

ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT (ESIA) FOR PRINOS OFFSHORE DEVELOPMENT PROJECT



Chapter 11 Impact Assessment

TABLE OF CONTENTS

11 ASSESSMENT AND EVALUATION OF THE ENVIRONMENTAL AND SOCIAL IMPACTS	11-4
11.1 METHODOLOGICAL REQUIREMENTS	11-4
11.2 IMPACT ASSESSMENT FROM ROUTINE ACTIVITIES	11-7
11.2.1 IMPACT ON THE CLIMATE AND BIOCLIMATE CHARACTERISTICS	11-8
11.2.2 IMPACT ON THE MORPHOLOGICAL AND TOPOLOGICAL CHARACTERISTICS	11-8
11.2.3 IMPACT ON THE GEOLOGICAL AND TECTONIC CHARACTERISTICS	11-9
11.2.4 IMPACT ON WATER ENVIRONMENT	11-11
11.2.5 IMPACT ON AIR ENVIRONMENT	11-13
11.2.6 IMPACT ON ACOUSTIC ENVIRONMENT	11-13
11.2.7 IMPACT ON BIOTIC ENVIRONMENT	11-14
11.2.8 IMPACT ON MANMADE ENVIRONMENT	11-24
11.2.9 SOCIOECONOMIC IMPACT	11-25
11.2.10 IMPACT ON TECHNICAL INFRASTRUCTURES	11-26
11.3 IMPACT ASSESSMENT FROM UNPLANNED EVENTS	11-28
11.3.1 IMPACT ON CLIMATE AND BIOCLIMATE CHARACTERISTICS	11-28
11.3.2 IMPACT ON MORPHOLOGICAL AND TOPOLOGICAL CHARACTERISTICS	11-28
11.3.3 IMPACT ON GEOLOGICAL AND TECTONIC CHARACTERISTICS	11-28
11.3.4 IMPACT ON WATER ENVIRONMENT	11-28
11.3.5 IMPACT ON AIR ENVIRONMENT	11-29
11.3.6 IMPACT ON ACOUSTIC ENVIRONMENT	11-29
11.3.7 IMPACT ON BIOTIC ENVIRONMENT	11-29
11.3.8 IMPACT ON MANMADE ENVIRONMENT	11-32
11.3.9 IMPACT ON SOCIOECONOMIC ENVIRONMENT	11-33
11.3.10 IMPACT ON TECHNICAL INFRASTRUCTURES	11-33

TABLES

Table 11-1: Impact nature assessment (STEP 1).....	11-4
Table 11-2: Considerations for magnitude and likelihood (STEP 2).....	11-5
Table 11-3: Impact significance assessment – Negative impacts (STEP 3).....	11-6

Table 11-4: Consideration of reversibility (STEP 4).....	11-7
Table 11-5: Explanation of impact assessment	11-7

ABBREVIATIONS

ALARP	As Low As Reasonable Practicable
EIA	Environmental Impact Assessment
ENERGEAN	Energean Oil & Gas S.A.
EU	European Union
IBA	Important Bird Areas
SIP	Self Installing Platform
SPA	Special Protection Areas

11 ASSESSMENT AND EVALUATION OF THE ENVIRONMENTAL AND SOCIAL IMPACTS

11.1 METHODOLOGICAL REQUIREMENTS

The assessment of the potential impacts of the construction, operational and abandonment phases of the project is based on a number of criteria, which are used to determine the **significance** of potential **positive and negative** effects of the project. Impacts are assessed taking into account the **identified receptors and resources** according to defined assessment criteria.

There is a number of ways, in which impacts may be described and quantified. An impact is essentially any change (whether positive or negative) to a resource or receptor brought about by the presence of the project component or by the execution of a project related activity.

The impact assessment terminology that will be used in the study is given as below:

The nature of the impact is primarily defined as positive or negative and then is categorized as direct, indirect and cumulative.

The assessment of the potential impacts is made on the construction, operational and abandonment phase.

Table 11-1: Impact nature assessment (STEP 1)

Term	Definition
Impact Nature	
Positive	An impact that is considered to represent an improvement on the baseline or introduces a positive change.
Negative	An impact that is considered to represent an adverse change from the baseline, or introduces a new undesirable factor.
<i>Direct impact</i>	Impacts that result from a direct interaction between a planned project activity and the receiving environment/receptors (e.g. between occupation of a site and the pre-existing habitats or between an effluent discharge and receiving water quality).
<i>Indirect impact</i>	Impacts that result from other activities that are encouraged to happen as a consequence of the Project (e.g. in-migration for employment placing a demand on resources).
<i>Cumulative impact</i>	Impacts that act together with other impacts (including those from concurrent or future third party activities) to affect the same resources and/or receptors as the Project.

Once **nature of impact** has been identified, significance will be determined for potential negative or positive impacts. For this assessment **impact significance** is determined by considering both the impact magnitude and the likelihood of the impact occurring (note this is not the likelihood of the activity itself occurring). Impact magnitude is considered to be a function of impact extent, duration and intensity. The criteria used by the consultant to determine significance are summarised in the table below.

Table 11-2: Considerations for magnitude and likelihood (STEP 2)

Criteria	Description
Impact magnitude	
Extent	<p>On-site – impacts that are limited to the boundaries of the project.</p> <p>Local – impacts that affect an area around the project route.</p> <p>Regional – impacts that affect regionally important environmental resources or are experienced at a regional scale as determined by administrative boundaries, habitat type/ecosystem.</p> <p>National – impacts that affect nationally important environmental resources or affect an area that is nationally important/ or have macro-economic consequences.</p>
Duration	<p>Temporary – impacts are predicted to be of short duration and intermittent/occasional.</p> <p>Short-term – impacts that are predicted to last only for the duration of the construction period.</p> <p>Long-term – impacts that will continue for the life of the Project, but cease when the Project stops operating.</p> <p>Permanent – impacts that cause a permanent change in the affected receptor or resource (e.g. removal or destruction of ecological habitat) and that endure substantially beyond the project lifetime.</p>
Intensity	<p>BIOPHYSICAL ENVIRONMENT: Intensity can be considered in terms of the sensitivity of the biodiversity receptor (i.e. habitats, species or communities).</p> <p>Negligible – the impact on the environment is not detectable.</p> <p>Low – the impact affects the environment in such a way that natural functions and processes are not negatively affected, or these natural functions are enhanced to a small degree.</p> <p>Medium – where the affected environment is altered but natural functions and processes continue, albeit in a modified way, or are considerably improved.</p> <p>High – where natural functions or processes are altered to the extent that it will temporarily or permanently cease; or in the case of a positive impact, will be restored to close to its natural state in terms of functions and processes.</p> <p>Where appropriate, national and/or international standards are to be used as a measure of the impact. Specialist studies should attempt to quantify the magnitude of impacts and outline the rationale used.</p> <p>SOCIO-ECONOMIC ENVIRONMENT: Intensity can be considered in terms of the ability of project affected people/communities to cope with or adapt to negative changes brought about by the Project, the degree to which their quality of life/ well-being will be enhanced as a result of the socio-economic benefits.</p> <p>Negligible – there is no perceptible change to people's quality of life.</p> <p>Low - People/ communities are able to cope with/ adapt to negative impacts with relative ease and maintain pre-impact quality of life/ well-being. People would marginally benefit from the proposed activity and would experience a relatively small improvement in quality of life/ well being.</p>

Criteria	Description
	<p>Medium - Able to cope with/ adapt to negative impacts with some difficulty and maintain pre-impact livelihoods but only with a degree of mitigation support. People’s quality of life/ well being are considerably improved as a result of benefits.</p> <p>High - Those affected will not be able to cope with/ adapt to negative changes and continue to maintain-pre impact quality of life/ well-being. People will have their quality of life/ well being significantly improved.</p>
Impact likelihood (Probability)	
Negligible	The impact will not occur.
Low	Impact may possibly occur i.e. occurs infrequently.
Medium	Impact is highly likely to occur i.e. occurs under most conditions.
Definite	Impact will definitely occur.

