assessment to the Hazard Source **"Forest Fire"** is evaluated as **low** (both under current and future conditions).



(Source: https://geo.adaptivegreecehub.gr/)

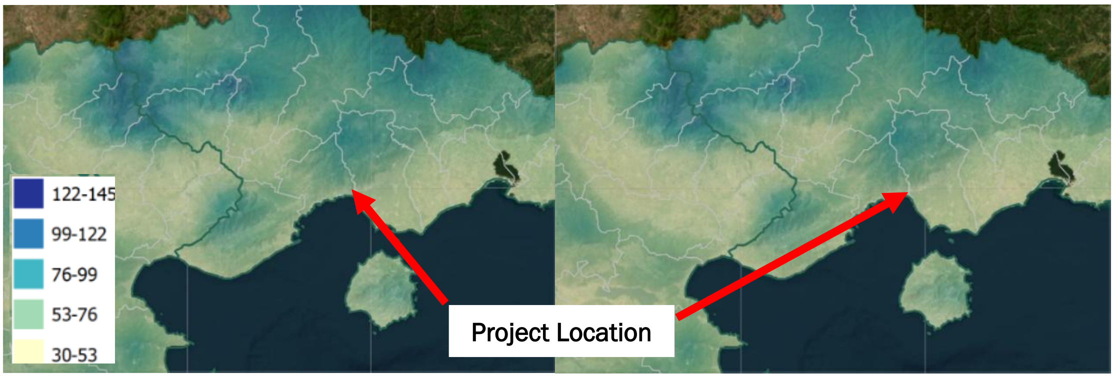
Figure 10–9: Number of days with extreme forest fire risk (FWI > 50) in the near future (2031-2060) (left: RCP 4.5 scenario and right: RCP 8.5 scenario)



(Source: https://geo.adaptivegreecehub.gr/)

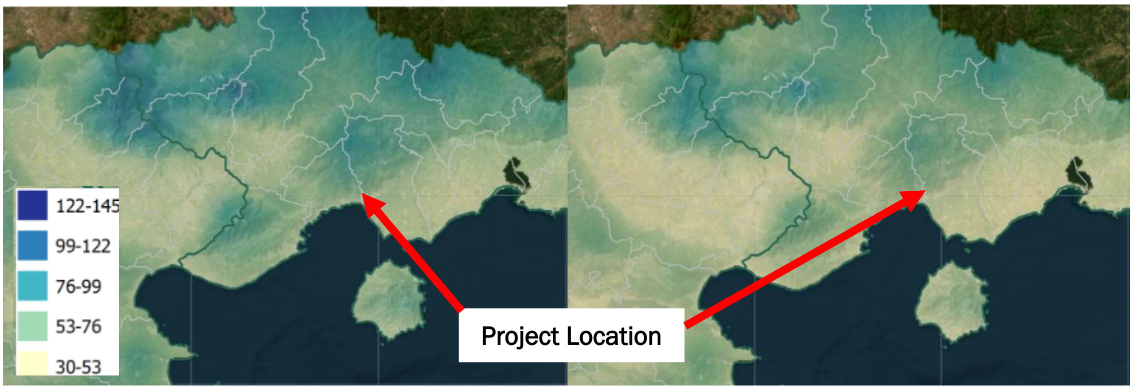
Figure 10–10: Number of days with extreme forest fire risk (FWI > 50) in the distant future (2071-2100) (left: RCP 4.5 scenario and right: RCP 8.5 scenario)

- Regarding the Hazard Sources "Cyclone, Severe Storms, Hurricane", "Storm (including Snowstorms, Dust Storms)", and "Tornado/Gale-Force Winds", the exposure of the project under assessment is evaluated as particularly low, as based on the characteristics of the area under assessment and the historical occurrence of related phenomena, there is no indication of the potential **occurrence** of such events at present, in the near or distant future.
- Regarding the Hazard Source **"Drought"**, the exposure of the project under assessment is evaluated as **moderate**, as also indicated by the trend of the index "Maximum length of consecutive days with PR < 1mm – maximum drought duration in days", as presented for the area in the following **Figures.**



(Source: https://geo.adaptivegreecehub.gr/)

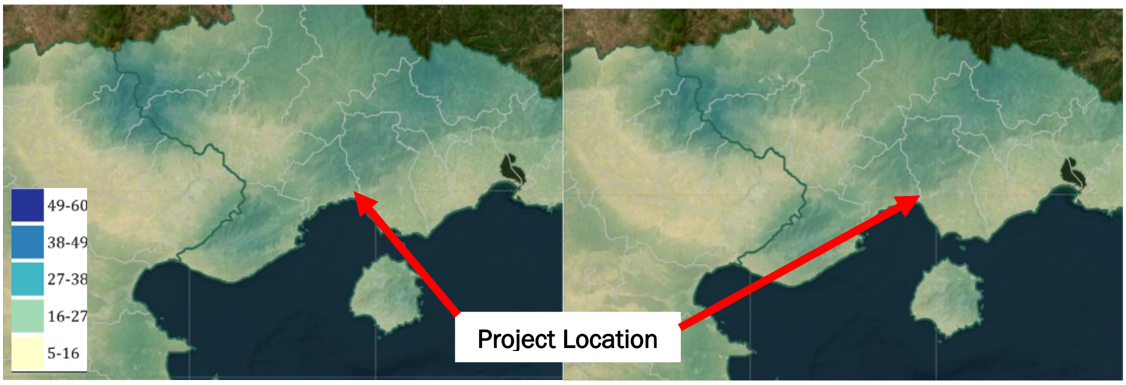
Figure 10–11: Maximum duration of consecutive days with PR < 1mm – maximum drought duration in days in the near future (2031-2060) (left: RCP 4.5 scenario and right: RCP 8.5 scenario)



(Source: https://geo.adaptivegreecehub.gr/)

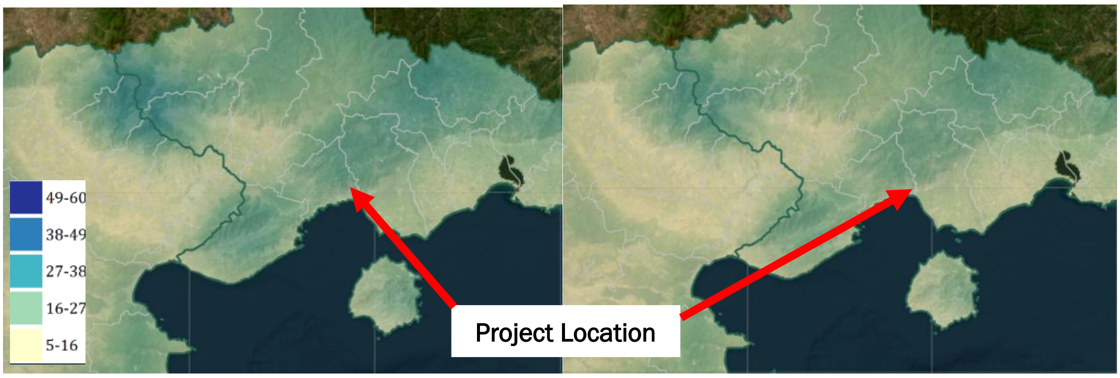
Figure 10–12: Maximum duration of consecutive days with PR < 1mm – maximum drought duration in days in the distant future (2071-2100) (left: RCP 4.5 scenario and right: RCP 8.5 scenario)

- Regarding the Hazard Source of **Heavy Precipitation (rain, hail, snow/ice),** the exposure of the examined project was assessed as moderate, as indicated by the evolution of the index 'Number of days with PR > 10mm - days of heavy rainfall', as presented for the area in the following **Figures.**



(Source: https://geo.adaptivegreecehub.gr/)

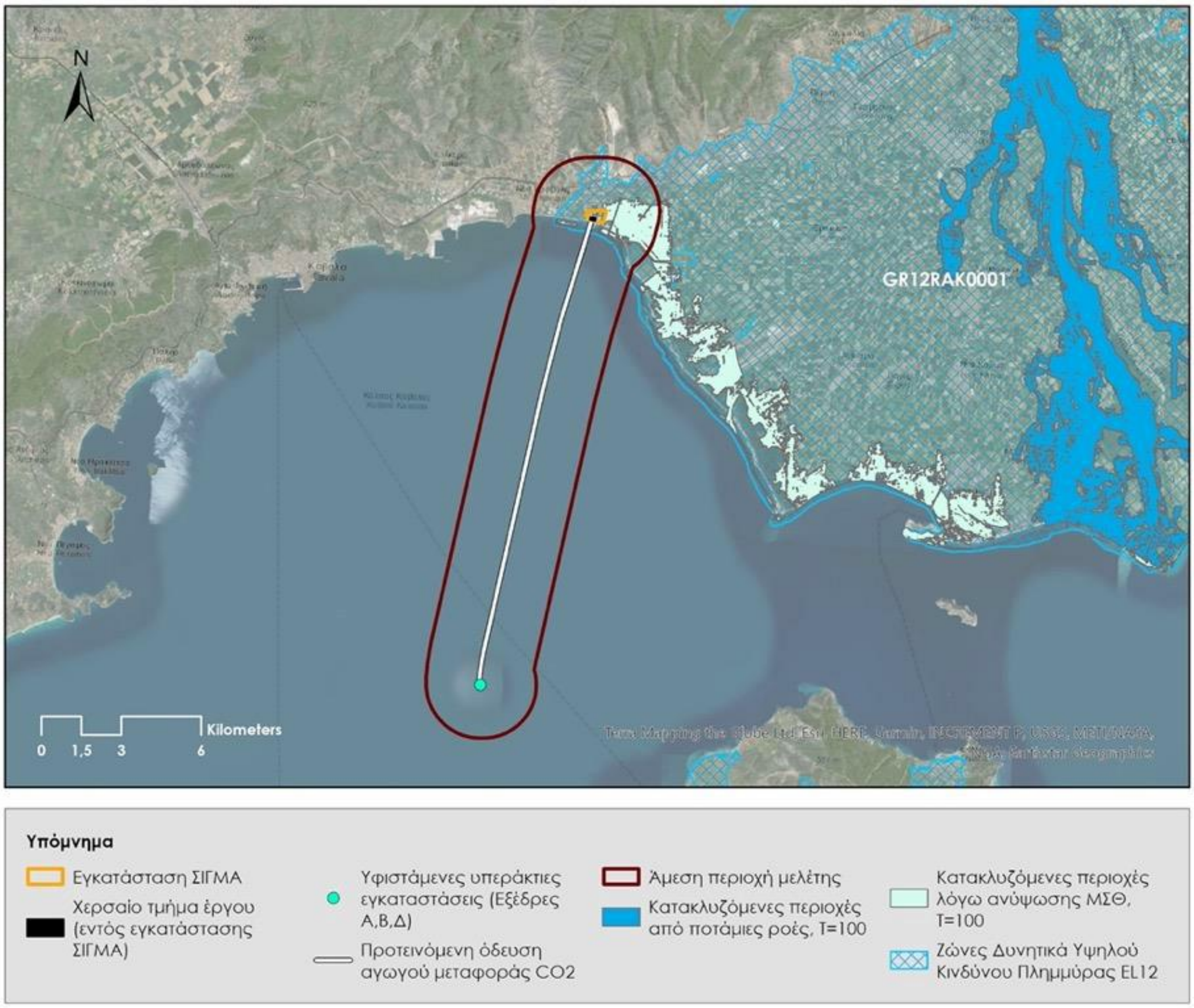
Figure 10–13: Number of days with PR > 10mm – days of heavy rainfall – in the near future (2031-2060) (left: RCP 4.5 scenario and right: RCP 8.5 scenario)



(Source: https://geo.adaptivegreecehub.gr/)

Figure 10–14: Number of days with PR > 10mm – days of heavy rainfall in the distant future (2071-2100) (left: RCP 4.5 scenario and right: RCP 8.5 scenario)

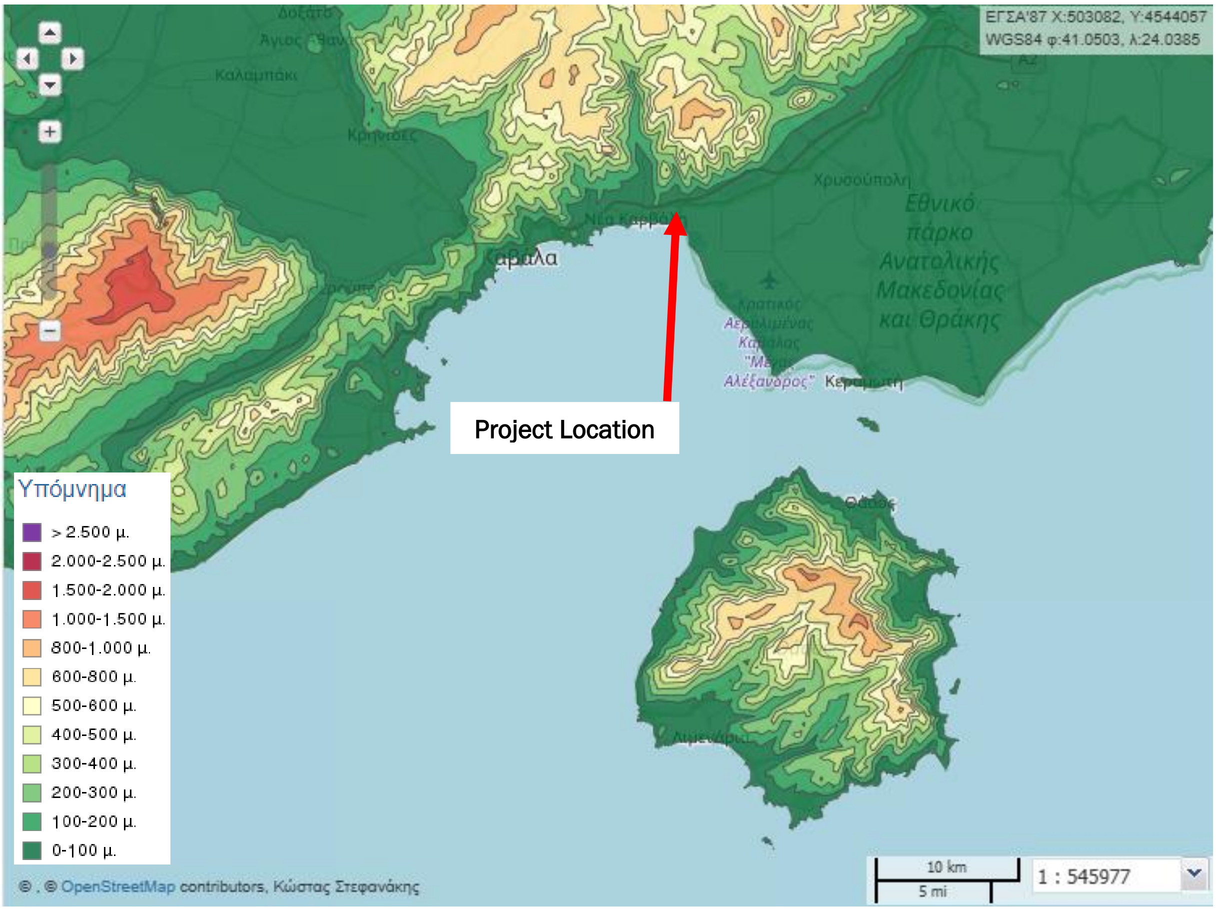
- Regarding the **Flood** Risk Source (**in coastal areas, rivers, due to rain, groundwater**), the report of the examined project was assessed as **moderate**, as although part of the examined project's area falls within a Potentially High Flood Risk Zone (PHFRZ), as shown for the area in the **figure** below, there is no area with a history of significant floods near the location of the examined project. According to the data from the Flood Risk Management Plan of the Water District of Thrace (EL12), the area designated for the examined project is partially located within the Potentially High Flood Risk Area (PHFRA) GR12RAK0001 "Xanthi - Komotini Plain (Low Flood Zones of the Nestos, Kosynthos, Kompsatos, Aspropotamos, Bosbozis, Filiouri rivers and the riparian areas of Lake Vistonida)".



(Source: ΥΠΕΝ-ΕΓΥ, 2018)

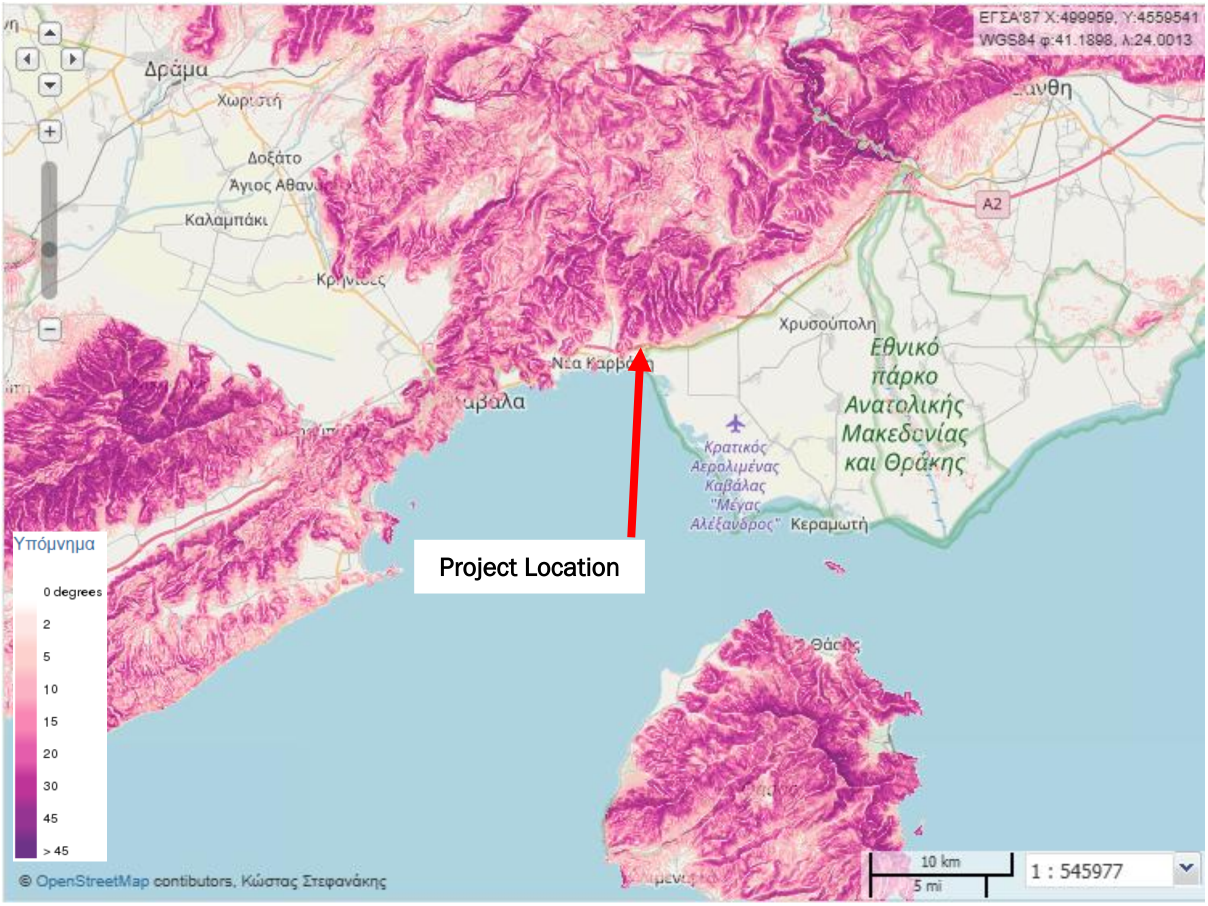
Σχήμα 10–15: Excerpt from the Flood Hazard Map for T100 in the project area

- Regarding the **Landslide/Erosion** Hazard Source, the report of the examined project was assessed as <u>**particularly low,**</u> as the area under examination is located in regions that include areas with very gentle slopes, which make an incident of landslide/soil erosion an unlikely possibility.



(Source: Spatial Data Infrastructure Web Portal of the Ministry of Environment and Energy (YPEN), https://mapsportal.ypen.gr/maps/299)

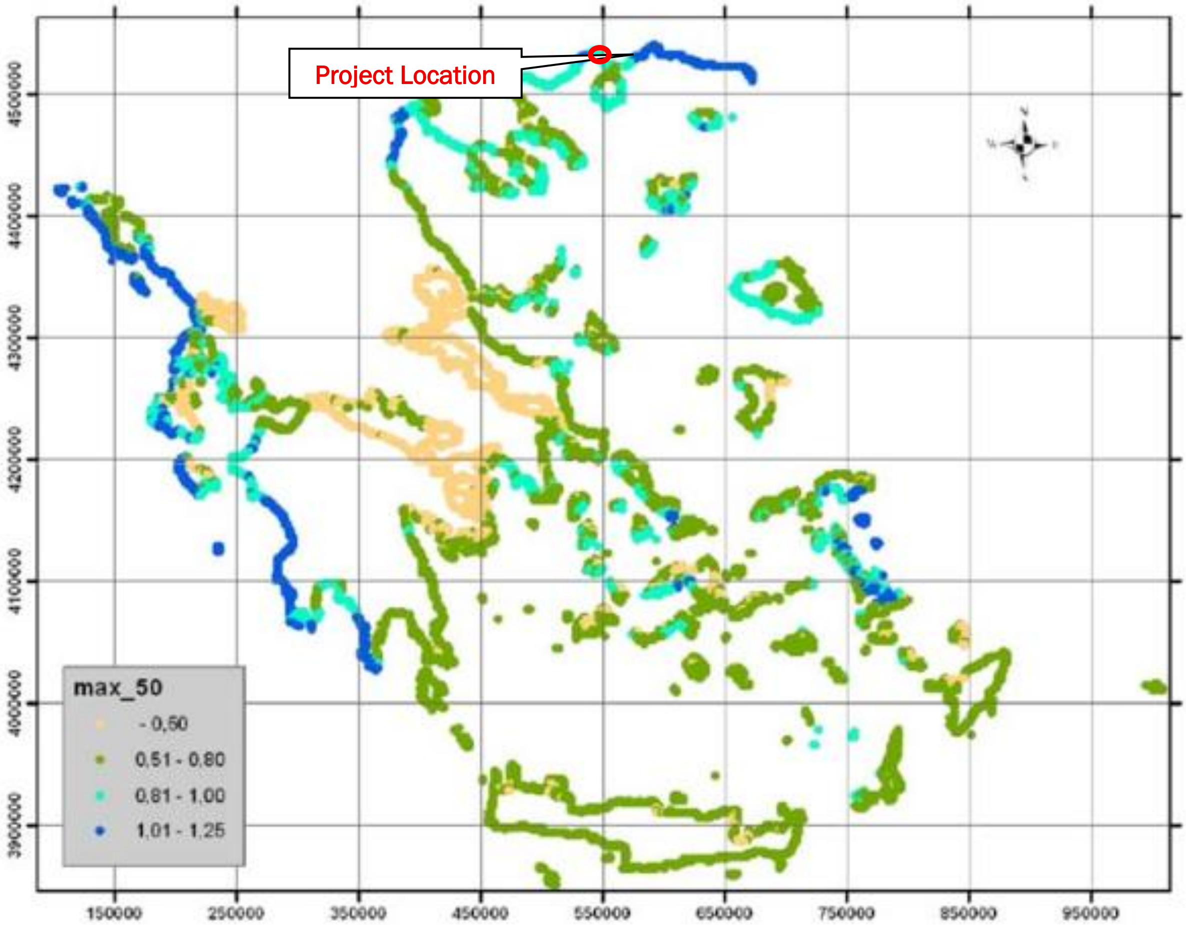
Figure 10–16: Excerpt from the elevation zones map of the Spatial Data Infrastructure Web Portal of the Ministry of Environment and Energy (YPEN)



(Source: Spatial Data Infrastructure Web Portal of the Ministry of Environment and Energy (YPEN), https://mapsportal.ypen.gr/layers/geonode:greece_slop_deg_8bit)

Figure 10–17: Excerpt from the digital terrain slope model of the Spatial Data Infrastructure Web Portal of the Ministry of Environment and Energy (YPEN)

- Regarding the following Sources of Risk, the exposure of the examined project was assessed as **low** based on the characteristics of the examined area as well as the historical occurrence of related phenomena in it: Change in average air temperature, urban heat island, thermal stress, temperature variability, change in solar radiation, change in wind characteristics, change in precipitation characteristics and types (rain, hail, snow/ice), precipitation variability or hydrological variability, change in average water temperature in water bodies, ocean acidification/salinity, saltwater intrusion, and brackishness of surface and groundwater.
- Regarding the Risk Source of Sea Level Rise, the exposure of the examined project was assessed as low, as the area of the examined site is located in regions that will not be flooded by potential sea level rise, even if it fluctuates at levels of 1 meter.



(ΥΠΕΝ-ΕΓΥ, 2017)

Figure 10–18: Total maximum sea level rise along the coastline (maximum astronomical tide and meteorological flood with maximum wave heights) for a return period of T=50 years

- Regarding the following Sources of Risk, the assessment of the examined project was considered **low** based on the characteristics of the examined area as well as the historical occurrence of related phenomena in it: Saltwater intrusion, salinization of surface and groundwater, availability and stress of water resources, coastal erosion, soil degradation, changes in salt content, desertification, changes in the duration of cultivation periods.

10.5.3 Vulnerability Analysis

Vulnerability analysis combines exposure and sensitivity analyses to determine which **hazard sources** are associated with the given infrastructure, **in terms of its type and geographical location.** It serves as the basis for determining whether the analysis will proceed to the second stage of detailed analysis.

For the analysis of sensitivity and exposure, a three-level assessment scale (low, moderate, high) has been established, which indicates the level of vulnerability for each climate risk (low, moderate, high).

In the case where the same hazard source is related to both sensitivity and exposure, the vulnerability of the infrastructure regarding this hazard source is the combination of the two cases.

Vulnerability = Combination {Sensitivity, Exposure}

If the vulnerability analysis reasonably concludes that the infrastructure does not exhibit vulnerability to any risk source, no further risk analysis is needed, and thus the examination of the infrastructure's adaptation to climate change is completed.

However, if moderate or high levels of vulnerability arise for certain risk sources, a detailed **risk assessment** should be conducted for each of them.

More specifically, the vulnerability analysis for the examined project, according to the computational tool of the General Secretariat for Public Investments & NSRF, Secretariat for Public Investments & NSRF, is summarized in the following **Table.**

Table 10-15. Vulnerability analysis for the project under consideration

Risk Source	Sensitivity	Exposure	Vulnerability
Heatwave	Low	Moderate	Low
Cold wave	Low	Moderate	Low
Frost (Number of days with Tmin ≤ 0 °C)	Low	Low	Low
Forest fire	High	ModerateLow	High
Cyclone, Severe Storms, Hurricane	Moderate	Low	Moderate
Storms (including snowstorms, dust storms)	Low	Low	Low
Tornadoes/Twisters, Winds	Moderate	Low	Moderate
Drought	Low	Moderate	Low
Severe precipitation (rain, hail, snow/ice)	Low	Moderate	Low

Risk Source	Sensitivity	Exposure	Vulnerability
Flooding (in coastal areas, rivers, due to rainfall, groundwater)	Moderate	Moderate	Moderate
Landslide/ / Soil erosion	Low	Low	Low
Subsidence	Low	Low	Low
Change in average air temperature	Low	Low	Low
Urban heat island	Low	Low	Low
Heat stress	Low	Low	Low
Variability of temperature	Low	Low	Low
Change in solar radiation	Low	Low	Low
Change in characteristics of winds	Low	Low	Low
Change in characteristics and types of precipitation (rain, hail, snow/ice)	Low	Low	Low
Variability of or hydrological variability	Low	Low	Low
Change in average temperature of water bodies	Low	Low	Low
Oxygenation/salinity of seawater	Low	Low	Low
Saltwater intrusion, contamination of surface and groundwater	Low	Low	Low
Sea level rise	High	Low	High
Availability and stress of water resources	Low	Low	Low
Coastal erosion	Low	Low	Low
Soil degradation, change in salt content, desertification	Low	Low	Low
Changes in duration of crop seasons	Low	Low	Low

From the above analysis, moderate to high levels of vulnerability emerge for the risk sources of forest fire, cyclone, severe storms, hurricane, tornado/stormy winds, flood (in coastal areas, rivers, due to rain, groundwater), sea level rise. Therefore, a **detailed risk assessment** will be conducted for each of these, as part of the following **Section.**

10.5.4 Detailed Analysis

10.5.4.1 General Information

The detailed analysis includes the following individual steps:

- Risk Analysis.
- Measures to enhance adaptation to climate change/Monitoring program.

10.5.4.2 Risk Analysis

The risk analysis conducted for climatic hazards identified as moderate or high by the vulnerability analysis is the combination of the **likelihood** of occurrence of each hazard source identified in the pre-screening stage of vulnerability and the **expected intensity** of the impacts of that hazard source.

From the analysis conducted in **Sections 10.5.1, 10.5.2, and 10.5.3**, moderate or high levels of vulnerability are identified for the risk sources of forest fire, cyclone, severe storms, hurricane, tornado/stormy winds, flood (in coastal areas, rivers, due to rain, groundwater), sea level rise. Therefore, a **detailed risk assessment** will be conducted for each of these, which is presented in the following **Table.**

Table 10-16. Calculation of inherent risk scale for the project under consideration

Source of Risk	Likelihood of Occurrence	Consequence Scale	Inherent Risk	
			Rating	Description
Forest fire	Rare	Catastrophic	10	Moderate
Cyclones, Severe Storms, Typhoons	Rare	Moderate	3	Χαμηλός
Tornadoes/Twisters, Winds	Rare	Of insignificant importance	4	Χαμηλός
Drought	Almost certain	Negligible	5	Χαμηλός
Floods (coastal areas, rivers, due to rain, groundwater)	Moderate	Moderate	9	Moderate
Sea level rise	Unlikely	Significant	4	Χαμηλός

10.5.4.3 Μέτρα για την Ενίσχυση της Προσαρμογής στην Κλιματική Αλλαγή και Υπολειπόμενος Κίνδυνος

Based on the results of the risk analysis, the inherent risks ranged from low to moderate (low to moderate risk). For moderate and significant inherent risks, (additional) adjustment measures must be considered to achieve the maximum possible reduction of the **residual risk.** Therefore, in this specific case, (additional) adaptation measures are being considered for cases with moderate inherent risk, as on one hand, the smaller risks (negligible and low) are excluded from risk analysis, while on the other hand, it is assessed that no greater risks (significant and very significant) arise.

In the following **Table**, the proposed measures for achieving additional adaptation and increased resilience to Climate Change are presented.

Table 10-17. Proposed measures for achieving additional adaptation and increased resilience to Climate Change and calculation of residual risk

Source of Risk	Likelihood of Occurrence	Consequence Scale	Inherent Risk		Adaptation Measures	Risk Reduction	Residual Risk	
			Rating	Description			Rating	Description
Forest fire	Rare	Catastrophic	10	Moderate	1 Appropriate organization of the surrounding area to prevent the spread of fire (for example, use of non-flammable construction and decoration materials, creation of firebreak zones at critical locations to interrupt the spread of a potential forest fire, installation of fire-fighting tanks and other firefighting equipment according to the fire protection studies of the area and the recommendations of the local fire department, etc.). 2 Systematic cleaning and maintenance of the surrounding area and the facilities within the project site to prevent the outbreak and spread of fire (for example, systematic removal of waste potentially dispersed by workers or occasional visitors to the wider area, systematic removal of biomass waste resulting from vegetation management in adjacent plots, regular inspection and monitoring of infrastructure networks, etc.). 3 Development of an effective fire-fighting system. Legal requirements for fire safety and firefighting may not be sufficient, and additional measures may need to be taken. For example, installation of more fire-fighting	6	4	Low

Source of Risk	Likelihood of Occurrence	Consequence Scale	Inherent Risk		Adaptation Measures	Risk Reduction	Residual Risk	
			Rating	Description			Rating	Description
					water tanks, installation of backup fire extinguishers, etc. 4 Development of a fire response procedure including organization of fire safety processes, staff training for emergency situations involving fire risk, and cooperation with the local fire department. 5 Provision of an adequate number of facilities for the collection of (hazardous and non-hazardous) solid waste, as well as an adequate number of modern absorbent materials (spill kits for oils, chemicals, general liquids, granular absorbents, etc.), aimed at adsorbing and thus containing potentially leaking fuels, lubricants, or other hazardous and/or flammable substances. After use, these absorbent materials must be collected in metal watertight containers and disposed of through further lawful management.			
Floods (in coastal areas, rivers, due to rain, groundwater)	Moderate	Moderate	8	Moderate	1 Any earthworks related to construction and maintenance should be carried out during the dry summer period to avoid soil erosion due to rainfall. In case of heavy rainfall during excavation phases, it is recommended to halt operations. 2 During earthworks execution, necessary measures must be taken to prevent any soil destabilization phenomena or dispersion of earthworks and inert materials of the project, such as landslides, slope erosion, washing away of inert material piles, etc.	4	4	Low

Source of Risk	Likelihood of Occurrence	Consequence Scale	Inherent Risk		Adaptation Measures	Risk Reduction	Residual Risk	
			Rating	Description			Rating	Description
					3 The technical interventions related to the effective drainage of the project site, hydraulic connectivity of adjacent areas, etc., must be regularly inspected, cleaned, and maintained at fixed intervals. 4 The effectiveness of the technical interventions (related to drainage and hydraulic connectivity as above) must be systematically reviewed concerning their design and performance, based on new scientific data or updated relevant plans (ESIA, EIA, etc.). 5 Development of an emergency response procedure shall include the organization of relevant action teams, training of personnel for emergencies involving heavy rainfall risk, and cooperation with competent authorities (fire service, civil protection, etc.). 6 Readiness of equipment and resources for handling such incidents according to the emergency response procedure's provisions. 7 Systematic inspection and monitoring of the condition of infrastructures, coastline, and soil to detect early any flood, landslide, or soil erosion issues and respond timely and effectively. 8 Systematic inspection, cleaning, and monitoring of the stormwater collection and drainage systems to address any potential flooding incidents promptly and efficiently.			

Based on the results of the above analysis, with the adoption of the proposed (or other relevant) adaptation measures, **the maximum possible reduction of the residual risk is achieved, and the entirety of the significant inherent risks becomes fully controllable and manageable.**

However, given that the assessment of risk sources is an ongoing process, it is important to establish a **monitoring program for the Project's adaptation to climate change** and the subsequent implementation of additional adaptation measures if required by the evolution of the area's climatic conditions.

However, given that the assessment of risk sources is an ongoing process, it is important to establish a **monitoring program for the adaptation of the Project to climate change** and the subsequent implementation of additional adaptation measures if required by the evolution of the climatic conditions in the area.

Therefore, within the framework of the examined project, it is proposed to develop and implement a broader environmental management system by the project management and operation entity, which will include the overall monitoring of the project's environmental performance and specifically for the improvement of its adaptation to climate change. The project management will create an environmental management team and appoint an environmental management officer. The system will consist of procedures and forms that will be inspected and reviewed annually by the environmental management team and possibly by an external certification body. The system will incorporate procedures for monitoring and evaluating the implemented adaptation measures. The evaluation will be conducted through the application of appropriate indicators that correspond suitably to each adaptation measure for each source of risk, such as the following (indicatively and not exhaustively):

- Forest fire
  - Measuring the humidity of the external environment. Conditions of high temperature and low humidity favor the onset and rapid spread of forest fires.
  - Monitoring of vegetation in the project area and its surroundings. Management of vegetation aimed at reducing combustible materials and frequent identification of scattered waste from infrastructure users and occasional visitors to the area. Coordination with local authorities for the seasonal cleaning of forested/semi-forested/pasture areas surrounding the project.
  - Regular periodic (at least annual test) of the project's fire protection system. At the same time, training can be provided for the personnel working on the project.
- Flood
  - Infrastructure control index. It includes the following parameters:
    - *Status of technical interventions (included in the implementation of the project and related to the effective drainage of the project areas, the hydraulic communication of the areas on either side of the project facilities, etc.).*
    - *Waste.*
    - *Leakage of hazardous substances on the project site.*
    - *Effectiveness of control measures.*
    - *Rainwater flushes / wastewater discharges.*

- *Water pollution accidents.*
- *Any activities that oppose the Project's Environmental Management Plan.*

- Monitoring meteorological conditions in the project area and corresponding forecasts of their evolution from models and studies analyzing the phenomenon of climate change.

10.6 ASSESSMENT OF CUMULATIVE/SYNERGISTIC IMPACTS

10.6.1 General Information

In this section, the potentially significant cumulative and synergistic impacts of the proposed project with other existing and planned projects and activities of the study area are examined.

Cumulative impacts are considered to be the total of the potential impacts of many individual projects or activities that either constitute a single project (or activity) subject to environmental licensing or are part of a set of projects (activities) of the same or similar type or, in any case, of the same or similar scale within the same spatial unit. **Synergistic effects** are those that arise from individual projects (activities), but when combined, they acquire a multiplicative character and result in impacts that are greater in terms of intensity and nature than the cumulative sum of the individual impacts.

10.6.2 Assessment of Cumulative Impacts

In the immediate area of the project, there are no and no foreseeable directly analogous or even smaller developmental or production projects (CO2 capture and storage) that could practically be considered in terms of their negative impacts alongside the present project. However, there may be an interaction between the proposed project and similar projects of the same nature and scale that are being implemented or planned at the national level.

As analyzed in **Section 4.7**, the proposed CO2 capture and storage project in Prinos represents the first such initiative in Greece and the SE Mediterranean and therefore cannot record interactions with projects of the same nature and scale at the national level, as such projects do not exist, are not being implemented, and are not being planned at this time. According to the revised National Energy and Climate Plan (NECP), two projects have already been approved for co-financing by the Innovation Fund: the IRIS project for CO2 capture at a hydrogen production unit in a refinery in Corinth, and the IFESTOS project for CO2 capture at a cement production plant in Boeotia. However, since these projects are in a very early design stage, it is not possible to assess the potential impacts in conjunction with the proposed project. However, it is important to note that in any case, due to the nature and general technical characteristics of these projects, any potential cumulative environmental and social impacts are expected to be **mostly positive.**

Recently, a coordinated effort focused on energy transition, reduction of GHG emissions, and ultimately achieving climate neutrality has been developing at both the **national level** [National Climate Law (4936 FEK A 105/27.5.2022) as amended and in force, ESEK, MS 2050, Regional Plans for Climate Change Adaptation, etc.], as well as at the **European level** (European Green Deal, 2030 Climate and Energy Framework, EU Strategy on Climate Adaptation) and at the international level [Paris Agreement under the United Nations Framework Convention on Climate Change (UNFCCC)].

In this context, EnEarth has designed and plans to implement a full-scale CO2 Storage facility in Prinos, capable of achieving the storage of a significant amount of CO2 with a subsequent notable offset of emissions, both at regional and national levels. Therefore, the Project demonstrates strong direct and indirect interaction with a wide range of actions, activities, and infrastructures aimed at mitigating/addressing climate change and achieving climate neutrality.

In conclusion, although there is no interaction between the Project and works of the same nature and similar scale at the national level, as such do not exist, are not being implemented, and are not currently planned, it is nonetheless easily understandable that it exhibits strong direct and indirect interaction with a wide range of actions, activities, and infrastructures (at the national, European, and international levels) aimed at mitigating/addressing climate change and achieving climate neutrality from the perspective of their environmental footprint.

10.6.3 Assessment of Synergistic Impacts

As presented in detail in **Section 4.7** of this Study, the proposed Project may interact with other projects or activities at the following three levels:

- **1st Level.** Interaction with future infrastructures and activities that are to be developed at a later stage of the overall Project's maturation, of which the examined Project is a part.
- **2nd Level .** Interaction with other projects and activities that exist in the immediate or broader area of the Project.
- **3rd Level .** Interaction with projects of the same nature and similar scale that are being implemented or planned at the national level (the present interaction concerns potential **cumulative impacts** and therefore falls under **Section 10.6.2**).

More specifically, the 1st and 2nd Level interactions that may potentially cause Synergistic Effects are summarized as follows.

1st Level. Interaction with future infrastructures and activities that are to be developed in a later stage of the overall Project's maturation, of which the Project examined in the context of this study is a part. As has been repeatedly emphasized, the subject of this Environmental Impact Assessment Study (EIA) is Phase 1 of the Project (the licensing of Phase 2 of the Project is not the subject of this study and will be implemented at the appropriate stage of its design maturation, through a request for modification of the approved environmental terms and a new, standalone ESIA).

2nd Level. Interaction with other projects and activities that exist in the immediate or broader area of the Project. In the **immediate area of the Project**, the **Prinos offshore development project** and the **Sigma onshore industrial unit** are located, as described below.

