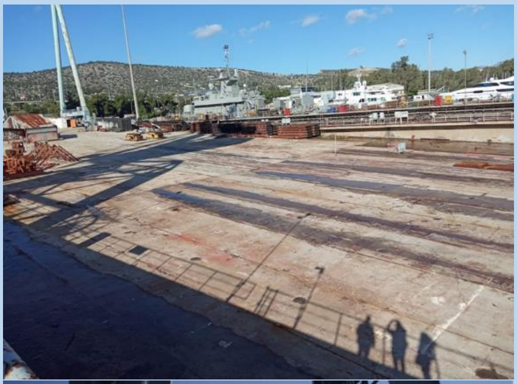
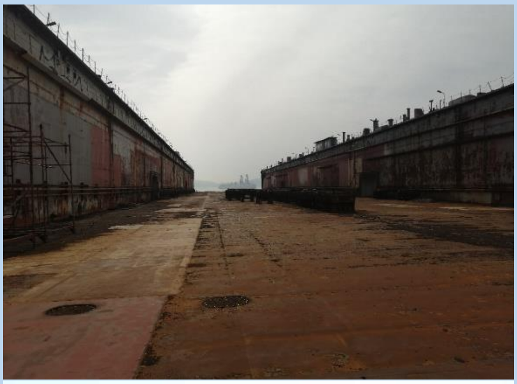
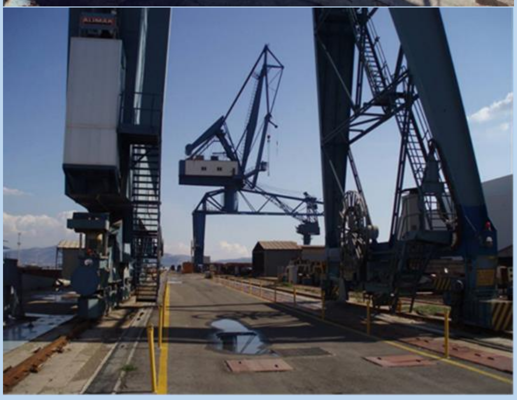
ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT (ESIA)

on the current status and the future operation of "Elefsis Shipyards"

Athens, July 2022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The **present ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT (ESIA)**

on the current status and the future operation of "Elefsis Shipyards"

Prepared from: **ENVITERRA P.C.**

Prepared on behalf of: **ONEX Technology Systems & Business Solutions S.A**

and hereinafter signed by their legal representatives

August 2022

For **ENVITERRA P.C.**	For **ONEX Technology Systems & Business Solutions S.A**.
A. Sotiroglou	I. Xenokostas

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AAMP	Athens-Attica Master Plan
ACM	Asbestos Containing Materials
ADR	Agreement for the International Carriage of Dangerous Goods by Road
AET	Approval of Environmental Terms
APT	Anti-Pollution Team
ASR	Anti-Seismic Regulation
BAT	Best Available Techniques
BP	Best Practices
BPL	Business Plans
BMW	Ballast Water Management
BWT	Ballast Water Treatment
CAPs	Criteria Air Pollutants
CBD	Convention on Biological Diversity
CSR	Corporate Social Responsibility
C/R	Constuction/Rehabilitation
DER	Digital Environmental Registry
DWR	Digital Waste Registry
DWT	Deadweight tonnage
EAK	Demolition/Removal Asbestos Licensed Companies
EC	European Commission
ECDW	Excavation, Construction & Demolition Waste
EEEW	Electrical & Electronical Equipment Waste
EF	Emission Factor
EHS	Environmental Health & Safety
EIA	Environmental Impact Assessment
ELSTAT	Hellenic Statistical Authority
EMP	Environmental Monitoring Program
EPR	Extended Producer Responsibility/Alternative Management System
E-PRTR	European Pollutant Release and Transfer Register
ES	Environmental & Social Procedures
ESIA	Environmental & Social Impact Assessment
ESMP	Environmental & Social Management Plan

ESSP	Environmental and Social Policy and Procedures
EU	European Union
EWC	European Waste Catalogue
EYDAP	Athens Water Supply and Sewerage Company
GRM	Grievance Redressal Mechanism
GUP	General Urban Plan
HCMR	Hellenic Center for Marine Research
HRA	Hellenic Recycling Agency
HRD	Human Resources Department
HW	Hazardous Waste
ILO	International Labor Office
IMO	International Maritime Organization
JMD	Joint Ministerial Decision
IoT	Information Technology
IPCC	Intergovernmental Panel on Climate Change
KEPEK	Occupational Risk Prevention Center
LCA	Life Cycle Assessment
MD	Ministerial Decision
MED	Marine Equipment Directive
MMAIP	Ministry of Maritime Affairs and Insular Policy
MRA	Mutual Recognition Agreements
MS	Member State
MSDS	Materials Safety Data Sheets
NCV	Net Calorific Value
NHW	Non-hazardous waste
NOA	National Observatory of Athens
NOEF	National Observatory of Electromagnetic Fields
NWMP	National Waste Management Plan
OG	Official Gazette
PAHs	Poly-aromatic hydrocarbons
PCB	Poly-carbonate Biphenyls
PCP	Pollution Control Protocol
PD	Presidential Decree
PPA	Piraeus Port Authority

PPC	Public Power Corporation
PPE	Personal Protective Equipment
PRO	Producer Responsible Organization
RES	Renewable Energy Sources
SWCMP	Ship Waste Collection and Management Plan
TBT	Tributyl Tin Compounds
TPA	Town Planning Authority
WB	World Bank
WFD	Waste Framework Directive
WMP	Waste Management Plan
WPP	Waste Prevention Plan
YPEN	Hellenic Ministry of Environment & Energy

EXECUTIVE SUMMARY

Background

ONEX Technology Systems & Business Solutions S.A (hereinafter **ONEX**) is currently considering the acquisition, restoration and operation of **Elefsis Shipyards** through rehabilitation process. Shipyards is currently managed under the **SHIPBUILDING AND INDUSTRIAL ENTERPRISES OF ELEFSINA SA**. The Shipyards were founded in 1962 and represent a valuable part of the Greek Industry and country's industrial and shipbuilding tradition. The company has been hit hard by the crisis in the European shipbuilding sector and the intense competition from Southeast Asian companies. For the last 2 years, Elefsis Shipyards are almost inactive.

The new company, through a bankruptcy consolidation plan and through a court decision, will acquire the fixed assets of Elefsis Shipyards. The plan provides for 12-24 months of repairs and rehabilitation works so that the Shipyards will be, not only operational, but also environmentally and socially viable. All repairs and rehabilitation works will be based on the current ESIA, and the required actions included in the standards set by the DFC.

The Shipyards are sited and operate near the 27th km of Old National Road Athens - Corinth, at Makria Ammos location, in the Municipality of Elefsis, in the Subregion of West Attica, in the Prefecture of Attica, Greece. Shipyards current basic operative features include:

- Construction of new ships
- Modifications of floating means (e.g., platforms) of oil extraction
- Ship repairs
- Industrial constructions

ONEX commissioned **ENVITERRA P.C.** to provide specific technical expertise and conduct the current document entitled: "**Environmental and Social Impact Assessment (ESIA)**

on the current status and the future operation of "Elefsis Shipyards". The assessment was conducted according to International Finance Corporation (IFC) Performance Standards, the U.S. International Development Finance Corporation (DFC) Environmental and Social Policy and Procedures, the World Bank (WB) Policies and Guidelines, the IFC/World Bank EHS Guidelines for Ports and Harbors, and the provisions of the Greek and EU legislation.

Golder Associates S.r.l. (hereinafter Golder) has also been engaged in the project providing high overview and advisory services to align the requirements towards the IFC and DFC requirements, as well as bringing international experience to the ENVITERRA's team.

The project under consideration is classified as Category A Project, according to DFC and WB Policy and Guidelines. With respect to national legislation activities (JMD No. 92108/1045/Φ.15/9.9.2020), the project under consideration is classified as Category A1 Project (9th Group/Industrial Activities and Related Facilities/no 189: Shipbuilding, conversion, repair, dismantling and maintenance of ships and boats > 120 m).

Objectives

The ESIA was initiated in November 2021, led by ENVITTERA P.C. and in close co-operation with ONEX and the current Shipyard's administration and personnel. The main objectives of the ESIA include:

- Investigate and describe the current situation and infrastructure (including waste management, buildings, and equipment status) of the Shipyard and prepare a baseline report
- Describe the environmental and social background of the Shipyard and its surroundings
- Describe the construction/rehabilitation works from the new operator and assess their environmental and social impacts

- Describe the operation phase (under the new operator) and assess its environmental and social impacts
- Prepare an Environmental and Social Management System (ESMS) for the forthcoming operating phase

The conduction of the ESIA was based on site visit observations, documentation made available by the current and new operator of the Shipyard and publicly available documentation.

Policy, Legal & Administrative Framework

The Project is required to conform with the following standards/regulations:

- The International Finance Corporation (IFC) Standards on Environmental and Social Sustainability [IFC, 2012]
- The U.S. International Development Finance Corporation (DFC), Environmental and Social Policy and Procedures [DFC, 2020]
- The World Bank (WB) Policies % Guidelines [WB, 2013]
- The applicable national and EU regulatory requirements

In Chapter 2 of the current document, an extensive analysis of the abovementioned framework is taking place. The requirements of IFC, DFC Standards and the WB Policies and Guidelines are first analyzed. Furthermore, the main sectors and legislative acts of EU and Greek legislation applicable to the project are highlighted, including waste management, environmental licensing, asbestos management, alternative management of waste, air pollution, water protection, noise, town planning, forest, and cultural heritage protection.

Baseline Report – Current Shipyard Conditions

The current conditions of Elefsis Shipyards are described in Chapter 3. That is a very crucial part of the ESIA, since it reveals the main problems and discrepancies of the current status of the Shipyards, and it comprises the guide for ONEX's future decision making in terms of rendering the facility operational.

More specifically, extensive information is provided in terms of current permits and certifications status, buildings, infrastructure, networks, waste present on site, wastewater management facilities and materials handling & storage. Furthermore, the current personnel and the OHS status are also described.

The crucial findings of the baseline report include the main actions need to be taken from ONEX prior to the commencement of the new operational phase. Key sectors include waste management (including asbestos), clean-up processes, infrastructure and network maintenance, material handling and storage and certifications renewal.

Environmental Background

In Chapter 4, the current environmental status of the Shipyards area of influence is described. Significant terms, such as intervention area, immediate and wider study area, are highlighted for purposes of assessing current and future environmental impacts. All aspects of environment are examined, including natural disasters that may affect the normal and safe operation of the facility.

An important point considering the examination of the current environmental conditions is that no measurements under real operating conditions could take place, since, as mentioned above, the Shipyards are almost not operational for more than 2 years now. For purposes of assessing the environmental pressures, older monitoring findings were evaluated (soil, seawater, sediments, noise etc.) and literature data were exploited.

Considering that the site has an industrial use for almost 60 years and the broader area consists of a heavily industrialized environment (Elefsis Gulf and Thriassian Plain), the background environmental conditions are satisfactory. No significant marine or terrestrial environmental pollution are detected. It should be also noted that the intervention area is located outside the boundaries of protected (e.g., NATURA) and forest or other areas under a special environmental or biodiversity regime.

Nevertheless, the transport of all stored waste (especially those stored in outdoor areas) from properly licensed companies is crucial for eliminating all hazards derived from past Shipyards operation.

Social – Anthropogenic Background

Elefsis Shipyards are located in the bay of Elefsis, at Makria Ammos location, near the 27th kilometer of the Old National Road from Athens to Corinth. Administratively, the facility is located within the borders of the Prefecture of Attica, the Subregion of West Attica and is part of the Municipality of Elefsis. The facility under study also belongs to the wider geographical area called “Thriasian Plain” i.e., the most industrialized area of Greece. Many industrial activities are developed in the immediate and wider area, including an oil refinery, a steel industry, ship repairing facilities etc.

Shipyards are fully compatible with urban and maritime planning of the broader area and land use regime is crystal clear, permitting industrial activities. Regarding settlements, the closest are Diodia and Makriammos and they are located 400m and 800m to the north, respectively. The city of Elefsis is developed more than 2.5km to the northeast.

No protected, urban, ecological, landscape, historical, cultural or folklore structures or areas of importance are found within the immediate project area.

In terms of water supply, Shipyards are covered by EYDAP S.A., while electricity is provided by PPC’s network. Access to the Shipyards is feasible through Old National Road Athens – Corinth and they are very close to both Attiki and Olympia Odos Highways. Shipyards are also close to Elefsis Port and have any easy access to international airport "Eleftherios Venizelos".

The project under study does not involve any land acquisition or population involuntary resettlement. On the other hand, no indigenous people are located in the immediate or the broader study area.

Finally, the man-made impacts on the environment on the wider area has been significantly mitigated over the last decade, due to the sufficient manage of industrial waste streams and the proper operation of Psyttalia Plant that treats almost all municipal wastewater produced in Attica Region.

Construction/Rehabilitation (C/R) Phase

The analysis illustrated in Chapter 6, includes all necessary stages for rendering the Shipyard, not only operational, but also environmentally and socially viable. The main target is to correlate (at a following next stage) all the C/R works with their possible environmental and social impacts.

According to ONEX BPL, the implementation schedule of the described works is estimated at 12-24 months in order to achieve full functionality of the Shipyards.

Regarding buildings and other structures, the new owner must acquire a new building permit by the competent Town Planning Authority. Asbestos must also be removed from several buildings and managed by properly licensed company.

Port facilities (tanks, shipbuilding bed, piers) need the appropriate maintenance before operation. Especially pier no 2, requires immediate repairing works and that task has been appointed by ONEX to an independent engineer.

Existing Petrol Station also requires maintenance and renewal of its license. Sufficient firefighting equipment exists, but many of the relevant certificates (especially for portable extinguishers) must be renewed. The rest of electrical-mechanical equipment, although in satisfactory condition, also needs maintenance and certifications renewal.

Waste removal works are described in detail at this Chapter. Some critical points include:

- All HW (including asbestos) and NHW must be removed from temporary storage areas according to the current Greek Law, by properly licensed companies that will undertake both collection and transport of waste
- All waste falling under the scope of alternative waste management (e.g., batteries, EEEW etc.) should be managed accordingly
- No leaks have been detected since all temporary waste storage areas are located on top of concrete floors. <u>Nevertheless, if, after waste removal, any inconsistency or disruption of the floor is observed, immediate action should be taken to remove concrete and the underlying soil to avoid any contamination. A sampling borehole should be established in order to assess the contaminant migration to the underlying soil.</u>

For materials indoor storage areas, no leakage was observed, but water intrusion has been detected. A static engineer should thoroughly assess the condition of the relevant buildings and initiate the proper measures.

Other necessary works include the thorough clean-up of the drainage network and ATEX certification for any infrastructure/equipment that is about to operate in specific environments with explosive atmospheres.

After the conduction of the abovementioned C/R works, the new operator is about to install some new activities (additionally to the existing ones) including:

- Conversions and improvements of merchant ships to reduce environmental footprint (carbon emissions) according to IMO regulations, through installing of scrubbers and ballast water treatment units.
- Implementing new technologies (nanotechnology) in materials production
- Producing information technology (IoT) systems for ships

During C/R phase it is estimated that some 7,200 tn of NHW, 7 tn of asbestos and 1 tn of other HW will be produced. With respect to liquid waste production, no significant streams are expected, with the exception of an accident. Air pollutants maybe generated during waste removal operations, works involving handling of inert materials (e.g., during pier repairing) and due to motorized equipment operation. Finally, noise and vibrations are expected in levels typical for a construction site.

Prior to the commencement of the Shipyards operation, the following permits and certificates should be obtained:

- AET, after conduction and approval of an ESIA from YPEN
- Renewal of the existing Occupational Safety Assessment and certification under OHSAS 18001
- Port Authority Permit for the conduction of port-related works (pier, tanks) after conduction and approval of the appropriate port, static and E/M studies
- New building permit
- Renewal of ISO 9001:2015 Quality Management System Certificate
- Renewal of ISO 14001:2015 Environmental Management Systems Certificate

Finally, the cost of C/R works was estimated approximately **40,000,000 €**, while the respective timeline is maximum **24 months**.

Environmental & Social Impacts from Construction/Rehabilitation (C/R) Phase

In Chapter 7, after a combined review of the elements of the current state of the environment and the project under consideration, an assessment and evaluation of the potential significant impacts expected from C/R phase is conducted. The main findings include:

- Stronger, collaborating, and probable effects are expected to the marine environment (including seawater quality), mainly due to the repair and maintenance works related to the pier and the floating tanks. Nevertheless, those impacts maybe eliminated by adopting the measures described in the following Chapters.

- For the terrestrial environment, impacts are expected to be typical for a construction site. The main cause of pollution is recognized to be the accidental releases of oils, lubricants, and similar wastes.
- Impacts on the social and anthropogenic environment are expected to be neutral or even positive due to creation of new jobs and reinforcement of the local economy (services, materials, scientific and technical personnel).
- Attention should be given to the collaboration of the expected effects with other anthropogenic sources of pollution in the broader area.
- No impacts with respect to cultural heritage, involuntary resettlement or indigenous people are expected

Environmental & Social Impacts Mitigation Measures for Construction/Rehabilitation (C/R) Phase

A detailed description of the measures proposed to be taken in order to address the expected environmental impacts from the C/R phase of the project under study, is presented in Chapter 8. All measures proposed aim at the prevention and avoidance, the reduction of the intensity and the extent as well as at the restoration of the environmental effects that may be caused by C/R phase.

For more sections of both the natural and the anthropogenic environment, the application of good construction site practices is considered sufficient to mitigate any impacts.

Especially for terrestrial environment, in the event of an unforeseen situation or accident during C/R works (including waste removal) responsible for dealing with it is the Operator who will receive all the necessary measures for cleaning of area and implement appropriate anti-pollution practices. Indicatively, the use of adsorbents such as sand, wood chips or special geotextiles is critical after accidental release. Disposal of those waste will be made in accordance with the relevant legislation for HW.

Special measures are proposed for C/R works performed next or in the sea (e.g., floating tank repairing), such as the use of floating dams, motorboat suitable for decontamination works, special equipment (mechanical sweeper, portable blowers, vacuums, shovels, brooms etc., depending on the conditions).

Finally, a mitigation scheme in the event of natural & anthropogenic disaster is also proposed, including individual measures for every type of disaster (e.g., explosion, flood etc.).

Operational Phase

ONEX plan for the operation of Elefsis Shipyards, after completion of the C/R phase, is based on the following pillars:

- Full utilization of the existing capacity of the facilities of the Elefsis Shipyard
- Reorganization of current activities (shipbuilding and ship repairing)
- Provision of additional services regarding modifications and improvements of merchant ships to reduce the environmental footprint (carbon emissions) (scrubbers, ballast water treatment etc.) and combining new technologies (nanotechnology) in production materials and IT (IoT) in ship systems.

In Chapter 9 all operative features are described and analyzed, with special emphasis to new ones. Under the new ownership, the Shipyards are expected to occupy 1200-1500 employees. The labor force during specific periods may exceed 2000, not including subcontractors. As far as resources consumption, the following amounts are expected:

- Water: 240 m^3/day
- Electricity: 20,000 MWh/year
- Fuels: 50.000 l/year

A prognosis for specific materials consumption such as solvents, pains, cables, sandblast etc. is also illustrated in this Chapter.

Some of the most important liquid waste streams expected during operation phase include water with petroleum products (EWC codes: 13 04 01 *, 13 04 03 *, 16 07 08*), used mineral oils (EWC code: 13 02 06 *), water with chemicals, reef colors and sanitary waste. Other streams may be derived from ships and include dirty ballast, slopes, bilge water etc.

Solid waste can be divided to those coming from the production process (e.g., metal scrap and similar waste, packaging materials, sandblasting waste) and those received from ships (e.g., municipal, operational, special waste etc.). All waste expected are categorized according to EWC codes.

Air pollutants are categorized in terms of their nature (e.g., PM, VOCs etc.) but also based on their origin (thermal cutting, sandblasting etc.). Finally, noise and vibrations levels expected are also distinguished according to their source (e.g., sandblasting activities).

Environmental & Social Impacts during Operational Phase

After a combined review of the elements of the current state of the environment (natural and social) and the project under consideration, an assessment and evaluation of the potential significant impacts expected from operational phase is conducted. Also, the impacts for which special emphasis should be given are highlighted.

The carbon footprint of the Shipyards during their operational phase is calculated relatively low, especially in comparison with similar anthropogenic activities in the broader area (e.g., Piraeus Port).

Significant collaborating, and probable effects are expected to the marine environment (including seawater quality), mainly due to the repair and shipbuilding works. Another important source of pollution may be the deliverance of waste from ships entering the facility. Nevertheless, those impacts maybe eliminated by adopting the measures described in the following Chapters.

Another environmental sector that maybe strongly affected by shipyards operation is the quality of atmospheric environment. Numerous sources of air pollutants are expected during Shipyards Operational Phase, including direct ones (i.e., related to the production process itself) but also indirect (i.e., related to vehicles and ship movement, boilers functioning etc.). A theoretical evaluation of air pollutants concentrations is performed based on international literature, utilizing emissions factors (EFs) specialized on certain air polluting processes (e.g., welding, sandblasting etc.).

Finally, an assessment of the vulnerability of the project, during its operational phase, with respect to natural and anthropogenic disasters, is conducted. Results show that moderate vulnerability is expected mainly due to the proximity of the Shipyards with SEVESO III facilities (oil refineries).

Environmental & Social Impacts Mitigation Measures for Operational Phase

A detailed description of the measures proposed to be taken in order to address the expected environmental impacts from the operational phase of the Shipyards, is presented in Chapter 11. Many of the measures proposed, apply to more than one environmental sector (e.g., soil and fauna/flora).

Specific limit values are proposed and are applicable for pollutants in all media (seawater, dredging, atmospheric & acoustic environment etc.)

Mitigation measures applicable to operational phase of the project, include among others:

- Rational management of ship and facility's waste
- Electricity generation from renewable sources were possible
- Provision of modern port infrastructure and means for the collection of ship waste and cargo residues, suitable to meet the needs of ships that normally use the Shipyards

- Specific technical interventions (e.g., installation of oil/grease separators) for limiting environmental impacts
- Preparation and implementation of modern Land and Marine Pollution Emergency Plans for the entire Shipyard Zone
- Development of strict regulations for carrying out shipbuilding and ship repair activities
- Compliance with all National and International Rules for the safe operation of all individual Shipyards' activities.
- Development of an integrated environmental monitoring system, for the identification of any releases and threshold values exceedances and their on-time treatment/management.
- Certification of Shipyards' activities and services, in accordance with the international standards of management, quality and environment ISO 9001:2015 (Quality Management) and ISO 14001:2015 (Environmental Management)
- Special measures for dealing with specific disasters (natural & anthropogenic)

Finally, extensive attention is given to OHS hazards mitigation, by proposing specific measures and equipment for different aspects of working conditions. On this field very crucial is considered the strict implementation of the relevant legislation and the certification of the Shipyards with OHSAS 18001.

Environmental & Social Management Plan (ESMP)

The proposed ESMP for the future operation of the Shipyards includes:

- Presentation of the Organizational Structure/Responsibilities, under ONEX administration, focusing on those related to environmental and social issues.
- Development and implementation of a modern Ship Waste Collection & Management Plan (SWCMP)
- Asbestos Management Plan for C/R phase
- Waste Management Plans for C/R and Operation Phase

- Air Pollution Management Plans for C/R and Operation Phase
- Development and implementation of a modern Sea Pollution Contingency Plan
- Dredging Management Plan
- Hazardous Materials Management Instructions and Measures
- Environmental Monitoring Program (EMP) regarding all crucial environmental parameters (air pollution, seawater, dredging, noise, treated effluent etc.)

Special attention is given to the social compliance of the proposed project focusing on the following sectors:

- Development of relevant Stakeholder (local community, YPEN, employees, suppliers etc.) engagement mechanism, including a detailed Grievance Redressal mechanism
- Plans for developing Corporate Social Responsibility (CSR) actions
- Human Resources and Labor Procedure and Plan
- Contractors Management Plan
- COVID-19 Management Plan

Benefits of the Project

The benefits of project under study for the local economy are directly related to the jobs created by the restart of the largest Shipyard of the country, as well as the direct and indirect development of many sectors related to shipbuilding, shipping, coastal shipping, waste management, supply of materials and services etc.

The project also contributes positively to the national economy, significantly to the country's GNP, while ONEX will constitute a major employer in the country, paying significant amounts for taxes and social security contributions. Consequently, the revival of Elefsis Shipyards is particularly beneficial for both local and national economy. Moreover, an important parameter is the operation of the facility in full compliance with national and Community legislation on environmental protection and rational management of natural resources.

Alternative Solutions

Analysis of alternatives to the project was undertaken in order to select the most environmentally friendly, technologically feasible and financially viable option. For the proposed project, the following alternatives have been considered and analyzed:

- No project scenario (Zero Solution)
- Abolition of Shipyards and their conversion to other port use
- Alternative locations
- Environmental & Social Factors

The analysis performed in Chapter 12 indicated that the solution described in the ESIA is the best among all alternatives examined.

1. INTRODUCTION

1.1 Project Title

The current project is titled: "***Environmental and Social Impact Assessment (ESIA) on the current status and the future operation of "Elefsis Shipyards***". The assessment was conducted according to International Finance Corporation (*IFC) Performance Standards*, the U.S. International Development Finance Corporation (*DFC) Environmental and Social Policy and Procedures*, *the World Bank (WB) Policies and Guidelines, the IFC/World Bank EHS Guidelines for Ports and Harbors*, and the provisions of the Greek and EU legislation. Specific analysis of the relevant regulatory and policy framework is given on Chapter 2.

Existing Greek legislation and the IFC Standards differ to a degree in the required approach for presenting Shipyards' EISA. However, the approach taken to assess potential environmental and social impacts, the structure of key sections (for example, those describing the Baseline Report and Impact Assessments) as well as the inclusion of early stakeholder sessions at the scoping stage, have been drafted accordingly to satisfy the requirement set by the IFC Standards.

1.2 Type and Size of Project

The project under consideration includes the following basic operative features:

- Construction (Shipbuilding) of commercial vessels, warships, and any vessel with a total capacity of up to 100,000 Deadweight tonnage (DWT).
- Transformation and repairs of any vessel with a total capacity of up to 300,000 DWT.
- Provision of additional services regarding modifications and improvements of merchant ships to reduce the environmental footprint

Other fundamental features are illustrated in Table 1.1. derived from the current status of the Shipyard.

Table 1.1: Basic features of the Project

Field area	241,103 m^2
Building area	54,848 m^2
Operating capacity (max)*	365 days / year, 3 shifts / day
Number of staff (max)*	848 people
Subcontractors (max)*	2000 people
Installed power	21,531.05 HP
Thermal power	11,466.33 KW

* Data from previous operation

The current assessment also deals with the fundamental works (including timeline and costs where possible) necessary for rendering the Shipyard capable of serving the aforementioned operating targets.

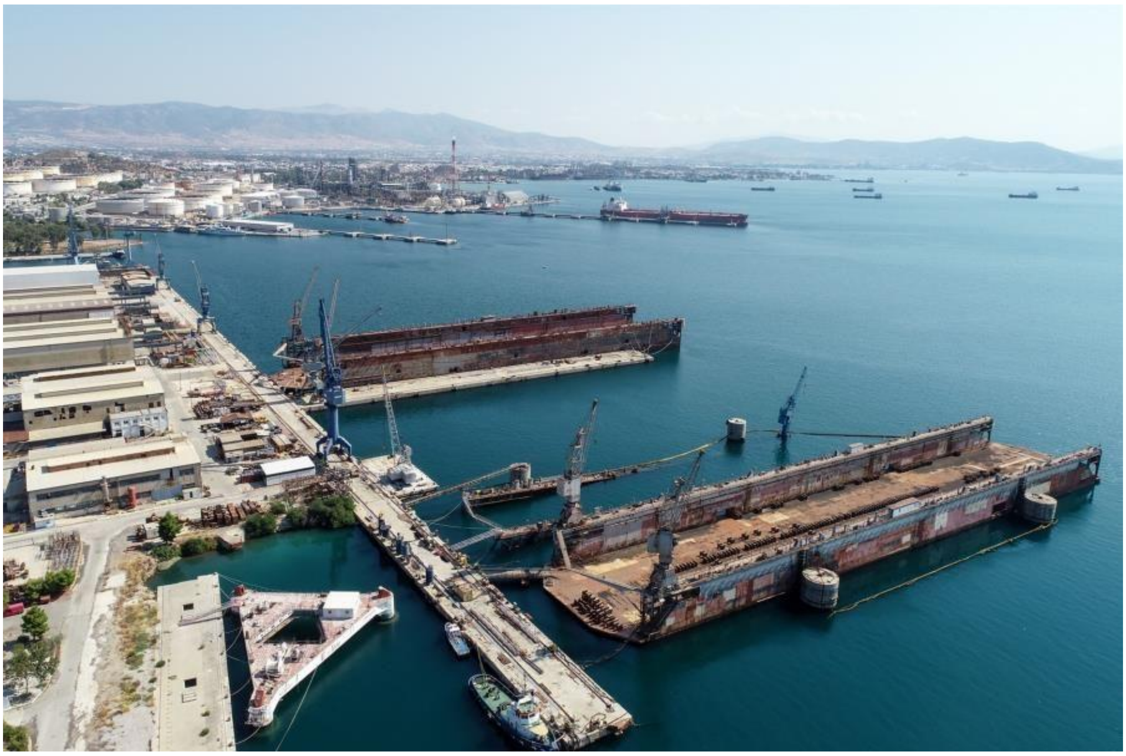

Figure 1.1 Elefsis Shipyards (photo from NW)

1.3 Scope/Objectives

The ESIA was initiated in November 2021, led by ENVITTERA P.C. and in close co-operation with ONEX and the current Shipyard's administration and personnel. The main Objectives of the ESIA are:

- Investigate and describe the current situation and infrastructure (including waste management, buildings, and equipment status) of the Shipyard and prepare a baseline report
- Describe the environmental and social background of the Shipyard and its surroundings
- Describe the construction/rehabilitation works from the new operator and assess their environmental and social impacts
- Prepare an Environmental and Social Management System (ESMS) for Construction/Rehabilitation Phase
- Describe the operation phase (under the new operator) and assess its environmental and social impacts
- Prepare an Environmental and Social Management System (ESMS) for the forthcoming operating phase

The conduction of the ESIA was based on site visit observations, documentation made available by the current and new operator of the Shipyard and publicly available documentation.

1.4 Geographical Location & Administration

The Shipyards are sited and operate near the 27th km of Old National Road Athens - Corinth, at Makria Ammos location, in the Municipality of Elefsis. The details about the project's geographical administration are given in Table 1.2.

Table 1.2: Location & Administration of the Shipyards

Location:	Makria Ammos
Municipality:	Elefsis
Municipal Subregion:	Elefsis
Prefecture/Region:	Attica
Subregion:	West Attica
Decentralized Administration:	Attica

The following satellite image provides a view of the location of the activity in relation to the wider area. The exact location of the activity is shown in a 1:50,000 scale Orientation Map found in the Appendix.

Figure 1.2: Satellite Image of Shipyards' location (source: Google Earth 2021)

1.5 Operator/Contractor

The ESIA was assigned to ENVITERRA P.C. by **ONEX Technology Systems & Business Solutions S.A** (hereinafter ONEX). The company is currently considering the acquisition, restoration and operation of Elefsis Shipyard through rehabilitation process.

The full details of ONEX are given below:

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1.6 Working Team

The current ESIA was prepared by ENVITERRA P.C, the details of which are given below:

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In the context of the present study, the following scientific collaborators were involved:

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Anastasios Sotiroglou, Geologist NCU, MSc

Stamatios Tsimas, Emeritous Prof., School of Chemical Engineering, NTUA

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Papastavropoulos Panagiotis, Mining Engineer - Metallurgist NTUA

Nicolaos Ragias, Mineral Resources Engineer, University of Crete

Dr. Panagiotis Merkos, Chemical Engineer NTUA

Dr. Iordanis Sahinoglou, Civil Engineer NTUA, Port Specialist

Members of the Working Team visited the site five (5) times during the conduction of the ESIA. More specifically ENVITERRA team performed five (5) site visits and conducted the necessary field work between 30th of November 2021 and 30 of March 2022. During those visits, ENVITERRA and its associates:

- Interviewed Elefsis Shipyard personnel
- Gathered and evaluated all the appropriate documents
- Made a thorough site inspection for all spaces/areas of interest

1.7 Technical Review/Gap Analysis

Golder Associates S.r.l. (hereinafter Golder) has also been engaged providing high overview and advisory services to align the requirements towards the IFC and DFC requirements, as well as bringing international experience to the aforementioned ESIA team. More specifically, Golder has provided the following devices:

<u>Project Management</u>: Hold a Kick-off meeting (KOM) via teleconference with the ONEX, ENVITERRA, and DFC, if deemed necessary in order to agree on the general approach to assist ONEX over the financing process. Result of the meeting will be to agree on the

Gap Analysis report which will include the actions still to be undertaken by ONEX to complete the ESIA process and reach compliance.

Documentation Review: Analyze previous studies carried out for the project site, provided by ONEX, including other reports relevant to the Project area, relevant permits and authorizations, records of the any stakeholder identification or results and engagement activities/plans, etc. Golder will then proceed to review the draft ESIA report, and the Environmental and Social Management Plan (ESMP) Framework included in the ESIA document focusing on its compliance against the applicable standards.

Gap Analysis: Provide full Gap Analysis Report with the results of the documentation review.

2. POLICY, LEGAL & ADMINISTRATIVE FRAMEWORK

2.1 General

The Project is required to conform with the following standards/regulations:

- The International Finance Corporation (IFC) Standards on Environmental and Social Sustainability [IFC, 2012]
- The U.S. International Development Finance Corporation (DFC), Environmental and Social Policy and Procedures [DFC, 2020]
- The World Bank (WB) Policies % Guidelines [WB, 2013]
- The applicable national and EU regulatory requirements

All the above are identified and analyzed in the following paragraphs. Some of the key laws, regulations, standards, and guidelines, applicable to the Project, are discussed below.

2.2 IFC Standards

The IFC Performance Standards are an international benchmark for identifying and managing environmental and social risk and has been adopted by many organizations as a key component of their environmental and social risk management. IFC's Environmental, Health, and Safety (EHS) Guidelines provide technical guidelines with general and industry-specific examples of good international industry practice to meet IFC's Performance Standards.

In many countries, the scope and intent of the IFC Performance Standards are addressed or partially addressed in the country's environmental and social regulatory framework. The IFC Performance Standards encompass eight topics:

- Performance Standard 1: ASSESSMENT AND MANAGEMENT OF ENVIRONMENTAL AND SOCIAL RISKS AND IMPACTS. Underscores the importance of identifying E&S risks and impacts and managing E&S performance throughout the life of a project.

- Performance Standard 2: LABOR AND WORKING CONDITIONS. Recognizes that the pursuit of economic growth through employment creation and income generation should be balanced with protection of basic rights for workers.
- Performance Standard 3: RESOURCE EFFICIENCY AND POLLUTION PREVENTION. Recognizes that increased industrial activity and urbanization often generate higher levels of air, water, and land pollution, and that there are efficiency opportunities.
- Performance Standard 4: COMMUNITY HEALTH, SAFETY AND SECURITY. Recognizes that projects can bring benefits to communities but can also increase potential exposure to risks and impacts from incidents, structural failures, and hazardous materials.
- Performance Standard 5: LAND ACQUISITION AND INVOLUNTARY RESETTLEMENT. Applies to physical or economic displacement resulting from land transactions such as expropriation or negotiated settlements.
- Performance Standard 6. BIODIVERSITY CONSERVATION AND SUSTAINABLE MANAGEMENT OF LIVING NATURAL RESOURCES. Promotes the protection of biodiversity and the sustainable management and use of natural resources.
- Performance Standard 7: INDIGENOUS PEOPLES. Aims to ensure that the development process fosters full respect for Indigenous Peoples.
- Performance Standard 8: CULTURAL HERITAGE. Aims to protect cultural heritage from adverse impacts of project activities and support its preservation.

IFC's Performance Standards offer a framework for understanding and managing environmental and social risks for high profile, complex, international, or potentially high impact project. The financial institution is required to verify as part of its environmental and social due diligence process that the commercial client/investee complies with the IFC Performance Standards. To do so, the financial institution needs to be knowledgeable of the environmental and social laws of the country in which it operates and compare the regulatory requirements against those of the IFC Performance Standards to identify gaps. A good understanding of both sets of requirements as well as potential gaps ensures that the financial institution will effectively identify and assess the key environmental and social risks and impacts that might be associated with a financial transaction.

The IFC Performance Standards help IFC, and its clients manage and improve their environmental and social performance through an outcomes-based approach and provide a solid base from which clients may increase the sustainability of their business operations. The desired outcomes are described in the objectives of each Performance Standard, followed by specific requirements to help clients achieve these outcomes through means that are appropriate to the nature and scale of the project and commensurate with the level of environmental and social risks (likelihood of harm) and impacts.

2.3 DFC Standards/ESPP

U.S. International Development Finance Corporation (DFC) is America's development finance institution. DFC investments adhere to high standards and respect the environment, human rights, and worker rights.

The DFC's Environmental and Social Policy and Procedures ("ESPP") addresses DFC's commitments regarding the environmental and social dimensions of sustainable development and provides Applicants notice of the general environmental and social requirements that are applied in evaluating prospective projects and monitoring on-going supported projects. These environmental and social requirements apply to all projects supported through insurance, reinsurance, direct loans, or investment guaranties.

The ESPP outlines how the DFC will put into practice its commitment to the development goals through its environmental and social review and monitoring processes. Specifically, the DFC will ensure through its processes that projects receiving support:

- Are environmentally and socially sustainable.
- Are compatible with low and no-carbon economic development.
- Avoid prejudice and discrimination and respect Human Rights, including the rights of Workers and the rights of Project Affected People.
- Avoid adverse impacts and, if such impacts are unavoidable, properly mitigate or compensate for the impacts.
- Undertake Meaningful Consultation with Project Affected People regarding project activities.
- Are undertaken in countries that are taking steps to adopt and implement laws that extend Internationally Recognized Worker Rights.

This ESPP implements applicable environmental and social requirements and procedures contained in U.S. law and, the International Finance Corporation's ("IFC") Performance Standards on Social and Environmental Sustainability and Industry Sector Guidelines.

In APPENDIX B of the latest version of DFC Standards [DFC, 2020] there is a Categorical Prohibitions for specific type of projects, including 19 project types than are excluded from any financing process. <u>The Shipyard under study is not classified under any of those categorial prohibition cases</u>.

2.4 World Bank Policies and Guidelines

2.4.1 Policies

The objectives of the WB's environmental and social safeguard policies are to prevent and mitigate undue harm to people and their environment in the project development.

These policies provide guidelines for WB and borrower staffs in the identification, preparation, and implementation of programs and projects.

The main document describing the World Bank Policy for environmental impact assessment is “Operational Policy/Bank Procedure (OP/BP) 4.01 Environmental Assessment”. The objective of the OP/BP 4.01 is to ensure the environmental and social soundness and sustainability of the investment project. In addition, the policy supports integration of environmental and social aspects of projects in the decision-making process.

The OP/BP 4.01 Environmental Assessment consists of seven basic elements:

1. Environmental Screening
2. Environmental assessment (EA) documentation
3. Public consultation
4. Disclosure
5. Review and approval of EA documentation
6. Conditionality in loan agreements
7. Arrangements for supervision, monitoring, and reporting

2.4.2 Guidelines

The EHS Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP) and are referred to in the World Bank’s Environmental and Social Framework and in IFC’s Performance Standards.

The EHS Guidelines contain the performance levels and measures that are normally acceptable to the World Bank Group, and that are generally considered to be achievable in new facilities at reasonable costs by existing technology.

When host country regulations differ from the levels and measures presented in the EHS Guidelines, projects will be required to achieve whichever is more stringent.

The EHS Guidelines applicable to the Project refer to ambient air quality, treated sanitary sewage discharges and noise level. Those Guidelines are illustrated in Tables 2.1 – 2.3.

Table 2.1 WHO Ambient Air Quality Guidelines (https://www.ifc.org)

	Averaging Period	Guideline value in μg/m^3
Sulfur dioxide (SO_2)	24-hour 10 minute	125 (Interim target-1) 50 (Interim target-2) 20 (guideline) 500 (guideline)
Nitrogen dioxide (NO_2)	1-year 1-hour	40 (guideline) 200 (guideline)
Particulate Matter PM_{10}	1-year 24-hour	70 (Interim target-1) 50 (Interim target-2) 30 (Interim target-3) 20 (guideline) 150 (Interim target-1) 100 (Interim target-2) 75 (Interim target-3) 50 (guideline)
Particulate Matter $PM_{2.5}$	1-year 24-hour	35 (Interim target-1) 25 (Interim target-2) 15 (Interim target-3) 10 (guideline) 75 (Interim target-1) 50 (Interim target-2) 37.5 (Interim target-3) 25 (guideline)
Ozone	8-hour daily maximum	160 (Interim target-1) 100 (guideline)

Table 2.2 Indicative Values for Treated Sanitary Sewage Discharges (https://www.ifc.org)

Pollutants	Units	Guideline Value
pH	pH	6 – 9
BOD	mg/l	30
COD	mg/l	125
Total nitrogen	mg/l	10
Total phosphorus	mg/l	2
Oil and grease	mg/l	10
Total suspended solids	mg/l	50
Total coliform bacteria	MPN[b] / 100 ml	400[a]

Notes:
[a] Not applicable to centralized, municipal, wastewater treatment systems which are included in EHS Guidelines for Water and Sanitation.
[b] MPN = Most Probable Number

Table 2.3: Noise Level Guidelines (https://www.ifc.org)

Receptor	One Hour L_{Aeq} (dBA)	
	Daytime 07:00 - 22:00	Nighttime 22:00 - 07:00
Residential; institutional; educational[55]	55	45
Industrial; commercial	70	70

2.5 EU Legislation

The EU has some of the world’s highest environmental standards, developed over decades. Environment policy helps the EU economy become more environmentally friendly, protects Europe’s natural resources, and safeguards the health and wellbeing of people living in the EU.