Once a rating is determined for magnitude and likelihood, the following matrices are used to determine the **impact significance** (depending on whether positive or negative).

Table 11-3: Impact significance assessment – Negative impacts (STEP 3)

		Significance Rating			
Likelihood		Negligible	Low	Medium	High
Magnitude	<i>Negligible</i>	Negligible	Negligible	Negligible	Negligible
	<i>Minor</i>	Negligible	Negligible	Minor	Minor
	<i>Medium</i>	Negligible	Minor	Moderate	Moderate
	<i>High</i>	Minor	Moderate	Major	Major

Significance definitions:

- **Negligible impact:** Negligible impact (or insignificant impact) is where a resource or receptor (including people) will not be affected in any way by a particular activity, or the predicted effect is deemed to be ‘negligible’ or ‘imperceptible’ or is indistinguishable from natural background variations.
- **Minor impact:** An impact of minor significance is one where an effect will be experienced, but the impact magnitude is small (with and without mitigation) and, for negative impacts, well within accepted standards, and/or the receptor is of low sensitivity/value.
- **Moderate impact:** An impact of moderate significance is one within accepted limits and standards. The emphasis for moderate impacts is on demonstrating that the negative impact has been reduced to a level that is as low, or positive impact enhanced as far as reasonably practicable (ALARP). This does not necessarily mean that ‘moderate’ negative impacts have to be reduced to ‘minor’ impacts, but that moderate impacts are being managed effectively and efficiently. In the same way, moderate positive impacts may not be able to be enhanced to have major positive impact.
- **Major impact:** An impact of major significance is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/ sensitive resource/ receptors. A goal of the EIA process is to get to a position where the Project does not have any major residual negative impacts and major positive impacts are enhanced as far as possible. For some aspects, however, there may be major residual

negative impacts after all practicable mitigation options have been exhausted.

Since mitigation measures are normally designed to address a project’s **negative** impacts, a third parameter is deemed as essential to determine a negative impact’s true significance. This factor is **reversibility** and it regards the ability of an ecosystem or receptor a) to reverse into a pre-impact state by using its own resilience mechanisms, or b) maintain its biological integrity, meaning its pristine state even though an impact has occurred. This process is presented in the table below.

Table 11-4: Consideration of reversibility (STEP 4)

Negative Impact Assessment					
Impact’s Reversibility		High Reversibility	Medium Reversibility	Low Reversibility	Irreversible
Impact Significance	<i>Negligible</i>	Negligible	Negligible	Negligible	Negligible
	<i>Low</i>	Negligible	Negligible	Minor	Moderate
	<i>Moderate</i>	Minor	Minor	Moderate	Major
	<i>High</i>	Minor	Moderate	Major	Critical Impact

Table 11-5: Explanation of impact assessment

Negative Impact Assessment				
Negligible	Minor	Moderate	Major	Critical Impact
Magnitude of change comparable to natural variation	Detectable but non-significant	Significant; Amenable to mitigation; Should be mitigated where practicable	Significant; Amenable to mitigation; Must be mitigated	Intolerable; Corresponds to a major impact, but not amenable to mitigation; Alternatives must be identified – Project Stopper

The final impact assessment will depend not only in the impact’s significance, but also on the impact’s reversibility, a strong factor to determine whether the impact will need to be mitigated and also in which extend. If reversibility is high (“**high reversibility**”), then the overall impact can be assessed as **minor** even if major in its significance. If on the other hand, reversibility is low (“**low reversibility**”) then the final assessment can also reach a **major** scoring, with the critical point (“**CRITICAL IMPACT**” – project stopper) being reached in case that no reversibility whatsoever will be plausible in the future.

11.2 IMPACT ASSESSMENT FROM ROUTINE

ACTIVITIES

11.2.1 Impact on the climate and bioclimate characteristics

As provided in Chapter 09, no significant impacts to climate and bioclimate characteristics have been predicted for this project. The rationale for excluding these parameters from further assessment is provided in Chapter 09.

11.2.2 Impact on the morphological and topological characteristics

11.2.2.1 Construction Phase

The impacts on the morphological characteristics of the seabed are expected by the activities of:

- Installation of permanent mooring;
- Leg lowering and suction anchor activities;
- Burial of the pipelines and umbilical's; and
- Modifications to Delta platform including new risers and j-tubes.

The aforementioned activities will cause local change in the morphological characteristics of the seabed. The impact significance is assessed as minor to moderate. Due to the high reversibility, the impact significance is finally assessed as negligible or minor.

Activity	Receptor	Type	Extent	Duration	Magnitude	Likelihood	Significance	Reversibility	Final assessment
Installation of permanent mooring	Seabed	Negative	Local	Short	Low	High	Minor	High	Negligible
Leg lowering and suction anchor activities	Seabed	Negative	On site	Short	Low	High	Minor	High	Negligible
Burial of the pipelines and umbilical's	Seabed	Negative	Local	Short	Medium	High	Moderate	High	Minor
Modifications to Delta platform including new risers and j-tubes.	Seabed	Negative	On site	Short	Low	High	Minor	High	Negligible

Mitigation measures to address the minor impacts expected from the activity of burial of the pipelines and umbilicals are presented in Chapter 12.4.2.

11.2.2.2 Operational Phase

The project activity that has the potential to interact with seabed conditions is the seabed cuttings disposal (0-400 m). The potential impact from this activity is localized changes in seabed features in an area of 600 m². The morphology of the seabed will change but it is expected to gradually return in the previous condition in the next 5-10 years. Based on the above, the likelihood of the negative impact is assessed as high; the impact intensity as medium and therefore the impact significance is characterized moderate. Due to the fact that the reversibility is high, the impact significance is assessed as minor.

Activity	Secondary receptor	Type	Extent	Duration	Magnitude	Likelihood	Significance	Reversibility	Final assessment
Seabed cuttings (0-400m)	Benthic communities	Negative	Local	Long	Medium	High	Moderate	High	Minor

Mitigation measures to address the minor impacts expected from the activity of seabed cuttings disposal are presented in Chapter 12.4.2.

11.2.2.3 Abandonment Phase

Potential impacts on the morphological and topological characteristics of the seabed features during abandonment phase are expected from the following project activities:

- Dispersal of seabed cuttings from piles (from existing platforms); and
- Removal of SIPs (planned and potentially planned platforms).

The aforementioned activities will cause local change in the morphological characteristics of the seabed. The impact significance is assessed as moderate. Due to the high reversibility, the impact significance is finally assessed as minor.

Activity	Receptor	Type	Extent	Duration	Magnitude	Likelihood	Significance	Reversibility	Final assessment
Existing platforms: dispersal of seabed cuttings from piles	Seabed	Negative	Local	Long	Medium	High	Moderate	High	Minor
New platforms: removal of SIPs	Seabed	Negative	Local	Long	Medium	High	Moderate	High	Minor

Mitigation measures to the seabed morphology from the activities of existing and new platforms removal during abandonment phase are presented in chapter 12.4.2.

11.2.3 Impact on the geological and tectonic characteristics

11.2.3.1 Construction Phase

It is anticipated that the only activity that may cause an impact during construction phase is the installation of permanent mooring of Energean Force Rig as well as the SIP2 platform installation and suction anchoring to penetrate in the seabed. Smothering of a portion of the seabed, leading to localised decrease in sediment's nutrient content

As described in Chapter 06, the tug boats, supply vessels and fast rescue vessel will not anchor. The impact is localized by modification of the seabed through creation of pock marks and scarring of the substrate. Furthermore, the currents will smooth over the pock marks with time. The physical alteration of the seabed sediments due to the creation of depressions from anchor handling will have a localised extent and will be reversible, because sediments will be redistributed. Some further indirect impacts are that suspended sediments are causing increased levels of turbidity that could potentially affect the benthic communities.