According to the valid Environmental Impact Assessment (EIA) DIPA/8413/24.04.2018 (ADA: ΨΓΛ14653Π8-Ζ79), **the Prinos Offshore Development project** concerns the existing offshore oil and natural gas extraction facilities located in the Gulf of Kavala, in the northeastern Aegean, and its expansion with two new platforms, one of which is long-term. The total production capacity is 27,000 barrels/day of stabilized crude oil.

The existing offshore project consists of the following individual facilities:

- Platform **Kappa** is located in the sweet natural gas field, not originating from an oil field, in South Kavala.
- 12 km, 6" pipeline (8-12 barg operating pressure) that transports sweet natural gas and condensate from South Kavala (Kappa platform) to the Delta platform of Prinos.
- Production platforms **Alpha** and **Beta**, each with twelve drilling heads (wells), which are part of the Prinos complex, are connected by bridges to the Delta platform and are designed to accommodate drilling, repair, maintenance, and other suitable drilling rigs.
- **Delta** processing platform that contains all the offshore initial processing facilities and which to date receives the oil, natural gas, water, and condensate produced from the Prinos, North Prinos, and Epsilon fields. The Delta platform is connected by bridges to the Alpha and Beta platforms as well as to its flare. New vertical connection risers are being added to the Delta platform to enable the reception of produced fluids from the Lambda platform (and possibly the Omicron platform) and to send natural gas (gas lift) and water for injection to the Lambda platform. A vertical protective pipe is also added for the installation of the multi-carrier cable that will transport energy, data, communications, and auxiliary fluids to the Lambda platform.
- **Flare** of the Prinos platform complex.
- 18 km pipeline, 12" (8 barg operating pressure) for the transport of sour natural gas from the Delta platform to the onshore facilities.
- 18 km pipeline, 8" (20-40 barg operating pressure) for the transportation of crude oil from the Delta platform to the onshore facilities.
- 18 km, 5.3" pipeline for the transportation of sweet natural gas (gas lift) from the onshore facilities to the Delta platform.
- Two underwater power cables with a capacity of 10 kVA each, from the onshore facilities to the Prinos platform complex.

The Sigma land-based industrial unit includes facilities for the desalination, dehydration, stabilization, and desulfurization of the produced crude oil, the conversion of the produced sour gas into sweet gas, the production of liquid and solid sulfur, as well as the necessary facilities for the safe storage and transportation of the produced crude oil, natural gas, and sulfur.

In the <u>broader study area</u> (which for the purposes of this Section consists of the Gulf of Kavala), a plethora of infrastructures and activities that could potentially interact with the proposed Project are identified, specifically the following:

- The ports of Kavala (commercial port "Philippos B'" and passenger port "Apostolos Pavlos").
- Passenger port of Keramoti.
- Part of the PATHE highway.
- Wastewater treatment plants (WWTP).
    - WWTP Kavala (GR115001016) with discharge into the sea.
    - WWTP of Old Tsifliki (GR 11500101117) with discharge into the sea.
    - WWTP Philippi (GR 1150100118) with flow discharge.

    - WWTP of Nea Peramos (GR 1150030115) with flow discharge.
    - WWTP Chrysoupolis (GR 115011018) with flow discharge.
    - Thassos Port WWTP (GR 1150040116) with discharge into the sea.
- Greek Fertilizers (ELFE), which were initially founded in 1961 (as Phosphate Fertilizer Industry S.A. (PFI) and began operations in Nea Karvali in 1965. The facilities include:
    - Ammonia production unit.
    - Unit for the production of nitric acid and nitrate fertilizers.
    - Production unit for sulfuric acid.
    - Phosphoric acid production unit.
    - Complex fertilizer production unit.
- Coral Oil, which is adjacent to the SIGMA facilities, and Revoil, approximately 1.5 km to the north, both of which operate as fuel storage and distribution sites.

The interaction of the proposed project with the aforementioned has been thoroughly examined within the framework of assessing the potential impacts of the proposed project on each Environmental Parameter, as the **Synergy (SI)** parameter of the impact has been incorporated into the equation for calculating the quantified importance value of each potential impact (for details, refer to **Section '10.1.2.2.1 Calculation of Impact Significance'**).

In conclusion, from the documentation provided in the **sections** evaluating the potential impacts on each Environmental Parameter, it appears that within the framework of the proposed project, **no significant adverse synergistic impacts are expected.**

10.7 ASSESSMENT OF TRANSBOUNDARY IMPACTS

In this **Section**, following the analysis of the potential significant impacts from the construction, operation, and cessation of operation/decommissioning of the proposed project, as described in detail in the previous **Sections** of this **Chapter**, the possible transboundary impacts are presented.

Within the framework of the proposed project, the total estimated impacts are limited to the project area and, in some cases, to areas adjacent to the project area within a radius of a few hundred meters. In any case, as documented in the preceding Sections, none of the facilities or activities of the proposed project are expected to cause significant adverse environmental and social impacts outside the immediate project area (2 km radius zone around the project) during the entire lifecycle of the project. Therefore, no adverse impacts are caused with the scope and geographical spread required to potentially lead to corresponding cross-border impacts.

Additionally, no potential adverse impact from the total estimated impacts during the entire lifecycle of the project exceeds the classification of Moderate, and indeed, after the formulation of measures for minimizing/avoiding/mitigating impacts, no residual impact exceeds the classification of Minor. Therefore, no adverse impacts are caused by the dynamics or intensity required to potentially lead to corresponding transboundary impacts.

In conclusion, based on both the preceding analysis and the conclusions of the previous Sections of this Chapter (where, among other things, the likelihood of cross-border impacts for each Environmental Parameter is examined in total), it is determined that no adverse cross-border impacts are expected from the implementation of the Proposed Project's interventions.

On the contrary, the operation of the proposed project may cause positive cross-border impacts, as it involves significant CO2 storage until 2046, since the related CO2 emissions have a negative balance and are considered stable and greater than 900,000 tn CO2 eq per year (detailed calculations are provided in **Section 4.4.1**). These quantities, without the presence and operation of the project under study, would be released into the atmospheric environment, which is not limited by local or even national borders.

Therefore, it is evident that the operation of the proposed Project contributes both to achieving international goals for overall reduction of GHG emissions and to achieving climate neutrality by 2050, as well as to offsetting any emissions that exist beyond 2050. Therefore, the implementation and operation of the project under study is expected to cause **strong positive cross-border impacts.**

CONTENTS

TABLES

11 MITIGATION MEASURES

11.1 INTRODUCTION

In the context of the implementation of the proposed project, EnEarth will develop and implement appropriate management systems to ensure that routine and unanticipated impacts on the environment are mitigated to a level as low as reasonably practicable (ALARP). Routine impacts are subject to an **Environmental and Social Management Plan (ESMP)** which forms part of this **Environmental Impact Study**. The effectiveness of these systems and procedures is regularly reviewed by the project operator. In planning the development of the facilities proposed herein, EnEarth intends to incorporate safety, prevention and mitigation measures for environmental and social risks into the design, where possible. It is clear that risk is more effectively mitigated/minimized through the preparation of appropriate studies and the integration of their findings/recommendations into the project implementation, than by attempting to mitigate risks through controls and taking emergency measures during the project life cycle.

EnEarth's general approach to managing impacts and risks related to the environment, society, health and safety is described in the overall **Environmental and Social Management Plan (ESMP)** that follows in **Chapter 12**. Mitigation and management controls as well as monitoring provisions are specified in a series of issue-specific management plans, which are attached to this EIA. These management plans are framework plans, fall within the ESMP, will be developed into full plans and will be integrated into the current Environmental and Health and Safety Management System prior to construction and operations, where necessary.

11.2 MEASURES DURING THE CONSTRUCTION PHASE

In addition to the measures incorporated into the design of the proposed project, this **Environmental and Social Impact Assessment Study** identified the need for additional mitigation measures, as described in detail in the paragraphs below.

In **Chapter 10**, the activities during the construction of the Project that could potentially cause undesirable adverse impacts were investigated, in terms of their interaction with a series of Environmental and Social Parameters.

The following presents the proposed minimization/mitigation/avoidance/coping measures for the potential impacts that have been analyzed/assessed and assessed as minor, moderate or significant as appropriate (within the context of this project, the estimated impacts range from negligible to moderate, as discussed in detail in the relevant **Chapter 10**).

In the event that during their Final Assessment, some impacts were assessed as **Moderate**, within the framework of this **Chapter**, prevention/mitigation/countermeasure measures are proposed, so that these impacts become at least **Minor**.

Furthermore, because within the framework of the proposed Project, the philosophy of the implementing body is to achieve the desired technical result while causing the minimum possible environmental footprint, <u>additional mitigation measures are proposed even in the case of potential impacts assessed as **Negligible**</u>.

The following are mentioned as general measures during the Construction Phase:

• Implementation of the Environmental Monitoring Program.

• Design and implementation of an Environmental Management Plan by the contractor/contractors, compatible with the corresponding ESMP of the Project.

The following Table presents the measures to prevent, minimize and address potential adverse environmental and social impacts during the Construction phase of the proposed Project.

Table 11-1: Measures to prevent, minimize and address potential adverse environmental and social impacts during the construction phase of the proposed Project

Environmental Parameter		Target of proposed measure	Construction Mitigation Measures (CMM)	Potentially Significant Impacts to Avoid/Minimize/Address
Natural Abiotic Environment	Climatic and bioclimatic Characteristics	Minimizing the impacts of air emissions (gas pollutants and GHGs) on climate change	CMM 1. In order to protect from the machinery and vehicles exhaust gases, their regular maintenance is required, which is necessary anyway. It is noted that maintenance should not be carried out within the work area.	Impacts that contribute to climate change due to combustion emissions from machinery, vehicles and vessels participating in construction work.
			CMM 2. In order to protect from the machinery and vehicles exhaust gases, their regular maintenance is required, which is necessary anyway. It is noted that maintenance should not be carried out within the work area.	
			CMM 3. The vessels to be used must fully comply with the international standards of the MARPOL 73/78 Convention, Annex VI "Regulations for the Prevention of Air Pollution from Ships". Annex VI regulates emissions of ozone-depleting compounds, nitrogen oxides (NOX), sulfur oxides (SOx) and volatile organic compounds (VOCs).	
			CMM 4. The drilling rig shall be designed and constructed in accordance with the API 4F standard and the latest European regulations, including low-emission emission specifications.	
			CMM 5. Transport of materials: Transport of construction materials and waste by sea shall be preferred over road transport, where technically possible and applicable.	Impacts related to waste management.
	Morphological and Topographical Characteristics	Minimization of impacts within the Project's occupancy zone	CMM 6. Any permanent, unlicensed covering of surfaces with impermeable material (e.g. asphalt mix or concrete) that does not serve the absolutely necessary operational needs of the project shall be prohibited. All other surfaces should be formed with a permeable coating, from materials as similar as possible to those of the immediate environment of the project	Impacts related to the extent of the project's occupation zone and minimization of the zone of influence of the impacts.
		Minimizing impacts outside the project's occupancy zone	CMM 7. The construction site is proposed to be installed within the designated area within the SIGMA industrial facility. Otherwise, the construction site facilities should be determined after approval by the relevant technical environmental study. Any activity outside the limits of those provided for the implementation of the projects of the premises and construction site, which may lead to a degradation of aesthetics and alteration of the landscape (disposal of waste materials, parking of machinery, etc.), should be prohibited.	Impacts related to activities outside the project's zone of occupation and minimization of the zone of influence of impacts.
		Minimizing impacts using good practices	CMM 8. The uncontrolled disposal of surplus materials in the immediate or wider area is prohibited. Under no circumstances is the disposal of these materials in stream beds or other water bodies permitted.	Impacts related to the management of waste and surplus materials.

Environmental Parameter		Target of proposed measure	Construction Mitigation Measures (CMM)	Potentially Significant Impacts to Avoid/Minimize/Address
			The technical interventions included in the implementation of the project and related to the effective drainage of the project site, the hydraulic communication of the areas on either side of it, etc., should be checked, cleaned and maintained systematically at regular intervals. The effectiveness of the technical interventions (included in the implementation of the project and related to the effective drainage of the project site, the hydraulic communication of the areas on either side of it, etc.) should be systematically checked in terms of their design and effectiveness, based on new scientific data or the corresponding revisions of the relevant Plans	
			CMM 9. Systematic maintenance of the infrastructure and maintaining the cleanliness of the Project area is required.	
			CMM 10. Solid waste collection points should be designated on the construction site, as well as their regular collection, so as to avoid degradation of the landscape.	
			CMM 11. Any storage, even temporary, of materials outside the construction site area is prohibited.	Impacts related to the management of construction materials and the project schedule.
			CMM 12. The schedule for the execution of the works should be structured so that the temporary storage of materials is used as soon as possible.	
		Minimizing impacts using good practices	CMM 13. Any type of construction site installation (machinery, temporary structures, any type of waste, etc.) must be removed after the end of the specific phase of the project, regardless of the ownership status of the construction site.	Impacts related to the condition and restoration of the project's occupation zone.
		Minimizing impacts by using good practices	CMM 14. Excavations and removal of soil material should be carried out using conservative methods, in harmony with the natural morphology of the soil. In addition, moderate levels of intensity of the work must be maintained.	Impacts related to the extent of the project's occupation zone and minimization of the zone of influence of impacts.
		Minimizing impacts by using good practices	CMM 15. Do not carry out work on days when weather conditions, the intensity and direction of sea currents favor the dispersion of the solids plume.	Impacts related to construction method and the project schedule.
		Minimizing impacts by using good practices	CMM 16. All technically possible measures should be taken to contain suspended materials (installation of filters/suspended solids retention curtains or other suitable equipment), with the aim of reducing the dispersion of the plume during the installation work of the offshore sections of the project (with emphasis on the CO2 transmission pipeline) and possible disposal of materials at sea. Κατά την εκτέλεση των εργασιών υλοποίησης του προτεινόμενου έργου, προτείνεται κατ' ελάχιστο η χρήση σύγχρονου εξοπλισμού για τη συγκράτηση των αιωρούμενων στερεών υλικών	Impacts related to construction work.

Environmental Parameter		Target of proposed measure	Construction Mitigation Measures (CMM)	Potentially Significant Impacts to Avoid/Minimize/Address
			ειδικά floating barriers - debris containment booms, siltation curtains, etc.) around the perimeter of the works being carried out, so that the quality and transparency of the water at a great distance is not affected by the construction activities, but also so that solid materials do not settle on a large area of the seabed. In the event that the measure proves to be partially sufficient during the construction phase of the project, additional measures should be taken, in accordance with the findings of the relevant monitoring program.	
		Minimizing impacts through the process of monitoring, identifying and addressing them	CMM 17. The implementation of the Environmental Monitoring Program is recommended.	Impacts related to the construction method
	Geological, tectonic and soil characteristics	Minimizing impacts on the ground and seabed	The measures for minimizing the impacts on Morphological and Topographical Features (CMM 5 to CMM 13) also apply to minimizing the impacts on Geological, Tectonic and Soil characteristics.	Impacts related to various influences on a wide range of environmental parameters from the construction of the project.
			CMM 18. Earthworks should be carried out primarily during the period of the year when there is no heavy rainfall and extreme wave conditions, in order to avoid soil washing and the creation of suspended particles, respectively. The planning of the works should include provision to avoid serious earthworks during the period of heavy rainfall and sea turbulence and to avoid earthworks on days when rain and strong waves are forecast. In the exceptional event of heavy rainfall or sea turbulence during the relatively short excavation phase, it is recommended to stop work and install geogrids on the slopes, if deemed geotechnically necessary.	Impacts related to the construction method and the project schedule.
			CMM 19. During the construction phase, methods and techniques should be applied to minimize the compaction of uncovered soils, such as limiting access during rainfall and using protective boards and low soil pressure machinery. Appropriate water-permeable materials should be used for the construction of parking areas within the construction site, so as to minimize rainwater runoff from the construction sites.	Impacts related to the construction method of the project.

Environmental Parameter	Target of proposed measure	Construction Mitigation Measures (CMM)	Potentially Significant Impacts to Avoid/Minimize/Address
	Protecting soil and seabed through proper waste management	**CMM 20.** For all waste and debris that will arise from site activities during the construction of the projects (solid and liquid, hazardous or not) appropriate management should be implemented with the care of the Project contractor, in accordance with the legislation, in order to avoid pollution of the area (soil, subsoil, surface and groundwater) from their uncontrolled disposal or from any leaks. A "Waste Management Plan" should be implemented during the construction / operation / decommissioning stages, examining all aspects of the project and the waste generated with the aim of ensuring that the waste generated (hazardous, non-hazardous) is managed properly.	Επιπτώσεις που σχετίζονται με τη μέθοδο κατασκευής και το χρονοδιάγραμμα του έργου.
		CMM 21. The construction sites should be equipped with waste bins in which to collect the urban waste of the workers on the construction sites. This waste should be collected by the Competent Local Authority or collection and transport body - in case this is not possible, the waste should be disposed of by the Project body in the existing collection system of the relevant Local Authority. It is noted that special care should be taken to ensure that this solid waste does not include rubble or materials that are hazardous, the disposal of which should be carried out in accordance with the applicable legislation on the respective categories of waste.	Επιπτώσεις που σχετίζονται με την διαχείριση αποβλήτων.
		CMM 22. For the management of liquid waste from the project's construction personnel, it is proposed to install chemical toilets and transport and dispose of them at the nearest available Wastewater Treatment Facility and/or use the sanitation facilities of the company's existing facilities in the area.	Επιπτώσεις που σχετίζονται με την διαχείριση αποβλήτων.
		CMM 23. Liquid and solid waste containing hazardous or potentially hazardous substances shall be immediately transferred to leak-proof containers, which shall be stored (temporarily for the short period of time during which the relevant works are carried out) in a covered area with an impermeable industrial concrete floor and the necessary secondary containment systems. Their transport and final disposal or treatment shall be carried out by a specialized and appropriately licensed company, in accordance with the best available practices.	Επιπτώσεις που σχετίζονται με την διαχείριση των αποβλήτων και των υλικών κατασκευής του έργου.
		CMM 24. The management of any excess excavation products, as well as (non-hazardous) AEKKK produced from construction works, shall be carried out in accordance with the provisions of Joint Ministerial Decree 36259/1757/E103 (Government Gazette 1312/24-08-2011) “Measures, conditions and program for the alternative management of waste from excavations, constructions and demolitions”. Materials that cannot be reused/recycled within the project shall be delivered to a Collective Alternative Management System (SSED) approved by EOAN. • The management of waste from excavations, constructions and demolitions in the Project area is carried out in accordance with the provisions of Joint Ministerial Decision	Επιπτώσεις που σχετίζονται με την διαχείριση αποβλήτων.

Environmental Parameter	Target of proposed measure	Construction Mitigation Measures (CMM)	Potentially Significant Impacts to Avoid/Minimize/Address
		36259/1757/E103/2010 through the following Alternative Management Systems (based on data from the Hellenic Recycling Organization (EOAN, https://www.eoan.gr): • SSED "Aggregates Recycling of Northern Greece S.A.", with the distinctive title "AN.A.B.E. S.A." • SSED "Aggregates Recycling of Central Macedonia S.A.", with the distinctive title "ANA.KEM." • SSED "Central Greece Recycling System Ltd.", with the distinctive title "S.A.N.K.E. Ltd." • SSED "PEDMEDE ECO Limited Liability Company," with the distinctive title "PEDMEDE ECO MEPE."	
		CMM 25. In the event that at the time of implementation of the proposed project, it is not within the geographical scope of a Collective Alternative Management System approved by EOAN, the excess material must be disposed of at the nearest approved Collective Alternative Management Systems or in an appropriate storage chamber, after submission and approval of a Technical Environmental Study by the competent licensing authority, in accordance with paragraph 2 of Article 7 of Law 4014/2011 (Government Gazette 209/A 21.09.2011). In this case, the land area proposed by the contractor will be approved by the competent authority and in accordance with the provisions of the ELOT specification ΤΠ 1501-02-05-00-00. When selecting the location of the storage chamber, attention should be paid to the following: • The location of the storage chamber should not be within the boundaries of an ecologically sensitive or protected area. • Avoid areas with natural vegetation or fauna habitats. • Avoid location on productive land or in locations with surface water bodies. • Avoid location in locations that would affect the landscape of the area or would conflict with existing anthropogenic uses and activities. The location of the storage chamber should be preferred to be in an already disturbed location, which would have positive impacts on the environment of the study area. The method of disposal and the arrangement of the deposits will be determined in a relevant technical environmental study, which will be prepared and submitted to the competent licensing authority before the start of the relevant works, in accordance with paragraph 2 of Article 7 of Law 4014/2011 (Government Gazette 209/A 21.09.2011).	
		CMM 26. The construction sites should be equipped with Recyclable Materials bins in which mixed recyclable materials of paper/cardboard, plastic, metal and glass should be collected. This waste should be collected by the Competent Local Authority or collection and transport entity - in case this is not feasible, the waste should be deposited by the Project entity in the existing collection system of the Local Authority (Recyclable Materials Sorting Center).	

Environmental Parameter		Target of proposed measure	Construction Mitigation Measures (CMM)	Potentially Significant Impacts to Avoid/Minimize/Address
			CMM 27. Separate collection of special waste streams such as Waste Electrical and Electronic Equipment (WEEE), Waste Batteries & Accumulators (WEE), Waste Lighting, Lamps and Small Appliances (WEE) should be carried out and collected by licensed collection, transport and management entities. In case this is not feasible, provision should be made for the disposal of the waste by the Project entity at appropriate WEEE recycling points.	
			CMM 28. The management of used mineral oils shall be carried out in accordance with the provisions of Presidential Decree 82/25.2.2004 (Government Gazette 64/A/2.3.04) on "Specification of measures and conditions for the management of used mineral oils", which replaced KYA 98012/2001/96. Waste lubricating oils (WLO) and liquids of each type shall be collected separately by category in order to be delivered to a Collective Alternative Management System approved by EOAN.	
			CMM 29. Hazardous waste management shall be carried out in accordance with the provisions of Joint Ministerial Decision 13588/725/2006 (Government Gazette 383B/28-3-2006) "Replacing Joint Ministerial Decision 19396/1546/97 (Government Gazette 604B/18-7-1997)".	
		Protection of soil and seabed through good construction practices	CMM 30. The storage of fuels, machinery and construction materials should be carried out in a way that minimizes the risk of pollution of soil and water resources. Chemicals, fuels and lubricants should be stored in appropriately designed and sealed areas away from water recipients. Collection containers should be used on stationary machinery to avoid pollution of soil and groundwater by oils and lubricants.	Impacts related to the management of construction materials.
			CMM 31. The maintenance of construction and material transport machinery should be carried out in an organized workshop in the area and not in the Works area. The manufacturer should ensure that the maintenance program of the construction site machinery is properly organized, so that the oil change and their regular maintenance is carried out in organized workshop areas. The oils, greases and other products of the mechanical parts of the earthmoving and other machinery should be collected and disposed of appropriately, as provided for by the legislation (PD 82/2004, GG 64/A/2.3.2004).	Impacts related to the cleaning and maintenance of vehicles and equipment
			CMM 32. Within the construction site, equipment and vehicles will be washed and cleaned frequently in specially designed areas in order to avoid leakage of hazardous substances through the generated liquid waste. To reduce the volume of liquid waste from this area, it is recommended that vehicles be cleaned first with dry means, e.g. brooms, brushes, etc. Also, low-water washing equipment such as pressure systems should be used.	

Environmental Parameter		Target of proposed measure	Construction Mitigation Measures (CMM)	Potentially Significant Impacts to Avoid/Minimize/Address
			CMM 33. Wet or damp concrete residues inside concrete mixers must not be discharged into the environment. The emptying and washing of concrete drum residues must be carried out at the ready-mix concrete supply industry site.	Impacts related to cleaning and maintenance of vehicles and equipment
			CMM 34. The contractor should implement an accidental pollution prevention control, take all preventive measures to avoid oil spills due to damage, negligence, etc. and carry out appropriate operations to minimize such incidents. In addition, the manufacturer's program should include the handling of accidents throughout the entire work. Thus, the manufacturer should have the appropriate materials in his workshop to deal with accidental pollution incidents both on land and in the sea. The manufacturer should have the appropriate absorbent materials (e.g. sawdust, sand) available at the construction site in sufficient quantities, through which the adsorption and consequently the containment and limitation of the dispersion of leaking fuels and lubricants will be sought. After use, these absorbent materials should be properly managed in accordance with applicable legislation as hazardous waste. In addition, at least one of the vessels participating in the construction work should be equipped with means to contain the spill, as well as with appropriate machinery for absorbing and dispersing chemicals to combat the spill. The above should be explicitly stated in the manufacturer's contract of obligations and their implementation should be appropriately supervised during construction.	Impacts related to accidental pollution.
			CMM 35. From the pipeline approach works (placing this particular section of the pipeline in a trench approximately 500 m long, approximately 5 m wide and 3 m deep), the volume of excavated materials from the seabed is expected to be approximately 7,500 m3. The excavated materials will be kept on the side of the trench, for subsequent backfilling. Additionally, avoid carrying out earthworks near the coastal front during high rainfall in the area or strong waves.	Impacts related to construction work
			CMM 36. The supply of raw materials (aggregate materials) required during construction shall be from legally operating quarries and environmentally approved quarrying areas.	Impacts related to the management of construction materials.
		Protection of the bottom by using non-hazardous materials	CMM 37. The cuttings from the section of the drilling up to a depth of 2,200 m will not contain hazardous substances and will be deposited on the seabed. In this section, a slurry based on seawater and lime will be used as drilling fluid, which will be biodegradable, without negative impacts on the environment. As for the products of the drilling operations from the section of the drilling up to a depth of 2,200 m, these can be disposed of as long as the analyses that will be carried out during the	Impacts related to the management of drilling products.

Environmental Parameter	Target of proposed measure	Construction Mitigation Measures (CMM)	Potentially Significant Impacts to Avoid/Minimize/Address
		construction phase confirm that they do not contain pollutant loads, they can be disposed of in the marine environment, after a positive opinion from an appropriate laboratory. For the disposal of these dredged materials in the marine environment, the following conditions must be met: • The disposal site must be located at a great distance from the Posidonia meadows, • The disposal site must be located at a short distance from the extraction point and at the greatest possible depth (ideally at a depth greater than 50 m), in order to avoid major movements, • The materials must be evenly distributed in accordance with the above conditions, • The disposal must be carried out vertically and as deep as possible from the sea surface.	
	Protection of the seabed through proper management of hazardous or potentially hazardous waste	CMM 38. For the section of drilling below a depth of approximately 2,200m, drilling fluids will be returned to the drill to remove cuttings and the slurry will undergo appropriate treatment.	Impacts related to the management of drilling products.
		CMM 39. Separate collection of waste containing hazardous substances. Temporary storage within the Project and disposal to licensed collection, transport and management entities For the waste produced that may contain hazardous substances, their immediate characterization by a specialized and certified entity should be provided for and then their immediate collection, removal and disposal, as far as possible, by an appropriate specialized and certified entity in approved suitable areas or waste treatment facilities.	Impacts related to the management of drilling products.
	Minimizing impacts through the process of monitoring, identifying and addressing them	The implementation of the Environmental Monitoring Program is recommended. (CMM 17).	Impacts related to construction work.
Air Quality	Minimizing impacts by using good practices	CMM 40. Wetting of surfaces and materials should be carried out to limit dust release during earthmoving work.	Impacts related to construction work, handling and transportation of materials
		CMM 41. The operation of machinery working on site should be carried out with careful handling, and the movement of trucks should be carried out at low speeds, in order to limit the release of dust.	
		CMM 42. Covering construction materials and excavation waste deposits with a canopy, until their use or disposal, respectively.	

Environmental Parameter	Target of proposed measure	Construction Mitigation Measures (CMM)	Potentially Significant Impacts to Avoid/Minimize/Address
		CMM 43. Trucks transporting aggregates should be equipped with a special cover in accordance with existing provisions and overfilling of trucks transporting bulk materials should be avoided.	
		CMM 44. In any construction or construction site activity, where there is a possibility of dust, suspended particles or odorous substances being emitted, procedures and equipment should be adopted that will ensure the drastic reduction of these emissions, while the times of these procedures should be minimized.	
	Minimizing the impacts of gas emissions	CMM 45. For the construction of the CO2 pipeline, marine fuel (Marine Gasoil DMA ISO 8217:2012) with a maximum sulfur content of 0.1% (M/M) shall be used on the construction vessel and auxiliary vessels.	Impacts that contribute to air pollution and climate change due to combustion emissions from machinery, vehicles and vessels participating in construction work.
		In addition, for construction work, it is recommended to apply the aforementioned measures CMM 1 to CMM 5	
Noise and vibrations	Minimizing impacts by using good practices	CMM 46. The contractor should choose the layout and scheduling of the individual tasks, so that there is no simultaneous operation of multiple machines in close locations and that the minimum possible disturbance is caused to the human-made environment of the immediate project area.	Impacts related to the construction method and project schedule.
		CMM 47. To avoid, as far as possible, the operation of the construction site and the movement of trucks on the urban road network within the settlements of the project area during quiet hours (Ministry of Public Works 1023/2/37/96 (Government Gazette 15/B/12.1.96).	
		CMM 48. The construction site machinery to be used must comply with the provisions of the legislation "on measures and conditions for noise emissions into the environment from equipment for use outdoors" (JMD 37393/2028/2003, Government Gazette 1418/B/2003, as amended by JMD 9272/471/2007, Government Gazette 286/B/2007) and must bear the CE conformity marking provided for by the above legislation.	Impacts contributing to noise emissions from machinery, vehicles and vessels involved in construction work.
	Minimizing impacts through the process of monitoring, identifying and addressing them	In any case, it is recommended to systematically monitor noise levels at the project boundaries during construction (implementation of the Environmental Monitoring Program (CMM 17)) and if exceedances are detected, additional measures should be taken. Furthermore, the measured levels of emitted noise should be taken into account, in terms of their impact on project workers and the workers should be provided with appropriate protective equipment (e.g. earplugs, etc.).	Impacts related to construction work

Environmental Parameter		Target of proposed measure	Construction Mitigation Measures (CMM)	Potentially Significant Impacts to Avoid/Minimize/Address
		Minimizing impacts by using good practices	CMM 49. In any case, all activities and works to be implemented will be in accordance with the applicable provisions of Greek legislation as listed below: • YA 2640/270 (Government Gazette 689/B/18.8.78), On the use of silenced air hammers. • PD 1180/81 (Government Gazette 293/A/6.10.81), On the regulation of issues related to the establishment and operation of industries, crafts, all types of mechanical installations and warehouses and the resulting environmental protection in general, as amended and in force. • YA 56206/1613 (Government Gazette 570/B/9.9.86), Determination of the sound emission of construction site machinery and equipment in compliance with Directives 79/113/EEC, 81/1051/EEC and 85/405/EEC. • YA 69001/1921 (Government Gazette 751/B/18.10.1988), EEC type approval for the noise level limit value of construction site machinery and equipment and in particular of motor-driven air compressors, tower cranes, welding and power generating sets and portable concrete breaking devices and pneumatic hammers, as amended. • YA 10399/91 (Government Gazette 359B/91), Determination of the noise level limit value of tower cranes in addition to YA 69001/1921/88 • YA 765/91 (Government Gazette 81B/21-2-91), Determination of the noise level limit values of hydraulic shovels, shovels with cables of earth movers, loaders and loaders - excavators, as amended by JMD 11481/523/97 (Government Gazette 295B/97) • JMD 37393/2028/01.10.2003, Measures and conditions for noise emissions into the environment from equipment for use outdoors (Government Gazette 1418B) as amended by Joint Ministerial Decree 9272/471/2007 • Presidential Decree 149/06, (159/A/28.7.2006) “Minimum health and safety requirements regarding the exposure of workers to risks arising from physical agents (noise) in accordance with Directive 2003/10/EC”.	
			CMM 50. In addition, the provisions of the following will be taken into account: • BS 5228 “Code of Practice for noise control on construction and demolition Sites in relation to the definition of the methodology for the prediction of Noise and Vibration during construction works and the applicable indicators and limits. • BS 6472 Vibration dose value – vdv in relation to the definition of the maximum permissible vibration dose, which concerns the nuisance to humans due to construction activities.	

Environmental Parameter	Target of proposed measure	Construction Mitigation Measures (CMM)	Potentially Significant Impacts to Avoid/Minimize/Address
		• BS 7385 in relation to the definition of the maximum permissible vibration level for the protection of buildings from structural damage. • YA 13586/724/06 (Government Gazette 384/B/28.3.2006) Definition of measures, conditions and methods for the assessment and management of noise in the environment, in compliance with the provisions of the directive 2002/49/EC "on the assessment and management of environmental noise" of the Council of 25.6.2002). • Ministerial Decree 211773/2012 (Government Gazette 1367/B/2012), Determination of Assessment Indices and Maximum Permissible Limits of Environmental Noise Indices originating from the operation of transport projects, technical specifications for special acoustic calculation and implementation studies of noise barriers, environmental noise monitoring specifications and other provisions.	
	Minimizing impacts by using good practices	CMM 51. Residents, users and visitors to the area should be informed of the operating hours of machines that may cause potential nuisance.	Impacts related to the construction method and project schedule.
Water	Minimizing impacts on the hydraulic regime of waters by using good practices	CMM 52. To meet the project's water needs, commercially bottled water will be used as drinking water for the workers. The needs of the operation of the construction sites as well as the wetting of the concrete will be met by installing water tanks on the construction site, which will be filled with tankers or from the network of the existing SIGMA industrial facility.	Impacts related to the use of natural resources during the construction of the project.
		Construction of ditches and other hydraulic interventions where provided for in the project design, so that the flow of surface water remains unimpeded (CMM 8).	Impacts on surface water flow.
	Minimizing impacts on surface and groundwater by using good practices	The uncontrolled disposal of surplus materials in the immediate or wider area is prohibited. Under no circumstances is the disposal of these materials in stream beds or other water bodies permitted. (CMM 8).	Impacts related to the production of surplus materials and their management during the construction of the project.
		Systematic maintenance of the infrastructure and maintaining the cleanliness of the Project area is required. (CMM 9).	Impacts related to project management and the methodology for implementing construction work.
		Solid waste collection points should be designated on the construction site, as well as their regular collection, so as to avoid degradation of the landscape. (CMM 10,11,21).	Impacts related to the production of solid waste and its management during the construction of the project.

Environmental Parameter	Target of proposed measure	Construction Mitigation Measures (CMM)	Potentially Significant Impacts to Avoid/Minimize/Address
		The schedule for the execution of the works shall be structured so that temporary material deposits are used as soon as possible and material washouts are avoided (CMM 9,15,18).	Impacts related to the construction method and the project schedule.
	Water protection through good construction practices	The storage of fuels, machinery and construction site materials shall be carried out in such a way as to minimize the risk of pollution of soil and water resources. Chemicals, fuels and lubricants shall be stored in suitably designed and sealed areas away from water recipients. Collection containers shall be used on static machinery to avoid pollution of soil and groundwater by oils and lubricants (CMM 30).	Impacts related to the production of surplus materials and their management during the construction of the project.
		Wet or damp concrete residues inside concrete mixers shall not be discharged into the environment. The emptying and washing of the remains of the concrete barrels shall be carried out in the area of the ready-mix concrete supply industry (CMM 33).	Impacts related to the cleaning and maintenance of vehicles and equipment
		CMM 53. The water that will arise in the trenches or excavations during the works for the installation of the land infrastructure will be removed with appropriate systems (pumps or wells) and after their characterization (after appropriate sampling and relevant laboratory analyses), their intended treatment / discharge into water bodies existing in the project area will be determined.	Impacts related to the production of liquid waste and their management during the construction of the project.
	Minimizing impacts on water quality through the use of good practices	The main factor for the general protection of the environment of the wider area during the construction works is the appropriate organization and proper operation of the construction site. For the protection of water quality, the implementation of measures (CMM 6 to CMM 8, CMM 11, CMM 13.	Impacts related to the organization and operation of the construction site and mainly the management of waste and construction materials.
		For the protection of water quality from activities of management, disposal, and use of construction materials and waste and cleaning and maintenance of vehicles and equipment, the implementation of measures from CMM 20 to CMM 29, CMM 31 to CMM 32 and CMM 38 to CMM 39	
	The protection of water quality from improper practices, damage or negligence.	For the protection of water quality from improper practices, damage or negligence, the measure CMM 34 is proposed.	Impacts related to accidental pollution during the normal activities of the construction phase
	Minimizing impacts through the	The implementation of the Environmental Monitoring Program is recommended. (MAK 17).	Impacts related to construction work.

Environmental Parameter		Target of proposed measure	Construction Mitigation Measures (CMM)	Potentially Significant Impacts to Avoid/Minimize/Address
		process of monitoring, identifying and addressing them		
		Protecting marine waters	CMM 53. Implementation of emergency risk prevention and mitigation measures related to a potential CO2 leak as included in Table 12 4: Measures to Prevent Significant Anomalies of this Chapter.	Impacts related to accidental pollution during normal construction phase activities.
			CMM 55. Compliance with international guidelines and the IMO International Safety Management Code (ISM), for the safe operation of ships and the prevention of environmental pollution, as well as strict compliance with navigation, communication and safety procedures.	Impacts related to construction operations, prevention of accidental pollution and implementation of good construction practices.
			CMM 56. Compliance with MARPOL requirements for waste and sewage, with emphasis on the following: Annex I Regulations for the Prevention of Pollution by Oil, Annex III Regulations for the Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form, Annex IV Regulations for the Prevention of Pollution by Sewage from Ships, Annex V Regulations for the Prevention of Pollution by Solid Wastes from Ships.	
			CMM 57. The vessels that will be used for the needs of the project will comply with the International Regulations for Preventing Collisions at Sea 1972	
		Protecting marine waters through good construction practices	CMM 58. Implementation of fueling procedures in accordance with applicable national regulations and vessel specifications.	
			CMM 59. All necessary measures should be taken to avoid pollution of the sea during the construction phase, as well as any additional measures that may be indicated by the relevant Port Authority, in accordance with Law 743/77 (Government Gazette A 319), as codified by Presidential Decree 55/98 (A' 58) and in force from time to time.	
		Protecting marine waters through proper waste management	Implement a "Waste Management Plan" during the construction / operation / decommissioning stages, examining all aspects of the project and the waste generated with the aim of ensuring that the waste generated (hazardous, non-hazardous) is managed properly (CMM 20).	Impacts related to construction operations, prevention of accidental pollution and implementation of good construction practices.
		Προστασία θαλάσσιων υδάτων	CMM 60. A Chemical Use Plan shall be implemented which shall include: (i) The chemicals which the operator intends to use during the operations. A list of the ecotoxicity of such chemicals. (ii) The purpose or purposes for which the operator intends to use the chemicals. (iii) The maximum concentrations of the chemicals which the operator intends to use in any other substances, as well as the maximum quantities intended to be used in any specified period. (iv) The area within which the chemical may escape into the marine environment.	

Environmental Parameter		Target of proposed measure	Construction Mitigation Measures (CMM)	Potentially Significant Impacts to Avoid/Minimize/Address
			CMM 61. Use approved biocides and anti-corrosion agents that meet the requirements of applicable national and EU legislation and comply with international marine protection conventions, such as the Barcelona Convention in particular. The substances to be used for the above purposes should be selected from the "OSPAR List of Substances Used and Discharged Offshore which Are Considered to Pose Little or No Risk to the Environment (PLONOR)" in its current version. The use of substances belonging to the "OSPAR List of Substances of Possible Concern (LSPC)" is not permitted.	
			CMM 62. To ensure that the construction and maintenance materials of the project (paints, insulation, coatings, etc.) do not contain the substances referred to in the decision of the Supreme Chemical Council 1100/91/91 (Government Gazette B' 1008/12−12−1991) and in the Ministerial Decrees 475/2002/03 (B' 208/2003) and 121/2003/03 (B' 1045/2003), as applicable from time to time, namely mercury, arsenic and organotin compounds, as well as other chemical substances that are considered hazardous, in accordance with the relevant legislation on hazardous substances and for which restrictions apply to their circulation and use in the marine and aquatic environment in general.	
			All technically feasible measures should be taken to contain suspended materials (installation of filters/suspended solids containment curtains or other suitable equipment), with the aim of reducing the dispersion of the plume during the installation work of the offshore sections of the project (with emphasis on the CO2 transmission pipeline) and possible disposal of materials at sea. During the execution of the implementation work of the proposed project, it is proposed at a minimum the use of modern equipment to contain suspended solid materials (special floating barriers - debris containment booms, siltation curtains, etc.) around the perimeter of the works being carried out, so that the quality and transparency of the water at a great distance is not affected by the construction activities, but also so that solid materials do not settle on a large area of the seabed. In the event that the measure proves to be partially sufficient during the construction phase of the project, additional measures should be taken, in accordance with the findings of the relevant monitoring program. (CMM 16).	Impacts related to construction work, prevention of accidental pollution and implementation of good construction practices.
Natural Biotic Environment	Flora, fauna, habitats and protected areas	Protection of the terrestrial living environment	CMM 63. During the construction phase in the onshore section, which is located in a zone outside Natura sites but with sand dunes, it is proposed: • (A) Avoiding disturbance and interventions in the sand dune zone during the breeding season of turtles and wading birds. In particular, avoiding the period from mid-April to the end of June for the excavation and installation of the pipeline in the sand dune zone. This restriction will avoid disturbance during the breeding season and the possible destruction / abandonment of bird or turtle nests.	Impacts related to construction work and the application of good construction practices.