EU environmental policies and legislation protect natural habitats, keep air and water clean, ensure proper waste disposal, improve knowledge about toxic chemicals and help businesses move toward a sustainable economy.

On climate change, the EU formulates and implements climate policies and strategies, taking a leading role in international negotiations on climate. It is committed to ensuring the successful implementation of the Paris Agreement and implementing the EU's Emissions Trading System (EU ETS). In this regard, EU countries have agreed to meet various targets in the years to come. The EU seeks to ensure that climate concerns are taken on board in other policy areas (e.g. transport and energy) and also promotes low-carbon technologies and adaptation measures.

EU environment policy is based on Articles 11 and 191-193 of the Treaty on the Functioning of the European Union. Under Article 191, combating climate change is an explicit objective of EU environmental policy. Sustainable development is an overarching objective for the EU, which is committed to a 'high level of protection and improvement of the quality of the environment' (Article 3 of the Treaty on European Union).

The fundamental EU legislation regarding environmental protection and waste management is presented below:

- Commission Decision 2000/532/EC: Replaces Decision 94/3/EC establishing a list of wastes pursuant to Article 1(a) of Council Directive 75/442/EEC on waste and Council Decision 94/904/EC establishing a list of hazardous waste pursuant to Article 1(4) of Council Directive 91/689/EEC on hazardous waste (notified under document number C (2000) 1147) - Classification of waste according to their source of origin, their type and their attributes, with a 6-digit code. CDW are classified in Chapter 17.

- The European Waste Catalog (EWC), in accordance with the Annex to Decision 2002/532/EC, as amended by Commission Decisions 2001/118/ EC, 2001/119/EC and 2001/573/EC.
- Regulation (EC) No 166/2006 of the European Parliament and of The Council of 18 January 2006 "concerning the establishment of a European Pollutant Release and Transfer Register and amending Council Directives 91/689/EEC and 96/61/EC".
- Directive 2008/98/EC: On waste and repealing certain Directives – Waste Framework Directive (WFD).
- Commission Decision 2011/753/EU: Establishes rules and calculation methods for verifying compliance with the targets set in Article 11(2) of Directive 2008/98/EC of the European Parliament and of the Council.
- Commission Decision 2014/955/EE: Amends Decision 2000/532/EC on the list of waste pursuant to Directive 2008/98/EC of the European Parliament and of the Council.
- Directive 2018/851/EU: Amendment of the Directive 2008/98/EC on waste (WFD): The goal is to incorporate, in the WFD, the targets of the Circular Economy.

Many other legislative EU acts are presented in the next paragraph (National Legislation) as incorporated into the Greek Law.

2.6 National Legislation

2.6.1 General

In general, the legislative framework for waste management and environmental protection in Greece is defined by Law 4042/2012 which incorporates the EU Waste Framework Directive - WFD (2008/98/EC) into Greek law. All provisions in the WFD related to waste management and environmental protection are valid for Greece and form the legal basis for the waste management in the country.

The Greek Ministry of the Environment and Energy (YPEN) is responsible for environmental and energy policy, setting the scope of national policy concerning the management of waste and drawing the draft legal framework for waste management and environmental protection.

2.6.2 Alternative Waste Management

According to National Legislation, "Alternative management" is defined as: "the collection, transport, temporary storage, reuse, processing and recovery of specific waste streams, so that by reusing or recovering them they return to the current market or are promoted to other uses". The Alternative Management Systems approved by the Hellenic Recycling Agency (HRA) cover the following waste streams:

- Packaging waste
- Lubricating Oil Waste (LOW)
- Used Vehicle Tires
- Waste Batteries & Accumulators
- End-of-Life Vehicles
- Waste Electrical and Electronic Equipment (WEEE)
- Waste from Excavations, Constructions and Demolition (ECDW)

The creation of Alternative Management Systems is based on the principle of Extended Producer Responsibility (EPR), which uses financial incentives to encourage producers to design more environmentally friendly products and renders them responsible for the cost of product management at the end of their life cycle. Greece has included in the institutional framework of alternative management a range of waste streams for which there are clear quantitative targets for recycling and recovery in European legislation, but not necessarily in the context of extended producer responsibility, such e.g., ECDW (Excavation, Construction and Demolition Waste). In this context, all producers/holders (manufacturers, traders, importers) are obliged to either organize or participate in Alternative Management Systems.

For the implementation of the legislation for the alternative waste management in Greece, the Hellenic Recycling Agency (HRA) has been established (under the control of YPEN) to supervise all operations regarding the re-use, recycling, and recovery of all waste streams. Individual or collective Systems are approved, monitored, and controlled by the HRA. The Systems constitute private entities known as Producer Responsible Organizations (PROs) which are set by law for the alternative management of the waste generated by their operations.

PROs are non-profit organizations, and they are responsible for organizing and supervising the operations of alternative management (collection, transport, recovery etc.) of CDW conducted by public or private legal bodies on behalf of the System and for informing the public administration and CDW holders about their obligations according to law.

The structure of actors and their responsibilities within the system of alternative waste management is theoretically sufficient to divert significant quantities of waste from landfills or illegal dumping to recovery.

2.6.3 Legislative Acts by category

The national legislative acts concerning environment and waste management in Greece is presented hereinafter. Relevant acts are presented in different categories, covering the different aspects of waste management, protection of the environment and other relevant social and environmental issues.

Waste Management Framework

- Law 4042/2012 (OG 24A/13-2-2012): "Criminal protection of the environment - Harmonization with Directive 2008/99/EC - Waste generation and management framework - Harmonization with Directive 2008/98/EC - Regulation of the Ministry of Environment, Energy and Climate Change"– The environmental protection through criminal law is instituted.

Environmental Legislation/Environmental Permits

- Law 4014/2011 (OG 209A/21-09-2011): “Environmental licensing of projects and activities, regulation of arbitrariness in connection with the creation of an environmental balance and other provisions under the competence of the Ministry of Environment” - Describes the framework, conditions and demands for Environmental Licencing.
- MD 1958/2012 (OG21B/13-01-2012):"Classification of public & private projects and activities in categories and subcategories according to article 1, par. 4, of Law 4014/2011 (Government Gazette 209A / 2011)" as has been amended and is in force”.
- MD 48963/2012 (OG 2703B/05-10-2012): "Content specifications of Decisions for the Approval of Environmental Terms for projects and activities of category A 'of No. 1958/13-01-2012 decision of the Minister of Environment, Energy and Climate Change (B '21), as in force, according to article 2 par. 7 of law 4014/2011 (A' 209) ".
- MD 1649/45/2014 (OG 45B/15-01-2014) "Specialization of the opinion procedures and the way of informing the public and participation of the interested public in consultation during the environmental licensing of projects and activities of Category A of the decision of the Minister of Environment, Of Energy and Climate Change No. 1958/2012 (OG 21), in accordance with the provisions of article 19 paragraph 9 of Law 4014/2011 (OG 209), as well as any other relevant details ".
- YPEN/Directorate of Environmental Permit/37674/10-08-2016 (OG 2471B/2016): “Amendment and codification of the ministerial decision 1958/2012 - Classification of public and private projects and activities in categories and subcategories according to article 1 paragraph 4 of Law 4014/21-09-2011 (OG 209/A/2011) as amended and in force”.
- JMD 43942/4026/2016: “Organization and operation of Digital Waste Registry (DWR), in accordance with its provisions Article 42 of Law 4042/2012

(A '24), as in force" - Regulates the organization and operation of the DWR, the mandatory electronic registration and recording of bodies, companies and facilities involved in the production and processing of waste, as well as in the waste collection and transport processes.

- YPEN/Directorate of Environmental Permits Decision 11936/836/2019: "Determination of procedure and supporting documents for the installation and operation of projects and activities of "Environmental Infrastructure Systems - Relates environmental permitting procedure with Waste Processing Facilities and the Organized areas for disposal of residues from waste processing.
- Law 4685/2020 (OG 92A/07-05-2020): "Modernization of environmental legislation, integration into the Greek legislation of the Directives 2018/844 and 2019/692 of the European Parliament and of the Council and other provisions" - Article 89 amends Law 4495/2017 regarding construction/demolition activities. Also, Article 85 excludes Collectors/Transporters of non-hazardous solid waste (including CDW), from any licensing obligation.
- JMD No. 92108/1045/Φ.15/09-09-2020 (OG 3833/B): Classification in categories of par. 1 of article 1 of law 4014/2011 (AD 209), of the processing and related activities provided in the provisions of the joint ministerial decision under no 3137/191/Φ.15/21-3-2012 (OG 1048), as in force, according to the provisions of par. 9a of article 20 of law 3982/2011 (A΄ 143).

Waste Management/Alternative Management

- Law 2939/2001 (OG 179A/06-08-2001): "Packaging and alternative management of packaging and other products. - Establishment of a National Organization for the Alternative Management of Packaging and Other Products (EOESAP) and other provisions" - For the first time the concepts "Alternative Management" and "Alternative Management System" as long as their basic operating principles are defined. EOESDAP is also instituted (transformed to HRA by Law 4042/2012).

- P.D. 82/2004 (OG 64A/02-03-2004) "Replacement of 98012/2001/1996 JMC" Definition of measures and conditions for the management of waste oils "(B'40)" Measures, terms and program for the alternative management of Waste Lubricating Oils ".
- JMD 36259/1757/E103/2010: "Measures, conditions, and program for alternative management of excavation, construction and demolition waste (ECDW)" - Fundamental definitions for ECDW (per 6-digit code -chapter 17, including 01 04 03 and 10 13 14 codes), PROs and ECDW Alternative Management Systems, obligations of PROs, general conditions for ECDW management (collection, transport, recycling) and quantitative targets for reuse, recycling and recovery of materials from CDW.
- Circular No. Pr. 129043/4345/08-07-2011: "Implementation of legislation for the management of non-hazardous solid waste"
- MD 23615/651/E.103/14 (OG 1184 /09-05-2014) "Definition of rules, terms and conditions for the alternative management of electrical and electronic equipment waste (WEEE), in accordance with the provisions of Directive 2012/19/EC "on waste electrical and electronic equipment (WEEE)", of the European Parliament and of the Council of 4 July 2012 and other provisions.
- Law 4496/2017 (OG 170A/8-11-2017): "Amendment of Law 2939/2001 on Alternative Management of Packaging and Other Products, Harmonization with Directive 2015/720/EU, Regulations of the Hellenic Recycling Agency (HRA) and other provisions"

Asbestos Management

- PD 43/2003 (OG 44/A /21-02-2003): "Amendment and supplementation of PD 399/94 "Protection of workers from risks related to exposure to carcinogens at work, in compliance with Council Directive 90/394/EEC (221/ A)"

- MD 82/2003/2003 (OG 1045/B'/29-07-2003): Amendment of the Presidential Decree 445/83 (166/A) in line with the Directive 1999/77/EC (EE L207/6-8 -1999) "for the sixth amendment to the technical progress of Annex I of the Directive 76/769/EEC on the approach of laws, regulations and administrative provisions of the Member States relating to restrictions on the marketing and use of certain dangerous substances and preparations (asbestos).
- PD 212/2006 (OG A΄ 212/09-10-2006): "Protection of workers exposed to asbestos at work, in compliance with Directive 83/477/EEC, as amended by Directive 91/382/EEC and Directive 2003/18/EC of the European Parliament and Council".
- JMD 4229/395/2013 (OG 318/B`/15-02-2013): Requirements for the establishment and operation of enterprises carrying out demolition and asbestos removal works and/or materials containing asbestos from buildings, structures, facilities and vessels, as well as maintenance, coating and encapsulation of asbestos and/or materials containing asbestos

Hazardous Waste Management

- MD 20655/2897 (OG 1495/ B '/2015) - Incorporation of Directive 2014/103 (ADR 2015 - RID 2015) "Adaptation of Greek legislation to the provisions of Commission Directive 2014/103/EU of 21 November 2014 on third adaptation to the scientific and technical progress of the Annexes to Directive 2008/68/EC of the European Parliament and of the Council concerning the internal transport of dangerous goods and the codification of 35043/2524 (OG 1385 /B '/ 2010), 52280/4720 (Government Gazette 2640 / B' / 2011), 52167/4683 (Government Gazette 37/B '/2012) and 40955/4862 (OG 2514 /B' /2013).

- MD 13588/725/2006 (OG 383/B): "Measures, conditions and restrictions for the management of hazardous waste in accordance with the provisions of Council Directive 91/689 / EEC "On hazardous waste" of 12 December 1991, as amended and in force".
- JMD 24944/1159/2006 (OG 791/B): "Approval of General Technical Specifications for the management of hazardous waste according to article 5 (par. B) of joint ministerial decision no. 13588/725 "Measures, conditions and restrictions for hazardous waste management, etc. " (BD383) and in accordance with the provisions of Article 7 (par. 1) of Council Directive 91/156 / EC of 18 March 1991, as amended and in force".

Town Planning Legislation

- Law 4067/2012 (OG 79A/09-04-2012): "New Building Regulation" - Article 17 stipulates that for the construction of any building and the landscaping of the building surroundings, the provisions of the relevant legislation for alternative management of waste from excavation, construction and demolition waste should be applied.
- Law 4495/2017 (OG 167A/03-11-2017): "Control and protection of the Building Environment and other provisions" - Provides for the mechanisms and means of quality control of the building environment, regulates the framework of construction, the control of the implementation of spatial planning, the issues related to public areas and the environmental balance. It also addresses arbitrary construction and other matters within the competence of YPEN

Water Management

- JMD 5673/400/1997 (OG 192/B/14-3-1997): "Measures and conditions for urban wastewater treatment"

- PD 51/2007 (OG 54/A/2007) “Definition of measures and procedures for the integrated protection and management of waters in accordance with the provisions of the Framework Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy "
- MD 145116/02-02-2011 (OG 354B/08-03-2011) "Definition of measures, terms and procedures for the reuse of treated wastewater and other provisions", as amended and in force.
- MD 182314/1241/2016 "Amendment of Annex II of article 8 of no. 39626/2208/2009 Joint Ministerial Decision (B'2075), in accordance with the provisions of Directive 2014/80/EU amending Annex II to Directive 2006/118/EC of the European Parliament and of the Council on the protection of groundwater from pollution and degradation "of the European Commission of 20 June 2014.
- Decision 903/21-12-2017 of the National Water Committee (OG 4672/B/29-12-2017) of the National Water Committee on “Approval of 1st Revision of its River Basin Management Plan Attica Water Department and the corresponding Strategic Environmental Impact Assessment ".
- Decision 41369/327/29-06-2018 (OG 2693 B/2018) of National Water Committee on "Approval of the Risk Management Plan Flood Basin of the Attica Water Department (EL06) and the corresponding Strategic Environmental Impact Assessment ".

Air Pollution

- MD 22306/1075/E103/29-05-2007 (OG B/920): “Target values and limits for estimating the concentrations of arsenic, cadmium, mercury, nickel, and polycyclic aromatic hydrocarbons in atmospheric air, with the provisions of Directive 2004/107/EC”.

- MD 9238/332/2004 (OG 405B/27-02-2004). "Limit and guideline values of atmospheric quality in benzene and carbon monoxide"
- MD 14122/549/ E103/24-03-2011 (OG B '488): "Measures to improve the quality of the atmosphere, in accordance with the provisions of Directive 2008/50/EC".
- MD 38638/2016/21-09-2005 (OG 1334B): "Limit and guideline values for ozone concentrations in the ambient air, in accordance with the provisions of Council Directive 2002/3/EC of 12 February 2002 of the European Communities".
- MD 36060/1155/E103 (OG 1450B/14-06-2013): Framework of rules, measures and procedures for the integrated prevention and control of environmental pollution from industrial activities, in compliance with the provisions of Directive 2010/75/EU "Industrial Emissions (Integrated Pollution Prevention and Control)" of the European Parliament and of the Council of 24 November 2010 (IPPC).
- JMD 174505/607/2017 (OG 1311/B/2017): "Amendment of Annexes IV and V of Article 8 of Joint Ministerial Decision No. 22306/1075/2007 (B΄920) and Annexes I, III, VI and IX Article 30 of JMD No 14122/549/2011 (BD488), in compliance with Directive 2015/1480/EU amending certain Annexes to Directives of the European Parliament and of the Council 2004/107/EC and 2008/50/EC, which lay down the rules on reference methods, validation of data and location of sampling points for the assessment of ambient air quality "of the European Commission".

Noise

- PD 1180/81 (OG 293/A/06-10-1981) "On the regulation of issues related to the establishment and operation of industries, handicrafts, all types of mechanical installations and warehouses and therefore ensuring the environmental protection in general".

- JMD 37393/2028/2003 (OG 1418/B/2003) "Measures and conditions for noise emissions into the environment from equipment for use outdoors".
- P.D. 149/2006 (OG 159/A`/28-07-2006) "Minimum health and safety standards regarding the exposure of workers to risks arising from natural factors (noise) in harmonization with the directive 2003/10 / EC"
- JMD 9272/471/2007 (OG 286/B/2007) "Amendment of article 8 of JMD 37393/2028/2003 (1418/B), in accordance with the provisions of Directive 2005/88/EC" on amending Directive 2000/14/EC on the approach of the laws of the Member States relating to the emission of ambient noise from equipment for outdoor use ", of the Council of 14 December 2005".

Waste Management Plans

- MD 51373/4684/2015 “Approval of the National Waste Management Plan (NWMP) and the National Strategic Waste Prevention Plan”.
- MD 62952/5384/2016 (OG 4326/B`/30-12-2016): “Approval of the National Hazardous Waste Management Plan (NHWMP), according to article 31 of Law 4342/2015”
- MD 31.8.2020 (OG 185 A '): "Approval of the National Waste Management Plan (ESDA) ".

Labor Law

- Law 4808/2021 (OG 101 A): “For the Protection of Labor - Establishment of an Independent Authority Labor Inspection”- Ratification of Convention 190 of the International Labor Organization for the Elimination of Violence and Harassment in the World of Labor - Ratification of Convention 187 of International Labor Organization for the Promotion of Occupational Safety and Health at Work - Implementation of Directive (EU) 2019/1158 of the European Parliament and of the Council of 20 June 2019 on the balance between work and private life, other provisions of the Ministry of Labor and Social Affairs and other urgent arrangements.

- Law 4826/21 (Government Gazette 160 A '): "Insurance Reform for the NEW GENERATION: Introduction of capital system systems, pre-defined contributions to auxiliary insurance, establishment, organization and operation of auxiliary capital insurance and security fund".
- Law 4756/2020 (OG 235 A): "Measures for strengthening the employed and vulnerable social groups, social security arrangements and provisions for them".
- MD (Ministry Labor, Social Security and Welfare) 27397/122 / 19-8-2013 (OG 2062/B/23-8-2013). "Imposition of administrative sanctions for directly proven violations of labor law, under the binding responsibility of the Labor Inspector".
- PD 180/2004: "Arrangements for the private sector employees with dependent work contracts".
- Law 3302 / 2004 (OG 267 / A / 28-12-2004): Regulation of annual leave of employees and other provisions
- PD 88/1999 (OG 94 / A / 13-5-1999): Minimum specifications for the organization of working time in compliance with Directive 93/104/EC.

Tax Law

- Law 4734/2020: Amendment of Law 4557/2018 (OG139) for the prevention and suppression of money laundering and terrorist financing Incorporation in the Greek legislation of Directive (EU) 2018/843 (L 156) and of Article 3 of Directive (EU) 2019/2177 (L 334) and other provisions
- Law 4646/2019: Tax reform with a development dimension for tomorrow's Greece.
- Law 4537/2018: Transposition into Greek legislation of Directive 2015/2366 / EU on payment services and other provisions

- Law 4493/2017: Ratification of the Memorandum of Understanding and the Agreement between the Government of the Hellenic Republic and the Government of the United States of America for the improvement of the international tax compliance.

Ports & Harbors

- Law 4878/2022 - OG 3/ A / 17-1-2022: Ratification of the Implementation Agreement between the Government of the Hellenic Republic, the Government of the Republic of Cyprus and the Government of the State of Israel for the Sub-Regional Emergency Plan for Marine Pollution from oil
- Law 4504/2017 (OG 184/A/29-11-2017): Lifelong training of staff of the Ministry of Shipping and Island Policy, strengthening transparency and meritocracy in matters of competence of the Ministry of Shipping and Island Policy, strengthening social participation in coastal shipping, civil issues completing provisions for port projects and other provisions.
- JMD 3122.3-15/79639/2016 (OG 3085B/28-09-2016): Amendment of the joint ministerial decision 8111.1/41/2009 (OG 412 BD): Measures and conditions for port reception facilities for waste generated on ships and cargo residues in accordance with the provisions of Directive No. 2007/71/EC”.
- MD 699/B/27-3-1978: “Elefsis Port Regulation” as amended and in force.

Occupational Health and Safety

- PD 34/2022 (OG 93/A/13-05-2022): “Amendment of Annexes I, II and III of Presidential Decree 396/1994 (A '220), as is valid, in order to adapt the Greek legislation to the provisions of Directive (EU) 2019/1832 of the Commission of 24 October 2019 "for the amendment of the annexes I, II and III of Council Directive 89/656/EEC as regards purely technical adaptations "(EU L279 / 31-10-2019).

- MD 29164/755/2019 (OG 2686/B/2-7-2019): “Categorization of violations and determination of the amount of fines imposed by the Labor Inspectors of the Labor Inspection Body (SEPE)”.
- MD 50067/28/2017 (OG 3952 / B '10-11-2017): “Electronic database for the registration of Safety Manager and the procedure for assigning the duties of a Safety Manager through SEPE “.
- PD 120/2016 (OG 203/A`/26-10-2016) “Harmonization with Directive 2013/35/EU “on the minimum health and safety requirements regarding the exposure of workers to risks arising from natural factors (electromagnetic fields) (20th special Directive within the meaning of Article 16 (1) of Directive 89/391/EEC) and repealing Directive 2004/40/EC".
- Law 3850/2010 (Government Gazette 84 / A /2-6-2010): Ratification of the code of laws for the health and safety of employees
- P.D. 17/96 (OG 11/18-01-1996): "Measures to improve the safety and health of workers at work”

Other

- Law 998/1979 (OG 289 /A/1979) on the protection of forests and forest areas as amended and in force.
- Law 3028/2002 for the protection of Antiquities and Cultural Heritage in general (OG 153 / A / 28-06-2002).
- MD 29407/3508/2002 (OG 1572B/ 16-12-2002) "Measures and conditions for the landfilling of waste".
- Law 3937/2011 (OG 60 / A / 31-03-2011) "Conservation of biodiversity and other provisions".
- JMD 1649/45/2014 (OG 45/B/2014): "Specialization of the procedures for expressing opinions, the way of information and the participation of Public and relevant Stakeholders in the public consultation during the environmental licensing of Category A projects and activities”

- JMD 37776/2645 (OG 1882B/30-05-2017): “Defining terms and conditions of establishment and operation of private gas stations for the service of vehicles and construction machinery (privately owned or contracted in any form with the owner or private service station), but also other operational needs of all kinds construction sites, mines, quarries and other temporary operating facilities as well as any other necessary details”.
- Law 4546/2018 (OG 101/Α΄/12-06-2018): “Transposition into Greek legislation of Directive 2014/89/EU "establishing a framework for maritime spatial planning" and other provisions”.

2.6.4 Dredging Management

Dredging management issues are not covered by a specific regulatory framework, both EU and National. By the end of 2020, YPEN issued the AET for Piraeus Port (Decision ΥΠΕΝ / 94701/5991/11-12-2020) and included a new status for dealing with those materials. More specifically, YPEN has imposed the adoption of the "*Updated Guidelines for the Management of Dredging Materials, of the decision IG.23/12 of the 20th Meeting of the Parties to the Barcelona Convention, 20-Dec-2017 (Updated Guidelines on Management of Dredged Materials, COP20 20-Dec-2017 - Decision IG.23 /12*”, until the establishment of a national legal framework for the management of dredges. Moreover, any dredging management work should take into account the corresponding provisions adopted in Italy, Spain and France, in the manner used as an example in the above Guidelines.

The relative legislative acts are presenting below:

- UNEP(DEPI)/MED WG.443/15. 2017. Draft Decision: Guidelines for Regulating the Dumping of Dredged Materials at Sea.
- COMISIÓN INTERMINISTERIAL DE ESTRATEGIAS MARINAS, 2015. Directrices para la caracterización del material dragado y sureubicación en aguas del dominio público marítimo-terrestre.

- Arrêté du 9 août 2006 relatif aux niveaux à prendre en compte lors d'une analyse de rejets dans les eaux de surface ou de sédiments marins, estuariens ou extraits de cours d'eau ou canaux relevant respectivement des rubriques 2.2.3.0, 4.1.3.0 et 3.2.1.0 de la nomenclature annexée à l'article R. 214-1 du code de l'environnement. NOR: DEVO0650505A Version consolidée au 03 septembre 2018
- Systema Nationale per la Protegione dell' Ambiente (2016) DOC N.81CF

2.6.5 Limit Values

Herein after, the applicable limit values for all relevant environmental parameters are presented.

Table 2.4: Air pollution Limit Values for Human Health Protection (2008/50/EK, 2004/107/EK & 2015/1480/EK)

Pollutant	Limit value	Average period	Permissible exceedances in a calendar year
Carbon Monoxide (CO)	10 μg/m^3	Maximum daily average of 8 hours	Not applicable
Nitrogen dioxide (NO_2)	200 μg/m^3	1h	18 times
	40 μg/m^3	1 year	Not applicable
Ozone (O_3)	120 μg/m^3	Maximum daily average of 8 hours	25 days per calendar year on average in 3 years
Sulphur Dioxide (SO_2)	350 μg/m^3	1 h	24 times
	125 μg/m^3	24 h	3 times
Suspended Particulates ($PM_{2.5}$)	25 μg/m^3	1 year	Not applicable
Suspended Particulates (PM_{10})	50 μg/m^3	24 h	35 times
	40 μg/m^3	1 year	Not applicable
Lead	0,5 μg/m^3	1 year	Not applicable
Benzene (C_6H_6)	5 μg/m^3	1 year	Not applicable
Arsenic	6 ng/m^3	1 year	Not applicable
Cadmium	5 ng/m^3	1 year	Not applicable
Nickel	20 ng/m^3	1 year	Not applicable

Pollutant	Limit value	Average period	Permissible exceedances in a calendar year
PAHs	1 ng/m^3 (as benzo-pyrene)	1 year	Not applicable

Table 2.5: Maximum Permissible Noise Values based on PD 1180/81

No	Type of Area	Noise Limit Value dB (A)
1	Industrial under law	70
2	Areas in which thepredominant element is industrial	65
3	Areas in which the industrial and urban elements are equally prevalent	55
4	Areas in which the urban element prevails	50

Table 2.6: Limit Values of certain pollutants for the protection of Groundwater quality [MD 1811/2011/OG 3322B'/30-12-2011]

Pollutant	Limit Value
NO_3^-	50 mg/l
Active pesticide substances	0.5 μg/l
pH	6,5-9,5
Conductivity	2500 μS/cm
As	10 μg/l
Cd	5 μg/l
Pb	25 μg/l
Hg	1.0 μg/l
Ni	20 μg/l
Cr (total)	50 μg/l
Al	200 μg/l
NH_4^+	0.5 mg/l
NO_2^-	0.5 mg/l
Cl^-	250 mg/l
SO_4^{-2}	250 mg/l
Trichloroethylene + Tetrachloroethylene	10 μg/l

Table 2.7: Limit Values of certain pollutants for the protection of Surface Waters (terrestrial and marine) quality [MD 51354/2641/E103/OG 1909B'/08-12-2010]

Pollutant (P: Priority Pollutant)	Freshwater (acute) (μg/L)	Freshwater (chronic – annual value) (μg/L)	Saltwater (acute) (μg/L)	Saltwater (chronic – annual value) (μg/L)
Aldrin (P)	3.0	—	1.3	—
Alkalinity	—	20000	—	—
alpha-Endosulfan (P)	0.22	0.056	0.034	0.0087
Arsenic	340	150	69	36
Bacteria	—	—	—	—
beta-Endosulfan (P)	0.22	0.056	0.034	0.0087
Cadmium (P)	1.8	0.72	33	7.9
Carbaryl	2.1	2.1	1.6	—
Chlordane (P)	2.4	0.0043	0.09	0.004
Chloride	860000	230000	—	—
Chlorine	19	11	13	7.5
Chlorpyrifos	0.083	0.041	0.011	0.0056
Chromium (III) (P)	570	74	—	—
Chromium (VI) (P)	16	11	1,100	50
Copper (P)	—	—	4.8	3.1
Cyanide (P)	22	5.2	1	1
Demeton	—	0.1	—	0.1
Dieldrin (P)	0.24	0.056	0.71	0.0019
Endrin (P)	0.086	0.036	0.037	0.0023
Guthion	—	0.01	—	0.01
Heptachlor (P)	0.52	0.0038	0.053	0.0036
Heptachlor Epoxide (P)	0.52	0.0038	0.053	0.0036
Iron	—	1000	—	—
Lead (P)	65	2.5	140	5.6
Malathion	—	0.1	—	0.1
Mercury (P)	1.4	0.77	1.8	0.94
Methoxychlor	—	0.03	—	0.03
Mirex	—	0.001	—	0.001
Nickel (P)	470	52	74	8.2
Nonylphenol	28	6.6	7	1.7
Parathion	0.065	0.013	—	—
Pentachlorophenol (P)	19	15	13	7.9
pH	—	6.5 – 9	—	6.5 – 8.5
Polychlorinated Biphenyls (PCBs) (P)	—	0.014	—	0.03
Selenium (P)	—	---	290	71
Silver (P)	3.2	—	1.9	—
Sulfide-Hydrogen Sulfide	—	2.0	—	2.0
Toxaphene (P)	0.73	0.0002	0.21	0.0002
Tributyltin (TBT)	0.46	0.072	0.42	0.0074
Zinc (P)	120	120	90	81
4,4'-DDT (P)	1.1	0.001	0.13	0.001

Table 2.8: Limits for Treated Sanitary Sewage Discharges (JMD 5673/400/1997)

Parameter	Units	Limit value
pH	-	6-9
BOD	mg/l	25
COD	mg/l	125
Total Nitrogen (N)	mg/l	15
Total Phosphorus (P)	mg/l	2
Oil & Grease	mg/l	10
Total Suspended Solids (TSS)	mg/l	35
Total Coliform Bacteria	MPN*/100ml	200

* MPN: Most Probable Number

2.7 EU/National vs EHS limit values

In this subsection, a comparison between local (see par. 2.6.5) and EHS (see par. 2.4.2) applicable limit values is taking place. The comparison is made on the basis of the following environmental parameters:

- Air quality
- Noise
- Treated sanitary sewage discharges

The purpose of this comparison is to identify the stringent limit values and the latter will be adopted as Project standards.

2.7.1 Air Quality

In Table 2.9 the limits set by National Legislation are compared with those proposed be EHS. Stringent limits are marked with green color and apply for the Project.

Table 2.9: Limit values for air quality applicable to the Project

Parameter	EU/Greek	EHS	Time period
Nitrogen dioxide (NO_2) μg/m^3	40	40	1 year
Nitrogen dioxide (NO_2) μg/m^3	-	200	1 hour
Nitrogen dioxide (NO_2)	200	-	18 times/year
Sulphur Dioxide (SO_2) μg/m^3	350	-	1h

Parameter	EU/Greek	EHS	Time period
Sulphur Dioxide (SO_2) μg/m^3	125	20	24h
Sulphur Dioxide (SO_2) μg/m^3	-	500	10min
Suspended Particulates (PM_{10}) μg/m^3	50	50	24h
Suspended Particulates (PM_{10}) μg/m^3	40	20	1 year
Suspended Particulates ($PM_{2.5}$) μg/m^3	25	10	1 year
Suspended Particulates ($PM_{2.5}$) μg/m^3	-	25	24h
Ozone (O_3) μg/m^3	120	100	Maximum daily average of 8 hours
Lead μg/m^3	0.5	-	Not applicable
Benzene (C_6H_6) μg/m^3	5	-	Not applicable
Arsenic ng/m^3	6	-	Not applicable
Cadmium ng/m^3	5	-	Not applicable
Nickel ng/m^3	20	-	Not applicable
PAHs (as benzo-pyrene) ng/m^3	1	-	Not applicable

2.7.2 Noise Levels

With respect to noise levels, both EU/Greek and EHS standards suggest the same limit value for industrial area, i.e., 70 d(B).

Table 2.10: Maximum Permissible Noise Values Based on PD 1180/81 and EHS (values in d(B))

No	Type of Area	Noise Limit (EU)	Noise Limit (EHS)
1	Industrial under law	70	70

2.7.3 Treated Sanitary Sewage Discharges

In Table 2.11 the limits set by National Legislation are compared with those proposed be EHS. Stringent limits are marked with green color and apply for the Project.

Table 2.11: Limits for Treated Sanitary Sewage Discharges applicable to the Project

Parameter	Units	Limit value (National)	EHS Guidelines
pH	-	6-9	6-9

Parameter	Units	Limit value (National)	EHS Guidelines
BOD	mg/l	25	30
COD	mg/l	125	125
Total Nitrogen (N)	mg/l	15	10
Total Phosphorus (P)	mg/l	2	2
Oil & Grease	mg/l	10	10
Total Suspended Solids (TSS)	mg/l	35	50
Total Coliform Bacteria	MPN*/100ml	200	400

2.8 Project Categorization according to DFC & WB Standards

According to DFC and WB Policy and Guidelines, all projects and subprojects are categorized as Category A, B, C or D based on environmental and social factors. An additional classification of Special Consideration may apply to projects that have heightened potential for adverse project- related social risks related to the involvement of or impact on Project Affected People including Workers.

(a) Category A: A proposed project is classified as Category A if it is likely to have significant adverse environmental impacts that are sensitive, diverse, or unprecedented. These impacts may affect an area broader than the sites or facilities subject to physical works. EA for a Category A project examines the project's potential environmental impact, both negative and positive, compares it with that of feasible alternatives (including the "without project" situation), and recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance.

(b) Category B: A proposed project is classified as Category B if its potential adverse environmental impacts on human populations or environmentally important areas--including wetlands, forests, grasslands, and other natural habitats--are less adverse than those of Category A projects. These impacts are site-specific; few if any of them are irreversible; and in most cases mitigatory measures can be designed more readily than for Category A projects. The scope of EA for a Category B project may vary from project to project, but it is narrower than that of Category A EA. Like Category A EA, it examines the project's potential negative and positive environmental impacts and recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance. The findings and results of Category B EA are described in the project documentation (Project Appraisal Document and Project Information Document).

(c) Category C: A proposed project is classified as Category C if it is likely to have minimal or no adverse environmental impacts. Beyond screening, no further EA action is required for a Category C project.

(d) Category D: A proposed project is reserved for initial approval of guaranties to Financial Intermediaries, which will make investments in or provide financing to projects or enterprises ("Subprojects,") engaged in activities within Categories A, B or C. Subprojects, originated by the Financial Intermediaries screened as Category D, are subsequently screened and subjected to the full scope of environmental and social assessment process including public disclosure and consultation, Greenhouse Gas emission accounting, and conditions and monitoring requirements as warranted by the nature and scope of the Subproject and its environmental and social risks and impacts.

The project under consideration is classified as Category A Project.

2.9 Project categorization according to National Legislation

The projects and activities of the public and private sector which may have an impact on the environment are classified into two categories (A and B) depending on their impacts to the environment (Law 4014/2011 & Law 4685/2020).

The first category (A) includes projects and activities that may have significant effects on the environment, and which require an Environmental Impact Assessment (EIA) in order to impose specific conditions and restrictions on the specific project or activity.

Category A projects and activities are further classified as:

A) those that are likely to have very significant impacts on the environment and constitute subcategory A1

B) those that are likely to have significant impacts on the environment and constitute subcategory A2.

The second category (B) includes projects and activities which are characterized by local and non-local effects only on the environment and are subject to general specifications, conditions and restrictions set for the protection of the environment, in accordance with the procedure laid down in Law 4014/2011 & Law 4685/2020.

According to the most recent classification of projects & activities (JMD No. 92108/1045/Φ.15/09-09-2020), the project is classified as follows:

9th Group/Industrial Activities and Related Facilities/no 189: Shipbuilding, conversion, repair, dismantling and maintenance of ships and boats > 120 m

<u>The project under consideration is classified as Category A1 Project.</u>

The evaluation of the EIA is conducted by YPEN and specifically from Directorate of Environmental Licensing. The same agency is responsible for the current edition of the Decision of Approval of Environmental Terms (AET).

3. BASELINE REPORT – CURRENT SHIPYARD CONDITIONS

3.1 Size & Location

Elefsis Shipyards are located in the bay of Elefsis, at Makria Ammos location, near the 27th kilometer of the Old National Road from Athens to Corinth. Currently, the Shipyards are operating under the name SHIPBUILDING AND INDUSTRIAL ENTERPRISES OF ELEFSIS S.A.

The total area of the Shipyards amounts to approximately 250,000 m^2, 57,400 m^2 of which is occupied by buildings. The plot is flat, with a level surface and an internal network of properly paved asphalt roads, with buildings and outdoor installations.

It should be mentioned that the rights to the exclusive use of the seashore, as well as of the seafront bordering the seashore, up to a distance of 500m from the edge of the pier, has been granted to the company "Shipbuilding and Industrial Enterprises of Elefsis S.A." for the entire duration of the operation of its facilities as a Shipyard, as defined in the Decision 278/16.4.1992 of the Prefecture of West Attica (OG 437 D').

The seashore was granted for use by the Elefsis Shipyards with the sub. Act N 2528/97. The length of the seashore is 1865m and the use includes installation and operation of quays and piers with cranes. Access to the coastline is achieved through the internal road network of the facility.

Figure 3.1: Entrance to Elefsis shipyards

3.2 Historic Land Use

Elefsis Shipyards has been operating as a shipbuilding construction and repair unit at the specific location since 1969. Before 1969 the land had nonspecific use.

The Elefsis Shipyard was founded in 1962 by Stratis Andreadis as a subsidiary of Emporiki Bank. In 1975 it came together with Emporiki Bank, to the State. In 1992 the Company was acquired by the Peratikos Group, which left in August 1995. In September 1995 the Company was placed in a special liquidation regime.

In June 1997 the Contract for the Transfer of the shipyard to the Company SHIPBUILDING AND INDUSTRIAL ENTERPRISES OF ELEFSINA SA was signed. The Convention was ratified by law in October 1997 and the Shipyard under new ownership became operational at the end of October 1997.

From 1997 to 2010, the main customer of the Shipyards was the Greek Navy. During this period, more than 15 different types of warships (including high-speed ferry type ships, fast attack crafts, missile frigates, supporting vessels etc.) were constructed and delivered.

The company, like others in its field, has been hit hard by the crisis in the European shipbuilding sector and the intense competition from Southeast Asian companies. For the last 2 years, Elefsis Shipyards are almost inactive.

3.3 Environmental Terms

The Elefsis Shipyards originally obtained an Approval of Environmental Terms from the Greek Ministry of Environment issued by Decision no. 31557/07-06-1996. In 2003 the Elefsis Shipyards received approval for the renewal and modification (due to building and mechanical modernization) of their Environmental Terms (Decision No. 119778/ 21-11-2003). A new comprehensive EIA (Annex I) was conducted in 2008 and a decision of Approval of Environmental Terms (Decision 165995/21-07-2021), was issued.

The Approval of Environmental Terms (AET) was extended in 2015 until 21/07/2020 (Decision 151143/22-02-2015). Another extension until 3rd of May 2021 (no. 66734/ 3996/15-07-2020) was granted in July 2020. Finally, at 25-06-2021 (Decision 55604/3687/25-06-2021) the latter AET extended until 03-05-2026, according to the provisions of Law 4685/2020.

3.4 Permits/Fines/Convictions

According to Greek Law, other permits and certificates issued for the Shipyard are illustrated below:

1. Permit to operate (Ref. No.: 4508/10-12-2018 No. File: Φ14.11 - indefinite duration)

2. ISO 14001:2015 Environmental Management Systems Certificate (expired in 2021)
3. ISO 9001:2015 Quality Management System Certificate (expired in 2021)
4. Active Fire-Protection Certificate (valid until 28-11-2026)
5. Use of seawater for fire-fighting purposes (valid until 31/12/2022)
6. Permit for discharge of the Biological Treatment effluent into the sea (issued 2004)
7. Regulatory Authority for Energy (RAE) exemption from obtaining production license for power generators

As presented in the above list, the fundamental permits have not yet expired. The only exception is the ISO Certificates, since the scheduled audits could not be performed during 2021.

According to the Shipyard's Legal Department, fines up to 75,000.00€ regarding sea pollution, noncompliance to environmental terms and customs violations have been imposed to the facility during the last decade.

3.5 Buildings – Structures

3.5.1 General

There are almost 150 buildings and structures (including shelters but not including port facilities) at the area of the Shipyards. Those structures may be divided in 5 main categories:

1. Repair and Construction buildings
2. Auxiliary buildings
3. Administrative Buildings
4. Service & Supply Buildings
5. Staff Service Buildings

A detailed list of buildings is presented in Table 3.1.

