1. GENERAL

This document is a part of the Environmental Assessment Report developed for the World Bank (WB) to make an appraisal of the Cargo Bulk Terminal (CBT) Project in the area of Port of Ploče.

In addition to the environmental assessment (EA), the Investor, the Port Authority of Ploce, is preparing also an Environmental Impact Assessment Study (EIAS) based on the Croatian legislation. EIASs in Croatia are developed in accordance with the *Environmental Protection Act (Gazette 82/94, 128/99)* and the Ordinance on *Environmental Impact Assessment (Gazette 59/00, 136/04)*. When making an EIA Study also any other relevant Croatian laws, bylaws and regulations should be observed inclusive of applicable international agreements signed by the Republic of Croatia. In spite of some differences in the contents of EA and EIAS, it is a question of similar document. Consequently, this EA integrates the most relevant facts and results of the environmental impact assessment of CBT including also the measures for environmental protection and a monitoring plan.

The Port of Ploče is situated in the area of the south Croatian seaside along the arterial road connecting the towns of Split and Dubrovnik. It is some hundred kilometres away from those two well know Croatian towns. This one of rare places where, beside good maritime conditions and a natural bay, there is an exceptionally good lowland railway connection towards the inland. This means that Ploče has a potential large gravity area covering, in addition to Croatia, also Bosnia and Herzegovina, Serbia and Monte Negro, and a substantial part of the Central and Easter European countries (a part of Austria, Hungary, Check Republic, Slovakia, Poland, and Romania) cf. **Figure 1** (see Appendix).

It was already at the end of 19th century when the railway Metković-Sarajevo was built thus opening the possibility of goods transport to hinterland. The port construction started in 1939 and was commissioned after the World War II, in 1945. The port traffic was growing from year to year and in 1988 it reached some 4.5 million tons. During the Croatian War of Independence, the traffic decreased to only 268,000 tons (1994). Pursuant to the decision by the Government of the Republic of Croatia of 13 February 1997, the Port Authority of Ploče was set up as a public, non-profit organization responsible for construction, maintenance, management, protection and improvement of the port traffic. Since 1997 the Port of Ploče has been reconstructing and repairing its obsolete and damaged port facilities, which helped it to increase its traffic to some 2 million tons in 2004.

The terminal planned for bulk cargo is one of the projects that will additionally improve and increase the traffic to some 5 million tons planned in 2010.

At the place of the present-day port, there were hardly any indigenous villages so the increase in the town of Ploče inhabitants took place along with the construction and increase in the Port traffic. In terms of social-economic aspect, the lives of almost all inhabitants of Ploče are directly or indirectly related to the Port.

This is the reason for relatively high tolerance to environmental impacts (dust and noise emission, etc.) that are unavoidably generated by the Port. The inhabitants of Ploče are ready to endure adverse impacts of the Port far beyond the applicable standards.

Another important characteristic of the area is the vicinity of the Neretva River Delta of exceptional local, regional, and even continental ecological importance. The spring of the Neretva River is at the foot of Zelengora Mountain in Bosnia and Herzegovina (BiH) 1095 m a.s.l. Its watercourse runs first in NE direction to Konjic and then turns southward forcing its way through the canyons and mountain-encircled valleys to the sea in the area of Ploče. Its total length is 225 km of which 203 km in BiH and 22 km in the Republic of Croatia. Around Metković, some twenty kilometres from its mouth, a wider area of the Neretva Delta starts – some 246 km^2 surface area.

The Neretva Delta is the only Mediterranean wetland habitat in Croatia and one of the last in the Mediterranean, which gives it also international importance.

Because of its natural values, the Neretva Delta is anticipated for protection in the nature park category by the strategic documents (National Strategy and Action Plan for Biodiversity and Landscape Protection, Strategy of Physical Planning in the Republic of Croatia, and Physical Plan of Dubrovnik-Neretva County). It has also been included in the Ramsar List of wetlands of international importance and in the Important Bird Areas Program implemented by the BirdLife International.

As a result of favourable geographical characteristics, there are two very different areas in its vicinity – the Port of Ploče and a very valuable ecological area.

Although no substantially adverse impacts of the Port of Ploče on the natural values of the Neretva Delta have been identified thus far (the impact of intensive farming in some parts of Delta is much more serious), when making the environmental impact assessment of CBT, special attention should be paid to the Project impact on this ecologically valuable region.

2. PROJECT DESCRIPTION

The entire CBT Project is planned at the area that, pursuant to the applicable physical planning documents, is intended for development of the Port of Ploče. That area covers some 230 hectares of which only its smaller part (c. 83 hectares) is used for the existing facilities:

Dry Bulk Cargo	9.35 ha
General and Loose Cargo	11.42 ha
Timber Storing	8.64 ha
Liquid Cargo	17.68 ha
Special Cargo	20.00 ha
Cooling Facilities	0.20 ha
Maintenance and Repair	2.24 ha
Passenger Terminal	1.50 ha
Office Buildings	1.44 ha
Garages	2.96 ha
Area Built but not Used	7.29 ha
Total Built	**82.72 ha**
Area for future development	**147.58 ha**
TOTAL	**230.30 ha**

CBT area will cover below areas:

- Access channel to the CBT berth and the entering part of Vlaška Channel, which should be dredged to achieve depth of 16 m for 80,000 DWT ships;
- Zone 1: The main area of the terminal planned on the current onshore part of the Port of Ploče onto which material was dumped for years from dredging and maintaining the access canal and Vlaška channel for the needs of the existing terminal for liquid cargo (zone 1 surface area of 190,000 m^2).
- Zone 2: An area planned for construction of berth, storage area along the berth, and a new working area for the future expansion of the terminal. Zone 2 of 65,000 m^2 will be fully developed as land expansion to the current offshore zone, which requires backfilling of sea (reclamation) at depths to 4.80 metres;
- Zone 3: Onshore area of the Port of Ploče of 277,455 m^2 provided for disposal of the material dredged;
- Zone 4: Offshore contained part of the Port of Ploče of 115,200 m^2 provided for disposal of the material dredged - maximum depth of 4.80 to 5.90 metres;

Figures 2, 3 and **4** shows the area of the Port of Ploče with current facilities plotted in and the areas provided for construction of the CBT. **Figures 5** and **6**shows the terminal (CBT) and its main facilities. Figures 2, 3, 4, 5 and 6 are given in Appendix.

Basic data on CBT:

- Import: 4.600.000 ton of coal, bauxite and iron ore per year
- Storage Capacity: 700,000 ton (main storage area) plus 60,000 ton (storage area along the berth for emergency use only)
- Average ship unloading rate: 35.000 ton per day (unloading from 80.000 DWT ships)
- Average wagon loading: 15.000 ton per day
- Approximately 78 port calls per year
- Service time per call manoeuvring, hatch moving, etc: 8 hours per call
- Total berth occupancy: 175 days (unloading from 80.000 DWT ships)
- Up to 350 working days per year

New Bulk Cargo Terminal is designed to perform the following main operations:
- handling bulk cargo as coal, iron ore, bauxite from ocean going ships,
- load rail wagons for transhipment of those products to the hinterland,
- provide a strategic and operational stocks for the operations and
- provide auxiliary services such as weighing, sampling and quality control.

The Project planned covers:
- deepening and broadening of access channel to CBT berth and to the Vlaška Channel (dredging),
- construction of the CBT berth and development of a new surface area by reclaiming the sea area,
- construction of storages (main storage area and outdoor storage alongside the berth that will be used for emergency use only),
- construction of supporting infrastructure, and
- use of the Project, i.e., use and operation of the bulk cargo terminal

The layout of CBT has been determined after a few options had been analyzed. The location chosen is almost fully drawn out of the Vlaška Channel thus eliminating the works within the nature park planned (left, i.e. south bank of the Vlaška Channel remains untouched) and considerably reducing the works on broadening the access navigable channel/waterway to the berth and terminal location.

To allow ships up to 80,000 DWT to come to the terminal, current navigable waterway should be broadened and deepened (dredged). Current channel is dredged to approximately 11.0 to 12.0 m below sea level. The required depth of the future channel is 16.0 m below sea level. The required bottom width of the future channel is 120 m. Slide slopes are assumed to have an inclination of 1:3 (in line with side slopes of the existing channel).

Two technical solutions for broadening and deepening of the access navigable waterway have been analyzed, which involves dredging of some 553,000 m^3 of the material from the sea

bottom and its disposal at the Zone 3 and if need be also at the Zone 4 , which, if utilized, will be constructed as a confined disposal area[1].