Environmental Parameter	Target of proposed measure	Construction Mitigation Measures (CMM)	Potentially Significant Impacts to Avoid/Minimize/Address
		• (B) In order to maintain the sand dunes in good condition during the excavation phase for the installation of the pipeline, the 20 cm deep surface layer (surface zone with seeds) should be removed and placed in a special zone separately (appropriately marked) from the sand of the deeper layers. After the pipeline is installed, this layer should be placed on the surface again. This way the seeds are preserved and the dunes will regenerate, • (C) No construction site or material storage area should be formed on the dunes to avoid soil compaction and the destruction of the flora on the dunes.	
		CMM 64. Implement a Biodiversity and Wildlife Management Plan and Environmental Monitoring Program (CMM 17), with specific actions and indicators, frequency and methodology for conducting recordings / fieldwork / measurements per environmental parameter.	Impacts related to construction work
	Marine Environment Protection	CMM 65. The speed of all vessels related to the implementation of the Project should not exceed 20 knots, in order to minimize the possibility of collision with marine mammals and sea turtles.	Impacts related to construction work, accident prevention and the application of good construction practices.
	Marine Environment Protection	CMM 66. The support vessel for the installation of a 20 km long submarine pipeline using the S-lay method (Phase 3) and its backfilling (Phase 5) shall carry 2 certified marine mammal observers (MMOs). Before the start of construction work, the MMOs should examine the presence of marine mammals within 500 m of the activity site. Noisy work should not commence if marine mammals have been sighted within this radius or until at least 20 minutes have passed since the last sighting. For periods of darkness or poor visibility (such as fog) the MMOs should use night vision binoculars or passive acoustic monitoring devices.	
		A Chemical Use Plan (CMM 60) should be implemented and for the suitability of the chemicals to be used, CMM 61 and CMM 62 should be observed.	
		CMM 67. In the event of a collision between a project vessel and marine mammals, the incident should be reported to the competent Directorate of Natural Environment and Biodiversity of the Ministry of Environment and the relevant Management Unit	Impacts related to construction work and potential accidents.
		CMM 68. It is recommended to avoid implementing the construction stage in the marine environment during the breeding season of the cormorant (February - May period).	Impacts related to construction work and the application of good construction practices.
	Minimizing Impacts on the Environment	The main factor for the general protection of the environment of the wider area during construction work is the appropriate organization and proper operation of the construction site.	Impacts related to activities outside the project area of occupancy and minimization of

Environmental Parameter		Target of proposed measure	Construction Mitigation Measures (CMM)	Potentially Significant Impacts to Avoid/Minimize/Address
		Using Good Practices	For the protection of water quality, the implementation of measures (CMM 6 to CMM 8, CMM 11, CMM 13) is recommended.	the zone of influence of impacts.
			CMM 69. All hazardous materials on site should be stored in a manner that prevents access by wildlife. Oil or fuel containers should be closed and deep holes or large pits in the ground should be covered. In addition, special care should be taken during construction to avoid trapping or killing wildlife.	Impacts related to waste and construction materials management.
			CMM 70. Appropriate organization of the surrounding area so as to prevent the spread of fire (for example, use of non-flammable building and decoration materials, creation of fire-fighting zones in key locations that will stop the spread of a potential forest fire, installation of fire tanks and other fire-fighting equipment in accordance with the fire protection studies of the area and the recommendations of the relevant fire department, etc.).	Impacts related to construction work, accident prevention and the implementation of good construction practices.
			CMM 71. Systematic cleaning and maintenance of the surrounding area and the facilities within the project site, so as to prevent the outbreak and spread of fire (for example, systematic cleaning of waste that may be spread by project workers or occasional visitors to the wider area, systematic cleaning of biomass waste resulting from the management of vegetation in adjacent areas, systematic control and monitoring of the condition of infrastructure networks, etc.).	
			CMM 72. Development of an effective fire extinguishing system. Legal requirements for fire safety and fire extinguishing may not be sufficient and additional measures may need to be taken. For example, installing more fire water tanks, installing backup fire extinguishers, etc.	
			CMM 73. Development of a fire response procedure that will include the organization of fire safety procedures, training of personnel for emergency situations involving the risk of fire and cooperation with the local fire department.	
			To protect the living environment from activities of management, disposal, and use of construction materials and waste and cleaning and maintenance of vehicles and equipment, it is proposed to implement measures from CMM 20 to CMM 29, CMM 31 to CMM 32 and CMM 38 to CMM 39	Impacts related to the operation of the construction site and mainly the management of waste and construction materials.
		The protection of the living environment from improper practices, damage or negligence.	To control and avoid possible incidents of accidental pollution that would have a direct impact on the soil and therefore on the living environment of the area. To protect the quality of the living environment from improper practices, damage or negligence, the measure CMM34 is proposed.	Impacts related to accidental pollution during normal construction phase activities

Environmental Parameter		Target of proposed measure	Construction Mitigation Measures (CMM)	Potentially Significant Impacts to Avoid/Minimize/Address
		Minimizing impacts through information / education / communication actions	CMM 74. Provide detailed information to employees, both during the construction and operational phases, so that all environmental conditions are met, especially those concerning the natural living environment.	Impacts related to construction work
Ανθρωπογενές Περιβάλλον	Spatial Planning - Land Use	Minimizing impacts on the human environment through the use of good practices	CMM 75. Compliance with the requirements of current spatial planning and best practices	Impacts related to construction work and the transport of materials and waste
			CMM 76. Particular attention should be paid when carrying out work and passing machinery/vehicles near infrastructure and buildings to avoid causing damage..	
			The contractor is obliged to remove all facilities created for the needs of the construction and to return the site to the condition it was in before the start of the project. Therefore, it is proposed to apply the measure (CMM13).	
	Structure and Functions of the Human Environment	Minimizing impacts on the structure and functions of the Anthropogenic Environment through the use of good practices	Proper organization and proper operation of the works will contribute to limiting the disturbance caused to the anthropogenic functions of the area and the temporary visual pollution caused. Also, the fencing of the construction site and the work areas should be done in an aesthetic manner, so as to limit the temporary alteration of the image of the area. For the protection of the anthropogenic environment, the implementation of measures (CMM 6 to CMM 8, CMM 11, CMM 13) is proposed.	Impacts related to the construction method and the project schedule.
			CMM 77. The works should be adjusted in time, so as to avoid intense pressures on productive anthropogenic activities and implementation of measures related to the reduction of negative impacts (indirectly from other parameters) that are proposed in detail in the relevant fields.	Impacts related to potential disturbances to the anthropogenic functions of the area during the construction phase.
			CMM 78. Implement a full Stakeholder Engagement Plan in line with EBRD PR1 / PR4 / PR5 / PR8 / PR10, including a Grievance Mechanism (GMM) to establish strong, constructive and flexible relationships with stakeholders and build understanding with the active participation of individuals, groups and organizations in the Project, and designate adequately trained staff (including a Grievance Mechanism Officer) to manage and monitor and report on the implementation of the Stakeholder Engagement Plan.	Impacts related to potential pressures on the anthropogenic functions of the area from construction work
			CMM 79 In accordance with the Stakeholder Engagement Plan and grievance management requirements, respond/provide feedback to stakeholders and affected communities and implement appropriate adjustments to the Project as a result of consultations and grievances.	Impacts related to potential lack of information regarding the construction of the Project, potential insufficient

Environmental Parameter	Target of proposed measure	Construction Mitigation Measures (CMM)	Potentially Significant Impacts to Avoid/Minimize/Address
			cooperation with stakeholders and handling of complaints.
Cultural Heritage – Underwater Cultural Heritage	Minimizing Impacts on Cultural Heritage – Underwater Cultural Heritage using Good Practices	CMM 80. Compliance with the specifications and requirements of applicable national legislation and best practices such as EBRD PR8 (Cultural Heritage).	Impacts related to the possible discovery of incidental findings during the construction phase
		CMM 81. Before the start of construction of the project, the competent Archaeological Services will be notified in a timely manner and in writing, so that they can arrange for the supervision of the projects by a specialized employee. The opinions and observations of the competent Archaeological Services will be taken into account. Any reservations of the archaeological services will be taken into account and, if necessary, appropriate modifications will be made to the design or construction methodology of the project. In the event of findings, construction activities will be suspended and the chance finds procedure required by Greek legislation ((Law 3028/2002 as amended and in force, Law 4858/2021 as amended and in force), EU legislation and in accordance with best practices such as PR8 of the EBRD (Cultural Heritage).	
Socio-economic environment	Minimizing impacts on the socio-economic environment through the use of good practices	Measures related to the reduction of negative impacts on the socio-economic environment (indirectly from other parameters) are proposed in detail in the relevant fields for noise, air pollution, dust, etc.	Indirect impacts from other environmental parameters related to construction work
		CMM 82. Utilization of local labor and technical resources as much as possible and preference for suppliers from the wider project area to stimulate local employment and economy.	Impacts on the local economy and employment related to construction work
		CMM 83. A particularly effective practice for dealing with and avoiding any protests from the residents of the area is, before the start of the works, informing the residents by the supervising authority and the contractor about the type and duration of the works. Therefore, it is proposed to implement the measures CMM 78 and 79	Impacts related to potential lack of information regarding the construction of the Project, potential inadequate cooperation with stakeholders and handling of complaints.
Health and safety	Minimizing health and safety impacts by using good practices	CMM 84. Implementation of a legal framework for labor matters and development and implementation of a Project-specific Human Resources Management Plan and Human Resources Policy.	Impacts on human resources and the local community related to construction work
		CMM 85. Strictly comply with the safety regulations provided for by law.	

Environmental Parameter	Target of proposed measure	Construction Mitigation Measures (CMM)	Potentially Significant Impacts to Avoid/Minimize/Address
		CMM 86. Since construction work by its nature involves the possibility of causing accidents. It is recommended: • Strictly comply with the safety regulations for construction sites provided for by law. • Preparation of an Occupational Risk Assessment (ORA) • Establishment of a Safety and Health Plan and File (OSH and OSH) and strict compliance with the provisions, in compliance with national legislation and the provisions of PR4 of the EBRD. The OSH and OSH should be adjusted in accordance with the progress of the work and in any case contain real and updated data.	
		CMM 87. Employment of a Safety and Health Coordinator and provision of Safety Technician and Occupational Physician services	
		CMM 88. Development of a policy for the prevention and response to violence and harassment at work and gender-based violence and harassment and inclusion in the Human Resources Management Plan	
		CMM 89. As part of the Human Resources Management Plan and the grievance mechanism, implement a procedure for reporting incidents of violence and harassment.	
		CMM 90. Informing and training employees in accessible formats on the risks, prevention, protection and obligations related to addressing violence and harassment at work and gender-based violence and harassment	
		CMM 91. Ensure the integration of requirements on addressing violence and harassment at work and gender-based violence and harassment in requirements for contractors and subcontractors.	
		CMM 92. Implementation of internal Occupational Health and Safety policies and actions (e.g. training and certification in the safe execution of work, "Work Stoppage Policy", "Work Stoppage Order", "Health, Safety, Environmental & Social Responsibility Policy", "Equal Opportunities Policy", the "Diversity and Inclusion Policy", "Code of Ethics", etc.)	
		CMM 93. Provision of all necessary protective equipment to personnel in accordance with Law 3850/2010 and OHS. Special equipment defined in accordance with the Fire Prevention Plan and the Waste Management Plan	
		CMM 94. The construction site must be fenced off so that the public cannot access it and places where the works are incomplete.	Impacts related to construction work
		CMM 95. There should be appropriate signage to inform the public about the dangers and at the same time prevent their access to the construction sites.	

Environmental Parameter	Target of proposed measure	Construction Mitigation Measures (CMM)	Potentially Significant Impacts to Avoid/Minimize/Address
Technical Infrastructures	Smooth operation of sewage and waste management infrastructure	To protect technical infrastructure from activities of management, disposal, and use of construction materials and waste and cleaning and maintenance of vehicles and equipment, it is proposed to implement measures from CMM 20 to CMM 29, CMM 31 to CMM 32 and CMM 38 to CMM 39.	
	Ensuring smooth and safe navigation conditions	CMM 96. Collaboration between the proposed Project operator, the relevant authorities and maritime bodies to identify safe navigation routes around the demarcated area for the development of the Project. This includes timely notification of the relevant port authorities regarding the planned works.	
		CMM 97. The works should be designed to minimize their impact on existing shipping lanes, such as scheduling activities, as far as possible, during periods of lower maritime traffic to avoid periods of intense fishing, commercial or tourist traffic.	
		CMM 98. Regular inspections should be carried out to ensure compliance with the regulations and conditions that have been set, in order to avoid any risks to navigation.	
	Minimizing impacts on the road network	CMM 99. During transport and travel on the wider road network, special precautions should be taken by machinery operators and heavy vehicle drivers to avoid causing damage to the networks.	
		CMM 100. If required, information signs and appropriate road safety markings should be placed in the immediate area of the project and traffic regulations should be implemented, under the responsibility of the contractor. Where possible, real-time updates should be provided via digital platforms (e.g. traffic management applications or GPS) to guide road users.	
		CMM 101. Optimization and minimization of vehicle movements, optimization of required travel times and maximization of vehicle utilization rates are the principles that apply to vehicles transporting passengers, goods and waste during construction.	
		CMM 102. The transport of bulky parts of the required equipment throughout the road network should be carried out after consultation with the competent Traffic Police Directorates and after their recommendations have been taken into account (e.g. escort vehicles, alternative routes, transport schedule, etc.).	
		CMM 103. Collaboration between the proposed Project entity and the relevant transport authorities to align construction schedules with public works or other infrastructure projects.	

Environmental Parameter		Target of proposed measure	Construction Mitigation Measures (CMM)	Potentially Significant Impacts to Avoid/Minimize/Address
			CMM 104. Scheduling transport to avoid, as far as possible, peak hours or times when the road transport network is congested.	
		Minimizing impacts on utility networks	CMM 105. Implementation of good energy management practices. Monitoring and control of heating, ventilation and cooling systems, as well as IT and communications systems. Installation of energy-saving lighting.	
			CMM 106. All persons responsible for the public utility networks that pass through the immediate area and may be affected must be notified in a timely manner by the manufacturer.	

11.3 MEASURES DURING THE OPERATION PHASE

Chapter 10 explored the activities during the normal operation of the Project that could potentially cause undesirable adverse impacts, in terms of their interaction with a series of Environmental and Social Parameters.

The following presents the proposed minimization/mitigation/avoidance/coping measures for the potential impacts that have been analyzed/assessed and assessed as minor, moderate or significant as appropriate (within the context of this project, the estimated impacts range from negligible to moderate, as discussed in detail in the relevant Chapter 10).

In the event that during their Final Assessment, some impacts were assessed as **Moderate**, prevention/mitigation/coping measures are proposed within the context of this Chapter, so that these impacts become at least **Minor**.

Furthermore, since within the framework of the proposed Project, the philosophy of the implementing body is to achieve the desired technical result while causing the minimum possible environmental footprint, additional mitigation measures are proposed even in the case of potential impacts that were assessed as **Negligible**.

The following are general measures during the Operation Phase:

- Implementation of the Environmental Monitoring Program.
- Implementation of the Project's EMS.

The following Table presents the measures to prevent, minimize and address potential adverse environmental and social impacts during the Operation phase of the proposed Project.

Table 11-2: Measures to prevent, minimize and address potential adverse environmental and social impacts during the operational phase of the proposed Project

Environmental Parameter		Objective of Proposed Measure	Operational Countermeasures (OCM)	Potentially Significant Impacts to Avoid/Minimize/Address
Natural Abiotic Environment	Climatic and Bioclimatic Characteristics	Minimizing the impacts of air emissions (pollutants and greenhouse gases) on climate change	OCM 1. In order to protect from the machinery and vehicles exhaust gases, their regular maintenance is required, which is necessary anyway. It is noted that maintenance should not be carried out within the work area.	Impacts contributing to climate change due to combustion emissions from machinery, vehicles and vessels during the operational phase of the Project.
			OCM 2. The machinery, vehicles and equipment that will participate in the operation of the project must also meet exhaust emission specifications in accordance with EU standards for such machinery and not be of old technology that emits increased pollutants.	
			ΜΑΛ 3. The vessels to be used shall fully comply with the international standards of the MARPOL 73/78 Convention, Annex VI "Regulations for the Prevention of Air Pollution from Ships". Annex VI regulates emissions of ozone-depleting compounds, nitrogen oxides (NOX), sulfur oxides (SOx) and volatile organic compounds (VOCs).	
			OCM 4. All machinery and devices that use electricity must be of the highest energy class.	
			OCM 5. Avoid unnecessary operation of the engines of vessels approaching the Project's infrastructure.	
			OCM6. Minimize vehicle movements within the project boundaries and avoid unnecessary operation of vehicle engines related to the operation of the project.	
			OCM 7. Avoid unnecessary operation of external lighting.	
			OCM 8. All interior lighting fixtures should be LED and controlled by an automation system that will adjust the intensity based on external lighting.	
		Minimizing impacts through the process of monitoring, identifying and addressing them	OCM 9. It is recommended to implement the Environmental Monitoring Program, as specified herein, which must include an annual calculation of the project's carbon footprint.	
	Morphological and		OCM 10. Systematic maintenance of the Project's onshore and offshore facilities.	
			OCM 11. Maintaining cleanliness, both of the land and sea areas of the Project.	

Environmental Parameter		Objective of Proposed Measure	Operational Countermeasures (OCM)	Potentially Significant Impacts to Avoid/Minimize/Address
	Topographical Characteristics	Minimizing impacts by using good practices	OCM 12. For the management of solid waste that will come from the packaging of materials/maintenance of the facilities and from the cleaning, living and hygiene materials of the staff, bins will be placed in appropriate locations of the facility. In addition, the waste will be transported outside the facility at frequent intervals.	Impacts related to the physical presence and operation of the project
			OCM 13. The waste resulting from maintenance (electromechanical equipment parts, conductors, batteries, etc.) will be transported outside the facility under the responsibility of the maintenance technicians and will be recycled.	
			OCM 14. The management of hazardous waste (collection, transport, storage, processing, recovery or disposal) should be carried out by a natural or legal person (public or private law) that has been granted a relevant permit, or the hazardous waste should be delivered with the authorization of the project contractor, to approved alternative waste management systems.	
			OCM 15. The temporary storage of hazardous waste (at the project facilities until its collection) should be carried out using special UN-standard packaging for solid waste.	
			OCM 16. The disposal of other (non-hazardous waste) is carried out in consultation with the relevant local authority as well as with device recycling bodies and in accordance with the general provisions governing waste management and the recycling of paper, glass, aluminum, etc. And always based on the provisions of Law 4819/2021. OCM 17. In the event that any potential failures are identified, the project body will be responsible for both addressing them and for the remediation of potential adverse environmental impacts as a result.	
			OCM 18. Regarding the risk of fire, all necessary fire safety and firefighting measures should be implemented in accordance with the legislation and the guidelines of the Fire Department.	
			OCM 19. Any storage, even temporary, of waste or construction materials (e.g. for facility maintenance work) outside the boundaries of the project facilities is prohibited.	
		Ελαχιστοποίηση των επιπτώσεων με τη χρήση ορθών ως προς τη συντήρηση / εκσυγχρονισμό του έργου	OCM 20. In the event that potential failures are identified, the project operator will be responsible for both addressing them and remediating potential adverse environmental impacts as a result.	

Environmental Parameter		Objective of Proposed Measure	Operational Countermeasures (OCM)	Potentially Significant Impacts to Avoid/Minimize/Address
		Minimizing impacts through the process of monitoring, identifying and addressing them	The implementation of the Environmental Monitoring Program, as prescribed in the present (OCM 9), is recommended.	
	Geological, tectonic and soil characteristics	Protecting the soil and seabed through sound waste management	The measures from OCM11 to OCM19 also apply to minimize the impacts on geological, tectonic and soil characteristics.	Impacts related to the physical presence and operation of the project
			OCM 21. Waste should be managed in accordance with the Waste Management Plan and based on applicable legislation. There should be a sufficient number (and appropriate size) of waste bins on the land area of the project. Also, recycling bins should be placed with visible markings so as to encourage their use.	Impacts related to waste management.
		Minimizing impacts on the seabed	OCM 22. Under the responsibility of the project owner, the discharge of solid waste from vessels and other users of the project directly into the sea should be strictly prohibited.	
			OCM 23. To ensure that the maintenance materials of the offshore sections of the Project do not contain the substances referred to in the decision of the Supreme Chemical Council 1100/91/91 (Government Gazette B' 1008/12–12–1991) and in the Ministerial Decrees 475/2002/03 (B' 208/2003) and 121/2003/03 (B' 1045/2003), as applicable from time to time, namely mercury, arsenic and organotin compounds, as well as other chemical substances that are considered hazardous, in accordance with the relevant legislation on hazardous substances and for which restrictions apply to their circulation and use for the marine and aquatic environment in general.	Impacts related to the physical presence and operation of the project
		Protecting the soil and seabed through sound waste management	OCM 24. Liquid and solid waste containing hazardous or potentially hazardous substances shall be immediately transferred to leak-proof containers, which shall be stored (temporarily and for a short period of time) in a covered area with an impermeable industrial concrete floor and the necessary secondary containment systems. Such waste shall be managed in accordance with the Waste Management Plan and in accordance with applicable legislation. Their transport and final disposal or treatment shall be carried out by a specialized and appropriately licensed company, in accordance with the best available practices.	Impacts related to waste management.

Environmental Parameter		Objective of Proposed Measure	Operational Countermeasures (OCM)	Potentially Significant Impacts to Avoid/Minimize/Address
		Minimizing impacts from poor practices, damage or negligence	OCM 25. The operation of the project's offshore facilities is expected to increase the movement of watercraft within the bay, increasing at the same time the risk of accidental pollution of the marine environment. Therefore, accidental pollution prevention control should be implemented by the project owner. All preventive measures should be taken to avoid oil spills due to damage, negligence, etc. and appropriate actions should be taken to minimize such incidents. Furthermore, the response to accidents (causing environmental impacts, such as the spillage of ship fuel) throughout the project should be provided for in the project owner's program. Thus, he should have the plan and the appropriate materials to respond to accidental pollution incidents both on land and in the marine area. The project owner must provide the project facilities with appropriate absorbent materials (e.g. sawdust, sand) in sufficient quantities, through which the adsorption and consequently the containment and limitation of the dispersion of leaking fuels and lubricants will be sought. After their use, these absorbent materials must be managed appropriately in accordance with applicable legislation as hazardous waste.	Impacts related to accidental pollution.
			OCM 26. The storage of fuels, machinery and construction materials should be carried out in a way that minimizes the risk of pollution of soil and water resources. Chemicals, fuels and lubricants should be stored in appropriately designed and sealed areas away from water recipients. Collection containers should be used on stationary machinery to avoid pollution of soil and groundwater by oils and lubricants.	Impacts related to accidental pollution.
		Minimizing impacts through the process of monitoring, identifying and addressing them	It is recommended to implement the Environmental Monitoring Program, as specified in the present context, which must necessarily include an annual calculation of the project's carbon footprint. (OCM 9).	Impacts related to the physical presence and operation of the project
	Air quality	Minimizing impacts through the use of good practices	For protection from exhaust gases from Project machinery and CO2 transport vehicles, the implementation of the aforementioned measures is recommended. OCM 1 to OCM 8	Impacts related to the physical presence and operation of the project

Environmental Parameter		Objective of Proposed Measure	Operational Countermeasures (OCM)	Potentially Significant Impacts to Avoid/Minimize/Address
		Minimizing impacts through the process of monitoring, identifying and addressing them	It is recommended to implement the Environmental Monitoring Program, as specified in the context of this (OCM 9).	
	Noise and vibrations	Minimizing impacts through the use of good practices	OCM 27. To avoid noise emissions from project equipment, vehicles and CO_2 transport vessels, their regular maintenance is required, which is necessary anyway..	Impacts related to the physical presence and operation of the project
			OCM 28. Project machinery, vessels and CO_2 transport vehicles must meet noise emission specifications in accordance with EU standards.	
			OCM 29. Implementation of appropriate soundproofing measures on the equipment within the compressor station, so that the legislative limits are respected within the boundaries of residential areas.	
			OCM 30. Operation of equipment on the platforms (pumps, electric heaters) based on low noise emission specifications. In the event that the implementation of the Environmental Monitoring Program or complaints from interested parties result in noise emission limits being exceeded, the necessary corrective measures should be taken, in the form of interventions in the project operation process or through the use of appropriate equipment (e.g. sound barriers).	
			OCM 31. Installation of soundproofing in noisy parts of machinery and equipment on platforms.	
			To avoid noise emissions, it is also recommended to implement the aforementioned measures OCM 1 to OCM 8.	
		Minimizing impacts through the process of monitoring, identifying and addressing them	The implementation of the Environmental Monitoring Program, as specified in the present (OCM 9), is recommended.	
	Water	Protecting marine waters through proper waste management	OCM 32. Under the responsibility of the project owner, the discharge of liquid waste (untreated sewage, lubricant residues, petroleum products and bilge water) from vessels approaching the project directly into the sea should be strictly prohibited.	Impacts related to waste management.

Environmental Parameter		Objective of Proposed Measure	Operational Countermeasures (OCM)	Potentially Significant Impacts to Avoid/Minimize/Address
		Minimizing impacts on water quality through good practices	OCM 33. In the event of discharge of liquid waste (untreated sewage, lubricant residues, petroleum products and bilge water), the Project Owner must have the plan and appropriate materials to deal with pollution incidents both on land and in the marine environment.	
		Protecting marine waters by preventing spills	OCM 34. Implementation of emergency risk prevention and mitigation measures related to a potential CO_2 leak as included in Table 12 4: Measures to Prevent Significant Incidents of this Chapter.	Impacts related to the operation of the project and potential accidental pollution.
		Protecting marine waters through good practices	OCM 35. Compliance with international guidelines and the IMO International Safety Management Code (ISM), for the safe operation of ships and the prevention of environmental pollution, as well as strict compliance with navigation, communication and safety procedures.	
			OCM 36. Compliance with MARPOL requirements for waste and sewage, with emphasis on the following: Annex I Regulations for the Prevention of Pollution by Oil, Annex III Regulations for the Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form, Annex IV Regulations for the Prevention of Pollution by Sewage from Ships, Annex V Regulations for the Prevention of Pollution by Solid Wastes from Ships.	
			OCM 37. A Chemical Use Plan shall be implemented which shall include: (i) The chemicals which the operator intends to use during the operations. A list of the ecotoxicity of such chemicals. (ii) The purpose or purposes for which the operator intends to use the chemicals. (iii) The maximum concentrations of the chemicals which the operator intends to use in any other substances, as well as the maximum quantities intended to be used in any specified period. (iv) The area within which the chemical may escape into the marine environment.	Impacts related to the operation of the project and the implementation of good management practices.
			OCM 38. Use approved biocides and anti-corrosion agents that meet the requirements of applicable national and EU legislation and comply with international marine protection conventions, such as the Barcelona Convention in particular. The substances to be used for the above purposes should be selected from the "OSPAR List of Substances Used and Discharged Offshore which Are Considered to Pose Little or No Risk to the Environment (PLONOR)" in its current version. The use of substances belonging to the "OSPAR List of Substances of Possible Concern (LSPC)" is not permitted.	
			To ensure that the construction and maintenance materials of the project (paints, insulation, coatings, etc.) do not contain the substances referred to in the decision of the Supreme Chemical Council 1100/91/91 (Government Gazette B' 1008/12−12−1991) and in the Ministerial Decrees 475/2002/03 (B' 208/2003) and 121/2003/03 (B' 1045/2003), as	Impacts related to the operation of the project and the implementation of good management practices.

Environmental Parameter		Objective of Proposed Measure	Operational Countermeasures (OCM)	Potentially Significant Impacts to Avoid/Minimize/Address
			applicable from time to time, namely mercury, arsenic and organotin compounds, as well as other chemical substances that are considered hazardous, in accordance with the relevant legislation on hazardous substances and for which restrictions apply to their circulation and use in the marine and aquatic environment in general. (OCM 23.).	
		Protecting marine waters through good practices	OCM 39. The vessels that will be used for the needs of the project will comply with the International Regulations for Preventing Collisions at Sea 1972 (IRCS).	Impacts related to accidental pollution during normal operations
			OCM 40. Implementation of fueling procedures in accordance with applicable national regulations and vessel specifications.	
			OCM 41. All necessary measures should be taken to avoid pollution of the sea during the construction phase, as well as any additional measures that may be indicated by the relevant Port Authority, in accordance with Law 743/77 (Government Gazette A 319), as codified by Presidential Decree 55/98 (A' 58) and in force from time to time.	
		Protecting marine waters through sound waste management	Implement a "Waste Management Plan" with the aim of ensuring that the waste produced (hazardous, non-hazardous) is managed properly. (OCM 21)	Impacts related to waste management.
		Protecting marine waters through sound practices	OCM 42. The water pumped from the wells will be treated in appropriate systems on the Delta platform, which will have an efficiency that will achieve the applicable discharge limits. In particular, the treatment that will be required will be further investigated after the collection and analysis of water samples from the aquifer in the storage complex.	
			OCM 43. To Water from the surfaces of the platforms (cleaning and rainwater) will be directed for disposal through appropriate cleaning systems, in accordance with the International Convention for the Prevention of Pollution from Ships (MARPOL).	
		Minimizing impacts through the process of monitoring, identifying and addressing them	It is recommended to implement the Environmental Monitoring Program, as specified in the context of this (OCM 9).	Impacts related to the physical presence and operation of the project
Natural Biotic	Flora, fauna, habitats and protected areas	Protection of the terrestrial and	OCM 44. Implement a Biodiversity and Wildlife Management Plan and Environmental Monitoring Program (CMM 17), with specific actions and indicators, frequency and methodology for conducting recordings / fieldwork / measurements per environmental parameter.	Impacts related to the operation of the project and

Environmental Parameter	Objective of Proposed Measure	Operational Countermeasures (OCM)	Potentially Significant Impacts to Avoid/Minimize/Address
	marine living environment		the implementation of good management practices.
		A Chemical Use Plan (OCM 35.) should be implemented and for the suitability of the chemicals to be used, OCM 23 and OCM 38 should be adhered to.	Impacts related to the operation of the project and the implementation of good management practices.
	Protection of the marine environment	OCM 45. In the event of a collision between a project vessel and marine mammals, the incident should be reported to the competent Directorate of Natural Environment and Biodiversity of the Ministry of Environment and Natural Resources and to the relevant Management Unit.	Impacts related to the operation of the project and the implementation of good management practices.
	Minimizing impacts on the living environment through the use of good practices	OCM 46. Appropriate organization of the surrounding area so as to prevent the spread of fire (for example, use of non-flammable building and decoration materials, creation of fire-fighting zones in key locations that will stop the spread of a potential forest fire, installation of fire tanks and other fire-fighting equipment in accordance with the fire protection studies of the area and the recommendations of the relevant fire department, etc.).	Impacts related to construction work and potential accidents.
		OCM 47. Systematic cleaning and maintenance of the surrounding area and the facilities within the project site, so as to prevent the outbreak and spread of fire (for example, systematic cleaning of waste that may be spread by project workers or occasional visitors to the wider area, systematic cleaning of biomass waste resulting from the management of vegetation in adjacent areas, systematic control and monitoring of the condition of infrastructure networks, etc.).	
		OCM 48. Development of an effective fire extinguishing system. Legal requirements for fire safety and fire extinguishing may not be sufficient and additional measures may need to be taken. For example, installing more fire water tanks, installing backup fire extinguishers, etc.	
	Minimizing impacts through information / education / communication actions	OCM 49. Development of an effective fire extinguishing system. Legal requirements for fire safety and fire extinguishing may not be sufficient and additional measures may need to be taken. For example, installing more fire water tanks, installing backup fire extinguishers, etc.	
		OCM 50. Provide detailed information to employees, both during the construction and operational phases, so that all environmental conditions are met, especially those concerning the natural living environment.	

Environmental Parameter		Objective of Proposed Measure	Operational Countermeasures (OCM)	Potentially Significant Impacts to Avoid/Minimize/Address
		Minimizing impacts through the process of monitoring, identifying and addressing them	It is recommended to implement the Environmental Monitoring Program, as specified in the context of this (OCM 9).	Impacts related to the physical presence and operation of the project
Man-made Environment	Spatial Planning - Land Use	Minimizing impacts through the process of monitoring, identifying and addressing them	OCM 51. Compliance with the requirements of current spatial planning and best practices	Impacts related to the operation of the project and the transport of materials and waste
	Structure and Functions of the Human Environment	Minimizing impacts on the Anthropogenic Environment through the use of good practices	OCM 52. Implementation of a Grievance Mechanism (GMM) to create strong, constructive and flexible relationships with stakeholders and build understanding with the active participation of individuals, groups and organizations in the Project, and designation of adequately trained staff (including a Grievance Mechanism Officer) to manage and monitor and report on its implementation.	Impacts related to potential pressures on the anthropogenic functions of the area from the operation of the project.
			OCM 53. In accordance with the Grievance Mechanism and grievance management requirements, respond/provide feedback to stakeholders and affected communities and implement appropriate adjustments to the Project as a result of consultations and grievances	Impacts related to potential deficiencies in information regarding the operation of the Project, potential insufficient cooperation with stakeholders and handling of complaints.
	Cultural Heritage	Minimizing impacts on the structure and functions of the Anthropogenic Environment through the use of good practices	OCM 54. In case of findings during construction works, the chance finds procedure required by Greek legislation ((Law 3028/2002 as amended and in force, Law 4858/2021 as amended and in force), EU legislation and in accordance with best practices such as EBRD PR8 (Cultural Heritage) will be applied in the operational phase.	Impacts related to the potential discovery of accidental finds of cultural interest

Environmental Parameter		Objective of Proposed Measure	Operational Countermeasures (OCM)	Potentially Significant Impacts to Avoid/Minimize/Address
		Minimizing impacts on Cultural Heritage – Underwater Cultural Heritage through the use of good practices		
	Socio-economic environment	Minimizing impacts on the socio-economic environment using good practices	OCM 55. Measures related to the reduction of negative impacts on the socio-economic environment (indirectly from other parameters) are proposed in detail in the relevant fields for noise, air pollution, dust, etc.	Indirect impacts from other environmental parameters related to the operation of the Project
			OCM 56. Measures related to the reduction of negative impacts on the socio-economic environment (indirectly from other parameters) are proposed in detail in the relevant fields for noise, air pollution, dust, etc.	Impacts on the local economy and employment related to the operation of the Project
	Health and Safety	Minimizing impacts on health and safety using good practices	OCM 57. Implementation of a legal framework for labor matters and development and implementation of a Project-specific Human Resources Management Plan and Human Resources Policy.	Impacts on human resources and the local community related to the operation of the Project
			OCM 58. Strictly adhere to the safety regulations provided for by law.	
			OCM 59. Employment of a Safety and Health Coordinator and provision of Safety Technician and Occupational Physician services	
			OCM 60. Development of a policy for the prevention and response to violence and harassment at work and gender-based violence and harassment and inclusion in the Human Resources Management Plan	
			OCM 61. As part of the Human Resources Management Plan and the grievance mechanism, implement a procedure for reporting incidents of violence and harassment.	
			OCM 62. Informing and training employees in accessible formats on the risks, prevention, protection and obligations related to addressing violence and harassment at work and gender-based violence and harassment	

Environmental Parameter	Objective of Proposed Measure	Operational Countermeasures (OCM)	Potentially Significant Impacts to Avoid/Minimize/Address
		OCM 63. Implementation of internal Occupational Health and Safety policies and actions (e.g. training and certification in the safe execution of work, "Work Stoppage Policy", "Work Stoppage Order", "Health, Safety, Environmental & Social Responsibility Policy", "Equal Opportunities Policy", the "Diversity and Inclusion Policy", "Code of Ethics", etc.)	

11.4 SHUTDOWN – RESTORATION PHASE

The measures to prevent, minimize and address potential adverse environmental and social impacts during the decommissioning - decommissioning phase of the proposed Project are in most cases equivalent to the measures proposed for the construction phase of the Project. However, as this phase is placed in the medium, long-term, **the project operator will update the proposed measures at the relevant relevant time, depending on the then existing environmental conditions, legal obligations and technological choices, so as to achieve the best possible result in terms of the objective of environmental protection**.

The following are the Basic Principles for addressing potential impacts during the decommissioning - rehabilitation phase:

• Decommissioning should be carried out in a manner that minimizes environmental impacts. If this method differs significantly from that described in the EIA, application of Article 6 of Law is required. 4014/2011 as applicable.

• The basic equipment and facilities have already been designed to be easy to install and remove with the least possible disturbance to the environment.

• All Project equipment that ceases to serve productive or support activities is removed from its installation site and either reused elsewhere or disposed of in accordance with applicable waste management provisions.

• All decommissioning activities should be documented in accordance with the requirements and subject to regular inspections and/or monitoring to ensure that health, safety and environmental protection issues are minimized and appropriately managed.

• Cold cutting equipment should be used for cutting metal components and the use of explosives should be avoided.

• After the Project is decommissioned, the Project area should be restored and returned to its pre-construction condition.

• For the infrastructures for which decommissioning is not foreseen (submarine pipeline) within the framework of this Project, it should be ensured that there is no negative impact on the environment of the area in the long-term.

Therefore, the following Table presents indicative measures for the prevention, minimization and treatment of potential adverse environmental and social impacts during the Decommissioning - Decommissioning phase of the proposed Project.

Tablee 11-3: Measures to prevent, minimize and address potential adverse environmental and social impacts during the decommissioning - rehabilitation phase of the proposed Project

Environmental Parameter		Objective of Proposed Measure	Mitigation measures during the stop of operation (SMM)	Potentially Significant Impacts to Avoid/Minimize/Address
Natural Abiotic Environment	Climatic and Bioclimatic Characteristics	Minimizing the impacts of air emissions (gas pollutants and GHG) on climate change	**SMM 1.** To protect against exhaust fumes from machinery and vehicles working on the project's removal, regular maintenance is required, which is necessary anyway. It is noted that maintenance should not be carried out within the work area.	Impacts contributing to climate change due to combustion emissions from machinery, vehicles and vessels involved in decommissioning/decommissioning operations.
			SMM 2. The machinery, vehicles and equipment that will participate in the decommissioning of the project must also meet exhaust emission specifications in accordance with EU standards for such machinery and not be of old technology that emits increased pollutants.	
			SMM 3. The vessels to be used shall fully comply with the international standards of the MARPOL 73/78 Convention, Annex VI "Regulations for the Prevention of Air Pollution from Ships". Annex VI regulates emissions of ozone-depleting compounds, nitrogen oxides (NOX), sulfur oxides (SOx) and volatile organic compounds (VOCs).	
			SMM 4. Transport of materials: The transport of construction materials and waste by sea should be preferred over road transport, where technically possible and applicable.	Impacts related to waste management.
	Morphological and Topographical Characteristics	Minimizing impacts outside the project area	SMM 5. The construction site is proposed to be located within the designated area within the SIGMA industrial facility. Otherwise, the construction site facilities should be determined after approval by the relevant technical environmental study. Any activity outside the limits of those provided for the implementation of the works of the premises and construction site, which may lead to a degradation of aesthetics and alteration of the landscape (disposal of waste materials, parking of machinery, etc.) should be prohibited.	Impacts related to activities outside the project area of occupancy and minimization of the impact zone.
		Minimizing impacts through the use of good practices	SMM 6. The uncontrolled disposal of surplus materials in the immediate or wider area shall be prohibited. Under no circumstances shall the disposal of these materials be permitted in stream beds or other water bodies. The technical interventions included in the decommissioning of the project and related to the effective drainage of the project site, the hydraulic communication of the areas on either side of it, etc., shall be checked, cleaned and maintained systematically at regular intervals.	Impacts related to the management of waste and surplus materials.
			SMM 7. Systematic maintenance of the infrastructure and maintaining the cleanliness of the Project area is required.	