The overall impact, by the installation of the drilling barge to the future platforms, extended locally (0.9 ha/platform), its duration is short, it has a medium impact magnitude and quite likely to happen. So although it is assessed as moderate, taking into account the high reversibility nature, it is considered as minor.

Activity	Receptor	Type	Extent	Duration	Magnitude	Likelihood	Significance	Reversibility	Final assessment
Installation of permanent mooring	Geological characteristics	Negative	Local	Long	Medium	High	Moderate	High	Minor

Mitigation measures to address the minor impacts expected from the activity of installation of permanent mooring are presented in Chapter 12.4.3.

11.2.3.2 Operational Phase

The project activity that has the potential to interact with seabed conditions is the seabed cuttings disposal (0-400 m). The potential impact from this activity is localized changes extended over an area of 600 m² nearby the well sites and will last during the execution of the drilling. Duration of the impact is expected to be long but it is expected to gradually return to its previous condition in the next 5-10 years. Impact intensity is low and likelihood of impact is high. Based on the above considerations the impact significance is minor. Taking into account the high reversibility nature, it is finally considered as negligible.

Activity	Receptor	Type	Extent	Duration	Magnitude	Likelihood	Significance	Reversibility	Final assessment
Seabed cutting disposal	Geological characteristics	Negative	Local	Long	Low	High	Minor	High	Negligible

Activity	Receptor	Type	Extent	Duration	Magnitude	Likelihood	Significance	Reversibility	Final assessment
(0-400m)									

11.2.3.3 Abandonment Phase

As provided in Chapter 09, no significant impacts on geologic and tectonic characteristics have been predicted for this project during the abandonment phase. The rationale for excluding these parameters from further assessment is provided in Chapter 09.

11.2.4 Impact on water environment

11.2.4.1 Construction Phase

The impacts on water environment result from the following activities:

- Leg lowering and suction anchor installation of the new SIPs;
- Installation of pipelines and umbilical's;
- Burial of pipelines and umbilical's; and
- Modifications to Delta (new risers/J tubes).

The impact from the above mentioned activities on water quality is increased turbidity. The sediment pollution levels are negligible, so there will be no dispersion of pollution in the water column, nor in the seabed. Based on experience from other oil and gas projects, it is estimated that the suspended sediment will settle within a few hundred meters of the disturbed area.

The proposed development will not affect the inland surface waters and groundwater of the area and therefore will not significantly affect the water resources. The marine part of the project is not constructed near natural water resources or other water streams. The impact significance is assessed as minor to moderate. Due to the moderate - high reversibility the impacts are finally characterized as negligible and minor.

Activity	Receptor	Type	Extent	Duration	Magnitude	Likelihood	Significance	Reversibility	Final assessment
Leg lowering and suction anchor installation	Water environment	Negative	Primary impact Area	Short	Low	High	Minor	Moderate High	Negligible
Installation of pipelines and umbilical's	Water environment	Negative	Primary impact Area	Short	Low	High	Minor	Moderate High	Negligible
Burial of pipelines and umbilical's	Water environment	Negative	Primary impact Area	Short	Medium	High	Moderate	Moderate High	Minor
Modifications to Delta (new	Water environment	Negative	Primary impact	Short	Low	High	Minor	Moderate High	Negligible

Activity	Receptor	Type	Extent	Duration	Magnitude	Likelihood	Significance	Reversibility	Final assessment
risers/J tubes)			Area						

Possible mitigation measures to address the minor impacts expected from the activity of burial of the pipelines and umbilicals to the water environment are presented in Chapter 12.4.4

11.2.4.2 Operational Phase

Potential impacts on the water environment are expected from the seabed cuttings disposal (0-400m). This activity will cause increased turbidity. However, it is noted that the sediments are clean with no hydrocarbon content and low heavy and trace metal concentrations. Any existing contaminants will disperse over a wide area but are unlikely to be noticeable against background levels due to the already low (below any thresholds) levels of concentration. Moreover, the amount of seabed cuttings (400MT) is not considered to be significant. Based on the above considerations the significance of the impacts is assessed as moderate. Taking into account the high reversibility nature, it is finally considered as minor.

Activity	Receptor	Type	Extent	Duration	Magnitude	Likelihood	Significance	Reversibility	Final assessment
Seabed cuttings (0-400m)	Water environment	Negative	Local	Short	Low	High	Moderate	High	Minor

Possible mitigation measures to address the minor impacts expected from the activity of seabed cutting disposal are presented in Chapter 12.4.4

11.2.4.3 Abandonment Phase

The potential impact to the water from the decommissioning works originate from the

- Dispersal of drill cutting from piles of the existing platforms
- Drilling Cuttings from the piles of the existing drilling platforms (Alpha and Beta)
- Removal of SIP of the new platforms (Lamda & Omicron)

The potential impact on the water environment is increased turbidity leading to adverse effects to water quality. The project abandonment will deteriorate the water quality and the status of the environment as long as the decommissioning phase lasts. With the completion/decommissioning of the project and the removal of the effect the natural mechanisms will restore the physical, marine environment and the water quality will be improved in short period of time. The impact significance is assessed as minor and due to the high to moderate reversibility; the impact is finally characterized as minor or negligible.

As far as the technology of decommissioning method concern, the new platforms are better decommissioned in a more environmental friendly method. The SIP may be relocated to another similar location by towing in the upright position. An alternative decommissioning solution is the disposal of the platforms in deep-water. The exact deep-water disposal technique applied will be a result of extensive environmental, legal, social and technical studies. The decommissioning design method will be done when the time is closing by, in order to make use of the best available techniques, methods and international experience available at the time.

Activity	Secondary receptor	Type	Extent	Duration	Magnitude	Likelihood	Significance	Reversibility	Final assessment
Existing platforms: Dispersal of seabed cuttings from piles	Water environment	Negative	Local (1200m ²)	Short	Low	High	Minor	Moderate	Minor
Existing platforms: Cut piles	Water environment	Negative	Local	Short	Low	High	Minor	High	Negligible
New platforms: Removal of SIP	Water environment	Negative	Local	Short	Low	High	Minor	High	Negligible

The mitigation measures to the water environment from the activity of seabed cuttings dispersion from the existing platform abandonment phase are presented in chapter 12.4.4

11.2.5 Impact on air environment

As provided in Chapter 09, no significant impacts to air quality have been predicted for this project. The rationale for excluding this parameter from further assessment is provided in Chapter 09.

11.2.6 Impact on acoustic environment

As provided in Chapter 09, no significant impacts to the acoustic environment for airborne have been predicted for this project. The rationale for excluding this parameter from further assessment is provided in Chapter 09.

The Project will conduct several activities during construction that will generate underwater noise. This noise may cause adverse impacts on sensitive species (i.e. marine mammals) in the area. Further detailed assessment of the impacts on the underwater environment is presented in 11.2.7.

11.2.7 Impact on biotic environment

The impacts on biotic environment concern the benthic communities, plankton, fish ecology and marine mammals. Note that impacts to other species (e.g. sea and coast birds and terrestrial ecology) have been scoped out as detailed in Chapter 09.

11.2.7.1 Construction phase

11.2.7.1.1 Plankton

As provided in Chapter 09, no significant impacts to plankton have been predicted for this project during routine construction phase activities. The rationale for excluding this parameter from further assessment is provided in Chapter 09.