A) Hydraulic dredging:

A1) TSHD (Trailing Suction Hopper Dredger) is a special-purpose ship that intakes the material from the channel and takes it to its storage tanks. When TSHD is fully loaded, the ship goes to the disposal site where the material dredged is unloaded by means of a piping. TSHD can move freely thus allowing free pass for other ships. By this dredging technology up to 200% of water is taken with the material, which results in some 1,659,000 m^3 of mud that should be transported and disposed at a place provided.

A2) CSD (Cutter Suction Dredger) is a craft without its own drive, with mechanical rotary dredging unit and the pumps for transport of the material dredged to a disposal site. This technology increases the volume of the material dredged by some 100 % thus generating c. 1,106,000 m^3 of mud.

B) Mechanical dredging:
Mechanical dredging by a standard navigable dredger using a hanging grab for dredging and empting the material dredged to a barge which, when fully loaded, takes that material to unloading places, where the material is loaded onto trucks or re-pumped directly to the disposal site. The volume becomes only 20% larger by this technology meaning that only some 664,000 m^3 of the material has to be disposed. However, the working speed and the capacity of those machines is some ten times lower than of the previous ones so more time is needed even if several machines work at the same time.

Advantages of hydraulic dredging (TSHD and CSD) are faster operation and lower price, its drawbacks are difficulties in engaging a big ship for relatively small scope of works and possible higher rate of seawater mud silting up because of large quantity of seawater brought onshore and drained back to the sea, which would require additional environmental protection measures.

On the other hand, mechanical dredging brings 5-6 times less water onshore, so it is more environmentally favourable and the technology is more suitable for the Project. Its drawbacks are somewhat higher price, longer time of works execution and possible additional problems relating to onshore handling (additional reloading, transport by trucks and additional handling works at the location).

After an in-depth analysis, it was decided to propose both options (hydraulic and mechanical) at the EIAS level and to make final decision during the next phase of the Project.

The total volume of 1,161,000 m^3 of stone will be required for CBT construction (for breakwaters, fills, containment of Zone 4, and similar). As it does not exist at the location of the

[1] Construction of areas for disposal of dredged material (Zone 3 and 4) is described in Chapter 2.2.1. Deepening and Broadening (Dredging) of Access Channel to CBT and to Vlaška Channel and in Environmental Management Plan - Chapter 6.1.1. Mitigation measures under the items 1, 2 and 3.

Port of Ploče the stone material will be provided from excavations made for construction of a nearby section of the Adriatic Highway.[2]

The construction of the new 7.5 km long access road for transport of reclamation-purpose and soil-improvement stone to the CBT area, and an environmental impact assessment for those works will be a subject matter of a separate EIA Study. The access road and highway section to Ploče design and EIA preparation are in progress (financed by HAC, Croatian Highway Corp.).

Beside stone supplied from the places outside the location of the Port of Ploče, some fresh water will also be supplied for the needs of the CBT (wetting water to prevent dust emission, firewater, and similar). Water for those needs will be supplied by a separate water supply pipeline from a lake Jezerine at the foot of Veliki Trovro Mountain (**Figure 7**, see Appendix).

[2] Based on current and planned status of these activities, the licensing process (location permit, construction permit) and the construction of the access road and delivery of stone material to the Port area is expected to be largely harmonized with the CBT Ploče planned schedule of licensing and development activities.

3. ENVIRONMENTAL CHARACTERISTICS OF SITE AND ITS VICINITY

Land Ecology

As already mentioned in the introduction, there are many valuable ecological regions – either protected or recommended for protection. The natural values protected and the regions foreseen for protection in the broader region of the Project location are showed on **Figure 8** (see Appendix). The closest to the port area are special ichthyological and ornithological preserves Parila Lake and Neretva Mouth.

Because of its natural values, the Neretva Delta is anticipated for protection in the nature park category by the strategic documents (National Strategy and Action Plan for Biodiversity and Landscape Protection, Strategy of Physical Planning in the Republic of Croatia, and Physical Plan of Dubrovnik--Neretva County). It has also been included in the Ramsar List of wetlands of international importance and in the Important Bird Areas Program implemented by the BirdLife International.

Habitats in the area of the Neretva Delta could be grouped in several categories of which the most important ones from the nature protection point of view are the habitats of surface land waters, wetland habitats, and the seacoast. In the Delta, there is the most developed area of brackish waters in Croatia with the most representative saltmarshes, shoals, and muddy marshes overgrown with halophytes (communities of glasswort, *Salicornia Spp*.), areas with reed-patches, and the lagoons of Vlaška and Parila. Prominent also are Neretva current waters with backwaters Desanka and Crna Rijeka, and Matica, then the lakes of Baćinska, Birina, Vlaška, Desne, and a number of water sources (Modro oko, Klokun, and others).

On the SE part of the Neretva mouth (some 2 km from the Project location), there is an ichtyiological-ornithological reserve (Neretva mouth). The Physical plan of Dubrovačko-neretvanska County anticipates the area of Ploče-Parila near the Project location for is proposed for protection as an ichtyological and ornithological preserve. The Parila Lagoon is one of very few conserved lagoons and a very suitable place for fish spawning and feeding and growing of fish fry. There is a series of fish species breeding there – a few species of greys, sea bass, sole, gilthead, and others. It is an important habitat of abundant population of chequered carpet shell (*Tapes decussates*) and vital for birds migration and wintering.

In the Delta area, there are three ornithological preserves, Pod Gredom (Vid, Prud (Metković), and Orepak (Kula Norinska), and an ichthyological-ornithological preserve the Neretva Mouth including a large area with glasswort at the very entrance of Neretva River into sea. Furthermore, there are surrounding shoals and lagoons important as a resting place during bird migrations and for wintering and nesting of numerous bird species, as well as for fish spawning, and feeding and growing of fish fry.

At the very location of CBT, vegetation is meagre and grows on the material dredged from sea when the Vlaška Channel was broadened. In terms of environmental protection, this area does not have either local or regional importance.

Marine ecology

For the EIAS purpose diving survey, during days and nights, to detect communities of the sea bed and coast and the composition of flora and fauna in the area that will be dredged was conducted. Results are displayed in:

- table of identified plant and animal species (**Table 1**);
- table of identified marine biocenoses (**Table 2**);
- map of marine biocenoses distribution (**Figure 9**, see Appendix).

In the project broader area fish population and population of other economically important organisms are still relatively rich and only partly affected by human activities. Some of these organisms inhabit this area permanently, either as a benthos or in pelagic zone, while others come occasionally to seek food, shelter or for spawning. Economically most important organisms are European eel (*Anguilla anguilla*), *Mugil spp*., diverse fish from familiy *Sparidae* and Striped red mullet (*Mullus surmuletus*). Moreover, marine shrimps *Crangon crangon*, *Penaeus keraturus* (usually inhabit depths between 10 and 40 m) and *Squilla mantis* are also important for the local economy. There are numerous cephalopods such as squids *Loligo vlgaris* and *L. media*, Common cuttlefish (*Sepia officinalis*) and to a less extent Common octopus (*Octopus vulgaris*). Diverse cockles from genus *Cardium* and genus *Venerupis* are also present.

Almost all mentioned species migrate through the Vlaška Channel. The largest is the migration of adult eels toward the sea in the autumn. Before winter Gilthead seabream and soles migrate upwards through the channel for spawning. Moreover, diverse fish and molluscs come in the shallow waters in the autumn and spring. Daily migration is also important in the area, fish from family *Sparidae* and genus *Mullus* and especially pelagic cephalopods come during night. Thus “small” fishery is developed in the area of Ploče City. Unfortunately, in the moment it is much unorganized and illegal fishery prevails. Diverse fishing devices are being used but we will mention only the ones which are being used in the project area. Bivalves are harvested in the shallow sea and trawl lines are thrown in the Vlaška Channel during day. During night numerous fishing nets are being thrown and crustaceans are harvested. Moreover, during diving survey of area nearby the location of new CBT shells’ remains of protected bivalve *Pinna nobilis* have been found but no living organisms were found.