Environmental Parameter	Objective of Proposed Measure	Mitigation measures during the stop of operation (SMM)	Potentially Significant Impacts to Avoid/Minimize/Address
		SMM 8. Solid waste collection points should be designated on the construction site, as well as their regular collection, so as to avoid degradation of the landscape.	
		SMM 9. Any storage, even temporary, of removal materials outside the construction site area is prohibited.	Impacts related to the management of decommissioning materials and the project decommissioning schedule.
		SMM 10. The schedule for the execution of the works must be structured so that temporary material deposits are removed as soon as possible.	
	Minimizing impacts within the project's occupancy zone	SMM 11. Any type of project installation (machinery, structures, any type of waste, etc.) must be removed after the end of the specific phase of the project, regardless of the ownership status of the construction site.	Impacts related to the restoration of the project's occupation zone.
	Minimizing impacts using good practices	SMM 12. Moderate levels of work intensity are required.	Impacts related to the extent of the project's occupation zone and minimization of the zone of influence of the impacts.
	Minimizing impacts using good practices	SMM 13. All technically feasible measures should be taken to contain suspended materials (installation of filters/suspended solids containment curtains or other suitable equipment), with the aim of reducing the dispersion of the plume during the decommissioning of the offshore parts of the project and possible disposal of materials at sea. During the decommissioning of the proposed project, it is recommended, at a minimum, that modern equipment be used to contain suspended solid materials (special floating barriers - debris containment booms, siltation curtains, etc.) around the perimeter of the works being carried out, so that the quality and transparency of the water at a great distance is not affected by the construction activities, but also so that solid materials do not settle on a large area of the seabed. In the event that the measure proves to be partially sufficient during the construction phase of the project, additional measures should be taken, in accordance with the findings of the relevant monitoring program.	Impacts related to the removal operations.

Environmental Parameter		Objective of Proposed Measure	Mitigation measures during the stop of operation (SMM)	Potentially Significant Impacts to Avoid/Minimize/Address
		Minimizing impacts through monitoring, detection and response	SSM 14. The implementation of the Environmental Monitoring Program is recommended.	Impacts related to decommissioning operations
	Geological, tectonic and soil characteristics	Minimizing impacts on soil and seabed	The measures to minimize impacts on Morphological and Topographical Features also apply to minimizing impacts on Geological, Tectonic and Soil Features (SMM 5 to SSM 10).	Impacts related to various influences on a wide range of environmental parameters from the decommissioning of the project.
			SMM 15. Earthworks should be carried out primarily during the period of the year when there is no heavy rainfall and extreme wave conditions, in order to avoid soil washout and the creation of suspended particles, respectively. The planning of the works should include provision to avoid serious earthworks during the period of heavy rainfall and sea turbulence and to avoid earthworks on days when rain and strong waves are forecast. In the exceptional case of heavy rainfall or sea turbulence during the relatively short phase of the excavations, it is recommended to stop the works and place a geogrid on the slopes, if deemed geotechnically necessary.	Impacts related to the decommissioning method and project schedule.
			SMM 16. During the removal phase, methods and techniques should be applied to minimize the compaction of uncovered soils, such as limiting access during rainfall and using protective boards and low soil pressure machinery. Appropriate water-permeable materials should be used for the formation of parking areas within the construction site so as to limit rainwater runoff from the construction sites as much as possible.	Impacts related to the decommissioning method of the project.
		Protecting soil and seabed through proper waste management	SMM 17. All waste and debris that will arise from site activities during the decommissioning of the projects (solid and liquid, hazardous or not) should be appropriately managed by the Project Contractor, in accordance with the legislation, in order to avoid pollution of the area (soil, subsoil, surface and groundwater) from their uncontrolled disposal or from any leaks. A "Waste Management Plan" should be implemented during the construction / operation / decommissioning stages, examining all aspects of the project and the waste generated with the aim of ensuring that the waste generated (hazardous, non-hazardous) is managed properly.	Impacts related to the decommissioning method and project schedule.

Environmental Parameter		Objective of Proposed Measure	Mitigation measures during the stop of operation (SMM)	Potentially Significant Impacts to Avoid/Minimize/Address
			SMM 18. The construction sites should be equipped with waste bins in which to collect the urban waste of the workers on the construction sites. This waste should be collected by the Competent Local Authority or collection and transport body - in case this is not possible, the waste should be disposed of by the Project body in the existing collection system of the relevant Local Authority. It is noted that special care should be taken to ensure that this solid waste does not include rubble or materials that are hazardous, the disposal of which should be carried out in accordance with the applicable legislation on the respective categories of waste.	Impacts related to waste management.
			SMM 19. For the management of liquid waste from the project's decommissioning personnel, it is proposed to install chemical toilets and transport and dispose of them at the nearest available wastewater treatment plant and/or use the sanitation facilities of the company's existing facilities in the area.	Impacts related to waste management.
			SMM 20. Liquid and solid waste containing hazardous or potentially hazardous substances shall be immediately transferred to leak-proof containers, which shall be stored (temporarily for the short period of time during which the relevant work is carried out) in a covered area with the necessary secondary containment systems. Their transport and final disposal or treatment shall be carried out by a specialized and appropriately licensed company, in accordance with the best available practices.	Impacts related to the management of waste and project decommissioning materials.
			SMM 21. The management of any excess excavation products, as well as (non-hazardous) AEKKK produced from construction works, shall be carried out in accordance with the provisions of Joint Ministerial Decree 36259/1757/E103 (Government Gazette 1312/24-08-2011) “Measures, conditions and program for the alternative management of waste from excavations, constructions and demolitions”. Materials that cannot be reused/recycled within the project shall be delivered to a Collective Alternative Management System (SSED) approved by EOAN. • The management of waste from excavations, constructions and demolitions in the Project area is carried out in accordance with the provisions of Joint Ministerial Decision 36259/1757/E103/2010 through the following Alternative Management Systems (based on data from the Hellenic Recycling Organization (EOAN, https://www.eoan.gr): • SSED “Aggregates Recycling of Northern Greece S.A.”, with the distinctive title “AN.A.B.E. S.A.” • SSED “Aggregates Recycling of Central Macedonia S.A.”, with the distinctive title “ANA.KEM.” • SSED “Central Greece Recycling System Ltd.”, with the distinctive title “S.A.N.K.E. Ltd.”	Impacts related to waste management.

Environmental Parameter	Objective of Proposed Measure	Mitigation measures during the stop of operation (SMM)	Potentially Significant Impacts to Avoid/Minimize/Address
		• SSED "PEDMEDE ECO Limited Liability Company," with the distinctive title "PEDMEDE ECO MEPE."	
		SMM 22. In the event that at the time of decommissioning of the proposed project, it is not within the geographical scope of an approved Collective Alternative Management System by the Hellenic National Agency for Waste Management, the excess material must be disposed of at the nearest approved SSED or in an appropriate storage facility, after submission and approval of a Technical Environmental Study by the competent licensing authority, in accordance with paragraph 2 of Article 7 of Law 4014/2011 (Government Gazette 209/A 21.09.2011). In this case, the land area proposed by the contractor will be approved by the competent authority and in accordance with the provisions of the ELOT specification ΤΠ 1501-02-05-00-00. When selecting the location of the storage chamber, attention should be paid to the following: • The location of the storage chamber should not be within the boundaries of an ecologically sensitive or protected area. • Avoid areas with natural vegetation or fauna habitats. • Avoid location on productive land or in locations with surface water bodies. • Avoid location in locations that would affect the landscape of the area or would conflict with existing anthropogenic uses and activities. The location of the storage chamber should be preferred to be in an already disturbed location, which would have positive impacts on the environment of the study area. The method of disposal and the arrangement of the deposits will be determined in a relevant TEPEM, which will be prepared and submitted to the competent licensing authority before the start of the relevant works, in accordance with paragraph 2 of Article 7 of Law 4014/2011 (Government Gazette 209/A 21.09.2011).	
		SMM 23. The construction sites should be equipped with Recyclable Materials bins in which mixed recyclable materials of paper/cardboard, plastic, metal and glass should be collected. This waste should be collected by the Competent Local Authority or collection and transport entity - in case this is not feasible, the waste should be deposited by the Project entity in the existing collection system of the Local Authority (Recyclable Materials Sorting Center).	

Environmental Parameter		Objective of Proposed Measure	Mitigation measures during the stop of operation (SMM)	Potentially Significant Impacts to Avoid/Minimize/Address
			SMM 24. Separate collection of special waste streams such as Waste Electrical and Electronic Equipment (WEEE), Waste Batteries & Accumulators (WEE), Waste Lighting, Lamps and Small Appliances (WEE) should be carried out and collected by licensed collection, transport and management entities. In case this is not feasible, provision should be made for the disposal of the waste by the Project entity at appropriate WEEE recycling points.	
			SMM 25. The management of used mineral oils shall be carried out in accordance with the provisions of Presidential Decree 82/25.2.2004 (Government Gazette 64/A/2.3.04) on "Specification of measures and conditions for the management of used mineral oils", which replaced KYA 98012/2001/96. Waste lubricating oils (WLO) and liquids of each type shall be collected separately by category in order to be delivered to a Collective Alternative Management System approved by EOAN.	
			SMM 26. Hazardous waste management shall be carried out in accordance with the provisions of Joint Ministerial Decision 13588/725/2006 (Government Gazette 383B/28-3-2006) "Replacing Joint Ministerial Decision 19396/1546/97 (Government Gazette 604B/18-7-1997)".	
		Protection of soil and seabed through good construction practices	SMM 27. The maintenance of the removal and material transport machinery shall be carried out in an organized workshop in the area and not in the Works area. The contractor shall ensure that the maintenance program of the construction site machinery is properly organized, so that the oil changes and their regular maintenance are carried out in organized workshop areas. The oils, greases and other products of the mechanical parts of the earthmoving and other machinery shall be collected and disposed of appropriately, as provided for by the legislation (PD 82/2004, GG 64/A/2.3.2004).	Impacts related to the management of removal materials.
			SMM 28. Within the construction site, equipment and vehicles will be washed and cleaned frequently in specially designed areas in order to avoid leakage of hazardous substances through the generated liquid waste. To reduce the volume of liquid waste from this area, it is recommended that vehicles be cleaned first with dry means, e.g. brooms, brushes, etc. Also, low-water washing equipment such as pressure systems should be used.	Impacts related to cleaning and maintenance of vehicles and equipment

Environmental Parameter		Objective of Proposed Measure	Mitigation measures during the stop of operation (SMM)	Potentially Significant Impacts to Avoid/Minimize/Address
			SMM 29. The contractor should implement an accidental pollution prevention control, take all preventive measures to avoid oil spills due to damage, negligence, etc. and carry out appropriate operations to minimize such incidents. In addition, the manufacturer's program should include the handling of accidents throughout the entire work. Thus, the contractor should have the appropriate materials in his workshop to deal with accidental pollution incidents both on land and in the sea. The contractor should have the appropriate absorbent materials (e.g. sawdust, sand) available at the construction site in sufficient quantities, through which the adsorption and consequently the containment and limitation of the dispersion of leaking fuels and lubricants will be sought. After use, these absorbent materials should be properly managed in accordance with applicable legislation as hazardous waste. In addition, at least one of the vessels participating in the removal operations should be equipped with means to contain the spill, as well as with appropriate absorption and chemical dispersion machines for combating spills. The above should be explicitly stated in the contractor's contract of obligations and their implementation should be appropriately supervised during the removal.	Impacts related to accidental pollution.
		Minimizing impacts through the process of monitoring, identifying and addressing them	Συνίσταται η εφαρμογή του Προγράμματος Περιβαλλοντικής Παρακολούθησης (SMM 14).	Impacts related to the removal operations.
	Air quality	Minimizing impacts by using good practices	SMM 30. Wetting of surfaces and materials should be carried out to limit dust release during earthmoving work.	Impacts related to decommissioning operations, handling and transportation of materials
			SMM 31. The operation of machinery working on site should be carried out with careful handling, and the movement of trucks should be carried out at low speeds, in order to limit the release of dust.	
			SMM 32. Covering excavation waste deposits with a cover until their collection.	

Environmental Parameter		Objective of Proposed Measure	Mitigation measures during the stop of operation (SMM)	Potentially Significant Impacts to Avoid/Minimize/Address
			SMM 33. Trucks transporting aggregates should be equipped with a special cover in accordance with existing provisions and overfilling of trucks transporting bulk materials should be avoided.	
			SMM 34. In any construction site activity, where there is a possibility of dust, suspended particles or odorous substances being emitted, procedures and equipment should be adopted that will ensure the drastic reduction of these emissions, while the times of these procedures should be minimized.	
	Noise and vibrations	Minimizing impacts by using good practices	SMM 35. The contractor should choose the layout and scheduling of the individual tasks, so that there is no simultaneous operation of multiple machines in close locations and that the minimum possible disturbance is caused to the human-made environment of the immediate project area.	Impacts related to the removal method and project schedule.
			SMM 36. To avoid, as far as possible, the operation of the construction site and the movement of trucks on the urban road network within the settlements of the project area during quiet hours (Ministry of Public Works 1023/2/37/96 (Government Gazette 15/B/12.1.96).	
			SMM 37. The construction site machinery to be used must comply with the provisions of the legislation "on measures and conditions for noise emissions into the environment from equipment for use outdoors" (JMD 37393/2028/2003, Government Gazette 1418/B/2003, as amended by JMD 9272/471/2007, Government Gazette 286/B/2007) and must bear the CE conformity marking provided for by the above legislation.	Impacts contributing to noise emissions from machinery, vehicles and vessels involved in the removal operations.
		Minimizing impacts through the process of monitoring, identifying and addressing them	SMM 38. In any case, it is recommended to systematically monitor noise levels at the project boundaries during the relocation (implementation of the Environmental Monitoring Program and if exceedances are detected, additional measures should be taken. In addition, the measured levels of emitted noise should be taken into account, in terms of their impact on project workers and the workers should be provided with appropriate protective equipment (e.g. earplugs, etc.).	Impacts related to the removal operations

Environmental Parameter		Objective of Proposed Measure	Mitigation measures during the stop of operation (SMM)	Potentially Significant Impacts to Avoid/Minimize/Address
		Ελαχιστοποίηση των επιπτώσεων με τη χρήση ορθών πρακτικών	SMM 39. In any case, all activities and works to be implemented will be in accordance with the applicable provisions of Greek legislation as listed below: • YA 2640/270 (Government Gazette 689/B/18.8.78), On the use of silenced air hammers. • PD 1180/81 (Government Gazette 293/A/6.10.81), On the regulation of issues related to the establishment and operation of industries, crafts, all types of mechanical installations and warehouses and the resulting environmental protection in general, as amended and in force. • YA 56206/1613 (Government Gazette 570/B/9.9.86), Determination of the sound emission of construction site machinery and equipment in compliance with Directives 79/113/EEC, 81/1051/EEC and 85/405/EEC. • YA 69001/1921 (Government Gazette 751/B/18.10.1988), EEC type approval for the noise level limit value of construction site machinery and equipment and in particular of motor-driven air compressors, tower cranes, welding and power generating sets and portable concrete breaking devices and pneumatic hammers, as amended. • YA 10399/91 (Government Gazette 359B/91), Determination of the noise level limit value of tower cranes in addition to YA 69001/1921/88 • YA 765/91 (Government Gazette 81B/21-2-91), Determination of the noise level limit values of hydraulic shovels, shovels with cables of earth movers, loaders and loaders - excavators, as amended by JMD 11481/523/97 (Government Gazette 295B/97) • JMD 37393/2028/01.10.2003, Measures and conditions for noise emissions into the environment from equipment for use in outdoor areas (Government Gazette 1418B) as amended by Joint Ministerial Decree 9272/471/2007 • Presidential Decree 149/06, (159/A/28.7.2006) “Minimum health and safety requirements regarding the exposure of workers to risks arising from physical agents (noise) in accordance with Directive 2003/10/EC”.	
			SMM 40. In addition, the provisions of the following will be taken into account: • BS 5228 “Code of Practice for noise control on construction and demolition Sites in relation to the definition of the methodology for the prediction of Noise and Vibration during construction works and the applicable indicators and limits. • BS 6472 Vibration dose value – in relation to the definition of the maximum permissible vibration dose, which concerns the nuisance to humans due to construction activities.	

Environmental Parameter		Objective of Proposed Measure	Mitigation measures during the stop of operation (SMM)	Potentially Significant Impacts to Avoid/Minimize/Address
			• BS 7385 in relation to the definition of the maximum permissible vibration level for the protection of buildings from structural damage. • YA 13586/724/06 (Government Gazette 384/B/28.3.2006) Definition of measures, conditions and methods for the assessment and management of noise in the environment, in compliance with the provisions of the Directive 2002/49/EC "on the assessment and management of environmental noise" of the Council of 25.6.2002). • Ministerial Decree 211773/2012 (Government Gazette 1367/B/2012), Determination of Assessment Indices and Maximum Permissible Limits of Environmental Noise Indices originating from the operation of transport projects, technical specifications for special acoustic calculation and implementation studies (EAMYE) of noise barriers, environmental noise monitoring specifications and other provisions.	
		Minimizing impacts by using good practices	SMM 41. Residents, users and visitors to the area should be informed of the operating hours of machines that may cause potential nuisance.	Impacts related to the method of decommissioning and the project schedule.
	Water	Minimizing impacts on the hydraulic regime of waters using good practices	SMM 42. To meet the project's water needs, commercially bottled water will be used as drinking water for the workers. The needs of the operation of the construction sites as well as the wetting of the concrete will be met by installing water tanks on the construction site, which will be filled with tankers or from the network of the existing SIGMA industrial facility.	Impacts related to the use of natural resources during the decommissioning of the project.
		Minimizing impacts on surface and groundwater using good practices	The uncontrolled disposal of surplus materials in the immediate or wider area is prohibited. Under no circumstances is the disposal of these materials in stream beds or other water bodies permitted (SMM 6).	Impacts related to the production of surplus materials and their management during the decommissioning of the project.
			Systematic maintenance of the infrastructure and maintaining the cleanliness of the Project area is required (SMM 7).	Impacts related to the management of the project and the methodology for implementing the decommissioning works.
			SMM 43. Solid waste collection points should be designated on the construction site, as well as their regular collection, so as to avoid degradation of the landscape.	Impacts related to the production of solid waste and its management during the decommissioning of the project.

Environmental Parameter	Objective of Proposed Measure	Mitigation measures during the stop of operation (SMM)	Potentially Significant Impacts to Avoid/Minimize/Address
		The schedule for the execution of the works shall be structured so that temporary material deposits are used as soon as possible and material washouts are avoided (SMM 10)	Impacts related to the decommissioning method and the project schedule.
	Minimizing impacts on water quality through good practices	SMM 44. The main factor for the general protection of the environment of the wider area during construction works is the appropriate organization and proper operation of the construction site. For the protection of water quality, the implementation of the corresponding measures mentioned in previous Environmental Parameters is proposed.	Impacts related to the organization and operation of the construction site and mainly the management of waste and decommissioning materials.
		SMM 45. To protect water quality from activities related to the management, disposal, and use of construction materials and waste, and the cleaning and maintenance of vehicles and equipment, it is proposed to implement corresponding measures mentioned in previous Environmental Parameters.	
	Protecting water quality from improper practices, damage or negligence.	To protect water quality from improper practices, damage or negligence, it is recommended to implement corresponding measures mentioned in previous Environmental Parameters.	Impacts related to accidental pollution during the normal activities of the decommissioning phase
	Minimizing impacts through the process of monitoring, identifying and addressing them	The implementation of the Environmental Monitoring Program (SMM 14) is recommended.	Impacts related to decommissioning operations.
	Protecting marine waters	SMM 46. Compliance with international guidelines and the IMO International Safety Management Code (ISM), for the safe operation of ships and the prevention of environmental pollution, as well as strict compliance with navigation, communication and safety procedures.	Impacts related to decommissioning operations, prevention of accidental pollution and the implementation of good practices.
		SMM 47. Compliance with MARPOL requirements for waste and sewage, with emphasis on the following: Annex I Regulations for the Prevention of Pollution by Oil, Annex III Regulations for the Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form, Annex IV Regulations for the Prevention of Pollution by Sewage from Ships, Annex V Regulations for the Prevention of Pollution by Solid Wastes from Ships.	

Environmental Parameter		Objective of Proposed Measure	Mitigation measures during the stop of operation (SMM)	Potentially Significant Impacts to Avoid/Minimize/Address
			SMM 48. The vessels that will be used for the needs of the project will comply with the International Regulations for Preventing Collisions at Sea 1972.	
		Protecting marine waters through good removal practices	SMM 49. Implementation of fueling procedures in accordance with applicable national regulations and vessel specifications.	
			SMM 50. All necessary measures should be taken to avoid pollution of the sea during the construction phase, as well as any additional measures that may be indicated by the relevant Port Authority, in accordance with Law 743/77 (Government Gazette A 319), as codified by Presidential Decree 55/98 (A' 58) and in force from time to time.	
		Protecting marine waters through proper waste management	Implement a "Waste Management Plan" during the construction / operation / decommissioning stages, examining all aspects of the project and the waste generated with the aim of ensuring that the waste generated (hazardous, non-hazardous) is managed properly (SMM 17).	Impacts related to decommissioning operations, prevention of accidental pollution and implementation of good practices.
		Marine water protection	SMM 51. A Chemical Use Plan shall be implemented which shall include: (i) The chemicals which the operator intends to use during the operations. A list of the ecotoxicity of such chemicals. (ii) The purpose or purposes for which the operator intends to use the chemicals. (iii) The maximum concentrations of the chemicals which the operator intends to use in any other substances, as well as the maximum quantities intended to be used in any specified period. (iv) The area within which the chemical may escape into the marine environment.	
Natural Biotic Environment	Flora, fauna, habitats and protected areas	Protection of the terrestrial living environment	SMM 52. During the relocation phase in the terrestrial part, which is located in a zone outside Natura sites but with sand dunes, it is proposed: • Avoiding disturbance and interventions in the sand dune zone during the breeding season of turtles and wading birds. In particular, avoiding the period from mid-April to the end of June. This restriction will avoid disturbance during the breeding season and the possible destruction / abandonment of bird or turtle nests. • (B) Not to form a construction site on the sand dunes in order to avoid soil compaction and the destruction of the flora in the dunes.	Impacts related to decommissioning operations and the implementation of good practices.
			SMM 53. A Biodiversity and Wildlife Management Plan and Environmental Monitoring Program should be implemented, with specific actions and indicators, frequency and methodology for conducting recordings / fieldwork / measurements per environmental parameter.	Impacts related to the decommissioning construction works
		Protection of the marine environment	SMM 54. The speed of all vessels associated with the Project's decommissioning should not exceed 20 knots, in order to minimize the possibility of collision with marine mammals and sea turtles.	Impacts related to decommissioning operations, accident prevention and

Environmental Parameter	Objective of Proposed Measure	Mitigation measures during the stop of operation (SMM)	Potentially Significant Impacts to Avoid/Minimize/Address
	Protection of the marine environment	SMM 55. The support vessel for the removal of the project's offshore facilities shall carry 2 certified marine mammal observers (MMOs). Before the commencement of removal operations, the MMOs shall conduct a survey of marine mammals within 500 m of the site of the activity. Noisy operations shall not commence if marine mammals have been sighted within this radius or until at least 20 minutes have elapsed since the last sighting. During periods of darkness or poor visibility (such as fog), MMOs shall use night vision goggles or passive acoustic monitoring devices.	the implementation of good practices.
		SMM 56. In the event of a collision between a project vessel and marine mammals, the incident should be reported to the competent Directorate of Natural Environment and Biodiversity of the Ministry of Environment and Natural Resources and to the relevant Management Unit.	Impacts related to the removal work and possible accidents.
		SMM 57. It is recommended to avoid implementing the relocation stage in the marine environment during the breeding season of the shag (February - May period).	Impacts related to decommissioning operations and the implementation of good practices.
	Minimizing impacts on the living environment through the use of good practices	SMM 58. All hazardous materials on site should be stored in a manner that prevents access by wildlife. Oil or fuel containers should be closed and deep holes or large pits in the ground should be covered. In addition, special care should be taken during the removal period to avoid capturing or killing wildlife.	Impacts related to waste management and removal materials.
		SMM 59. Appropriate organization of the surrounding area so as to prevent the spread of fire (for example, use of non-flammable building and decoration materials, creation of fire-fighting zones in key locations that will stop the spread of a potential forest fire, installation of fire tanks and other fire-fighting equipment in accordance with the fire protection studies of the area and the recommendations of the relevant fire department, etc.).	Impacts related to decommissioning operations, accident prevention and the implementation of good practices.
		SMM 60. Systematic cleaning and maintenance of the surrounding area and the facilities within the project site, so as to prevent the outbreak and spread of fire (for example, systematic cleaning of waste that may be spread by project workers or occasional visitors to the wider area, systematic cleaning of biomass waste resulting from the management of vegetation in adjacent areas, systematic control and monitoring of the condition of infrastructure networks, etc.).	

Environmental Parameter		Objective of Proposed Measure	Mitigation measures during the stop of operation (SMM)	Potentially Significant Impacts to Avoid/Minimize/Address
			SMM 61. Development of a fire response procedure that will include the organization of fire safety procedures, training of personnel for emergency situations involving the risk of fire and cooperation with the local fire department.	
		Structure and functions of the anthropogenic environment	SMM 62. To control and avoid possible incidents of accidental pollution that would have a direct impact on the soil and therefore on the living environment of the area. To protect the quality of the living environment from improper practices, damage or negligence.	Impacts related to accidental pollution during normal activities of the decommissioning phase
		Minimizing impacts through information / education / communication actions	SMM 63. Provide detailed information to employees, both during the relocation phase, so that all environmental conditions are respected, especially those concerning the natural living environment.	Impacts related to decommissioning operations
Man-made Environment	Spatial Planning - Land Use	Minimizing impacts on the human environment through the use of good practices	SMM 64. Compliance with the requirements of current spatial planning and best practices	Impacts related to decommissioning operations and the transportation of materials and waste
			SMM 65. Particular attention should be paid when carrying out work and passing machinery/vehicles near infrastructure and buildings to avoid causing damage.	
			SMM 66. The contractor is obliged to remove all facilities created for the needs of the construction and to return the site to the condition it was in before the start of the project.	
	Structure and functions of the anthropogenic environment	Minimizing impacts on the structure and functions of the Anthropogenic Environment through the use of good practices	SMM 67. Proper organization and proper operation of the works will contribute to limiting the disturbance caused to the anthropogenic functions of the area and the temporary visual pollution caused. Also, the fencing of the construction site and the work areas should be done in an aesthetic manner, so as to limit the temporary alteration of the image of the area.	Impacts related to the decommissioning method and the project schedule.
			SMM 68. The works should be adjusted in time, so as to avoid intense pressures on productive anthropogenic activities and implementation of measures related to the reduction of negative impacts (indirectly from other parameters) that are proposed in detail in the relevant fields.	Impacts related to potential disruptions to anthropogenic functions in the area during the decommissioning phase.
	Socio-economic environment	Minimizing impacts on the socio-economic	Measures related to the reduction of negative impacts on the socio-economic environment (indirectly from other parameters) are proposed in detail in the relevant fields for noise, air pollution, dust, etc.	Indirect impacts from other environmental parameters related to construction operations

Environmental Parameter		Objective of Proposed Measure	Mitigation measures during the stop of operation (SMM)	Potentially Significant Impacts to Avoid/Minimize/Address
		environment through the use of good practices	SMM 69. Utilization of local labor and technical resources as much as possible and preference for suppliers from the wider project area to stimulate local employment and economy.	Impacts on the local economy and employment related to the relocation works
			SMM 70. A particularly effective practice for addressing and avoiding any protests from the residents of the area is for the supervising authority and the contractor to inform the residents of the type and duration of the work before the work begins.	Impacts related to potential lack of information regarding the construction of the Project, potential insufficient cooperation with stakeholders and handling of complaints.
			SMM 71. Implementation of support measures to find alternative employment for human resources after the completion of the decommissioning, such as: • Internal relocation (Identification of other projects within the company where the skills of the affected employees can be utilized), • “Cross-training” (providing a training program that equips employees with the skills they need for other employment positions within the company or industry), • “Outplacement” services (Providing support for finding a job in cooperation with recruitment agencies, providing training on CV writing, interview techniques to improve the employment opportunities of the workforce). A key mitigation measure is also the implementation of the Stakeholder Engagement Plan to enhance open and transparent communication with stakeholders regarding the closure and relocation process, the timelines and the potential impacts. Regular briefings and meetings with employees and local community members can help manage expectations, build trust and mitigate potential negative impacts.	Impacts on the local economy and employment related to the decommissioning works
	Health and Safety	Minimizing impacts on health and safety through the use of good practices	SMM 72. Implementation of a legal framework for labor matters and development and implementation of a Project-specific Human Resources Management Plan and Human Resources Policy.	Impacts related to the removal works
			SMM 73. Strictly comply with the safety regulations provided for by law.	
			SMM 74. Since construction work by its nature involves the possibility of causing accidents. It is recommended: • Strictly comply with the safety regulations for construction sites provided for by law. • Preparation of an Occupational Risk Assessment (ORA)	

Environmental Parameter		Objective of Proposed Measure	Mitigation measures during the stop of operation (SMM)	Potentially Significant Impacts to Avoid/Minimize/Address
			• • Establishment of a Safety and Health Plan and File (OSP and OSF) and strict compliance with the provisions, in compliance with national legislation and the provisions of PR4 of the EBRD. The OSP and OSF should be adjusted in accordance with the progress of the work and in any case contain real and updated data.	
			SMM 75. Employment of a Safety and Health Coordinator and provision of Safety Technician and Occupational Physician services	
			SMM 76. As part of the Human Resources Management Plan and the grievance mechanism, implement a procedure for reporting incidents of violence and harassment.	
			SMM 77. Informing and training employees in accessible formats on the risks, prevention, protection and obligations related to addressing violence and harassment at work and gender-based violence and harassment	
			SMM 78. Implementation of internal Occupational Health and Safety policies and actions (e.g. training and certification in the safe execution of work, "Work Stoppage Policy", "Work Stoppage Order", "Health, Safety, Environmental & Social Responsibility Policy", "Equal Opportunities Policy", the "Diversity and Inclusion Policy", "Code of Ethics", etc.)	
			SMM 79. Provision of all necessary protective equipment to personnel in accordance with Law 3850/2010 and OHS. Special equipment defined in accordance with the Fire Prevention Plan and the Waste Management Plan	
			SMM 80. The construction site must be fenced off so that the public cannot access it and places where the works are incomplete.	Impacts related to the removal works
			SMM 81. There should be appropriate signage to inform the public about the dangers and at the same time prevent their access to the construction sites.	
	Τεχνικές Υποδομές	Εξασφάλιση συνθηκών ομαλής και ασφαλούς ναυσιπλοΐας	SMM 82. Cooperation between the proposed Project operator, the relevant authorities and maritime authorities to determine safe navigation routes around the demarcated area for the Project decommissioning. This includes timely notification of the relevant port authorities regarding the planned works.	
			SMM 83. Removal works should be designed to minimize their impact on existing shipping lanes, such as scheduling activities, as far as possible, during periods of lower maritime traffic to avoid periods of intense fishing, commercial or tourist traffic.	

Environmental Parameter	Objective of Proposed Measure	Mitigation measures during the stop of operation (SMM)	Potentially Significant Impacts to Avoid/Minimize/Address
		SMM 84. Regular inspections should be carried out to ensure compliance with the regulations and conditions that have been set, in order to avoid any risks to navigation.	
	Minimizing impacts on the road network	SMM 85. During transport and travel on the wider road network, special precautions should be taken by machinery operators and heavy vehicle drivers to avoid causing damage to the networks.	
		SMM 86. If required, information signs and appropriate road safety markings should be placed in the immediate area of the project and traffic regulations should be implemented, under the responsibility of the contractor. Where possible, real-time updates should be provided via digital platforms (e.g. traffic management applications or GPS) to guide road users.	
		SMM 87. Optimization and minimization of vehicle movements, optimization of required time distances and maximizing the rate of vehicle utilization are the principles that apply to vehicles transporting passengers, goods and waste during relocation.	
		SMM 88. The transport of bulky parts of the equipment that was removed from the entire road network should be carried out after consultation with the competent Traffic Police Directorates and after their recommendations have been taken into account (e.g. escort vehicles, alternative routes, transport schedule, etc.).	
		SMM 89. Scheduling transport to avoid, as far as possible, peak hours or times when the road transport network is congested.	
	Minimizing impacts on utility networks	SMM 90. All persons responsible for the utility networks that pass through the immediate area and may be affected should be notified in a timely manner by the manufacturer.	

11.5 MEASURES FOR RISK PREVENTION AND MANAGEMENT

The following are measures to prevent significant anomalies (in accordance with article 173 of Law 4964/2022), as well as measures to address the risk of accidents or disasters related to the CO2 Storage Project.

11.5.1 General

The following are general accident prevention measures:

- Development of robust monitoring and contingency plans for rapid detection and containment of leaks. EnEarth will implement a Monitoring Plan of Paragraph 2 of Article 14 of the Joint Ministerial Decision 48416/2037/E.103/2011, which is prepared in accordance with the requirements of Annex II of the above Joint Ministerial Decision. Monitoring of the intake wells, the storage complex (including, whenever possible, of the CO2 plume), and, where appropriate, the surrounding environment (**Annex 16.2**).
- Provision of comprehensive training programs and personal protective equipment to personnel involved in the handling and activities of CO2 infiltration.
- For the facilities of the CO2 Storage Project, pressure relief systems, regular cleaning, use of corrosion-resistant materials are planned.
- During the development of the planning, the vulnerability in the event of loss of utilities is assessed and the risk is addressed, e.g. with spare equipment, emergency shutdown systems.
- Compliance with relevant national/international standards and good practices (including the choice of construction materials, design, use of design standards and equipment).
- The contingency arrangements at the existing Sigma site (including communications with authorities and neighboring facilities) will be expanded to include the Project.
- The new CO2 pipeline will be located on the same corridor as the existing gas/oil pipelines, so it will be necessary to ensure that any interaction is avoided both during the construction and operation of the Project.
- An exclusion zone for external shipping 500 m from the offshore facility of Prinos is applied.
- Development of comprehensive maintenance and contingency plans to deal with failures in a timely manner and minimize operational disruptions.
- All fire safety and fire-fighting system specifications will be applied to the vessels used during the construction and operation of the Project, including pipeline construction and trench excavation vessels.
- Specifically, the following are mentioned as measures to prevent/mitigate hydrocarbon leakage:
  - As part of the project's design, extensive investigations of the underlying geology have been carried out to select the optimal location of the boreholes, so that there is no interaction with the hydrocarbon extraction activity.
  - Within the framework of the design of the Project, simulation studies of reservoirs have been carried out to evaluate the possible effects of CO2 intake on hydrocarbon production zones.

- Implementation of pressure management strategies, such as adjusting intake rates or using barriers to mitigate the risk of CO2 migration to hydrocarbon deposits.
- Implementation of an emergency plan in Prinos for the mitigation of an oil spill (including isolation, communication, development of measures to deal with the oil spill, such as floating dams, etc.)

11.5.2 Measures to Prevent Significant Anomalies

Measures for the prevention of significant anomalies (in accordance with article 173 of Law 4964/2022) are mentioned below, based on the risks related to the facilities and wells of the Project as possible CO2 leakage routes from the storage site, as analyzed in **Chapter 11** of this EIA.

Table 11-4: Measures to Prevent Significant Anomalies

AA	Hazard description	Possible impacts	Prevention measures
Facilities			
1	CO2 leakage due to pipeline corrosion, impurities in the CO2 stream or environmental conditions	• CO2 leakage into the atmosphere - greenhouse gas emissions • Risks to human health • Environmental damage (soil and/or water pollution)	• Use of corrosion-resistant materials and protective coatings • Installation of monitoring equipment, leak detection systems • Design and construction of facilities according to codes and standards, with third-party certification • The pipeline will be inspected by special equipment (pigging) according to best practices and its wall thickness will be measured.
2	CO2 leakage due to mechanical failure (e.g. poor welding, material wear)	• CO2 leakage into the atmosphere - greenhouse gas emissions • Risks to human health • Environmental damage (soil and/or water pollution))	• Use of corrosion-resistant materials and protective coatings • Performing welds according to codes and standards, with non-destructive testing methods (NDT), hydraulic tests • Monitoring the composition of the CO2 stream to ensure compliance with design specifications
3	CO2 leakage due to accidental damage from external causes (e.g. construction work)	• CO2 leakage into the atmosphere - greenhouse gas emissions • Risks to human health • Environmental damage (soil and/or water pollution)	• Clear signage of pipeline routes • Installation of monitoring equipment, leak detection systems • Design in accordance with the applicable rules of equipment layout to ensure sufficient free space
4	Partial/total pipeline rupture due to overpressure, equipment failure, or operational errors	• Large-scale CO2 leakage causing risks to the safety of humans and animals (potential risk of suffocation) • Significant environmental pollution • High repair costs and downtime	• Design of pipelines with adequate safety margins and pressure relief systems • Application of automated pressure control and emergency shutdown systems • Pipeline operation procedure according to flow assurance studies

AA	Hazard description	Possible impacts	Prevention measures
5	Partial/total rupture of a pipeline due to significant corrosion or material defects leading to structural failure	• Large-scale CO_2 leakage causing risks to the safety of humans and animals (potential risk of suffocation) • Significant environmental pollution • High repair costs and downtime	• Design of pipelines with adequate safety margins and pressure relief systems • Application of Automated Pressure Control and Emergency Shutdown Systems (IEC 61508/61511) • Pipeline operation procedure according to flow assurance studies
6	Pipeline blockage due to the formation of hydrates or other solid deposits within the pipeline	• Disruption of CO_2 flow leading to inadequate operation. • Possible increase in pressure resulting in the risk of leaks or explosions. • Increased maintenance and cleaning costs	• Frequent inspection (pigging) and cleaning of pipes. • Continuous monitoring of pipeline conditions and supply • Ensuring the purity of the CO_2 stream based on the specified specifications • Pipeline operation procedure according to flow assurance studies
7	Pipeline blockage due to accumulation of impurities or pollutants in the CO_2 stream	• Disruption of CO_2 flow leading to inadequate operation. • Possible increase in pressure resulting in the risk of leaks or explosions. • Increased maintenance and cleaning costs	• Frequent inspection (pigging) and cleaning of pipes. • Continuous monitoring of pipeline conditions and supply • Ensuring the purity of the CO_2 stream based on the specified specifications • Pipeline operation procedure according to flow assurance studies
8	Hydraulic blow to the pipeline due to quick valve closure or compressor failure, combined with incomplete design, no safety margin or high pressure protection mechanism	• Possibility of damage to the pipeline due to pressure spikes • Increased wear on the pipeline components, leading to failures	• Pipeline design with appropriate relief systems • Application of automated flow and pressure control systems
9	Accidents during unloading CO_2 loads (failure during lifting) due to mechanical failure of crane/other lifting equipment, inadequate maintenance	• Drop in CO_2 cargoes, possible structural damage to containers • Risk of tank rupture or high-pressure CO_2 leakage	• Training and certification of operators for the use of the lifting equipment. • Appropriate design to ensure the adequacy of the equipment in terms of the required lifting specifications
10	Accidents during unloading CO_2 loads (failure during lifting) due to mechanical failure of crane/other lifting equipment, inadequate maintenance	Serious injury or death to personnel and damage to infrastructure	Regular inspection and maintenance of lifting equipment
11	Failures during connection (connection/disconnection hoses) due to improper connection/disconnection procedures	Risk of CO_2 leakage at connection points, risk to safety and the environment	Use of high-quality fasteners and sealants suitable for CO_2 transport
12	Failures during connection (connection/disconnection hoses) due to incompatibility of materials or degradation of connections and sealants	• Delay in operation and increase in repair costs • Increased risk of equipment damage and injury	Use of high-quality fasteners and sealants suitable for CO_2 transport
13	CO_2 pressure drop in pipes and pipelines (bulk / loads) due to friction and resistance losses	Reduced intake rate if the pressure is lower than optimal	Continuous pressure monitoring throughout the CO_2 transmission system for fast detection and response to pressure drops

AA	Hazard description	Possible impacts	Prevention measures
	due to the roughness of the inner surface of the pipeline		
14	Drop in CO_2 pressure in pipes and pipelines (bulk/loads) due to ice accumulation (hydride formation) or corrosion products in pipes or pipelines	Possibility of requiring an additional compressor to compensate for the pressure drop, resulting in higher energy consumption and operating costs.	Design based on the flow assurance study, to define the safe operating limits and the appropriate pressure control system
15	CO_2 pressure drop in pipes and pipelines (bulk / loads) due to friction and resistance losses due to the roughness of the inner surface of the pipeline	Delays in operation leading to reduced performance	Design based on the flow assurance study, to define the safe operating limits and the appropriate pressure control system
16	Πτώση πίεσης CO_2 σε σωλήνες και αγωγούς (χύδην / φορτίων) κατά τη μεταφορά λόγω μεταβολών θερμοκρασίας (ψύξη) τη χειμερινή περίοδο, που προκαλεί σχηματισμό αλάτων και πάγου στο εξωτερικό των αγωγών / σωλήνων	• Possibility of requiring an additional compressor to compensate for the pressure drop, resulting in higher energy consumption and operating costs. • Delays in operation leading to reduced performance	Use of a starter heater and/or other appropriate equipment on the Beta platform to ensure appropriate intake conditions
17	CO_2 leakage after an accident (tipping over or falling of object) in trucks	• CO_2 leakage into the atmosphere - greenhouse gas emissions • Risks to human health • Environmental damage (soil and/or water pollution)	Implementation of road transport procedures and plan
18	Partial/total rupture of pipeline by fishing / trawls	• CO_2 leakage into the atmosphere - greenhouse gas emissions • Risks to human health • Environmental damage (soil and/or water pollution)	Pipeline burial to eliminate the risk of pipeline breakage by fishing and trawling activities
19	Riser rupture due to ship impact on platform	• Safety risks, including suffocation and extreme cooling caused by the rapid decompression of compressed CO_2 • Risks to the ecosystem, including marine acidification • Shutdown due to leakage and secondary damage to other equipment	Protection of the riser from ship impact
20	Losses due to platform collapse	Well rupture, pipeline and riser rupture	• Follow operating instructions • Inspection of facilities
21	Natural hazards due to weather conditions (strong wind, rain, extreme temperatures) that may affect the facilities	Facility failure and risks to personnel	Installation design taking into account extreme weather conditions

AA	Hazard description	Possible impacts	Prevention measures
22	Solidification/formation of dry CO2 ice due to low temperatures due to CO2 container volume reduction during intake	Facility failure and risks to personnel	• Investigation of the effect of CO2 removal from storage containers on operating temperature • Protection of personnel based on the above investigation
23	High temperatures due to heat from compression	• Staff injury • Design temperature exceedance (manifold, pipeline, well manifold)	Determination of CO2 heating and cooling supply if necessary
24	Wves / adverse environmental conditions	Delays in operation or need to disconnect/stop the insertion	Planning of sea transport with favorable weather conditions
25	Parallel operation of the Sigma and Prinos facilities, interaction with the operation of the CO2 Storage Project	Possibility of delays due to poor synchronization	1 Design and disclosure of CO2 management operations, including a full risk assessment (SIMOPs) for all phases (construction, operation, decommissioning) and all modes of operation (e.g. pick-up, connection, ship transportation, compression, etc.)
Wells			
1	Poor condition of abandoned boreholes. After an analysis of the integrity of the boreholes, 12 were deemed unsuitable based on their condition "as abandoned"	CO2 / oil / water leakage through the wells in the layers of the formations or on the surface	• Παρεμβατική γεώτρηση για τοποθέτηση βαθύτερου φραγμού κατά μήκος κατάλληλων σχηματισμών • Παρακολούθηση γεωτρήσεων με αισθητήρες οπτικών ινών DTS (distributed temperature sensing) και DAS (distributed acoustic sensing)
2	Drilling of interventional boreholes. Failure of interventional drilling and inability to install barriers at greater depth in high-risk drilling	CO2 / oil / water leakage through the wells in the layers of the formations or on the surface	• Use of proven interventional drilling technology • Planning of interventional boreholes by trained competent personnel. • Investigation of options for dealing with possible failure of interventional drilling
3	Abandoned inaccessible boreholes - 29 abandoned boreholes have not been abandoned in accordance with modern industry standards, e.g. special marking of cement blocks, pressure tests, installation on a mechanical basis	CO2 / oil / water leakage through the wells in the layers of the formations or on the surface	• Detailed investigation of the integrity of all abandoned boreholes and boreholes where the barriers were not placed according to modern standards. Qualitative risk analysis for each barrier. • It has been confirmed through independent geological study that salt formations within the evaporative sequence will move around the shell with an incomplete cement coating and create a seal with resistance to the expected CO2 storage pressure.
4	Abandoned Legacy Inaccessible Boreholes - 17 boreholes have been abandoned where the base of their inner barrier is placed within the evaporative sequence and therefore the borehole has been abandoned at depths of non-permeable formations. However, it has been found that there are permeable layers	CO2 / oil / water leakage through wells in the layers of the formations - secondary containment warehouse	Study to confirm whether the evaporative sand layers are suitable as a secondary retention depot and that they are not classified as leakage routes.