Buildings Classification by terms of use:

- Industrial spaces of secondary production
- Warehouses for raw materials
- Administrative buildings (Offices, Changing rooms, Sanitary facilities, Canteens, Clinics, Training schools)
- Power Stations (Electrical Substations, Compressed Air and Industrial Gas Production Station)
- Various shelters and worksites

Buildings Classification by construction standards:

- Industrial buildings and shelters made of metal
- Administrative buildings and power stations made of reinforced concrete
- Prefabricated settlements of auxiliary stumps of either wooden or composite construction with metal frames and panels.
- Prefabricated buildings (ISOBOX type etc.) for ancillary services and functions.

Buildings Classification by Number of floors:

- Industrial buildings are single-story to two-story
- The Central Warehouse building has two floors
- The administrative and other buildings are single-story to three-story

Use of uncovered surface:

- Outdoor storage
- Assembly floors
- Internal road network
- Car parks and planted flower areas
- Garbage storage areas
- Scrap storage
- Gas station
- Sandblasting area etc.

Port facilities:

- Quay wall approximately 510 m long
- Pier vertical to the quay wall, 205 m long
- Pier, extending from the quay wall, 115 m long
- Shipbuilding bed 190 m long.
- Three floating tanks
- New quay wall at the western end of the Shipyard, approximately 215 m long.

Excluding asbestos removal issues (see par. 3.11), buildings are generally in good condition and many of them are still being used, despite the fact that no works are taking place on site.

A point of interest is that there is a significant number of buildings for servicing the employees. Most of those buildings are temporary structures (e.g., containers) with no building permit as shown in Table 3.1. The process, timeline and cost of buildings legalization is presented in Chapter 6.

Table 3.1: List of Elefsis Shipyards Buildings (Reference to Drawing ENV 02)

No	BUILDING DESCRIPTION	LAND OCCUPING AREA (m^2)	TOTAL FLOOR AREA (m^2)	VOLUME m^3	No BUILDING PERMIT	LEGALIZATION OF BUILDINGS WITHOUT BUILDING PERMITS
005	AIR COMPRESSORS BUILDING	550	550	2858	4904/67	
006	MAIN SUBSTATION BUILDING	299	299	1721	4905/67	
007	FIREFIGHTING & MEDICAL STATION	417	417	1884	Δ/3898/67	
008	PPC SUBSTATION	39	39	127	21373/68	
009	TRAINEES LOCKER ROOM	246	246	789		N. 720/77
010	TRAINEES SCHOOL BUILDING	969	969	4314		N. 720/77
011	CANTEEN & (LOCKER ROOMS - WCs)	938	938	4249	32902/69	

No	BUILDING DESCRIPTION	LAND OCCUPING AREA (m^2)	TOTAL FLOOR AREA (m^2)	VOLUME m^3	No BUILDING PERMIT	LEGALIZATION OF BUILDINGS WITHOUT BUILDING PERMITS
012	METAL SHED "E" (A΄ FLOOR - SAW MILL)	1348	2604	14993	13743/68	N. 720/77
013	METAL SHED "E" (GROUND FLOOR - ELECTRICS WORKSHOP)					
014	METAL SHED OF THE SHIPBUILDING DEPARTMENT (WAREHOUSE)	318	318	2275		N. 720/77
015	SHIPBUILDING DEPARTMENT OFFICES	126	126	407		
020	SUBSTATION V & OFFICES	163	326	1304		N. 720/77
021	METAL SHED "G" (GROUND FLOOR - WAREHOUSE)	2530	6302	38571	22233/68	N. 720/77
022	METAL SHED "H" (FOUR FLOORS WAREHOUSE)					
023	TECHNICAL ADMINISTRATION OFFICES (FORMER SHIP REPAIRS OFFICE)	512	512	1954		N. 720/77
025	METAL. SHED "J+K-LP" (APPLICATION-MECHANICAL-PIPEWORKS, PROPANE GAS SHED)	7385	7385	117751	28855/69	N. 720/77
026	MAINTANENCE METAL SHED	780	882	4263		N. 720/77
029	METAL SHED "N-O-M" (OSE RAIL CARGO CARRIER WORKSHOP)	12071	12071	212730	28856/69	N. 720/77 κ' 2528 /97
030	METAL SHED FOR SANDBLUSTING & PAINTING	389	389	2915		N. 720/77

No	BUILDING DESCRIPTION	LAND OCCUPING AREA (m^2)	TOTAL FLOOR AREA (m^2)	VOLUME m^3	No BUILDING PERMIT	LEGALIZATION OF BUILDINGS WITHOUT BUILDING PERMITS
037	SUBSTATION IV & OFFICES - NAVAL DEPARTMENT	418	1001	3703		N. 720/77
043	MAIN ENTRANCE BUILDING	491	491	1670		N. 720/77
044	ADMINISTRATION OFFICES BUILDING (+ substation iii)	1109	3292	11286	28858/69	N. 720/77
045	WEIGHBRIDGE (CONTROL BOOTH)	7	7	19		N. 720/77
046	FRESH WATER PUMPSTATION (FOR DRINKING & FIREFIGHTING)	201	201	714		N. 720/77
048	LOCKER ROOM - WCs	553	1105	4145	316/89	
049	PANEL LINE BUILDING	1116	1116	10037		N. 2528/97
050	PREPARATORY SHED (ex-WOODWARE STOREHOUSE)	193	193	1049		N. 720/77
051	SHED OF DELIVERED N/G FOR OSE	654	654	3845		N. 2528/97
052	CONSTRUCTION MATERIALS SHED	40	40	152		1/2 N.1337/83(56)
053	GAS STATION (PUMP SHED)	5	5	13		N.1337/83(68)
054	N/G WAREHOUSE OF OSE	75	75	404		N. 2528/97
055	OUTPOST "B"	4	4	10		N. 720/77
056	OUTPOST "D"	4	4	10		N. 720/77
058	PROVISIONAL MATERIALS WAREHOUSE	228	228	765		N. 720/78
059	PAINTERS WAREHOUSE	75	75	255		N. 720/77
060	OUTSHOUSE OF THE ELECTRICAL WORKSHOP	12	12	29		N. 2528/97
061	CARTONS SHED	42	42	115		N. 720/77
062	GUARDHOUSE ON TOP OF WATER TANK	17	17	54		
063	BOILERS SHED	124	124	1025		N. 2528/97
064	EQUIPMENT MAINTENANCE SHED	254	254	1621		N. 2528/97

No	BUILDING DESCRIPTION	LAND OCCUPING AREA (m^2)	TOTAL FLOOR AREA (m^2)	VOLUME m^3	No BUILDING PERMIT	LEGALIZATION OF BUILDINGS WITHOUT BUILDING PERMITS
065	BUS MAINTENANCE SHED	120	120	580		N. 2528/97
066	"X-RAY" ROOM	15	15	35		
067	SHED OF SCAFFOLDS	338	338	1830		N. 2528/97
069	BUS SHED"A"	14	14	35		N. 720/77
070	BUS SHED"B"	14	14	35		N. 720/78
071	BUS SHED"C"	14	14	35		N. 720/79
072	BUS SHED"D"	14	14	35		N. 720/80
73	BUS SHED"E"	14	14	35		N. 720/81
074	BUS SHED"Z"	14	14	35		N. 720/82
075	BUS SHED"H"	14	14	35		N. 720/83
076	2-MAN OFFICE TRAILER	15	15	36		
077	2-MAN OFFICE TRAILER - TIMEKEEPING	15	15	36		
078	2-MAN OFFICE TRAILER	15	15	36		
079	2-MAN OFFICE TRAILER	15	15	36		
080	2-MAN OFFICE TRAILER	15	15	36		
081	SENE RECORDS TRAILER	15	15	36		
082	2-MAN OFFICE TRAILER	15	15	36		
083	OFFICE TRAILER	25	25	74		
084	CANTEEEN TRAILER	13	13	30		
085	CONSTRUCTION WORKS OFFICE - WOODEN TRAILER	25	25	76		N.1337/83 (80)
086	TRANSPORTS OFFICE - WOODEN TRAILER	95	95	307		N. 2528/97
087	SENE OFFICES TRAILER	59	59	152		N.1337/83
088	INVENTORY & EQUIPMENT METAL SHED	33	33	141		1/2 N.1337/83(56)
090	TUBERS DEPARMENT TRAILER	63	63	320		N. 2528/97
091	WELDERS DINING TRAILER	30	30	87		
092	CLEANING CREW TRAILER	15	15	48		N.1337/83(61)
095	PAINTERS STOREROOM TRAILER	11	11	31		N. 2528/97
096	MAINTENANCE TOOLS TRAILER	11	11	32		
097	CANTEEN TRAILER	15	15	38		
098	OFFICE SUPPLIES TRAILER	10	10	32		N.1337/83(74)

No	BUILDING DESCRIPTION	LAND OCCUPING AREA (m^2)	TOTAL FLOOR AREA (m^2)	VOLUME m^3	No BUILDING PERMIT	LEGALIZATION OF BUILDINGS WITHOUT BUILDING PERMITS
099	OSE DYEING SHED	74	74	270		
100	CONSTRUCTION SPRINGERS DINING TRAILER	43	43	123		N. 2528/97
102	CRANE OPERATORS DINING TRAILER	43	43	123		N. 2528/97
103	OSE DINING TRAILER	43	43	123		N. 2528/97
104	LAND CLEANING CREW DINING TRAILER	43	43	123		N. 2528/97
105	RETROFITTERS STOREROOM AND OFFICES	43	43	123		N. 2528/97
106	TRANSPORTERS AND CRANE OPERATORS DINING TRAILER	43	43	123		N. 2528/97
113	SAILORS DINIGN AREA	43	43	123		N. 2528/97
115	NEW CONSTRUCTION TUBERS DINING TRAILER	24	24	73		
116	INSULATION CREW TRAILER	29	29	79		
118	ENGINEERS SCHOOL BUILDING	1735	1735	6505	2510/72	
119	FORMER GROCERY STORE	303	303	1056		N. 2528/97
120	FORMER GROCERY STORE WAREHOUSE	116	116	521		N. 2528/97
124	"KATHESTIDI" HOUSE	76	76	259		N. 2528/97
125	"KOKOTSAKI" WAREHOUSE	42	42	98		N. 2528/97
126	DYES WAREHOUSE	66	66	218		N. 2528/97
127	GARAGE SHED	41	41	124		
128	MAINTENANCE SUPPLYHOUSE TRAILER	66	74	198		
129	SHIPBUILDING BERTH WATCHPOST	2	2	5		N. 2528/97
130	PARKING WATCHPOST	2	2	5		N. 2528/97
131	INFRASTRUCTURE MAINTENANCE SUPPLYHOUSE	36	36	107		
132	MAIN WAREHOUSE STORAGE SHED	148	148	770		
133	ELECTRICIANS OUTHOUSE (B)	15	15	39		
134	GARAGE SHED	40	40	119		720/77

No	BUILDING DESCRIPTION	LAND OCCUPING AREA (m^2)	TOTAL FLOOR AREA (m^2)	VOLUME m^3	No BUILDING PERMIT	LEGALIZATION OF BUILDINGS WITHOUT BUILDING PERMITS
135	WORKERS DINING TRAILER	292	292	805		
136	CLIENT OFFICE TRAILER	126	126	322		
137	OFFICE TRAILER	40	40	102		
138	OFFICE TRAILER	18	18	42		
139	CLIENTS AND VISITORS WASHROOM	12	12	31		
140	CONSTRUCTIONS OUTHOUSE	24	24	61		
141	LADDER CONSTRUCTIONS OFFICE TRAILER	18	18	50		720/77
142	NEW SHIPBUILDING SUPPLYHOUSE	367	367	2177		N. 2528/97
143	GRINDER SHED	167	167	845		
144	SHEET METAL WAREHOUSE MANAGEMENT OFFICE TRAILER	15	15	37		
145	CHEM LAB TRAILER	25	25	76		
146	DYERS AND CLEANERS OUTHOUSE TRAILER	7	7	19		
147	OFFICE TRAILER	25	25	65		
148	CONSTRUCTION MATERIALS WAREHOUSE	52	52	157		
149	INFRASTRUCTURE MAINTENANCE SUPPLYHOUSE	21	21	53		
150	ADMINISTRATION CAR SHED	52	52	153		N. 2528/97
151	AMBULANCE SHED	31	31	93		N. 2528/97
152	ADMINISTRATION CAR SHED	134	134	287		N. 2528/97
153	ADMINISTRATION CAR SHED					N. 2528/97
154	NAVAL MILITARY PERSONEL HOUSING TRAILER	30	60	149		
155	OSE MATERIAL DYEING WORKSHOP	79	79	417		N. 2528/97

No	BUILDING DESCRIPTION	LAND OCCUPING AREA (m^2)	TOTAL FLOOR AREA (m^2)	VOLUME m^3	No BUILDING PERMIT	LEGALIZATION OF BUILDINGS WITHOUT BUILDING PERMITS
156	SANDBLAST WAREHOUSE SHED	266	266	2835		N. 2528/97
157	OSE MATERIALS WAREHOUSE	171	171	767		N. 2528/97
158	ROMNEY-TOLL TYPE SHED No 1	132	132	599		1337/83 (70)
159	ROMNEY-TOLL TYPE SHED No 2	66	66	285		1337/83 (71)
160	VEHICLES SHED	303	303	1450		N. 2528/97
161	FIREFIGHTING EQUIPMENT MAINTENANCE	25	25	76		1337/83
162	SWARF CLEANING SHED	38	38	117		
163	MAINTENANCE SUPPLIES TRAILER	18	18	45		N. 2528/97
164	TACKLES AND TORCHES MAINTENANCE SHED	48	48	193		
165	CAULDRON WORKERS WAREHOUSE	21	21	61		N. 2528/97
166	DYERS OFFICE ISOBOX	23	23	68		N. 2528/97
167	INFRASTRUCTURE MAINTENANCE SUPPLYHOUSE	25	25	74		N. 2528/97
168	OXYGEN GAS TANKS SHED	133	133	654		
169	CO2 GAS TANKS SHED	24	24	86		N. 2528/97
170	CASTEEN REFRESMENTS STOREHOUSE SHED	18	18	53		1337/83
172	EQUIPEMNT MAINTENANCE SHED	25	25	76		N. 2528/97
173	WORKERS DINING TRAILER	135	135	369		
174	QUALITY CONTROL TRAILER	13	13	40		N. 2528/97
175	SUNDBLAST SHED					
176	BIOLOGICAL TREATMENT PLANT					

No	BUILDING DESCRIPTION	LAND OCCUPING AREA (m^2)	TOTAL FLOOR AREA (m^2)	VOLUME m^3	No BUILDING PERMIT	LEGALIZATION OF BUILDINGS WITHOUT BUILDING PERMITS
179	SHIP CARPENTERS OFFICE TRAILER	15	15	42		
181	FITTERS DINING TRAILER	8	8	18		N. 2528/97
185	PORTABLE AIR COMPRESSORS TRAILER	204	204	910		N. 2528/97
187	SAFETY TOOLS STOREHOUSE	36	36	131		
188	WATER TANK OUTPOST W.C.	3	3	9		
189	ELECTRONIC EQUIPMENT STOREROON	30	30	84		
191	OSE WORKS BUILDING	3050	3050	26076	756/2003	
192	WC	18	18	45		
193	SHEET METALS STORAGE SHED	2086	2086	27555		
194	TECHNICAL WORKERS ISOBOX	30	30	75		
195	TECHNICAL SERVICES OFFICES	423	785	2130		
196	WC	18	18	45		
205	DEPARTMENT BUILDING SHED	7009	7718	160186	756/2003	
	TOTAL	**54848**	**64568**	**700738**		

Buildings outside of Compound

Table 3.2: Total Area and Volume of Buildings

	Area (m^2)	Volume (m^3)
Buildings within the compound	52576	62296
Buildings outside the compound	2272	2272

3.5.2 Main Production Buildings

The main buildings associated with ship repairing and construction are (see also Drawing ENV 02 and Table 3.1):

- Auxiliary work building (carpentry, etc.) (012)
- Warehouse building (021-022)
- Fitting Machine - Pipework - Machine Shop (025)
- Boiler Shop - Rolling Mill (029)
- Shed for construction of Ships Sectors (189)
- Administration Building (044)

There is also a significant number of small buildings (mostly temporary structures and ISOBOXEs) used for servicing employees.

Figure 3.2: Administration Building & Parking Space

3.5.3 Outdoor Areas

There are many outdoor areas used for:

- Prefabrication of ship sections 38 m X 175 m
- Sandblasting
- Scrap (stored for reuse, not waste) storage

- Waste storage

3.5.4 Parking spaces

There are six parking spaces together with the laundry space and the crane parking space (see Fig. 3.2 and Drawing ENV-02).

- Outdoor parking about 11,000m^2.
- Parking lot in front and next to the headquarters 10,000m^2.
- Parking space next to the headquarters for executives 500 m^2
- Parking area one next to the gate 1,000 m^2.
- Parking space of the washing machine 650 m^2 and the
- Parking lot behind the production administration building 1,100 m^2.
- Crane parking space 300 m^2

3.5 Infrastructure/Equipment

3.5.1 Port facilities

As mentioned above, Elefsis Port Facilities include (see also Drawing ENV02):

- Two quay walls of 510 m and 215 m long
- Two piers of 200 m x 20 m and 120 m x 15 m
- Three floating tanks, in which ships can be tanked up to 120,000 DWT
- A shipbuilding bed of 55 m x 190 m, with a maximum water depth of 5 m and a slope of 5%, suitable for shipbuilding up to 100,000 DWT.

The general condition of the port facilities is summarized below. More details, along with respective environmental impacts for any additional works needed are provided in Chapters 6 and 8 of the current assessment.

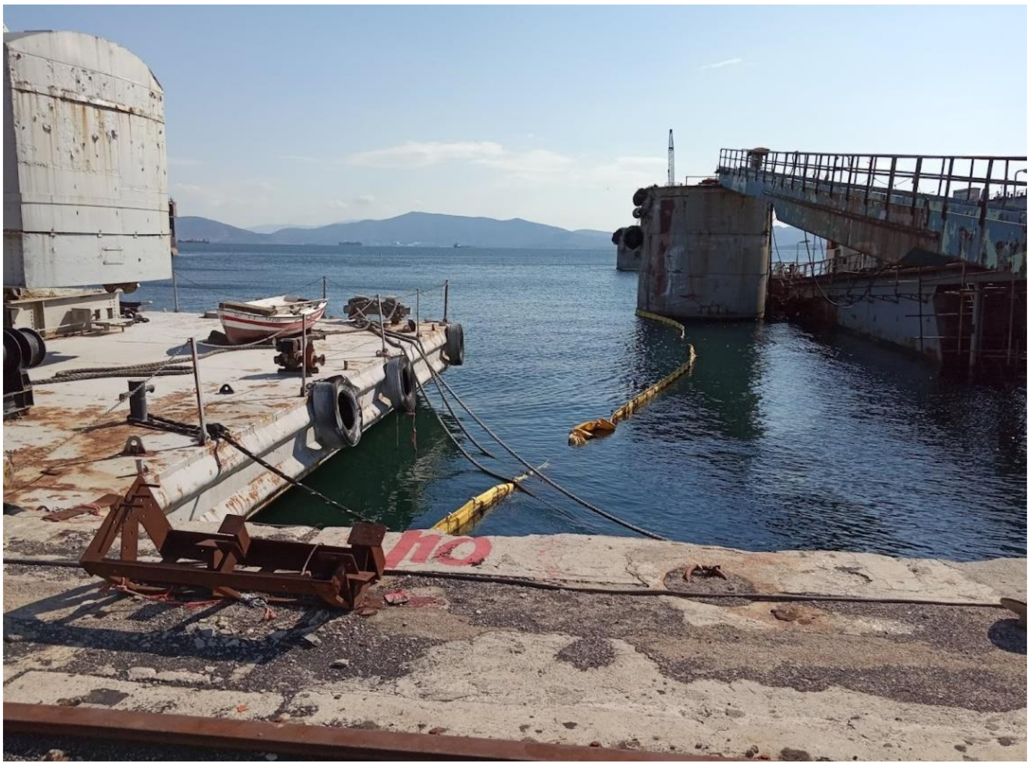


Figure 3.3: Floating Tank (under water)

Figure 3.4: Floating Tank (out of water)

Figure 3.5: Pier

Figure 3.6: Shipbuilding Bed

Quay walls: The first quay wall is 510 m long and has a foundation depth from -11.0 m to -6.5 m. The second is 215m long and it has been founded in 2010. It was constructed of artificial boulders and creates a land area of 6,000 m^2. It rests at a depth of -8.5 m, but the artificial boulder foot (to protect it against corrosion), reduces its useful depth to 7.0 m (from Average Sea Level).

Quay walls are in good condition and no repairs or maintenance is required.

Piers: There is a pier 200 m long and 20 m wide, which also has infrastructure for a crane and was built perpendicular to the quay wall at a distance of 455 m from the corner of the Shipyard. The sea depths exceed 18 m at the edge of the pier. The construction of the pier was conducted on piles.

The second pier, which continues along the quay wall, 120 m long and 15 m wide, has also been built on piles and the superstructure is 2.5 m higher from the Average Sea Level. This pier is equipped with supply channels.

The first pier is in good condition but the second (in the southern part of the Shipyard) presents significant static problems and requires immediate repairs. In Chapter 6 (Construction-Rehabilitation Phase), a technical description of the necessary works along with a cost and time-line estimation is presented. An independent engineer has been assigned for preparing the necessary assessment for the repairing works.

Floating tanks: The Shipyard has three floating tanks (FT), in which ships up to 120,000 DWT can be tanked. The main technical characteristics of the tanks are given in Table 3.3.

Table 3.3: Technical characteristics of Floating Tanks (FTs)

Description	FT No 1	FT No 2	FT No 3
Nominal tank capacity / DWT	22000	70000	120000
Lifting capacity / tn	7500	18000	28000
Total length / m	162	227	252
Maximum vessel length / m	164	230	276

Description	FT No 1	FT No 2	FT No 3
Width between walls / m	24	35	41
Maximum vessel width / m	22.8	32.2	39.8

All three floating tanks require maintenance and repair works, before being operational again, including:

- Mechanism & equipment repair &maintenance
- Rolling works
- Immersion - lift control
- Painting works
- Installation of cathodic protection
- Water jet cleaning
- Buoyancy control

Shipbuilding bed: Requires maintenance and small repairs mainly related to removal of rust and impurities.

3.5.2 Cranes - Crane bridges

There is a significant number of cranes and crane bridges necessary for conducting heavy lifting works within the facility. A short description of the relevant equipment is illustrated below:

- In the Tanks there are six (6) cranes, four (4) with a lifting capacity of 20 tons and two (2) 15 tons.
- On the quay wall one (1) 40 ton crane (west) and east two (2) 15 ton cranes (east).
- At the pier perpendicular to the quay wall one (1) crane of 15 tons.
- In the Shipbuilding Bed one (1) crane of 400 tons (Goliath).
- At the pier of the Shipbuilding Bed one (1) crane of 15 tons.

- In the Prefabrication area one (1) crane of 80 tons, one (1) crane of 15 tons and one (1) crane of 10 tons.
- On the new quay wall a crane with a lifting capacity of 15 tons

In total, the main cranes are 15.

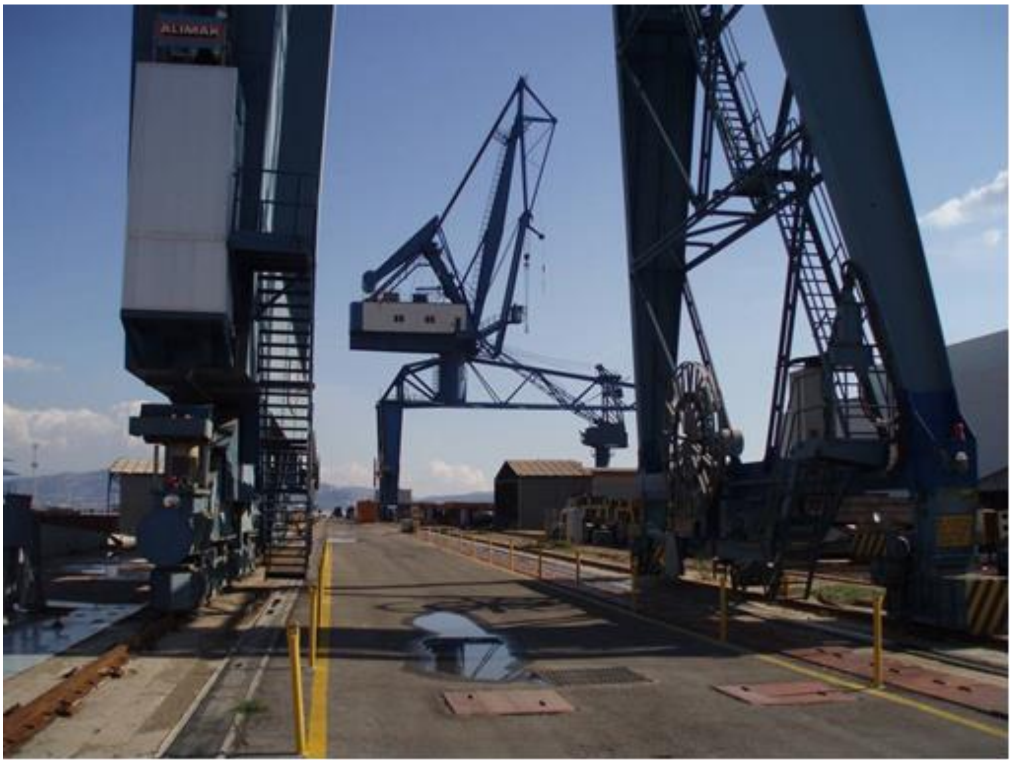


Figure 3.6: Crane

The cranes and crane bridges are in acceptable condition and may be operational after undergoing simple maintenance.

3.5.3 Service (petrol) station

The petrol station within the boundaries of the facilities is shown with no. 053 at the respective drawing and consists of:

- Two above-ground diesel tanks, with a capacity of 12,5 m^3 each
- Two underground petrol tanks (unleaded simple and super), with a capacity of 7,6m^3 and 3,6m^3
- A dual pump (diesel / Super unleaded)

- A single pump for simple lead-free petrol.

In order to deal with accidental leakage from the above-ground storage tanks, a safety basin has been constructed around the tanks with a capacity of 30.22 m^3 (i.e., 120% of the total capacity of the tanks).

The petrol station is not operational at the moment since its license has expired. The structure has been sealed by Greek Custom.

Figure 3.7: Petrol Station

3.5.4 Fire Protection Equipment

The Shipyard contains adequate infrastructure for active fire protection. Layouts of the facility fire safety plan and yard fire control plan are given in the Appendix.

The heart of the firefighting system is the permanent firefighting network. The latter is supplied with water from the sea (the relevant permit is available and not expired see also par. 3.3) and meets the requirements of Greek legislation regarding its specifications. Nevertheless, many of the hoses are out of order and require maintenance or substitution.

According to our findings from the site visit, almost all the fire extinguishers (dry powder fire extinguishers) on site had expired certificates and should have been recalled.

Certain buildings (e.g., chemicals or paints) warehouses required special means of fire protection equipment such as roof extinguishers. According to our inspection, those means are installed, but their certificates have also expired.

3.6 Networks

3.6.1 General

There are various supply networks including:

1. Sewage (see par. 3.8)
2. Drinking water
3. Drainage of rainwater
4. Electricity
5. Acetylene
6. Compressed air
7. Oxygen
8. Firefighting network (see above)
9. Nitrogen
10. Argon

Hereinafter a short description of networks is presented, along with an evaluation of their operational status.

3.6.2 Power Supply Network

There are ten (10) medium voltage substations located within the facility borders. There is also a power supply network for emergency situations. The electricity network exceeds 5,000 meters and is located mainly within supply channels. The network is divided into high voltage network and low voltage network. It is estimated that, during an average operation period, 20,000 MWh/year were consumed.

3.6.3 Drinking Water Supply Network

The Shipyards are directly connected to the Athens Water Supply and Sewerage Company (EYDAP S.A.) water system. The water supply network is about 2.0km long. There is no groundwater extraction or use for drinking or other purposes. There are no specific requirements for the quality of the water utilized, which is mainly used for cleaning purposes, as no pre-treatment procedures or galvanizing were taking place on-site.

There was also little concern in relation to the water quality for human consumption as there were several vending machines with bottled water on site.

3.6.4 Drainage Network

Stormwater is discharged through a 0.8 km drainage system towards the sea (See Figure 3.8). Although the network is well designed, in several cases, spills close to the drainage were found and the drainage channels are blocked by solid wastes.

3.6.5 Gas networks

Several gas networks are found in the facility including:

1. Acetylene network (length approximately 6.5 km) and pipes Φ40 '' - Φ50 ''

2. Compressed air network (approximately 8.0 km long) and pipes Φ125 '' - Φ8 ''

3. Oxygen network (length about 6.5 km)

4. Nitrogen and Argon Networks (these are networks of local importance depending on the service location)

Figure 3.8: Drainage network filled with solid waste

3.7 Internal Road Network

As shown in the attached topographic diagrams, access to the area under consideration is achieved through the Old National Road Athens - Corinth. Within the Complex, there is a fully developed internal road network.

Although the internal road network is generally in good condition, traffic safety has not been adequately promoted during the operation of the Shipyards. There is no Traffic Impact Study (TIS) and/or a Traffic Impact Analyses (TIA) available for the site. Road marking is rather insufficient, and no pedestrian crossing marks have been situated. Some traffic signs are also present, but not at all places necessary.

Since a new development of the Shipyards is proposed by ONEX, expected to generate augmented traffic load, a new comprehensive Traffic Impact Study (TIS) and/or a Traffic Impact Analyses (TIA) should be prepared by a competent traffic/transportation engineer.

Figure 3.10: Typical Direction Sign not conforming with traffic standards

Figure 3.11: Closer view of internal road network

3.8 Short Description of Operative Process

3.8.1 Shipbuilding

The main works, also related to waste production, included:

- Pipe Shop – Machine Shop: Development of mechanical components
- Rolling Mill - Boiler Shop: Plate preparation - Boiler manufacturing
- Pre-Construction Facilities: Welding house - Welding and assembly
- Construction: Construction of individual units
- Ship Erection/Shipbuilding: Welding of the individual units to form the boat

The heavy and light rolling mill are large, covered areas where there are cutting machines, both automatic and manual, plate forming machines, presses - rollers - scissors, welding machines as well as cranes for transporting materials.

The carpentry is involved in "carpentry" work performed on ships and for the needs of the Shipyards. In the area of the carpentry there are the necessary machinery: ribbon, planer, etc. as well as a separate area where only glazing work is done. There is adequate ventilation of the premises as well as a mechanism for suction of cutting products, sawdust, etc.

In the **Heavy Rolling Mill**, carving, cutting and shaping works of the plates and cast irons are performed. In some cases, welding works are performed for the construction of prefabricated support ships. The current production capacity of the workshop reaches 60tn per day.

The **Light Rolling Mill** manufactures and assembles the metal equipment items of the ships, both in new constructions and in repairs. It has limited equipment for cutting and shaping sheets (mechanical cutting of thin sheets), welding machines for steel, aluminum, etc. Ventilation networks have been installed in the areas where welding is performed.

In the **Machine Shop**, the machining and shaping of metals (turning, planning, milling, etc.) is performed for the construction of machine parts and connections of metal construction parts and serves the needs of all categories of projects performed in the Shipyards.

At the **Application Shop**, engines and machines of all kinds of repaired ships are opened, inspected and repaired, as well as preparation for the installation of machines, machines and mechanisms on shipbuilding ships and industrial constructions.

Pipe Shop: Designs and manufactures ship piping networks for both new shipbuilding and ship repairs. The production process includes engraving, cutting of pipes, either by mechanical means or by using flame, welding and hydraulic tests. The prefabricated sections are transported and sandblasted in the open sandblasting area and are either painted or transported outside the Shipyard for galvanizing in specialized units (galvanizing plants). In some cases, chemical cleaning of pipes is done either by immersion in a bath or by filling parts of the networks with chemicals. The workshop has a watertight floor to prevent oil spills to the ground.

The production capacity of the Pipe Shop can be expressed in equivalent pipe meters or in weight of treated material per unit time and amounts to 1500tn / year.

Boiler Shop: Repairs boilers, refrigerators, heat exchangers, performing a series of related tasks (cleaning, re-ventilation, insulation repairs, boiler insulation, etc.). Ventilation networks have been installed in the areas where welding is performed, and the floor is watertight to prevent oil spills to the ground.

Electrical Shop: It is equipped to perform measurements, adjustments and repairs of electric motors, instruments, panels, and electrical equipment in general. It has a special chamber for washing and cleaning electric motors with special chemical cleaners. The floor of the chamber is sealed to prevent oil spills to the ground.

Carpentry: The Carpentry is fully equipped for all woodworking activities, the manufacture of furniture and other wooden structures, both for the needs of the ships (new constructions and repairs), and the needs of the shipyard itself.

The workshop has a system for removing dust and suspended particles from woodworking, with a fan and air ducts connected locally to each machine. The air ducts drive the abducted dust, shavings, etc. in a silo placed outside the building.

The paints for the carpentry are mixed in a closed chamber which is equipped with a droplet holding filter.

Prefabrication/Pre-assembly

The Prefabrication area is an open construction site with specially designed floors, suitable for assembly and welding of sections of the ship. It is equipped with lifting equipment, electricity and industrial gases. The sections assembled here are from flat or curved sections of the ship to spatial sections of metal construction and special constructions (ramps, caps, etc.).

The main occupation of the workshop concerns the new constructions, but it also deals with major repairs.

The production capacity of the prefabricated amounts, in large new constructions, amounts to 250tn per week.

For prefabrication of sections in large rolling work of repaired ships or for repairs of hull covers, ramps, etc., the spaces along the pier and in front of the workshops are also used. The space is served by lifting means and in some places has special metal floors and supplies of electricity and industrial gases.

Construction - Shipbuilding Bed

The shipbuilding area is located at the eastern end of the facility. It is a sloping tank that at the end to the sea has a depth of 5m and is closed with a door boat, while at its end to the land its depth is zero. It has powerful pumps for its pumping after the closing of the doorway, lifting means with a capacity of up to 400tn and supplies of electricity, industrial gases, compressed air and water.

The prefabricated sections for the assembly and shaping of the metal construction of the ships are transported and assembled in the shipbuilding bed. To a certain extent, the ship is also equipped with equipment before launching, mainly metal equipment (stairs, rails, doors, auxiliary equipment bases, manholes), piping work, installation of axles and rudders, etc. In some cases, sandblasting and painting of the outer surface of the ship can be done before launching. In this case, the bed area is cleaned before the ship is launched.

3.8.2 Ship Repairing

The process of Ship Repairing usually involved the stages presented below:

- Dismantling and replacement of vessel parts
- Dismantling and replacement of network parts, hydraulic tests
- Inspection and control of electric motors, repair and reinstallation, wiring, inspection and repair of ship instruments
- Carpentry works

- Inspection and control of main machines and auxiliary machines, on-site repair or dismantling and transport to the workshop, re- installation
- Insulation works - dismantling of insulation and installation of new ones on sides, ceilings, pipes, air ducts, flues
- Sandblasting / painting - interior of ships (with ships moored at piers) and exterior of ships in floating tanks

In particular, the following works were performed on floating tanks:

- Reef inspections.
- Rolling work on the reefs of the boat.
- Repairs of shafts - rudders - propellers.
- Repair of sections of nets that suck or drain into the reefs of the boat.
- Repair of cathodic protection systems of the boat.
- Reef cleaning bursts.
- Sandblasting / painting of exterior parts of the boat.

3.8.3 Industrial constructions

The area of industrial constructions is closed and covered and has lifting means, welding machines of various types, supplies of electricity, industrial gases and compressed air, as well as special devices for the productive execution of the works. For painting there is a special closed chamber for painting and drying of paints (painting oven) with a controlled system of temperature, and ventilation of the space.

3.9 Products

The main products of Elefsis Shipyards were:

- Construction of new ships
- Modifications of floating means (e.g. platforms) of oil extraction
- Ship repairs

- Industrial constructions

The existing facilities at Elefsis Shipyards could build ships and other vessels up to 200m long, approximately. The length of ships constructed is strongly related to the length of the shipbuilding bed. Note that, there is a capability for shipbuilding bed expansion, so as to build even longer ships. During the last 20 years, more than 30 ships (mainly Navy warships) were successfully constructed and delivered.

From 1997 to 2019, more than 2000 ships, commercial and transport ones, both foreign and Greek, were repaired at the Elefsis Shipyards.

During the same period, cranes were constructed at the Elefsis Shipyards for the Thessaloniki Port Authority, pressure vessels for the Aspropyrgos Refineries, fly ash deposits for the Public Power Corporation lignite mines, etc. The shipyards industrial constructions also provided various types of wagons for the Hellenic Railaways Organization.

3.10 Waste Management Facilities - Biological Treatment Unit

3.10.1 General

In the Elefsis Shipyards a Biological Treatment Unit has been installed for treating the sewage coming from the sanitary areas of the employees. The system includes:

1. The collectors where the local collection of wastewaters from adjacent sanitary areas takes place.

2. The sewage transport network from the collectors to the Biological Treatment plant almost 2.0 km long.

3. The Biological Treatment plant.

Figure 3.12: View of the Biological Treatment Unit

The collectors have been constructed in the form of a septic underground tank. The sewage piping network includes the automatic sewage suction pumps from the collectors and the piping network for the transport of sewage to the Biological Treatment plant. Each collector has two pumps, one of which is standing by and is only activated when the first malfunctions. The pumps are automated via a regulator and start when the liquid level reaches a certain threshold and stop when it reaches the lower limit. The entire system is designed and operated to ensure the minimum residence time of sewage into the collectors.

The system of Biological Treatment of Elefsis Shipyards collects and treats only the urban wastewater produced in their various areas of activity. Liquid waste derived from any other operational activity such as petroleum products, chemicals, etc. are not taken into account in the operation of the Biological Treatment system.

It is noted that the facility was originally designed for treating up to 260 m^3 of wastewater, corresponding to 3,500 people.

Due to the long distances between the different supply points and the lack of altitude differences, the wastewater is collected at the Biological Treatment Plant by collectors, through special sewage pumps. Two direct suction pumps are installed at each pumping point, one of which is auxiliary. Both pumps operate automatically via a level regulator.

Generally, the biological treatment plant, despite the fact that it works properly today, requires maintenance, especially with respect to the static condition of the tanks.

Hereinafter, a description of the biological treatment plan operation is presented.

3.10.2 Wastewater Loads

The treated wastewater overflowing from the sedimentation tank contains a maximum of:

- Total organic load (BOD_5) 30 ppm
- Total Suspended Solids (TSS) 40 ppm

3.10.3 Chlorination

Sewage overflowing from the effluent tank is disinfected by chlorination. An amount of 4-5 ppm of chlorine, in the form of a hypochlorite solution, is added to the outgoing water, utilizing a dosing pump. The chlorination tank has a capacity of 5-6 m^3, so that the chlorination lasts at least 20 minutes.

3.10.4 Drying Beds

Three drying beds with a total area of 60 m^2 have already been constructed. Their construction was designed based on the prospect of employing 3,500 people. The water drained from the settling tank is channeled into the chlorination tank then is led together with the treated wastewater to the final destination.

3.10.5 Final Discharge

The discharged water is channeled into the sea, near the area of the ventilation tank and at a depth of more than one meter from the surface. This is necessary in order to achieve the best dispersion and mixing with seawater at the point of discharge.

3.11 Waste Management Status

3.11.1 Waste Sources

The Shipyard is practically inactive for almost 2 years. Hence, any solid waste (apart from some municipal ones) has been stored temporarily and are stable with respect to their quantities. Those waste has been generated from the activities of the shipyard at the points shown in Table 3.4:

Table 3.4: Waste Sources from previous Shipyards Operation

Floating Tanks, Pier	• Sandblasting sand • Petroleum sludges • Lint, sawdust, etc. materials contaminated with oil • Empty packages of paints and lubricants • Household waste
Outdoor space & indoor sandblasting machine	• Sandblasting sand • Empty paint packages
Workshops	• Scrap, grease, various metals, damaged components • Empty lubricant packages • Batteries & accumulators • Waste electrical & electronic equipment • Household waste
Office buildings	• Household waste • Paper/Cardboard • Mixed batteries

In the following paragraphs, the abovementioned wastes are categorized with respect to EWC codes and their current management practices on site.

3.11.2 Waste Categorization & Quantities

According to the most recent official waste report (YPEN/Digital Waste Registry - DWR platform), the waste present on site by the end of the year 2021 are illustrated in Table 3.5.

Table 3.5: Quantities of stored waste per EWC-code

EWC Code	Description	Quantity Stored at 31/12/2021 (t)	Year Storage has started
12 01 17	waste blasting material other than those mentioned in 12 01 16 (i.e., non-hazardous)	3.701,48	2015
15 01 06	mixed packaging	0,50	2018
15 01 10*	packaging containing residues of or contaminated by hazardous substances	5,50	2018
16 06 01*	lead batteries	1,50	2017
16 07 08*	wastes containing oil	159,36	2015
17 04 05	iron & Steel	25,00	2021
20 03 01	mixed municipal waste	100,00	2018
20 01 36	discarded electrical and electronic equipment other than those mentioned in 20 01 21, 20 01 23 and 20 01 35	1,00	2017

It should be noted that Table 3.5 does not make any reference to *asbestos containing waste*. The latter is evaluated in specific paragraph of the current study (3.11.4).

a. <u>Sandblasting sand</u> (EWC code: 12 01 17)

The used sandblasting sand was collected from the floating tanks and the outdoor sandblasting area together with the remains of the closed sandblasting machine and is temporarily stored as described in the next paragraph. Periodically, it was delivered to properly licensed companies for further management or re-use. No such deliverance or transportation has taken place in the last 6 years.