11.2.7.1.2 Benthic communities

The project activities that have the potential to interact with benthic communities are the following:

- Installation of permanent mooring;
- Installation of pipelines and umbilical's;
- Leg lowering and suction anchor installation;
- Burial of pipelines and umbilical's; and
- Modifications to Delta platform (new risers/J tubes).

The potential impact on benthic communities is disturbance and in cases relocation due to the increased water turbidity and/or smothering of a portion of seabed, which in addition to the direct impacts on benthic species, can also result in reduced sediment nutrient quality. . It is noted that the benthic communities in the study area are typical of the Kavala Gulf Mediterranean as presented by the outcomes of the marine ecology study, (Chapter 8.7.2). No rare or protected species were identified.

Installation of permanent mooring and installation of pipelines and umbilical's

The duration of the activities is short but the duration of the impact is considered long as these project elements will remain permanently in place. The potential extent of the impact is local with the occupational zone of pipelines and umbilical's to be more extent comparing with the occupational zones of platforms (0.9ha/platform). The impact intensity is characterized as medium, the likelihood as high and therefore the significance is characterized as moderate. As the new platform will form a new place for benthic colonisation, the impact reversibility is characterized as high and the final impact significance as minor.

Leg lowering and suction anchor installation and modification to Delta platform

The duration of these activities and their impacts is short. The occupational zones of these activities are small and therefore there is a small change / disturbance of the seabed and the benthic communities. The potential extent of the impact is on site. Based on these, the impact intensity is characterized as low, the likelihood as high and therefore the significance is

characterized as minor. As the new platform will form a new place for benthic colonisation, the impact reversibility is characterized as high and the final impact significance as negligible.

Burial of pipelines and umbilical's

The duration of activity and impacts is short and the potential extent of the impact is local. The impact intensity is characterized as medium, the likelihood as high and therefore the significance is characterized as moderate. As the new platform will form a new place for benthic colonisation, the impact reversibility is characterized as high and the final impact significance as minor.

Activity	Receptor	Type	Extent	Impact Duration	Intensity	Likelihood	Initial Significance	Reversibility	Final assessment
Installation of permanent mooring	Benthic species	Negative	Local (0.9ha/ platform)	Long	Medium	High	Moderate	High	Minor
Installation of pipelines and umbilical's	Benthic species	Negative	Local	Long	Medium	High	Moderate	High	Minor
Leg lowering and suction anchor installation	Benthic species	Negative	On site	Short	Low	High	Minor	High	Negligible
Burial of pipelines and umbilical's	Benthic species	Negative	Local	Short	Medium	High	Moderate	High	Minor
Modifications to Delta (new risers/J tubes)	Benthic species	Negative	On site	Short	Low	High	Minor	High	Negligible

Mitigation measures to address the minor impacts to the benthic community expected from the activities of installation of permanent mooring, installation and burial of pipelines and umbilicals are presented in Chapter 12.4.7

11.2.7.1.3 Fish ecology

As provided in Chapter 09, no significant impacts to fish ecology have been predicted for this project during routine construction phase activities. The rationale for excluding this parameter from further assessment is provided in Chapter 09.

11.2.7.1.4 Marine mammals

The project construction activities that have the potential to interact with marine mammals are the following:

- Suction anchoring;
- Operation of support vessels; and
- Modifications to Delta platform (new risers / J tubes).

Suction anchors

Suction pumps will operate for around 12 hours overall (short period) with 40 dB noise emissions. The necessary dumb cargo barges and two tugs noise emission is considered to be 1% of the total noise level of a typical installation.

Naturally occurring noise levels in the ocean as a result of wind and wave action, may range from 90 dBA re 1 μ Pa under very calm, low wind conditions to 110 dB re 1 μ Pa under windy conditions.

Underwater noise may cause marine animals to alter their behavior (such as diving, surfacing, vocalizing, feeding, and/or mating), move away from the area of noise, prevent marine animals from hearing important sounds (masking), cause hearing loss (temporary or permanent), or damage tissue. Behavioral responses depend on a number of factors, including an individual animal's hearing sensitivity, tolerance to noise, exposure to the same noise in the past, behavior at the time of exposure, age, group composition. The degree of masking is influenced by the level, frequency band, and the duration of the noise in comparison to the sound of interest. Hearing loss depends on the hearing sensitivity of the animal in comparison to the intensity of the sound, the frequency of the sound, and the duration of exposure to the sound. The functional hearing group of marine mammals likely to be found in the Kavala Gulf is presented in the chapter 8.7.4 of the current study. The marine mammals recorded in the project area during the seismic survey are sperm whale, common bottlenose dolphin, striped dolphin and short-beaked common dolphin (see chapter 8.7.4.5). It is noted that none of the marine mammals species present are known to be breeding within the project area. They use a wide area for feeding and as such a very small area of increased noise over a small period of time will not lead to a significant impact.

The intensity of the underwater noise caused by this activity is expected to be low and within the range of existing noise given existing baseline conditions in the area (fishing boats and gear, boats, ferries etc). The duration of the activity is short (12 hours), the impact intensity is assessed as negligible and for that reason the significance is also characterised as negligible

Operation of support vessels

The potential impact on marine mammals from the operation of vessels is noise disturbance and risk of collision. Underwater noise from vessels may cause marine animals to alter their behaviour, move away from the area of noise and prevent marine animals from hearing important sounds (masking),. The duration of the activity is medium and the potential extent of the impact is local. The impact intensity is characterized as low because visits will occur at most every two weeks using existing vessels that move staff between shore and Prinosa or Prinosa and South Kavala. As it is described in the chapter 8.8.3, the traffic density in the Kavala Gulf is high and the number of distinct vessels on a daily basis is estimated more than 140. Therefore, the impact likelihood from this activity is low. However the impact intensity is high and for that reason the impact significance is moderate. Due to the fact that in case of a collision the impact reversibility is low, the final impact significance is assessed as moderate.

Modifications to Delta platform (new risers/J tubes)

This activity will generate underwater noise of low intensity and the duration of activity and impact will be short. Based on these, the impact intensity is low. However, the impact significance is high and so the significance is moderate. Due to the high reversibility, the final assessment of impact is minor.

Activity	Receptor	Type	Extent	Impact Duration	Intensity	Likelihood	Significance	Reversibility	Final assessment
Suction anchoring	Marine mammals	Negative	Local	Short	Negligible	High	Negligible	High	Negligible
Operation of support vessels	Marine mammals	Negative	Local	Medium	High	Low	Moderate	Low	Moderate
Modifications to Delta (new risers/J tubes)	Marine mammals	Negative	On site	Medium	Low	High	Moderate	High	Minor

Mitigation measures to address the moderate and minor impacts to the marine mammals expected from the activities of support vessels operation and modifications to Delta platform are presented in Chapter 12.4.7.

11.2.7.2 Operational phase

11.2.7.2.1 Plankton

As provided in Chapter 09, no significant impacts to plankton have been predicted for this project during routine operation phase activities. The rationale for excluding this parameter from further assessment is provided in Chapter 09.

11.2.7.2.2 Benthic communities

The operation activities that have the potential to affect benthic communities are:

- Maintenance of exclusion zones; and
- Seabed cuttings disposal (0-400 m)

Maintenance of exclusion zones

By preventing fishing in the exclusion zones, the benthic habitat will be impacted positively.

Seabed cuttings disposal (0-400m)

The seabed cuttings will not contain any oil or hazardous chemicals, but will represent a physical change to the local seabed topography. The potential impact from this activity is localized to within an area of 600 m². An indirect impact from this activity is expected on the benthic communities in the vicinity of the platforms. As presented in Chapter 8, these communities are considered to be of low sensitivity. Based on the above considerations, the likelihood of the

negative impact is assessed as high; the impact intensity as medium and therefore the impact significance is characterized moderate. Due to the fact that the reversibility is expected to be high, the impact significance is assessed as minor.