AA	Hazard description	Possible impacts	Prevention measures
	within the evaporative sequence beneath the bases of these internal barriers. Over time, the pipes could erode and the sandstones could be exposed to CO2.		
5	Use of Portland cement in the construction and abandonment process of (abandoned) boreholes. Portland cement can react with the carbonic acid of the CO2 plum.	CO2 / oil / water leakage through boreholes in the borehole of the formations - secondary containment warehouse	• According to extensive research, the effect of CO2 on Portland cement is extremely slow and is limited to 0-10 m for 10,000 years, as long as good installation practices are followed. Drilling integrity analysis has evaluated the risks of cement-as-barrier operations. • It has been confirmed through independent geological study that salt formations within the evaporative sequence will move around the shell with an incomplete cement coating, thus reducing the need for Portland cement in some boreholes.
6	There is no data for the P-6 exploration well, so the "as abandoned" status is unknown.	CO2 / oil / water leakage through boreholes in the borehole of the formations - secondary containment warehouse	• The position of P-6 on the seabed is known from previous survey data. A program should be designed to confirm the position and monitor the well, e.g. acoustic monitoring or real-time camera • The other 5 exploration and appraisal wells have been abandoned with cement blocks and there is no indication of non-compliance with procedures.
7	The accessible wells on the Alpha and Beta platforms that remain active are not designed for exposure to an acidic CO2/water mixture.	CO2 / oil / water leakage through boreholes in the borehole of the formations - secondary containment warehouse	• Reservoir modelling can predict when the CO2 plume will reach each well. Before this “CO2 wetting” occurs, the wells will be abandoned to prevent integrity issues. Based on the integrity analysis of these wells, they can be abandoned in accordance with current OEUK industry standards. • Determination of CO2 concentration during oil production through sampling.
8	In new water production wells there is a possibility of pump failure (ESP)	Reduction of CO2 storage capacity	• Planning for periodic equipment replacement, availability of spare pumps. The current budget provides for replacement every 3 years. • Use of Hydraulic Workover Unit (HWU) for pump replacement. • Use of proven pump technology. • Design of pumps and water wells by trained competent personnel.
9	The new injection wells have not been constructed to deliver CO2 for storage.	CO2 / oil / water leakage through boreholes in the borehole of the formations - secondary containment warehouse	• Use of materials with specifications suitable for CO2 atmosphere (25Cr Super Duplex steel or similar material) • Use of best available cement slurry to avoid CO2 impact

AA	Hazard description	Possible impacts	Prevention measures
			• Good practices for placement and lining of casings and liners, including post-installation logging to verify cement quality prior to CO2 injection • Use of proven drilling technology. • Well design by qualified personnel. • The Prinos field is mature, with over 70 wells, so it is unlikely that there will be unforeseen conditions that could seriously jeopardize the construction of new wells
10	Abandonment of CO_2 wells	CO2 / oil / water leakage through boreholes in the borehole of the formations - secondary containment warehouse	• The wells will be constructed to modern standards and the cemented rings will be logged to verify the quality of the cemented ring, allowing the location of the abandonment barrier to be selected. • The abandonment plan will be known in advance and precisely defined in the closure plan. This means that the construction plan can include the abandonment design and ensure that it is workable. • Implementation of best practices for abandonment, including cement types. • Use of best available cement slurry to avoid CO2 impact • Good practices for placing and lining casings and liners, including post-installation logging to verify cement quality prior to CO2 injection • Use of proven drilling technology. • Drilling design by trained and competent personnel.

11.5.3 Measures to Address the Risk of Accidents or Disasters Related to the CO2 Storage Project

Measures to address the risk of accidents or disasters related to the CO2 Storage Project are listed below.

11.5.3.1 Fire Prevention Measures (Climate Change)

The following are mentioned as fire prevention measures:

• Appropriate organization of the surrounding area so as to prevent the spread of fire (for example, use of non-flammable building and decoration materials, creation of fire-fighting zones in key locations that will stop the spread of a potential forest fire, installation of fire tanks and other fire-fighting equipment in accordance with the fire protection studies of the area and the recommendations of the relevant fire department, etc.).

• Systematic cleaning and maintenance of the surrounding area and the facilities within the project site, so as to prevent the outbreak and spread of fire (for example, systematic cleaning of waste that may be spread by project workers or occasional visitors to the wider area, systematic cleaning of biomass waste resulting from the management of vegetation in adjacent areas, systematic control and monitoring of the condition of infrastructure networks, etc.).

• Development of an effective fire extinguishing system. Legal requirements for fire safety and fire fighting are likely to be insufficient and additional measures must be taken. For example, installation of more fire water tanks, installation of backup fire extinguishers, etc.

• Development of a fire response procedure that will include the organization of fire safety procedures, training of personnel for emergency situations, which include the risk of fire and cooperation with the local fire department.

• A sufficient number of infrastructures for the collection of (hazardous and non-hazardous) solid waste should be available, as well as a sufficient number of modern absorbent materials (spill kits for oils, chemicals, general liquids, granular absorbent materials, etc.), through which the adsorption and consequently retention of potentially leaking fuels and lubricants or other hazardous and/or flammable substances will be sought. After their use, these absorbent materials should be collected in metal watertight containers and disposed of for further legal management.

11.5.3.2 11.5.3.2 Flood Risk Prevention Measures (Climate Change)

The following are listed as preventive measures for the risk of flooding:

• Any earthworks, construction and maintenance works should be carried out during the summer period when there is no rainfall to prevent soil leaching. In the event of heavy rainfall during the excavation phase, it is recommended to stop the works.

• During the execution of earthworks, the necessary measures should be taken to avoid any kind of soil destabilization phenomena or dispersion of earthworks and aggregate materials of the project, such as landslides or erosion of slopes, leaching of piles of aggregate materials, etc.

• The technical interventions included in the implementation of the project and related to the effective drainage of the project site, the hydraulic communication of the areas on either side of it, etc., should be checked, cleaned and maintained systematically at regular intervals.

• The effectiveness of technical interventions (included in the implementation of the project and related to the effective drainage of the project site, the hydraulic communication of the areas on either side of it, etc.) to be systematically checked in terms of their design and effectiveness, based on new scientific data or the corresponding revisions of the relevant Plans.

• Development of an emergency response procedure will include the organization of corresponding action groups, training of personnel for emergency cases, which include the risk of heavy rainfall incidents and cooperation with the competent authorities (fire department, civil protection, etc.).

• Readiness of equipment and resources to deal with similar incidents based on the provisions of the relevant emergency response procedure.

• Systematic control and monitoring of the condition of the infrastructure, the coast and the soil, so that any issues of flooding, landslides and soil erosion are detected at an early stage and are addressed promptly and effectively.

• Systematic control, cleaning and monitoring of the condition of the rainwater collection and channeling interventions so that potential flooding phenomena are addressed promptly and effectively.

• The equipment within the project's land facilities will be designed for flood resistance with a T50 return period.

11.5.3.3 11.5.3.3 Wave Protection Measures

The following are preventive measures for the risk of high waves:

• The measures already implemented at the existing offshore facilities of Prinos to monitor and respond to high wave/adverse sea conditions will also include the CO2 Storage Project.

• The offshore installation of the CO2 Storage Project is designed to be resilient to waves, providing for measures that will include isolation and shutdown, which will be specified in the final design phase.

11.5.3.4 11.5.3.4 Earthquake Measures

The following are mentioned as measures to prevent and mitigate the effects of earthquakes:

• Appropriate design of boreholes so as not to cause cracking from seismic activity.

• Monitoring of reservoir conditions during operation to ensure that there are no leaks or, in the event of their occurrence, that there is immediate response, in accordance with the Monitoring Plan of Paragraph 2 of Article 14 of JMD 48416/2037/E.103/2011 (Annex 17.2).

11.5.3.5 Measures for Road Accidents

The following are mentioned as measures to prevent road accidents:

• In order to avoid road accidents, the speed limit and the scheduled hours of drivers will be observed. The vehicles will comply with all legal requirements for technical inspection, will be provided by competent companies and will be driven by certified drivers.

• The main roads will be selected for access to the land facilities, while the internal roads will be sufficient for the movement of large vehicles and for turning. Driving through secondary roads in the area will be avoided.

• All EU Member States are contracting parties to the Agreement on the International Carriage of Dangerous Goods by Road (ADR). CO2 is included in the list of dangerous goods of the ADR. ADR sets appropriate standards for the integrity of vehicles carrying dangerous goods, including resistance to damage in the event of a road accident, and requires all drivers of dangerous goods to be trained to a specific standard.

11.5.3.6 Measures for Marine Accidents

The following are listed as measures to prevent maritime accidents:

• To avoid collisions between vessels, existing IMO regulations and protocols must be observed.

• Maritime operational activities are based on fundamental principles and regulations, i.e. on harmonized national rules based on international conventions and resolutions adopted by the International Maritime Organization (IMO).

11.5.3.7 Interaction with Activities at the Sigma Plant and Neighboring Facilities

To prevent accidents related to the Sigma plant and neighboring facilities, the following are recommended:

• A safety distance of > 15 m will be maintained between the Project's onshore facilities and the Sigma unit to reduce the likelihood of damage.

• Safety measures within the Sigma facilities to mitigate potential hazards (e.g. fire and gas detection/prevention), in accordance with the requirements of the Seveso Directive.

• Appropriate personnel training to make emergency arrangements to contain/restore major incidents within the Sigma facilities (fire, gas release, etc.).

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12 ENVIRONMENTAL MANAGEMENT AND MONITORING

12.1 ENVIRONMENTAL MANAGEMENT

The purpose of the Environmental and Social Management and Monitoring Plan (ESMP) is to:

• Present an overview of the Environmental and Social Management System (ESMS) that is being implemented to ensure the systematic and effective execution of environmental and social obligations (ESM) related to the project's construction phase, operation, future operations, as well as the final decommissioning/abandonment phases.

• Provide a summary of the role and responsibilities of EnEarth, the Engineering, Procurement and Construction (EPC) contractors and other contractors in each phase of the Project.

Therefore, it ensures that ESM mitigation and management measures have been taken and will be implemented in accordance with the commitments made to date.

To this end, the following documents:

• Identify and communicate the relevant legal requirements and good practices adopted as Project Standards that will govern H&S management.

• Provide guidance for the implementation of these Project Standards by proposing a Health, Safety and Environmental Management System (HSEMS).

• Describe how the HSEMS will continue to evolve to ensure effective and sustainable H&S management as the company moves towards Project operation.

This is a dynamic document as EnEarth's H&S programme, in conjunction with Energean's active H&S programme, is expected to be further developed at various stages of Project development and as a result of ongoing stakeholder engagement and consultation. This document will be regularly reviewed and revised (where and when required) to ensure that the E&C management approach remains fit for purpose and continues to be in line with good practice. The E&C Management Plan will be updated as follows:

• Prior to the Contractor's bid,

• Periodic updates, in relation to the results of monitoring programmes and during operation (every 3 years),

• Updates due to environmental and social issues arising,

• Integration of new legislative and regulatory provisions,

• Unscheduled updates.

The E&C Management Plan is supported by relevant Management Plans (MPs), which, like the E&C Management Plan, are dynamic documents and are intended to be completed prior to the commencement of the construction phase. The E&C Management Plan includes the following in relation to the subject of MS:

- Waste Management Plan (WMP).
- Stakeholder Participation Plan (SPP).
- Chemical Use Plan.
- Cultural Heritage Incident Procedure.
- Emergency Plan.
- Health, Safety and Environment (HSE) Management Plan.
- Traffic Management Plan.
- General Construction Management Plan.
    - Biodiversity and Wildlife Management Plan.
    - Pollution Prevention Plan.

The following are provided as Annexes to this EIA: Waste Management Plan, Stakeholder Participation Plan (SPP), Chemical Use Plan, General Construction Management Plan.

12.1.1 Health, Safety and Environmental Management System

EnEarth will implement a Health, Safety and Environmental Management System (HSEMS) for the construction and operation of the proposed CO2 Storage Project in Prinos, in accordance with the EIA commitments, applicable legal and regulatory standards and EnEarth policy. The HSEMS will:Promote compliance with legislation,

- Regularly assess the environmental and social impacts of the Project,
- Promote the principles of good environmental practice in all processes, during normal operation and in emergency conditions,
- Develop goals and objectives to address significant issues,
- Define the roles and responsibilities (constructor, supervising engineer, contractors, operators, other relevant parties), and in particular, the environmental and social obligations of the Project Owner during the construction/installation phase.
- Defines the legal requirements, guidelines and good industrial practices applicable to the Project,
- Ensures that the works are carried out in accordance with the applicable environmental legal framework (permit procedures, national and international standards and good practices),
- Provides clear procedures and timelines for the management of environmental impacts, including corrective actions.
- Defines procedures for the recruitment and training of personnel,
- Defines a monitoring mechanism in order to:

- Ensure the full implementation of all mitigation measures,
- Ensure the effectiveness of mitigation measures,
- Define environmental monitoring and control requirements,
- Provide a mechanism for timely action in the event of environmental emergencies,
- Define training requirements at the various levels.

This system will be implemented with the aim of ensuring continuous improvement of performance. The main elements of the EMP are the following (as applicable):

- Purpose,
- Project definition and facilities,
- Legislation and guidelines and applicable standards,
- Organizational structure (roles and responsibilities),
- Monitoring / Management Plan,
- Environmental monitoring,
- Notification and documentation,
- Change management,
- Training and education program,
- Waste management plan,
- Contractor and supplier management,
- Decommissioning and rehabilitation,
- Traffic management,
- Non-compliance, accident and action management, and
- Reporting.

The commitments included in the EMP will be implemented through the functions of the Environmental Management System.

12.1.2 Scope

The scope of this document includes the activities to be carried out during the construction and operation phases of the Project.

The organizational structure of EnEarth and the main contractors are likely to evolve and change during the construction period and operation of the Project. For this reason, in parallel with the creation of this document, EnEarth will develop an approach that responds to the need for flexibility regarding future roles and responsibilities regarding the implementation of the various compliance tasks during the construction and operation of the Project.

The requirements and commitments set out in this document are directly applicable to all Project personnel, including employees (full-time, part-time, temporary and seconded personnel, etc.). Contractors and suppliers are required to implement management systems that meet the minimum specifications set out in the EnEarth OH&S Management System, as referred to in this document.

EnEarth's HSE Management System (in conjunction with Energean's active HSE Management System) will be continuously updated to address all aspects of "sustainability" as referred to in the EBRD Performance

Requirements. It will therefore take into account the protection of the environment, social, occupational health and safety and working conditions. For the sake of brevity, the acronym H&S is used throughout this document.

12.1.3 Project Standards

The following are the Project Standards that have been adopted and implemented in the EMP:

- EnEarth's HSE Policy, modeled after Energean's HSE Policy,
- Legislation related to carbon dioxide storage projects in geological formations (JMD 48416/2037/E.103/2011, Directive 2009/31/EC, Law 4964/2022 (Article 173, Article 175)),
- National Legislation (L.4014/2011) and all relevant regulations governing national permitting and the expanded environmental protection framework,
- European Legislation (CCS, EIA and Offshore Activities Directives, as well as all relevant environmental and safety Directives),
- International Conventions:
    - International Convention for the Prevention of Pollution from Ships (MARPOL)
    - International Convention on Marine Oil Pollution Preparedness, Cooperation and Response (OPRC)
    - Agreement for the Conservation of Cetaceans in the Black Sea, the Mediterranean Sea and the Contiguous Atlantic Area (ACCOBAMS)
    - United Nations Convention on the Law of the Sea (UNCLOS)
    - International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage (FUND)
    - Stockholm Convention on Persistent Organic Pollutants (POP)
    - Aarhus Convention
- Good Oilfield Practices and Good Industry Industrial Practice (GIIP): EnEarth, following the model of Energean's HSE Policy, is committed to following Good Oilfield Practices during the construction and operation of CO_2 injection and water production wells.
- EBRD Standards:
    - PR 1: Assessment and Management of Environmental and Social Impacts and Issues: The Project is subject to the requirements for an EIA based on National legislation.
    - PR 2: Labor and Working Conditions: The implementation of the actions necessary to meet the requirements of this PR will be managed by the Environmental and Social Management System.
    - PR3 - Resource Efficiency and Pollution Prevention and Avoidance: The implementation of the actions necessary to meet the requirements of this PR will be managed by the Environmental and Social Management System.
    - PR 4 - Health and Safety: The Company has a duty to identify, avoid, minimize or mitigate risks and adverse impacts on the health and safety of workers and the local community.

- PR 5: Land acquisition, involuntary resettlement and economic displacement: Certain requirements will need to be addressed during the environmental and social assessment process and generally during the Project.
- PR 6: Conservation of biodiversity and sustainable management of natural resources: The implementation of the actions necessary to meet the requirements of this PR will be managed by the Company's ESMP.
- PR7 - Indigenous populations: There are no indigenous populations in Greece according to the definition presented in PR7 and, therefore, this requirement is not applicable to the Project.
- PR8 – Cultural heritage: Certain requirements should be addressed during the environmental and social assessment process and generally during the Project.
- PR9 - Financial intermediaries: Not applicable to this Project.
- PR10 - Stakeholder engagement and participation: This PR recognizes stakeholder engagement and information as an ongoing process.

12.1.4 Setting Goals and Objectives

The main purpose of the EIA is to provide a framework for the implementation of the measures indicated in the EIA in order to avoid, mitigate or compensate for adverse environmental and social impacts, as well as to minimize and make manageable the risks to the environment, personnel and the local community.

The HSE during the construction of the Project will:

- Outline the manner in which EnEarth will monitor and review the Contractor's performance,
- Define the roles and responsibilities of the Contractor,
- Ensure environmental protection at the highest possible level,
- Ensure a high standard of working conditions,
- Assist the Contractor in:
    - Identifying potential risks associated with the work process and taking appropriate measures to reduce the risks,
    - Preventing potential environmental damage or damage to third party property,
    - Preventing and averting potential damage to third party property caused by construction processes and/or operations,
    - Ensuring environmental protection at the highest possible level,
    - Implementing impact minimization measures,
    - Ensuring that all work complies with EnEarth's HSE Policy, national legislation, international best practices and all relevant EBRD PR, in order to avoid all possible losses.

12.1.5 12.1.5 Review of EnEarth's Health, Safety and Environmental Management System

12.1.5.1 Overview

EnEarth is responsible for the environmental and social management of the construction and operation activities, with the aim of ensuring the implementation of the Project commitments and compliance with applicable environmental and social legal and corporate requirements.

EnEarth is to implement a Health, Safety and Environmental Management System (HSEMS), in line with Energean's current HSEMS, which will define the principles to be observed by all employees and contractors associated with the Prinos CO2 Storage Project. This system will cover the proposed new infrastructure / operations of the Project under study.

This Management System is based on internationally recognized good practices in the management of HSE risks in the exploration & production (E&P) industry and is structured around a classic PLAN – DO – ASSESS – ADJUST cycle.

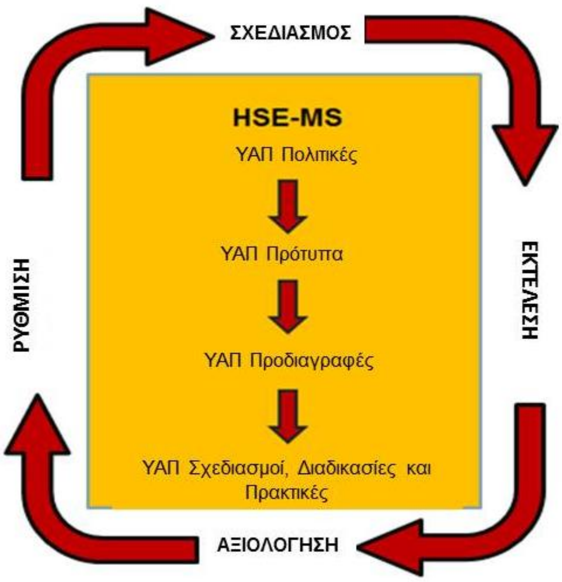

Figure 12-1: HSE MS

In this way of managing risks:

- All risks associated with the Project's operations are properly understood,
- Necessary actions are taken to manage these risks and the level of risk is reduced to the extent reasonably practicable.
- The effectiveness of performance is assessed through measurements, monitoring, reviews, audits and investigations,
- Plans and procedures are adjusted based on these assessments.
- All personnel are included and participate at all levels in this continuous cycle.

12.1.5.2 Risk assessment - threat/opportunity identification and risk management

The EIA and risk assessment of the proposed CO2 Storage Project identify the risks and potential impacts that require mitigation and control. The identification and assessment of impacts is carried out through a process that includes consultation, process simulations, on-site observations, literature review and experience in similar projects.

EnEarth will commit to the Health and Safety Control Hierarchy and the Environmental and Social Risk Control Hierarchy. This hierarchy is taken into account when developing appropriate mitigation strategies and management measures.

Figure 12-2: Hierarchy of controls for Occupational Health and Safety (OHS) hazards

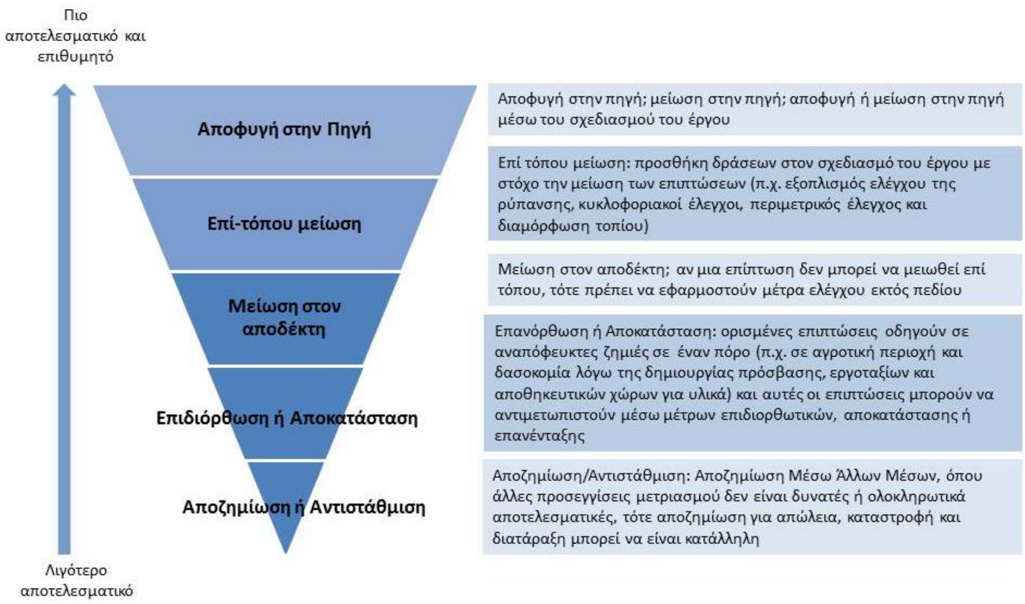

Figure 12-3: Hierarchy of controls for controlling environmental and social risks

To ensure ongoing risk management throughout the Project, the Contractors' Engineering, Procurement and Construction (EPC) department will develop and maintain a risk register for the Project during the construction phase. This risk register will be developed to reflect the findings of the EIA study and other P&C studies related to the construction phase. As part of the development of the risk register for the Project, the EPC team will ensure that HSE and social risks are systematically identified, assessed and evaluated.

The methodologies for identifying, assessing and analysing risks are defined in relation to their scope, nature and timing. This ensures that risks are identified, prioritised and documented, and that control measures are implemented. The methodologies used will be in line with international good practice. The EPC department will adhere to the Control Hierarchy and ALARP techniques when designing risk control measures.

The EPC department will ensure that Project personnel are aware of the key social and OH&S risks identified in the assessment process and the measures to be implemented. The risk register, management procedures and risk assessment will be available to EnEarth for review at any time. Risk information will be distributed to the various parts of the Project as shown Figure 12-4. EnEarth will review the major risks associated with the Project and the associated mitigation and management measures at least once every two months.

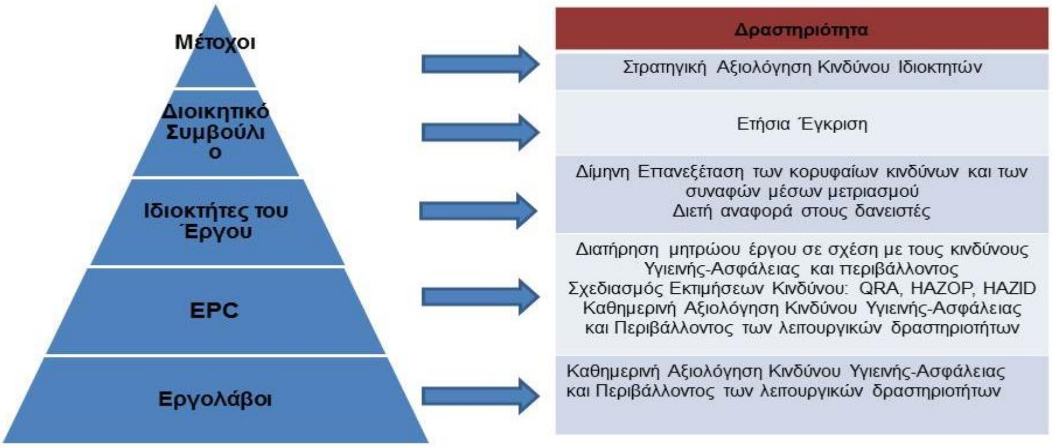

Figure 12-4: Hierarchy of responsibility for risk management

12.1.5.3 Legal and other requirements

The Project compliance framework (Project Standards) is summarised in Section 12.1.3 of this EIA, while more detailed information is provided in Chapter 5 of this EIA, which includes an analysis of relevant legislation, national policy and development plans.

Compliance with all relevant legislation will be a core commitment of EnEarth and will be publicly communicated as part of its environmental and social policy.

EnEarth will require EPC contractors to establish procedures for the active recognition of legislation and other standards relevant to the E&S management of their activities. It will also require that they establish measures to ensure that project personnel are aware of and comply with all relevant legal requirements. EPC contractors will compile a register of legal and other requirements in accordance with the Project Standards, which should be updated and communicated to Project personnel, as appropriate.

12.1.6 The Environmental Monitoring and Management System as a management system for EnEarth

In support of the ESMP, environmental and social management plans will be developed and implemented to manage and mitigate the E&C issues associated with the Project, in conjunction with the ESMPs already in place by Energean at its existing facilities. The following table presents the elements of this management. The Project's environmental and social management plans will be developed into full plans upon the mobilisation of the main construction and installation contractors, and will be regularly reviewed as construction progresses.

Table 12-1: Environmental and Social Management Plans

Plan Title	Issues covered
Chemical usage plan	Regulatory Framework Register of Chemical Substances Use and Quantities
Waste management plan	Waste Management and Principles Non-Hazardous Waste Management Procedures Hazardous Waste Management Procedures Wastewater/Sewage Management Procedures Monitoring, Reporting and Auditing
Stakeholder Engagement Plan (SEP) and Grievance Mechanism	Communication mechanism Management and monitoring of nuisances (e.g. construction noise, artificial light in work areas) Interaction with the local community (e.g. prior notification of noisy activities, traffic congestion due to freight transport) Monitoring and reporting
Cultural heritage discovery process	Cultural Heritage Education Chancellor's Finds Process Monitoring and Reporting
Emergency plan	Spill Prevention Spill Response Training Spill Management / Response Monitoring and Reporting
Pollution Prevention	Pollution prevention training Energy efficiency (vehicle, vessel and equipment selection, maintenance) Emission and dust management (e.g. vehicle and equipment emissions, dust management) Chemical selection and management, hazardous materials management Noise and vibration management and maximum permissible levels Contaminated soil management Monitoring and reporting
Health, Safety/Social and Environmental Plan (HSEP)	Responsibilities Applicable regulations, standards, rules and procedures Access to drilling sites Training Emergency drills Safety checks Monitoring and reporting Environmental policy Personnel protective equipment Personal health Medical assessment
Traffic management plan	Driver/Boat Training Vehicle/Vessel Movements in the Field Vehicle Movements Outside the Facility and Off-Road Driving Prohibition Risk Assessment for Cargo Transportation Monitoring and Reporting

Plan Title	Issues covered
Construction management plan	Διαχείριση έργου – Επιστήμη μηχανικών και διαδικασίες Ρόλοι και υποχρεώσεις Τυποποίηση έργου Διάγραμμα υλοποίησης Μετριασμός επιπτώσεων και διαδικασίες ελέγχου Επίβλεψη Εκπαίδευση Αξιολόγηση και αναφορά
Wildlife Biodiversity Management Plan	Biodiversity and wildlife education Protocols for offshore operations, including marine mammal mitigation measures Pre-construction ecological surveys and wildlife inspections Protection of habitats and species during construction (i.e. movement restrictions, code of conduct) Monitoring and reporting

EnEarth will manage the construction phase of the Project, monitoring and controlling the technical, environmental and social performance of its contractors throughout the construction phase. This will be done through the implementation of the Management Plans and the HSE Management System. The contractors will be responsible for managing their personnel and ensuring compliance with EnEarth's HSE management system, management plans and applicable requirements.

EnEarth will implement the Project by implementing the HSE Operational Phase, in line with the established HSE already implemented by Energean, based on the "design – do – evaluate – regulate" cycle. The commitments arising from the EIA and the EIA management plans will be integrated into the HSE management system.

12.1.7 Other related HSE MS'

The drilling rig used for the construction of the Project will implement a specific Health, Safety and Environmental Management Plan. The alignment of the drilling rig's plans, procedures and reporting requirements with the EnEarth Health, Safety and Environmental Management Plans will be achieved by creating a Bridging Document. This document will clearly define how all activities will be managed to ensure compliance with EnEarth's requirements.

The Bridging Document HSE is a dynamic document and will be reviewed at least annually. Both the EnEarth HSE and the drilling rig's HSE follow the same goals and objectives, which are reviewed separately as part of the internal review process.

Drilling monitoring and reporting will be carried out in accordance with EnEarth policy and procedures and will be defined within the rig's Environmental Operating Procedure, which details the method and frequency of reporting for the following categories:

- Deck drainage and wash water, waste water/liquid/oily waste management, fuel usage records,
- Drilling fluid management, cuttings, water-based mud (WBM) properties,
- Waste sent to shore,
- Drilling/well maintenance/cementing/test chemicals,
- Mud sampling and labeling,
- Drilling chemicals reporting,
- Reports of any environmental accidents, incidents, spills,
- Well closure environmental report.

Auditing and review are a key element of both HSEs. Where necessary, additional audits and inspections may be carried out to address identified areas of concern. Joint audits are carried out to ensure that procedures are being followed. Both HSEs have systems in place to control communication, track and follow up on audit and inspection recommendations.

12.1.8 Roles and Responsibilities

EnEarth is responsible for the detailed design, procurement, construction and operation of the proposed CCS Plant in Prinos.

As the Project Owner, EnEarth will have ultimate responsibility for the implementation of the ESMP, which will include:

- Ongoing management of environmental and social issues that arise as the detailed design progresses.
- Monitoring and auditing the Contractor's performance in relation to HSE (including working conditions).
- Assisting the Contractor in the implementation of the ESMP and specific management plans.
- Acting as a point of contact for consultation with Authorities and stakeholders.
- Monitoring and reporting on environmental and social compliance.
- Ensuring Contractors' compliance with Project standards and regulations.
- Recording of compliance and non-compliance with the provisions of the EIA.

The main construction and installation contractors for the construction of the proposed facilities are expected to fully comply with the relevant areas of the EnEarth EHS Management Plan, which will provide the framework for managing social and environmental issues throughout construction, prior to the operation of the new facilities.

The main construction and installation contractors will be required to develop and implement their own Construction Phase Management Plans for the Prinos CO2 Storage Facility, which should meet or exceed the requirements of the EnEarth EHS Management Plan.

The aforementioned EHS Management Plan will be used to fulfill the commitments of the Project's EIA and to coordinate and review the Project's environmental and social performance during the construction phase. Particular attention will be paid to the following:

- Practical training and increasing environmental and social awareness of personnel.
- Supervision and monitoring of environmental and social issues.
- Continuous improvement of environmental and social performance throughout the Project.
- The Contractor will be responsible for:
- Comply with national environmental protection legislation and permit conditions,
- Demonstrate how the requirements will be implemented during construction,
- Demonstrate commitment to the ESMP, specific management plans and EnEarth's HSE Management Plan at all levels, including subcontractors,
- Create a Contractor ESMP, in line with the ESMP and EnEarth's HSE Management Plan,
- Monitor and comply with any changes in the legislative and regulatory framework,
- Update the ESMP, as required.

12.1.9 Training

12.1.9.1 Introduction

Environmental training will help ensure that the requirements of the EIA and EMS are understood and adhered to by all Project personnel throughout their duration.

Environmental training will form part of the environmental management system. General environmental awareness training will be provided to all personnel.

Within the framework of the EMS, training programs will be provided on the implementation of mitigation measures, monitoring programs, etc. and to enhance the capabilities of personnel in relation to the EMS.

The training will apply to both the construction and operational phases. More specifically:

- Training during the construction phase:
    - Training on specific topics (in accordance with the EHS Management Plan)
    - Site/construction site management
    - Monitoring and control
    - Record keeping
    - Stakeholder engagement and Grievance Mechanism.
    - Emergency situations.
    - Health and safety.
- Training during the operation phase:
    - Training on specific topics (according to the HSE SD)
    - Operation of facilities
    - Monitoring and control
    - Record keeping
    - Emergency situations.
    - Health and safety.

12.1.9.2 Objectives of the training program

The main objective of the training program is to ensure that the requirements of the EIA are clearly understood and adhered to throughout the Project. Staff training will contribute to the communication of the environmental controls set out in the EIA and the EIA.

12.1.9.3 Roles and responsibilities

The Environmental Manager of EnEarth and the Environmental Consultant of the contractor will be initially responsible for providing all Project personnel with training related to the potential environmental issues of the Project or training related to the HSE.

The Contractor will prepare a Project-related training manual for this purpose. Contractors will be required to provide introductory training/informative training to all their personnel prior to the commencement of any activity on the Project site.

12.1.9.4 Training log

A training record will be maintained by EnEarth and the contractor(s). The training record will include:

- Topic,
- Date, time and location,
- Trainer, and
- Participants.

12.1.9.5 Educational needs assessment

In addition to the training specified in the training record, specific/additional training will be provided during each activity. The criteria for assessing the need for training will be based on the following:

- When a percentage of personnel has recently been introduced to the Project,
- When any non-compliance is repeatedly reported, retraining will be provided on this subject,
- When any accident/incident of major or minor importance occurs,
- Upon the arrival of a new contractor/subcontractor,
- Upon the start of a new process/activity.

12.1.9.6 Educational material

The EnEarth Environmental Manager and the Contractor's Environmental Consultant will develop and prepare the training materials for environmental and HSE awareness, for the EIA, the EMP and the controls to be followed during the Project. Separate training materials may be prepared for each topic. Table 12-2 includes general training topics according to the EIA and EMP requirements.

Table 12-2: Indicative scope of the educational program

Staff	Contents	Timeline
Selected management personnel and contractor(s) / subcontractor(s)	Environmental sensitivity of the Project area Key findings of the EIA Mitigation measures Site management Monitoring and control Record keeping Stakeholder participation and Grievance mechanism. Emergency situations. Health and safety.	Before the start of Project activities
All Project staff	Environmental sensitivity of the Project area Key findings of the EIA Good operating procedures Mitigation measures Waste management Site management / construction site Monitoring and control Record keeping Emergency situations. Health and safety	Before the start of Project activities

12.1.9.7 Training during the construction phase

During the construction phase, the Contractor shall be primarily responsible for the training of personnel. The Contractor shall ensure that personnel directly involved in the implementation of the CPMP shall have the adequate qualifications and skills required to perform this work.

Prior to the commencement of construction, the Contractor shall prepare a Training Plan. The Training Plan shall include:

- Induction training program for all personnel,
- Training procedures,
- Information material for personnel,
- Information material or training program for subcontractors
- Means of monitoring the effectiveness of the training plan.

Any specific Management Plan to be implemented during the construction of the Project shall also include the specifications for the relevant training.

12.1.9.8 Training during the operational phase

Training during operation will be implemented at all levels:

- Senior Management
- Drilling Personnel
- Barge Personnel
- Consultants and HSE Personnel.

Emergency response exercises will be part of the training program.

Each specific Management Plan that will be implemented during the operation of the Project will also include the specifications for the relevant training.

12.1.10 Communications

12.1.10.1 Communications during the construction phase

Communication between EnEarth and the Contractor

During construction, there will be a direct line of communication between the Contractor and the Company. The establishment of the line of communication is the responsibility of the Contractor. Other responsibilities of the Contractor regarding communication are:

- To inform the Company in advance regarding the schedule, progress and key activities of the construction.
- To inform EnEarth immediately in the event that any representative of the authorities or interested party intends to visit the Project.
- To inform EnEarth before each visit to the Authorities.
- To communicate to the Company any complaints from interested parties.
- To maintain a record of contacts.
- To communicate with other Contractors, if necessary, through EnEarth's communication procedures.