The characteristics of the material have been explored several times by shipyards in recent years [Sahinoglou, 2008]. In 2003, a Research was carried out by the NTUA and Professor D. Kaliambakos on "Characteristics of sandblasting waste" on behalf of the Shipyards, while in 2007 the company Intergeo S.A. carried out analyses to determine the characteristics of the material, the risk assessment and the available solutions for its utilization or disposal. In addition, during the year 2004, the Development Association of Municipalities and Communities of Thriasio Pedio took samples and carried out analyses, which were then sent for evaluation to the Ministry of Environment, Physical Planning and Public Works.

Based on the results of the above research, the following conclusions were drawn:

- The sandblasting sample meets the conditions for its disposal in a landfill as non-hazardous waste, and the parameters examined did not exceed the limits for inert materials, except for chlorides and TDS.
- The material consists mainly of oxides of iron and silicon, while the detectable amounts of heavy metals do not pose a risk to the environment in case of disposal in landfills due to the low concentrations in the extraction samples, proving its adequate entrapment in the mass of the material.

b. Solid petroleum products (EWC 16 07 08 *)

Petroleum residues from ship tanks as well as any kind of solid materials contaminated by petroleum products (e.g., sawdust) were collected in open tanks and drums and were periodically delivered to a licensed hazardous waste management company. No such deliverance or transportation has taken place for the last 6 years. All relevant data are declared on the annual waste reports on the DWR platform.

c. Packaging Waste (EWC 15 01 06 and 15 01 10*)

Paint cans, metal lubricant packaging barrels and metal deionized water packaging barrels are included. Paint cans are collected in a remote open area of the Shipyard (see par. 3.11.3) and used to be collected for alternative management at regular intervals. Nevertheless, no such collection or transportation has taken place during the last 3 years.

It is possible that many of the packaging waste are containing hazardous substances from their previous use. Hence, they are categorized under code 15 01 10*: *packaging containing residues of or contaminated by hazardous substances*

d. Batteries and accumulators (EWC- codes 16 06 01*)

These consist mainly of lead-acid batteries, as well as mixed household type batteries. They come from vehicles, cranes, portable devices and, often, from repaired ships. They can be divided by size, into large ones (lead-acid) and small ones (mainly household type, batteries for small mobile devices).

Until 2018, they were periodically collected by competent licensed companies. All relevant data are declared on the annual waste reports on the DWR platform. No such collection or transportation has taken place for the last 4 years.

e. Waste electrical and electronic equipment (EWC code: 20 01 36)

The waste of electrical and electronic equipment consists mainly of personal computers and peripherals (printers, screens etc.). There also some old refrigerators, not containing any hazardous substances, since cooling agents have been removed.

f. Metal scrap, grit, metal scraps, damaged parts (EWC code: 17 04 05)

These are temporary collected in bins in the individual parts of the facility where they are produced. When the bins are full, they are transported to a designated area (see next paragraph) where they are separated and delivered to properly licensed companies for further management or re-use. A portion of them can be re-used within the facility and do not end-up as waste.

g. Mixed Municipal Waste (EWC code: 20 03 01)

This refers to waste that has been collected from ships visiting the site in the past. Other source of this waste are the daily activities of the working personnel. Most of this waste is not biodegradable and includes non-hazardous packaging, paper & cardboard, glass and plastics. Very small quantities of biodegradable waste are present within the bulk of municipal waste gathered in a designated area (see next paragraph).

3.11.3 Waste Storage Areas

There are several waste storage areas within the facility as described below.

a. Sandblast Waste Storage Areas

There are 3 areas within the facility that sandblast waste is stored:

A1. Area 1: It consists of a metal storage shed, previously used for the storage of the original sandblast (before used in ship cleaning), as shown in Figure 3.13 and in Drawing no ENV 02 and ENV 05. The shed is open on one side and the sandblast waste is exposed to rain and wind.

Figure 3.13: Sandblast waste storage Area 1

Figure 3.14: Sandblast waste storage Area 2

Figure 3.15: Sandblast waste storage Area 3

A2. Area 2: This also consists of metal shed and the sandblast waste was stored there prior to transport for further management. That shed is also open on one side and exposed to rain and wind.

A3. Area 3: A large pile of sandblast waste has gathered next to the municipal waste storage area, totally exposed to the elements (Figure 3.15)

Petroleum Waste Storage Areas

There are 2 Areas that petroleum related waste is stored.

a. Area 1: It consists of an open area partially covered by a metallic shed where petroleum waste mainly in the form of polluted solids and sludges are stored in open steel drums/tanks without any cover (Figure 3.16). Wastes are coming from previous ship cleaning and repairing procedures. The area lies on top of concrete floor which is damaged in some parts and spills to the soil were observed. No spill prevention measures have been adopted so far.

b. Area 2: It consists mainly of an open area, partially covered by a metallic shed. In this area, mainly liquid waste (oily waste derived from ships) is stored in steel tanks. The area possesses a drainage system that leads any spillage to an underground containment tank (Figure 3.17). Nevertheless, during site inspection, the tank was overflowing with rainwater and oily residue is leaking from the underground tank.

Electrical & Electronic Equipment Storage Area

This consists of a small area, on top of concrete floor as shown in Figure 3.18. Mainly old computers and peripherals are stored here before being delivered for further management. There is also a small portion of refrigerators not containing hazardous substances Nevertheless, no collection or transportation of those wastes has been reported during the last 5 years.

Figure 3.16: Petroleum waste storage Area 1

Figure 3.17: Petroleum waste storage Area 2

Figure 3.18: Electrical & Electronic waste storage area

Packaging Waste Storage Area

It consists of an open metallic shed as shown in Figure 3.19. Wastes are placed on a top of concrete floor to avoid possible soil contamination. Most of those waste is categorized as “packaging containing hazardous substances”.

Figure 3.19: Packaging Waste Storage Area

Used Batteries Storage Area

Currently, used batteries are stored in an indoor area on top of a wooden floor. They are to be delivered to an Alternative Management System for recycling, but no such action has happened in the past 5 years.

Figure 3.20: Used Batteries Storage Area

Mixed Municipal Waste Storage Area

This consists of an area on the western part of the facility, where temporary storage of municipal waste coming from visiting ships was taking place. There, even with no recent waste collection, waste has piled up over the years.

It should be noted that, following our inspection, no smells or leaking of waste were observed. The bulk of the municipal waste is non-biodegradable, with very small quantities of biodegradable waste.

Metals & Scrap Storage Area

For scrap and metal waste, an open area with soil ground is used, as it is shown in Figure 3.22. Other waste of similar types is temporarily collected in bins, close to their source.

Figure 3.21: Mixed Municipal Waste Storage Area

Figure 3.22: Metals and Scrap Storage Area

3.11.4 Asbestos Waste

Asbestos cement sheets are present in several buildings and other structures within the Shipyard area. Asbestos is present mainly in roofing sheets and wall cladding as it is shown in Figures 3.23 and 3.24. In many cases (Figure 3.23) the asbestos sheets are heavily damaged, being a significant threat to human health.

Asbestos materials have been traced in the buildings shown in Table 3.6 (reference also to Drawing ENV 02).

Table 3.6: Asbestos Cement Material present in buildings

Building No	Type of Building	Estimated Surface Covered by Asbestos (m^2)	Estimated Quantity of Asbestos (kg)
12 – 13	METAL SHED "E" (A΄ FLOOR - SAW MILL) METAL SHED "E" (GROUND FLOOR - ELECTRICS WORKSHOP)	2,500	400
21 – 22	METAL SHED "G" (GROUND FLOOR - WAREHOUSE) METAL SHED "H" (FOUR FLOORS WAREHOUSE)	5,500	880
25	METAL. SHED "J+K-LP"(APPLICATION-MECHANICAL-PIPEWORKS, PROPANE GAS SHED)	12,000	1,920
29	METAL SHED "N-O-M" (OSE RAIL CARGO CARRIER WORKSHOP)	20,000	3,200
	Totals	**39,000**	**6,800**

It is estimated that a total surface of 39,000 m^2, including roofs and walls, is covered by asbestos cement material. According to its specifications, 1m^2 of that material weights approximately 16kg. Consequently, from the entirety of the main buildings, a total quantity of 6,8 tons of asbestos should be removed.

A smaller portion of asbestos is also present in some of the ISOBOX buildings and on outdoor sheds that do not possess building permit. This amounts to an additional area of 500m^2 covered by asbestos sheets, and approximately 80 kg of asbestos more.

Figure 3.23: Asbestos present in damaged wall cladding

Figure 3.24: Asbestos present in wall cladding (2)

3.12 Materials Status & Storage

Raw materials used for the activities of the Shipyard include:

- Sheets
- Prefabricated ship sections
- Hardware of various types, shapes, and quality
- Machinery and spare parts
- Thin sheets and molds
- Pipes of various diameters and quality of material
- Flanges, shrinkage and other components
- Cables
- Electrical instruments
- Electrodes
- Industrial gases
- Paints and solvents

- Sandblasting material
- Oils and lubricants for machinery and equipment
- Cleaning petroleum products
- Anti-rust liquids

There is a significant quantity of the abovementioned raw materials stored in various warehouses within the facility. Hereinafter, some critical (in terms of safety) areas are examined.

3.12.1 Chemicals/Solvents/Oils/Lubricants

Those materials are used during ship repairing operations and they are stored in a designated warehouse within the facility (see also Figure 3.25 and Drawing ENV 02), where some metallic bins containing waste are also found, as shown in Figure 3.25.

The floor of the warehouse is concrete, but the intrusion of water is obvious in several locations. Saw-dust is accessible for dealing with any accidental spillage. The firefighting system is in place and operational (roof fire extinguishers and hoses), but lights and electrical panels are not in accordance with ATEX 2014/34/EU regulation. Fire extinguishers certificates have also expired.

Figure 3.25: Chemical, Oils & Lubricants Storage Area

3.12.2 Paints

Paints are also stored in a designated area (see also Figure 3.13 and Drawing ENV 02). Paints have been stored for ship repairing and maintenance works, and they are certified to follow the Marine Equipment Directive (MED) guidelines and the Mutual recognition agreements (MRA) conducted between EU and third countries. The Producing Company has generally invested in anti-fouling and ballast water cleaning technologies.

As in the case of the chemicals warehouse, the floor is concrete, but the intrusion of water and salts formations are obvious in several spots. Saw-dust is again available for dealing with any accidental spillage. The firefighting system is in place (roof fire extinguishers and hoses), but lights and electrical panels are not conformed with ATEX 2014/34/EU regulation. Fire extinguishers certificates have also expired.

Finally, it should be mentioned that, due to the cease of Shipyards operation, a significant quantity of paints may expire soon, thus creating a waste stream that requires appropriate management.

Figure 3.26: Paints Storage Area

3.12.3 Industrial Gases

No industrial gases are stored in the warehouses of Elefsis Shipyards. Only empty gas canisters are stored in the Packaging Waste Storage Area waiting for refill.

3.13 Personnel

3.13.1 Workforce Distinution & Demographics

The ENVITERRA team gathered information from the Shipyards Administration Records, about the workforce currently employed. According to those records, the distribution of the workforce in the Elefsis Shipyards is presented in the Table 3.7.

Table 3.7: Workforce distribution at Elefsis Shipyards (data from January 2022)

POSITIONS	Employee	Handymen	Total
Accountants	7	0	**7**
Administrative Officers	25	0	**25**
Analyst-Programmers	1	0	**1**
Assistant Accountants	6	0	**6**
Automotive Cleaners	0	1	**1**

POSITIONS	Employee	Handymen	Total
Automotive Conductors	0	1	**1**
Automotive Electricians	0	1	**1**
Automotive Technicians	1	0	**1**
Carpenters	1	7	**8**
Chemical Engineers	1	0	**1**
Civil Engineers	1	0	**1**
Cleaners	0	4	**4**
Cleaning Services	0	2	**2**
Conductors	1	16	**17**
Crane Operators	2	17	**19**
Deck Builders	1	14	**15**
Designers	1	0	**1**
Dock Workers	1	9	**10**
Drivers	6	1	**7**
Electrical Engineers	2	0	**2**
Electricians	3	45	**48**
Electronics Engineers	2	0	**2**
Engineers	1	0	**1**
Firemen	5	21	**26**
Floating Tanks and Ship Beds Technicians	0	1	**1**
Guards	20	0	**20**
Hewers	1	12	**13**
Hoisting Equipment Operators	1	8	**9**
Insulation Workers	1	7	**8**
Inventory Managers	1	0	**1**
Janitors	1	5	**6**
Lawyers	3	0	**3**
Licensed Electrical Engineers	1	0	**1**
Licensed Electricians	1	0	**1**
Licensed Naval Engineers	6	0	**6**
Licensed Shipwrights	4	0	**4**
Mechanics	22	0	**22**
Mechanical Engineers	3	0	**3**
Millwrights	4	33	**37**
Naval Engineers	8	0	**8**
Nurses	3	0	**3**
Outdoors Cleaning Crew	1	6	**7**
Physician	1	0	**1**
Plumber/Steamfitters	1	6	**7**
Programmers	2	0	**2**
Propeller Millwrights	2	7	**9**
Provisional Linking Technicians	1	7	**8**
Quartermasters	1	5	**6**
Radiographers	1	0	**1**
Riggers	0	2	**2**
Rolling Mill Line Workers	5	29	**34**
Rolling Mill Operators	1	23	**24**
Safety Technicians	2	4	**6**
Sand Blaster Painters	2	8	**10**

POSITIONS	Employee	Handymen	Total
Secretary	15	0	**15**
Ship Carpenters	0	4	**4**
Ship Janitors	1	7	**8**
Solderers	2	19	**21**
Technical Assistants	7	0	**7**
Topman	0	1	**1**
Tube Makers	5	26	**31**
Tugboat Captain	1	0	**1**
Tugboat First Lieutenant	1	0	**1**
Tugboat First Mechanic	1	0	**1**
Tugboat Licensed Pilot	1	0	**1**
Tugboat Sailors	2	0	**2**
Tugboat Second Mechanics	2	0	**2**
Welders	3	27	**30**
	209	**386**	**595**

The educational level of the current employees is presented in Table 3.8.

Table 3.8: Educational Level of Elefsis Shipyards Employees (data January 2022)

a/a	Education Level	Number
1	PhD	1
2	Master Degree	8
3	Bachelor Degree	40
4	Advanced Technical School	32
5	Certificate of Captain	5
6	Highschool Degree	90
7	Technical School Degree	296
8	Middle School Degree	77
9	Elementary School Degree	46
	Total	**595**

This number represents the current workforce employed in the site and fluctuates depending on the active tasks, time period and needs of the facility at a 15-20% rate. About 70-75% of the employees live in the nearby towns of the area.

In periods of increased productivity, the Shipyard has employed up to 1200 people, usually contracted for smaller periods, and 300-400 outside contractors. In periods of low productivity, at least 60-70 people are kept in reserve each day as a maintenance crew, manning three shifts.

The average age of the 209 employees is 50,9 years, and of the 386 handymen 47 years. The average age of the entire workforce is 48.4 years. In general, the market is considered to be in decline during the last 15 years and, as an effect, there is an increase in the average age of the workforce as there is a decrease in young blood entering the field. In case of future increase in production there will be a need for more welders and riggers. That said, depending on the project undertaken, no changes may be needed in the existing workforce.

3.13.2 Salaries & Retirement

Given the cascading changes in the insurance legislation, according to the new laws, about 35 members of the workforce are considered eligible for retirement, while this number is estimated to increase to include 70 or 80 more people in the near future.

According to the total cost of salary expenses is 1,360,000.00 euros per month. This number is divided as follows: 730,000.00 euros towards payrolls, 130,000.00 euros towards insurance cots of the employees, 285,000.00 euros towards insurance costs of the employer, and 215,000.00 euros towards payroll tax cuts.

3.13.3 Unions activities, strike history, specific arrangements

During the past decade there have been some events of strikes from the employees, given the political and economic state in Greece. Usually, participation in strikes is organized by -and follows the lead of- organized Unions. The workforce has and organized Union represented by a team of 13 members, with whom there is a constant open channel of communication for the immediate resolution of any needs and demands, usually involving day to day working of the facility. Demands usually involve salary negotiations for the entirety of the workforce.

3.14 Occupational Health and Safety

Elefsis Shipyards are not certified according to OHSAS 18001. Regarding occupational hazards, a detailed assessment was conducted by National Technical University of Athens (NTUA), back in 2001. Obviously, the assessment requires an update, so as to be aligned with the current legislation and standards.

The Shipyards have assigned two of their engineers as safety technical managers, responsible for the implementation of the Occupational Hazards Assessment.

Hazardous areas are properly singed (see for example Figure 3.27), but the protective equipment needs maintenance and/or substitution.

Finally, the Shipyard possesses a fully equipped First Aid / Medical Station and occupies a full-time doctor and nurses.

Work accidents were dealt according to Greek legislation requirements. No fatal work accidents have happened in the last 20 years. According to facility's records, no serious accidents that led to injury or loss of life have occurred in the facility for the same period. Also, there are no notes of any serious long-term effects to health caused by the working environment.

Figure 3.27: Safety signs in the entrance of Chemicals Warehouse

4. ENVIRONMENTAL BACKGROUND

4.1 Study Area - Definitions

The terms "intervention area", "immediate study area" and "wider study area" are used to determine the scale of analysis followed in the present study.

The area in which the proposed project is to be implemented (i.e., the area of the Shipyard) is considered as the intervention area. It is the narrow area of the project which will be directly affected by the construction/rehabilitation works and the future operation of the Shipyards.

The immediate area is the area of 1 km on either side of the project as also defined in Ministerial Decision 170225/20-01-2014. In this area it is more likely to identify direct and indirect effects coming from construction/rehabilitation and operation phase.

The wider area is defined as the area in which the analysis of the present study is extended to cover, in the most efficient way, the description of the respective environmental sectors as well as any cumulative effects and synergies with other projects and activities. More specifically, the wider land area of the project refers to the "Thriassion Plain". That is a plain of Attica peninsula, located 25 km west of the metropolitan area of Athens, surrounded by Aigaleo Mt. (453 m) to southeast, Parnitha Mt. (1410 m) to the north and Patera Mt (450 m) to the west. It covers a surface of 250 km^2 and comprises the towns Elefsina, Aspropyrgos, Mandra, and Magoula (Figure 4.1).

Finally, the coastal part of the study area, called the Elefsis Bay, is named after the largest ancient settlement of Elefsis. The Elefsis Bay is part of the Saronic Gulf, which spreads over an area of 2,600Km^2. The Saronic Gulf is situated north and west of the coast of Attica, west of the coast of Corinth and southwest of the Argolic Gulf. It is geographically separated from the Aegean Sea by the comprehensible limit between

Poros and Sounio (about 45km distance). The Saronic Gulf reaches from 38o 03’N to 37o 27’N and from 23o 00’E to 24o 02’E. (Figure 4.1).

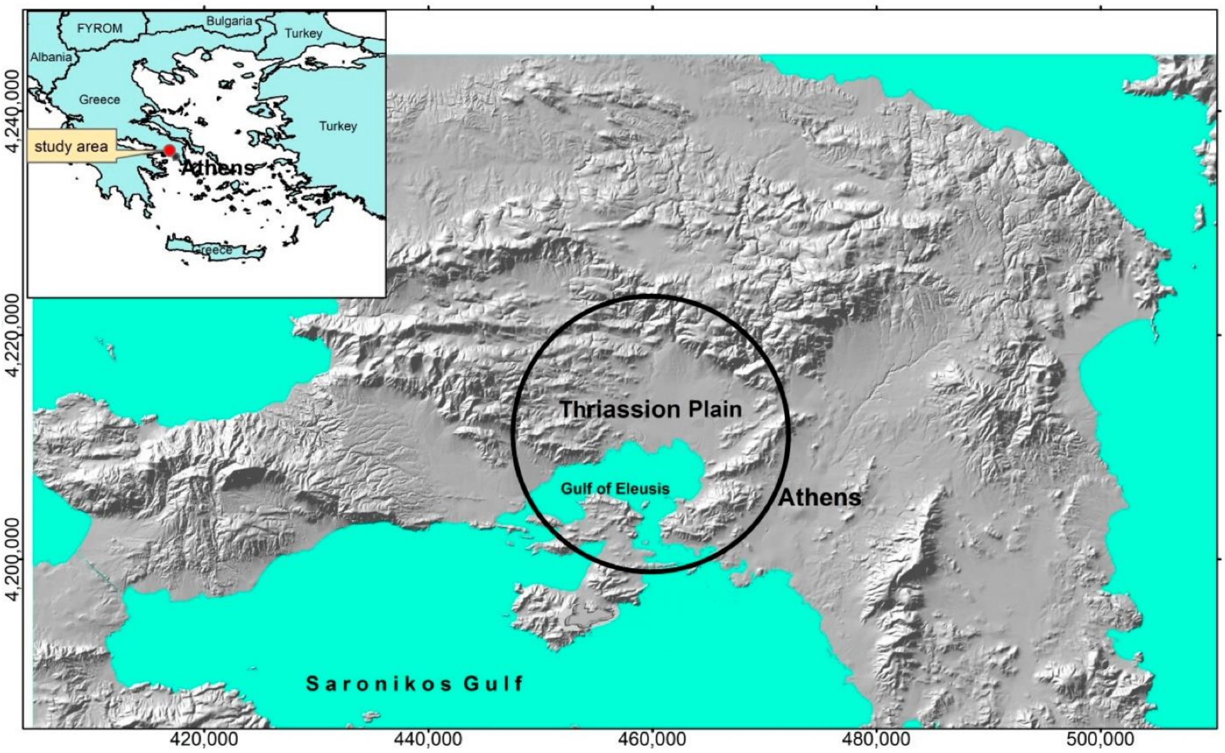


Figure 4.1: The Triassion Plain, the Elefsis Gulf and the Saronic Gulf (Wider Study Area)

4.2 Climate and Meteorological Data

4.2.1 General

The eastern and southeastern parts of Central Greece exhibit a terrestrial Mediterranean climate. The Mediterranean climate is generally characterized by rainy winters and droughts with high temperatures during the summer months. Proximity to the sea makes the climate milder, while in the mainland, as distance from the coast increases, winters grow harsher and the summers warmer.

In the area of the project, the climatic conditions match the ones prevailing throughout the Attica region. That is, Mediterranean climate, with semi-dry - warm summer and mild winter (Emberger diagram – See Figure 4.5).

For the investigation of the climatic conditions of the wider study area, data from Elefsis Station of the Greek National Meteorological Service were used. The above station was selected for its proximity to the study area and provides satisfactory recordings of meteorological data over a significant period of time (1958-2020). The station is located at longitude 23° 56' E, latitude 38° 06' N and at an altitude of 20m and is operated by the National Meteorological Service (Directorate C/Department of Hydrology).

The following meteorological parameters were selected for the present study:

- Wind
- Temperature (in C °), namely the average temperature (dry thermometer, calculated as the average temperature at 6:00, 12:00, 18:00 and 24:00), the mean and the absolute maximum temperature, as well as the mean and the absolute minimum temperature.
- The relative humidity (%)
- Mean cloud cover (for sky coverage greater than 6.5 / 8)
- Number of days with precipitation (rain) and precipitation height
- Snowfall

4.2.2 Wind

According to the wind direction data for the area, as presented in Figure 4.2, the prevailing wind directions point north. Regarding the seasonal fluctuations of the wind intensity, it is observed that the strongest winds manifest during July and August (over 7 on the Beaufort scale). It can rarely go over 8 but such speeds are hardly if ever observed for more than a day a year in total), while strong winds (over 6 on the Beaufort scale) occur in the months of January, February, March, June, September, and October for short periods of time.

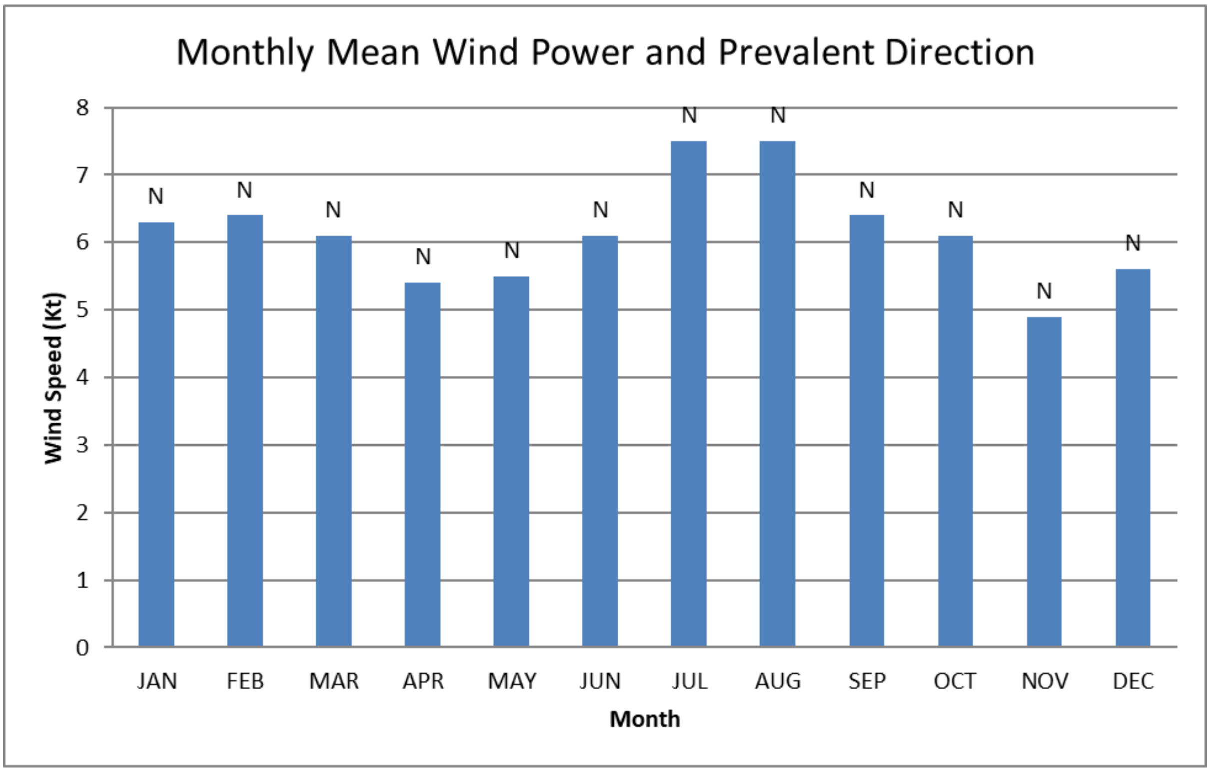


Figure 4.2: Monthly mean wind power and direction for the study area

4.2.3 Temperature

Temperature exhibits the following annual variations:

- Mean temperature: The highest value of the mean temperature occurs in July (28.6°C), with high values also appearing in August (28.2°C). The lowest mean temperature appears in January (9.2°C), with low values also in February (9.7°C) and December (10.9°C).
- Maximum temperature: Mean maximum temperature values per month are observed in July (32.9°C), August (32.7°C), June (30.6°C) and September (28.9°C). The highest temperature ever noted, from 1958 to 2010, for July was 48°C, for June 43.8°C and for August 43.5°C.
- Minimum temperature: Lowest values of the average minimum temperature per month are observed in January (5.4°C), February (5.6°C), March (7.1°C) and December (7.2°C). The lowest temperature for the period 1958-2010 for January and February was -5.0°C and for December -3.0°C.

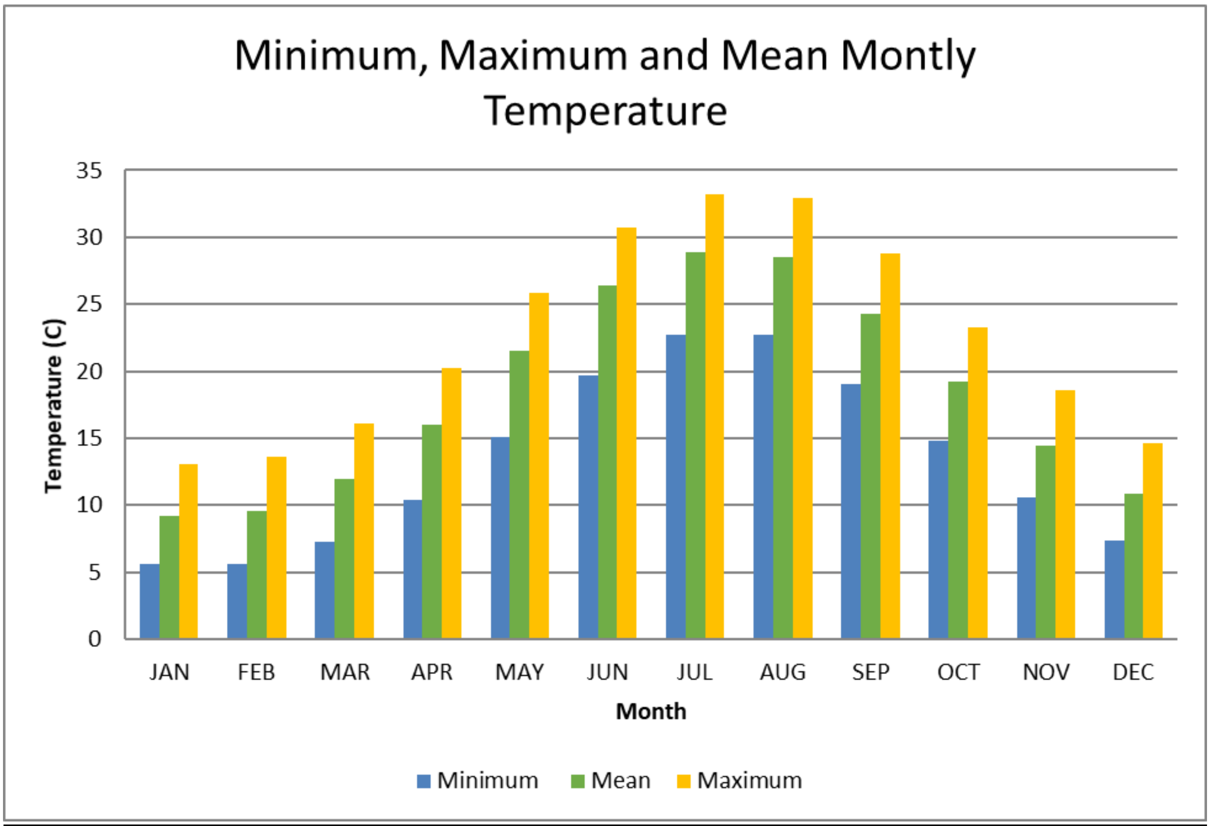


Figure 4.3: Monthly mean temperature for the study area

4.2.4 Humidity

The average relative humidity exhibits minimal annual fluctuation:

- The highest values are observed in December and January, the most humid months at 73.3 and 72.0% respectively, and relatively high values also appear in November (70.8%), February (69.9%), and March (67.2%) .
- The minimum value is found in July (42.8%), with relatively low percentages also observed in the months of August (44.5%) and June (46.6%).

4.2.5 Cloud Coverage

The area has an annual average of 43.2 cloudy days (>6.5/8) (12% of the year). Most cloudy days are observed during January (8.2), February (6.4), March (6.6) and December (7.1). On the other hand, June (0.3), July (0.1), August (0.1), and September (0.4) have the least cloudy days.

Accordingly, it is estimated that the area enjoys an average of 322 sunny days per year.

4.2.6 Precipitation & Snowfall

The average number of rainy days throughout the year is 87 (23.8%),

Most rainy days are observed in December (12.3), January (11.8), February (11.0) and March (10.6). Precipitation during the year averages 372.9mm, most of which falls during November (58.8mm), December (67.9mm) and January (48.4mm).

June (8.4mm), July (5.5mm) and August (5.4mm) exhibit minimal to no precipitation.

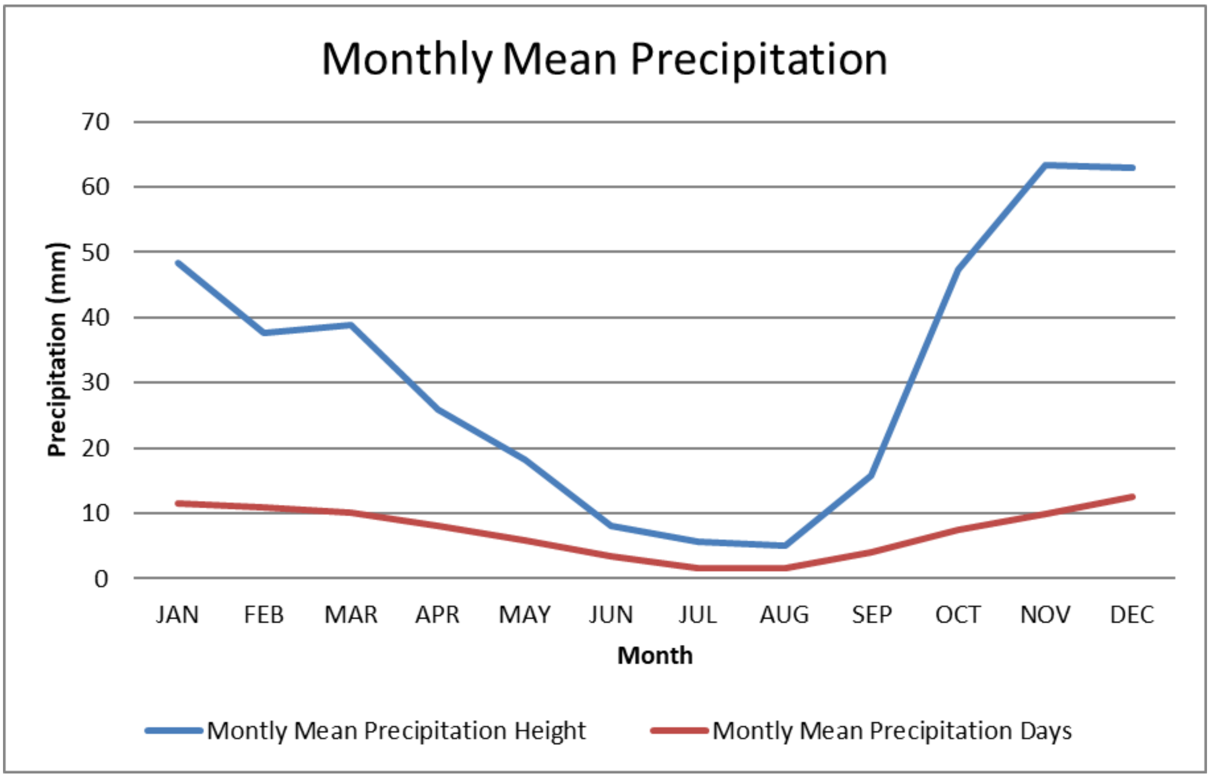


Figure 4.4: Monthly mean precipitation for the study area

The days of snowfall in the area are few and far between (3.4) and usually if ever happens in November (0.1), December (0.4), January (1.3) and February (1.1).

No snowfall is noted throughout the rest of the year.

4.2.7 Bioclimate

The individual climatic factors examined above (wind, temperature, rain, relative humidity), interact with each other and with the geography and flora of the region, creating a complex ecosystem. For the Mediterranean region, the results of this interaction are better captured in and explained by the Emberger formula (ombrothermal quotient, Dafis 1986):

Where: Q_2 = omvrothermal quotient

P = annual precipitation in mm

M = mean temperature of the warmest month in ° C

m = mean temperature of the coldest month in ° C

and so, in our case: **Q2 = 46.42**

The smaller the quotient Q, the drier the climate.

For the Mediterranean region, Emberger distinguishes seven bioclimates or bioclimatic floors:

- Very dry (deserted) climate
- Dry
- Semi-dry
- Semi-wet
- Wet
- Ultrawet
- Mediterranean climate of high mountains

The individual bioclimates or bioclimatic floors are divided into five sub-levels: warm, temperate, cool, cold and very cold. This distinction is made on the basis of the average value of the minimum temperatures of the coldest month (m ° C) as follows:

- 7°C<m: warm, warm winters without frost
- 3°C<m<7°C: temperate, mild winters, rare frost
- 0°C<m<3°C: cool, cold winters, frequent frost
- -10°C<m<0°C: cold, severe winters, frequent persistent frost
- m<-10°C: very cold, very severe winters, prolonged frost

According to the above and based on the meteorological data and the pluviometric coefficient, the study area is part of the semi-dry bioclimatic floor, with mild winters.

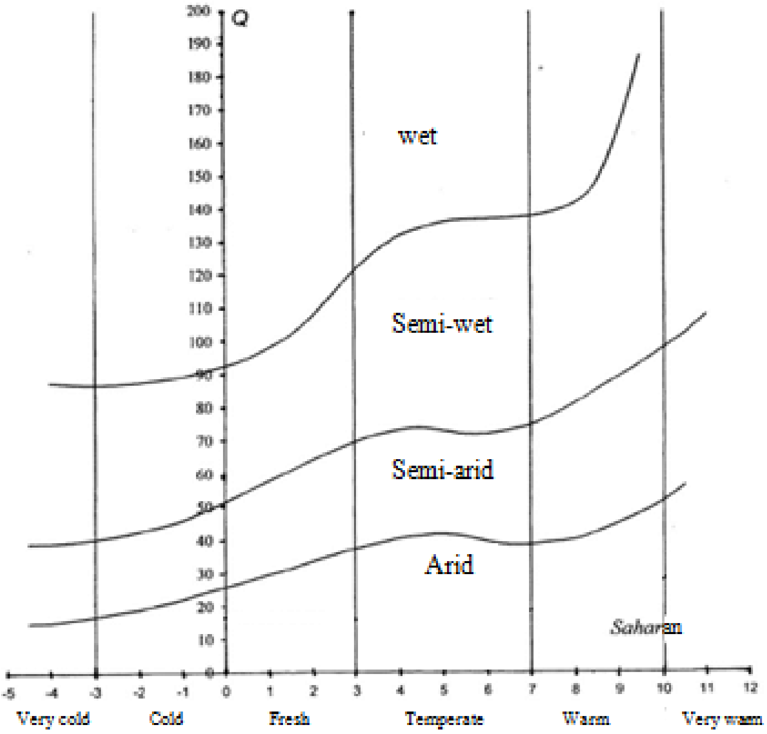


Figure 4.5: Emberger Diagram

4.2.8 Hydrology

The hydrological study of a basin consists in the most accurate determination of the hydrological parameters, as those appear in the equation of its hydrological equilibrium, namely:

P = R + E + I

where:

P = the volume of the annual atmospheric precipitation

R = the volume of surface water

E = the volume of water, which is lost through evaporation

I = the volume of the infiltrating water.

Estimation of the hydrological equilibrium of the study area is not possible, as it is not a single basin, but includes sections of several sub-basins. Even if it was feasible, it would not be possible to calculate a hydrological equilibrium due to lack of necessary data, such as measurements of surface runoff, magnitude of springs, evapotranspiration, penetration, etc.

Surface runoff

The quantity of water that flows superficially from the area is very small, however this have not been determined by measurements.

The fact that most of the project area is covered by carbonate rocks, which usually have a high degree of decomposition, contributes to the extremely reduced surface runoff.

Most streams in the area are intermittent, some sustaining flow for only a few hours and only after heavy rainfall, when in a short period they receive a large quantity of water.

Only in areas of watertight formations, i.e., neo-Paleozoic rocks, Neogene sediments and quaternary clay deposits, the streams that pass through retain water for a relatively longer period, depending on their scale.

The most important of these streams, i.e., those with banks on watertight formations within the study area, are the streams Mavratzas and Kamaras in the basin of Megara. Since a substantial part of these streams flows through neonatal sediments, they retain water for longer periods after rainfall. Moreover, the water that flows through them rarely reaches the sea, as it penetrates into the quaternary deposits of the coastal zone.

Regarding the other streams of the area, only Sarandapotamos and specifically its length in Pelkes, retains small amounts of water in various lengths of its route, for a long time. It retains water mainly in its length that passes through the valley of Oinoi, where a large part of the ground consists of impermeable formations, i.e., practically impermeable neo-palaeozoika layers and quaternary deposits. These waters penetrate the bedrock when they reach areas where the stream bed passes through limestone.

Figure 4.6: Hydrographic network of the wider area

<u>Penetration</u>

Penetration, i.e., the process through which water passes through the surface layers of the soil and moves towards the aquifer, is the most important part of the hydrological cycle, since the quantities of water that enter the aquifers annually through it, constitute the majority of the annual replenishment of groundwater storage. The rate of infiltration is expressed as the quotient of water entering the soil to the annual height of precipitation, as follows: I = x 100 = 51.2%

Table 4.1: Average annual and average monthly water values in the limestone areas of Parnitha – Kithairon during the application of the Kessler coefficients

Month	Monthly distribution of rainfall Parnithas - Kithairon	Penetrating water within the limestone

	Monthly percentage	Equivalent in mm	Percentage per Kessler	Equivalent in mm
October	11,2	74,7	12,3	9,1
November	12,7	84,3	24,3	19,9
December	18,1	120,6	51,3	62,0
January	17,6	116,7	50,2	58,8
February	11,9	79,3	73,3	58,3
March	10,0	66,9	123,6	82,8
April	5,3	35,1	65,4	23,1
May	4,7	30,7	47,2	14,5
June	2,4	15,6	28,7	4,5
July	1,4	8,7	20,6	1,8
August	0,9	5,6	18,1	1,3
September	3,8	25,1	15,6	3,9
Annual	100,0	663,3	-	340,0

Evapotranspiration

The evaporation of an area depends on the following key factors:

- Humidity of the air
- Soil moisture
- Vegetation and its type
- Air temperature
- Amount of rainfall
- Fall and distribution through the rocks

Moreover, Figure 4.7 graphically presents the fluctuation of the above three factors during the year.