Table 1: *Plant and animal species identified during the biological survey of the project area. Abundance: ccc – very numerous taxa; cc – very frequent taxa; c – frequent taxa; + – usually present taxa; r – rare taxa; rr – very rare taxa (according to Péres, J.-M. and H. Gamulin Brida, 1973)*

TAXA	ENGLISH NAME (if exists)	ABUNDANCE	COMMENTS
Algae - algae			
Codium adhaerens (Cabrera) Agardh		r	Small specimens
Corralina sp.		c	On concrete docks of inner part of the port
Ulva sp.	Sea lattuce	+	Inner part of the port
Small, unidentified algae		+	On lower parts of docks
Plantae - plants		c	
Cymodocea nodosa (Ucria) Ascherson	-	c	On several localities by the channel mouth
Zostera nana	Small eel-grass	c	Within community of *C. nodosa*
Zostera marina	Eel-grass	r	Individual specimens within community of *C. nodosa*
Porifera – sponges			
Cnidaria –cnidarians			
Bunodeopsis strumosa Andres 1881	-	c	On plants' leaves, can be seen only during night
Anemona sulcata	Snake lochs		
Eudendrium sp.	-	+	Only in a fouling
Mollusca –molluscans			
Arca noae *L.*	Noah's ark	r	On concrete docks of the port and across the port
Acanthocardia tuberculata (L.)	cockle	c	Dense populations
Bittium reticulatum (da Costa)	-	?	Only shells have been found
Cerastoderma edule (L.)	Common cockle	c	Buried in sediment, only shells have been found
Chama sp.	-	+	
Chiton sp.	Chiton	+	
Gibbula sp.	-	r	
Gourmia rupestre Risso	Cornet	+	
Hexaplex trunculus (L.)	Apple murex	+	
Loligo vulgaris	Sqiud	c	Can be seen only during night
Mactra corallina (L.)	Mactra surf clam		
Modiolus barbatus (L.)	Bearded horse mussell	r	
Monodonta turbinata (Born)	Turban shell	c	Small specimens
Mytilus galloprovincialis Lam.	Common mussell	c	The most common taxa in a fouling
Nassarius reticulatus (L.)	-	?	
Octopus vulgaris Cuv.	octopuss	?	
Ostrea edulis L.	Common oyster	+	
Ozaena moschata (Lam.)	Musky octopus	?	
Patella caerulea (L.)	Limpet	+	
Pholas dactylus L.	Common pidock	+	In shallow waters on harder sediment
Sepia officinalis L.	Common cuttlefish	?	Only eggs have been seen
Sepiola rondeleti Steenstrup	Little cutle	c	A few specimens have been seen during night, they are buried in sand during daytime
Tapes decussata (L.)	Calico clam	c	Numerous, edible, collected by people
Thracia papyracea (Poli)	-	c	
Turritella communis Risso	Screw shell	?	buried
Crustacea –crustaceans			
Balanus sp.	Common barnacle	c	On concrete part of docks
Chthamalus stellatus (Poli)	-	c	On the limestone parts of the coast
Ethusa mascarone (Herbst)	-	?	Only one specimens have been seen
Maja squinado (Herbst)	Spider crab	c	Small specimens
Mysidae gen. sp.	-	r	Small groups
Pachygrapsus marmoratus (Fabr.)	-	r	Relatively small specimens, found only in the

TAXA	ENGLISH NAME (if exists)	ABUNDANCE	COMMENTS
			inner parts of docks
Paguridae gen. sp.	-	+	
Pagurus sp.	-	+	
Sqilla mantis	Mantis crab	+	In holes in the sediment
Polychaeta – polychaetes			
Sabella pavonina	-	r	
Pomatoceros triqueter	-	c	
Sabella spallanzanii (Viviani)	-	c	On a hard substrate – solid wastes
Echinodermata – echinoderms			
Holothuria tubulosa	Common sea cucumber	r	
Paracentrotus lividus Lam.	Common urchin	r	Only by solid waste
Ochnus planci	-	r	
Bryozoa – bryozoans			
Schizobrachiella sanguinea (Norman)	-	+	In a fouling
Tunicata – ascidians			
Phallusia mammilata (Cuvier)	White ascidian	r	In a fouling
Pisces – fish			
Anguilla anguilla	Common eel	c	Main specie in a catch, migrates through the channel, only holes in a sediment where it lives have been seen
Atherina boyeri Risso	Silverside	c	In warm part of the season
Blennius sanguinolentus Pall	Red-speckled blenny	+	
Blennius gattorugine Brunn.	Tompot blenny	+	
Boops boops (L.)	Bogue	?	Small specimens
Boops salpa (L.)	Salema	c	
Callionymus dracunculus	Spotted dragonet	c	
Charax puntazzo (L.)	Sheepshead bream	+	
Conger conger(L.)	Conger eel	r	In the port, beneath docks
Coris julis (L.)	Raibow wrasse	c	Small specimens
Crenilabrus tinca *(Brunn.)*	Peacock wrasse	c	
Diplodus annularis (L.)	Annular bream	c	
Diplodus vulgaris (Geoffroy Saint-Hilaire)	Two- banded bream	c	Solitary, not in a haul
Dicentrarchus labrax (L.)	Sea bass	?	
Gobius jozo (L.)	Black gobby	c	
Gobius sp.	-	+	
Lithognatus mormyrus	Stripped bream	+	
Mullus surmuletus (L.)	Stripped mullet	c	Small specimens, numerous
Mugil cephalus Cuv.	Grey mullet	+	
Mugil labeo Cuv.	Harbour grey mullet	c	
Mugilidae gen. sp.	Mullets	c	Important for fishery
Myliobatis aqiula (L.)	Eagle ray	?	Can be caught with a trawl-line
Pagellus erythrinus	Pandora	?	Specie important for fishery
Pomatomus saltatrix	Sea arrow	c	Specie more and more important in fishery
Serranellus hepatus (L.)	Brown comber	c	
Solea solea	Common sole	+	
Sparus aurata	Gilt-head bream	+	Uses the area for spawning
Spicara maena	Low-body picarel	c	
Sygnatus acus	Pipe fish	r	
Trachinus draco	Greater weewer	?	Only one specimens have been seen
Trachurus trachurus (L.)		?	In pelagic zone

***Table 2**: Identified marine communities*

No.	Marine communities according to Croatian National Habitat Classification	Community code according to Barcelona Convention	Community code according to EUNIS Convention	Comments and community location
1	F.1.1.1.1. Mediterranean glassword swards	-	A2.6513	Encompasses sandy and muddy parts of the coast above upper levels of high tide. Present in the whole area, especially on the west part of the coastline opposite to the terminal.
2	(F.5.1. Anthropogenic habitats on a sea coast) F.5.1.2.1. Constructed parts of a coast	-	-	Encompasses all constructed docks for small and large vessels in the inner and outer parts of Ploče Port
3	F.4.2.1. Biocenosis of supralittoral rocks	I.4.1.	-	It can be found on all lime parts of the coast (middle part of the port which has not been built yet, all west coast and coastline of small islands in the area)
4	G.1.1.2.1. Aquatorium of a port	-	-	Includes sea area as far as outer part of the bulky cargo terminal. Outside of this area the aquatorium is almost natural.
5	G.2.1.1. Biocenosis of mediolittoral muddy sands and muds	-	-	Encompasses parts of the coast with sediment in the zone between high and low tides. Occurs in protected parts of channel Vlaška and lake Parila.
6	G.2.4.1. Biocenosis of upper mediolittoral rocks	II.4.1.	A1.13	Encompasses rocky zone above the average sea level to upper level of high tide. In all places occurs below biocenosis of supralittoral rocks – approximately 20 cm high zone. It is partly modified, degraded and has fewer taxa due to decreased salinity in the area.
7	G.2.4.2. Biocenosis of lower mediolittoral rocks	II.4.2.	A1.14	Encompasses rocky zone bellow the average sea level to lower level of low tide. It contains decreased number of taxa and specimens.
8	G.2.5.2. Mediolittoral biocenosis on a hard substrate with anthropogenic influence	-	-	Encompasses zone between high and low tide in constructed parts of Ploče Port. Number of taxa and their specimens is very small.
9	G.3.1.1. Euryhaline and eurythermal biocenosis	III.1.1.	A4.41	Encompasses major part of the sea bed with sediment above wave base. It is best developed in Lake Parile, outside of the influence of the project.
10	G.3.2.1. Biocenosis of fine sands in shallow waters	III.2.1.	A4.22	Encompasses areas with larger wave influence down to 2 m depth. It is nicely developed in the shallow sea on the right coast of the channel mouth.
11	G.3.8.2. Anthropogenic infralittoral biocenosis on a hard substrate	-	-	Encompasses the zone bellow lower level of high tide on already constructed parts of the coast of the bulk cargo terminal. It also covers hard items thrown from the port
12	G.3.2.3. Biocenosis of muddy sands in shelterd areas of the coast	III.2.3.	A4.33	Encompasses all other areas of the sea bed with sediment bellow wave base (deeper than 2 m)

Characteristics of Marine Sediments

The results of 28 off boreholes have been analyzed for the EIS which were made onshore and offshore. Granulometric composition of sea bottom layers in the terminal area is illustrated on **Figure 10** (see Appendix) by a curve of maximum and minimum graduation. It is obvious that analysed layers consist of fine particles (sand and silt) and that 60-90 percent of particles are smaller than 0.1 mm, and 10-45 percent of particles are smaller than 0.01 mm.