Contact with Authorities

EnEarth will be responsible for contacting the Authorities. In case the Contractor wishes to have a meeting with the Authorities, he must inform EnEarth before any action.

Contact with Interested Parties

Contact with Interested Parties is described in the SOP and the Complaints Mechanism.

12.1.10.2 12.1.10.2 Communications during the operation phase

Communication with authorities

EnEarth will be responsible for contacting the Authorities.

Communication with interested third party

Communication with Stakeholders is described in the SOP and the Complaints Mechanism.

12.1.11 Change Management

12.1.11.1 Overview

Although the Project will be designed at the level of the Implementation Study, there are always uncertainties in its development (construction and operation phase), which need to be addressed in a structured manner. The way changes are managed in the period after the submission or after the approval of the EIA will depend on the size and nature of the change.

The main legal framework in Greece for the environmental permitting of Project modifications is the provisions set out in Law 4014/11 as supplemented by the relevant Joint Ministerial Decisions (JMD). EnEarth will follow the regulatory framework, but the actions to be taken will be based on the size and nature of the change:

- Minor modifications usually do not require new or advanced environmental studies, but only environmental reports and notifications to the competent Authorities. Changes to the EIA will likely be minimal.
- Moderate changes usually require Reports for Modification of the Approved Environmental Terms or even a new EIA. In such a case, a revision of certain sections of the EIA is required.
- Major changes require a new EIA and a complete revision of the EIA.

12.1.11.2 Emergency preparedness and response

EnEarth will require all Project personnel, including the EPC department and contractors, to identify potential and actual emergency situations and respond to these situations in an appropriate manner, in order to prevent or mitigate potential adverse E&C impacts.

EnEarth will require that the needs of stakeholders (e.g. emergency services, local community, neighbouring facilities) are considered as part of this process, and that practices are reviewed, tested and revised at regular intervals, and where necessary.

For the construction phase, the EPC team will develop emergency response procedures. These procedures will be implemented and tested during the first 3 months of the Project, with provision for training for the personnel involved.

EnEarth will review and monitor the performance of the EPC team and related emergency response plans during the monthly Project Management Meetings, where appropriate.

During the operational phase of the Project, Emergency Preparedness and Response will be the responsibility of EnEarth, based on the Qualitative Risk Assessment (QRA) of the Project design.

12.1.12 Contractor and Supplier Management

All Contractors and Suppliers shall follow EnEarth's OHS Policy, OHS Management Plan and OHSMP. Contractors shall develop their own OHSMP in accordance with this.

Contractors and Suppliers shall be aware of and comply with duties and responsibilities arising from national, EU and international regulations and EBRD standards in relation to OHS and labour issues.

EnEarth shall be responsible for providing Contractors and Suppliers with all relevant documentation and implementing a compliance audit process.

12.1.13 Environmental monitoring and reporting

12.1.13.1 Environmental Compliance Monitoring

Compliance monitoring will be carried out to ensure compliance with the requirements of the EIA. The objectives of EIA compliance monitoring will be:

- The systematic monitoring of the Project's construction activities,
- Ensuring compliance of the works with the EIA, the EMP, the HSE Management System and other specifications set by EnEarth,
- Recording and communicating observations to the relevant EnEarth persons, so that timely corrective measures can be taken, if required,
- Keeping a record of incidents of environmental significance and the related actions and corrective measures.

Compliance monitoring will be the responsibility of all groups involved in the construction, namely EnEarth and the contractor(s)/subcontractor(s) and will therefore be carried out at two levels.

- Monitoring by the Environmental Manager of EnEarth HSE and
- Monitoring by the Environmental Engineer(s) of the contractor(s)/subcontractor(s) as appropriate.
- During the compliance monitoring, the following parameters will be checked, among others:
- Visual inspection of gaseous pollutant emissions,
- Recording of water consumption for each Project activity,
- Waste management (hazardous and non-hazardous),
- Recording of noise levels from each Project activity and
- Recording of environmental complaints in a complaints register (in accordance with the communication mechanism).

The proposed Monitoring Program is set out in Section 12.2.2. 12.2.2

12.1.13.2 Complaints register

The Environmental Officer will maintain a register of complaints received from the local community and the measures taken to mitigate these concerns. All complaints from the local community will be forwarded to the Environmental Manager for further action.

The procedure will be defined as described in the Grievance Mechanism chapter, based on the Stakeholder Engagement Plan.

12.1.13.3 Photographic archive

Η EnEarth θα τηρεί φωτογραφικό αρχείο όλων των περιοχών που πρόκειται να χρησιμοποιηθούν κατά τη διάρκεια του Έργου. Το φωτογραφικό αρχείο θα περιλαμβάνει κατ' ελάχιστον τις φωτογραφίες των περιοχών πριν και μετά από τις δραστηριότητες του Έργου. Το φωτογραφικό αρχείο θα τηρείται επίσης για οποιαδήποτε μη-συμμόρφωση που παρατηρείται κατά τη διάρκεια του Έργου.

12.1.13.4 Audit reports

As part of EnEarth's responsibilities, the company's Environmental Consultant will be called upon to conduct weekly inspections of the work sites.

The Environmental Consultant will be called upon to inspect on a daily basis any other construction site for which the Contractor is responsible, in accordance with the following table where applicable.

Table 12-3: Daily workplace inspections

Controls through observation
Waste
Separation of solid waste by system (general, hazardous, recyclable, waste materials)
Leaks
Effectiveness of control measures
Stormwater leachates / wastewater discharges
Water use
Water pollution accidents
Any activities not compatible with the WMP

The Contractor's Environmental Consultant will be required to conduct monthly inspections of all construction sites, which may also involve subcontractors, and may include, but are not limited to, the following:

- Implementation of the Monitoring Program
- All construction sites/points of the Project,
- Environmentally sensitive areas that could potentially be affected,
- Waste storage facilities (general, hazardous, recyclable, waste materials, etc.),
- Dumping areas.

EnEarth will maintain a record of all internal or external audits and inspections carried out to verify compliance with the EMP.

12.1.13.5 Disclosure and Documentation

An effective mechanism for storing and communicating environmental information during the Project is an essential requirement of a PMMS. The key features of such a mechanism are:

- Accurately recording and maintaining all information collected during monitoring,
- Sharing the information in a central (digital) location,
- Processing the information to produce periodic reports, and
- Providing information and responding to questions regarding Project monitoring from various observers and stakeholders

12.1.13.6 Meetings

The following Environmental Meetings will be held during the Project:

- Kick-off Meeting

The purpose of the kick-off meeting will be to present the Environmental Management Plan to the senior management of the Project team and for the contractors to discuss its implementation.

- Weekly Meetings

A weekly meeting will be held to discuss the environmental performance during the operation of the Project, the non-conformities noted by the Environmental Consultant and their remediation measures.

The purpose of the weekly Environmental Meeting will be to review the weekly performance of the Project operation by examining the number of non-conformities and environmental incidents that occurred during the week, the progress of daily operations, and to determine additional controls, mitigation measures or monitoring requirements.

The meeting will be recorded in the form of a weekly Environmental Monitoring report including a log of actions.

12.1.14 Non-Compliance Incident Management

EnEarth's responsible persons for the HSE MP shall conduct an inspection for non-compliance. Inspections shall be conducted at all construction sites and operational areas of the Project. In case of non-compliance, a report shall be prepared for the HSE Manager. The HSE Manager shall decide on the approval of the report. If the report is accepted, corrective actions shall be taken.

Incidents shall be promptly investigated. All personnel shall immediately report all incidents and near misses, in accordance with the company's HSE system and procedures.

Incidents and non-compliances related to construction work and HSE management shall be reported, in the first instance, by the EPC Team and shall be reviewed by the EnEarth HSE Team Manager. The EPC team shall maintain procedures for incident reporting, investigation, corrective/preventive action and resolution (as defined in the EPC Team HSE Manual), and shall develop these procedures to include reporting lines to the HSE Team Manager. Any exceedance of a standard or threshold shall be recorded as an incident.

Incident/non-compliance reporting procedures shall be part of the initial training of Project employees prior to commencement of employment.

12.1.15 Report Writing

EnEarth will prepare weekly and monthly environmental monitoring reports for each activity, as well as in special cases such as change of management, end of period or for external audit needs (Error! Reference source not found.). The reports will be prepared by the HSE Team and reviewed by the EnEarth HSE Manager.

Table 12-4: Environmental monitoring report

Έκθεση	Χρονική Παρακολούθηση
Weekly	On the first day of the following week
Monthly	Within 7 days of the end of the reporting period
Management of change	Whenever required
Final	Within 30 days of the end of the reporting period
Audit report	Whenever required

12.2 ENVIRONMENTAL MONITORING

12.2.1 Introduction

The implementation of the EIA will aim to comply with the requirements of the EIA. Compliance assessment is carried out by:

- Systematic monitoring of the implementation of the measures,
- Verification of the effectiveness of the measures,
- Record keeping,
- Drafting of Reports.

Within the framework of the EIA, a monitoring mechanism is defined and monitoring parameters are defined in order to:

- Ensure the full implementation of all mitigation measures,
- Ensure the effectiveness of the mitigation measures,
- Define the requirements for environmental monitoring and control,
- Provide a mechanism for timely action against environmental emergencies,
- Define the training requirements at the various levels.

The monitoring program ensures that the impacts of the Project are within the foreseen limits and that timely information is provided in case an unacceptable impact occurs. For each component of the monitoring program, the following information should be presented:

- Mitigation measures recommended by the EIA,
- Monitoring responsible,
- Monitoring parameters,
- Monitoring frequency.

Monitoring of key environmental and social parameters is essential for the analysis of impacts from the construction and operation of the Project. The monitoring process will allow EnEarth to identify changes in the environmental performance of the Project and will facilitate improvements in the environmental and social management system. EnEarth's HSE Manager will be responsible for monitoring impacts. The optimal monitoring techniques and the monitoring frequency of the selected parameters will be defined.

12.2.2 Proposed Monitoring Program

The monitoring plan for the Prinos CO2 Storage Project will be aligned with the monitoring parameters foreseen for the existing Prinos facilities and which Energean is already monitoring.

In case of new legal/regulatory obligations, the Monitoring Plan for the Prinos CO2 Storage Project will need to be extended to cover those that are added.

The following Tables present the proposed Environmental Monitoring Plan (EMP) of the project which focuses on monitoring the significant environmental parameters of the study area, during the construction and operation phases of the proposed project. The findings of the EMP during the construction and operation of the proposed project will be summarized in a relevant Annual Report, which should be formulated in a way that is understandable to the public and made public via the internet. The report will be communicated to the Ministry of Environment, which exercises responsibilities for environmental licensing, environmental inspection and control, as well as management of biodiversity and protected areas.

It is noted that the EIA during the decommissioning/decommissioning phase of the project will be prepared at the appropriate time, taking into account the results of the observations that will have arisen by then and will concern the construction and operation stages of the Project.

Furthermore, it is important to note that the following EIA of the project does not include provisions for the monitoring of the possibly released CO2, which is the subject of the specific CO2 Monitoring Plan of Paragraph 2 of Article 14 of JMD 48416/2037/E.103/2011 and is set out in the relevant Annex 16.2.

Table 12-5: Proposed Environmental Monitoring Plan during the construction phase of the project

Construction phase						
A/A.	Environmental / Social Parameter	Indicator	Measurable Indicator Parameters	Sampling / observation methodology	Sampling / observation frequency	Locations / extent of sampling / observations
1	Ύδατα					
1.1	Sea Waters	Seawater quality	Quality of water that will arise in the trenches or excavations during the works for the installation of land infrastructure. Based on the results of the analyses, their characterization will result and the intended appropriate treatment / discharge into water bodies will be determined. Indicatively, parameters to be controlled are Polycyclic Aromatic Hydrocarbons (PAHs - 16 USEPA PAHs) and (heavy) metals (to be determined based on the sources of potential pollution in the area).	Λήψη δειγμάτων και χημική ανάλυση τους σε πιστοποιημένο εργαστήριο (ακολουθώντας την αντίστοιχη μεθοδολογία που χρησιμοποιείται για τις αναλύσεις του παραγόμενου επεξεργαζόμενου ύδατος από της υφιστάμενες εγκατάστασης εξόρυξης ΥΓ).	Ανά εβδομάδα κατά τη Φάση 3 και Φάση 5 των εργασιών τοποθέτησης και ενταφιασμού του υπεράκτιου αγωγού. Ανά δίμηνο κατά την υλοποίηση των υπόλοιπων εργασιών εντός του θαλάσσιου περιβάλλοντος.	Από σημείο εντός ορύγματος για τις εργασίες για την εγκατάσταση των χερσαίων υποδομών (χερσαίο τμήμα αγωγού μεταφοράς CO_2)
1.2	Sea Waters	Seawater quality	• • Seawater quality with measurements with a portable instrument (pH, turbidity, dissolved oxygen (DO), total dissolved solids (TDS), temperature, salinity and electrical conductivity) at the bottom and at the surface of the water column. • • Analyses in an accredited laboratory (indicatively: total dissolved carbon (TIC), total nitrogen (TN), total phosphorus (TP), 16 USEPA PAHs) on water samples from the bottom and the surface.	It is proposed to adopt the methodology applied in the context of the environmental monitoring of the offshore installations of Prinos (AEPO DIPA/8413/24.04.2018), so that the results are comparable and that the historical data that have emerged in the context of the environmental monitoring of the offshore installations are also taken into account. Therefore, this Indicative Methodology includes the following: • At the sampling stations, on-site measurements should be carried out (with the help of a boat) using a portable multiparameter instrument in the surface and benthic waters for the parameters pH, turbidity, temperature, dissolved oxygen (DO), total dissolved solids (TDS), salinity, conductivity. • • Sampling should be carried out with NISKIN water sampling equipment from the surface and the seabed. The water samples shall be stored in sterile jars and analyzed for 16 PAHs according to the United States Environmental Protection Agency (USEPA) in an accredited laboratory. The results shall then be evaluated in relation to the limits set out in WFD 2000/60, WFD 2008/56 and the report "Directorate-General for Public Works and Water Management (Rijkswaterstaat), 2002, Water pollution control in the Netherlands".	Weekly during Phase 3 and Phase 5 of the offshore pipeline installation and burial works. Bimonthly during the implementation of the remaining works within the marine environment.	It is proposed to take into account the locations of the sampling points studied in the context of the environmental monitoring of the Prinos offshore facilities (AEPO DIPA/8413/24.04.2018), so that the results are comparable. In addition to the sampling stations investigated in the context of the EIA and the EMP of the Prinos offshore facilities (i.e. 9, 11, 12, 13-REF- as defined in the context of the EIA and EMP of the Prinos offshore facilities), within the context of this project it is proposed to include 2 more sampling stations along the CO2 transport pipeline and one more sampling station in the coastal section near the onshore facilities of the project.
2	Biodiversity					
2.1	**Biodiversity**	Monitoring of benthic macroinvertebrates	Identification of benthic macroinvertebrates as an indicator of the ecological status of the marine environment (application of statistical analysis and the BENTIX ecological index).	It is proposed to adopt the methodology applied in the context of the environmental monitoring of the offshore installations of Prinos (AEPO DIPA/8413/24.04.2018), so that the results are comparable and that the historical data that have emerged in the context of the environmental monitoring of the offshore installations are also taken into account. Therefore, this Indicative Methodology includes the following: Sampling to be carried out by divers, with corers of 10 cm diameter and 35 cm height. The samples to be taken by inserting the corer into the bottom sediment to a depth of 20 cm, closing and transporting to the surface (four (4) replicate samples per sampling point). The content of each corer to be sieved separately, with a 1 mm opening sieve. The material retained on the sieve should be stored in plastic containers, fixed in a solution of 4% formalin and 96% seawater and stained with Bengal red.Στο εργαστήριο, τα είδη βενθικών μακροασπόνδυλων να αναγνωριστούν με οπτικό μικροσκόπιο. Να υπολογιστεί ο πλούτος ειδών (S), η αφθονία (N), ο δείκτης ποικιλότητας Shannon (H).	With seasonal frequency and in any case no later than every three (3) months	It is proposed to take into account the locations of the sampling points studied in the context of the environmental monitoring of the Prinos offshore facilities (AEPO DIPA/8413/24.04.2018), so that the results are comparable. In addition to the sampling stations investigated in the context of the EIA and the EIA of the Prinos offshore facilities (i.e. 9, 11, 12, 13-REF- as defined in the context of the EIA and EMP of the Prinos offshore facilities), within the context of this project it is proposed to include 2 more sampling stations along the CO2 transmission pipeline and one more sampling station in the coastal section near the onshore facilities of the project. At sediment sampling points for benthic macroinvertebrates, a sediment sample should be taken for physicochemical analyses so that the results can be correlated.

Construction phase						
A/A.	Environmental / Social Parameter	Indicator	Measurable Indicator Parameters	Sampling / observation methodology	Sampling / observation frequency	Locations / extent of sampling / observations
				Στα αποτελέσματα να εφαρμοστεί στατιστική ανάλυση με τη χρήση του λογισμικού PRIMER ή R. Ο δείκτης BENTIX να εφαρμοστεί για την αξιολόγηση της οικολογικής κατάστασης, καθώς είναι ο επιλεγμένος βιοτικός δείκτης για το συγκεκριμένο πεδίο εφαρμογής (για τα υδάτινα σώματα της Ελλάδας) σύμφωνα με την Οδηγία-Πλαίσιο για τα Ύδατα 2000/60 και την οδηγία-πλαίσιο για τη θαλάσσια στρατηγική 2008/56.		
2.2	**Biodiversity**	Marine mammal monitoring	Monitoring and recording the occurrence of marine mammals (Phocoena phocoena, Tursiops truncates) which are protected objects of the Natura 2000 SPA – SCI with code GR1150014 and name "Marine Area of Kavala – Thassos".	For the recording of avifauna in the marine environment, it is proposed to apply the recording methods that were also applied in the MEOA of the project (for more detailed descriptions, refer to the MEOA of the project (Annex 16.2 of this document). Indicatively • Visual recordings from a boat • Aerial visual recordings • Acoustic recordings by boat	Continuous monitoring during Phase 3 and Phase 5 of the offshore pipeline installation and burial works. With seasonal frequency, during the implementation of the remaining works within the marine environment and in any case no later than every three (3) months.	The on-site observations will be divided into the following time periods: • 50% in the project's field research area, as defined by the project's MEOA. • 50% of the time in the project's extended field research area, as defined by the project's MEOA.
2.3	**Biodiversity**	Sea turtle monitoring	Monitoring and recording the appearance of the sea turtle Caretta caretta, which is a protected object of GR1150001. Observation also for the other species of sea turtles Chelonia mydas, Dermochelys coriacea.	For the recording of birdlife in the marine environment, it is proposed to apply the recording methods that were also applied in the MEOA of the project (for more detailed descriptions, refer to the MEOA of the project (Annex 16.2 of this document). Indicatively • Visual recordings from a boat • Aerial visual recordings • Acoustic recordings by boat • Additional research on the coast along the entire length of the field research area but also on the coast up to Keramoti in order to record dead animals and possible signs of nesting.	Continuous monitoring during Phase 3 and Phase 5 of the offshore pipeline installation and burial works. With seasonal frequency, during the implementation of the remaining works within the marine environment and in any case no later than every three (3) months.	The on-site observations will be divided into the following time periods: • 50% in the project's field research area, as defined by the project's MEOA. • 50% of the time in the project's extended field research area, as defined by the project's MEOA.
2.4	**Biodiversity**	Seabird monitoring	Monitoring and recording of the bird species Phalacrocorax aristotelis desmarestii, Puffinus yelkouan which are protected objects of the Natura 2000 marine area SPA – SCI with code GR1150014 and name "Marine Area of Kavala – Thassos" as well as other bird species which are protected objects of the neighboring SPA areas of the Natura 2000 network and regularly use GR1150014.	For the recording of avifauna in the marine environment, it is proposed to apply the recording methods that were also applied in the MEOA of the project. Indicatively: • A) Visual recordings from vessels using the European Seabirds at Sea «ESAS» method include the recording of birds and other species of marine fauna at sea along linear routes based on Tasker et al. (1984) and Champhuysen & Garthe (2004), as adopted in Greek/Mediterranean conditions through the LIFE Nature project for the identification of Important Marine Bird Areas (IMBAs) in Greece, entitled "Concrete Conservation Actions for the Mediterranean Shag and Audouin's Gull in Greece, including the Inventory of Relevant Marine IBAs" (LIFE07 NAT/GR/000285) and described by Fric & Gaganis (2009). • B) Visual surveys from a boat along the coastline include the recording of birds and other fauna species in the coastal marine and terrestrial zone from a boat, as described in Fric et al. (2012) and Dimalexis et al. (2008). • C) Visual surveys from pre-selected viewpoints on the coast include the recording of birds and other fauna species in the coastal marine and terrestrial zone from observational viewpoints on the coast, as described in Fric et al. (2012), with the aim of recording space use and migration/movement flows in areas where, due to the topography of the areas, concentrations of seabirds are expected, in order to assess the	With seasonal frequency, during the implementation of the remaining works within the marine environment and in any case no later than every three (3) months.	The on-site observations will be divided into the following time periods: • 50% in the project's field research area, as defined by the project's MEOA. • 50% of the time in the project's extended field research area, as defined by the project's MEOA.

Construction phase						
A/A.	Environmental / Social Parameter	Indicator	Measurable Indicator Parameters	Sampling / observation methodology	Sampling / observation frequency	Locations / extent of sampling / observations
				flow of seabirds to and from the Gulf of Kavala. These areas include the Keramoti-Thassos channel, Cape Vrasidas in Nea Peramos and the Capes of Kefalas and Skala Prinos in Thassos.		
2.5	**Biodiversity**	Monitoring of wading birds and land turtles.	Monitoring and recording of breeding wading bird species and land turtles (protected objects of GR1150001 and GR1150010) in the sand dune zone / on either side of the Sigma factory.	For recording birdlife in the marine environment, it is proposed to apply the recording methods that were also applied in the MEOA of the project. For recording birdlife in the terrestrial and wetland environment: • Direct observation (Look-and-See) concerns the recording of birds from selected observation points that are selected based on the existing knowledge of the area regarding the species of interest and their habitats (e.g. Hadjicharalambous et al., 2004) with the aim of assessing the distribution and abundance of birdlife. The points were chosen so as to cover the area under consideration to the greatest possible extent spatially. The identification and identification of birdlife species and the counting of individuals are done with the naked eye, binoculars or a telescope depending on the distance from the observer. In the case of cryptic species, the identification and identification of species can also be done acoustically. For recording terrestrial reptiles in the terrestrial environment: • Recording with slow movement in space. In the sand dunes, the population of land turtles was recorded with the movement of 2 researchers in lines, when it was found that it has a significant population depending on the sand dunes in protected areas in northern Greece.	Before the start of work to determine the base prices. With seasonal frequency, during the implementation of the work and in any case no later than every three (3) months.	In the coastal section (with emphasis on the sand dunes) of the land part of the project.
2.6	**Biodiversity**	Fauna - Birdlife Species	Index of dead/injured individuals of fauna and avifauna	Identification and recording of dead/injured individuals of fauna and avifauna in the immediate area of influence of the project. The reasons for injury/death of these individuals should be investigated (e.g. in the event that an individual has been injured by the construction activities of the project.	Continuous macroscopic visual observation by project workers.	Total project
3	Acoustic environment - Vibrations					
3.1	**Acoustic environment**	Environmental noise assessment index	Indicatively includes the parameters: • **LAeq** • **Lden (day-evening-night level)**, which results from the indicators: ○ L_{day} ○ $L_{evening}$ ○ L_{night}	Measurements with a sound level meter.	Montlhy basis	On the work front.
3.2	**Acoustic environment**	Underwater noise assessment index	Indicatively includes the parameter: PSD (**dB re 1** μPa ^{2} Hz)	24 hour measurements with autonomous recording unit (ARU)	Montlhy basis	In position 150 m from the front of the works.
5	Environmental performance of the project					
4.1	**Waste**	Waste generation and disposal index.	Includes the parameters: • Generated quantities: • Liquid waste. • Solid waste. • Household waste. • Hazardous waste. • Methods of managing the above waste and corresponding quantities. • Alternative methods of managing the above waste (e.g. recycling) and corresponding quantities.	Processing of data on the project's waste production.	Bimonthly basis	Throughout the project

Construction phase						
A/A.	Environmental / Social Parameter	Indicator	Measurable Indicator Parameters	Sampling / observation methodology	Sampling / observation frequency	Locations / extent of sampling / observations
4.2	**Inflow of energy and raw materials**	Energy and raw material use index.	Includes the parameters: • Resource inputs: • Energy. • Water. • Fuels. • Raw materials (chemicals). • Other resources. • Methods of saving upstream resources.	Processing project resource usage data.	Bimonthly basis	Throughout the project
4.3	**Workspaces**	Workplace control index.	Workplace Inspections: • Waste. • Solid waste segregation by system (general, hazardous, recyclable, waste materials). • Hydrocarbon leakage. • Effectiveness of control measures. • Stormwater/wastewater discharges. • Water pollution accidents. • Any activities that contravene the EHSM.	On-site visual observation.	Weekly basis	The entire project area. Environmentally sensitive areas that could potentially be affected on a case-by-case basis. Liquid and solid waste storage facilities (general, hazardous, recyclable, waste materials, etc.). Dumping areas.
4.4	**Environmental terms**	Environmental conditions control index	It includes all general Project ETs that are not included in any other specialized monitoring indicator in this table.	On a case-by-case basis, depending on the requirements of each ET.	On a case-by-case basis, depending on the requirements of each ET.	Throughout the project
5	Human-made environment					
5.1	**Human-made environment**	Social impact index	It includes parameters such as the following: • Social acceptance of the project. • Potential issues of the local community related to the operation of the project. • Infrastructure projects. • Impacts - on the productive structure of the local economy and on other economic activities (e.g. livestock production and tourism).	• Processing of data from the Concerns Communication Mechanism. • Review of data (studies, announcements, publications, etc.) from public and private entities related to the activities in the project area (legal entities of the administration, chambers, universities, etc.).	Monthly basis	The entire project area.
5.2	**Human-made environment**	Corporate awareness index	It includes parameters such as the following: • Corporate social responsibility actions of the company. • • Project employees from the wider project area.	Editing project details.	Monthly basis	The entire project area.
6	Health and Safety					
6.1	**Health and Safety**	Working conditions, health and safety	It includes parameters such as: • Health and Safety (H&S) Monitoring and Audits. • H&S Performance Evaluation • Personal Protective Equipment Monitoring	• Total recordable incidents, lost time incidents and other H&S indicators. • Records verifying the status of Personal Protective Equipment	Monthly basis	Throughout the project
6.2	**Health and Safety**	Working conditions, health and safety	It includes parameters such as: • Concern communication mechanism files • Training files	• Maintain a mechanism for communicating concerns • Analyze employee and community complaint trends • Maintain training records	Monthly basis	Throughout the project

Table 12-6: Proposed EMP for the project's operational phase

Operations phase						
A/A.	Environmental / Social Parameter	Indicator	Measurable Indicator Parameters	Sampling / observation methodology	Sampling / observation frequency	Locations / extent of sampling / observations
1	Water					
1.1	**Seawater**	Seawater quality	Qualitative characteristics of the treated water from the pumping wells before its discharge into the marine environment. The parameters to be monitored will be determined based on the characteristics of the water to be pumped from the reservoir. The pumped water is expected to have a higher salinity than that of seawater and may contain oil impurities. In addition to the parameters to be determined, the temperature of the treated water should be monitored before its discharge into the sea.	Taking samples and chemical analysis in a certified laboratory (following the corresponding methodology used for the analyses of the treated water produced by the existing HS mining facility).	Weekly basis	At the exits of tanks and pipelines required before the discharge of the produced treated water into the marine environment.
1.2	**Seawater**	Seawater quality	• Seawater quality with measurements with a portable instrument (pH, turbidity, dissolved oxygen (DO), total dissolved solids (TDS), temperature, salinity and electrical conductivity) at the bottom and at the surface of the water column. • Analyses in an accredited laboratory (indicatively: total dissolved carbon (TIC), total nitrogen (TN), total phosphorus (TP), 16 USEPA PAHs) on water samples from the bottom and the surface.	It is proposed to adopt the methodology applied in the context of the environmental monitoring of the offshore installations of Prinos (AEPO DIPA/8413/24.04.2018), so that the results are comparable and that the historical data that have emerged in the context of the environmental monitoring of the offshore installations are also taken into account. Therefore, this Indicative Methodology includes the following: • At the sampling stations, on-site measurements should be carried out (with the help of a boat) using a portable multiparameter instrument in the surface and benthic waters for the parameters pH, turbidity, temperature, dissolved oxygen (DO), total dissolved solids (TDS), salinity, conductivity. • Sampling should be carried out with NISKIN water sampling equipment from the surface and the seabed. The water samples shall be stored in sterile jars and analyzed for 16 PAHs according to the United States Environmental Protection Agency (USEPA) in an accredited laboratory. The results shall then be evaluated in relation to the limits set out in WFD 2000/60, WFD 2008/56 and the report "Directorate-General for Public Works and Water Management (Rijkswaterstaat), 2002, Water pollution control in the Netherlands".	Every 3 years	It is proposed to take into account the locations of the sampling points studied in the context of the environmental monitoring of the Prinos offshore facilities (AEPO DIPA/8413/24.04.2018), so that the results are comparable. In addition to the sampling stations investigated in the context of the EIA and the EIA of the Prinos offshore facilities (i.e. 9, 11, 12, 13-REF- as defined in the context of the EIA and EMP of the Prinos offshore facilities), within the context of this project it is proposed to include 2 more sampling stations along the CO2 transport pipeline and one more sampling station in the coastal section near the onshore facilities of the project.
2	Έδαφος/Θαλάσσιος Πυθμένας					
2.1	**Seabed**	Seabed Qualitative Characteristics	Bottom quality with sediment analyses in an accredited laboratory for the parameters. Indicatively includes the parameters: granulometric analysis, pH, total organic carbon (TOC), total nitrogen (TN), total phosphorus (TP), 16 USEPA PAHs, metals (according to the United States Environmental Protection Agency (USEPA) Cu, Fe, Zn, Mn, Pb, Cd, Ni, Cr, As, Co, Mo), calcium carbonate ($CaCO_3$), sulfates $SO4_{2-}$, VOCs).	It is proposed to adopt the methodology applied in the context of the environmental monitoring of the offshore installations of Prinos (AEPO DIPA/8413/24.04.2018), so that the results are comparable and that historical data that have emerged in the context of the environmental monitoring of the offshore installations are also taken into account. Therefore, this Indicative Methodology includes the following: Sampling to be carried out by divers, with corers (indicative diameter 10 cm and height 35 cm). The samples to be taken by inserting the corer into the bottom sediment to a depth of 20 cm, closing and transporting to the surface. At least 2 repetitions of the sample to be taken at each sampling location. The sediment incorporated into the corers should be stored in appropriate jars and sent to an accredited laboratory for laboratory analysis.	Every 3 years	It is proposed to take into account the locations of the sampling points studied in the context of the environmental monitoring of the Prinos offshore facilities (AEPO DIPA/8413/24.04.2018), so that the results are comparable. In addition to the sampling stations investigated in the context of the EIA and the EIA of the Prinos offshore facilities (i.e. 9, 11, 12, 13-REF- as defined in the context of the EIA and EIA of the Prinos offshore facilities), within the context of this project it is proposed to include 2 more sampling stations along the CO2 transmission pipeline and one more sampling station in the coastal section near the onshore facilities of the project
3	Biodiversity					
3.1	**Biodiversity**	Monitoring of benthic macroinvertebrates	Identification of benthic macroinvertebrates as an indicator of the ecological status of the marine environment (application of statistical analysis and the BENTIX ecological index).	It is proposed to adopt the methodology applied in the context of the environmental monitoring of the offshore installations of Prinos (AEPO DIPA/8413/24.04.2018), so that the results are comparable and that the historical data that have emerged in the	Every 3 years.	It is proposed to take into account the locations of the sampling points studied in the context of the environmental monitoring of the Prinos offshore facilities (AEPO DIPA/8413/24.04.2018), so that the results are comparable.

Operations phase						
A/A.	Environmental / Social Parameter	Indicator	Measurable Indicator Parameters	Sampling / observation methodology	Sampling / observation frequency	Locations / extent of sampling / observations
				context of the environmental monitoring of the offshore installations are also taken into account. Therefore, this Indicative Methodology includes the following: Sampling to be carried out by divers, with corers of 10 cm diameter and 35 cm height. The samples to be taken by inserting the corer into the bottom sediment to a depth of 20 cm, closing and transporting to the surface (four (4) replicate samples per sampling point). The content of each corer to be sieved separately, with a 1 mm opening sieve. The material retained on the sieve should be stored in plastic containers, fixed in a solution of 4% formalin and 96% seawater and stained with Bengal red. In the laboratory, the species of benthic macroinvertebrates should be identified with an optical microscope. The species richness (S), abundance (N), Shannon diversity index (H) should be calculated. The results should be subjected to statistical analysis using PRIMER or R software. The BENTIX index should be applied to assess the ecological status, as it is the selected biotic indicator for the specific scope of application (for the water bodies of Greece) according to the Water Framework Directive 2000/60 and the Marine Strategy Framework Directive 2008/56.		In addition to the sampling stations investigated in the context of the EIA and the EIA of the Prinos offshore facilities (i.e. 9, 11, 12, 13-REF- as defined in the context of the EIA and EIA of the Prinos offshore facilities), within the context of this project it is proposed to include 2 more sampling stations along the CO2 transmission pipeline and one more sampling station in the coastal section near the onshore facilities of the project. At sediment sampling points for benthic macroinvertebrates, a sediment sample should be taken for physicochemical analyses so that the results can be correlated.
3.2	Biodiversity	Marine mammal monitoring	Monitoring and recording the occurrence of marine mammals (Phocoena phocoena, Tursiops truncates) which are protected objects of the Natura 2000 SPA – SCI with code GR1150014 and name "Marine Area of Kavala – Thassos".	For the recording of avifauna in the marine environment, it is proposed to apply the recording methods that were also applied in the MEOA of the project (for more detailed descriptions, refer to the MEOA of the project (Annex 16.2 of this document). Indicatively • Visual recordings from a boat • Aerial visual recordings • Acoustic recordings by boat	Every 3 years.	The on-site observations will be divided into the following time periods: • 50% in the project's field research area, as defined by the project's MEOA. • 50% of the time in the project's extended field research area, as defined by the project's MEOA.
3.3	Biodiversity	Sea turtle monitoring	Παρακολούθηση και καταγραφή της εμφάνισης της θαλάσσιας χελώνας *Caretta caretta* που αποτελεί προστατευτέο αντικείμενο της GR1150001. Παρατήρηση και για τα άλλα είδη θαλάσσιων χελωνών *Chelonia mydas, Dermochelys coriacea*.	For the recording of birdlife in the marine environment, it is proposed to apply the recording methods that were also applied in the MEOA of the project (for more detailed descriptions, refer to the MEOA of the project (Annex 16.2 of this document). Indicatively • Visual recordings from a boat • Aerial visual recordings • Acoustic recordings by boat • Additional research on the coast along the entire length of the ROP but also on the coast up to Keramoti in order to record dead animals and possible signs of nesting.	Every 3 years.	The on-site observations will be divided into the following time periods: • 50% in the project's field research area, as defined by the project's MEOA. • 50% of the time in the project's extended field research area, as defined by the project's MEOA.
3.4	Biodiversity	Seabird monitoring	Monitoring and recording of the bird species Phalacrocorax aristotelis desmarestii, Puffinus yelkouan which are protected objects of the Natura 2000 marine area SPA – SCI with code GR1150014 and name "Marine Area of Kavala – Thassos" as well as other bird species which are protected objects of the neighboring SPA areas of the Natura 2000 network and regularly use GR1150014.	For the recording of avifauna in the marine environment, it is proposed to apply the recording methods that were also applied in the MEOA of the project. Indicatively: • A) Visual recordings from vessels using the European Seabirds at Sea "ESAS" method includes the recording of birds and other species of marine fauna at sea along linear routes based on Tasker et al. (1984) and Champhuysen & Garthe (2004), as adopted in Greek/Mediterranean conditions through the LIFE Nature project for the identification of Important Marine Bird Areas (IMBAs) in Greece, entitled "Concrete Conservation Actions for the Mediterranean Shag and Audouin's Gull in Greece, including the Inventory of Relevant Marine IBAs" (LIFE07 NAT/GR/000285) and described by Fric & Gaganis (2009). • B) Visual surveys from a boat along the coastline include the recording of birds and other fauna species in the coastal marine	Every 3 years.	The on-site observations will be divided into the following time periods: • 50% in the project's field research area, as defined by the project's MEOA. • 50% of the time in the project's extended field research area, as defined by the project's MEOA.

Operations phase						
A/A.	Environmental / Social Parameter	Indicator	Measurable Indicator Parameters	Sampling / observation methodology	Sampling / observation frequency	Locations / extent of sampling / observations
				and terrestrial zone from a boat, as described in Fric et al. (2012) and Dimalexis et al. (2008). • C) Visual surveys from pre-selected viewpoints on the coast include the recording of birds and other fauna species in the coastal marine and terrestrial zone from observational viewpoints on the coast, as described in Fric et al. (2012), with the aim of recording space use and migration/movement flows in areas where, due to the topography of the areas, concentrations of seabirds are expected, in order to assess the flow of seabirds to and from the Gulf of Kavala. These areas include the Keramoti-Thassos channel, Cape Vrasidas in Nea Peramos and the Capes of Kefalas and Skala Prinos in Thassos.		
3.5	**Biodiversity**	Monitoring of wading birds and land turtles.	Monitoring and recording of breeding wading bird species and land turtles (protected objects of GR1150001 and GR1150010) in the sand dune zone / on either side of the Sigma factory.	For recording birdlife in the marine environment, it is proposed to apply the recording methods that were also applied in the MEOA of the project. For recording birdlife in the terrestrial and wetland environment: • Direct observation (Look-and-See) concerns the recording of birds from selected observation points that are selected based on the existing knowledge of the area regarding the species of interest and their habitats (e.g. Hadjicharalambous et al., 2004) with the aim of assessing the distribution and abundance of birdlife. The points were chosen so as to cover the area under consideration to the greatest possible extent spatially. The identification and identification of birdlife species and the counting of individuals are done with the naked eye, binoculars or a telescope depending on the distance from the observer. In the case of cryptic species, the identification and identification of species can also be done acoustically. For recording terrestrial reptiles in the terrestrial environment: • • Recording with slow movement in space. In the sand dunes, the population of land turtles was recorded with the movement of 2 researchers in lines, when it was found that it has a significant population depending on the sand dunes in protected areas in northern Greece.	Before the start of work to determine the base prices. With seasonal frequency, during the implementation of the work and in any case no later than every three (3) months.	In the coastal section (with emphasis on the sand dunes) of the land part of the project.
3.6	**Biodiversity**	Fauna - Birdlife Species	Index of dead/injured individuals of fauna and avifauna	Identification and recording of dead/injured individuals of fauna and avifauna in the immediate area of influence of the project. The reasons for injury/death of these individuals should be investigated (e.g. in the event that an individual has been injured by the construction activities of the project.	Continuous macroscopic visual observation by project workers.	Total project
4	Ακουστικό περιβάλλον - Δονήσεις					
4.1	**Acoustic environment**	Environmental noise assessment index	Indicatively includes the parameters: • **LAeq** • **Lden (day-evening-night level)**, which results from the indicators: ○ L_{day} ○ $L_{evening}$ ○ L_{night}	Measurements with a sound level meter.	Every 6 months for the first 2 years of operation of the project, every two years thereafter.	On the platform and in a position at the boundaries of the onshore facility
4.2	**Acoustic environment**	Underwater noise assessment index	Indicatively includes the parameter: PSD (**dB re 1** μPa ^{2} Hz)	24 hour measurements with autonomous recording unit (ARU)	Every 6 months for the first 2 years of operation of the project, every two years thereafter.	Located 150 m from the platform.
5	Atmospheric environment – Climate					
5.1	**Atmospheric environment**	Atmospheric environment assessment index	Monitoring the project's Carbon Footprint.	In order to achieve the long-term goal of climate neutrality in accordance with the provisions of the National Energy and Climate Plan, the National Climate Law (Law 4936/Government Gazette 105A/27-05-2023) was passed, which establishes	Yearly basis	Total project

Operations phase						
A/A.	Environmental / Social Parameter	Indicator	Measurable Indicator Parameters	Sampling / observation methodology	Sampling / observation frequency	Locations / extent of sampling / observations
				measures and policies for the country's adaptation to climate change and ensuring the decarbonization path by the year 2050. For example, climate change mitigation, i.e. the reduction of greenhouse gas emissions and the contribution of infrastructure to achieving climate neutrality, in accordance with the provisions of Law no. 18 of Law 4936/2022 (Government Gazette 105/A/27.05.2022) and the guidelines specified in the European Commission text entitled "Technical guidelines on strengthening the resilience of infrastructure to climate change for the period 2021-2027" (2021/C 373/01) hereinafter referred to as the "Technical Guideline". For the calculation of GHG emissions, the main focus of the guidelines is the use of the "2006 IPCC Guidelines for National Greenhouse Gas Inventories" standard, as amended and including direct greenhouse gas emissions and indirect greenhouse gas emissions from energy consumption, as defined in the "GHG Protocol WORLD RESOURCES INSTITUTE" standard or alternatively, according to the "ISO 14064 1:2018" standard, categories 1 and 2 (article 20, par. 3 of Law 4936/2022).		
6	Περιβαλλοντική απόδοση του έργου					
6.1	**Waste**	Waste generation and disposal index.	Includes the parameters: • Generated quantities: • Liquid waste. • Solid waste. • Household waste. • Hazardous waste. • Methods of managing the above waste and corresponding quantities. • • Alternative methods of managing the above waste (e.g. recycling) and corresponding quantities.	Processing of data on the project's waste production.	Yearly basis	Throughout the project
6.2	**Inflow of energy and raw materials**	Energy and raw material use index.	Includes the parameters: • Resource inputs: • Energy. • Water. • Fuels. • Raw materials (chemicals). • Other resources. • • Methods of saving upstream resources.	Processing project resource usage data.	Yearly basis	Throughout the project
6.3	**Workspaces**	Workplace control index.	Workplace Inspections: • Waste. • Solid waste segregation by system (general, hazardous, recyclable, waste materials). • Hydrocarbon leakage. • Effectiveness of control measures. • Stormwater/wastewater discharges. • Water pollution accidents. • • Any activities that contravene the EHSM.	On-site visual observation.	Weekly basis	The entire project area. Environmentally sensitive areas that could potentially be affected on a case-by-case basis. Liquid and solid waste storage facilities (general, hazardous, recyclable, waste materials, etc.). Dumping areas.