Data show that the average annual relative humidity is rather low, at 60.7%; a characteristic of the dry climate of the region. The driest month is August with a mean relative humidity of 46.8% and a corresponding mean temperature of 29 °C, while the wettest month is January with a mean relative humidity of 72.6% and a corresponding mean temperature of 9.6 °C. August is the driest and, at the same time, the warmest month of the year, while January is the wettest and coldest.

In general, the range of the relative humidity values during the year appears diametrically opposite to that of the air temperature, while on the other hand, it is proportional to that of the atmospheric precipitation (Figure 4.7).

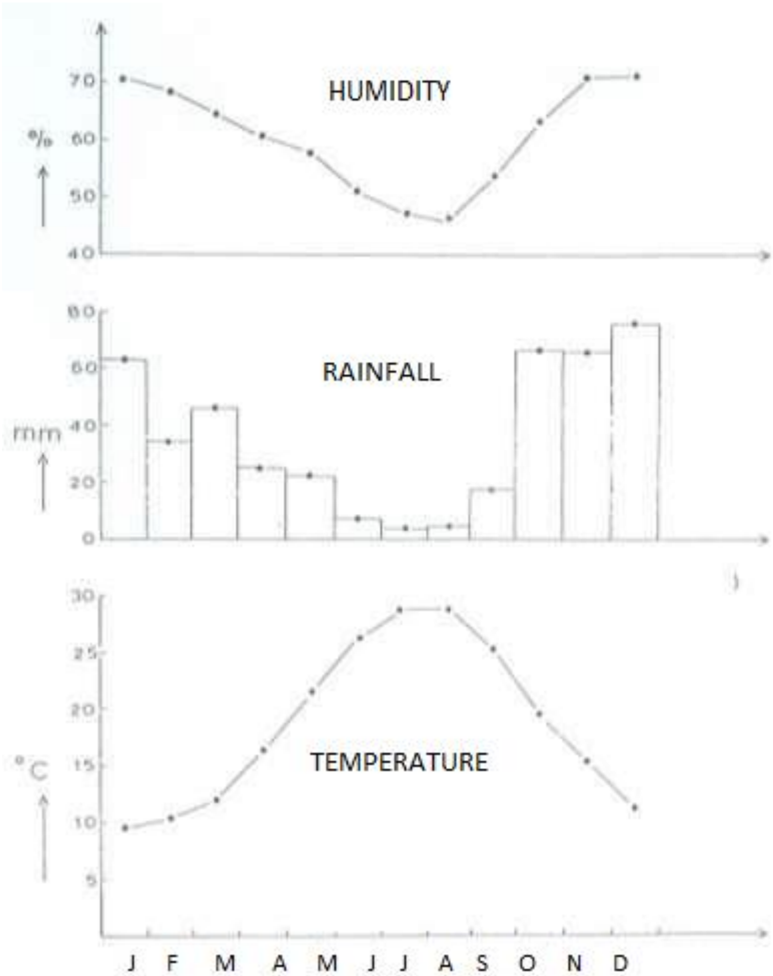


Figure 4.7: Monthly mean values of humidity, rainfall and air temperature respectively, as measured at Megara Station.

Since no measurements have been made in the area to calculate the evapotranspiration factor which is generally the most difficult to calculate of all the coefficients of the hydrological equilibrium equation, we must resort to empirical and indirect methods.

Usually, in cases of lack of measurements, evapotranspiration is determined through the empirical type of Turc, based on the average temperature of the place and the average volume of the annual precipitation, as follows:

where:

E = Actual annual evaporation in mm

P = Average annual rainfall in mm

L = Coefficient = 300 + 25T + 0.05 T3

T = Average annual temperature

The above formula is applied in basins with relatively high rainfall, high runoff rate and average annual temperature.

D. Burdon - N. Papakis (1963b) suggests that in karst areas and in cases of lack of evapotranspiration evidence, the following indicators are used to formulate the equation of the hydrological equilibrium:

1. In areas with annual precipitation of more than 1,000 mm, 500 mm are deducted from the volume of precipitation of 150 days, from November to March, and the rainfall of the remaining months is ignored. This is the maximum possible rate of evaporation loss.

2. In areas with rainfall less than 1,000 mm but greater than 250mm, the volume of precipitation of the winter months is reduced by 50% and all the rainfall of the remaining months is ignored. This is also the maximum rate of evaporation loss

3. In areas with less than 250 mm of rainfall, all is lost to evaporation, except for cases where the intensity of rain or other favorable factors lead to surface concentration and, accordingly, to penetration.

By applying the above indicators and adding the corresponding values of the average monthly rainfall heights and the average annual rainfall from Table 4.5, we have:

Evaporation = 663.3 - (0.5 x 467.8 + 195.5) = 233.9

Evapotranspiration rate 35.2% (= 233.9 / 663.3).

This value appears quite low, given that the average annual temperature in the area is quite high.

Observations on the factors of the hydrological equilibrium

Regarding the runoff rate, it is calculated, for the entire subject area, at a value of 10%, and is estimated to be very close to the actual value. Of course, most of the area is covered in limestone, which exhibits very low runoff, but the rest (about ¼) is occupied by semi-permeable and mostly watertight formations, which have a fairly high runoff.

The penetration for the limestone areas was calculated by applying the Kessler formula to 51.6% of the falling precipitation.

Taking into account that about ¼ of the area, as mentioned before, consists of semipermeable and impermeable formations, which have a much lower penetration rate, then the average rate should be much lower than that calculated by the Kessler formula and which is estimated at 35%.

Finally, the evapotranspiration rate for the limestone section was found with the application of the indices of D. Burdon - N. Papakis, equal to 35.2%. This estimated rate is considered to be much lower than the actual one, since the rest of the area consists of watertight and semi-permeable formations. This coefficient is considered sufficient as the value of the average evapotranspiration coefficient for the entire area should be much higher than that calculated by the Burdon - Papakis formula. This is estimated at 55% of all rainfall.

Thus, the hydrological equilibrium coefficients for the entire region are estimated as follows:

- Flow rate 10%
- Penetration rate 35%
- Evaporation rate 55%

Total 100%

D. Burdon - N. Papakis (1963a), referring to the Parnassos - Gionas area, which manifests several similarities with the area examined here in terms of relief, climate, distribution of geological formations, etc., reach similar coefficients to those calculated above and presented here:

- Flow rate 8.1%
- Penetration rate 36.5%
- Evaporation rate 55.4%

Total 100.0%

4.3 Morphology and Topology

The terrain of the site of the Elefsis Shipyards is in general flat. The altitude of the area occupied by the compound ranges from 0 to 50 m above sea level. The topographic relief of the area is slightly sloped towards the sea, but without any heavily pronounced or steep slopes in any direction.

The depth of the sea in the area of the Shipyards ranges from 0 to 20m with the maximum depth occurring near the pier of the floating tanks. In general, the seabed is sandy and smooth and in accordance with the typical depths of the rather rocky beachside of the area. The construction of the shipyard and the embankments hasn't affected the nature of the seabed.

As for the artificial - structured elements of the landscape, in the immediate study area, the land port facilities in the coastal zone dominate. Across the coastal zone, embankments have also been constructed to make up for the naturally rocky seashore. Additionally, large boulders, positioned in front of the embankment, supplement the construction by absorbing the energy of the waves from the gulf, to avoid erosion phenomena. Wherever the old natural shoreline is still accessible, as it happens close to the eastern border of Elefsis Shipyards, successive layers of sandstone and beach rock formations appear.

More specifically, the Intervention Area consists mainly, of structured surfaces or hardscape, i.e., hard surfaces with laying of construction materials (asphalt, concrete, layer of gravel, stones), while the presence of vegetation can be characterized as insufficient. Vegetation, where it exists, is limited, and is distinguished according to its form in three categories: a) trees and shrubs of the Mediterranean flora, b) trees - and shrubs of ornamental species (mainly foreign) and c) herbaceous vegetation (lawn) from annual plants.

In general, the intervention area is not visible from any settlement or any other important point of observation (e.g., cultural site).

4.4 Geological, Tectonic and Soil Characteristics

4.4.1 Geology

The wider area of the Elefsis Shipyards is part of the Pelagonian Geotectonic zone. The geological background of the area includes limestones of the Upper Cretaceous of the Pelagonian Zone. Specifically, the upper layers consist of deposits of clay-sandy materials and scattered cobblestones of low consistency. To the east, Post-Meteorite and Bradytectonic sediments (modern alluvial deposits of the Holocene) appear, while to the west, there are lake and land deposits. To the north, to the limestones of the Upper Cretaceous, limestones of the Triadic and Middle Triadic of the Pelagonian Zone are added.

The Limestones of the area of the Elefsis Shipyards are transgressive. At their base they are thin-layered and locally marly. On higher layers, they range from meso-stratified to thick-layered. In the upper parts of the formation the limestones range from thin to interlayered marly. Locally and inconsistently, they supersede the Kenoman - Tauronian limestones or even older pre-Cretaceous formations.

"Beach sands" (beachrocks) are coastal cohesive geoforms, of variable crushing strength, composed of materials that have undergone some degree of diagenesis. Even though they have been studied for a long time, the methods and conditions of their genesis remain unclear. The divergence of opinions originates from the variety of forms of the adhesive material (cement) -usually calcite and aragonite in cryocrystalline or microcrystalline state- of the beachrocks, in the different climate of the zones where the phenomenon is observed. On the other hand, opinions converge on the levels of wave energy needed, which must be very low in order to achieve grain generation and complexation. Coastal sandstones typically occur in mid-tidal zones.

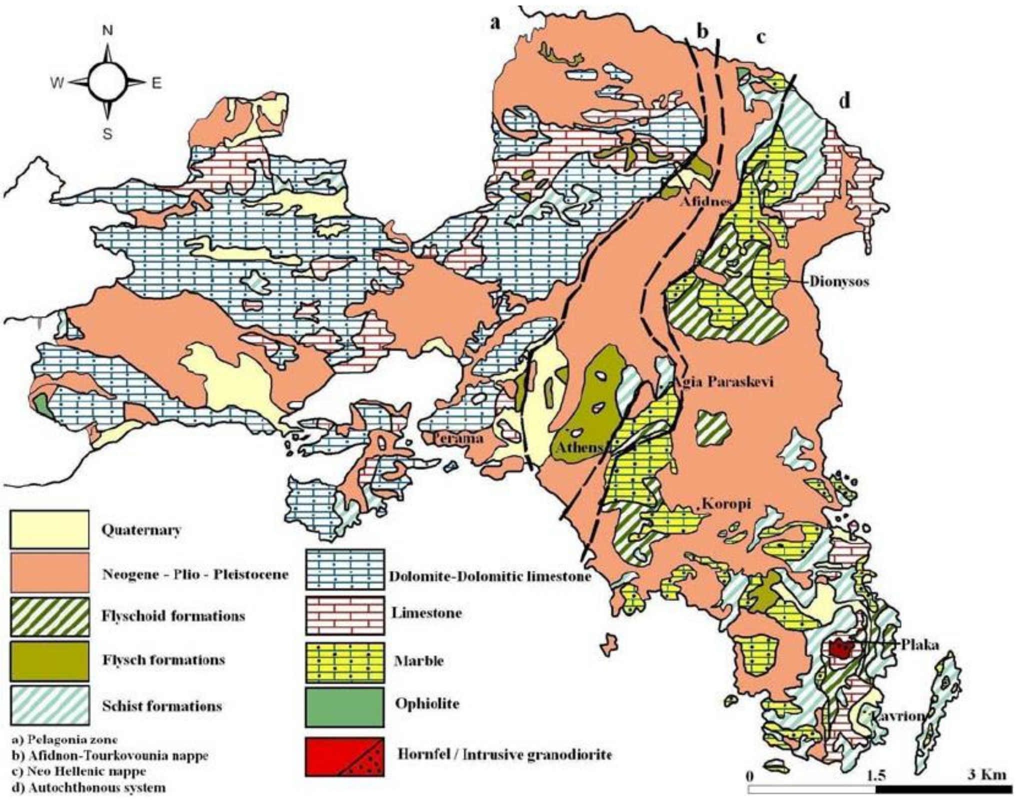


Figure 4.8: Simplified geological map of Attica County.

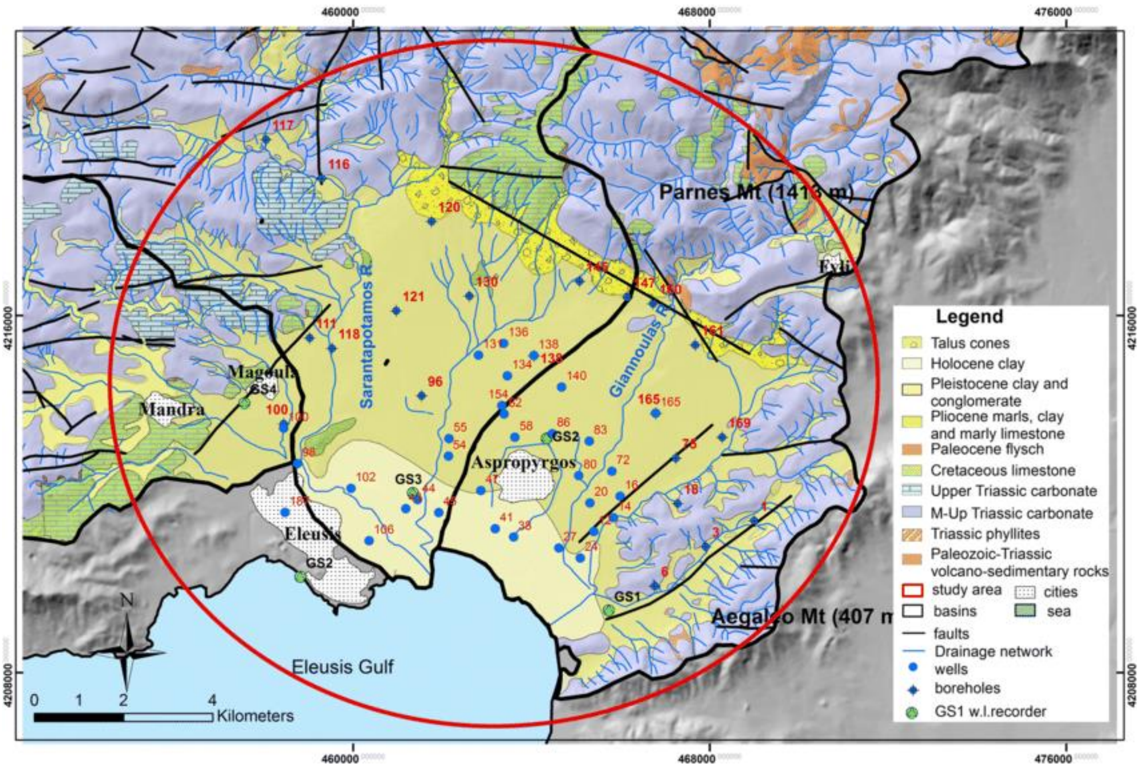


Figure 4.9: Geological map of the Thriassion Plain

4.4.2 Tectonics & Seismicity

The study area, according to the anti-seismic regulation (ASR 2003) and the new seismic hazard zones, belongs to Zone I of seismic hazard scale as shown in the map below. For this category the seismic acceleration coefficient is equal to 0.16 (Figure 4.10).

In general, the seismicity in the region of Attica, both from the historical data and from the data of instrumental seismicity, can be characterized as low to medium as large-scale earthquakes are rare. The New Anti-Seismic Regulation (NASR) seems to agree with this, as the seismic hazard was considered to come only from seismic sources, which were located around Attica in a radius of 50 - 100 km such as the faults of the Eastern Corinth or the fault of Atalanti.

According to historical data, since 1964 and in a radius of 45km from the site's location, 7 earthquakes with a magnitude of above 5 on the Richter Scale have taken place.

The main earthquakes that took place in the 20th century in Attica are shown below:

- 1914, October 17. The earthquake occurred between Thebes and Chalkida, at an epicenter distance of 47 Km and had a magnitude of Ms = 6.2.
- 1928, April 22. Vibration Ms = 6.3 occurred near Corinth, 77 Km from Athens.
- 1930, April 17. In the SW of the Saronic Gulf an earthquake with a epicenter of 59 Km from Athens.
- 1938, July 19-20. A strong tectonic earthquake centered on Oropos and a focal depth of 25-30 Km, shook NW Attica and caused casualties and material damage. The size was Ms = 6 and the intensity VIII degrees. It was strongly felt in Athens and weaker as far as Volos, Skyros and the city of Patras. On July 26-27, the strongest earthquake with a magnitude of Ms = 5 took place.
- 1956, April 13. The quake, which struck near Parnitha, caused minor damage in downtown Athens and the surrounding area.
- 1981, February 24-25, March 4. Destructive earthquakes focusing on the Alcyone Islands caused severe damage in Attica as well as in Corinth and Boeotia. Where the ground was resilient the damage was negligible. The disasters in Kaparelli, Thebes and Plataea were very serious, where a crack 15 km long and 80 cm wide opened in the ground (Spyropoulos, 1997; Ambraseys, 1994).
- September 7, 1999. A strong earthquake of magnitude Mw = 5.9, shook western Attica. The epicenter was located in the area of Thriasio Pedio, at a depth of 8 Km. Small aftershocks occurred before the main earthquake. The quake was triggered by a normal earthquake, with an ANA-DBD direction and an NN slope. There were many aftershocks after the main earthquake. The damage recorded was very serious, as 143 people lost their lives and more than 70,000 were left homeless by the collapse of homes and factories on the outskirts of Attica.

Figure 4.11 shows the earthquakes with a magnitude greater than 3.5 ML, for the period 1/1/1964 - 1/1/2017 and within a radius of 35km, as recorded by the Geodynamic Institute of Athens.

The risk for the shipyard is considered low due to the strict regulations on building codes in Greece and no previous records have shown any significant damage done to shipyard assets by earthquakes.

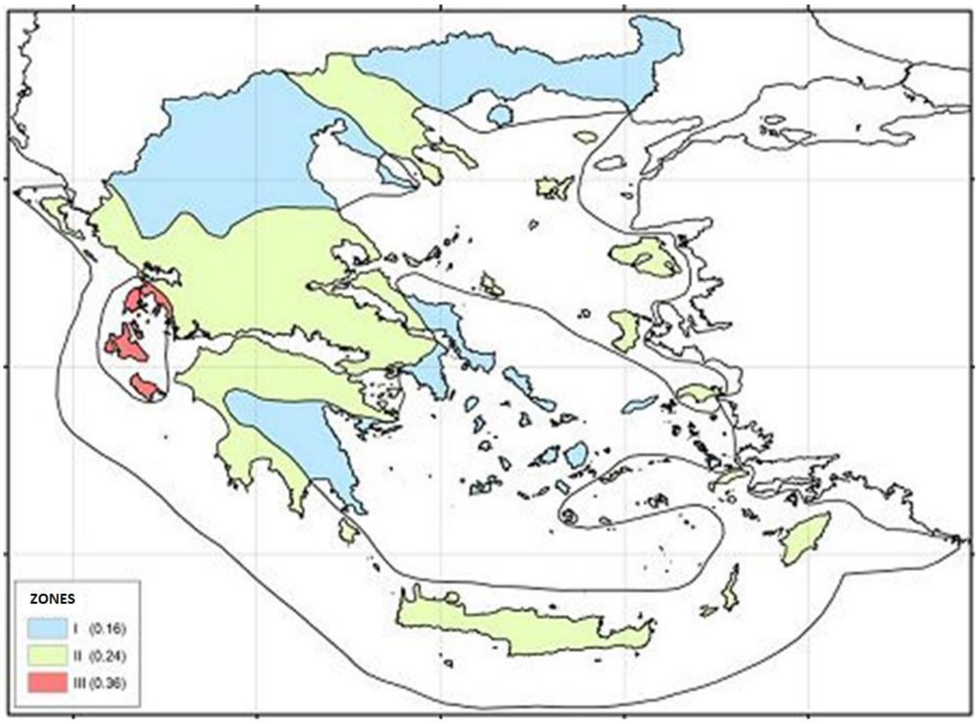


Figure 4.10: New seismic hazard map according to ASR, 2003

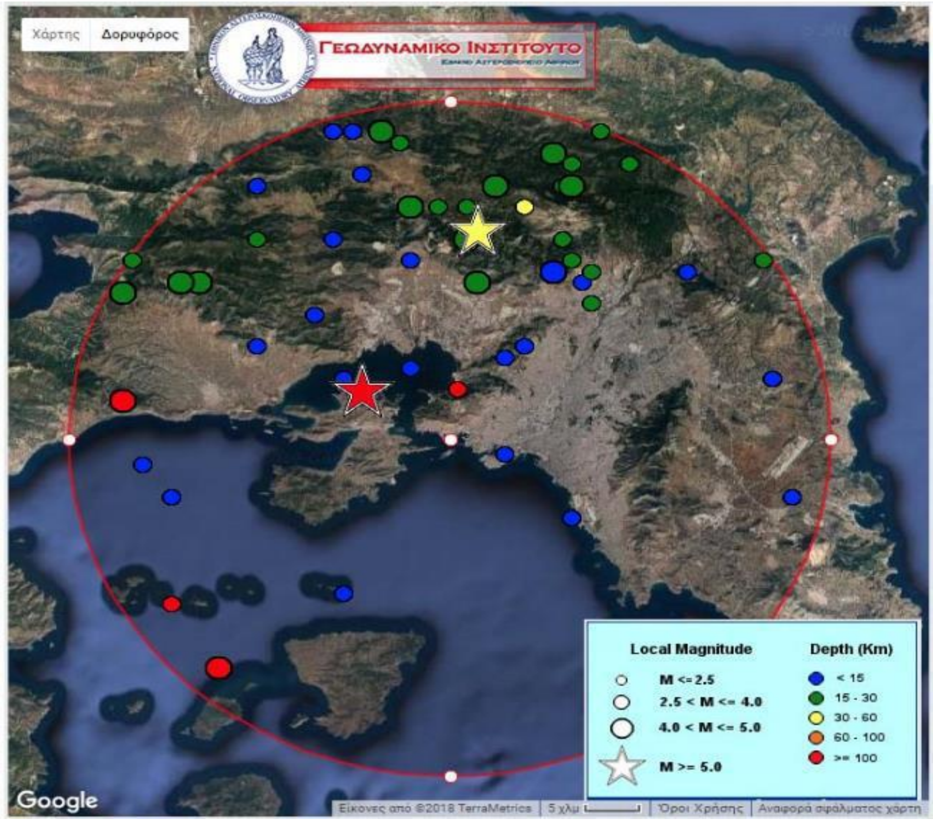


Figure 4.11: Earthquakes with M> 3.5 ML, for the period 1/1/1964 - 1/1/2017

4.4.3 Soil Characteristics & Quality

The soil is a valuable natural resource for human survival and for the overall environmental quality of an area. Although it is considered a renewable natural resource, the rate of its renewal in combination with the increased pressures it receives from all anthropogenic interventions, results in its gradual degradation.

The soil formations, which cover the wider area of the project are washed saline red soils that come from the erosion of the existing geological formations. Thus, mainly soils from red soils (terra rosa) and calcareous basic soils (renzines) are identified, which are created as disintegrated horizons of limestone rocks and marls.

It is important to notice that, in the land part of the coastal zone there is a lack of beach which was covered by the embankments. In order to avoid erosion effects from the action of the sea and the waves, large natural boulders have been placed on the front of the embankment in order to absorb the wave energy.

For purposes of assessing soil quality in the study area, soil samples were collected and analyzed (2020). Three sample locations were collected as representative of possible soil degradation, as it is shown in Figure 11. Two of them (S1 and S2) were included within Intervention Area and one was collected outside the borders of the Shipyard to be used as blind sample or reference sample.

The area of S1 is an area where metal sheets are collected for recycling or disposal. The area of S2 is a small coastal area at the western part of the Shipyard. It should be noted that positions S1 and S2 were almost the only uncovered areas (i.e., with no concrete or other type of artificial floor). Soil samples analyses results are presented in Table 4.2.

Table 4.2: Soil Monitoring & Analyses Results (2020)

No.	Parameters	Units	S1	S2	Blind Sample
1.	Arsenic (As)	mg/kg	**11.8**	**10.8**	10.0
2.	Tin (Sn)	mg/kg	<25	<25	<25
3.	Chromium (Cr^{6+})	mg/kg	<10	<10	<10
4.	Selenium (Se)	mg/kg	<5	<5	<5
5.	Sulphite (SO_3^{-2})	mg/kg	**18.1**	**11.1**	10.1
6.	Benzene	mg/kg	<0.02	<0.02	<0.02
7.	Toluene	mg/kg	<0.02	<0.02	<0.02
8.	Ethylbenzene	mg/kg	<0.02	<0.02	<0.02
9.	Total Xylene	mg/kg	<0.02	<0.02	<0.02
10.	Formaldehyde	mg/kg	<0.2	<0.2	<0.2
11.	Acetaldehyde	mg/kg	<0.2	<0.2	<0.2
12.	Cyanides (CN^-)	mg/kg	<0.15	<0.15	<0.15
13.	Ammonium ions (NH_4^{+})	mg/kg	<1	<1	<1
14.	Phenols	mg/kg	<1.0	<1.0	<1.0
15.	Cadmium (Cd)	mg/kg	<0.5	<0.5	<0.5
16.	Chromium (Cr)	mg/kg	**152.6**	140.1	149.9
17.	Copper (Cu)	mg/kg	60.6	66.6	87.6
18.	Aluminum (Al)	mg/kg	**2259.1**	2215.1	2225.1
19.	Boron (B)	mg/kg	<25	<25	<25
20.	Barium (Ba)	mg/kg	43.5	**44.5**	44.0

21.	Iron (Fe)	mg/kg	1.1	**1.4**	1.3
22.	Lead (Pb)	mg/kg	**130.6**	110.6	120.1
23.	Manganese (Mn)	mg/kg	**399.2**	354.5	384.5
24.	Zine (Zn)	mg/kg	**489.2**	**481.2**	401.2
25.	Nickel (Ni)	mg/kg	21.4	21.1	22.1
26.	Mercury (Hg)	mg/kg	<0.5	<0.5	<0.5
27.	Fluoride (F-)	mg/kg	**0.96**	0.76	0.79
28.	Nitrates (NO_2-)	mg/kg	<0.5	<0.5	<0.5
29.	Nitrites (NO_3-)	mg/kg	9.45	7.14	17.22

Figure 4.12: Soil Sampling Monitoring Points

As it shown from the results presented in Table 4.2, soils within the area of the Shipyard present similar pollutant values with the Blind Sample. For S1, there is a slight exceedance worth mentioning, with respect to lead, zinc, manganese, and chromium. S2 presents, more or less, the same condition with the blind sample.

4.5 Natural Environment (broader area)

The gulf of Elefsina has been characterized as a sensitive area according to the IMO 19661/1982/99 “Amendment of the Interministerial Order 5673/400/97“ Measures and conditions for the treatment of urban wastewater (Government Gazette 192 / B / 97) ”- List of sensitive areas for the disposal of urban wastewater in accordance with Article 5 (par 1) of this decision”.

In the wider area of the project there are also some ecologically important areas that have either been granted a protection status or have been included in lists of ecologically important areas.

4.5.1 Flora and Vegetation

The vegetation of the broader area is typical thermo-Mediterranean, it belongs phytosocially to the Oleo Ceratonion (union of Agrielia - Carob) with characteristic species:

- Pistacia lentiscus (Schinos)
- Ceratonia Siliqua
- Olea Oleaster (wild olive)
- Quercus Coccifera (Pournari)

Pinus halepensis (Aleppo pine), which forms forest clusters, settles secondarily. Other species that compose the vegetation of the area are the formations of the phrygana, a sample of high degradation of the vegetation and the soil where they are:

- Teucrium polium
- Prasium majus
- Cistus incanus
- Cistus monspeliensis
- Thymus capitatus
- Genista acanthoclada

- Phlomis fruticosa
- Trifolium angustifolium
- Dactylis glomerata
- Stroma bromoides

In the broader area, the large presence of Aleppo Pine and Phoenixes (Phoennix dactylifera), especially palm trees (anthropogenic operation) testify to the existence of non-saline ground water at a depth of 6 - 6.5m. In general, in the wider study area, especially near Dervenochoria, the flora is rich.

The most important of these plants in the broader area is Centaurea Attica Margarensis, which does not grow anywhere else in the world.

Most of the vegetation is bushy. These formations, beyond their normal growth in some areas, reflecting climatic, soil and topographic conditions, are largely the result of the effect of human activity on vegetation in the area. The bushy vegetation can be divided into two categories, both found in the area of the project, hardwood shrubs, or makkia, and phrygana.

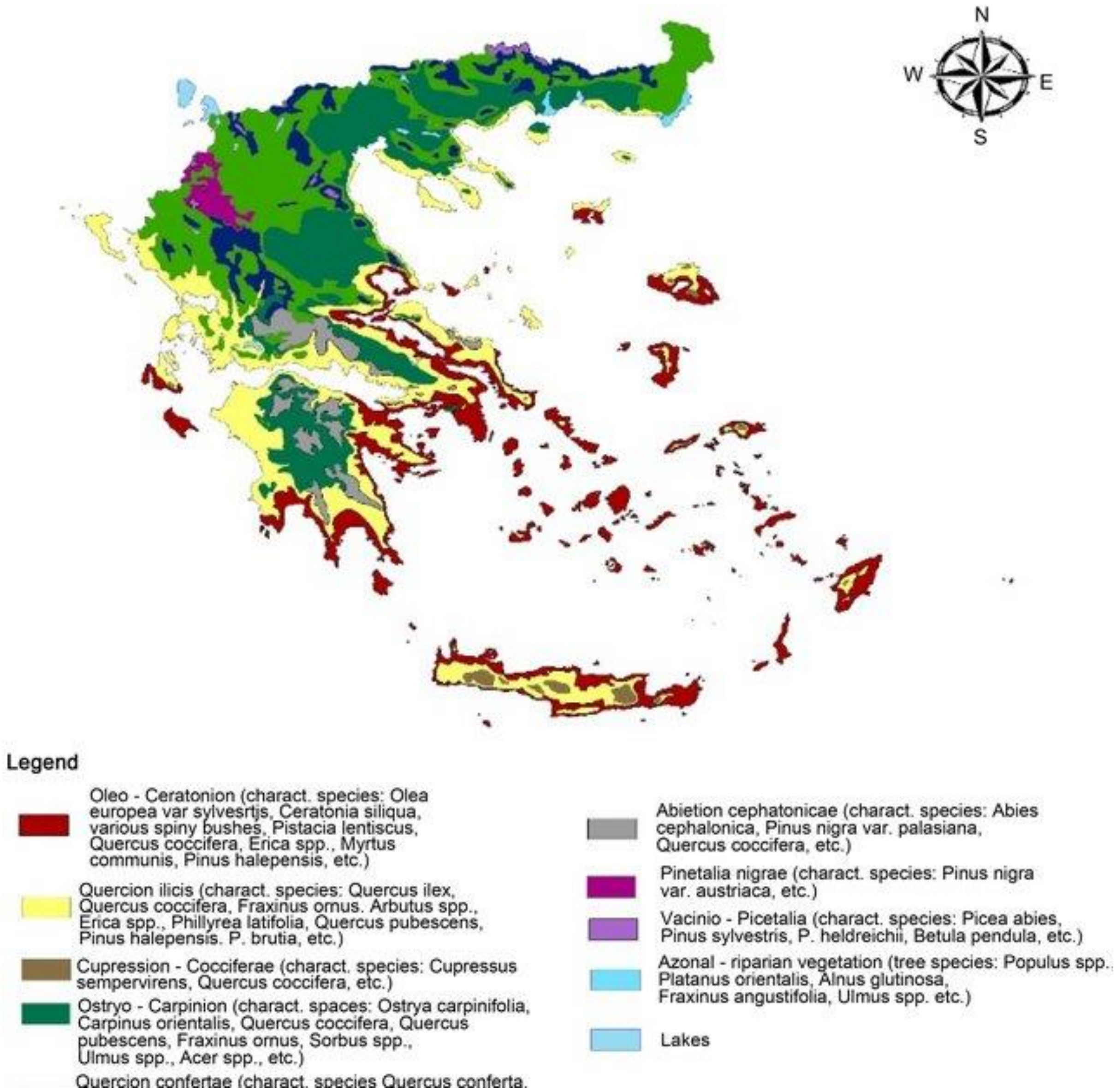


Figure 4.13: Map of forest vegetation zones (existent or potential) of Greece.

<u>Evergreen - hardwood shrubs (makkia)</u>

This formation is composed of dense shrubs up to 2 - 3m high of hardwood-evergreen species so as to create an impenetrable vegetation network. Makkia prevails in coastal and inland areas of Southern Greece and Crete while in Northern Greece it is limited to coastal areas mainly, as the evergreen-hardwoods cannot withstand very cold winters.

The species that predominate in the makkia are the bush cypress (Juniperus phoenicea), the holly (Quercus coccifera), the aria (Quercus ilex), the laurel (Laurus nobilis), the asparagus (Calycotome villosa), the asparagus (Spartium) goldenwood (Cotinus coggygria), the spruce (Pistacia lentiscus), the paliurus (Paliurus spina-cristi), the myrtle (Myrtus communis), the heather (Erica arborea, E. manipuliflora), the leaf (Phillyrea lattifolia) Arbutus unedo, A.adrachne).

In makkia, the species of flora are few, so an area may have rich vegetation and poor flora, while in contrast, in other formations, such as phrygana, the vegetation may be poor but the flora rich.

Phryganae

The formation of makkia after intense and lasting human impact (clearings, fires, overgrazing) turns phryganic, composed of lower shrubs or herbaceous, often thorny, plants. It is more widespread and richer in flora. Many species of plants of the Greek flora are species found exclusively in phrygana areas.

Phrygana is the most widespread form of vegetation in the Mediterranean climate zone that is associated with drought. Characteristic woody, thorny and herbaceous plants of the Greek phrygana are: holly, astebi (Sarcopoterium spinosum), hood (Euphorbia acannthothamnos), and aspalathos, aphana (Genista acanthoclada), oleanders (Cistus incanus, C. salvifolius), thyme (Thymus capitatus), sturgeon (Globularia alypum), asparagus (Phlomis fruticosa), oregano (Origanum onites), micromeria (Micromeria) juliana), daffodil (Asphodelus aestinus), onions (Muscari comosum), and musk (Eryngium campestre).

The herbaceous formations

Herbaceous formations include the various types of meadows. These include lowland, semi-mountainous, mountainous and alpine meadows as well as salty coastal meadows.

Of particular interest are some plant formations composed of mainly herbaceous but also small shrub species. The most important are:

Rocky soil vegetation (pseudo-steppe)

This form of vegetation has been strongly affected by human activities and especially in areas that have undergone intensive and repeated deforestation, wildfires and overgrazing resulting in the loss of most of their soil's integrity. Despite this intense operation, the pseudo-steppe is of great interest in terms of flora and, at the beginning of Spring, appears green and beautiful, full of different, colorful types of flowers.

Noteworthy are several genera of monocotyledonous plants such as Crocus, Colchicum, Asphodelus, Gagea, Romulea, Iris, Allium, Bulbs (M). wild dog (Ornithogalum), cormorant (Orchis).

Marine flora is examined along with the rest of marine environment elements in par. 4.8.

4.5.2 Fauna

The ecological balance of the terrestrial fauna of the project area has been severely shifted. The uses that prevail in the project area, are not at all environmentally friendly (Urban land - industrial / craft activities). The result of the above processes resulted in the destruction or extinction of the habitats of the fauna species that participated in the construction of the natural ecosystem. Fauna species that can coexist in such an environment are some anthropophiles who manage to coexist with humans and their inhospitable activities and to provide their daily food such as Streptopelia decaocto, sparrows (Parus sp.) small mammals such as mice (Apodemus flavicolis) and rats (Rattus sp.), gulls (Larus sp.), cats and dogs.

More specifically, per category of vertebrates, species that can be found in the remaining natural habitats of the wider area are the following:

Reptiles

Elaphe situla (σπιτόφιδο)

Colyber najadum (σαΐτα)

Vipera ammodytes (οχιά)

Lacerta trilineata (πράσινη σαύρα)

Chalcides ocellatus (λιακόνι)

Ablepharus kitaibeli (αβλέφαρος)

Testudo marginata (χελώνα)

Testudo hermaní(χελώνα)

Of these, the two species of turtle (Testudo marginata, Testudo hermani) are particularly sensitive. More specifically, they are vulnerable to the direct effects of vehicle traffic. The impact of such anthropogenic effects are not known for the other species.

Other species of fauna

Other groups of animals that may be present in the wider area include:

- Mammals such as rodents (Apodemus flavicolis, Rattus rattus), hedgehog (Erinaceous concolor), hare (Lepus europaeus), fox (Vulpes vulpes and Canis vulpes), weasel (Mustela nivalis), ferret (Martes foina), badger (Me).
- Invertebrates (spiders, scissors, isopods, insects, coleoptera, lepidoptera, orthoptera).

The weasel and the ferret are considered ecologically adapted.

There is a population increase of the foxes (Canis vulpes) which, in combination with the destruction of many habitats due to forest fires in Aleppo, lead to foxes migrating to other areas, decimating other habitats of hare, wild rabbits and partridges, resulting to the near extinction of those species.

In the area, Chalcides ocellatus (Liaconi) and Lacerta trillineata (Transosaurus) can also be found. Pigeons (Pigeons, Eighteen, Gulls, Kingfishers, Buzzards) and the transiting Trigonias, Quails and Eagles as well as the oystercatchers, birds that do not nest for long, have evaded endangerment by the foxes, as well as Herons, Teri, and Partridges.

Avian fauna

The wider area is a shelter and catering area for many species. The species that are found are widespread, adapted to living in urban areas and accustomed to human presence.

From the on-site identification of the Shipyards area, only certain species of birds were identified. The birds that were observed were White-tailed deer (Motacilla alba), Cinderella (Motacilla cinerea), Papaditses (Parus major), Sparrows (Passer domesticus), Spinners (Fringilla coelebs), Decrets (Stretoptelia decaocto),

From records and bibliographic data of species distribution, the following table was compiled, cataloging the species of birdlife that may use the wider study area for nesting or shelter.

Table 4.3: Species of Avian Fauna found in the wider study area

Scientific Name	Greek name	Presence	Population	Protection Status		
				SPEC	79/409	R.B.
Strigidae						
Otus scops	Γκίωνης	R	P	2		
Athene noctua	Κουκουβάγια	R	R	3		
Passeriformes						
Columbidae						
Streptopelia deaocto	Δεκαοχτούρα	R	C			
Curculidae						
Curculius canorus	Κούκος	M	R			
Apodidae						
Apus apus	Σταχτάρα	B	C			
Alaudidae						
Gelerida cristata	Κατσουλιέρης	R	C	3		
Alauda arvensis	Σταρήθρα	W	C	3		

Hirundinidae						
Hirundo rustica	Χελιδόνι	B	C	3		
Delichon urbica	Σπιτοχελίδονο	B	C			
Troglodytidae						
Turdidae						
Erithacus rubecula	Κοκκινολαίμης	W	C	4		
Luscinia	Αηδόνι	B	R	4		
Phoenicurus	Καρβουνιάρης	W	C			
Turdus merula	Κότσυφας	R	R	4		
Turdus pillaris	Κεδρότσιχλα	W	R	4		
Turdus philomelos	Τσίχλα	W	R	4		
Turdus iliacus	Κοκκινότσιχλα	W	R	4		
Sylvidae						
Cettia cetti	Ψευταηδόνι	R	R			
Sylvia cantillans	Κοκκινοτσιροβάκος	B	R	4		
Synvia	Μαυροτσιροβάκος	R	R	4		
Sylvia atricapilla	Μαυροσκούφης	W	R	4		
Phylloscopus	Δασοφυλλοσκόπος	M	R	4		
Phylloscopus	Θαμνοφυλλοσκόπος	M	R			
Muscicapidae						
Muscicapa striata	Μυγοχάφτης	B	R	3		
Paridae						
Parus major	Καλόγερος	R	C			
Parus caeruleus	Γαλαζοπαπαδίτσα	R	C	4		
Corvidae						
Pica pica	Καρακάξα	R	C			
Corvus corone	Κουρούνα	R	C			

Table 4.3 legend

Protection Status	**Population**
B : Nesting	C : Common
M : Migrating through	R : Rare
R : Residing permanently	V : Very Rare
W : Winteing	P: Present but not estimated
R.B.: Red Book of Endangered Species	**SPEC : (Species of special concern)**
E1 : Endangered Species	1 : Endangered World-Wide
V : Vulnerable Species K : Unknown/Insufficient Data	2: Population found only in Europe, under harsh preservation directive

	3: Population not only found in Europe, under harsh preservation directive
	4: Population found only in Europe, under lax preservation directive

4.5.3 Forest Areas

According to the Greek Forest Legislation (Law 998/79 and Law 4512/2018, Article55, par 5), a part of the area of the shipyards has been declared as a reforestated area, but it is excluded from any restrictions with respect to land uses derived from the aforementioned legislation. On the other hand, as it is shown in Figure 4.14, the surroundings of the Shipyard consist mainly of forested areas, submitting to the restrictions of the Greek Forest legislation with respect to land uses.

Figure 4.14: The area of shipyards according to Greek Forest Legislation

4.5.4 Areas under protection by Natura 2000 Directive, and included in law N.3937/2011 (Gazette 60/A)

The intervention area is located outside the boundaries of protected areas of the Natura 2000 Network. Table 4.3 provides information on the protected Areas located in the wider study area. The exact location of the Shipyards with respect to Protected areas is illustrated at Figure 4.15.