Sediment samples taken on two places on the sea bottom are from five sea depths. One sample is taken close to the CBT at 10 m depth, and the other at 20 m depth at a distance of some 800 metres towards the high sea. The samples have been adequately processed and subject to chemical analysis in a certified laboratory (ACME – Analytical Laboratories Ltd. 852 E Hastings Street, Vancouver, BC, Canada). Forty one (41) off elements have been identified in the samples. Following **Table 3** shows the results for the main elements. The results are within the limits for fully clean areas taking into account local natural conditions.

***Table 3**: Composition of sediments (main elements):*

ELEMENT	Mo	Cu	Pb	Zn	Ni	Co	Mn	As	Cd	Ca	P	Cr
SAMPLES	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	%	ppm
10m 5cm	0.6	20.5	21.1	71	41.2	10.7	507	14	0.3	11.7	0.054	59.6
10m 10cm	1	19.4	21.3	72	38.8	10	515	13	0.2	11.56	0.053	59.7
10m 15cm	0.7	17.9	20.4	71	36.7	9.6	487	14	0.3	12.93	0.056	57.8
10m 20cm	0.8	14.4	17	60	31.6	8.7	472	11	0.1	12.54	0.049	50.8
10m 25cm	0.8	14	16.1	60	30.6	9	453	9	0.2	12.6	0.046	47.8
20m 5cm	1.1	24.5	25.2	81	44.1	10.7	459	13	0.4	16.52	0.053	57
20m 5cm R	1.3	27.8	26.6	88	49.1	12.7	439	15	0.5	15.9	0.056	61.6
20m 15cm	1.6	27.1	26.9	87	45.3	13.2	520	14	0.4	16.21	0.052	59.2
20m 25cm	1.4	25.4	27.6	89	48.3	13	524	13	0.4	17.03	0.055	53.2
20m 25cm R	1.5	29	30	94	50.7	12.3	515	15	0.4	17.06	0.057	57.7

Site Meteorology

Basic meteorological characteristics in the area of Ploče have been developed from the weather station Ploče located on site at 2 m a.s.l. Data are available from the period 1978-1994.

The climate in the area of Dalmatian coast and also in the area of Ploče is Mediterranean climate characterised by moderately warm and rainy winters and with hot and dry summers.

Maximum mean monthly air temperature is about 25 degC in July and August and minimum mean air temperature is in about 6 degC in January.

Average annual relative humidity is some 63%, the lowest being in summer months and the highest in October and November.

Total annual precipitation for Ploče amounts 1100 mm on average. The precipitation amount is minimal in summer months and maximal in late fall (October and November).

Annual course of the number of days with precipitation and thunder is showed on **Figure 11.** Two maxima could be noticed - one in the spring months (March, April) and the other in the fall (October, November, and December). On average there are about 100 days per year with precipitation although the largest number of days with less than 1 litre/m^2. The amount of precipitation in some 10% cases is larger than 10 litres per square metre and in some 5% cases it is larger than 20 litres per square metre, whereas there are only 3 days in a year when very heavy precipitation could be expected (50 litres per square metre and more).

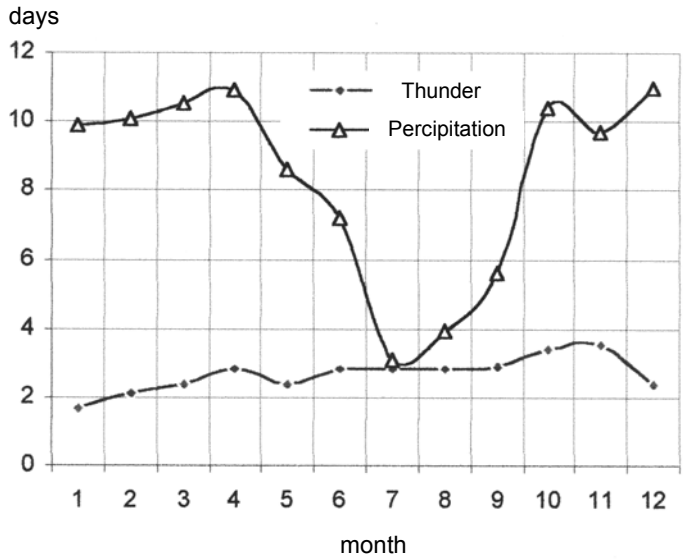


Figure 11: Annual course of precipitation and thunder days

Air quality

The time wind roses show that the flow direction from the north quadrant (N-E) prevails in the morning and in the evening, whereas during the day the air flow is from the west and south-west direction. Considering all that (all three climatological observation times) in the area of Ploče north winds prevail.

The most frequent wind is not at the same time the strongest by its intensity. The strongest winds are related to south-east (SE) flow direction.

Five monitoring stations have been installed for the purpose of EIA Study to measure total deposited matter (TDM) and the following parameters in TDM: insoluble and soluble part; lead (Pb), cadmium (Cd), thallium (Tl), aluminium (Al) and iron (Fe) in insoluble part; calcium (Ca^{2+}), chlorides (Cl^{-}) and sulphates (SO_4^{2-}) in soluble part.

Monitoring started at 1st of October 2005 and three-months results show that concentrations of total deposits and the elements contained therein on all monitoring points are inside the limit values stipulated by the *Regulations about limit values of pollutants in air (Gazette 133/05).*

4. ENVIRONMENTAL IMPACT ASSESSMENT

It was assessed that possible significant environmental impacts are the following:

- Impact on sea water quality and on marine communities
- Noise impact
- Impact on the air quality
- Waste production

Impact on sea water quality and on marine communities

The largest impact on sea water and marine communities during the construction of CBT is produced by excavation/deepening of sea bed for the ship landing. Rising of sediment and increased sedimentation of particles on the both sides of construction works will occur during this stage.

Due to shallow sea and large inflow of fresh water from the Baćinska Lakes, the Neretva River and other smaller sources most of the colloid particles will be kept in an upper layer with smaller density. Because of that dispersion of particles will be large and their sedimentation will occur in a large area thus with smaller amounts per area unit. Larger impacts on marine communities will appear only in the relatively small area near construction works. Any impact in areas more distant than 400 m in all direction is not expected.

Impacts in the excavation area, approximately 15 ha, is high because the upper layer of sediment with all benthic organisms will be removed. Sedimentation of material will have negative impact on benthic organisms only for a short period because they will return fast to the sediment surface. It can be assumed that the major negative impact will be on organisms which live on the sea bed and can not move e.g. sea grass from genus Posidonia and algae.

Due to construction of the Zone 2 and Zone 4 (if needed) of the terminal a part of the sea bed will be covered including biologically important area with protected bivalve *Pinna nobilis*[3] and the sea grass. This is an important negative effect of the project. Although negative, the impact is of very limited range as important species located there are present in other areas in the vicinity and the percentage of destroyed population is almost negligible.

Noise impact

There is a noise impact both during construction and during the operation. Because of special characteristics of some sources and their environmental impact, the noise impact during the terminal construction has been considered through three project phases:

- excavating of sea bed for ship approach to the CBT
- construction works on the coast and its skirting part
- berth construction – piling

[3] During diving survey no living organisms but only shells' remains have been found.

Excavating of sea bed Trailing Suction Hopper Dredger" was analysed in detail as a worst technology. Noise generated by TSHD, later in the document considered as one source, comes from several different components. Primary components are divided according to the environment to which they emit noise:

a) Noise to water: suction pipe, operating propeller, generators, gearbox, pumps
b) Noise to air: ship's engine, generators, ventilation systems, pumps

It is used the emission level generated by TSHD Taccola (*Ref. Langworthy 2004, An Assessment of the Underwater Noise Radiated by the Dredger Taccola, Report No. 614 R 0205*). The capacity of TSHD Taccola is 4400 m^3, and the one foreseen by the technical analysis 5000 m^3. They are both categorized as medium size TSHDs. Since the split up within the group is made according to the capacity, the ship selected could be considered representative.