Operations phase						
A/A.	Environmental / Social Parameter	Indicator	Measurable Indicator Parameters	Sampling / observation methodology	Sampling / observation frequency	Locations / extent of sampling / observations
6.4	**Environmental terms**	Environmental conditions control index	It includes all general Project ETs that are not included in any other specialized monitoring indicator in this table.	On a case-by-case basis, depending on the requirements of each ET.	On a case-by-case basis, depending on the requirements of each ET.	Throughout the project
7	Ανθρωπογενές περιβάλλον					
7.1	**Human-made environment**	Social impact index	It includes parameters such as the following: • Social acceptance of the project. • Potential issues of the local community related to the operation of the project. • Infrastructure projects. • Impacts - on the productive structure of the local economy and on other economic activities (e.g. livestock production and tourism).	• Processing of data from the Concerns Communication Mechanism. • Review of data (studies, announcements, publications, etc.) from public and private entities related to the activities in the project area (legal entities of the administration, chambers, universities, etc.).	Yearly basis	The entire project area.
7.2	**Human-made environment**	Corporate awareness index	It includes parameters such as the following: • Corporate social responsibility actions of the company. • Project employees from the wider project area.	Editing project details.	Yearly basis	The entire project area.
8	Υγιεινή και ασφάλεια					
8.1	**Health and Safety**	Working conditions, health and safety	It includes parameters such as: • Health and Safety (H&S) Monitoring and Audits. • H&S Performance Evaluation • Personal Protective Equipment Monitoring	• Total recordable incidents, lost time incidents and other H&S indicators. • • Records verifying the status of Personal Protective Equipment	Yearly basis	Throughout the project
8.2	**Health and Safety**	Working conditions, health and safety	It includes parameters such as: • Concern communication mechanism files • Training files	• Maintain a mechanism for communicating concerns • Analyze employee and community complaint trends • • Maintain training records	Yearly basis	Throughout the project

CONTENTS

13 SUMMARY OF FINDINGS AND PROPOSED ENVIRONMENTAL TERMS FOR APPROVAL

13 SUMMARY OF FINDINGS AND PROPOSED ENVIRONMENTAL TERMS FOR APPROVAL

This chapter presents a codified summary of the findings and recommendations of the Environmental and Social Impact Assessment (ESIA) in the form of environmental terms related to the project **"CO_2 Storage Unit in Prinos."**

13.1 TYPE AND SCALE OF ACTIVITY

The proposed CO_2 storage site is located within the Prinos Basin, in the Gulf of Kavala, in the Northeastern Aegean Sea. The area of interest for CO_2 storage exploration lies within the Prinos Concession, where Energean holds 100% ownership and operatorship for oil and gas exploration and development activities since 2007. The potential CO_2 storage location is situated within the Prinos and Epsilon structures. The area extends from a depth of 1,900 m to 4,200 m, with the defined storage volume estimated at 93.4 km^3.

The operation of the CO_2 storage facility in Prinos is planned to be developed in two distinct phases (Phase 1 with a nominal capacity of up to 1 MTPA and Phase 2 with an expansion to a final nominal capacity of up to 3 MTPA), in order to ensure scalability and adaptability to market conditions.

The sources of CO_2 and the main reception processes during Phase 1 of operation are expected to include the following:

- Bulk CO_2 supply via pipeline
- Reception of CO_2 parcels

The new facilities and wells planned for the operation of the CO_2 storage Project include:

- Onshore facilities: modification of a designated area within the existing premises at the Sigma plant for the construction of the reception manifold and an unloading area.
- Offshore pipeline: a subsea pipeline connecting the Sigma plant area to the offshore Beta platform, approximately 20 km in length.
- Offshore platform: modification of the existing offshore Prinos facilities to receive CO_2 from the new subsea pipeline and from containerized CO_2 shipments, and to inject it into the new wells.
- Wells: 2 CO_2 injection wells and 2 water production wells on the existing Beta platform of the offshore Prinos complex.

The Project is described in detail in Chapter 6 of the Environmental and Social Impact Assessment (ESIA).

13.2 GEOGRAPHICAL LOCATION

The onshore facilities of the proposed CO_2 storage Project are located within the operational area of Energean's Sigma facilities and fall under the administrative jurisdiction of the Municipality of Kavala, in the Regional Unit of Kavala, Region of Eastern Macedonia and Thrace, near the border with the Municipality of Nestos (according to Law 3852/2010 (A'87) of the "Kallikratis" Programme). Energean's existing offshore facilities at Prinos, along with the proposed offshore CO_2 storage installations, are located within the Gulf of Kavala.

CO_2 Storage Site Coordinates

The centroid coordinates of the existing offshore platforms of the Project, provided in WGS84 UTM Zone 35N, WGS 84, and HGRS87 (Greek Grid), are as follows:

	UTM Zone 35N		WGS 84		HGRS 87	
	X	Y	Lat (φ)	Lon (λ)	X	Y
Alpha	288857,07	4519496,74	40º 47΄ 57.62''N	24º 29΄ 49.64''E	547186,80	4516315,55
Beta	288964,60	4519423,14	40º 47΄ 55.34''N	24º 29΄ 54.31''E	541896,72	4516245,70
Delta	288869,28	4519413,33	40º 47΄ 54.94''N	24º 29΄ 50.26''E	541801,85	4516232,65
Flare	288934,28	4519361,74	40º 47΄ 53.32''N	24º 29΄ 53.09''E	541868,54	4516183,34

The coordinates of the new subsea pipeline of the Project, provided in WGS84 UTM Zone 35N, WGS 84, and HGRS87 (Greek Grid), are as follows::

	UTM Zone 35N		WGS 84		HGRS 87	
	X	Y	Lat (φ)	Lon (λ)	X	Y
Start *	293069,290	4537067,796	40,958554	24,5411604	545392,53	4534011,65
Middle	292877,822	4528686,074	40,883070	24,54168558	545488,62	4525632,42
End **	289555,024	4540394,628	40,987597	24,4983086	541767,94	4537214,24

** The starting point refers to the pipeline inlet at the proposed onshore CO_2 storage facilities.*

*** The end point refers to the pipeline connection point at the existing Beta platform.*

The coordinates of the proposed onshore facilities of the Project, in WGS84 UTM Zone 35N, WGS 84, and HGRS87 (Greek Grid), are as follows (centroid point):

	UTM Zone 35N		WGS 84		HGRS 87	
	X	Y	Lat (φ)	Lon (λ)	X	Y
Proposed Onshore Facilities	293090,229	4536912,162	40,957159 (ºN)	24,541461 (ºE)	545418,79	4533856,91

13.3 PROJECT OWNER

The Project Owner is EnEarth Greece Single Member S.A.

On 31.08.2022, Energean Oil & Gas submitted a request to HEREMA (Hellenic Hydrocarbons and Energy Resources Management Company) to activate the right to continue and complete the investigation of the

Prinos and Epsilon structures in order to assess their suitability as CO_2 storage sites. This request was accepted through the Decision on the Activation of the Right to Investigate for CO_2 Storage, as approved by HEREMA's Decision No. 14577/29.09.2022 (published in Government Gazette 5247/B/11.10.2022). The Decision approved the preliminary eligibility of the proposed storage site, which lies within the boundaries of the Prinos license and includes the Prinos and Epsilon fields, as well as the underlying aquifer. It also approved the continuation and completion of the investigation of the area as a CO_2 storage site for a period of twenty-two (22) months, starting from 1 October 2022, by Energean Oil & Gas.

With the progress and completion of the investigation procedures for the Area as a CO_2 storage site, EnEarth, as an affiliated company of Energean, submitted on 30.06.2024 an application to assess the suitability of the geological formation as a CO_2 storage site and to activate the storage right of the Project Owner, in accordance with Article 173(5) of Law 4964/2022. Energean, as the holder of the right to continue and complete the investigation, has co-signed the aforementioned application.

13.4 PROJECT CLASSIFICATION

According to Ministerial Decision DIPA/37674/10-8-2016, as amended by Ministerial Decisions 2307/2018 and ΥΠΕΝ/ΔΙΠΑ/17185/1069/2022 (Government Gazette B' 841/24.2.2022), the Project falls under Category 11: "Transport of energy, fuels and chemical substances", entry no. 6: "Infrastructure for the transport and storage of carbon dioxide streams in geological formations, pursuant to Directive 2009/31/EC," which includes:

- Transport pipelines, including associated pressure boosting stations,
- Storage sites,
- CO_2 capture facilities for the purpose of storage in geological formations,

and is classified under **Subcategory A1**.

13.5 INSTITUTIONALLY DESIGNATED KEY CHARACTERISTICS OF THE PROJECT AREA AND ENVIRONMENTALLY SENSITIVE FEATURES

13.5.1 Spatial Planning and Land Uses

The spatial planning framework applicable to the wider area of the Project is defined as follows:

- By the General Framework for Spatial Planning and Sustainable Development (GFPSSD) (Government Gazette 128/A/03-07-2008), with whose strategic choices and directions the Project is compatible.
- By the Regional Framework for Spatial Planning and Sustainable Development of the Region of Eastern Macedonia and Thrace (Ministerial Decision ΥΠΕΝ/ΔΧΩΡΣ/68605/1092, Government Gazette 248/ΑΑΠ/25-10-2018), with whose directions and objectives the Project installations are aligned.

- By the Special Framework for Spatial Planning and Sustainable Development for Industry (Joint Ministerial Decision 11508/2009, Government Gazette 151/AAP/13-4-2009), with whose choices and directions the Project is compatible.
- By the Special Framework for Spatial Planning and Sustainable Development for Renewable Energy Sources (Joint Ministerial Decision 49828/2008, Government Gazette 2464/B/2008).
- By the Special Framework for Spatial Planning and Sustainable Development for Aquaculture (Government Gazette 2505/B/2011).

13.5.2 Land Uses

The onshore facilities of the proposed CO_2 storage Project are located within the operational area of Energean's Sigma plant. Administratively, they fall under the jurisdiction of the Municipality of Kavala, within the Regional Unit of Kavala, in the Region of Eastern Macedonia and Thrace, near the border with the Municipality of Nestos (in accordance with Law 3852/2010 (Government Gazette A'87), known as the "Kallikratis" Program).

For the Municipality of Kavala, within the Regional Unit of Kavala—where the onshore facilities are located—a General Urban Plan (hereinafter GUP) has been developed and approved (Decision No. 5248π.ε./04-02-2013), and published in Government Gazette 69/AAP/11-03-2013. The boundaries of the GUP coincide with the administrative boundaries of the Municipal Unit of Kavala and include the city of Kavala as well as the settlements of Aspri Ammos, Palio, Nea Karvali, Chalkero, Lefki, and Ano Lefki.

- For the settlement of Chrysoupoli, a General Urban Plan (GUP) has been developed and approved, according to Government Gazette 814/D/26-08-1987.
- No settlements are located within the study area. The closest settlements are Nea Karvali (~2,600 m east of the project) and Nea Komi (~2,700 m northeast of the project).
- A Residential Control Zone (RCZ) has been designated in the area outside the city plan and outside the boundaries of settlements that existed before 1923, within the Municipality of Kavala (Regional Unit of Kavala) and the communities of Amisiana, Amygdaleonas, Nea Karvali, Chalkero, and Kokkinoxoma (Regional Unit of Kavala), according to Government Gazette 326/D/1995.

13.5.3 Environmental Sensitivity Features of the Project Area

13.5.3.1 Protected Areas

The Project study area lies within the boundaries of zones designated under the National System of Protected Areas in accordance with Law 3937/2011.

The proposed Project is located within the Natura 2000 protected area SCI & SPA GR1150014 "Marine Area of Kavala – Thasos." Within the broader study area, the following Natura 2000 sites are also identified: SCI GR1150010 "Nestos Delta and Keramoti Lagoons – Wider Area," SPA GR1150001 "Nestos Delta and Keramoti Lagoons and Thasopoula Islet," and SPA GR1150012 "Thasos (Mount Ypsario and Coastal Zone)."

13.5.3.2 Forests and Forested Areas

The onshore facilities of the Project are located within areas classified under the codes AA (Alternative form/cover in older aerial photographs) and PA (Finalized decisions and rulings of designation – non-forested), which are not subject to the restrictions of forest legislation.

13.5.3.3 Water Management Plans

The study area falls within the River Basin Districts (RBDs) EL11 "Eastern Macedonia" and EL12 "Thrace," where the 1st Revision of the River Basin Management Plans for these RBDs was approved by Government Gazette B 4679/29.12.2017 and B 4680/29.12.2017, respectively. The onshore facilities of the proposed project fall entirely within the Nestos River Basin (EL1207), while the proposed pipeline route crosses both the Nestos River Basin (EL1207) and the Strymonas River Basin (EL1106).

Part of the proposed pipeline route lies within the coastal Water Bodies (WBs) of Western Kavala Gulf (EL1106C0004N) and Eastern Kavala Gulf (EL1207C0001N).

The onshore facilities fall entirely within the Transitional Water Body of the Nestos Delta (EL1200060).

13.5.3.4 Flood Risk Management Plans

According to the Flood Risk Management Plan for the River Basin District (RBD) of Thrace (RBD12) (Government Gazette 2688/B/2018), the onshore facilities are located within the boundaries of a Potentially High Flood Risk Zone (hereinafter PHFRZ), named "Plain of Xanthi – Komotini (Lowland Zones of the Nestos, Kosynthos, Kompsatos, Aspropotamos, Bosbozis, Filiouris rivers and the riparian areas of Lake Vistonida)," with the identification code GR12RAK0001, as illustrated in the following Figure. It is also noted that the onshore facilities fall within flood-prone areas for a return period of T=100 years (flooding due to sea level rise under Mean Sea High Tide conditions).

13.5.4 Specific Emission Limit Values for Pollutant Loads and Concentrations According to Applicable Regulations

For ambient air quality levels, the following provisions apply:

- Joint Ministerial Decision (JMD) 14122/549/E103/24.3.2011 (Government Gazette B’ 488): This decision establishes measures for the improvement of ambient air quality, in compliance with the provisions of Directive 2008/50/EC, as currently in force and amended.
- Joint Ministerial Decision (JMD) 22306/1075/E103/29.5.2007 (Government Gazette B’ 920): This decision sets target values and assessment thresholds for the concentrations of arsenic, cadmium, mercury, nickel, and polycyclic aromatic hydrocarbons (PAHs) in ambient air, in compliance with the provisions of Directive 2004/107/EC, as currently in force and amended.

- Council of Ministers Act 25/18.3.88 (Government Gazette A' 52/22.3.88) and PYS 34/30.5.02 (Government Gazette A' 125/5.6.02), "Limit and guideline values for air quality regarding sulphur dioxide, nitrogen dioxide and nitrogen oxides, particulate matter, and lead."
- Presidential Decree 1180/81 (Government Gazette 293/A/1981) for point source emissions of solids (suspended particulates) from construction sites and project installations, the limit of 100 mg/m³ established in Article 2, paragraph (d), applies.

For liquid waste, the following apply:

- Joint Ministerial Decision 145116/2011 (Government Gazette B' 354), on the establishment of measures, conditions, and procedures for the reuse of treated wastewater, as amended and currently in force.
- Health Regulation No. E1β/221/1965 (Government Gazette B' 138), concerning the disposal of sewage and industrial wastewater, as amended and still in force, based on Circular No. οικ.191645/3.12.2013 (ADA: ΒΛ0Χ0-9ΝΥ).
- Special provisions that may have been imposed in the project's area.

For solid and hazardous waste, the following apply:

- For the management of used mineral oils, the provisions of Presidential Decree 82/2004 (Government Gazette A' 64/2.3.2004) apply, which replaced Joint Ministerial Decision 98012/2001/95 (Government Gazette B' 40/19-1-1996).
- For waste electrical and electronic equipment (WEEE), the provisions of Joint Ministerial Decision 23615/651/E.103/2014 (Government Gazette B' 1184) apply.
- For waste batteries and accumulators, the provisions of Joint Ministerial Decision 41624/2057/E103/2010 (Government Gazette B' 1625) apply.
- For source separation, collection, transport and management of solid waste, both recyclable and non-recyclable, the provisions of Law 4042/2012 (A' 24) as amended and in force, of the National Waste Management Plan ratified by Joint Ministerial Decision 51373/4684/2015 (B' 2706), and of Law 2939/2001 (A' 179) as amended by Law 4496/2017 (A' 170), apply.
- For source separation, collection, transport and management of hazardous waste, both recyclable and non-recyclable, the provisions of Law 4042/2012 (A' 24), as amended and in force, of the National Hazardous Waste Management Plan approved by Joint Ministerial Decision 62952/5384/2016 (B' 4326), and of Law 2939/2001 (A' 179) as amended by Law 4496/2017 (A' 170), apply.
- For the collection, transport and management of Construction and Demolition Waste (CDW), the provisions of Joint Ministerial Decision 36259/1757/E103 (Government Gazette 1312/24-08-2011) "Measures, conditions and program for the alternative management of waste from excavations, construction and demolitions (CDW)" apply.
- For the collection, transport and management of extractive waste, the provisions of Joint Ministerial Decision 39624/2209/E103/2009 "Measures, conditions and restrictions for the management of waste from the extractive industry in compliance with the provisions of Directive 2006/21/EC" apply.

- For the management of polychlorinated biphenyls and polychlorinated terphenyls (PCB/PCT), the measures and conditions of Joint Ministerial Decision 7589/731/2000 (Government Gazette B' 514) apply.

The specific limit values for noise and vibration levels are determined by the following applicable regulations:

- 2640/270/78 (Government Gazette 689/B/1978) "On the use of muffled pneumatic hammers",
- JMD 56206/1613/86 (Government Gazette 570/B/1986) "Determination of the acoustic emission of construction site machinery and equipment in compliance with Directives 79/113/EEC, 81/1051/EEC, and 85/405/EEC of the Council of 19 December 1978, 7 December 1981, and 11 July 1985",
- JMD 69001/1921/88 (Government Gazette 751/B/1988) "EEC type approval for the noise level limit of construction machinery and equipment, specifically motorized air compressors, tower cranes, welding generator sets, power generator sets, and portable concrete breakers and pneumatic hammers,"
- JMD 10399/91 (Government Gazette 359/B/1991) "Determination of the noise level limit for tower cranes as a supplement to JMD 69001/1921/88"
- JMD 765/91 (Government Gazette 81/B/1991) "Determination of the noise level limits for hydraulic shovels, cable shovels, bulldozers, loaders, and loader-excavators," as amended by JMD 11481/523/97 (Government Gazette 295/B/1997).
- JMD 17252 (Government Gazette 395/B/1992) "Determination of indicators and maximum noise limits originating from traffic in road and transport infrastructure projects."
- Joint Ministerial Decision (JMD) 37393/2028/01.10.2003 (Government Gazette 1418/B/2003) "Measures and conditions for noise emissions into the environment from equipment intended for outdoor use," as amended by JMD 9272/471/2.3.2007 (Government Gazette 286/B/2007).
- Joint Ministerial Decision (JMD) 13586/724/2006 (Government Gazette 384/B/2006) "Establishment of measures, conditions, and methods for the assessment and management of environmental noise, in compliance with the provisions of Directive 2002/49/EC 'relating to the assessment and management of environmental noise."
- Presidential Decree 149/2006 (Government Gazette 159/A/28.07.2006), "Minimum health and safety requirements regarding the exposure of workers to risks arising from physical agents (noise), in harmonization with Directive 2003/10/EC."
- Joint Ministerial Decision 9272/471/2007 (Government Gazette 286/B/2007), "Amendment of Article 8 of Joint Ministerial Decision no. 37393/2028/2003 (1418/B), in compliance with the provisions of Directive 2005/88/EC 'amending Directive 2000/14/EC on the approximation of the laws of the Member States relating to the noise emission in the environment by equipment for use outdoors,' of the Council of 14 December 2005."
- Ministerial Decision 211773/2012 (Government Gazette 1367/B/2012), "Establishment of Evaluation Indicators and Maximum Permissible Limits of Environmental Noise Indicators resulting from the operation of transport infrastructure projects, technical specifications for special acoustic studies for the calculation and implementation (EAMYE) of noise barriers, specifications for environmental noise monitoring, and other provisions."

13.6 TERMS, MEASURES, AND RESTRICTIONS TO BE TAKEN FOR THE MITIGATION (PREVENTION – MINIMIZATION – REMEDIATION – RESTORATION) OF POTENTIAL ENVIRONMENTAL IMPACTS

13.6.1 General Terms

1 For individual modifications in relation to the project design described in the Environmental Impact Assessment (EIA) and summarized in the section "1) Type and scale of activity" of the present decision, which are due to the need to comply with safety requirements, a Final Design Compliance File must be submitted (Article 7§1 of Law 4014/2011, as amended and in force), provided that these changes do not result in significant adverse alterations in terms of environmental impacts.

2 The Project Operator, as well as any natural or legal person to whom part of the implementation and operation of the Project is assigned (hereinafter referred to as "third parties"), shall be responsible for complying with the environmental terms, measures, and restrictions imposed by the present decision, to the extent that they are applicable to them.

3 The Project Operator is required to take all necessary measures to ensure:

3.1 Compliance with the environmental terms by all parties involved in the Project.

3.2 The ability to address and remediate situations that are detrimental to the environment, resulting from actions or omissions in violation of the environmental terms.

4 During the procedures for concluding agreements between the Project Operator and third parties, as well as between the latter themselves, explicit provisions must be included to ensure compliance with the requirements for adhering to the environmental terms.

5 The Contractor(s) must design and implement appropriate Applied Environmental Management Plans compatible with the corresponding Environmental and Social Management Plan (ESMP) of the project, as described in Chapter 13 of the project's Environmental and Social Impact Assessment (ESIA).

6 The Project Operator is obliged to appoint an organizational unit or staff member responsible for monitoring compliance with the environmental terms and has the option to request a similar appointment from third parties.

7 From the expenses related to the implementation and operation of the Project, priority must be given to those concerning environmental protection works that are necessary for full compliance with the terms and restrictions of this decision.

8 During the finalization of the design, construction, and operation of the Project, the "Stakeholder Engagement Plan (SEP)" included in the Annex of the ESIA shall continue to be implemented.

9 For the protection of the marine environment, the proper condition and safe operation of the project facilities' equipment must be ensured, in accordance with the requirements of Article 6 of Law 2252/1994 (Government Gazette A' 192), and simultaneously applying paragraph 2(a) of Article 12A of Law 2289/1995 (Government Gazette A' 27), as amended by Article 164 of Law 4001/2011 (Government Gazette A' 179).

10 The existing platforms and vessels involved in the construction of the works, as well as those supporting the operation of the platforms, must comply with the requirements of the relevant Annexes of the International MARPOL Convention.

11 Compliance with international guidelines and the International Safety Management (ISM) Code of the IMO is required for the safe operation of ships and for the prevention of environmental pollution, along with strict adherence to navigation, communication, and safety procedures.

12 The floating vessels to be used for the needs of the project shall comply with the International Regulations for Preventing Collisions at Sea, 1972 (COLREGs).

12.1 The individual installations and activities of the project must comply with the environmental requirements of the 5th Protocol of the Barcelona Convention, which refers to the protection of the Mediterranean Sea against pollution resulting from exploration and exploitation of the seabed and its subsoil (known as the "Offshore Protocol"). In this context:

12.2 The Chemical Use Plan included in the Annex of the Environmental and Social Impact Assessment (ESIA) shall be implemented.

12.3 Approved biocides and anti-corrosion agents shall be used, which meet the requirements of the applicable national and EU legislation and comply with international conventions for the protection of the sea, in particular the Barcelona Convention. The substances to be used for the above purposes must be selected from the current version of the "OSPAR List of Substances Used and Discharged Offshore which Are Considered to Pose Little or No Risk to the Environment (PLONOR)." The use of substances included in the "OSPAR List of Substances of Possible Concern (LSPC)" is not permitted.

12.4 Records shall be kept to document compliance with the quantities and concentrations of the chemical substances used.

12.5 All other necessary measures shall be taken to meet the environmental requirements of the Offshore Protocol.

13 During both the implementation and operation phases of the Project, appropriate measures must be taken to prevent direct or indirect pollution of soil, surface water, and groundwater.

14 An environmental protection management and control system must be implemented, which must meet the following requirements:

14.1 An internal control system ensuring compliance with the environmental terms of this Decision.

14.2 Ensuring the integrity of the installations, through the process of verifying safe operation, namely through, (a) regular implementation of an inspection and monitoring program, (b) immediate restoration of any findings and re-inspection, (c) renewal of the necessary certificates.

14.3 The mechanical equipment of the drilling operations must be inspected and maintained at regular intervals, in accordance with the manufacturers' specifications. For each maintenance or adjustment operation, the designated maintenance - adjustment form must be completed and signed by the technician and filed for record-keeping.

15 A Stakeholder Engagement Plan shall be implemented, including the establishment of a Grievance Mechanism (GM), in order to create strong, constructive, and responsive relationships with stakeholders and to foster mutual understanding through the active involvement of individuals, groups, and organizations in the Project.

13.6.2 Waste Management

13.6.2.1 Waste Management Plan

A Waste Management Plan shall be implemented throughout all phases of the Project. The Project Operator must take special care to ensure the application of source separation practices, as well as the proper collection and transportation of waste by all natural and legal persons operating within the Project under a relevant contract. Additionally, the Operator must submit the annual waste report electronically through the platform of the Electronic Waste Registry (EWR) (http://wrm.ypeka.gr/) by the end of March of the following year. Furthermore:

15.1 The collection and transportation of non-hazardous solid waste during all phases of the project's implementation and operation shall be carried out in compliance with the obligations arising from the applicable legislation regarding source separation of the four waste streams (glass, plastic, metals, paper), packaging materials, biowaste (food residues), and other recyclable streams.

16 The generation of non-hazardous waste shall be minimized through the application of the waste hierarchy. Non-hazardous waste must be packaged in appropriate containers before being transported to the onshore facilities. The non-hazardous waste generated shall be transferred to Energean's onshore facilities and then collected by the competent municipality for disposal.

16.1 Hazardous waste generated offshore (such as oily sludge and waste, oil-contaminated rags, absorbent materials, etc.) shall be transported to the onshore facilities via barge in order to be delivered to a properly certified waste management contractor.

17 Waste subject to special collection and disposal requirements (e.g. waste electrical batteries and accumulators, waste electrical and electronic equipment, etc.) shall be collected separately and disposed of in accordance with the applicable legislation in force and the provisions of the Waste Management Plan (WMP).

18 All waste transport activities shall be accompanied by the relevant documentation, a copy of which shall be retained by the waste producer.

19 The management of hazardous waste shall be carried out in accordance with the provisions of Joint Ministerial Decision 13588/725/2006 (Government Gazette 383B/28-3-2006) "Replacement of JMD 19396/1546/97 (Government Gazette 604B/18-7-1997)", as amended and currently in force.

20 The management of used mineral oils shall be carried out in accordance with the provisions of Presidential Decree 82/25.2.2004 (Government Gazette 64/A/2.3.04) on the "Establishment of measures and conditions for the management of used mineral oils", which replaced Joint Ministerial Decision 98012/2001/96. Waste lubricating oils (WLOs) and liquids of all types shall be collected separately by category so that they can be delivered to a Collective Alternative Management System (CAMS) approved by the Hellenic Recycling Agency (EOAN).

13.6.2.2 Types of Expected Waste

EWC Code	EWC Description
01	**WASTE FROM PROSPECTION, MINING, QUARRYING AND PHYSICAL AND CHEMICAL TREATMENT OF MINERALS**
01 05	Drilling muds and other drilling wastes
01 05 04	Sludges and wastes from water drilling
01 05 05*	Oil-containing drilling muds and wastes
01 05 06*	*Drilling muds and other drilling wastes containing hazardous substances*
01 05 07	Barite-containing drilling muds and wastes other than those mentioned in 01 05 05 and 01 05 06
01 05 08	Chloride-containing drilling muds and wastes other than those mentioned in 01 05 05 and 01 05 06
08	**WASTES FROM THE MANUFACTURE, FORMULATION, SUPPLY AND USE (MFSU) OF COATINGS (PAINTS, VARNISHES AND VITREOUS ENAMELS), ADHESIVES, SEALANTS AND PRINTING INKS**
08 01	Wastes from MFSU and removal of paint and varnish
08 01 11*	Waste paint and varnish containing organic solvents or other hazardous substances
08 04	Waste paint and varnish containing organic solvents or other hazardous substances
08 04 09*	Waste adhesives and sealants containing organic solvents or other hazardous substances
10	**WASTES FROM THERMAL PROCESSES**
10 13	Wastes from cement, lime and plaster production and products made from them
10 13 14	Waste concrete and concrete sludge
13	**OIL WASTES AND WASTES OF LIQUID FUELS (EXCEPT EDIBLE OILS, AND THOSE IN CHAPTERS 05, 12 AND 19)**
13 01	Waste hydraulic oils
13 01 11*	Synthetic hydraulic oils
13 02	Waste engine, gear and lubricating oils
13 02 06*	Synthetic engine, gear and lubricating oils
13 05	Oil/water separator contents
13 05 07*	Oily water from oil/water separators
15	**WASTE PACKAGING; ABSORBENTS, WIPING CLOTHS, FILTER MATERIALS AND PROTECTIVE CLOTHING NOT OTHERWISE SPECIFIED**

EWC Code	EWC Description
15 01	Packaging (including separately collected municipal packaging waste)
15 01 01	Paper and cardboard packaging
15 01 02	Plastic packaging
15 01 04	Metallic packaging
15 01 05	Composite packaging[1]
15 01 06	Mixed packaging
15 01 07	Glass packaging
15 01 10*	Packaging containing residues of or contaminated by hazardous substances
15 02	Absorbents, filter materials, wiping cloths and protective clothing
15 02 02*	Absorbents, filter materials (including oil filters not otherwise specified), wiping cloths, protective clothing contaminated by hazardous substances
17	**CONSTRUCTION AND DEMOLITION WASTES (INCLUDING EXCAVATED SOIL FROM CONTAMINATED SITES)**
17 01	Concrete, bricks, tiles and ceramics
17 01 01	Concrete
17 02	Wood, glass and plastic
17 02 01	wood
17 02 04*	Glass, plastic and wood containing or contaminated by hazardous substances
17 04	Metals (including their alloys)
17 04 05	Iron and steel
17 04 09*	17 04 09* Metal waste contaminated by hazardous substances
17 05	Soil (including excavated soil from contaminated sites), stones and dredging spoil
17 05 04	Soil and stones other than those mentioned in 17 05 03
17 05 06	Dredging spoil other than those mentioned in 17 05 05
20	**MUNICIPAL WASTES (HOUSEHOLD WASTE AND SIMILAR COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL WASTES) INCLUDING SEPARATELY COLLECTED FRACTIONS**
20 01	Separately collected fractions (except those mentioned in 15 01)
20 01 01	Paper and cardboard
20 01 02	Glass
20 01 13*	Solvents
20 01 14*	Acids

[1] Beverage packaging (such as Tetra Pak), snack packaging (e.g., chips, cheese puffs), and tablet packaging.

EWC Code	EWC Description
20 01 15*	Alkaline waste
20 01 19*	Pesticides
20 01 21*	Fluorescent tubes and other mercury-containing waste
20 01 23*	Discarded equipment containing chlorofluorocarbons
20 01 25	Edible oils and fats
20 01 27*	Paints, inks, adhesives and resins containing hazardous substances
20 01 29*	Detergents containing hazardous substances
20 01 33	Batteries and accumulators mentioned in 16 06 01, 16 06 02 or 16 06 03 and mixed batteries and accumulators containing such batteries
20 01 34	Batteries and accumulators other than those mentioned in 20 01 33
20 01 35*	Discarded electrical and electronic equipment other than those mentioned in 20 01 21 and 20 01 23 containing hazardous components
20 01 36	Discarded electrical and electronic equipment other than those mentioned in 20 01 21, 20 01 23 and 20 01 35
20 01 37*	Wood containing hazardous substances
20 01 39	Plastics
20 01 40	Metals
20 03	Other municipal wastes
20 03 01	Mixed municipal waste
20 03 04	Septic tank sludge

13.6.2.3 Construction Waste

20.1 Excavations will be limited to the absolutely necessary extent, while the excavated materials will be reused as a priority for backfilling needs within the framework of the Project's construction. In case part of the surplus earthworks material needs to be disposed of, the disposal method and layout of the deposition areas shall be defined in a relevant Technical Environmental Study (ΤΕΠΕΜ), which shall be prepared and submitted to the competent permitting authority beforehand.

21 The management of C&DW (Construction and Demolition Waste) in the Project area is carried out in accordance with the provisions of Joint Ministerial Decision (JMD) 36259/1757/E103/2010 through the following Alternative Management Systems (based on data from the Hellenic Recycling Agency – HRA, https://www.eoan.gr):

- Collective Alternative Management System (CAMS) "Recycling of Inert Materials of Northern Greece S.A.", under the trade name "AN.A.V.E. S.A."
- CAMS "Recycling of C&DW of Central Macedonia S.A.", under the trade name "ANA.KE.M."
- CAMS "Recycling System of Central Greece Ltd.", under the trade name "S.AN.K.E. Ltd."

- CAMS “PEDMEDE ECO Limited Liability Company”, under the trade name “PEDMEDE ECO LLP”

22 For the disposal of excavation materials (or construction materials) that are not used immediately, the following shall apply:

22.1 The temporary deposition of surplus earthwork materials resulting from the project's excavations shall take place within the boundaries of the construction site, as previously described and delineated.

22.2 Temporary deposition shall be carried out in a manner that prevents erosion and runoff phenomena (e.g., shaping into gentle slopes, covering with appropriate plastic sheeting, hydroseeding, fencing, etc.).

22.3 Large surface areas of exposed soil shall not be left uncovered for extended periods, and excavated (or construction) materials shall be transported for management or disposal as soon as possible.

22.4 Stormwater drainage works (e.g. peripheral ditches) shall be constructed to ensure the unobstructed flow of surface water and to prevent the transport of deposited materials.

13.6.2.4 Wastewater and Liquid Waste

22.5 The existing facilities at Sigma will be used to serve personnel needs. Alternatively, chemical toilets may be installed within the construction site. These shall be regularly emptied and maintained by a licensed company, under the responsibility of the project's contractor.

23 During the construction phase of the CO_2 pipeline, domestic wastewater will be generated on the vessel from worker habitation. The wastewater will be treated in a biological treatment system onboard the vessel.

Other aqueous waste expected to be generated on the vessel during the construction of the CO_2 pipeline, such as bilge water, shall be managed in accordance with Annex I of MARPOL 73/78 (Regulations for the Prevention of Pollution by Oil) and its relevant amendments. The treatment equipment (bilge water separator) shall comply with the IMO Guidelines and Specifications for Pollution Prevention Equipment for Machinery Space Bilges of Ships (IMO Resolution MEPC.107(49)). Ballast water shall also be managed in compliance with Annex I of MARPOL 73/78 and the requirements of the International Convention for the Control and Management of Ships’ Ballast Water and Sediments (Ballast Water Management – BWM). The ballast water treatment system installed onboard shall comply with the D-2 standard, which pertains to the treatment of ballast water.

24 During the drilling phase, the domestic wastewater generated from the workers' accommodation on the platform complex is collected and stored in dedicated tanks located on each platform. These tanks are periodically emptied into a barge or into the tank of a support vessel. The contents of the tank are then transported via the barge to the onshore facilities for biological treatment.

25 The stormwater on the platforms, which may potentially contain hydrocarbons, is collected through the closed drainage system via the bunded areas. To minimize the quantities of such runoff, the size of the bunded areas has been reduced and protected from rainfall wherever feasible.

26 The produced water from the new water wells on the Beta platform will be directed for treatment to the existing systems on the Prinos Delta platform, which will operate with efficiency that meets the applicable discharge limits in force at any given time. Water from the platform surfaces (cleaning and stormwater) will be discharged through appropriate treatment systems, in accordance with the International Convention for the Prevention of Pollution from Ships (MARPOL).

26.1 The liquid waste generated from well cleaning and maintenance operations, as well as from the cleaning of various tanks and pipelines on the platforms, is transferred via a piping system to Energean's support barge ("Limin Prinos"), which is equipped with 15 tanks. From there, it is transported to the onshore facilities for appropriate treatment, following the same process as that applied to existing wells.

13.6.2.5 Drilling Waste

26.2 In the initial section of the drilling, up to a depth of approximately 2,200 meters, a drilling mud based on seawater and lime will be used. This mud will be biodegradable and will have no adverse environmental effects. The cuttings from this section will be deposited on the seabed.

26.3 The volume of cuttings that may disperse on the seabed during the initial phase of a new drilling operation must be minimized by taking all appropriate technical measures, such as, where possible, limiting the depth of the initial section (riserless drilling), using pipes with the smallest possible diameter, etc.

26.4 Below the depth of approximately 2,200 m, the drilling fluids will return to the drilling rig, where the cuttings will be removed and the mud will be treated. The solid phase of the drill cuttings is separated by centrifugation from the liquid phase in the rig's mud unit, temporarily stored in specially sealed containers, and transported to the onshore facilities for further treatment and disposal by an appropriately certified waste management contractor.

27 The drilling muds are temporarily stored in designated mud tanks and are reused throughout the ongoing drilling process until they are no longer needed or have been fully depleted.

28 The management of extractive waste is carried out in accordance with Joint Ministerial Decision 39624/2209/E103 (Government Gazette B/2076/25.9.2009). In accordance with the provisions of Article 3, paragraph 16, the Project does not include a "waste facility."

13.6.3 Construction of Installations

13.6.3.1 Offshore Works

1 Smooth navigation in the Gulf of Kavala and the prevention of maritime accidents with environmental consequences must be ensured through full compliance with all requirements of the applicable legislation. More specifically, before the commencement of any activity, the following must be ensured:

1.1 A relevant permit from the competent Port Authority must have been obtained, where required.

1.2 All maritime safety measures must have been implemented, as defined by the instructions of the Port Authority, including daytime and nighttime marking measures.

1.3 The conditions of safe navigation in the wider area must not be disrupted due to any restrictions during the construction period of the works.

2 Continuous monitoring of production process data shall be carried out in the control room to enable the timely detection of leaks and the fastest possible mobilization for their containment.

3 All necessary measures shall be taken to prevent marine pollution during the construction phase, as well as any additional measures that may be indicated by the competent Port Authority, in accordance with Law 743/77 (Government Gazette A 319), as codified by Presidential Decree 55/98 (A' 58), and as currently in force.

3.1 The port works must be marked with navigational lights in accordance with the instructions of the Hellenic Navy Lighthouse Service. Furthermore, during their construction, the port works must be temporarily marked with navigational lights as instructed by the Lighthouse Service to prevent maritime accidents. This temporary lighting must remain operational in the event of work suspension or completion, until the installation and operation of the permanent navigational lighting.