Table 4.4: The Natura 2000 protected areas found in the wider study area

Site Name	Site code	Site Type	Area Size
OROS PARNITHA	GR3000001	pSCI, SCI or SAC, SPA	14.933,37 ha
OROS YMITTOS	GR3000015	SPA	8.311,38 ha
YMITTOS - AISTHITIKO DASOS KAISARIANIS - LIMNI VOULIAGMENIS	GR3000006	pSCI, SCI or SAC	8.819,69 ha

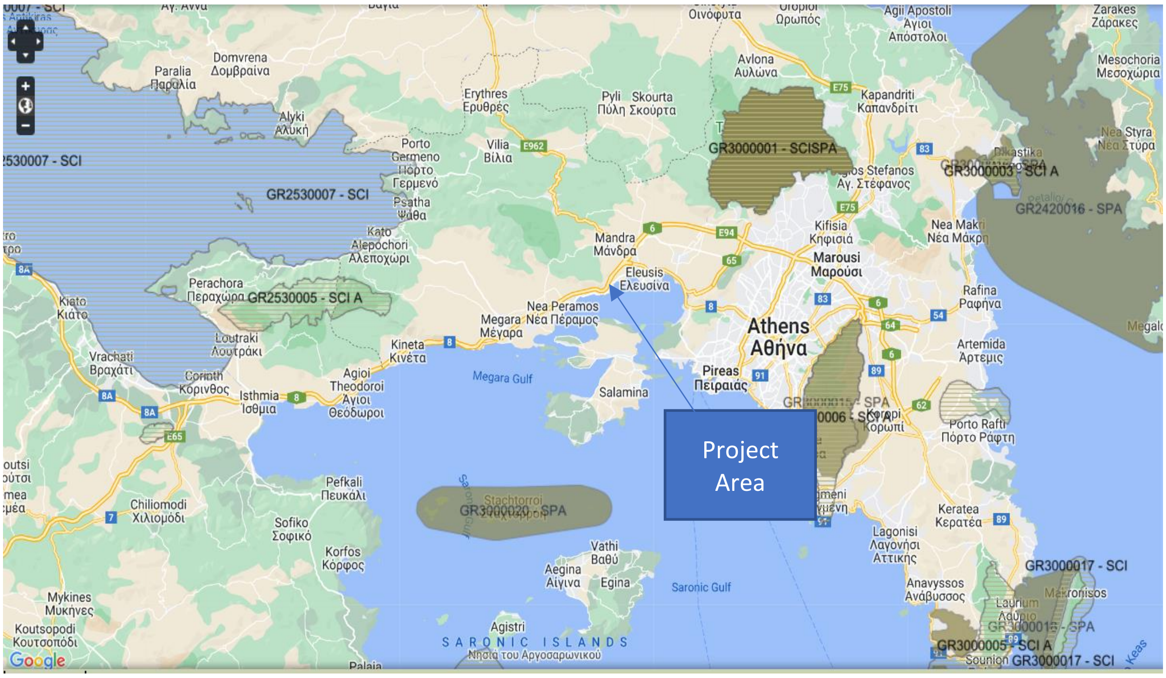


Figure 4.15: The Natura 2000 Ecological Network areas in relation to the study area

A brief description of Protected areas is given below.

GR3000001

The mountain of Parnitha (1413 m, Karambola) is located in the northern part of Attika, very close (40 km) to the centre of Athens. The mountainous block of Parnitha consists mainly of marbles and schists. The climate is typical Mediterranean with mean annual rainfall exceeding 650 mm. The site is a well forested area, characterized mainly by forests of the endemic greek fir, Abies cephalonica, on fairly poor and dry soil (a habitat type not included in Annex I, with CORINE 91 code 42.18); temperate coniferous forests (mainly Pinus halepensis); sclerophyllous scrub/maquis, mountain grassland, rocky cliffs, springs and streams. Regarding the zonal vegetation of the area, two main zones exist: 1. The zone of Abies cephalonica at the upper parts (starting from 600 - 800 m and upwards), with A. cephalonica forest, also characterised by Quercus ilex formations as well as by the presence of Quercus pubescence, Fraxinus ornus and other high altitude Mediterranean shrubs; and 2. The zone of Pinus halepensis and the evergreen, sclerophyllous shrubs (Quercus coccifera, Arbutus unedo, Phillyrea media, Myrtus communis, Olea europea, Ceratonia siliqua, Pistacia lentiscus etc.) which occur in unmixed communities or understorey vegetation of the pine forests. The area has been characterized as a national park since 1961. The core of the National Park is located in the centre of the site and includes the summit area of the mountain. It must be mentioned that habitat type 9540 concerns Pinus halepensis forests.

The National Park of Parnitha is a very interesting region regarding biodiversity, suitable to function as a shelter for the protection and conservation of the flora and fauna of southern Greece. Moreover, it has already been designated as a Special Protection Area (SPA) for birds. This is an important area for species associated with conifer forest species and upland scrub. Species of concern include: Emberiza caesia The flora of mount Parnitha is one of the richest in Greece. There have been recorded hundreds of plant species, many of which are endemic or threatened by extinction. It also hosts a variety of animal species, vertebrates and invertebrates, many of them legally protected at national and international level. In addition, it is the only area in southern Greece where the red Deer (Cervus elaphus) survives. The proximity of the site to the city of Athens in combination to its great ecological and aesthetic value contribute to its significance as an area which has to be studied and protected.

GR3000006

Ymittos is a long but narrow mountain (total length 20 km), with its highest peak reaching 1026 m. An intense but short gorge separates the northern part of the mountain from the southern. The commonest rock of northern Ymittos is the schist, while limestones can also be found particularly at the southern and western parts of the mountain. This explains the lack of springs, which can only be found at those parts of the site, where the two kinds of rock overlap. Occasionally, there are massif layers of marble under the schist. The annual precipitation ranges from 400 to 600mm. Finally, the site of Ymittos includes a great number of small and large caves. The maquis vegetation of the site consists of low individuals of Quercus coccifera.

It is essential for the improvement of life quality in the urban areas to act towards the conservation of wild nature that might be neighboring the urban areas in question. This is the case for the request for the conservation of the natural habitats and the wild nature in general of Mt. Ymittos. Despite the fact that the natural ecosystems of the mountain have more or less been affected by human pressure, a well-organized and ecologically sound management plan will certainly contribute towards the conservation and enrichment of its wildlife. Although not few people regard Ymittos as an area for waste deposits or as a land to host new settlements, the wildlife of the mountain still survives any type of pressure and does not stop to surprise us by a biodiversity unique for a mountain so close to a huge urban area. Many endemic taxa have been noted in its flora (some of which are protected under the greek law (Presidential Decree 67/81). The most interesting endemic of the site is Fritillaria obliqua that is included in the Bern convention (Revised Appendix I, 1992) and in Appendix IV of the Council Directive 92/43/EEC. In addition, some other taxa are of community interest as Greece is the only EU country where they can be found: Onosma graeca and Veronica glauca ssp. glauca (balkan endemics); Anthemis cretica ssp. cretica (only in Anatolia out of Greece); Dianthus serratifolius ssp. serratifolius (found only in Attki and Libya); Atraphaxis billardieri (Greece and Asia); Brassica cretica ssp. cretica (a chasmophyte found only in C. & S. Lebanon out of Greece. Carum graecum ssp. Graecum is a balkan endemic. The site of Ymittos is closely related to the history of the development of botany and ecology in Greece. As a matter of fact, since as far back as the times of Orphanides and Heildreich (mid-19th century), many plant species were first collected and described from here. This is the reason why many plants of the Greek flora have as a second name the word "hymettia" or "hymetium". Concerning the fauna of the site, it includes many endemic taxa of invertebrates and many protected species. A specific reference must be made to Paranemonia vouliagmenensis, a stenoendemic to Limni Vouliagmeni (Vouliagmeni lake). Limni Vouliagmeni lies at the southern slopes of the mountain. It is certain that there are subterranean channels that allow the sea to communicate with the lake. The lake is quite deep and a submarine cave ends there. Also in the area of the lake a new species, Trimium atticum, has recently been found, providing evidence of the fact that the flora and fauna of Ymittos is far from being completely known. Apart from its ecological value, the site of Ymittos is of historical importance. Many monasteries are built on its slopes, dating from the 15th century. The most famous of them all is the Kaisariani monastery, which is found inside the Kaisariani aesthetic forest. In conclusion, the wildlife of the mountain can be ideally used for educational purposes not only by the students of the University of Athens but by students of every age of the general area of Athens. OTHER IMPORTANT SPECIES WITH MOTIVATION D Plants: Centaurea attica, Scorzonera crocofolia, Fritillaria obliqua, Consolida tenuissima are endemic species protected by the Presidential Decree 67/81. Atraphaxis billardieri is an isolated representative of an asiatic genus, a rare species on rocky macchie on limestone in Sterea Ellas (Ymittos, Euboea, Tymfristos), Kriti, Samos, Chios, Rodos. The mammal Pipistrellus pipistrellus, the amphibian Bufo viridis, the reptiles Lacerta viridis, Coluber najadum, Chalcides ocellatus, Natrix natrix, and Malpolon monspessulanus are protected by the Presidential Decree 67/81.

GR3000015

This site is very important for breeding warbler and especially for the Ruppell's Warbler (Sylvia rueppelli). It is also very important for birds of prey like the Long-legged Buzzard (Buteo rufinus), the Peregrine Falcon (Falco peregrinus), and the Short-toed Eagle (Circaetus gallicus). Other important species include the Cretzchmar's Bunting (Emberiza caesia), the Subalpine Warbler (Sylvia cantillans), the Eastern Orphean Warbler (Sylvia crassirostris) and the Black-eared Wheatear (Oenanthe hispanica), all of them breeding in scrub and phrygana.

4.6 Biodiversity

4.6.1 General

The IFC's Performance Standard 6 deals with Biodiversity Conservation and Sustainable Management of Living Natural Resources. The applicability of this Performance Standard is established during the environmental and social risks and impacts identification process. The implementation of the actions necessary to meet the requirements of this Performance Standard is managed through the client's Environmental and Social Management System (ESMS), the elements of which are outlined in Performance Standard 1.

Based on the risks and impacts identification process, the requirements of this Performance Standard are applied to projects:

- Located in modified, natural, and critical habitats
- That potentially impact on or are dependent on ecosystem services over which the client has direct management control or significant influence; or
- That include the production of living natural resources (e.g., agriculture, animal husbandry, fisheries, forestry).

4.6.2 Area of influence (AOI) - biodiversity

The literature review covered an area more than 10 km around the project, however, the survey area focused just on the Project Development Area and an approximately 500m buffer to identify species and habitats that may be affected by indirect impacts.

4.6.3 Past field data collection in the Project area

Secondary data were used to characterize the biodiversity of the Project area, provide context to the information returned from the biodiversity field surveys and to identify potential critical habitat qualifying features. Secondary data sources in the Project area included:

- European Environmental Agency (EEA) (https://eunis.eea.europa.eu/habitats/10098)
- IUCN, International Union for Conservation of Nature (https://www.iucn.org)
- World Wildlife Fund Global Ecoregions (https://www.worldwildlife.org/biomes)
- Marine Mammal Protected Area Taskforce (https://www.marinemammalhabitat.org/portfolio-item/central-aegean)
- Greek Ornithological Corporation (http://www.ornithologiki.gr/el/oi-draseis-mas/diatirisi-erevna/simantikes-perioxes-gia-ta-poulia-tis-elladas)
- WWF Greece (http://www.oikoskopio.gr/en/index.html)

4.6.4 Current field data collection in the Project area

The biodiversity baseline survey was conducted between 20 and 27 of May 2022. The primary objective of the surveys was to identify the priority biodiversity values for the Project. The study area for the field survey comprised the Project footprint and a 500m buffer area surrounding the borders of the facility.

4.6.5 Habitats Mapping & Flora

The dominant habitat types located within the study area were identified and their floristic composition was characterized. The survey confirmed the presence/likely absence of any rare or threatened habitats of conservation importance within the study area.

The survey also confirmed the presence or absence of any vascular plant species of conservation importance. In the context of this baseline assessment, vascular plants of conservation importance are defined as nationally and/or globally rare or threatened species, and endemic and/or restricted range species. Focus was given to species that may trigger critical habitat in accordance with PS6 (IFC, 2012).

Habitat mapping was undertaken using visual interpretation of satellite imagery, supplemented by existing baseline data and ground-truthing conducted during the surveys. The mapping was further validated and refined based on the findings of the field surveys to include any priority habitats that were not previously identified.

Habitats were further categorized into modified and natural habitats in accordance with IFC PS6 criteria (IFC, 2012) which defines these as follows:

- Natural habitats are areas composed of viable assemblages of plant and or animal species of largely native origin, and or where human activity has not essentially modified an area’s primary ecological functions and species composition.
- Modified habitats are areas that may contain a large proportion of plant and/or animal species of non-native origin, and/or where human activity has substantially modified an area’s primary ecological functions and species composition. Modified habitats may include areas managed for agriculture, forest plantations, reclaimed coastal zones, and reclaimed wetlands.

According to the methodology described above, the habitat mapping of the Shipyards area is illustrated in Figure 4.16. The only habitat present within at least 500m radius from the Shipyards is "*Xeric Mediterranean Phrygana and Grasslands*". The latter is considered heavily modified due to industrial and pastoral activity.

Figure 4.16: Habitat Mapping - Xeric Mediterranean Phrygana and Grasslands

Plant species found during baseline study of the Shipyards area are illustrated in Table 4.5.

Table 4.5: Plant Species identified in the Project Area

Name	IUCN Status	Habitat	General Status	Protection Status
Pistacia lentiscus (Schinos)	Least Concern	Xeric Mediterranean Phrygana and grasslands, Woodlands and scrub	Native / Non Range-Restricted	None
Ceratonia Siliqua	Least Concern	Xeric Mediterranean Phrygana and grasslands, Woodlands and scrub	Native / Non Range-Restricted	None

Name	IUCN Status	Habitat	General Status	Protection Status
Quercus Coccifera (Pournari)	Least Concern	Xeric Mediterranean Phrygana and grasslands Woodlands and scrub	Native / Non Range-Restricted	None
Thymus capitatus	Not Evaluated	Xeric Mediterranean Phrygana and grasslands	Native / Non Range-Restricted	None
Phlomis fruticosa L.	Not Evaluated	Xeric Mediterranean Phrygana and grasslands	Native / Non Range-Restricted	None
Prasium majus L.	Not Evaluated	Xeric Mediterranean Phrygana and grasslands, Woodlands and scrub	Native / Non Range-Restricted	None

As it was expected, the above plants are typical for the habitat “Xeric Mediterranean Phrygana and grasslands” and they do not possess any specific protection status.

4.6.6 Critical habitat assessment

ENVITERRA conducted a critical habitat assessment which provided a technical assessment of the extent of natural and critical habitats of relevance to the proposed Project. Natural and critical habitats are areas of high biodiversity value, where stringent requirements must be met if Project activities are to be permitted within them.

Critical habitats are areas with high biodiversity value determined on the basis of meeting one or more of the following criteria defined by IFC (2012):

- Criterion 1: habitats of significant importance to critically endangered (CR) and/or endangered (EN) species
- Criterion 2: habitat of significant importance to endemic and/or restricted-range species

- Criterion 3: habitat supporting globally important concentrations of migratory and/or congregatory species
- Criterion 4: highly threatened and/or unique ecosystems
- Criterion 5: areas associated with key evolutionary processes.

The fulfilment of any one of these criteria is enough to qualify habitat as critical. Critical habitats can be either natural habitats or modified. The presence of critical habitat does not necessarily mean that the project will impact particular critical habitat-qualifying features. A number of scenarios are possible, from impacts that are negligible, readily avoided or temporary, to those that are significant, long-term and challenging to mitigate.

The identified habitat "Xeric Mediterranean Phrygana and Grasslands" does not fulfil any of the criteria posed for being a Critical Habitat.

4.6.7 Priority fauna survey

A priority fauna survey of the study area was undertaken between 20 and 27 of May 2022. The primary objective of the survey was to increase the current level of understanding regarding the presence/likely absence of priority fauna species' habitat usage in the study area including mammals, reptiles, amphibians and invertebrates. Priority fauna of conservation importance are defined as nationally and/or globally rare or threatened species, and endemic and/or restricted range species and congregatory species present in significant numbers. Surveyors searched for direct evidence (i.e. sightings, vocalisations) and indirect evidence of fauna activity (i.e. prints, scats, feeding remains, scents-urine).

If evidence of a priority fauna or flora species was observed, the following parameters were recorded:

- Species
- Location

- Surrounding habitat type

The species of fauna identified in the Project Area are presented in Table 4.6.

Table 4.6: Species of fauna identified in the Project Area

Name	Type	IUCN Status	Habitat
Lacerta trilineata	Reptile	Least Concern	Shrubland, Artificial/Terrestrial
Chalcides ocellatus	Reptile	Least Concern	Savanna, Shrubland, Grassland, Wetlands (inland), Rocky areas (e.g., inland cliffs, mountain peaks), Caves and Subterranean Habitats (non-aquatic), Artificial/Terrestrial
Ablepharus kitaibeli	Reptile	Least Concern	Forest, Shrubland, Grassland, Artificial/Terrestrial
Rattus rattus	Mammal	Least Concern	Shrubland, Artificial/Terrestrial

4.6.8 Priority avian fauna survey

A bird survey was undertaken between 20 and 27 of May 2022. The survey began between one or two hours after sunrise to coincide with peak bird activity. All bird species that were sighted or heard vocalizing were recorded on field maps along with notes of behavior. Focus was given to priority bird species of conservation importance namely: nationally and/or globally rare or threatened species, endemic and/or restricted range species, and congregatory and migratory bird species present in significant numbers.

The species of avian fauna identified in the Project Area are presented in Table 4.7.

Table 4.7: Species of Avian Fauna identified in the Project Area

Scientific Name	IUCN Status	Presence	Population	Protection Status		
				SPEC	79/409	R.B.
Streptopelia	Least Concern	R	C			
Hirundo rustica	Least Concern	B	C	3		
Delichon urbica	Not Evaluated	B	C			

Scientific Name	IUCN Status	Presence	Population	Protection Status		
				SPEC	79/409	R.B.
Turdus merula	Least Concern	R	R	4		
Pica pica	Least Concern	R	C			

Table legend

Protection Status	Population
B : Nesting	C : Common
M : Migrating through	R : Rare
R : Residing permanently	V : Very Rare
W : Winteing	P: Present but not estimated
R.B.: Red Book of Endangered Species	**SPEC : (Species of special concern)**
E1 : Endangered Species	1 : Endangered World-Wide
V : Vulnerable Species K : Unknown/Insufficient Data	2: Population found only in Europe, under harsh preservation directive
	3: Population not only found in Europe, under harsh preservation directive
	4: Population found only in Europe, under lax preservation directive

4.6.9 Marine ecosystems

No field survey was possible during the conduction of the ESIA. All relevant data were collected from literature and presented in paragraph 4.10.

4.7 Ecosystem Services

IFC PS6 defines ecosystem services as “the benefits that people, including businesses, derive from ecosystems”. PS6 distinguishes ecosystem services into four types:

- Provisioning services, which are the products people obtain from ecosystems
- Regulating services, which are the benefits people obtain from the regulation of ecosystem processes

- Cultural services, which are the nonmaterial benefits people obtain from ecosystems
- Supporting services, which are the natural processes that maintain the other services.

4.7.1 Provisioning services

Provisioning services are characterized by the ability of humans to obtain products from ecosystems, such as food, water and resources, including wood, oil and genetic resources and medicines.

Provisioning services within the Project socio-economic AOI may be considered:

- Freshwater
- Land (including crop farming and livestock)
- Hunting
- Fishing/aquaculture/underwater mining

4.7.2 Regulating Services

Regulating services are categorized as any benefit obtained from the natural processes and functioning of ecosystems [Earth.Org, 2022]. Examples include climate regulation, flood regulation and other natural hazard regulation, pollination, water purification and more.

Regulating services within the Project socio-economic AOI may be considered:

- Forest areas
- Marine ecosystems
- Freshwater ecosystems
- Important Habitats

4.7.3 Cultural Services

Cultural services include non-material benefits that people can obtain from ecosystems [Earth.Org, 2022]. These include spiritual enrichment, intellectual development, recreation and aesthetic values. These types of services can be hard to monitor and value compared to regulating and provisioning services, but research in this area is growing. For example, studies have shown that an ability to see or interact with nature, through hospital windows or hospital gardens respectively, increases the speed of patient recovery.

4.7.4 Supporting services

Supporting services are those which relate to habitat functioning themselves, and therefore influence survival [Earth.Org, 2022]. For example, photosynthesis, the water cycle and nutrient cycles are the basis of ecosystems, which in turn allow us to support ourselves. This type of ecosystem service also goes down to the genetic level, such as the maintenance of viable species gene pools.

4.8 Groundwater

4.8.1 General information

The lithological formations involved in the formation of the project area, are mainly limestones, dolomite limestones and dolomites of the Paleozoic and Mesozoic, shales and sandstones of the Paleozoic, including among them layers of cobblestones, chalaziton etc. as well as bodies of basic eruptive rocks, neonatal formations of marly, clays, sandstones, marly limestones, cobblestones, etc. and finally typical Quaternary formations.

The circulation of the infiltrating water in the ground and the formation of aquifers largely depend on the affected location in relation to the watertight formations of the area.

In coastal areas and, generally, in areas where the contact of an aquifer with its underlying seal happens below sea level, the movement of fresh water is affected by the sea, as it soaks through the aquifer deep into the land, and acts as a bed on which the fresh water "floats", as a lighter liquid.

4.8.2 Karst aquifers

The most interesting aquifers are those, which are formed in the limestones, especially in the middle-upper triads. These limestones occupy most of the project area, often in layers up to 350m thick. They range from loose to thick layered limestones and have undergone intense fragmentation from flooding, a favourable factor towards strong decomposition.

These limestones are fed on the one hand by rainwater that falls directly on them and, on the other, by the lateral transfusion of water from the torrents of the area during the wet period of the year.

These limestones also receive water transfused through, directly or indirectly, the overlying Cretaceous and Upper Triassic limestones.

The direction of the inflow of water depends partially on its downward path to the meeting point of the watertight Palaeozoic layer, where it is forced to change course in a direction matching the slope formed by the permeable and impermeable limestone formations.

The paths of the moving water converge to deeper basins formed by watertight layers, either due to subduction, transition or other reasons. This way, greater richer flows are formed along subterranean "rivers", as groundwater flows to deeper levels.

This controlled movement of the groundwater along watertight layers stops once the water meets the aquifer, where it pools.

Should the flowing groundwater flowing along the watertight layers encounter a natural intersection along the way, which intersects transversely from the area of contact of the permeable and watertight formation to surface, then a spring manifests.

Springs of this kind that are found in the area, such as those of Villia, Kaza, etc., are all of low magnitude.

The aquifers that form in karst Mesozoic limestones, occupy mainly coastal areas, where the impermeable Palaeozoic layers grow at negative altitudes, well below sea level, where fresh water in the limestones is at a dynamic equilibrium with sea water.

The above aquifers discharge their waters to the sea through coastal and underwater springs. The most important of these springs are those found in the bays of Psatha and Porto Germeno and, secondarily, those in the area north of Skaramaga, in Lake Koumoundourou and on the south bank of the stream Chaverdella found further north, next to the facilities of Aspropyrgos Refineries.

Finally, coastal and underwater karst springs manifest along the coast from Elefsina to Loutropyrgos and beyond, up to Megalo Pefko (Neraki spring), but their magnitude is even lower than the ones already mentioned.

The presence of Neogene sediments, which, in their entirety, are considered to be waterproof formations, and which, due to transitions, come into tectonic contact with the limestones and constitute barriers to the flow of groundwater, also has a key role in the circulation of karstic aquifers towards certain directions.

4.8.3 Groundwater Bodies (NRBP)

The study area lays over the EL0600060 groundwater body, according to the National River Basin Plan (NRBP) of the Water Department of Attica (EL06) [YPEN, 2017] i.e., Patera water body (see also Figure 4.17). The Elefsis Bay is the meeting point for 5 different Groundwater bodies: Patera, Thriasio Pedio, NE Parnitha, Megara-Alepohori and Salamina, the qualities of which are presented in Table 4.8.

Figure 4.17: Groundwater Bodies of Attica

Table 4.8: Quantity/Quality Evaluation of Groundwater Bodies

Designation	Name	Area (km^2)	Mean annual supply (hm^3)	Mean annual pumping (hm^3)	Irrigation (hm^3)	Other uses (hm^3)	Quantity	Quality
EL0600060	**Patera**	**325**	**60**	**2,12**	**1,58**	**0,53**	**Good**	**Good**
EL0600051	Megara Alepohori	148	22	23,3	23,30	0,00	Bad	Bad
EL0600080	NE Parnitha	445	85	10,28	4,46	5,84	Good	Good
EL0600090	Thriasio Pedio	79	8	8,48	5,20	3,29	Bad	Bad
EL0600190	Salamina	95	8,6	2,2	2,2	0,0	Bad	Bad

As shown in the above Table, the groundwater body of interest (EL0600060), presents good quality, despite the presence of many heavy industrial facilities in the area. That is probably due to the fact that the particular body presents lower annual pumping rate

(2,12 hm^3/year) than the other groundwater bodies found around Elefsina Bay. The main use of the GR0600060 body corresponds to irrigation and the rest is used mainly for industrial purposes.

4.9 Surface Waters

Surface water bodies may include rivers, streams, lakes, coastal and transitional waters. The latter are defined as: "*Surface water systems near the mouth of rivers which are partly saline due to their proximity to coastal waters, but which may be substantially affected by freshwater currents*". Coastal Waters (CW) are defined as *"surface waters on the land side of a line which is one nautical mile to the sea from the nearest point of the baseline from which the amplitude of the territorial waters is measured and which, as the case may be, extends to the extreme lim*it".

According to the National River Basin Plan of the Water Department of Attica (EL06) [YPEN, 2017], no rivers, streams, lakes, lagoons, estuaries or deltas, temporary or permanent, of any significance appear in or around the immediate study area. The only surface water bodies refer to Coastal Waters. The study area is adjacent to the Elefsina bay and its coastal bodies (CW) of water, as presented below (Table 4.9- YPEN, 2017).

Table 4.9: Surface Water Bodies found at the area of interest [YPEN, 2017]

Cat.	Designator	Name	Ecological State	Chemical State	Total State	Area (km^2)	Circum. (km)	Type
CW	EL0626C0006H	West Elefsis Bay	average	good	average	58.7	76.7	Natural
CW	EL0626C0007H	East Elefsis Bay	average	good	average	12.8	22.1	Particularly Modified

To date, human activity has altered the original characteristics of some water systems. According to the Directive 2000/60/EK, a *particularly modified water system* (PMWS) is defined as: "*a surface water system whose character has changed substantially due to* *natural alterations from human activities, and which is defined by the Member State*" (Definition in accordance with Article 2, paragraph 9 of the Directive).

The PMWS system of the East Elefsina Bay CW body (see Table 4.6) has been designated for sailing, trade and industrial use, while West Elefsis bay CW (designated as natural), and specifically the areas of Elefsina (GRBW069229028, GRBW069229027), Perama (GRBW069231072), Ai Nikola - Batsi (GRBW069211098), Vasilika (GRBW069211085), Ble Limanaki (GRBW069211080), Psili Ammos (GRBW069211089) are designated as recreational areas and beaches [YPEN, 2017].

Also, according to Ministerial Decision 19661/1982/1999 (Gazete 1811B'/29.09.1999) and NRBP of Department of Attica - EL06, the areas presented in Table 4.10 have been designated as environmentally sensitive.

Table 4.10: Environmentally sensitive areas of the Saronic Gulf [YPEN,2017].

Sensitive Area Code	Water Body Code	Name
EL0626C0006NUW	**EL0626C0006N**	**West Elefsina Bay**
EL0626C0007NUW	**EL0626C0007N**	**East Elefsina Bay**
EL0626C0011NUW	EL0626C0011N	Central Saronikos - Psitalleia
EL0626C0008HUW	EL0626C0008H	Peiraiki - Perama Coast

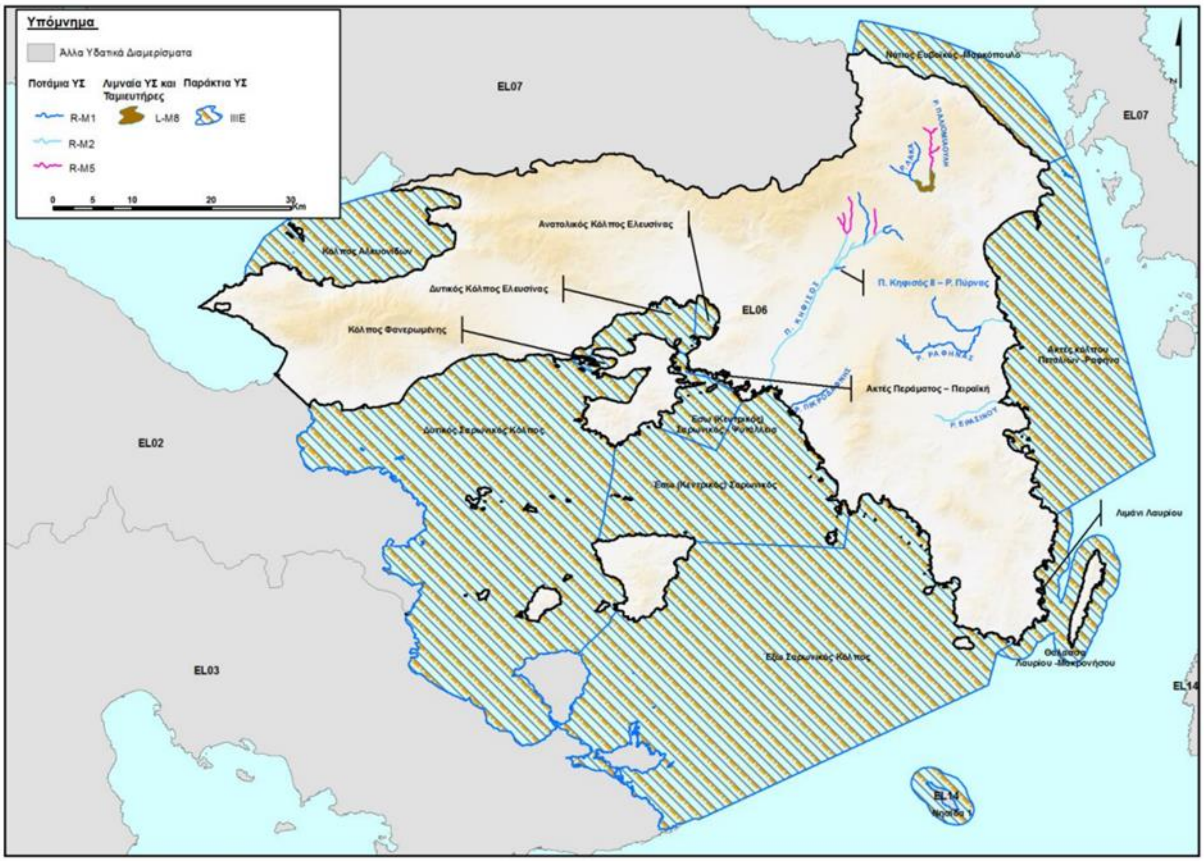


Figure 4.18: Surface water bodies of Attica

4.10 Marine Environment

4.10.1 Saronic Gulf

The area of Elefsis Shipyards belongs to the Saronic Gulf, a marine ecosystem for which we have a lot of information about its physicochemical and biological parameters, its geological and depth characteristics and the structure and dynamics of marine masses. The existence of the scope and quantity of this information is due both to its geographical location and to the fact that it is an area in which anthropogenic interventions have affected and continue to affect the ecosystem.

Saronikos Gulf is located in the Aegean Sea between Attica and eastern Peloponnese Peninsula and is considered as one of the most important gulfs of Greece, due to its particular environmental conditions and sea floor morphology. Through the ages, the coastal areas surrounding the gulf were used for economic and strategic purposes, with the most important of these being the Piraeus port and Elefsis Bay. Both are located on the north-eastern part of the gulf and are strongly linked to human activities since the beginning of the ancient Greek civilization.

The area holds a great geomorphological and environmental interest, due to the human intervention since ancient times but also due to the various landforms and processes that form its amazing underwater and coastal landscape, such as the active submarine volcano "Pausanias", the volcano of Methana peninsula and the tectonic profile of the area. Saronikos Gulf is characterized by mild recent seismicity but in its north and east margins occurred both historical and recent earthquakes. In addition, the industrial activities along the coast of Elefsis Bay affect the ecosystems of NE Saronikos Gulf, leaving traces of human activity that impacts the environmental status of the inner Saronikos Gulf.

4.10.2 Elefsis Bay

The bay of Elefsis has been characterized as a sensitive area according to the JMD 19661/1982/99 (OG 1811/B).

The bay of Elefsina is an inner gulf and is located in northern part of the Saronic Gulf. It is a semi-enclosed sea basin that extends in the direction A - D, to a length of about 12 miles, where it is defined from the southern coasts of Attica and specifically from Skaramaga bay, (east), to Megalo Pefko, (west), and from its northern shores Salamina (south) and is the result of neotectonic processes that led splitting the wider area. Two basic ruptured systems dominate in the region, the DBD-ANA system and the SW-NE [Lekkas, 2001]. In the area there is a smaller catchment area which mainly extends to the north part of the bay.

The hydrographic network of the area is seasonal and ends in the bay of Elefsina which also contributes to the supply of the gulf with sediments. Regarding the depth of the bay, at in its eastern part there are areas with depths of 10-25 meters while in its western part section depths exceed 30 meters. The systematic profile of the bottom shows the thickness of the Holocene sediment to cover 3-5 meters east section and 10-15 meters to the west [Fragou et al. 2020].

The bay of Elefsina differs from the rest of the Saronic Gulf due to the sharp reduction of soluble oxygen in the deeper layer in the western part of the gulf with transient states of anoxic conditions. The reduction of soluble oxygen occurs because the stratification that occurs during the summer months with the development of the thermocouple and the accumulation of organic material in the area below it results in the consumption of oxygen in the deeper layer.

In the western basin of the gulf the soluble oxygen presents a peculiar distribution which in the upper layer 0 - 100 meters are similar to that presented in the inner Saronic at the respective depths while at a depth of 100 meters the western basin is completely different from the rest of the gulf due to intense reduction of oxygen to the bottom.

According to various studies, the western basin of the Saronic Gulf is a reservoir where both organic load and nutrients accumulate with water stagnation conditions prevailing at depths greater than 100 meters to make it sensitive to the accumulation of organic pollutants and its complete recovery requires 8.1 years, a period that is significantly longer compared to the inland Saronic Gulf, the corresponding renewal period for which is only a few months. The Saronic Gulf presents a wide range of food conditions due to the eutrophication phenomena that have emerged in recent decades as a result of pollution mainly from municipal and industrial waste and have gradually changed its natural oligotrophic character. Various environmental impact studies describe the changes that occur in relation to phytoplankton populations and refer to patterns of spatial and temporal changes due to existing terrestrial sources of pollution.

In general, maximum concentrations of chlorophyll and phytoplankton are recorded in the areas of the bay of Elefsina, confirming their eutrophic character. Studies in the Saronic Gulf show the predominance of large algae of the genus Cystoseira that are the final aspect of the biocommunity of photophilous algae and reflect conditions of ecological balance.

Nitrophilous species that are considered indicators of mainly organic pollution such as the chlorophyll Ulva Rigida show significant abundance in the area of Elefsina on the west coast of the bay. However, even in this area the structure of the marine vegetation shows that the benthos is in stages of transition from a typically degraded plant community to a healthy one with the predominance of large algae. Benthic organisms due to their direct and permanent contact with the seabed clearly reflect environmental changes of small or large intensity and duration.

4.10.3 Marine Ecosystems

Benthic organisms (phytobenthos and zoobenthos) are the most vulnerable to environmental disturbances, while due to their direct and permanent contact with the seabed they clearly reflect environmental changes of small or large intensity and duration and therefore reflect a stable image. of the marine ecosystem. Thus, the composition and structure of benthic biocommunities reliably reflect environmental conditions and describe the state of the entire marine ecosystem, that is, they serve as "environmental history books".

<u>Phytobenthos</u> are the photosynthetic organisms (producers) while <u>zoobenthos</u> are either the secondary consumers or the tertiary consumers.

The benthic biocommunities of the Saronic Gulf and Elefsis Gulf in general and the immediate study area have been studied from time to time mainly by the Hellenic Center for Marine Research (HCMR).

In general, the entire benthic ecosystem of the study area can be divided into the following zones:

1. <u>Hyper-coastal or neo-coastal zone</u>. This zone is located above the upper sea level. It is the coastal rocky or sandy area that is exposed to the effects of the waves

and is completely absent of significant vegetation. In the rocky parts of the coast, the presence of lichens is observed, which give the black color to the rocks locally in a width of 0.20-0.30 meters, as well as less frequently cyanotic and chlorophyll.

2. Meso-coastal zone. It is located between the upper and lower sea level. It has a relatively small range and includes the zone where the breaking and deformation of the sea wave takes place, up to the upper limit where the algae of the genus Cystoseira appear. The rocky and stony parts of the coast in this zone are covered by a large number of chlorophylls (mainly of the genus Ulva). In this zone live on rocky substrates mainly, some species of invertebrates (eg horseshoes of the genera Patella and Chathamalus & snails of the genus Monodonta) as well as a few crabs of the genus Carcinus).
3. Sub-coastal zone. It starts below the sea level and extends to the upper limit of the spread of phytophilic algae and marine angiosperms (Posidonia oceanica occurrence zone). In the case of the study area, this limit rarely exceeds -25m. depth. In this zone, and according to the results of HCMR, there is a change in the annual cycle both in the composition and in the structure of the marine vegetation.
4. Deep coastal zone. It extends from the level of appearance of the marine phanerogamous Posidonia oceanica to the depth where the marine vegetation stops completely. (Note: Posidonia oceanica is particularly sensitive to pollution and is of great ecological importance).

Phytobenthos

In the bay of Elefsina, due to the reduced water transparency, the phytobenthos is located only up to the first 3-5m water depth. Also typical is the absence of typical Mediterranean biocommunities such as the Posidonia oceanica submarine meadow in the coastal zone and the coral biocommunity in the coastal zone. In the southern part of the bay of Elefsina, on the rocky shores of Salamina, there is a bio-community of photophilous algae (bio-communities that usually present 100-150 species) which is mainly dominated by the chlorophyll Ulva rigida and Enteromorpha intestinalis. Large quantities of biomass, detached from the above plants are observed along the coastline which rot consuming oxygen and intensifying the phenomenon of anoxic conditions.

The Shipyard area is located outside the marine areas of the Natura 2000 network and outside areas where Poseidonia meadows are found [Mentzafou et al., 2015].

Zoobenthos

In the case of macrozoobenthos, due to the absence of oxygen in the deeper layer of the water column during the warm season, the populations of benthic organisms are reduced to complete extinction (nitrogenous state) from September to December. After mixing the water column in October-November and enriching the deeper layer followed by oxygen sediment, the benthic larvae colonize the sediment, forming a new biocommunity. This cycle is repeated due to the periodicity of the anoxic conditions.

Comparison of the ecological indicators with historical data of the period 1975-1985 in the Gulf of Elefsis show a spectacular improvement of the situation of the benthic societies from 1985 until today. The benthic fauna of the region of the Western basin is at a moderate level of organization. The relatively poor benthic fauna and the low level of organization of biocommunities are probably associated with increased organic load as indicated by the high concentrations of organic carbon at the bottom and the presence in high concentrations of species of transitional zones and indicators of instability.

Marine fauna

The species of marine fauna, whose presence is expected in the marine environment of the study area, are the following: Mugil cephalus (κέφαλος) και Dicentrarchus labrax (λαβράκι), while in deeper waters in the open are expected species that live in moderate depths of the Saronic Gulf, such as: Atherina hepsetus (αθερίνα), Engraulis enrcrasicholus (γάβρος), Boops boops (γόπα), Mugil cephalus (κέφαλος), Scomber japonicus (κολιός), Dicentrarhus labrax (λαβράκι), Pagellus erythrinus (λιθρίνι), Oblada melanura (μελανούρι), Mullus surmuletus (μπαρμπούνι), Boops salpa (σάλπα), Diplodus sargus (σαργός), Sardina pilchardus (σαρδέλα), Scorpaena sp. (σκόρπαινα), Diplodus annularis (σπάρος), Spicara smaris (μαρίδα), Octopus vulgaris (χταπόδι) κ.ά..

4.10.4 Shipyard Area of Influence

In order to better assess the condition of the marine environment of the Shipyard area, sampling and measurements have been performed according to existing recent monitoring records.

Sampling was performed on a water column in 5 different locations (see Table 4.11), while sediment samples were taken from sea the bottom at the same locations. Sampling and monitoring cover a period from 2011 to 2021:

Table 4.11: Marine and Aquatic Monitoring Sampling Points

No	Sampling Point	Type of Sample
S1	Shipbuilding Bed	Seawater, Sediment
S2	Vertical Pier	Seawater, Sediment
S3	Floating Tank	Seawater, Sediment
S4	Small Port	Seawater, Sediment
S5	New Quay	Seawater, Sediment

Figure 4.19: Seawater and Sediment Sampling Points

Seawater: Hereinafter, monitoring results for seawater quality are presented.