Table 4 reviews the noise emission level by octaves for heavy-duty construction machines used at the begging stage. Later on, this situation will be modelled as the worst possible case. Data have been taken from *DEFRA, Update of Noise Database for Prediction of Noise on Construction and Open Sites 2005*.

Table 4: *Sound characteristics of construction machines*

Noise Source	Sound power per octaves, dB(A)								L_W dB(A)
	63	125	250	500	1k	2k	4k	8k	
Dumper	90	97	101.3	105.4	107.8	108	102.6	95	113
Dozer	82.8	93.9	92.4	89.8	94	91.2	89	85.1	100.1
Tracked excavator	70.8	88.9	81.4	89.8	90	89.2	84	78.1	96
Loader	88.3	89.2	90.5	94.7	99.1	98.5	90.1	78.2	103.4
Generator	62.8	72.9	78.4	76.8	79	81.2	77	74.1	86.3
Roller	73.8	78.9	88.4	88.8	87	83.2	75	67.1	93.6
Pile driver	66.8	68.9	76.4	80.8	90	93.2	93	89.1	97.8

The only technique still used for construction of berths and underwater piling is impact piling (hammer piling), which is also the noisiest method.

At this stage of design development, no specific piling equipment has been selected. On the market, there are diesel, air, steam and hydraulically operated pile hammers. They are listed herein according to the noise emission level they radiate, from the most silent to the loudest. They also considerably differentiate according to the place of piling, under or above the water level, which depends on the noise level radiated to air or water. When determining the noise emission levels, the worst possible case will be considered – the noise emission level; the least favourable case for each medium.

Noise emission level to air will be taken according to *DEFRA*. For piling ∅ 600 mm piles, a 5 ton hydraulic hammer is sufficient. Below are its noise emission levels per octaves (**Table 5**).

Table 5: *Sound characteristics of a hydraulic hammer for air*

Noise Source	Sound power per octaves, dB(A)								L_W dB(A)
	63	125	250	500	1k	2k	4k	8k	
Hydr. hammer	75.8	85.9	93.4	105.8	103	99.2	96	91.1	108.7

Noise in Water

Theoretically, it is difficult to assume sound propagation in shallow coastal belt. Sometimes, the calculations are made with cylindrical and sometimes with spherical divergence. Each method gives better results at a certain distant area and a certain location.

British Petrol (BP) conducted a series of geological investigations on the south-east of England in a underwater area similar to that around Ploče *(An Investigation Of Underwater Sound Propagation In Shallow Coastal Waters, by J. R. Nedwell (Subacoustech Ltd.), K. Needham (Subacoustech Ltd), A.W. H. Turnpenny (Fawley Aquatic Research Laboratories Ltd.) and R. M. H. Seaby (Fawley Aquatic Research Laboratories Ltd.))*. The Port of Poole Bay, situated at the river mouth has an average sea depth between 5 and 20 metres and shallow sea depth of 1 to 5 metres. The sea bottom is sandy with gradual increase in depth. By mathematical calculation and calculation modelling for theoretically ideal sea surface, expected attenuation of sound of some 40log(R) was obtained, but actual measurements during rough sea showed sound attenuation between 21log(R) and 26log(R). Since underwater noise sources have the highest intensity at low frequencies similar to those used by so called "airgun" for geological investigations, the results of that investigation are used for predicting sound propagation attenuation in water.

Dredging - deepening and broadening of access channel to CBT berth and to the Vlaška Channel

For assumed noise emission level of 180.4 dB (1μPa), below are the ground level emissions depending on the source distance (**Figure 12**).

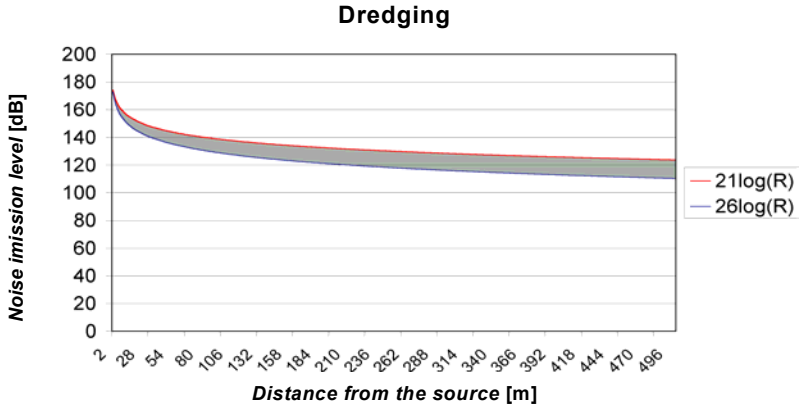


Figure 12: Ground level noise intensity at different distances during dredging

Piling

According to above described theory of sound wave propagation in water/sea, below is ground-level emission depending on the distance from the source **(Figure 13)**. The level of noise radiated by a hydraulic hammer is 194 dB (1μPa).

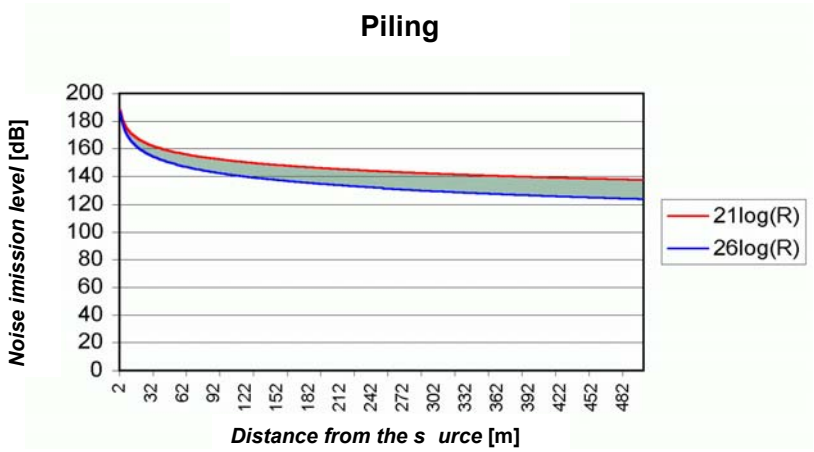


Figure 13: Ground level noise intensity during piling

Noise during CBT construction

The calculation does not take into account meteorological correction. A coefficient of soil absorption is 0 (zero) and land is assumed completely flat. The calculation parameters of sound attenuation due to air absorptions are:

- Temperature 20^{0}C
- Pressure 101.33 kPa
- Relative humidity 60%

The situation was modelled according to ISO (described in document ISO 9613-2).

Noise emission during operation of CBT

Table 6 gives a review of assumed emission levels of ship unloader, trucks and cranes per octaves.

Table 6: *Assumed noise emission levels of equipment at the port terminal*

Noise Source	Sound power per octaves, dB(A)								L_W dB(A)
	63	125	250	500	1k	2k	4k	8k	
Gantry crane	82.9	92	95.5	99.9	103	105.3	100	88	109
Conveyer belt	39	58.1	62.6	71	69.2	68.5	60.2	49.1	75 dB(A)/m
Stacker/reclaimer	75.8	84.9	88.4	92.8	96	98.2	93	85.9	102
Loader	88.3	89.2	90.5	94.7	99.1	98.5	90.1	78.2	103.4
Train loading station	82	101.1	105.6	114	112.2	111.4	103.2	92.1	118
Truck	78.8	89.9	97.4	98.8	101	100.2	98	86.9	106.4
Truck crane	80.8	85.9	89.4	90.8	91	88.2	81	70.9	96.7

Table 7 gives a review of noise emission level per octaves for a point source.

Table 7: *Noise emission levels for a CBT – calculated surface area of 235 000 m²*

Noise source	Sound power per octaves, dB(A)								L_W dB(A)
	63	125	250	500	1k	2k	4k	8k	
Terminal	66.8	85.9	96.4	105.8	110	114.2	112	108.1	118.7

Two situations are modelled: the worst possible scenario and a scenario that best resembling the reality. Both understand 24-hour work time of the terminal when a ship arrives to the port. It is assumed that all noise sources, except for auxiliary loaders and trucks, and auxiliary truck crane, are continuous emitter of noise during that time.