3.2 Suitable and modern equipment (such as floating barriers, siltation curtains, etc.) must be readily available to contain suspended solid materials in case increased turbidity is observed during dredging operations. The use of the aforementioned containment systems shall be applied, when necessary, around the perimeter of the dredging areas.

3.3 The seabed must be restored, as far as possible, to its pre-existing condition following the trenching of the pipeline. In cases where trenching is not feasible due to the nature of the seabed, the exposed sections of the pipeline shall be covered with a concrete layer for additional protection.

4 Appropriate modern equipment (e.g., floating booms, etc.) must be available to contain oil and suspended solids in the event of an accidental spill or significant increase in turbidity during the works.

4.1 Provisions must be made for the lighting of the work areas and completed structures.

4.2 During operations on the support vessel for the installation of the 20 km subsea pipeline using the S-lay method (Phase 3) and its backfilling (Phase 5), two certified Marine Mammal Observers (MMOs) must be on board. Prior to the commencement of construction activities, the MMOs must check for the presence of marine mammals within a 500 m radius of the activity site. No noisy operations shall begin if marine mammals are detected within this radius or until at least 20 minutes have passed since the last sighting. During periods of darkness or poor visibility (e.g., fog), the MMOs must use night vision binoculars or passive acoustic monitoring devices.

5 All vessels involved in the implementation of the new works must not exceed a speed of 20 knots in order to minimize the risk of collision with marine mammals.

6 In the event of a collision between a project vessel and marine mammals, the incident must be reported to the competent Directorate of Natural Environment and Biodiversity of the Ministry of Environment and Energy (YPEN) and to the relevant Management Unit of the Natural Environment and Climate Change Agency (OFYPEKA/YPEN).

7 It is recommended to avoid carrying out the construction phase in the marine environment during the reproductive period of the European Shag, which occurs from February to May.

8 The drilling rig shall be designed and constructed in accordance with the API 4F standard and the latest European regulations, including low-emission specifications.

8.1 For the construction of the CO_2 pipeline, the construction vessel and the support vessels shall use marine fuel (Marine Gasoil DMA ISO 8217:2012) with a maximum sulphur content of 0.1% (m/m).

9 Materials used for the construction, impregnation, coating, or painting of the subsea pipeline shall not include substances considered hazardous or harmful to the marine and, more generally, the aquatic environment, in accordance with applicable legislation.

13.6.3.2 Onshore Works

9.1 The maintenance of construction and material transport machinery must be carried out at an organized local workshop, and not within the project area. The contractor must ensure the proper organization of the maintenance schedule for the construction site machinery, so that oil changes and regular servicing are performed in designated workshop facilities. Oils, gear oils, and other products from the mechanical parts of earthmoving and other machinery shall be collected and disposed of appropriately, in accordance with applicable legislation (Presidential Decree 82/2004, Government Gazette 64/A/2.3.2004).

9.2 Hazardous or potentially hazardous chemical substances required during the implementation of the project shall be stored (temporarily and only for the duration of the corresponding activities) in a covered area with an industrial-grade impermeable concrete floor and the necessary secondary containment systems.

9.3 The storage of fuels, machinery, and construction site materials shall be conducted in a manner that minimizes the risk of soil and water resource pollution. Chemicals, fuels, and lubricants must be stored in properly designated and sealed areas, away from water receptors. Collection containers shall be used under stationary machinery to prevent soil and groundwater contamination from oil and lubricants.

9.4 Any fuel or oil leaks shall be addressed immediately using absorbent materials such as sand, sawdust, or specialized geotextiles, in order to minimize the risk of contamination of surface soil layers or stormwater runoff. The construction site must be equipped with adequate quantities of absorbent materials.

9.5 Any permanent, unauthorized coverage of surfaces with impermeable materials (e.g. asphalt or concrete) that does not serve strictly essential operational needs of the project shall be prohibited. All other surfaces must be treated with permeable coverings made of materials as similar as possible to those found in the immediate surroundings of the project area.

9.6 In the event of accidental pollution caused by construction vehicles, immediate clean-up shall be carried out at the expense of the polluter and under the supervision of the Project Operator.

9.7 During the construction phase on the terrestrial section located outside Natura 2000 sites but within a dune zone, the following measures are recommended: (A) Avoid disturbance and interventions in the dune zone during the reproductive period of sea turtles and shorebirds. Specifically, excavation and pipeline-laying activities within the dune zone should be avoided from mid-April to the end of June. This restriction aims to prevent disturbance during the reproductive season and the potential destruction or abandonment of nests by birds or turtles. (B) To preserve the dunes in good condition during trenching for pipeline installation, the top 20 centimeters of surface soil (the surface layer containing seeds) must be carefully removed and placed in a separate designated area, clearly marked and kept apart from the deeper sand layers. After the pipeline is installed, this surface layer must be reinstated to its original position to allow seed preservation and natural dune regeneration. (C) No construction site or material storage area shall be established on the dunes to avoid soil compaction and damage to dune vegetation.

9.8 Earthworks shall primarily be carried out during periods of the year when intense rainfall and extreme wind conditions are not expected, in order to prevent soil washout and the generation of suspended particles, respectively.

10 The storage of materials, even on a temporary basis, is strictly prohibited outside the designated construction site area.

11 To minimize the impact of gaseous emissions (air pollutants and greenhouse gases) on climate change and overall air quality, the following measures shall be implemented:

11.1 To mitigate emissions from machinery and vehicles used for the execution of the project, regular maintenance is required, which is essential regardless. It is noted that maintenance shall not be carried out within the construction site area.

11.2 The machinery, vehicles, and equipment involved in the construction of the project must also comply with EU emission standards applicable to such machinery and must not be of outdated technology that emits elevated levels of pollutants.

12 reduce airborne particulate matter generated by construction activities, the following measures must be implemented:

12.1 The piles of excavation materials, stored aggregates, and in general all areas within the construction site must be regularly watered. During dry periods of the year and/or in conditions of strong winds, the loading and unloading of loose materials as well as the movement of construction vehicles within the construction zone must be carried out under wet conditions or using an equivalent dust suppression method. The required water for the wetting of materials and earthen surfaces may be supplied using seawater through mobile pumps or tankers, under the responsibility of the project operator.

12.2 The load of heavy vehicles transporting construction materials must be covered—both during transit outside the construction zone (as required by current traffic regulations) and within the construction zone—in order to minimize dust emissions. Trucks transporting aggregates and excavation materials must be properly covered with appropriate means, and overloading must be avoided.

12.3 The operation of machinery within the site must be conducted with careful handling, and truck movement must occur at low speeds to limit dust generation.

12.4 The drop height during material handling must be kept to a minimum.

12.5 In any construction or site-related activity where there is potential for the emission of dust, suspended particulates, or odorous substances, procedures and equipment must be adopted to ensure the effective reduction of such emissions, while the duration of these operations must be minimized.

13 The operation of the construction site and the circulation of trucks on the urban road network within the settlements of the Project area must be avoided as much as possible during designated quiet hours, in accordance with Ministerial Decision 1023/2/37/96 (Government Gazette 15/B/12.1.96).

14 The contractor must select the layout and scheduling of individual tasks in such a way that multiple machines do not operate simultaneously in close proximity, thereby minimizing disturbance to the human environment in the immediate area of the project.

15 Cultural Heritage

- The construction works will be carried out in accordance with the national regulatory framework (Law 3028/2002, as amended and in force, and Law 4858/2021, as amended and in force), as well as the opinions and recommendations of the competent authorities.
- The opinions and comments of the competent Archaeological Services must be taken into account. Any reservations expressed by the archaeological authorities should be duly considered, and, if deemed necessary, appropriate modifications must be made to the project design or construction methodology.

- Prior to the commencement of construction works, the competent Archaeological Services shall be notified in a timely and written manner, in order to ensure the supervision of the works by a qualified official.
- In the event of archaeological findings, construction works shall be suspended and an archaeological excavation shall follow in accordance with national legislation. Additionally, the procedure for chance finds required by Greek law, EU legislation, and EBRD Performance Requirement 8 (PR8 – Cultural Heritage) shall be implemented.

15.1 Safety regulations for construction sites, as prescribed by applicable legislation, shall be strictly observed. Full compliance with the provisions of the project's Health and Safety Plan and File (HSP and HSF) is required.

15.2 The construction site shall be fenced off to prevent public access to the area and to any locations where works are incomplete.

15.3 Appropriate signage shall be installed to inform the public of potential hazards and to prevent unauthorized access to the construction site.

16 The burning of any type of waste or surplus materials is strictly prohibited within the project execution zone or any associated facilities (e.g. construction sites).

17 Washing of project machinery and vehicles shall take place outside the construction site area.

18 The water needs of the workers will be met both by the water supply network of the Sigma facilities and by bottled water.

19 The potable water requirements for concrete works will be covered by the water supply network of the Sigma facilities.

13.6.4 Operation of Installations

1 The management and control system must meet the following requirements:

1.1 An internal audit system to ensure compliance with the environmental terms of the present study and the requirements of the operating license.

1.2 Ensuring the integrity of the installations, including the pipeline, through the safe operation certification process, namely by means of, namely (a) regular implementation of an inspection and monitoring program, (b) immediate restoration of any findings and subsequent reinspection, and (c) renewal of the relevant certificates.

1.3 Compliance with the requirements of the pollution prevention certificate (in accordance with MARPOL).

1.4 It must be ensured that the maintenance materials used in the Project do not contain the substances referred to in the decision of the Supreme Chemical Council 1100/91/91 (Government Gazette B' 1008/12−12−1991) and Ministerial Decisions 475/2002/03 (B' 208/2003) and 121/2003/03 (B' 1045/2003), as in force, namely mercury, arsenic, and organotin compounds, as well as other chemical substances classified as hazardous under the relevant legislation on hazardous substances, for which restrictions apply regarding their circulation and use in the marine and broader aquatic environment.

1.5 During the operation of the facilities, all necessary measures must be taken to prevent direct or indirect pollution of the sea, in accordance with Law 743/1977 (Government Gazette A' 319), as codified by Presidential Decree 55/1998 (A' 58), Law 2252/1994 (A' 192), and Presidential Decree 11/2002 (A' 6).

2 To prevent air pollution from the exhaust emissions of the Project's machinery and CO_2 transport vehicles, regular maintenance is required, which is necessary in any case. It is noted that such maintenance must not take place within the Project site.

3 The Project's machinery and CO_2 transport vehicles must comply with exhaust emission standards in accordance with applicable EU regulations.

4 Implementation of appropriate soundproofing measures for the equipment within the compression station, in order to ensure compliance with the legal noise limits within residential areas.

5 Installation of soundproofing on noisy parts of machinery and equipment on the platforms.

5.1 The project operator is required to comply with the specifications of the International Ship and Port Facility Security (ISPS) Code of the International Maritime Organization (IMO).

5.2 The offshore pipeline shall be inspected every five years or in other instances of system shutdown. For this purpose, an intelligent pigging tool will be used to measure the pipe wall thickness in order to ensure its integrity is maintained. The tool will detect any defects, wall thickness loss due to corrosion, or other impacts, so that corrective actions can be taken if repairs are necessary. The tool is inserted into the pipeline from the onshore end using a launcher and operates by applying water pressure until it reaches the pipeline end at Platform Beta.

13.6.5 Minimization of Environmental Consequences from an Incident or Accidental Release

1 The effective response of personnel to an incident or accidental release, and the consequent minimization of impacts on the marine environment, requires continuous training in the use of specialized equipment and all other available means of marine pollution control.

2 To maintain operational readiness that enables the immediate and effective implementation of the Emergency Response Plan for pollution incidents, regular preparedness drills shall be conducted based on hypothetical incident scenarios.

3 Emergency risk prevention and mitigation measures related to potential CO_2 leakage shall be implemented.

4 The fire and gas detection system shall be maintained at a frequency that ensures its proper and uninterrupted operation.

5 To protect the subsea pipelines from potential accidents (e.g. maritime navigation, seismic events), a prevention and response plan shall be in place. Particular emphasis shall be placed on the regular inspection and periodic maintenance of the subsea section of the pipeline network.

6 All necessary fire prevention and response measures shall be taken, as specified in a dedicated Fire Risk Prevention Plan.

7 Informational signs and appropriate road safety signage, along with traffic control measures, shall be installed in the immediate vicinity of the project area.

13.6.6 Decommissioning – Cessation of Operations

1 All project equipment that no longer serves production or support functions shall be removed from its installation site and either reused elsewhere or disposed of in accordance with the applicable waste management regulations.

2 The uncontrolled disposal of surplus materials in the immediate or wider area is prohibited. Under no circumstances shall such materials be disposed of in streambeds or other water bodies.

2.1 In the case of excavations, earthworks shall be carried out primarily during periods of the year when there are no intense rainfall events or extreme wind conditions, in order to prevent soil erosion and the generation of suspended particles, respectively.

2.2 Vehicles, machinery, and vessels involved in the decommissioning of the Project must comply with EU emission standards applicable to such equipment.

2.3 The decommissioning shall be carried out in a manner that minimizes environmental impacts. If the applied method differs significantly from what is described in the Environmental Impact Assessment (EIA), Article 6 of Law 4014/2011, as amended, shall apply.

3 The following are identified as key principles for addressing potential impacts during the decommissioning and restoration phase:

3.1 Cold cutting equipment shall be used for the dismantling of metal components, and the use of explosives shall be avoided.

3.2 The pipelines within the onshore section of the CO_2 transport system shall be depressurized, cleaned, and purged with nitrogen to ensure safety in accordance with international guidelines and best practices (UK Offshore Petroleum Regulator for Environment and Decommissioning, 2022. Decommissioning of Offshore Oil and Gas Installations and Pipelines Guidelines, OEUK Decommissioning Pipelines Guidelines). The onshore section shall be isolated from the offshore pipeline by means of a sealed flange, dismantled, and the area shall be restored to its original condition.

3.3 The offshore pipeline and riser shall be depressurized, cleaned through standard pigging operations, and subsequently inerted by introducing nitrogen. The pipeline shall then be isolated from the offshore platform, sealed with welded caps or flanges, and left in place in accordance with international standards. The piping from the top of the riser to the wellheads shall be depressurized and filled with nitrogen to render the system inert. The piping shall be disconnected from the wellheads, capped, and left in place.

4 Geological surveys of the reservoir formations shall be conducted to identify potential leakage pathways or geological hazards and to minimize the risk of CO_2 leakage into the marine environment. In addition, monitoring parameters of the wells, such as pressure, temperature, and composition, shall be observed to ensure safety against leaks.

5 All activities during the decommissioning phase shall be documented in accordance with applicable requirements and shall be subject to regular inspections and monitoring to ensure that health, safety, and environmental protection issues are minimized and appropriately managed.

6 A specific waste stream generated during decommissioning originates from the development of marine organic matter within support piping, which is preferably removed using water jets rather than onshore during the dismantling phase.

7 Other commonly occurring special categories of waste include metal scrap, Waste Electrical and Electronic Equipment (WEEE), Waste Batteries and Accumulators (WBA), and Waste Lighting Equipment, Lamps, and Small Devices classified under WEEE.

13.6.7 Monitoring

1 The Project Owner is required to prepare an appropriate environmental monitoring program and coordinate its implementation in order to monitor the project's impact and the implementation of the environmental terms related to its operation.

2 Within the framework of this program, the collection, processing, and evaluation of data and results of the Monitoring Program must be carried out by qualified scientific personnel with expertise and experience in each relevant environmental parameter, who will form the Environmental Unit.

3 A Biodiversity and Wildlife Management Plan and an Environmental Monitoring Program must be implemented, including specific actions and indicators, frequency, and methodology for conducting recordings / fieldwork / measurements for each environmental parameter.

4 The Environmental Unit shall be organized and operated under the sole responsibility of the Project Owner, who shall ensure that the Environmental Unit:

4.1 Has the responsibilities and competences necessary for effective intervention during the design, implementation, and operation phases of each project arising within the framework of the program, as well as during the subsequent phases of completion or decommissioning.

4.2 Is oriented toward environmental responsibilities, which may only be combined with occupational health and safety matters, while ensuring that this unit remains independent from other units in the organizational structure that focus on technical or financial responsibilities.

4.3 Is staffed with personnel that is adequate in number and appropriately qualified.

4.4 Has the necessary infrastructure and resources required for its effective operation.

5 As part of the environmental monitoring program, an effective mechanism must be designed and implemented for the collection, storage, evaluation, processing, and dissemination of environmental information throughout the duration of the project. The key features of this mechanism should include the accurate recording and retention of all information generated during monitoring, the communication of information to a central location, the processing of information for the production of periodic reports, and the provision of information and responses to queries regarding monitoring from interested stakeholders.

5.1 The summary of the final environmental monitoring results (and their evaluation, with potential proposals for required corrective actions) shall be presented in an annual report, which must be formulated in a manner that is easily comprehensible to the public and published online on a dedicated website maintained by the Environmental Unit. On the same website, interested members of the public shall have the opportunity to express their opinions on the content of the report by submitting signed comments. The publication of this report shall be notified to the competent departments of the Ministry of Environment and Energy (MoEE) responsible for environmental permitting, inspection, and enforcement (Environmental Permitting Directorate), as well as to other relevant administrative departments involved in the project's operation (e.g., the Directorate of Water Resources of Eastern Macedonia and Thrace of the Decentralized Administration of Macedonia and Thrace, and the Directorate of Environment and Spatial Planning of Eastern Macedonia and Thrace). The report shall include the main conclusions drawn from the results of environmental monitoring over the course of the year, while the primary data (e.g., measurement, recording, or analysis results) shall be included in annual reports submitted to the competent Ministry and made available to the Authorities upon request.

5.2 The following tables present the proposed Environmental Monitoring Programme (EMP) of the project, which focuses on monitoring the significant environmental parameters of the study area during the construction and operation phases of the proposed project. The findings of the EMP during the construction and operation phases will be summarized in a relevant Annual Report, which must be formulated in a manner that is easily comprehensible to the public and published online. The report shall be communicated to the Ministry of Environment, which holds responsibilities for environmental permitting, environmental inspection and enforcement, as well as biodiversity and protected area management.

The Environmental Monitoring Programme (EMP) for the decommissioning/removal phase of the project shall be developed at the appropriate time and, in any case, prior to the cessation of the project's operation. It shall take into account the results of the observations made up to that point concerning the construction and operation phases of the Project.

S/N	Indicator	Measurable Indicator Parameters	Frequency	Locations / Area
Construction Phase				
1.1	Marine Water Quality	Quality of waters resulting from pits or excavations during the installation of onshore infrastructure. Based on the analysis results, their classification will	Weekly during Phase 3 and Phase 5 of the offshore pipeline installation and burial	From a point within the excavation for the works related to the installation of the onshore

S/N	Indicator	Measurable Indicator Parameters	Frequency	Locations / Area
		be determined, and the appropriate treatment/disposal into water bodies will be specified. Indicatively, parameters to be monitored include Polycyclic Aromatic Hydrocarbons (PAHs – 16 USEPA PAHs) and (heavy) metals (to be determined based on the potential pollution sources in the area).	works. Every two months during the execution of the remaining works within the marine environment..	infrastructure (onshore section of the CO_2 transport pipeline).
1.2	Marine water quality	• Marine water quality measured with a portable instrument (pH, turbidity, dissolved oxygen (DO), total dissolved solids (TDS), temperature, salinity, and electrical conductivity) at both the seabed and the surface of the water column. • Analyses in an accredited laboratory (indicatively: total inorganic carbon (TIC), total nitrogen (TN), total phosphorus (TP), 16 USEPA PAHs) on water samples from the seabed and the surface.	Weekly during Phase 3 and Phase 5 of the offshore pipeline installation and burial works. Every two months during the execution of the remaining works within the marine environment..	It is proposed to take into account the locations of the sampling points studied in the context of the environmental monitoring of the Prinos offshore facilities (DAET DIPA/8413/24.04.2018), so that the results are comparable. In addition to the sampling stations investigated in the context of the EIA and the EMP of the Prinos offshore facilities (i.e. 9, 11, 12, 13-REF- as defined in the context of the EIA and EMP of the Prinos offshore facilities), within the context of this project it is proposed to include 2 more sampling stations along the CO2 transport pipeline and one more sampling station in the coastal section near the onshore facilities of the project.
2.1	Monitoring of benthic macroinvertebrates	Identification of benthic macroinvertebrates as an indicator of the ecological status of the marine environment (application of statistical analysis and the BENTIX ecological index).	With seasonal frequency and in any case no later than every three (3) months	It is proposed to take into account the locations of the sampling points studied in the context of the environmental monitoring of the Prinos offshore facilities (DAET DIPA/8413/24.04.2018), so that the results are comparable. In addition to the sampling stations investigated in the context of the EIA and the EIA of the Prinos offshore facilities (i.e. 9, 11, 12, 13-REF- as defined in the context of the EIA and EMP of the Prinos offshore facilities), within the context of this project it is proposed to include 2 more sampling stations along the CO2 transmission pipeline and one more sampling station in the coastal section near the onshore facilities of the project. At sediment sampling points for benthic macroinvertebrates, a sediment sample should be taken for physicochemical analyses so that the results can be correlated.
2.2	Marine mammal monitoring	Monitoring and recording the occurrence of marine mammals (Phocoena phocoena, Tursiops truncates) which are protected objects of the Natura 2000 SPA – SCI with code GR1150014 and name "Marine Area of Kavala – Thassos".	Continuous monitoring during Phase 3 and Phase 5 of the offshore pipeline installation and burial works. With seasonal frequency, during the implementation of the remaining works within the marine environment and in any	The on-site observations will be divided into the following time periods: • 50% in the project's field research area, as defined by the project's AA. • • 50% of the time in the project's extended field research area, as defined by the project's AA.

S/N	Indicator	Measurable Indicator Parameters	Frequency	Locations / Area
			case no later than every three (3) months.	
2.3	Sea turtle monitoring	Monitoring and recording the appearance of the sea turtle Caretta caretta, which is a protected object of GR1150001. Observation also for the other species of sea turtles Chelonia mydas, Dermochelys coriacea	Continuous monitoring during Phase 3 and Phase 5 of the offshore pipeline installation and burial works. With seasonal frequency, during the implementation of the remaining works within the marine environment and in any case no later than every three (3) months.	The on-site observations will be divided into the following time periods: • 50% in the project's field research area, as defined by the project's AA. • 50% of the time in the project's extended field research area, as defined by the project's AA.
2.4	Seabird monitoring	Monitoring and recording of the bird species Phalacrocorax aristotelis desmarestii, Puffinus yelkouan which are protected objects of the Natura 2000 marine area SPA – SCI with code GR1150014 and name "Marine Area of Kavala – Thassos" as well as other bird species which are protected objects of the neighboring SPA areas of the Natura 2000 network and regularly use GR1150014.	With seasonal frequency, during the implementation of the remaining works within the marine environment and in any case no later than every three (3) months.	The on-site observations will be divided into the following time periods: • 50% in the project's field research area, as defined by the project's AA. • 50% of the time in the project's extended field research area, as defined by the project's AA.
2.5	Monitoring of wading birds and land turtles.	Monitoring and recording of breeding wading bird species and land turtles (protected objects of GR1150001 and GR1150010) in the sand dune zone / on either side of the Sigma factory.	Before the start of work to determine the base prices. With seasonal frequency, during the implementation of the work and in any case no later than every three (3) months.	In the coastal section (with emphasis on the sand dunes) of the land part of the project.
2.6	Fauna - Birdlife Species	Index of dead/injured individuals of fauna and avifauna	Identification and recording of dead/injured individuals of fauna and avifauna in the immediate area of influence of the project. The reasons for injury/death of these individuals should be investigated (e.g. in the event that an individual has been injured by the construction activities of the project.	Total project
3.1	Environmental noise assessment index	Monitoring of environmental noise emissions	Montlhy basis	On the work front.
3.2	Underwater noise assessment index	Monitoring of underwater noise emissions	Montlhy basis	In position 150 m from the front of the works.
4.1	Waste generation and disposal index	Includes the parameters: • Generated quantities: • Liquid waste. • Solid waste. • Household waste. • Hazardous waste. • Methods of managing the above waste and corresponding quantities. • • Alternative methods of managing the above waste (e.g. recycling) and corresponding quantities.	Bimonthly basis	Total project

S/N	Indicator	Measurable Indicator Parameters	Frequency	Locations / Area
4.2	Energy and raw material use index.	Includes the parameters: • Resource inputs: ○ Energy. ○ Water. ○ Fuels. ○ Raw materials (chemicals). ○ Other resources. • Methods of saving upstream resources.	Bimonthly basis	Total project
4.3	Workplace control index.	Workplace Inspections: • Waste. • Solid waste segregation by system (general, hazardous, recyclable, waste materials). • Hydrocarbon leakage. • Effectiveness of control measures. • Stormwater/wastewater discharges. • Water pollution accidents. • • Any activities that contravene the EHSM..	Weekly basis	The entire project area. Environmentally sensitive areas that could potentially be affected on a case-by-case basis. Liquid and solid waste storage facilities (general, hazardous, recyclable, waste materials, etc.). Dumping areas.
4.4	Environmental conditions control index	It includes all general Project ETs that are not included in any other specialized monitoring indicator in this table.	On a case-by-case basis, depending on the requirements of each ET.	Total project
5.1	Social impact index	It includes parameters such as the following: • Social acceptance of the project. • Potential issues of the local community related to the operation of the project. • Infrastructure projects. • • Impacts - on the productive structure of the local economy and on other economic activities (e.g. livestock production and tourism).	Monthly basis	The entire project area.
5.2	Corporate awareness index	It includes parameters such as the following: • Social acceptance of the project. • Potential issues of the local community related to the operation of the project. • Infrastructure projects. • • Impacts - on the productive structure of the local economy and on other economic activities (e.g. livestock production and tourism).	Monthly basis	Total project
6.1	Working conditions, health and safety	It includes parameters such as: • Health and Safety (H&S) Monitoring and Audits. • H&S Performance Evaluation • • Personal Protective Equipment Monitoring	Monthly basis	Total project
6.2	Working conditions, health and safety	It includes parameters such as: • Concern communication mechanism files • • Training files	Monthly basis	Total project

S/N	Indicator	Measurable Indicator Parameters	Frequency	Locations / Area
Operation Phase				
1.1	Seawater quality	Qualitative characteristics of the treated water from the pumping wells before its discharge into the marine environment. The parameters to be monitored will be determined based on the characteristics of the water to be pumped from the reservoir. The pumped water is expected to have a higher salinity than that of seawater and may contain oil impurities. In addition to the parameters to be determined, the temperature of the treated water should be monitored before its discharge into the sea.	Weekly basis	At the exits of tanks and pipelines required before the discharge of the produced treated water into the marine environment.
1.2	Seawater quality	• • Seawater quality with measurements with a portable instrument (pH, turbidity, dissolved oxygen (DO), total dissolved solids (TDS), temperature, salinity and electrical conductivity) at the bottom and at the surface of the water column. • Analyses in an accredited laboratory (indicatively: total dissolved carbon (TIC), total nitrogen (TN), total phosphorus (TP), 16 USEPA PAHs) on water samples from the bottom and the surface.	Every 3 years	It is proposed to take into account the locations of the sampling points studied in the context of the environmental monitoring of the Prinos offshore facilities (DAET DIPA/8413/24.04.2018), so that the results are comparable. In addition to the sampling stations investigated in the context of the EIA and the EIA of the Prinos offshore facilities (i.e. 9, 11, 12, 13-REF- as defined in the context of the EIA and EMP of the Prinos offshore facilities), within the context of this project it is proposed to include 2 more sampling stations along the CO2 transport pipeline and one more sampling station in the coastal section near the onshore facilities of the project.
2.1	Seabed Qualitative Characteristics	Bottom quality with sediment analyses in an accredited laboratory for the parameters. Indicatively includes the parameters: granulometric analysis, pH, total organic carbon (TOC), total nitrogen (TN), total phosphorus (TP), 16 USEPA PAHs, metals (according to the United States Environmental Protection Agency (USEPA) Cu, Fe, Zn, Mn, Pb, Cd, Ni, Cr, As, Co, Mo), calcium carbonate (CaCO3), sulfates SO4$_{2-}$, VOCs).	Every 3 years	It is proposed to take into account the locations of the sampling points studied in the context of the environmental monitoring of the Prinos offshore facilities (DAET DIPA/8413/24.04.2018), so that the results are comparable. In addition to the sampling stations investigated in the context of the EIA and the EIA of the Prinos offshore facilities (i.e. 9, 11, 12, 13-REF- as defined in the context of the EIA and EIA of the Prinos offshore facilities), within the context of this project it is proposed to include 2 more sampling stations along the CO2 transmission pipeline and one more sampling station in the coastal section near the onshore facilities of the project
3.1	Monitoring of benthic macroinvertebrates	Identification of benthic macroinvertebrates as an indicator of the ecological status of the marine environment (application of statistical analysis and the BENTIX ecological index).	Every 3 years.	It is proposed to take into account the locations of the sampling points studied in the context of the environmental monitoring of the Prinos offshore facilities (DAET DIPA/8413/24.04.2018), so that the results are comparable. In addition to the sampling stations investigated in the

S/N	Indicator	Measurable Indicator Parameters	Frequency	Locations / Area
				context of the EIA and the EIA of the Prinos offshore facilities (i.e. 9, 11, 12, 13-REF- as defined in the context of the EIA and EIA of the Prinos offshore facilities), within the context of this project it is proposed to include 2 more sampling stations along the CO2 transmission pipeline and one more sampling station in the coastal section near the onshore facilities of the project. At sediment sampling points for benthic macroinvertebrates, a sediment sample should be taken for physicochemical analyses so that the results can be correlated.
3.2	Marine mammal monitoring	Monitoring and recording the occurrence of marine mammals (Phocoena phocoena, Tursiops truncates) which are protected objects of the Natura 2000 SPA – SCI with code GR1150014 and name "Marine Area of Kavala – Thassos".	Every 3 years.	The on-site observations will be divided into the following time periods: • 50% in the project's field research area, as defined by the project's AA. • • 50% of the time in the project's extended field research area, as defined by the project's AA.
3.3	Sea turtle monitoring	Monitoring and recording the occurrence of the sea turtle *Caretta caretta*, which is a protected species under GR1150001. Observation will also include other sea turtle species: *Chelonia mydas* and *Dermochelys coriacea*.	Every 3 years.	The on-site observations will be divided into the following time periods: • 50% in the project's field research area, as defined by the project's AA. • 50% of the time in the project's extended field research area, as defined by the project's AA.
3.4	Seabird monitoring	Monitoring and recording of the bird species Phalacrocorax aristotelis desmarestii, Puffinus yelkouan which are protected objects of the Natura 2000 marine area SPA – SCI with code GR1150014 and name "Marine Area of Kavala – Thassos" as well as other bird species which are protected objects of the neighboring SPA areas of the Natura 2000 network and regularly use GR1150014.	Every 3 years.	The on-site observations will be divided into the following time periods: • 50% in the project's field research area, as defined by the project's AA. • 50% of the time in the project's extended field research area, as defined by the project's AA.
3.5	Monitoring of wading birds and land turtles.	Monitoring and recording of breeding wading bird species and land turtles (protected objects of GR1150001 and GR1150010) in the sand dune zone / on either side of the Sigma factory.	Every 3 years.	In the coastal section (with emphasis on the sand dunes) of the land part of the project.
3.6	Fauna - Birdlife Species	Index of dead/injured individuals of fauna and avifauna	Continuous macroscopic visual observation by project workers.	Total project
4.1	Environmental noise assessment index	Monitoring of environmental noise emissions.	Every 6 months for the first 2 years of operation of the project, every two years thereafter.	On the platform and in a position at the boundaries of the onshore facility

S/N	Indicator	Measurable Indicator Parameters	Frequency	Locations / Area
4.2	Underwater noise assessment index	Monitoring of underwater noise emissions.	Every 6 months for the first 2 years of operation of the project, every two years thereafter.	Located 150 m from the platform.
5.1	Air Quality Assessment Index	Monitoring of the project's carbon footprint	Annual basis.	Total project
6.1	Waste generation and disposal index	It includes the following parameters: 1. Quantities generated: ○ Liquid waste. ○ Solid waste. ○ Domestic-type waste. ○ Hazardous waste. 2. Waste management methods for the above waste categories and corresponding quantities. Alternative waste management methods for the above waste categories (e.g., recycling) and corresponding quantities.	Annual basis.	Total project
6.2	Energy and raw material use index	It includes the following parameters: 3. Resource inputs: ○ Energy. ○ Water. ○ Fuels. ○ Raw materials (chemicals). ○ Other resources. Methods for conserving the above resources.	Annual basis.	Total project
6.3	Workplace Monitoring Index	• Workplace inspections: • Waste. • Segregation of solid waste by system (general, hazardous, recyclable, non-usable materials). • Hydrocarbon leakage. • Effectiveness of control measures. • Stormwater runoff / wastewater discharges. • Water pollution incidents. • Any activities that contravene the EMS.	Weekly basis	The entire project footprint area. Environmentally sensitive areas that could potentially be affected on a case-by-case basis. Facilities for the storage of liquid and solid waste (general, hazardous, recyclable, non-usable materials, etc.). Disposal areas.
6.4	Environmental Terms Compliance Index	ETs that are not covered by any other specific monitoring indicator in this table.	On a case-by-case basis, depending on the requirements of each ET	Total project
7.1	Social Impact Index	It includes parameters such as: • Social acceptance of the project. • Potential issues within the local community related to the operation of the project. • Infrastructure projects. Impacts on the productive structure of the local economy and on other economic activities (e.g., livestock production and tourism).	Semi-annual basis.	Wider project area.
7.2	Corporate Responsibility Awareness Index	It includes parameters such as: • Corporate social responsibility (CSR) actions of the company. Personnel employed on the project from the wider project area.	Annual basis.	Total project

S/N	Indicator	Measurable Indicator Parameters	Frequency	Locations / Area
8.1	Workplace Conditions, Hygiene and Safety	It includes parameters such as: • Health and Safety (H&S) Monitoring and Audits. • H&S Performance Evaluation • Personal Protective Equipment Monitoring	Annual basis.	Total project
8.2	Workplace Conditions, Hygiene and Safety	It includes parameters such as: • Concern communication mechanism files • Training files	Annual basis.	Total project

13.7 DURATION OF VALIDITY OF THE ENVIRONMENTAL TERMS APPROVAL DECISION – CONDITIONS FOR RENEWAL AND MODIFICATIONS

1 The environmental terms of this decision are valid for fifteen (15) years from the date of its issuance, subject to Article 2, paragraphs 8a and 9 of Law 4014/2011 (Government Gazette 209/A') as in force, and Article 1, paragraph 1 of Law 4685/2020 (Government Gazette 92/A'), provided that there is no change in the conditions on the basis of which it was issued. Its validity may be extended for six (6) years if the project has an Environmental Management System based on the "Eco-Management and Audit Scheme" (EMAS) standards, for as long as the System remains in force, and for four (4) years if the project has an Environmental Management System certified under ISO 14001 or another equivalent standard, for as long as the System remains in force. For the above extensions, a relevant certification act is issued. Failure to timely renew the above Environmental Management Systems results, during the period of such extensions, in the automatic expiration of the Environmental Terms Approval Decision (AEEPO). Additionally, the project operator is required to maintain a valid Environmental Management System for at least one (1) year prior to the expiration of the AEEPO renewal deadline.

2 Before the expiration of this period, the project operator must initiate the process for the renewal of the environmental terms, as specified in Article 5 of Law 4014/2011, as in force. According to the same article, if the renewal dossier is submitted on time (at least two months prior to the expiration of validity), the environmental terms remain in effect for the period until the completion of the renewal process.

3 For the modernization, improvement, expansion, or modification of the project, as described in Section 1 of this decision and implemented in accordance with the environmental terms, compliance with Article 6 of Law 4014/2011, as in force, is required.

4 In the event that regular or extraordinary environmental inspections identify serious environmental degradation issues, or if environmental impacts not anticipated in the EIA and this decision are observed, additional environmental terms shall be imposed or the terms of this decision shall be modified, as provided in paragraph 9 of Article 2 of Law 4014/2011, as in force, in conjunction with Article 6 of the same law.

13.8 OTHER PROVISIONS

This decision:

1 Does not cover safety issues, which continue to be regulated by the existing relevant provisions, including those of Law 4409/2016 (A' 136).

2 Does not exempt the project proponent from the obligation to obtain any other permits, approvals, or regulatory acts required by the applicable legislation for the project.

13.9 OBLIGATIONS REGARDING THE MONITORING OF COMPLIANCE WITH ENVIRONMENTAL TERMS

1 This decision and the accompanying Environmental Impact Assessment (EIA), as well as any future files regarding renewals, amendments, or technical environmental studies along with the relevant decisions, must be available on the project site. These documents must be presented by the responsible project operator to any competent authority or inspection body, in accordance with the applicable legislation.

1.1 The project operator, both during the implementation phase and during the decommissioning phase, must:

1.2 Maintain records that demonstrate compliance with the environmental terms of the project (e.g., contracts, supporting documents, invoices, data registries, electronic files, etc.).

1.3 Allow access to the project site for any competent inspection authority and facilitate the conduct of inspections.

1.4 Provide all required documents and information

1.5 Facilitate inspections and comply with the recommendations or instructions of the competent authorities responsible for enforcing environmental legislation

1.6 If issues arise during the implementation of this decision that are not covered by its terms, their resolution shall be carried out in accordance with the applicable legislation, and where this is not possible, based on the approved project studies or any future files related to the project's environmental permitting.

2 In the event of pollution or any other environmental degradation, or a violation of the terms of this decision, the project operators shall be subject to the penalties provided for in Articles 28, 29, and 30 of Law 1650/1986, as amended and currently in force.

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14 ADDITIONAL INFORMATION

14.1 SPECIALIZED STUDIES

Within the framework of this Environmental Impact Assessment (EIA), the following Supporting Studies, Plans, and Reports were prepared:

1. Waste Management Plan (WMP). LDK Consultants SA, 2024.
2. Special Ecological Assessment Study (SEA). LDK Consultants SA, 2024.
3. Stakeholder Engagement Plan (SEP). LDK Consultants SA, 2024.
4. Technical Report for the CCS Exploration License Application. Energean Oil and Gas SA, August 2022.
5. Prinos CCS Exploration License Deliverables (*Step 1: Data collection, Step 2: Building the three-dimensional static geological earth model, Step 3: Characterisation of the storage dynamic behaviour, sensitivity characterisation, risk assessment*). Energean Oil and Gas SA, September 2023.
6. Seismotectonic Investigation of Kavala Area – Geometry and Kinematics of Active Structural Elements Investigation based on Seismological, Geological and Geodetic Data (Deliverable D1: Technical Report-Database – Catalogue of Revised Seismic Events 2008-2023. Deliverable D5: Active Fault Map and report). NOA – ENERGEAN SA, October 2023.
7. Prinos CO_2 Storage Permit Application Deliverables, *Step 3: Characterisation of the storage dynamic behaviour, sensitivity characterisation, risk assessment*. Energean Oil and Gas SA, June 2024.
8. Prinos Containment Risk Assessment & Conceptual Monitoring, Measurement, and Verification (MMV) plan. Halliburton, 2024.
9. Metocean Criteria - Kavala, Greece. BMT ARGOSS, March 2017.
10. Consequence modelling assessment for Prinos CCS facilities. WSP, July 2024.
11. Report on Major Accidents and Disasters for Prinos CCS facilities. WSP, July 2024.

The main points and conclusions of the above Studies, Plans and Reports are incorporated into the main text of the EIA in the corresponding sections.

14.2 IMPLEMENTATION CHALLENGES AND SOLUTIONS

For the preparation of this Environmental Impact Assessment (EIA), the existing specifications of Greek legislation and the European Union were used. Due to the pioneering nature of this Project for both Greek and European standards (CO_2 storage in geological formations) and the absence of corresponding expertise on similar Projects, data/information from various online sources regarding critical environmental issues of similar projects were also utilized, as well as the study team's experience from previous Environmental Impact Assessment approaches.

In any case, an effort was made for this study to satisfactorily cover both the formal requirements of the legislation and the substantive requirements of the project and its environmental impacts.

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15 MAPS/DRAWINGS

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EIA - 5.2	MAP OF LAND USE AND COVER	1:10.000
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EIA - 9.1	MAP OF THE PROPOSED ENVIRONMENTAL MONITORING PROGRAM DURING CONSTRUCTION	1:100.000
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16 ANNEXES

LIST OF ANNEXES

Code	Title
16.1	Special Ecological Assessment Study (SEAS)
16.2	CO_2 Monitoring Plan and Corrective Measures Plan
16.3	Waste Management Plan
16.4	Draft Stakeholder Engagement Plan
16.5	Chemical Usage Plan
16.6	Construction Management Plan

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