Activity	Receptor	Type	Extent	Duration	Magnitude	Likelihood	Significance	Reversibility	Final assessment
Maintenance of exclusion zones	Benthic communities	Positive	Local	Long	Medium	High	Positive		Positive
Seabed cuttings (0-400m)	Benthic communities	Negative	Local (600m ²)	Long	Medium	High	Moderate	High	Minor

Mitigation measures to address the minor impacts to the benthic community expected from the activity of seabed cuttings disposal are presented in Chapter 12.4.7.

11.2.7.2.3 Fish ecology

The operation activities that have the potential to affect fish ecology are:

- The installation of conductors (new wells) planned; and
- The spudding and drilling of wells, including cementing of initial casings.

Those activities are expected to generate noise, which could be of nuisance to particular species. However, fish species in the area of study, are not under any protection status and they are in good populations as presented in Chapter 8. Therefore the receptor's sensitivity is considered low. Moreover, the duration of the activity and therefore of any potential impact is low.

Based on the above considerations, the likelihood of the negative impact is assessed as high; the impact magnitude low and therefore the impact significance is characterized minor. Due to the fact that the reversibility is expected to be high, the overall impact significance is assessed as negligible.

Activity	Receptor	Type	Extent	Impact Duration	Intensity	Likelihood	Significance	Reversibility	Final assessment
Installation of conductors (new wells)	Fish ecology	Negative	Local	Short	Low	High	Minor	High	Negligible
Spudding and drilling of wells, including cementing initial casings	Fish ecology	Negative	Local	Short	Low	High	Minor	High	Negligible

11.2.7.2.4 *Marine mammals*

The operation activities that have the potential to affect marine mammals are:

- Maintenance of exclusion zones;
- Installation of conductors (new wells only);
- Spudding and drilling of wells, including cementing of initial casings;
- Operation of support vessels.

Maintenance of exclusion zones

By maintaining the operation of exclusion zones, fishing activities are prevented within those areas, something that is expected to cause increases in fish populations, which in turn are the predominant food supply of marine mammals.

Installation of conductors (new wells only) - Spudding and drilling of wells, including cementing of initial casings – Operation of support vessels

These activities are expected to generate noise and collision risk is increased due to the support vessels traffic.

Naturally occurring noise levels in the ocean as a result of wind and wave action, may range from 90 dBA re 1µPa under very calm, low wind conditions to 110 dB re 1µPa under windy conditions.

As described previously in this chapter, underwater noise may cause impact marine mammals in various ways from forcing them to move away from the area of noise to extreme cases of hearing loss and tissue damage. The magnitude of the impact depends on the intensity of the sound, the frequency of the sound, the duration of exposure to the sound and the sensitivity of the animal to such noise. The functional hearing group of marine mammals likely to be found in the Kavala Gulf is presented in the chapter 8.7.4 of the current study. The marine mammals recorded in the project area during the seismic survey are sperm whale, common bottlenose dolphin, striped dolphin and short-beaked common dolphin (see chapter 8.7.4.5). It is noted that none of the marine mammals species present are known to be breeding within the project area. They use a wide area for feeding and as such a very small area of increased noise over a small period of time will not lead to a significant impact.

With regards to the conductors, they are traditionally hammered into the seabed to a distance of 40 to 50 m to support the wells drilled from a platform. These are large diameter (30") tubes through which the well is drilled. When hammer driving conductors, sound levels up to 180 dB can be generated. It is noted that the sound levels generated by the typical marine craft that service platforms is approximately 120 dB.

The hearing of mammals can be damaged at the sound levels up to 180 dB produced by the conductors, in a range of 3 to 10m (depending on noise frequency) with behavioural modifications noted out to 200 m. It is noted that, five (5) conductors will be driven initially. This will take approximately 5 days to complete, although noise would only be generated for about a third of this period. Impacts such as hearing loss and behavioural changes may only result if

marine mammals are present in close proximity to the conductor driving location. Conductor driving, however, will only take place if marine mammals are not within 500m of the conductor drilling area to avoid noise related impacts. The Company will also consider alternatives to hammering such as vibropile to reduce noise levels.

With regards to the spudding and drilling of wells, the estimated noise levels are expected to be lower but may still result in significant impacts. Similarly the Company will ensure that marine mammals are not present within 500m of the drilling site before commencing drilling activities.

Operation of support vessels

The potential impact on marine mammals from the operation of vessels is noise disturbance and risk of collision. Underwater noise from vessels may cause marine animals to alter their behaviour, move away from the area of noise and prevent marine animals from hearing important sounds (masking). The duration of the activity is medium and the potential extent of the impact is local. The impact intensity is characterized as low because visits will occur at most every two weeks using existing vessels that move staff between shore and Prinós or Prinós and South Kavala. As it is described in the chapter 8.8.3, the traffic density in the Kavala Gulf is high and the number of distinct vessels on a daily basis is estimated more than 140. Therefore, the impact likelihood from this activity is low. However the impact intensity is high and for that reason the impact significance is moderate. Due to the fact that in case of a collision the impact reversibility is low, the final impact significance is assessed as moderate.

Activity	Receptor	Type	Extent	Impact Duration	Intensity	Likelihood	Significance	Reversibility	Final assessment
Maintenance of exclusion zones	Marine mammals	Positive	Local	Long	Medium	High	Positive	-	Positive
Installation of conductors (new wells)	Marine mammals	Negative	On site	Short	Medium	Medium	Moderate	High	Minor
Spudding and drilling of wells, including cementing initial casings	Marine mammals	Negative	On site	Short	Medium	Medium	Moderate	High	Minor
Operation of support vessels	Marine mammals	Negative	Local	Short	High	Low	Moderate	Low	Moderate

Mitigation measures to address the minor and moderate impacts to the marine mammals expected from the activities of installation of conductors, drilling wells and operation of support vessels are presented in Chapter 12.4.7.

11.2.7.3 Abandonment phase

11.2.7.3.1 Plankton

As provided in Chapter 09, no significant impacts to plankton have been predicted for this project during routine abandonment phase activities. The rationale for excluding this parameter from further assessment is provided in Chapter 09.

11.2.7.3.2 *Benthic communities*

The abandonment activities that have the potential to benthic communities are:

- Dispersal of historic drill cuttings on seabed (from existing platforms); and
- Removal of SIPs (planned and potentially planned platforms)

The impact from the decommissioning of the facilities will have a limited duration (recovery time), while it will be withdrawn completely after the end of the decommissioning period, and it will be localized. The impacts will arise from the removal of the existing and new (currently planned) platforms. The historic drill cuttings on the seabed near the platforms will be pneumatically dispersed, which may cause disturbance to benthic communities on and around them (from direct physical disruption and increased turbidity). Drill cutting materials will disperse over a wide area and are unlikely to be noticeable against background levels. The amount of seabed cuttings is considered to be small. The seabed will be reformed in the next 5-10 years and the seabed quality will improve.

Following the removal of the platforms it is assumed that either onshore deconstruction or recycling of the material or deep-water disposal will be the preferred disposal route. It should be noted that the decommissioning method has not been chosen.

As far as the technology of decommissioning method concern, the new platforms are better decommissioned in a more environmental friendly method. The SIP may be relocated to another similar location by towing in the upright position. An alternative decommissioning solution is the disposal of the platforms in deep-water. The exact deep-water disposal technique applied will be a result of extensive environmental, legal, social and technical studies.

The decommissioning design method will be done when the time is closing by, in order to make use of the best available techniques, methods and international experience available at the time. The project offshore area will be maintained in a clean condition throughout the duration of the decommissioning phase. Upon completion of the project, each temporary facility, waste, tools, equipment, materials, machinery installations, will be removed and parts of the site that may have been damaged will be repaired and rehabilitated.