Table 4.12: Monitoring Results for Seawater Quality in Sampling Point 1 (Shipbuilding Bed) (nd: non-detected)

Parameter	Unit	2011	2013	2015	2016	2017	2020
pH	-	8,08		8,1	8,3	8,2	8,0
Total petroleum hydrocarbons (TPH index)	mg/l	nd	0,5	nd	nd	nd	nd
Total suspended solids (TSS)	mg/l	nd	2,8	20	20	98	17,4
Ammonium (NH4 +)	mg/l	nd	nd	nd	nd	5,5	nd
Total phosphorus (P)	μg/l	nd	nd	nd	nd	nd	nd
Biochemically required oxygen (BOD)	mg/l	nd	nd	68	45	nd	nd
Chemically Required Oxygen (COD)	mg/l	nd	38	179	110	nd	19,3
Copper (Cu)	mg/l	nd	nd	0,2	0,1	nd	nd
Zinc (Zn)	mg/l	nd	0,04	nd	nd	nd	nd

Parameter	Unit	2011	2013	2015	2016	2017	2020
Lead (Pb)	mg/l	nd	nd	0,07	0,05	nd	nd
Cadmium (Cd)	mg/l	nd	nd	nd	nd	nd	nd
Mercury (Hg)	mg/l	nd	nd	nd	nd	nd	nd
Arsenic (As)	mg/l	nd	nd	nd	nd	nd	nd
Cobalt (Co)	mg/l	nd	nd	nd	nd	nd	nd
Nickel (Ni)	mg/l	nd	nd	nd	nd	nd	nd
Total chromium (Cr)	mg/l	nd	nd	nd	nd	nd	nd
Hexavalent chromium (Cr VI)	mg/l	nd	nd	nd	nd	nd	nd
Manganese (Mn)	mg/l	nd	nd	nd	0,1	nd	nd
Iron (Fe)	mg/l	nd	nd	nd	nd	nd	nd

Table 4.13: Monitoring Results for Seawater Quality in Sampling Point 2 (Vertical Pier)

Parameter	Unit	2011	2013	2015	2016	2017	2020
pH	-	8,12		8,2	8,3	8,0	8,0
Total petroleum hydrocarbons (TPH index)	mg/l	nd	0,2	nd	nd	nd	nd
Total suspended solids (TSS)	mg/l	nd	5,2	18	18	107	18,1
Ammonium (NH4 +)	mg/l	nd	nd	nd	nd	8,1	nd
Total phosphorus (P)	μg/l	nd	nd	nd	nd	nd	-
Biochemically required oxygen (BOD)	mg/l	nd	nd	46	37	11,5	nd
Chemically Required Oxygen (COD)	mg/l	nd	44	115	90	nd	19
Copper (Cu)	mg/l	nd	nd	0,1	0,1	nd	nd
Zinc (Zn)	mg/l	nd	0,04	nd	nd	0,12	nd
Lead (Pb)	mg/l	nd	nd	nd	nd	nd	nd
Cadmium (Cd)	mg/l	nd	nd	nd	nd	nd	nd
Mercury (Hg)	mg/l	nd	nd	nd	nd	nd	nd
Arsenic (As)	mg/l	nd	nd	nd	nd	nd	nd
Cobalt (Co)	mg/l	nd	nd	nd	nd	nd	nd
Nickel (Ni)	mg/l	nd	nd	nd	nd	nd	nd
Total chromium (Cr)	mg/l	nd	nd	nd	nd	0,065	nd
Hexavalent chromium (Cr VI)	mg/l	nd	nd	nd	nd	nd	nd
Manganese (Mn)	mg/l	nd	nd	nd	0,1	nd	nd
Iron (Fe)	mg/l	nd	nd	nd	nd	nd	nd

Table 4.14: Monitoring Results for Seawater Quality in Sampling Point 3 (Floating Tank)

Parameter	Unit	2011	2013	2015	2016	2017	2020
pH		8,09		7,8	8,1	8,2	8,01
Total petroleum hydrocarbons (TPH index)	mg/l	nd	0,2	nd	nd	nd	nd
Total suspended solids (TSS)	mg/l	nd	2	10	15	66	35,9

Parameter	Unit	2011	2013	2015	2016	2017	2020
Ammonium (NH4 +)	mg/l	nd	nd	nd	nd	3,2	nd
Total phosphorus (P)	μg/l	nd	nd	nd	nd	nd	nd
Biochemically required oxygen (BOD)	mg/l	nd	nd	17,4	30	nd	nd
Chemically Required Oxygen (COD)	mg/l	nd	52	40	75	nd	20,9
Copper (Cu)	mg/l	nd	nd	nd	nd	nd	nd
Zinc (Zn)	mg/l	nd	0,02	nd	nd	nd	nd
Lead (Pb)	mg/l	nd	nd	nd	nd	nd	nd
Cadmium (Cd)	mg/l	nd	nd	nd	nd	nd	nd
Mercury (Hg)	mg/l	nd	nd	nd	nd	nd	nd
Arsenic (As)	mg/l	nd	nd	nd	nd	nd	nd
Cobalt (Co)	mg/l	nd	nd	nd	nd	nd	nd
Nickel (Ni)	mg/l	nd	nd	nd	nd	nd	nd
Total chromium (Cr)	mg/l	nd	nd	nd	nd	nd	nd
Hexavalent chromium (Cr VI)	mg/l	nd	nd	nd	nd	nd	nd
Manganese (Mn)	mg/l	nd	nd	nd	nd	nd	nd
Iron (Fe)	mg/l	nd	nd	nd	nd	nd	nd

Table 4.15: Monitoring Results for Seawater Quality in Sampling Point 4 (Small Port)

Parameter	Unit	2011	2013	2015	2016	2017	2020
pH		7,78		7,3	8,1	8,1	7,64
Total petroleum hydrocarbons (TPH index)	mg/l	nd	nd	nd	nd	nd	nd
Total suspended solids (TSS)	mg/l	nd	4,4	10	12	107	835,1
Ammonium (NH4 +)	mg/l	nd	nd	nd	nd	nd	nd
Total phosphorus (P)	μg/l	nd	nd	nd	nd	nd	nd
Biochemically required oxygen (BOD)	mg/l	nd	nd	12,5	24	10,1	nd
Chemically Required Oxygen (COD)	mg/l	nd	46	30	60	nd	28,9
Copper (Cu)	mg/l	nd	nd	nd	nd	nd	nd
Zinc (Zn)	mg/l	nd	0,04	nd	nd	nd	nd
Lead (Pb)	mg/l	nd	nd	nd	nd	nd	nd
Cadmium (Cd)	mg/l	nd	nd	nd	nd	nd	nd
Mercury (Hg)	mg/l	nd	nd	nd	nd	nd	nd
Arsenic (As)	mg/l	nd	nd	nd	nd	nd	nd
Cobalt (Co)	mg/l	nd	nd	nd	nd	nd	nd
Nickel (Ni)	mg/l	nd	nd	nd	nd	nd	nd
Total chromium (Cr)	mg/l	nd	nd	nd	nd	nd	nd
Hexavalent chromium (Cr VI)	mg/l	nd	nd	nd	nd	nd	nd
Manganese (Mn)	mg/l	nd	nd	nd	nd	nd	nd

Iron (Fe)	mg/l	nd	nd	nd	nd	nd	nd

Table 4.16: Monitoring Results for Seawater Quality in Sampling Point 5 (New Quay)

Parameter	Unit	2011	2013	2015	2016	2017	2020
pH		7,94		8,1	8	7,8	7,91
Total petroleum hydrocarbons (TPH index)	mg/l	nd	nd	nd	nd	nd	nd
Total suspended solids (TSS)	mg/l	nd	1,1	16	12	119	138,2
Ammonium (NH4 +)	mg/l	nd	nd	nd	nd	2,8	nd
Total phosphorus (P)	μg/l	nd	nd	nd	nd	nd	nd
Biochemically required oxygen (BOD)	mg/l	nd	nd	48	22	nd	nd
Chemically Required Oxygen (COD)	mg/l	nd	31	120	55	nd	24,4
Copper (Cu)	mg/l	nd	nd	0,1	0,1	nd	nd
Zinc (Zn)	mg/l	nd	0,03	nd	nd	nd	nd
Lead (Pb)	mg/l	nd	nd	0,08	0,08	nd	nd
Cadmium (Cd)	mg/l	nd	nd	nd	nd	nd	nd
Mercury (Hg)	mg/l	nd	nd	nd	nd	nd	nd
Arsenic (As)	mg/l	nd	nd	nd	nd	nd	nd
Cobalt (Co)	mg/l	nd	nd	nd	nd	nd	nd
Nickel (Ni)	mg/l	nd	nd	nd	nd	nd	nd
Total chromium (Cr)	mg/l	nd	nd	nd	nd	nd	nd
Hexavalent chromium (Cr VI)	mg/l	nd	nd	nd	nd	nd	nd
Manganese (Mn)	mg/l	nd	nd	nd	nd	nd	nd
Iron (Fe)	mg/l	nd	nd	nd	nd	nd	nd

Regarding the results of the monitoring program for seawater presented in the above Tables, the following conclusions can be made:

- Heavy metals (a strong indicator for industrial pollution) are non-detectable in all samples for all years
- Petroleum Hydrocarbons are also not present, thus indicating no incident of industrial pollution
- COD and BOD values are low (non-detectable is many cases), thus indicating that no organic pollution is present (e.g., from sewage or other municipal waste entering the sea)
- pH values are typical for a clean saltwater body

- The measured values are in compliance with the National Recommended Water Quality Criteria for Aquatic Life protection proposed by US EPA [US EPA, 2009]

Sediment/Dredging: Hereinafter, monitoring results for sediment/dredging quality are presented:

Table 4.17: Monitoring Results for Sediment Quality in Sampling Point 1 (Shipbuilding Bed)

Parameter	Unit	2011	2013	2013	2015	2016	2017	2020
Arsenic (As)	mg/kg	0	29	52	35	540	48	nd
Lead (Pb)	mg/kg	181	420	3949	400	6100	490	nd
Cadmium (Cd)	mg/kg	nd	nd	nd	nd	3,2	0,3	nd
Total chromium (Cr)	mg/kg	120	560	807	790	2400	390	nd
Iron (Fe)	mg/kg	2500	27500	126933	35400	200000	52000	134,5
Copper (Cu)	mg/kg	320	1400	626	710	980	480	nd
Manganese (Mn)	mg/kg	310	1200	3982	1980	5400	720	nd
Nickel (Ni)	mg/kg	95	310	1066	510	520	160	nd

Table 4.18: Monitoring Results for Sediment Quality in Sampling Point 2 (Vertical Pier)

Parameter	Unit	2011	2013	2013	2015	2016	2017	2020
Arsenic (As)	mg/kg	0	42	23	39	40	390	nd
Lead (Pb)	mg/kg	311	280	1660	133	160	2700	nd
Cadmium (Cd)	mg/kg	0	1	0	nd	nd	1,1	nd
Total chromium (Cr)	mg/kg	294	1720	766	530	610	160	nd
Iron (Fe)	mg/kg	13900	26200	78643	67000	65000	61000	124,9
Copper (Cu)	mg/kg	690	1200	429	1667	1580	520	nd
Manganese (Mn)	mg/kg	820	510	1915	600	750	1600	nd
Nickel (Ni)	mg/kg	108	290	271	305	420	73	nd

Table 4.19: Monitoring Results for Sediment Quality in Sampling Point 3 (Floating Tank)

Parameter	Unit	2011	2013	2013	2015	2016	2017	2020
Arsenic (As)	mg/kg	0	25	26	22	27	28	nd
Lead (Pb)	mg/kg	374	360	2067	370	310	310	nd
Cadmium (Cd)	mg/kg	0	0,7	0	nd	nd	0,3	nd
Total chromium (Cr)	mg/kg	250	1900	313	1300	1750	1300	nd
Iron (Fe)	mg/kg	155000	110000	61753	95000	95000	83000	199,9
Copper (Cu)	mg/kg	780	1300	803	730	1400	2400	nd
Manganese (Mn)	mg/kg	795	1700	2711	1967	1900	1200	nd
Nickel (Ni)	mg/kg	111	360	121	440	390	240	nd

Table 4.20: Monitoring Results for Sediment Quality in Sampling Point 4 (Small Port)

Parameter	Unit	2011	2013	2013	2015	2016	2017	2020
Arsenic (As)	mg/kg	nd	55	20	29	58	65	nd
Lead (Pb)	mg/kg	322	510	880	260	490	760	nd
Cadmium (Cd)	mg/kg	nd	0,4	0	nd	nd	0,3	nd
Total chromium (Cr)	mg/kg	271	1100	821	370	1050	1100	nd
Iron (Fe)	mg/kg	133000	80000	75360	36300	78000	84000	101,9
Copper (Cu)	mg/kg	721	1200	1023	380	1360	1000	nd
Manganese (Mn)	mg/kg	745	810	1471	500	950	1300	nd
Nickel (Ni)	mg/kg	104	240	164	35	260	150	nd

Table 4.21: Monitoring Results for Sediment Quality in Sampling Point 5 (New Quay)

Parameter	Unit	2011	2013	2013	2015	2016	2017	2020
Arsenic (As)	mg/kg	nd	23	10	25	28	17	nd
Lead (Pb)	mg/kg	120	140	63	200	210	130	nd
Cadmium (Cd)	mg/kg	nd	0,4	nd	nd	nd	nd	nd
Total chromium (Cr)	mg/kg	101	240	81	100	290	260	nd
Iron (Fe)	mg/kg	1310	28000	1148	2000	26000	23000	111,9
Copper (Cu)	mg/kg	151	1200	228	230	760	710	nd
Manganese (Mn)	mg/kg	280	480	235	250	460	380	nd
Nickel (Ni)	mg/kg	89	99	39	110	93	71	nd

Regarding the results of the monitoring program for sediment/dredging presented in Tables 4.17-4.21, the following conclusions can be made:

- The monitoring parameters are not sufficient to describe the sediment quality. According to UNEP(DEPI)/MED WG.443/15.2017. “Draft Decision: Guidelines for Regulating the Dumping of Dredged Materials at Sea” (see Chapter 2), parameters such as Mercury (Hg), Zinc (Zn), PCBs, PAHs and TBT have not been evaluated. Note that the above decision does not recommend any limit values for Fe and Mn.
- Regarding the measured parameters for the years 2011 – 2017, according to the above decision, the values of Cr, Pb and Cu do not permit any dumping of sediments (in case they are extracted for example during dredging activities).
- Sediment concentrations measured are rather typical or even lower from other samples coming from commercial or industrial areas e.g., from the Port of Piraeus or Vouliagmeni Marine [HCMR, 2015]

- Since the seawater quality is excellent, sediment if not disturbed, do not pose any immediate threat.
- There is a great discrepancy between the results coming from the period 2011-2017 and those derived from 2020. We consider that the latest results are rather biased. A constant monitoring program should be established before and during the forthcoming operation of the Shipyard (see also Chapters 10 & 11).

4.11 Atmospheric Environment

4.11.1 General

The degradation of the atmospheric environment is mainly related to the release of gaseous pollutants into the atmosphere or to the increase in the concentration of solid suspended particles. The factors that determine the existing quality of the atmospheric environment of an area are the type and quantity of pollutants emitted, always in combination with the existing atmospheric and meteorological/climate conditions (see par. 4.2).

Air pollution is defined as the presence in the atmosphere of undesirable substances in large quantities capable of having harmful effects. This definition does not refer only to those materials produced by anthropogenic activity, although often the focus is only on them. Sources of air pollution are divided into man-made and natural:

Anthropogenic

- Combustion of fossil fuels
- Industrial activity

Natural

- Fires
- Volcanic activity
- Soil erosion (dust production)

- Earthquake vibrations,
- Geothermal activities
- Incidents of strong winds

A group of air pollutants have been identified in the USA and the EU that are critical to controlling air pollution:

- CO
- O_2
- O_3
- SO_2
- PM_{10} (particles with diameter <10μm)
- $PM_{2.5}$ (particles with diameter <2.5μm)
- Lead

Especially for particles with a diameter of less than 10μm (PM_{10} suspended particles), high background values have been measured in Greece, while high values appear both in the in the city's center (Athens, Thessaloniki, Patras, Volos, Larissa, Heraklion, Kozani, Ptolemaida) and in the province.

4.11.2 Emission Limit Values

Human health

Directive 2008/50/EC sets the assessment limits per pollutant, the criteria for the assessment method (in particular for the installation of sampling points), the reference measurement methods, the limit values for the protection of human health and the environment, as well as the obligation to reduce population exposure to $PM_{2.5}$ particles, information limits and alarm, critical levels for vegetation protection and the list of information to be included in action plans to improve air quality When the levels of air pollutants exceed any limit or target value, as well as any corresponding tolerances, the

MS shall draw up air quality plans for those zones in order to achieve the corresponding pre-defined limit values or target values.

Another critical legislative act is the Directive 2004/17/EC. The latter Directive is focusing on:

(a) Establishing a target value for the concentration of arsenic, cadmium, nickel and benzo (a) pyrene in ambient air in order to avoid, prevent or limit the adverse effects of arsenic, cadmium, nickel and polycyclic aromatic hydrogen peroxide on human and the environment as a whole.

(b) Ensuring that, in the case of arsenic, cadmium, nickel and polycyclic aromatic hydrocarbons (PAHs), ambient air quality is maintained where it is good and improved in other cases

(c) Identifying common methods and criteria for estimating the concentrations of arsenic, cadmium, nickel, mercury, nickel and (PAHs) in ambient air, and the deposition of arsenic, cadmium, mercury, nickel, and PAHs.

Table 4.22: Limit Values for Human Health Protection

Pollutant	Limit value	Average period	Permissible exceedances in a calendar year
Carbon Monoxide (CO)	10 μg/m^3	Maximum daily average of 8 hours	Not applicable
Nitrogen dioxide (NO_2)	200 μg/m^3		18 times
	40 μg/m^3		Not applicable
Ozone (O_3)	120 μg/m^3	Maximum daily average of 8 hours	25 days per calendar year on average in 3 years
Sulphur Dioxide (SO_2)	350 μg/m^3	1 h	24 times
	125 μg/m^3	24 h	3 times
Suspended Particulates ($PM_{2.5}$)	25 μg/m^3	1 year	Not applicable
Suspended Particulates (PM_{10})	50 μg/m^3	24 h	35 times
	40 μg/m^3	1 year	Not applicable

Lead	0,5 μg/m^3	1 year	Not applicable
Benzene (C_6H_6)	5 μg/m^3	1 year	Not applicable
Arsenic	6 ng/m^3	1 year	Not applicable
Cadmium	5 ng/m^3	1 year	Not applicable
Nickel	20 ng/m^3	1 year	Not applicable
PAHs	1 ng/m^3 (as benzo-pyrene)	1 year	Not applicable

Engines (non-road)

Emissions and engine type approval procedures installed on non-road mobile machinery (such as excavators, bulldozers etc.) are regulated by Regulation (EU) 2016/1628 "on emission limit requirements for gaseous and particulate pollutants and Type-approval for internal combustion engines for non-road mobile machinery, amending Regulations (EU) No 182/2011 1024/2012 and (EU) no. 167/2013 and amending and repealing Directive 97/68 / EC ".

Industrial Installations

In relation to emissions from industrial installations, Directive 2010/75/EU "on industrial emissions (integrated pollution prevention and control)", which brings together Directive 2008/1/EC (also called the "IPPC Directive") and six more directives in a single directive on industrial emissions. Directive 2010/75 / EU covers industrial activities with strong pollution potential (energy industries, metal production and processing, mineral industry, chemical industry, waste management, animal husbandry, etc.).

Shipping Emissions

As shipping is an international industry, environmental, safety and security standards are generally developed by the International Maritime Organization (IMO), a specialized agency of the United Nations and the Executive Body of the MARPOL International Convention. The EU, in compliance with Annex VI of the International Convention MARPOL 73/78 "Regulations for the Prevention of Air Pollution from Ships" and its amendments, adopted Directive 2016/802/EU "on the reduction of the content of certain liquid fuels in sulfur” which also regulates sulfur oxide emissions from shipping.

Since 1 January 2020, EU Member States should ensure that ships in all EU waters, except SOx-Emission Control Areas (SOx-ECA), use sulfur-containing fuels not exceeding 0.5% by mass. The same requirement will enter into force globally, as decided in October 2016 by the International Maritime Organization (IMO), a United Nations specialist.

The latter decision is expected to significantly reduce the impact of ship emissions on human health and ensure a uniform global competition field for ship operators. In accordance with the Directive, MS shall take all necessary measures to ensure that vessels docked in Union ports with a sulfur content of more than 0.10% by mass are not used, providing sufficient time for the crew to complete each necessary refueling work as soon as possible after arrival at the port and as close as possible to departure.

Finally, implementing Decision 2015/253/EU established control rules by sampling the sulfur content of used marine fuels intended for combustion on board, located in EU sea areas and ports.

4.11.3 Shipyards Environment

During **the conduction of the ESIA** and at least one year before, the shipyards were functionally non-operational. Thus, no air pollution sources related to Shipyard operation can be identified, and no representative measurements can be performed.

A current source of air pollution could be considered the emission of exhaust gases from the movement of vehicles in the national, provincial, municipal, and agricultural network of the wider region. Nevertheless, since the Shipyard is not operational, the vehicles movement from and to the Shipyard is rather insignificant.

Another source of pollution could be attributed to the industrial facilities located in the vicinity of the site.

4.11.4 Elefsis Station

Regarding the atmospheric environment of the wider area, more information is given in this paragraph.

The quality of the atmospheric environment of the Attica basin is systematically monitored, through the stations of the National Air Pollution Monitoring Network (NAPMN), the operation of which began in 2000. Responsible for the operation of the network of air pollution measuring stations in the region of Attica, is the Department of Atmospheric Quality (KAPA), which belongs to the Department of Climate Change and Atmospheric Quality YPEN.

In 2020, the KAPA Department operated fifteen (15) air pollution measuring stations in the Attica region (see following Figure), for the needs of the Atmospheric Pollution Transboundary Transport Assessment Program

Figure 4.20: Map of air pollution measuring stations of YPEN in Attica [Source: www.geodata.gov.gr]

The closest station to the study area is that at Elefsina, less than 1,5 km far form Shipyards Boundaries. Pollutants are measured on a continuous basis 24 hours a day. The response time of automatic analyzers is of the order of one minute, ie each analyzer gives a value approximately every minute. With a microprocessor, located at each automatic station and connected to the automatic analyzers, the average hourly pollution values are calculated every hour. These values are transferred to the server of YPEN, through a telephone line and in this way, it is possible to continuously monitor the levels of air pollution in the area.

The characteristics of the Station at Elefsis are presented in Table 4.23. The pollutants under monitoring, along with the measurement method, are given in Table 4.24.

Table 4.23: Elefsis Atmospheric Pollution Station

Name	Longitude WGS84	Latitude WGS84	Altitude (m)	Characterization
Elefsis (ELE) [12]	23,53843	38,05132	20	Periastic-Industrial

Table 4.24: Measured pollutants and measurement methods

Pollutant	Measurement Method
Nitrogen Oxides (NO, NO_2)	Chemiluminescence
Ozone (O_3)	UV absorption
Sulphur Dioxide (SO_2)	Fluorometry
Suspended Particuates (PM_{10}–$PM_{2.5}$)	Absorption of β radiation
Benzene (C_6H_6)	Gas chromatography (GC)

Hereinafter, detailed Diagrams present the changes over time of the average annual values, of the concentrations of all the measured pollutants.

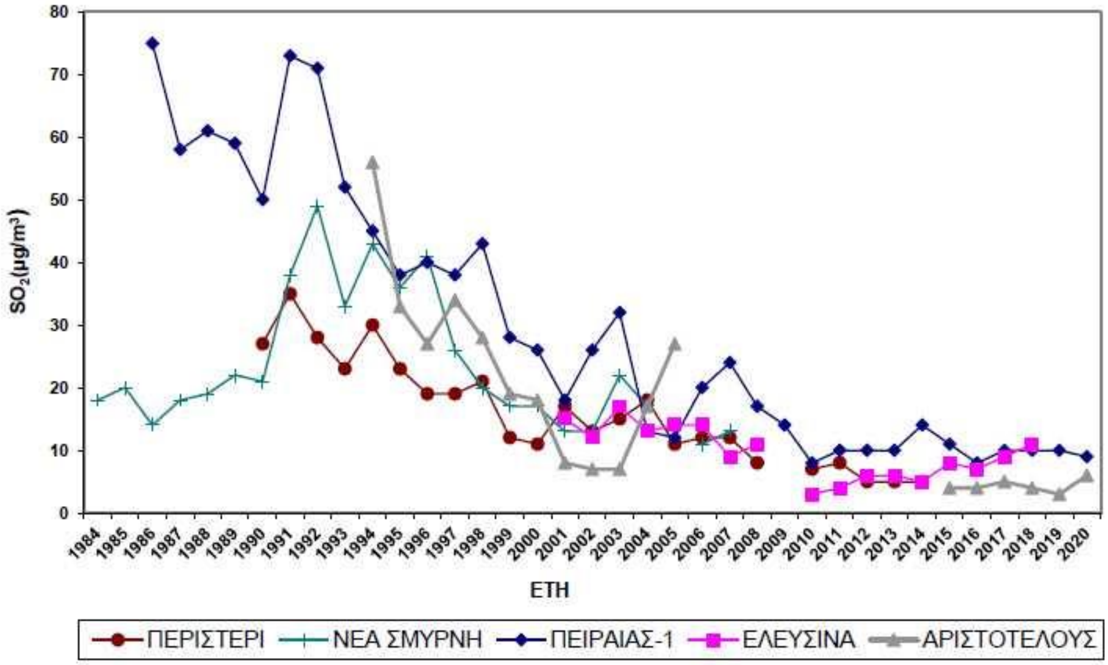


Figure 4.21: Time Variation of average annual SO_2 values, in μg /m³

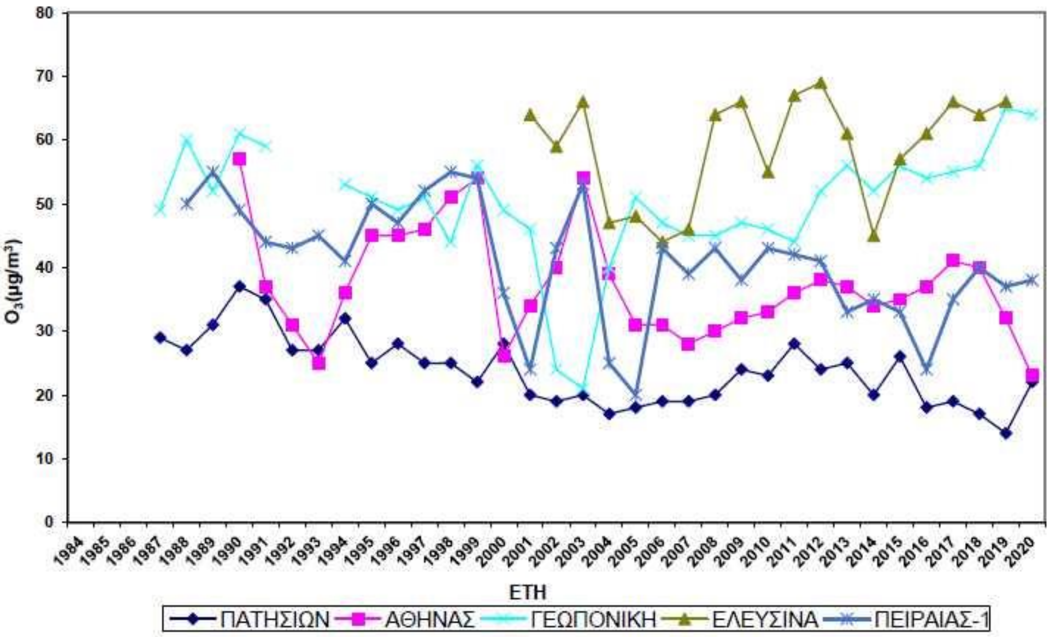


Figure 4.22: Time Variation of average annual O_3 values, in μg /m³

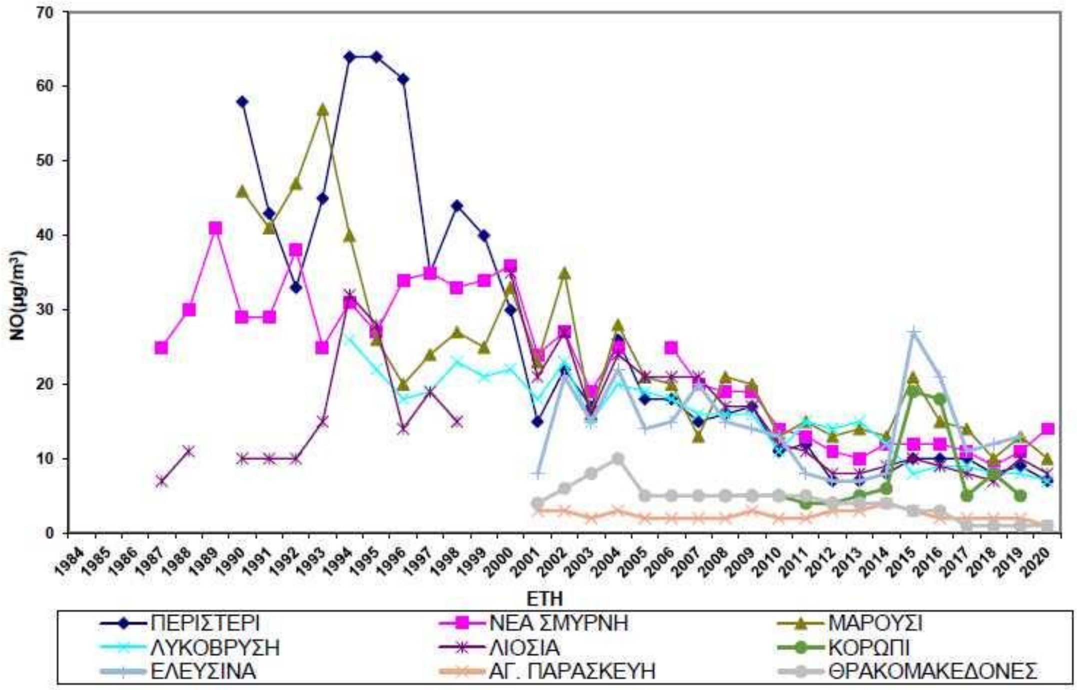


Figure 4.23: Time variation of average annual NO values, in μg/m³

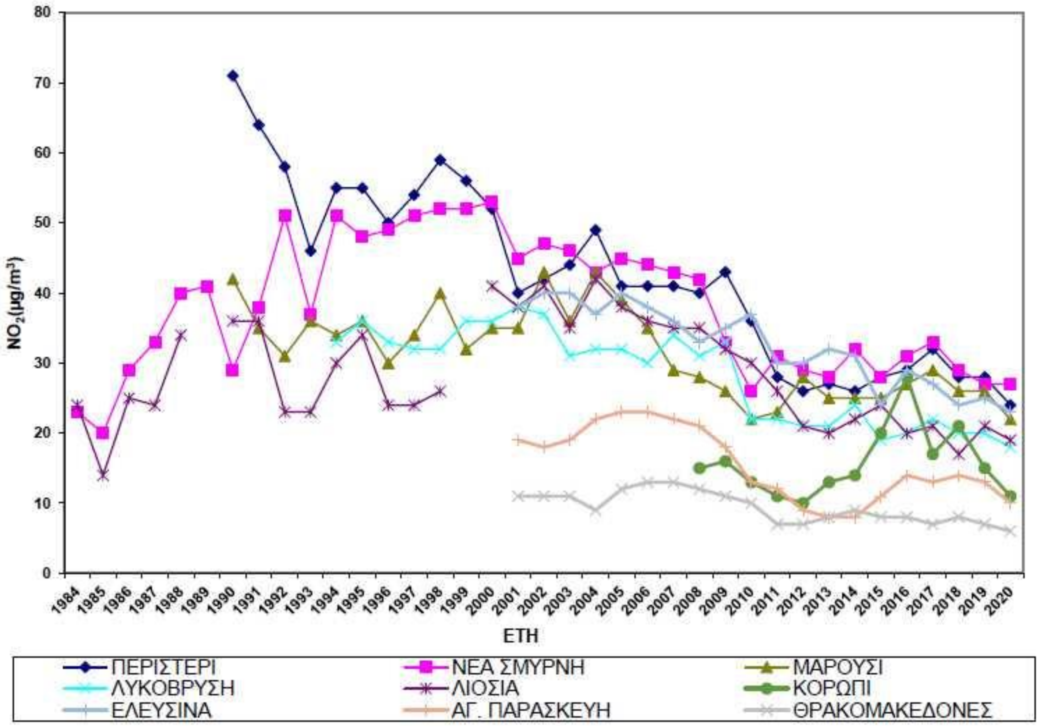


Figure 4.24: Time variation of average annual NO_2 values, in μg/m³

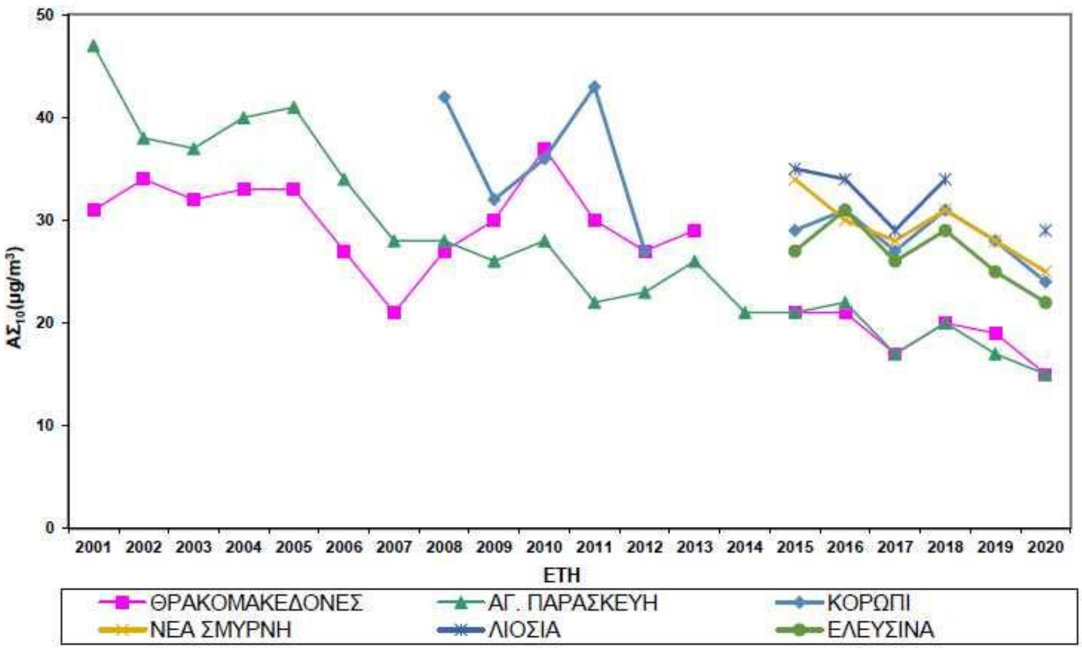


Figure 4.25: Time variation of average annual PM_{10} values, in μg/m^3

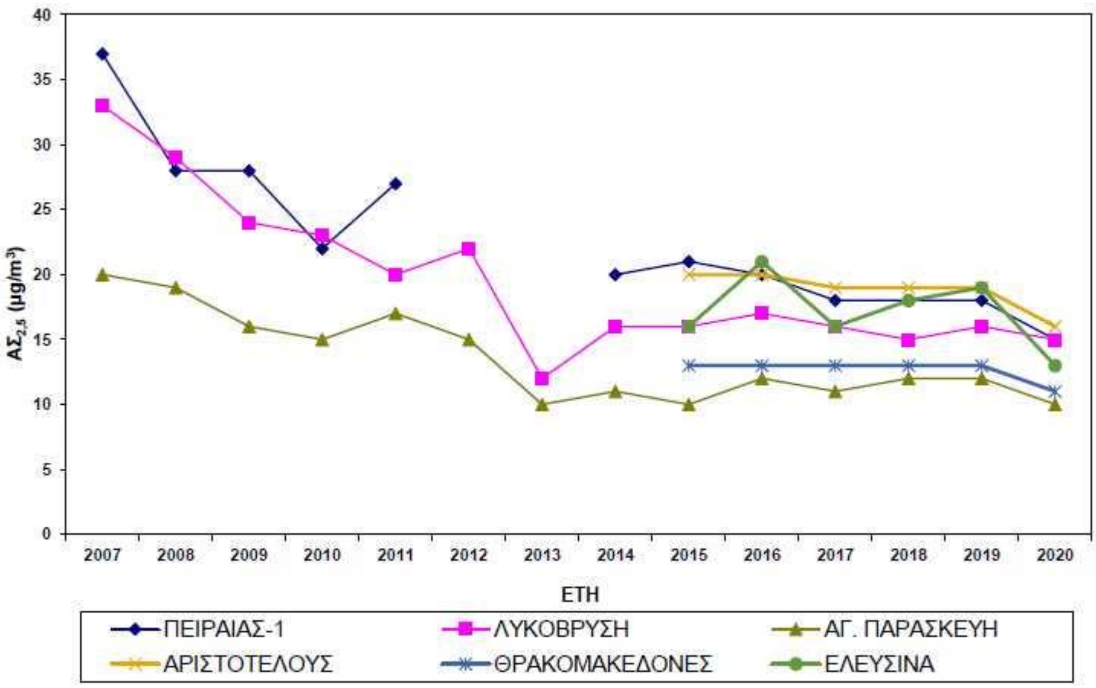


Figure 4.26: Time variation of average annual $PM_{2.5}$ values, in μg/m^3

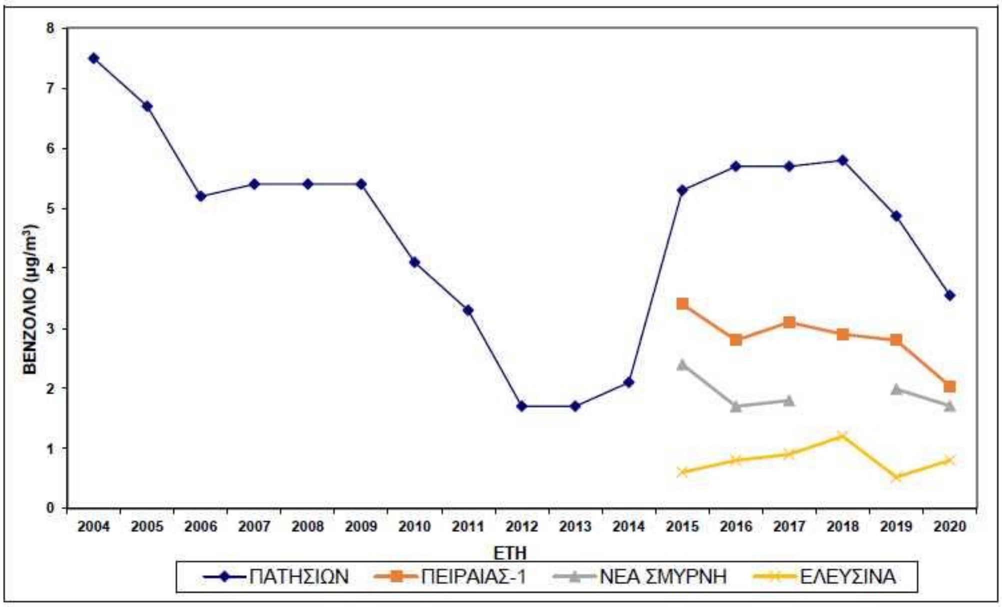


Figure 4.27: Time variation of average annual Benzene values, in μg/m^3

Specifically for each pollutant the following observations are made:

- For sulfur dioxide, there is an increase trend values with a maximum value of 13 μg/m^3 in 2018. Nevertheless, those values are lower than those observed e.g., at the port of Piraeus.
- For $PM_{2.5}$ there is a decreasing trend for the last 2 years, falling below 15 μg/m^3 for 2020.
- For PM_{10} there is a decreasing trend for the last 3 years, reaching a five-year minimum of 23 μg/m^3 for 2020.
- For benzene, values are relatively low, with a maximum of 1.1 μg/m^3 in 2018. Nevertheless, the values at Elefsis station are lower than those observed in mayor urban areas of Athens and Piraeus.
- For nitrogen monoxide, there is a decreasing trend for the last 3 years, after reaching a maximum back in 2016 (30 μg/m^3). In 2020, the respective value is 12 μg/m^3
- For nitrogen dioxide, there is a decreasing trend for the last 3 years, reaching a value of 23 μg/m^3 for 2020.

- Ozone is the only parameter that presents an increasing tread, reaching a max of 65 μg/m^3 in 2020. Furthermore, O_3 is the only pollutant for which Elefsis Station presents higher values than those from Athens urban areas and the Port of Piraeus.
- As a general conclusion it can be stated that, except for ozone, all pollutants measured at Elefsis Station are lower than those measured in mayor urban areas of the capital of Athens and at Piraeus Port.
- The increased values of ozone concentration (especially in the summer months) are due to the increased sunshine during these months, as this pollutant is formed by photochemical processes in which sunlight plays a decisive role.
- In all cases, pollutants values do not exceed limit values for the protection of human health (see Table 4.14)

4.12 Acoustic Environment

4.12.1 General

Noise is one of the most important factors in degrading the environment and therefore the quality of life. The type of effects of noise on human health has been a key area of research and study for many years. Today it is sufficiently documented that the effects of noise on humans are distinguished into physiological and psychological.

The most important sources of noise in Attica are:

- Road traffic
- Rail traffic
- Air traffic
- Industrial/Commercial activity
- Mining activity

Within the area of interest, as main sources of noise are defined the road activity and the industrial/commercial activity.

4.12.2 Environmental Noise Limit Values & Indicators

In the context of combating noise nuisance, the EU has developed a common approach to preventing, or minimizing the harmful effects of exposure to environmental noise through Directive 2002/49/EC, as amended by Regulation 1137/2008/EC and Directive 2015/996/EU.