In relation to noise impact it is concluded the following: By determining the noise impact a worst-case scenario is considered. Such includes the minimal construction time and therefore, development of more construction activities at the same time. Modelling was done according to ISO 9613 standard, which is regulated by the *Croatian Noise Protection Act (Official Gazette No. 20/03)*

According to the noise maps (**Figures 14**and **15**, see Appendix), it is obvious that the noise from the CBT location ***does not influence the population areas of Ploče*** *(Ordinance on highest noise levels in areas where people live and work, Official Gazette No. 20/04*).

As for the noise influence on marine species it is difficult to make a final conclusion. No country in the world has regulations on that matter and since the monitored area is not from the special interest for the underwater world it is assumed that there would not be a significant impact.

The problem appears in the area of nature preserve in Delta of Neretva River. The regulation do not prescribe the permissible noise levels for this area, but in order to respect the general recommendations of the majority of European and world countries - related to noise influence on birds - the necessary abatement measures should be carried out. The scope of measures will depend on detailed monitoring which will be conducted during the later phases of Project.

Birds, except for owls, have hearing organs that cover the same range of sound frequencies and level like people so generally the limits for the highest allowed levels of noise stipulated for people are also appropriate for birds *(EPA – Environment Protection Authority, Best Practice Environmental Management – Guidelines for Dredging*).

During the execution of the works, birds affected by the noise will leave the area and go to more suitable places. They will probably return when the works are over.

When determining the optimum time for execution of the works, it should be taken into account that birds are extremely sensitive during migration. Birds leave the area affected by high noise and this unnecessary use of energy could disturb their feeding process and resting during migration. The area of Neretva River estuary is an important rest place for the bird migration, mainly from the north of Europe to Africa, from the second half of August to the end of October

and from the end of March to July and as wintering site. Higher noise level is also a problem for the birds during nesting, spring and summer, because parents could leave the nest permanently or, because of higher noise level, they could leave nests more often and for longer time thus exposing the nest, eggs and their young to predators and overheating. The area of the project is less important as a nesting than migration and wintering site.

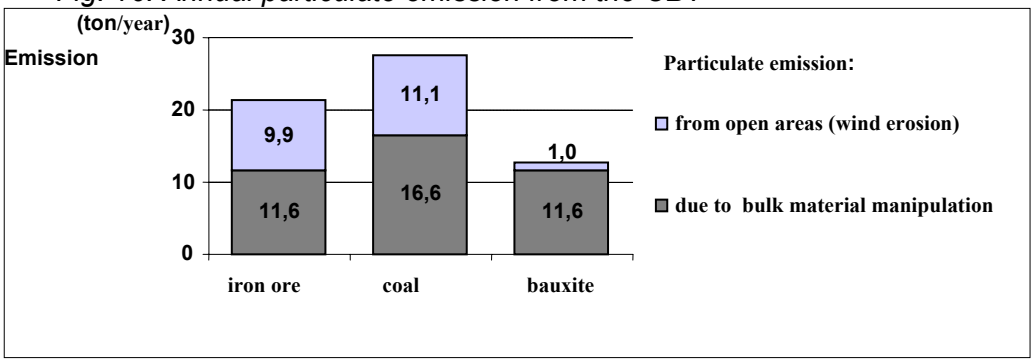
Because of above-mentioned impact, the most suitable time that is the time of the lowest impact on bird fauna for execution of works would be summer period until the start of autumn migration. In that period there would be no impact on migratory birds thus they could feed and rest normally and on wintering birds.

Impact on the air quality

The major ambient air impact during operation of the bulk cargo terminal will be that from fugitive emission from the bulk cargo handling and storage. Fugitive emissions are caused by the bulk cargo unloading from the ships to the stockpile, wind erosion of material disposed on the stockpile, and reloading from the stockpile into the bulk cargo wagons.

AP-42 methodology of the American Environmental Protection Agency (EPA) was used for calculation of fugitive emissions. **Figure 16** shows annual emission calculated for maximum use of New Cargo Bulk Terminal capacity, and its annual capacity is 2,800,000 ton of coal, 600,000 ton of bauxite and 1,200,000 of iron ore.

Fig. 16: Annual particulate emission from the CBT



Modern equipment for bulk cargo handling is of environmental design, i.e. in-use dust emission should be even lower than estimated. Further, according to the design documentation, spraying of the bulk cargo stockpile will also reduce emission.

The project impact on ambient air quality was assessed on the bases of the ISCST3 air quality calculation model. A method is applied that gives conservative results. This method asks for use of the so-called “worst case meteorological data”, namely set of meteorological data used to

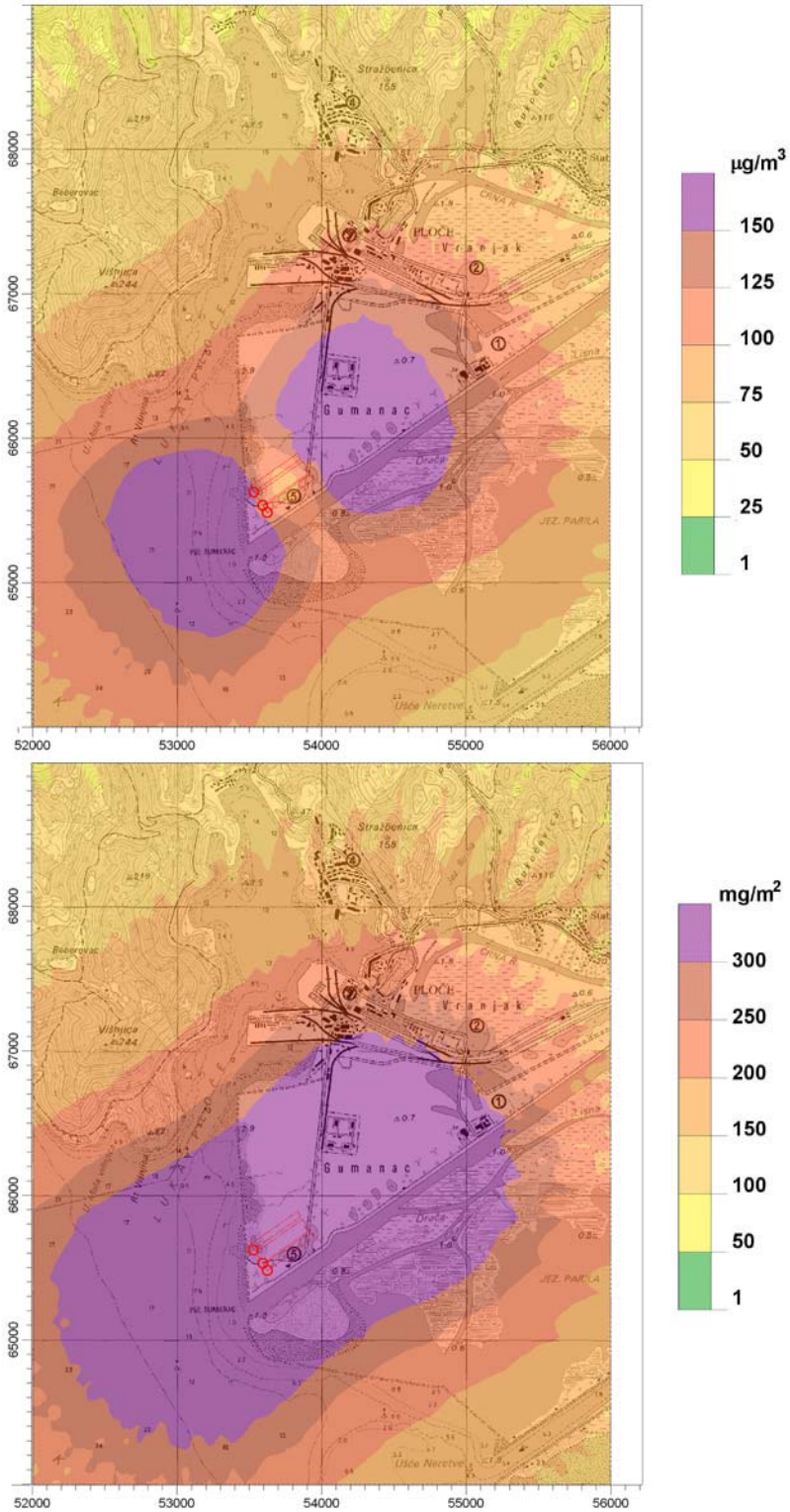
simulate different combination of meteorological parameters needed for calculation of dispersion and deposition.

Figure 17 shows results of calculation of maximum hourly concentration of PM-10 and deposition, and **Table 8** gives maximum calculated values.