The final impact to seabed features is assessed to be of small intensity, local extent and of long-term duration. All necessary measures will be taken for remediation and restoration of operating spaces in a satisfactory condition. With the completion of the project and the removal of the effect the natural mechanisms will restore the physical, marine environment. The impact to seabed features after the implementation of the proposed remediation measures will be minor.

Activity	Receptor	Type	Extent	Duration	Magnitude	Likelihood	Significance	Reversibility	Final assessment
Existing platforms: dispersal of seabed cuttings from piles	Benthic communities	Negative	Local	Long	Medium	High	Moderate	High	Minor
New platforms: removal of SIPs	Benthic communities	Negative	Local	Long	Medium	High	Moderate	High	Minor

Mitigation measures to address the minor impacts expected from the activities of decommissioning of existing and new platforms to the benthic community are presented in Chapter 12.4.7.

11.2.7.3.3 Fish ecology

The operation activities that have the potential to affect fish ecology are:

- Sever conductors;
- Existing platforms: cut piles;
- Existing platforms: remove jacket; and
- New platforms: removal of SIP.

The activities of sever conductors and cut piles of existing platforms will generate underwater noise that may result in disturbance and / or harm of fish. The activities of removal of the jacket of the existing platforms and new the SIP of the new platforms will result in the destruction of this man-made habitat which is (will be) used by various marine species including fish. However, the activities will take place for a short period of time in a local extent and also the fish in the study area is not considered sensitive. Based on the above considerations, the likelihood of the negative impact is assessed as high; the impact magnitude low and therefore the impact significance is characterized minor. Due to the fact that the reversibility is expected to be high, the overall impact significance is assessed as negligible.

Activity	Receptor	Type	Extent	Impact Duration	Intensity	Likelihood	Significance	Reversibility	Final assessment
Sever conductors	Fish ecology	Negative	Local	Short	Low	High	Minor	High	Negligible
Existing platforms: cut piles	Fish ecology	Negative	Local	Short	Low	High	Minor	High	Negligible
Existing platforms: remove	Fish ecology	Negative	Local	Short	Low	High	Minor	High	Negligible

Activity	Receptor	Type	Extent	Impact Duration	Intensity	Likelihood	Significance	Reversibility	Final assessment
jacket									
New platforms: removal of SIP	Fish ecology	Negative	Local	Short	Low	High	Minor	High	Negligible

11.2.7.3.4 Marine mammals

The project abandonment activities that have the potential to interact with marine mammals are the following:

- Sever conductors;
- Operation of support vessels;
- Existing platforms: cut piles;
- Existing platforms: Remove jacket; and
- New platforms: removal of SIP

Sever conductors

The potential impacts on marine mammals from the sever conductors are noise disturbance and risk of collision.

Potential impacts to marine mammals due to underwater noise are described elsewhere in this chapter.

The noise associated with severing the conductors may result in some impacts to marine mammals, No permanent hearing damage is anticipated however behaviour responses to the noise are possible. The likelihood and the intensity of the impacts are assessed as medium and therefore the significance is characterized as moderate. Due to the fact that the reversibility is expected to be medium, the overall impact significance is assessed as moderate. Measures will be implemented to minimise noise levels associated with this activity and further avoid potential noise related impacts.

Operation of support vessels

The potential impacts on marine mammals from the operation of support vessels are noise disturbance and risk of collision. However, the Kavala Gulf already supports a significant number of marine traffic (regular ferry lines, commercial, and leisure). As it is described in the chapter 8.8.3, the traffic density in the Kavala Gulf is high and the number of distinct vessels on a daily basis is estimated more than 140. Therefore, the impact likelihood for this activity is low. However the impact intensity is high and for that reason the impact significance is moderate. Due to the fact that in case of a collision the impact reversibility is low, the final impact significance is assessed as moderate. Moreover, it could be considered that mammals are

already accustomed to the noise from existing marine traffic in the area.

Existing platforms: cut piles

The potential impact on marine mammals from cut piles is noise disturbance and / or harm. The noise levels and the impacts expected will depend on the exact method to be decided. Explosives are considered as a worst case scenario in which the impact intensity is assessed as high, the likelihood as medium and therefore the significance is characterized major.

Existing platforms: remove jacket and New platforms: removal of SIP

Removal of the jacket of the existing platforms and the SIP of the new platforms will result in the destruction of this man-made habitat and potentially reduces the quality / abundance of the food supply for marine mammals. However, the impact intensity is low since the mammals have numerous areas of habitats in the region. The impact significance is characterized as minor. As the impact reversibility is medium, the final impact assessment is minor.

Activity	Receptor	Type	Extent	Impact Duration	Intensity	Likelihood	Significance	Reversibility	Final assessment
Sever conductors	Marine mammals	Negative	On site	Short	Medium	Medium	Moderate	Medium	Moderate
Operation of support vessels	Marine mammals	Negative	Local	Short	High	Low	Moderate	Low	Moderate
Existing platforms: cut piles	Marine mammals	Negative	Local	Short	High	Medium	Major	Medium	Major
Existing platforms: remove jacket	Marine mammals	Negative	Local	Long	Low	High	Minor	Medium	Minor
New platforms: removal of SIP	Marine mammals	Negative	Local	Long	High	High	Minor	Medium	Minor

Mitigation measures to address the impacts expected from sever conductors, jacket removal, existing and new platforms removal and operation of support vessels are investigated in Chapter 12.3.7.

11.2.8 Impact on manmade environment

The Project will conduct several activities during construction, operation and abandonment phase that will generate pressures to the fisheries and aquacultures, marine traffic and tourism. As provided in Chapter 09, no significant impacts to the manmade environment have been predicted for this project. The rationale for excluding this parameter from further assessment is provided in Chapter 09.

11.2.9 Socioeconomic impact

11.2.9.1 Construction Phase

Employment will increase during the construction phase of the project. Local contractors will be employed to assist in construction activities, thus supporting the local economy. The impact on the socioeconomic environment during construction is assessed to be positive. The duration of the activity is considered to be medium and the impact intensity to the socioeconomic structure of the area in scope is medium.

Activity	Receptor	Type	Extent	Duration	Magnitude	Likelihood	Significance	Reversibility	Final assessment
All	Socioeconomic environment	Positive	Regional	Medium	Medium	High	Positive		Positive

11.2.9.2 Operational Phase

The employment indicators will not change during the operational phase. While no new jobs will be created as part of the expansion, these activities will improve the life of the fields, thereby allowing the company to retain the existing employment levels (355 jobs, of which 308 are locally resourced). The impact on the socioeconomic environment, during operation is assessed to be positive. The duration of the activity and the impact to the region of Kavala is medium.

Activity	Receptor	Type	Extent	Duration	Magnitude	Likelihood	Significance	Reversibility	Final assessment
All	Socioeconomic environment	Positive	Regional	Long	Medium	High	Positive		Positive

11.2.9.3 Abandonment Phase

Following abandonment of all platforms (existing and new), the existing workforce will need to find alternative employment. The impact significance is assessed as moderate.

Activity	Receptor	Type	Extent	Duration	Magnitude	Likelihood	Significance	Reversibility	Final assessment
All	Socioeconomic environment	Negative	Regional	Long	Medium	High	Moderate	High	Minor

Mitigation measures to address the minor impacts to the socioeconomic environment during the abandonment phase are presented in Chapter 12.4.9.

11.2.10 Impact on technical infrastructures

11.2.10.1 Construction Phase

As provided in Chapter 09, no significant impacts on technical infrastructures i.e. transport infrastructures; telecommunication, health services and urban waste water have been predicted for this project during construction phase. The rationale for excluding this parameter from further assessment is provided in Chapter 09.

11.2.10.2 Operational Phase

The project activity that has the potential to interact with social infrastructure is the treatment and disposal of drilling cuttings (from 400 – 3,150 m). These drill cuttings will contain oil-based muds and will be disposed at an existing waste facility onshore. Depending on the capacity and existing use of this facility, this waste stream could adversely affect the site's overall capacity for other users. The potential impact from this activity is regional due to the large amount of drilling cuttings that will be treated. Energean will audit the waste facility to make sure it has capacity before it sends the waste for further treatment. Based on the above, the likelihood of the negative impact is assessed as high; the impact intensity as medium and therefore the impact significance is characterized moderate. Due to the fact that the reversibility is medium (since Energean will also look for alternatives in case the aforementioned audit prove that this is required), the final impact significance is assessed as minor.

Activity	Receptor	Type	Extent	Duration	Magnitude	Likelihood	Significance	Reversibility	Final assessment
Cuttings treatment and disposal (400 - 3150 m)	Social infrastructure (waste)	Negative	Regional / national	Long	Medium	High	Moderate	Medium	Minor

Mitigation measures to address the minor impacts expected from the activity of cuttings treatment and disposal are presented in Chapter 12.4.10

11.2.10.3 Abandonment Phase

During the decommissioning phase of the platforms wastes associated with abandonment, including waste metal, will be disposed at an existing waste facility(s) onshore. Depending on the capacity and existing use, this waste could adversely affect the site(s)'s overall capacity for other users. Based on the above, the likelihood of the negative impact is assessed as high; the impact intensity as medium and therefore the impact significance is characterized moderate. Due to the fact that the reversibility is medium (since a number of alternative facilities could be potentially used), the final impact significance is assessed as minor.

Activity	Receptor	Type	Extent	Duration	Magnitude	Likelihood	Significance	Reversibility	Final assessment
Existing platforms	Social infrastructure (waste)	Negative	Regional / national	Long	Medium	High	Moderate	Medium	Minor

Mitigation measures to address the minor impacts expected from the activity of existing platforms decommissioning are presented in Chapter 12.3.10.

11.3 IMPACT ASSESSMENT FROM UNPLANNED EVENTS

11.3.1 Impact on climate and bioclimate characteristics

As provided in Chapter 09, no interaction with climate and bioclimate characteristics has been predicted for this project during construction, operation and abandonment phases. The rationale for excluding these parameters from further assessment is provided in Chapter 09.

11.3.2 Impact on morphological and topological characteristics

As provided in Chapter 09, no interaction with seabed has been predicted for this project during construction, operation and abandonment phases. The rationale for excluding this parameter from further assessment is provided in Chapter 09.

11.3.3 Impact on geological and tectonic characteristics

As described in Chapter 10, a spill of hydrocarbons is unlikely and a significant spill would only occur due to incidents. Marine diesel will disperse naturally, evaporating quickly on release, and any components that settle to the seabed will be naturally biodegraded by microbes within one to two months. Oil will not pool on the seabed. However, elevated concentrations of hydrocarbons may be noticeable in sediments close to the discharge point after a large spill, which in turn could be toxic to benthic species. Given the rarity of such an event and based on the fact that the oil floats on the water surface, the impact significance on the geological characteristics is assessed as minor.

Activity	Receptor	Type	Extent	Duration	Magnitude	Likelihood	Significance	Reversibility	Final assessment
Operational oil spill unplanned event	Seabed	Negative	Local	Short	Medium	Low	Minor	Low	Minor

Mitigation measures to address the minor impact expected from the activity of operational oil spill and unplanned event to the geological characteristics of the project area are presented in Chapter 12.2 and in Annex 13 (Contingency plan)

11.3.4 Impact on water environment

The accidental spill of hydrocarbons could cause localized and significant effects on the water quality. The water environment constitutes the pathway to the secondary biotic receptors such as plankton, fish ecology, marine mammals and seabirds. (see chapter 11.3.7 biotic environment). Based on the above considerations and given the fact that the likelihood of the impact is moderate; the impact significance is assessed as minor. The worst case scenarios of the potential leak points, the sensitive locations affected and the released quantities by an oil spill unplanned event have been described in chapter 10.8.2. The mitigation measures in case of an emergency are described in chapter 12.2 and in Annex 13 (Contingency plan).

Activity	Receptor	Type	Extent	Duration	Magnitude	Likelihood	Significance	Reversibility	Final assessment
Operational oil spill unplanned event	Water environment	Negative	Local	Short	High	Low	Moderate	Moderate	Minor

11.3.5 Impact on air environment

As provided in Chapter 09, no interaction with air quality has been predicted for this project during construction, operation and abandonment phases. The rationale for excluding this parameter from further assessment is provided in Chapter 09.

11.3.6 Impact on acoustic environment

As provided in Chapter 09, no interaction with underwater noise has been predicted for this project during construction, operation and abandonment phases. The rationale for excluding this parameter from further assessment is provided in Chapter 09.

11.3.7 Impact on biotic environment

Plankton and Fish ecology

An accidental spill of diesel or hydrocarbons may affect the plankton and fish ecology of the study area. The likelihood of such an event occurring has been assessed in Chapter 10 and is minimized through mitigation measures required by the governing legislation and supported by industry best practices.

In fish life cycles the egg and juvenile stages are the most vulnerable to toxicity in the water column, as adult fish are highly mobile and generally able to avoid polluted areas. Fish and shellfish will be vulnerable to toxic effects from oil spill in the water. Localised fatalities would

occur in the immediate vicinity of the spill, but fish are likely to avoid the area if the situation persists, and any effects are unlikely to be felt on a population level. A major spill has therefore been assessed as having the potential for an impact of moderate significance.

Benthic communities

Elevated concentrations of hydrocarbons may be noticeable in sediments close to the discharge point after a large spill, which in turn could be toxic to benthic species. Benthic community recovery after an impact of this kind is expected within three months to two years. Based on the above considerations, the impact significance is assessed as low.

Marine mammals

There is the potential that marine mammals could be significantly affected if a large hydrocarbon spill was to occur, the likelihood of which is extremely low (see Chapter 10).

An oil spill may affect marine mammals through inhalation, ingestion, and dermal pathways. Each pathway could cause a suite of physiological responses that could compromise health as well as long-term survival and reproduction. With regards the monk seal, the most serious health threats from oil are (i) hypothermia; (ii) respiratory system damage from inhalation of the volatile and highly toxic aromatic components of oil; (iii) gastrointestinal damage from ingestion of oil through grooming or consumption of contaminated prey; and (iv) eye, skin, and mucus membrane damage from oil and excessive grooming. For most cetaceans, the greatest threat is likely to be acute respiratory injury if they encounter fresh oil. For those species that primarily live or feed nearshore, incidental ingestion of oil and chronic respiratory exposure may be the most damaging over the long term. In addition, any marine mammal population could be indirectly impacted by an oil spill that reduces prey populations locally or over a broad area. The marine mammals recorded in the project area during the seismic survey are sperm whale, common bottlenose dolphin, striped dolphin and short-beaked common dolphin although in low numbers (see chapter 8.7.4.5). The impact intensity is assessed high but the likelihood of the impact (the oil spill) occurring is very low and therefore the impact significance is assessed as moderate.

Avifauna

There is the potential that birds and especially the seabirds could be affected negatively if a large spill of hydrocarbons occurred. As is mentioned in the Chapter 8.7.5, the study area overlaps with the Marine Important Bird Areas IBA GR250 and IBA GR12. The main seabirds are the Yelkouan Shearwater (*Puffinus yelkouan*) and the Mediterranean Shag (*Phalacrocorax aristotelis desmarestii*). It is noted that the Yelkouan Shearwater arrival to breeding sites occurs in March, the egg laying period is from March to May and the fledging period is at July. The Mediterranean Shag arrival to breeding sites occurs between December and January, the egg laying period is at the end of January (peaking in mid-February) and the fledging period is at the end of May. The highest species richness is recorded in the Vasova Lagoon in the Natura GR1150001, while the largest congregations were recorded in the coastal waters eastnorth of the Study Area.