Table 8: Maximum values obtained with ISCST3 model calculation

LOCATION	***WIND DIRECTION***	***CALCULATED MAXIMUM HOURLY VALUES***		***ESTIMATED VALUES***	
		Concentration of PM-10 $\mu g/m^3$ *(h)*	***Quantity of deposited matter*** $mg/m^2/h$	***Maximum daily concentration of PM-10*** $\mu g/m^3$	***Quantity of deposited matter*** $mg/m^2/day$
Max. impact on LAND	**SW**	315 (6454100,4766050)	558 (6453450,4765600)	126 (factor: 0,4)	89 (wind frequency 16%)
Max. impact on SEA	**NE**	306 (6453250, 4765450)	548 (6453450, 4765600)	122 (factor: 0,4)	88 (wind frequency 16%)

(All points are within Port of Ploče borders, see figure 17)



Maximum hourly concentration of particulate matter (PM-10)

Maximum hourly quantities of total deposited matter (TDM)

***Fig. 17**: Maximum hourly concentration of particulate matter (PM-10) and total deposited matter (TDM)*

Based on the calculation results obtained by application of the dispersion model and information on the climate characteristics, particularly the wind conditions at the town of Ploče area, it can be concluded that operation of the New Cargo Bulk Terminal will not cause degradation of the first category air quality[4] due to the particulate concentration (PM-10) and deposition at the town of Ploče area.

Waste management

Most of the waste produced during the Project operation will be the waste from ships. It will consist of waste oil (hazardous waste) and oiled waste – oiled water, oiled materials (hazardous waste), bilge water (hazardous waste), cargo residues, sewage water, and other waste such as food leavings, food packaging material, etc.

Currently, the services for receiving liquid waste generated on board ships are solved on a contract basis with the company Pomorski servis – Luka Ploče ltd (concession holder), which is authorized for collection of hazardous waste by the Ministry of Environmental Protection, Physical Planning and Construction. Following the opinion of the current concession holder, current system for receiving waste in the area of Ploče Port hardly meets the current situation. Below are the actions required before commissioning of the Project:

- Development of a Plan for reception and handling of waste from watercrafts and cargo residue in the area of the Ploče Port; according to the content defined in the *By-law stipulating conditions for port operation (Gazette 110/04).*
- Installation of waste reception facilities for waste generated on board ships having sufficient capacity for all types of waste. Provision of an adequate place for collecting and storing all types of waste generated during the Project operation that will satisfy the provisions of the *Law on Waste (Gazette 178/04)* and other operational and supporting documents of that Law. If there is no possibility for *adequate final treatment* of waste at the Project location, treatment of single types of waste should be contracted with a legal entity registered for that line of business.
- Types, quantities, place of origin, way and place of storing, treatment and disposal of waste shall be duly recorded. Data on handling different types of waste shall be regularly submitted to competent authorities on stipulated forms and reporting sheets. Likewise, once a year, the competent authorities should be informed about the condition of reception facilities for waste and cargo residue. The Porth Authority of Ploče should be recommended to present a Waste Management Plan.

[4] First Category Air Quality - clean or slightly polluted air; the limit values (LV) are not exceeded for any pollutant (see, Chapter 4, Table 4.2.1-1).

5. MITIGATION MEASURES AND ENVIRONMENTAL MONITORING PLAN (from EMP)

5.1. MITIGATION PLAN DURING THE PROJECT CONSTRUCTION

5.1.1. DEEPENING AND BROADENING (DREDGING) OF ACCESS CHANNEL TO CARGO BULK TERMINAL (CBT) BERTH AND TO THE VLAŠKA CHANNEL

1.1. MITIGATION MEASURES FOR PROTECTION OF THE SEA AND MARINE COMMUNITIES (BIOCENOSES)

1. Dredged material shall be disposed in the area of the zone 3 and zone 4 which are within the area of the Port of Ploče – Ploče basin according to the *Decision of establishment of the Port Authority of Ploče (Gazettes 19/97, 139/97, 18/99)*. Area of the zone 3 and zone 4 are given on Figure 3 in Appendix.
2. a) In case that *hydraulic dredging* is chosen:
   To prevent dispersion of the disposed material into the sea and to allow leakage of water from the material piled in the zone 3, it is necessary to make:
   - peripheral stone fills covered with geotextile and sand;
   - a drainage system consisting of drain pipes protected with geotextile and sand;

   b) In case of *mechanical dredging* this mitigation measure (i.e. construction of dikes and drainage system) will be excluded.
3. To prevent dispersion of the disposed material into the sea it is necessary to make a protection dike in sea (on the sea side of the zone 4). Dike is to be made of stone fill and covered with geotextile on its inner side.
4. During dredging process, economically justified BATNEEC technologies should be used to mitigate muddying up the seawater.
5. This phase of the Project construction should be scheduled in the period of the least effect on fishes e.g. fish migration period should be avoided.

1.2. NOISE MITIGATION MEASURES (NOISE PROTECTION MEASURES)

6. During dredging, economically justified BATNEEC technologies should be used to mitigate noise emission.
7. To maintain current noise emission, regular maintenance of dredgers is required.
8. Rate of excavation should be limited thus reducing the power required and the noise emitted.
9. Working hours of dredging operation should be limited in area long side Ploče - Parila.

1.3. ORNITHOFAUNA PROTECTION MEASURES

10. This phase of Project construction will scheduled in the period of the least effect on birds.

NOTE:
By application of the mitigation measures under the items 5, 6, 7, and 8, the noise impact on birds and marine organisms during the Project construction is reduced so this measure could

also be considered the measure for protection of ornithofauna and marine communities (biocenosis).

2. CONSTRUCTION OF BERTH, NEW OPERATIONAL ZONE AND STORAGE AREA OF THE TERMINAL (ONSHORE PART OF TERMINAL) AND EQUIPMENT AND FACILITIES USED DURING REGULAR OPERATION OF THE BULK CARGO TERMINAL

2.1. MITIGATION MEASURES FOR PROTECTION OF THE SEA AND MARINE COMMUNITIES (BIOCENOSIS)

11. To mitigate the impact of wastewater generated during the Project usage on the seawater quality and indirectly on marine communities (biocenosis), it is necessary to build
    - a system for drainage and treatment of rainfall (storm waters) from the terminal area to achieve the quality of water for discharge into the sea stipulated by the Water License;
    - a system for collection and treatment of sanitary wastewater from the terminal area;

2.2. MITIGATION MEASURES FOR AIR PROTECTION

To reduce emission of particulates to air during the Project construction, it is necessary:

12. to limit the vehicle speed at the building site to 25 – 30 km/h;
13. to spray water onto the area of construction machinery operation to reduce dust raising from ground.

To reduce particulate emission to air due to bulk cargo handling and dispersion of bulk cargo by wind during the Project usage, it is necessary:

14. to build a system for spraying/wetting bulk cargo and unloading/reloading places (transfer points);
15. to design closed unloading/reloading places (transfer points) on the belt conveyor line;
16. to plant vegetation and make a green belt on all places that will not interfere with the terminal operation.

2.3. NOISE MITIGATION MEASURES (NOISE PROTECTION MEASURES)

17. Low-noise-emission machinery should be used for construction of the terminal.
18. During the terminal construction, economically justified BATNEEC technologies should be used to reduce noise emission. Possible technological measures whose capabilities should be appraised in the main design are:
    A) For mitigating underwater noise at piling:
        - use of air-bubble curtains
        - use of acoustic curtains
    B) For mitigating noise emitted to air:
        - use of shock absorbers
        - fit a shroud around the pile; the pile shroud is constructed from rings of polythene bellows, with each section typically 1.5 m long. These rings are connected to the piling hammer at the bottom of the noise-reducing casing and reach down to water

or ground level depending on the environment. They are connected to each other by special flanges, and as the pile is driven, the rings concertina together.

19. Regular maintenance of machinery and equipment used for construction for the onshore part of the terminal;
20. Before selecting the equipment and facilities for regular operation of the terminal, it is necessary to conduct a target-oriented research of noise impact on ornithofauna (see the monitoring program) in the area of Ploče - Parila (an area planned for protection in the category of special ornithological and ichthyological reserve). The results of that research should be used as limit values when selecting the equipment and facilities. They must not be exceeded during the regular operation of the terminal.

2.4. MITIGATION MEASURES FOR PROTECTION OF ORNITHOFAUNA

21. In order to protect ornithofauna, further design phases should provide direction of the light opposite to the area of Ploče - Parila and lights should be directed on the ground, as much as reasonably possible.