The main breeding sites of avifauna species are located in the Natura areas SPAs GR1150001

"Delta Nestou kai limno thalasses Keramotis kai nisos Thasopolula" and Natura GR1150012 "Thasos (Oros Ypsario kai parakatia zoni)" which are northeast and east of the project (see chapter 8.7.6). Natura area GR1150001 is also important for mating, foraging, roosting, maintenance (e.g. moulting) and wintering (see chapters 8.7.5 and 8.7.6).

Oils spill could lead to the degradation of marine fauna and flora, which would result in the limited food availability. It would also temporarily reduce the foraging habitats at sea, as well as roosting and maintenance sites along the coast. However unlikely but potential oil spill could have negative impact on habitats and individuals and lead to the loss of some individuals and habitats. Individuals might be lost either due to mortality or temporary displacement to other areas. Crude oil is toxic to fauna and may lead severe damage to internal organs and mortality. Additionally, bird contact with oil causes feather oiling. If oil sticks to bird's feathers it caused them to mat and compromised waterproofing leading to exposure of skin to surrounding temperature and hypothermia. Feather oiling may lead to loss of buoyancy and ability to flight. All bird species could potentially be at risk of poisonous impacts gas leak, while primarily seabirds and pelicans are expected to be most vulnerable to oil spills.

Given the likelihood of the impact is very low, and the importance of the area with regards to avifauna, it is assessed that the impact on seabirds would be of moderate significance. The impact significance is expected to be lower in the period from August until December which is the post breeding period. However, it is noted that **resident seabirds and herons, migratory passerines, as well as post-breeding concentrations of particular species e.g. Mediterranean Shag (*Phalacrocorax aristotelis*) and Dalmatian Pelican (*Pelecanus crispus*) are disperse after the breeding season.**

Environmental Protected Areas

As it is discussed in the Chapter 8.7.6, the importance of the area has been recognized on the (I) global level, by inclusion as a Ramsar Site "Nestos Delta and Adjoining Lagoons" (designated in 1975), (II) EU level by inclusion in the network of Natura 2000 sites, as an SPA GR1150001 and SAC GR1150010, and (III) national level by inclusion in the National Park of Eastern Macedonia and Thrace with the Management Body of Nestos Delta - Vistonis and Ismaris. The complex of wetlands, including lakes and lagoon consisting the National Park of Eastern Macedonia and Thrace is considered to be one of the most important in Europe. Moreover, the international importance of the area is further supported by its inclusion in the network of Important Bird Areas (IBAs) identified by the BirdLife International i.e. the study area is part of the IBAs GR12 "Nestos Delta and coastal lagoons" and GR 250 "Gulf of Kavala and marine area of Thasos Island". The most vulnerable components of the protected ecosystems to oil spills in offshore and coastal environments are seabirds and marine mammals, due to their close association with the sea surface. It is noted that the closest marine part of Natura 2000 site (GR1150010) is at a distance of 12 km from the project area. In case that an oil spill reaches the coast, it will significantly affect the integrity of coastal protected areas. The features for designation may also be adversely affected. However, the likelihood of this event is very low.

The worst case scenarios of the potential leak points, the sensitive locations affected and the

released quantities by an oil spill unplanned event have been described in chapter 10.8.2. The mitigation measures in case of an emergency are presented 2 in chapter 12.2 and in the relevant Annex 13 (Contingency Plan).

Activity	Receptor	Type	Extent	Duration	Magnitude	Likelihood	Significance	Reversibility	Final assessment
Operational oil spill unplanned event	Marine mammals Plankton and Fish ecology Avifauna	Negative	Regional	Long	High	Low	Moderate	Low	Moderate
Operational oil spill unplanned event	Benthic communities	Negative	Regional	Long	Medium	Low	Minor	Low	Minor

11.3.8 Impact on manmade environment

Fishing activities

Fishing vessels may be excluded from the affected area of oil spill unplanned event, although for short periods of time the fishing industry can generally relocate to other grounds without any detrimental impacts to catch. If fish stocks are contaminated there could be a loss of market confidence as people may be unwilling to buy fish caught in a contaminated area. Given the fact that the Kavala Gulf is an important fishing ground, the significance of the impact is assessed as moderate.

Marine traffic

A spill event could lead to the shipping lanes in the region being closed to facilitate emergency response operations to be implemented. Similarly, it is possible that shipping lanes could be routed around the affected area. There is the risk of economic impacts on shipping associated with longer routes and delays. Given the small area likely to be directly impacted and the rarity of such an event, a hydrocarbon spill has been assessed as having a low impact on the shipping activities. Details of the potential leak points, the amount of released oil and the duration that it will take to reach the shore are given in chapter 10.8.2.

Tourism and livelihood

An oil spill event would significantly affect, directly and indirectly, the tourism and the livelihood of the wider area of Kavala Gulf. A potential oil spill event would affect the coast quality, leisure activities, small businesses such as restaurants, hotels, seafood industry, gift shops etc. The oil spill accident would have a long term impact to the wider touristic area of Kavala gulf due to the negative visitors' perception. However, given the fact that the likelihood of the impact is low, the

impact significance is assessed as moderate. Details on the released oil quantity and time that the spill will reach the shoreline, in case of an accident, has been given in chapter 10.8.2.

Cultural heritage

As provided in Chapter 09, no interaction with cultural heritage has been predicted for this project during construction, operation and abandonment phases. The rationale for excluding this parameter from further assessment is provided in Chapter 09.

Activity	Receptor	Type	Extent	Duration	Magnitude	Likelihood	Significance	Reversibility	Final assessment
Operational oil spill unplanned event	Tourism and livelihood, Fishing activities	Negative	Regional	Long	High	Low	Moderate	Low	Moderate
Operational oil spill unplanned event	Marine traffic	Negative	Regional	Short	Medium	Low	Minor	Low	Minor

The mitigation measures in case of an emergency are presented in chapter 12.2 and in Annex 13 (Contingency plan).

11.3.9 Impact on socioeconomic environment

The oil spill unplanned event may affect the socioeconomic environment due to the negative economic impacts on the tourism industry and other livelihoods, fishing activities and shipping (see section 11.3.8). The impact significance is assessed as moderate. The potential source of leakage as well as the quantity of a potential oil spill is described in chapter 10.8.2.

Activity	Receptor	Type	Extent	Duration	Magnitude	Likelihood	Significance	Reversibility	Final assessment
Operational oil spill unplanned event	Socioeconomic environment	Negative	Regional	Long	High	Low	Moderate	Low	Moderate

The mitigation measures in case of an emergency are presented in chapter 12.2 and in the relevant Annex 13 (Contingency plan).

11.3.10 Impact on technical infrastructures

The oil spill unplanned event may affect the marine traffic as well as the technical infrastructures. This impact is described in the section 11.3.8. The technical infrastructures that might be affected

are the authorised waste treatment sites, the emergency response infrastructure for support such as boats and tug vessels and the public authorities that will participate in the restoration of the oil spill. However, given the fact that the likelihood of the impact is low, the impact significance is assessed as minor.

Activity	Receptor	Type	Extent	Duration	Magnitude	Likelihood	Significance	Reversibility	Final assessment
Operational oil spill unplanned event	Technical infrastructures	Negative	Regional	Short	Medium	Low	Minor	Low	Minor

The mitigation measures in case of an emergency are presented in chapter 12.2 and in Annex 13 (Contingency plan).