2.5. WASTE

22. An adequate area shall be provided for temporary dumping of waste generated during construction.
23. Waste generated during construction shall be collected separately by its type.
24. Transport of waste and its disposal shall be organized according to the Project construction schedule.
25. Building waste such as, concrete, stones, and excavation soil that cannot be used during construction and for site development, shall be taken to an adequate waste disposal site.
26. Metal waste generated during construction shall be used as secondary raw material.
27. Hazardous waste generated during construction shall be taken care of on a contract bases with legal entities licensed for collection, transport and handling of hazardous waste.
28. To provide for proper waste management during the terminal operation, at this stage of the Project it is necessary to made a Plan for reception and handling of waste and cargo residue from waterborne crafts according to the Addendum 1 to the *By-law on Port Operation (Gazette 110/04)*.
29. To provide for proper waste management during the terminal operation, before the start of the terminal operation adequate waste facility shall be installed for reception of all types of waste from ships.

2.6. ACCIDENTS

To mitigate possible accidents in the Port area during the terminal operation and to limit the consequences of such an accident, at this stage of the Project development it is necessary:

30. to provide means and equipment for prevention of sea pollution and remedy of the sea pollution consequences;
31. to make a maritime study according to the contents set out in the Article 5 of the *By-law on Port Operation (Gazette 110/04)*;
32. that the facilities and equipment to be used for unloading bulk cargos have adequate certificates.

33. A concession holder for unloading bulk cargo must have a quality system established, applied and maintained pursuant to the standard ISO 9001:2000 or other adequate system satisfying its minimum standards. The system operation shall be verified and demonstrated in accordance with the Guidelines ISO 10011:1991 or any other adequate standard satisfying the minimum conditions of those guidelines.

2.7. GENERAL MITIGATION MEASURES

34. Regular implementation of the monitoring program.

5.2. MITIGATION MEASURES DURING THE PROJECT OPERATION (USAGE)

1.1. MITIGATION MEASURES FOR PROTECTION OF THE SEA AND MARINE COMMUNITIES (BIOCENOSIS)

1. Regular maintenance of drainage systems for rainfall (storm waters) and sanitary wastewater is required.

1.2. MITIGATION MEASURES FOR AIR PROTECTION

2. Obligatory usage of a spraying / wetting system.
3. If necessary, polyelectrolytes for spraying of the material stored at the terminal shall be used.
4. Maintenance of internal roads is required.

1.3. NOISE MITIGATION MEASURES (NOISE PROTECTION MEASURES)

5. Regular maintenance of the facilities and equipment at the terminal is required.

1.4. WASTE

6. Reception of all waste generated on board ships is required.
7. Different types of waste generated during the terminal usage shall be collected separately.
8. Waste generated during the Project usage shall be received / collected only by legal entities satisfying the conditions stipulated by the *Law on Waste (Gazette 178/04)*.
9. If at the Project location, there is no possibility for final treatment of waste generated during the Project usage, final treatment of each type of waste shall be contracted with legal entities licensed for collection, transport and/or management of each type of waste.
10. Keeping records of type, quantity, place of origin, way and place of storing, treatment and disposal of waste is required.
11. If the quantities of non-hazardous waste during the Project usage exceed 150 t/year and/or the quantities of hazardous waste exceed 200 kg/year, a Waste Management Plan should be developed.

1.5. ACCIDENTS

12. Facilities and equipment for unloading bulk cargo shall be regularly maintained and kept in condition stipulated by the standards.
13. Persons performing the job of unloading bulk cargo shall be professionally educated and trained in terms of unloading safety and shall be provided with adequate protection outfit.
14. Bulk cargo unloading shall be carried out in accordance with the unloading plan.
15. A contingency plan shall be developed for environmental protection against hazardous substances if their quantities exceed the limits stipulated in the Appendix 2 to the *Intervention Plan for Environmental Protection (Gazette 82/99, 89/99, 12/01)*.
16. The means and equipment for prevention of sea pollution and remedy of the pollution consequences shall be regularly maintained and completed.
17. Training and occasional check up of the employees' competence for application of the measures stipulated by the maritime study and the contingency plan for environmental protection is required.

1.6. GENERAL MITIGATION MEASURES FOR ENVIRONMENTAL PROTECTION

18. Regular implementation of the environment monitoring program (see Section B)
19. Regular reporting to the competent authorities (see Section E)

5.3. MITIGATION MEASURES FOR DECOMMISSIONING

Decommissioning of the Project usage is not foreseen. Effects on and mitigation measures for environmental protection in case of stopping the Project usage and/or removal of the Project will be stipulated by a special study within the preliminary activities for stopping the Project usage and/or its removal.

5.4. MONITORING PLAN

						Cost (Euro)		Responsibility	
Phase	**What**	**Where**	**How**	**When**	**Why**	**Install**	**Operate**	**Install**	**Operate**
BASELINE	Total deposit matter (TDM) and composition of TDM	5 stations (Figure 18 in Appendix)		October 2005 - March 2006	Identification of baseline condition of air quality	3500		PORT AUTHORITY OF PLOČE Note: MADE (Public Health Institute)	
	Sediment	2 points: - entrance to Vlaška channel - reference point	Standard laboratory methods	October 2005	Chemical composition of sediments	2000		PORT AUTHORITY OF PLOČE Note: MADE	
	Marine communities	Area close to the Project location	Diving view	October 2005	Identification of biocenosis structure of sea bottom	7000		PORT AUTHORITY OF PLOČE Note: MADE	
	Ornithofauna	Area foreseen for protection under the category of a special reserve (Ploče – Parila)	Based on special research program	Before starting the Project construction	Target-oriented research of impact of some noise levels on bird population aimed at determining the limit values to be taken into account when selecting the facilities and equipment in further design phase	20000		PORT AUTHORITY OF PLOČE	

						Cost (Euro)		Responsibility	
Phase	**What**	**Where**	**How**	**When**	**Why**	**Install**	**Operate**	**Install**	**Operate**
CONSTRUCTION	Total deposit matter (TDM) and composition of TDM	5 stations (Figure 18 in Appendix)	Methods of authorized legal entities (Qualified Institution)	Once a month throughout the year	Air quality	7000 a year		- It depends on contractual obligations of contractors (some parts of the monitoring program can be included under the contractual obligations of some contractors thus making them responsible for their implementation). - The Port Authority of Ploče will be responsible for implementation of some parts of the monitoring program not contractually assigned to the contractors of some parts of construction. - Inspection office with the MEPPPC will control the implementation of the monitoring program determined during the environmental impact assessment process. - Qualified Institutions will conduct monitoring plan	
	Total suspended matter (Suspended particles in sea)	Check points close to the zone 4		Once a month throughout the year	Seawater quality	6000 a year			
	Noise	Check points		Once every six month	Identification of actual noise level during construction	4000			
	Ornithofauna	Ploče - Parila		During construction	Monitoring the impact of construction on orinthofauna	-	13000		
OPERATION/USAGE	Total deposit matter (TDM) and composition of TDM	5 stations (Figure 18 in Appendix)	Methods of authorized legal entities (Qualified Institution)	Once a month throughout the year	Air quality	7000 a year		- It depends on contractual obligations of contractors (some parts of the monitoring program can be included under the contractual obligations of some contractors thus making them responsible for their implementation). - The Port Authority of Ploče will be responsible for implementation of some parts of the monitoring program not contractually assigned to the contractors of some parts of construction. - Inspection office with the MEPPPC will control the implementation of the monitoring program determined during the environmental impact assessment process. - Qualified Institutions will conduct monitoring plan.	
	Total suspended matter (Suspended particles in sea)	Check points close to the zone 4		Acc. to the Water License conditions	Seawater quality	5000 a year			
	Sediment	2 points - entrance to Vlaška channel - reference point		Once in two years	Chemical composition of sediments Seawater quality	2000			
	Ornithfauna	Ploče - Parila		Once in the first year of the Project usage	Monitoring the impact of the Project usage on ornitho-fauna	-	20000		
	Wastewater quality (Parameters to be stipulated by Water License)	Discharge points		Acc. to the water license conditions	Seawater quality		3000 / per set of measure ments		
	Noise	Ploče - Parila (check points defined by the construction monitoring program before construction)		Once in the first year of the Project usage	Included in monitoring ornitho-fauna	-	-		
	Marine biocenosis	Area close to the Project location	Diving view	Once in three years	Identification of bio-cenosis structure of sea bottom	7000			