According to Presidential Decree 1180/81 (see Chapter 2), the maximum permissible noise limit emitted to the environment by installations is presented in the following table and is measured at the limit of the property on which the installation is located.

Table 4.25: Maximum Permissible Noise Values Based on PD 1180/81

No	Type of Area	Noise Limit Value dB (A)
1	Industrial under law	70
2	Areas in which the predominant element is industrial	65
3	Areas in which the industrial and urban elements are equally prevalent	55
4	Areas in which the urban element prevails	50

JMD 37393/2028/29-09-2003 is the compliance with the provisions of Directive 2000/14/EC by setting noise emission standards, the procedures for assessing compliance with these standards, marking, technical documentation and data collection with respect to ambient noise from equipment for outdoor use. The target is to reduce the adverse effects on the environment, and to promote the protection of human health, quality of life and the smooth operation of the market. The decision applies to equipment for outdoor use.

According to Article 4 of the above JMD, equipment may be placed on the market or put into service only if it complies with the provisions of that Decision, bears the CE marking, indicates the guaranteed sound power level, and is accompanied by an EC declaration of conformity. According to Article 8 for equipment subject to noise limits (and listed in the following table) the guaranteed sound power level may not exceed the permissible sound power level specified in the following limit value table (as amended by JMD 9272/471/2007).

With the P.D. 149/2006 (OG 159/A/28-07-2006) "Minimum health and safety standards regarding the exposure of workers to risks arising from natural factors (noise) in accordance with the directive 2003/10/EC" came the accordance of the national law with the Directive 2003/10/EC, which laid down minimum standards for the protection of workers against the risks to their safety and health which arise or are likely to arise as a result of noise exposure. In article 3 the exposure limit value, the upper exposure value for action and the lower exposure value for daily noise exposure levels and sound pressure peaks are defined.

a) Exposure limit values: LEX*, 8h = 87 dB (A) and P_{peak} = 200 Pa, respectively
b) Upper exposure values for action: LEX, 8h = 85 dB (A) and P_{peak} = 140 Pa, respectively
c) Lower exposure values for action: LEX, 8h = 80 dB (A) and P_{peak} = 112 Pa, respectively

*LEX: Level Exposure, P: Pressure

Article 6 of the above JMD stipulates that in case the risks arising from exposure to noise cannot be prevented by other means, appropriate means of personal hearing protection shall be made available to workers. The employer also makes every effort to ensure the use of these tools and is responsible for verifying their effectiveness.

4.12.3 Shipyards Environment

Regarding the acoustic environment of the wider area and bearing in mind that the Shipyard is not operational at the moment, noise is mainly affected by the traffic of vehicles on the road network of the wider area.

The most recent noise monitoring data under normal Shipyard's operation, were retrieved back in 2007, during the conduction of the EIA [Sahinoglou, 2008]. More specifically, measurements of the acoustic condition in the area around the Shipyard are given.

A series of acoustic airborne noise measurements were performed (Leq indicator) using the portable sound meter type of the French company 01dB in five (5) different points within the property of the Elefsis Shipyards. The measurements were carried out in conditions of normal activity of the shipyards (loading-unloading, blasting, water jet etc.), while special care was given to the recording of airborne noise both near the Water Jet works and during the end of the shift - departure of employees. A total of 5 acoustic measurements were performed.

The acoustic measurements were performed using a special statistical noise analyzer Class 1 type Solo type 01 dB France, at a fixed height of 1.20 m. in the following positions:

Position 1: Property limit near biological treatment plant

Position 2: Property limit near a circular tank

Position 3: Property limit within parking spaces

Position 4: Property limit against Shipbuilding Bed

Position 5: Yard Entrance

From the above recordings it was concluded that the noise due to the activities of the Shipyards <u>did not exceed the statutory limit of 65 dB (A)</u> (limit for industrial activities) at a distance of 20 m from the boundary of the Shipyards, as defined by the current legislation (see par. 4.10.2). Also, there is no exceedance of health and safety standards regarding the exposure of workers (par. 4.10.2).

4.13 Vibrations

Greek Legislation has not set vibration limit values. Nevertheless, there are some cases, potentially related to Shipyard's operation in general, worth mentioning.

Vibrations that transmitted through the ground: Certain machines or categories of works transmit vibrations to the ground. These vibrations can be random and strong or have a more continuous and periodic form depending on the type of machine. They are transmitted through their base and subbase to the ground in the form of waves such as seismic ones (transverse, longitudinal and Rayleigh).

Vibrations that transmitted through the air: The noise of internal combustion engines and especially of their exhaust is characterized by quite high levels in the range between 50 and 100 Hz of the acoustic spectrum. As noise, these frequencies are not annoying to the ear (as opposed to the range between 500 and 1000 Hz of the spectrum) and the noise measurement method in dB reduces with proper filtration their contribution to the total noise level. However, this noise, transmitted through the air, may (a) cause the surface of the road / ground to oscillate; (b) cause discomfort to parts of the human body (e.g., a man's chest) and (c) cause oscillation due to tuning at frequencies below 200 Hz of parts of buildings or other objects (glass, frames, floor, furniture), with frequent secondary noise (creaking, rattling) from them.

Regarding the vibration environment of the wider area and bearing in mind that the Shipyard is not operational at the moment, there is no vibration charge worth mentioning.

4.14 Electromagnetic Fields

The limits of safe exposure of the public to electromagnetic radiation emissions are defined in paragraphs 9 and 10 of article 31 of Law 3431 (OG 13/A/03-02-2006) on "On Electronic Communications and other provisions" and in Articles 2-4 of no. 53571/3839 (OG 1105/B/ 6-9-2000) MD "Measures to protect the public from the operation of antennas installed on land". The Ministerial Decision was based on the Recommendation of the Council 1999/519, "On the limitation of public exposure to electromagnetic fields 0 Hz - 300 GHz".

Greece is one of the countries that have established very strict limit values for electromagnetic fields. Basic limitations and reference levels for electromagnetic field exposure are provided in the current legislation. The key constraints are based directly on proven health effects and biological studies, and reference levels are used for practical exposure assessment to determine if the limitations are exceeded. PD 120/2016 (see Chapter 2) describes the minimum health and safety requirements regarding the exposure of workers to risks arising from natural factors (electromagnetic fields).

The control of the limits of safe exposure of the public to the electromagnetic fields, as they are determined by the current legislation, is conducted by the "National Observatory of Electromagnetic Fields" (NOEF), of the Hellenic Atomic Energy Committee (HAEC). According to the NOEF annual reports (http://www.iengineers.info). The report includes detailed measurement results of 500 measuring stations of the NOEF, as well as the mobile stations that operated in 8 Municipalities in 2020. Results show that the values recorded by all metering stations are much lower than the established safe public exposure limits. One of the above measuring stations is situated in the city of Elefsis.

In general, no sources of electromagnetic radiation are detected within the immediate or the wider study area.

4.15 Natural Disasters

4.15.1 Floods

According to the National Flood Risk Management Plan (NFRMP, YPEN 2017) for Attica Region (Code 06), parts of the shipyard are within a zone that is considered to have a potential flood risk (Figure 4.28)

However, considering a 100-year flood event (pluvial) there is a 1% chance a year. For 50-year flood events, the site does not show any vulnerability, based on the available information.

Figure 4.28: Area of the Shipyards lying within a potential flood risk zone

4.15.2 Sea Level Rise

According to the National Flood Risk Management Plan (NFRMP) for Attica Region (EL06), the Average Elevation was estimated as the sum of the elevations from astronomical and meteorological tides and from elevations due to ripples. The total maximum rise in the coastline of Attica for a recovery period of 50 years is shown in

Figure 4.29. More specifically, the sea rise in the area of the Shipyards is estimated up to 0,5m (orange zone in Figure 4.29).

For a 100-year recovery period, the meteorological tide will not vary significantly, while flooding due to waves is expected to be 10-20% higher. Therefore, to estimate the level rise over a period of 100 years, the astronomical tide is summed with the meteorological tide and the flood from the waves increased by 15%.

Given that the coastal areas of Attica (including the Elefsis Shipyard area) have a quay or ripple protection of at least 1.0 meter high, it is concluded that the areas that are at risk are those where the average sea level is raised by at least 1 meter.

In any case, within the intervention or the wider study area there is no zone that is in significant hazard from the sea level rise.

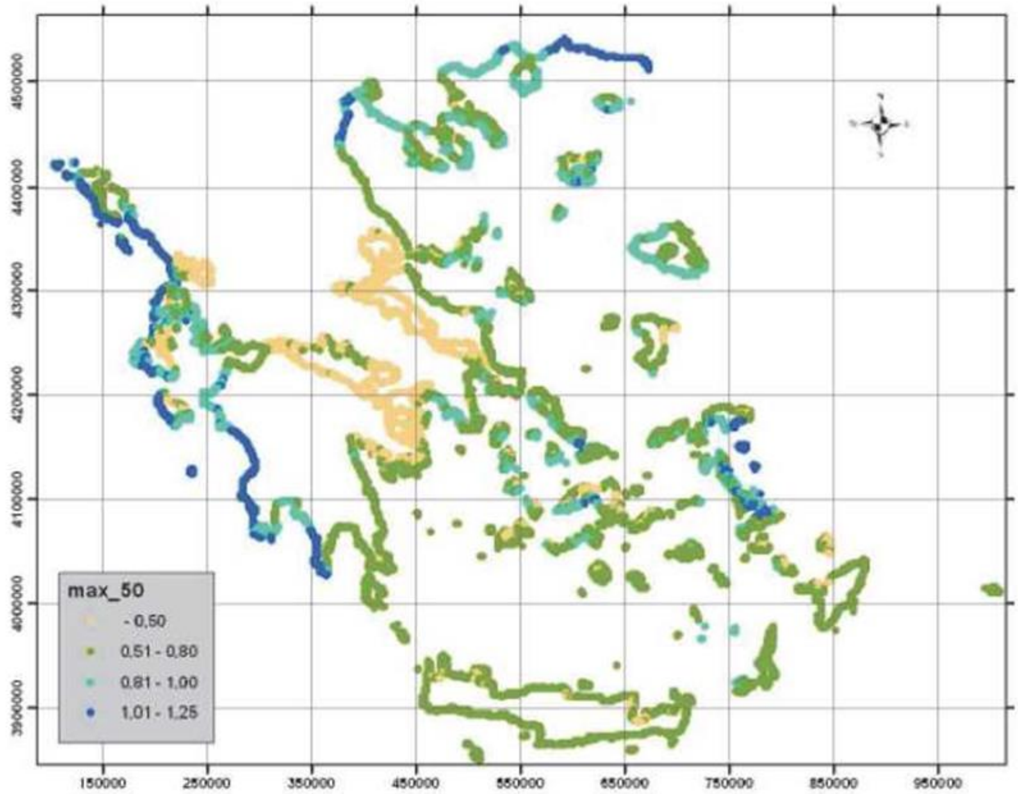


Figure 4.29: Overall maximum elevation on the shoreline for a recovery period of 50 years

4.15.3 Other Climatic Parameters

According to the measurements of National Observatory of Athens [NOA, 2020], the course of the average annual air temperature in Attica from the beginning of the last century until today follows, qualitatively, that of the northern hemisphere, with alternating warm and colder periods, but with an overall increasing trend of 0.5 ^{o}C for the period 1900-2008. However, the average annual temperature is on a continuous upward trajectory from the mid-1970s to the present (1.3^{o}C from 1976 to 2008). The average maximum annual temperature shows a similar behavior, which increases depending on the average of the 1970s, while the average annual minimum temperature (night temperature) begins to rise systematically with a delay of some years but at a faster rate (1.8 ^{o}C from 1984 to 2008).

The decade 1998-2007 was the warmest decade ever recorded in Attica in terms of maximum summer temperatures [NOA, 2020]. In contrast, no significant temperature trend (positive or negative) was observed during the winter. The decade 2001-2010 was the warmest decade recorded in Athens in terms of annual temperature values (average, maximum and minimum), always according to the historical archive of NOA.

However, apart from the long-term trends of average temperature values, a particularly interesting feature of the climate of Attica, in recent years, is the change in the occurrence of extreme weather events (particularly high temperatures) during the summer months. This change consists of:

- Increase in the frequency of extreme temperatures (individual hot days but also hot episodes lasting at least three days)
- Increase of the intensity of the phenomena (absolute maximum temperatures)
- Increase in the duration of the phenomena
- Temporal shift of the occurrence of phenomena (i.e. during a calendar year)

The number of days with temperatures above 37^{o}C/40^{o}C has increased significantly since the mid-1990s, accounting for more than 35% of the total time series. The percentage in the frequency of occurrence of heat waves is similar, i.e., a sequence of at least three consecutive days with a temperature higher than 37°C.

The temperature of 44.8°C that occurred on 24-6-2007 in Elefsis was an all-time record in EAA, according to 150 years of data.

As for the estimates for the future of the climate of Attica for the next decades, the forecasts are particularly ominous. Athens belongs to the Eastern Mediterranean region, which is considered one of the most vulnerable regions in the anthropogenic component of climate change. According to NOA, there will be an increase in the average maximum temperature in summer by 2°C for the period 2021-2050 and 4°C for the period 2071-2100. Simultaneously with the increase of the average temperature, NOA predict an increase of the temperature dispersion around its average value, thus the increase of the extreme maximum temperatures.

According to a study by WWF Hellas and the NOA, in the near future (2021-2050), Attica is predicted to experience up to 15 more days a year with a maximum temperature > 35°C (compared to the period 1961-1990) and up to one more month a year with night temperatures > 20°C.

Regarding the extreme rainfall phenomena, and by processing data of the daily rainfall for the years 1891-2004 of the NOA, a clear increase of the extreme rainfall results. In fact, according to NOA in the coming decades, the total amount of rainfall in Attica is expected to decrease, while increasing the incidence of extreme rainfall. The reduction of rainfall will certainly burden the quality of groundwater and is expected to be an additional factor for the expected climate change.

5. SOCIAL – ANTHROPOGENIC BACKGROUND

5.1 Study Area - Definitions

This chapter records, analyzes and evaluates the current parameters of the man-made environment in the study area, as well as their evolution trends without the project or activity.

The terms "intervention area", "immediate study area" and "wider study area" are used to determine the scale of analysis followed in the present study in the same way they are used in describing the Environmental Background (Chapter 4).

5.2 Geographical Administration

Elefsis Shipyards are located in the bay of Elefsis, at Makria Ammos location, near the 27th kilometer of the Old National Road from Athens to Corinth. Administratively, the facility is located within the borders of the **Prefecture of Attica**, **the Subregion of West Attica** and is part of the **Municipality of Elefsis** (Figure 5.1)

Elefsis also belongs to the wider geographical area called **"Thriasian Plain"**. Thriasian is located in the west of the prefecture of Attica, at a distance of 10 Km from Athens and its area amounts to approximately 345Km^2. The north part of the area borders with the Prefecture of Viotia, while in the south it is washed by the sea of the Gulf of Elefsis. Geomorphologically, most of area, consists of an extensive plain with a mild relief, average topographic slope of 2%, which is perimetrically surrounded by mountains and specifically north of Mount Pastra (1016m), south of the hills Rachi Sotiros (432m) and Korifi (384m), east of Mount Parnitha (1413m), northwest of Mount Kithaironas (1408m) and southwest of Mount Pateras [Kruska, 2014].

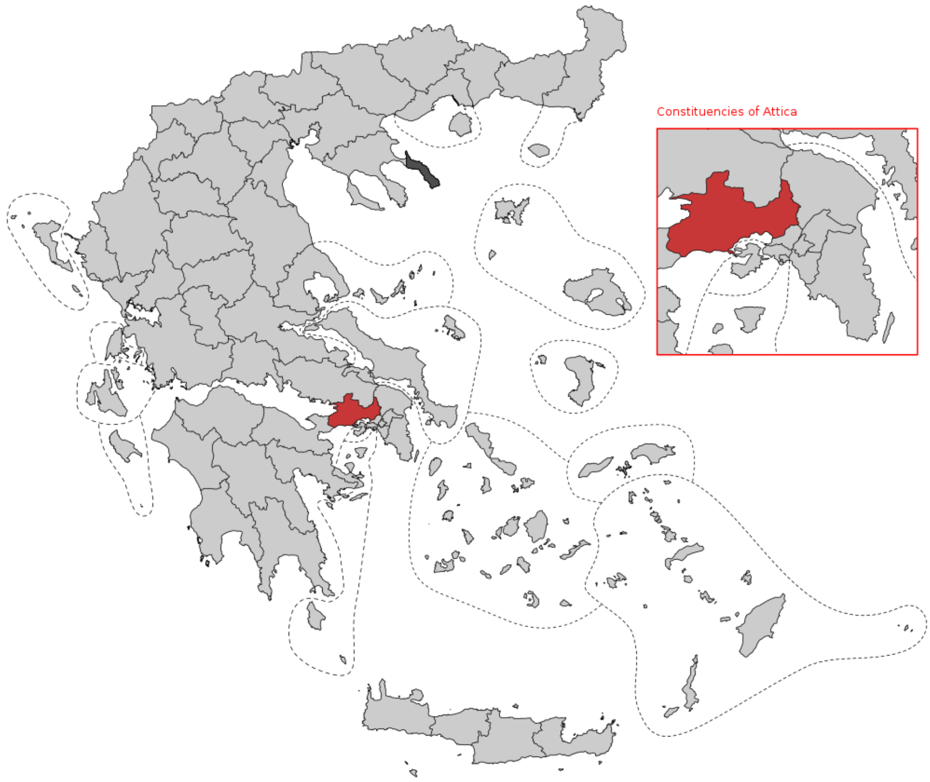


Figure 5.1: Subregion of West Attica (By Philly boy92 - Own work, CC BY-SA 4.0, https://commons.wikimedia.org/w/index.php?curid=77431110)

Figure 5.2: Attica Prefecture, West Attica Subregion and Study Area

The Subregion of **West Attica** consists of the following cities/towns:

- Ano Liossia
- Aspropyrgos
- Villia
- Elefsis
- Erythres
- Mandra
- Megara
- Zefyri
- N. Peramos
- Fyli

and the Communities of Magoula and Oinoi. The subregion covers an area of about 1,104km^2, and the population, according to the 2011 census, amounts to 160,927 residents. The Subregion, although geographically unified, can be divided into five municipalities:

- Municipality of the Aspropyrgos
- Municipality of Elefsis (Elefsis, Magoula)
- Municipality of Fyli (Fyli, Ano Liossia, Zefyri)
- Municipality of Megara (Megara, Neos Peramos)
- Municipality of Mandra-Eidyllia (Mandra, Erythres, Oinoi, Vilia)

These units mainly reflect the conurbations, the common economic characteristics and the activities of the Municipalities of the areas.

5.3 Urban Environment

5.3.1 Urban & Maritime Planning

<u>Urban Planning</u>

The last modification of the General Urban Plan (GUP) of Elefsis (2019) promotes the organization of residential extensions densely populated-sparsely populated areas, as well as the integration of existing ones industrial facilities in an industrial zone. The plan among others includes the extension of the GUP limits for the integration within these areas to urban planning. More specifically, the area of Elefsis Shipyards is now included officially in the Industrial Zone (see also Figure 5.3).

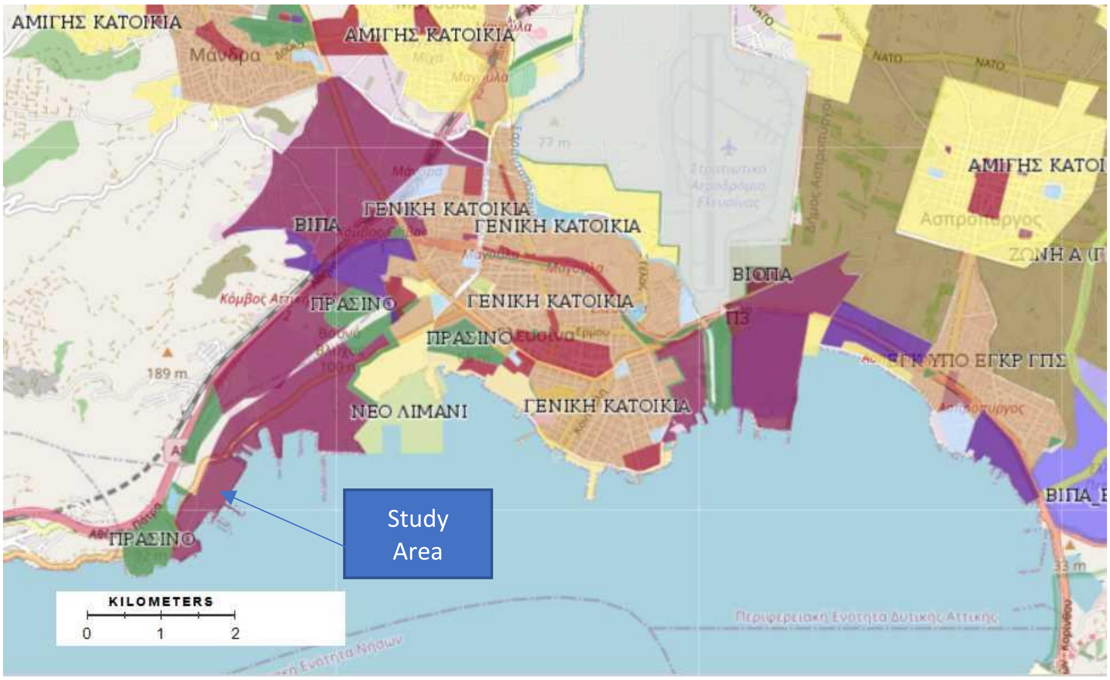


Figure 5.3: Illustration of the GUP of Elefsis. The area of Shipyards is declared as industrial zone (red color)

Marine spatial planning

Maritime spatial planning is part of the European Union's integrated maritime policy, as the cross-sectoral policy instrument that enables public authorities and stakeholders to implement a coordinated, integrated, and cross-border approach. Also, it contributes to the objectives of Article 3, in accordance with the United Nations Convention on the Law of the Sea (UNCLOS Convention), ratified by Law 2321/1995 (A '136).

"Marine spatial planning" is defined as the process by which the competent authority analyzes and organizes human activities in the marine and coastal areas (such as the study area) in order to achieve the evaluation of ecological, environmental, economic, social and cultural parameters in order to promote sustainable development.

The objectives of marine spatial planning include:

1. Supporting and promoting sustainable development and spatial cohesion between marine and coastal areas, taking into account land-sea interactions, ecosystem approach and the principles of sustainable management.

2. The rational and integrated spatial development of activities in the maritime and coastal areas, such as transport, shipping, shipbuilding, the energy sector, the extraction of raw materials, minerals and inert materials, fisheries, aquaculture and tourism, as well as conservation, protection and improvement of the natural and cultural environment, taking into account the maritime cultural heritage in general. In this context, the harmonious coexistence of all relevant activities and uses is ensured along with the resilience to the effects of climate change.

Law 4546/2018 defines the structure and content of marine spatial planning that includes:

- The national spatial strategy for the maritime space which is part of the national spatial strategy of article 3 of law 4447/2016.
- The maritime spatial plans which correspond to the regional planning level of article 2 of law 4447/2016 and refer to marine and coastal spatial units that can be sub-regional, regional or inter-regional level.

Maritime spatial planning determines the distribution of existing and future activities and uses in marine areas and coastal zones, to achieve the objectives and must be prepared by March 2022 at the latest. Competent authority with sole responsibility for the implementation of 4546/2018 is defined the YPEN.

The new Athens-Attica Master Plan (AAMP) (Law 4277/2014 / OG 156/A/2014): The AAMP contains all the objectives, policy directions, priorities, measures and programs necessary for the spatial, urban and residential organization of Attica and the protection of the environment, in accordance with the principles of sustainable development. According to Article 8 "Spatial organization" of the AAMP, the area of Attica is formed on the basis of spatial units, axes and poles of development, which are the key areas that play a fundamental role in the structure of the area.

Four (4) Spatial Units are defined, with distinction in sub-Spatial units, for the optimal spatial organization, based on the geographical structure and their individual physiognomic characteristics. More specifically, the Spatial Unit of Athens - Piraeus, the Spatial Unit of Eastern Attica, the Spatial Unit of West Attica and the Spatial Unit of the Island of Attica are defined.

According to the AAMP, the project area lies within the Spatial Unit of West Attica and the sub-unit of Thriassion Plain. The development directions for this Unit aim at the creation of organized business areas and the emergence of new promotional activities, strengthening the role of the region of Elefsis as a cultural and tourist center, in creation of development axes by utilizing new major roads and railways that penetrate the area and the integration of advanced technology in productive activities and targeted services and gradual reduction of environmental degradation.

Among the Priority axes of the Plan, those directly refer to the project include

a) The organization of a strong development and business pole of the secondary sector, wholesale and transit trade.

b) The sectoral development and the emergence of new promotional activities

c) The restriction of the expansion of industrial development, parallel to the coast, with the exception of units/facilities that their operation is strongly related to the sea (shipyards, ports, etc.)

As it is shown, the proposed project is fully aligned with the AAMP for the region of West Attica.

5.3.2 Land Use

As mentioned above, in the wider area of the project the GUP of the Municipality of Elefsis (OG 532D/88) with its modifications (last one at 2019) is in effect defining the permittable land uses. The total land use of the prefecture of Attica is presented below, as derived from Fields Recognition System (FRS) of the Greek Ministry of Agriculture (https://moa.gov). Another source for information about land coverage is WWF Greece, which provides land coverage map (Figure 5.5). Land uses and coverage are also illustrated in Drawing ENV-04 int the Appendix.

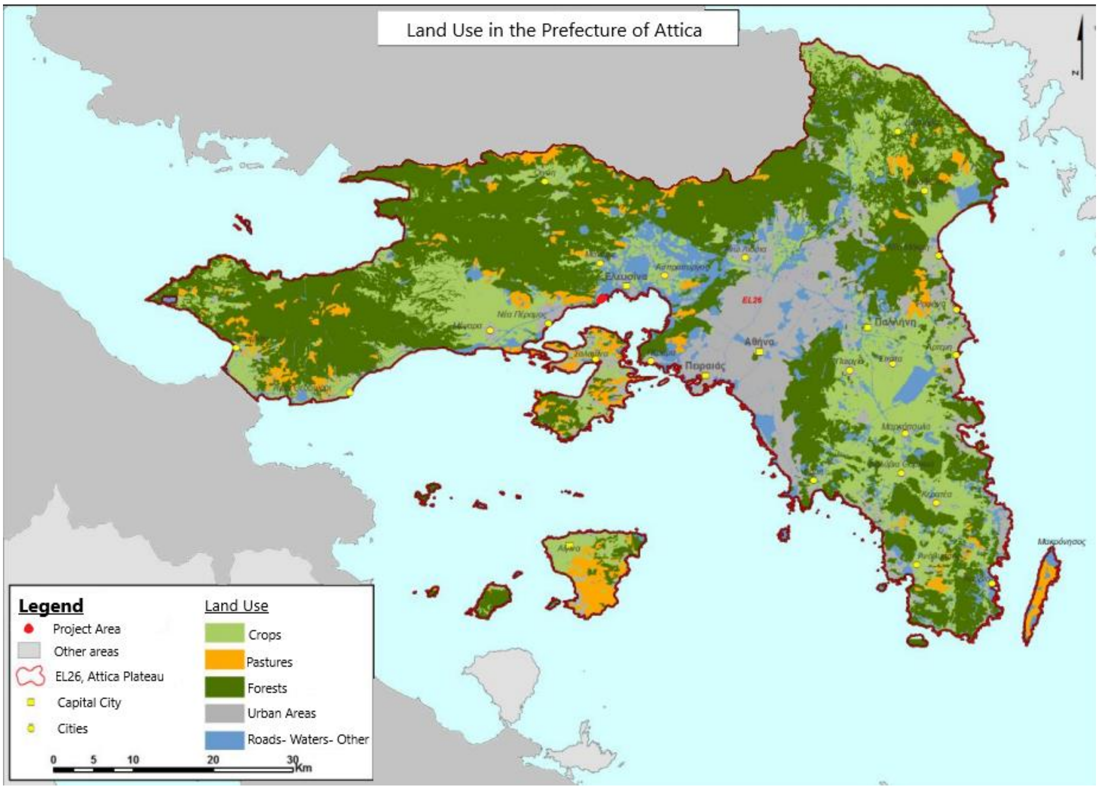
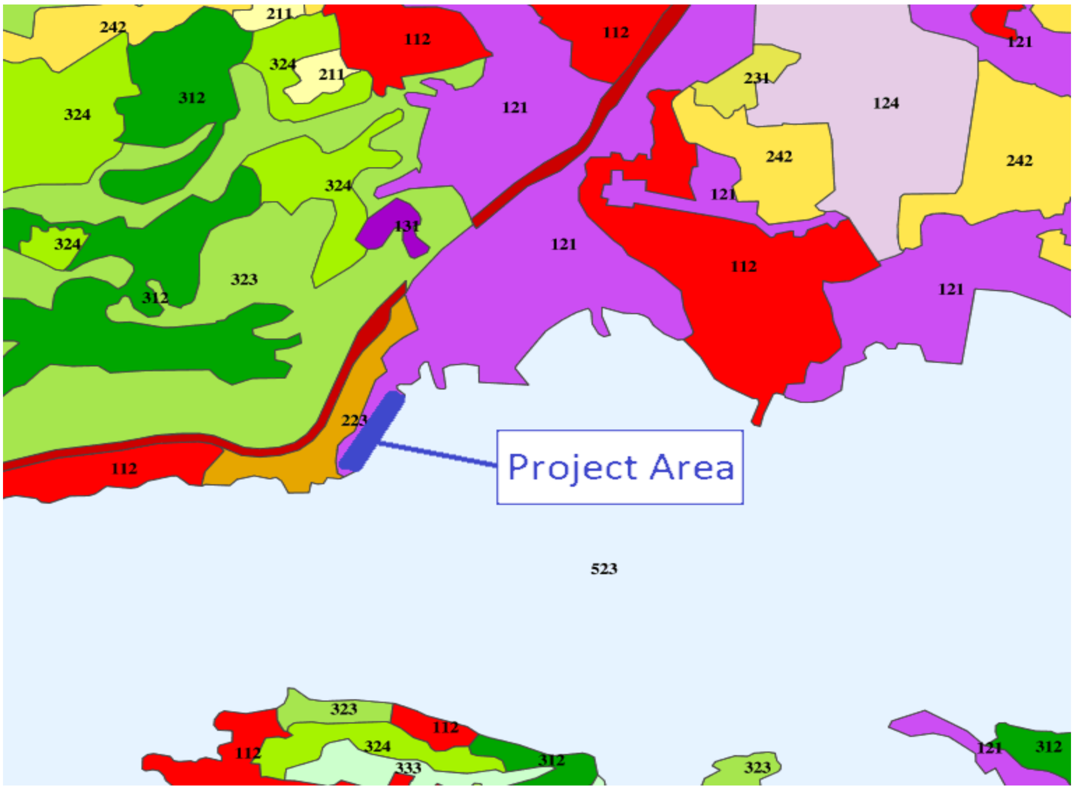


Figure 5.4: Land Use in the Prefecture of Attica



Legend:
112. Disconnected Urban Areas
121. Industrial / Commercial Zones
124. Airports
211. Non-irrigable arable land
223. Olive Trees
231. Meadows
242. Agricultural land
312. Pine Forest
313. Mixed Forest
323. Hardwood Vegetation
324. Transitional Wooded Areas
333. Scarce Vegetation Areas
523. Sea Areas

Figure 5.5: Land Coverage & Uses (sourse: WWF Greece http://www.oikoskopio.gr/resources.html)

In general, in the Prefecture of Attica, land use is as follows: 46% of the area are forest regions, 30% agricultural regions, 14% urban areas 11% roads and others uses (see also Figure 5.6).

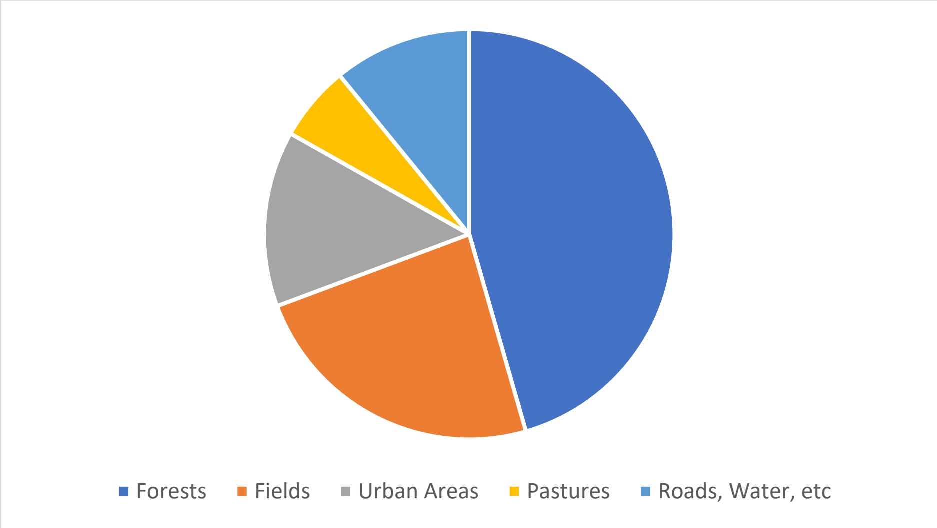


Figure 5.6: Land Uses in the Prefecture of Attica

The area of the project is within the limits of an industrial zone. The surrounding area is reserved for agricultural use, with some patches of wild vegetation in between.

5.3.3 Structure of the urban environment

In the immediate area of the project (1km) no major settlements or urban areas are found. The only small settlements are Diodia and Makriammos, 400m and 800m to the north, respectively. The city of Elefsis is developed more than 2.5km to the northeast. Finally, 1.5km to the southwest, the settlement Loutropyrgos is found (See also Drawing ENV-04 in the Appendix).

To the North-East, the compound borders the area occupied by the Hellenic Petroleum Industrial Site of Elefsis.

500m to the southwest, there is the Eftaksias' Villa and the church of St. Nikolas, while, at 650 in the same direction, there is the 200m long sandy stretch of Alopes Municipal Beach. The wreckage of MS Mediterranean Sky dots the coast 250m southwest of the shipyard, 50m out of Villa Eftaksia's beach.

No other protected, urban, ecological, landscape, historical, cultural or folklore structures or areas of importance are found within the immediate project area.

Apart from its reach cultural heritage, Elefsis, thanks to its natural port and strategic location, 21 km west of Athens, in the Thriassian Plain was transformed from the 19th century onwards in one of Greece's largest industrial centers. The signs of both heavy industrialization and -over the years- of deindustrialization are prominent on the body of the city that is keeping its cultural wealth well-guarded, like a timeless mystery. The entire history of modern Greece unfolds in Elefsis, as the substance of the city goes from the ancient glory to the industrial development, migration, labor movements but also to the decline of manufacturing and unemployment.

The excessive concentration of industry in the city resulted in major environmental degradation, but today pollution has been decreased. There is also an important effort to transform factories that are no longer in operation, to buildings that will host the contemporary industrial and technological history of the city. Elefsis has already gained awards for its urban reconstruction and its performance in ecology and recycling.

5.4 Cultural Sites – Cultural Heritage

The city of Elefsis

The city is developed more than 2,5km northeast with respect to the intervention area. Elefsis, whose name signifies the arrival of a notable person or an event, is one of the five most important sacred cities of antiquity known as the city of the Elefsinian Mysteries, the mystical rituals that were taking place in honor of the goddess of agriculture Demeter and her daughter Persephone. The Mysteries were a celebration of humans' association with Nature and Mother Earth praising the cycle of life, as it is described in the myth according to which Persephone went down to the land of the dead and returned to that of the living each year, in perpetual transition. The Elefsinian Mysteries were taking place every September and were held consistently for over 2,000 years celebrating the change of seasons offering a vision of eternal life and triumph over death.

One of the most important archaeological sites in Greece, Elefsis showcases the area's impressive history. Inhabited since the mid-Helladic era, it was known as the center of the Elefsinian Mysteries, as well as home to the writer Aeschylus. As far back as ancient Mycenae, the destiny of Elefsis has been linked to that of Athens.

Major monuments occupy this site, including the Sacred Yard; the Greater and Lesser Propylaea; the Small Propylaea; the Telesterion, the great hall; the Triumphal Arches, Roman copies of the Arch of Hadrian in Athens; the Kallichoron Well where, according to myth, Demeter sat during her quest for Persephone; the Ploutonion, a sacred cave with an entrance to Hades; and the Mycenaean manor, a rectangular temple.

Elefsis narrates 4,000 years of history of humans as producers, as creators and as workers. Until nowadays, Elefsis is a symbol of humans that struggle for a better future, showing dynamism and strength producing knowledge and wealth for their societies. Elefsis is a unique The excessive concentration of industry in the city resulted in major environmental degradation, but today pollution has been decreased.

It should be noted that there is also an important effort to transform factories that are no longer in operation, to buildings that will host the contemporary industrial and technological history of the city. Elefsis has already gained awards for its urban reconstruction and its performance in ecology and recycling. city firmly maintaining its soul, enthusiasm, and mystery.

Elefsis, one of the most important cities of ancient Greece and a prime industrial center today, has been named the "European Capital of Culture for 2021".

Other Sites

As it was mentioned above, 500m to the southwest, there is the Eftaksias' Villa (summer house) and the church of St. Nikolas.

Villa Eftaksia, the summer house of Labros Eutaksias, an important figure in the cultural and political scene of Greece during the previous century, lay in ruins for the better part of half a century, until it came under the wing of the Museum of the City of Athens and the Vouros-Eutaksias Foundation. It is currently used for hosting several outdoors cultural events during the summer period, while a renovation project for the site is also underway.

The church of St. Nikolas represents a typical orthodox church following the architectural status of those buildings.

All cultural sites of interest in the wider project area are illustrated in Drawing ENV-04 in the Appendix.

5.5 Socio-economic Environment

5.5.1 Demographic Data

The mass installation of industrial and other activities in Thriasio Pedio resulted in a corresponding increase in population during the decade 1991-2001. The increase of the population and the large concentration of activities were not accompanied by planning of the development of the settlements of the area, having as a consequence the anarchic and arbitrary construction, the pollution of the environment and a low level of social services.

According to the Hellenic Statistical Authority, in 2001 the population in the Prefecture of West Attica was 149,794 residents. The Municipalities with the greater population were Megara with 27,252 residents, Aspropyrgos with 27,927, Ano Liosia with 27,305 and Elefsis with 26,121 residents. These four Municipalities combined constituted 72,5% of the total population in the Prefecture of West Attica. At the population census of 2011 the Regional Unit of West Attica numbered 160,927 residents.

In the Municipality of Elefsis, nearest to the immediate study area, the population increased to 29,902 residents. From 2001 to 2011 there was an increase of 14.5% in the population of Elefsis and a 7.4% total increase in the Regional Unit of West Attica.

Note that a new National Census was performed at 2021, but results are not yet available from ELSTAT.

Table 5.1: Evolution of Population for West Attica Munipalities (2001 – 2011)

2001		2011	
Prefecture of West Attica	**149,794**	**Regional Unit of West Attica**	**160,927**
Municipality of Megara	27,252	Municipality of Megara	30,924
Municipality of Aspropyrgos	27,927	Municipality of Aspropyrgos	30,251
Municipality of Ano Liosia	27,305	Municipality of Filis	45,965
Municipality of Elefsis	**26,121**	**Municipality of Elefsis**	**29,902**
Municipality of Mandra	12,739	Municipality of Mandra - Eidillia	17,885

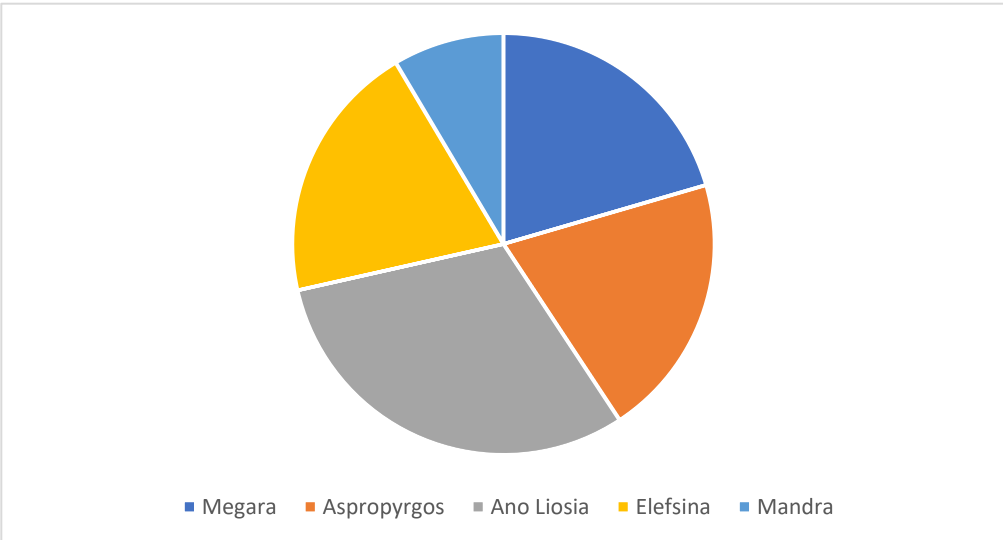


Figure 5.7: Population distribution among the mayor municipalities of West Attica

During the period 1991-2001, the region shows a large increase in population (20.7%). This increase is mainly due to reasons of internal migration, which followed the increased demand for labor in West Attica & Attica in general. Another reason is the low cost of land.

It must be pointed out, that the mass establishment of industrial, manufacturing and other activities in the area, with particular emphasis on Thriassian Plain, was followed by a corresponding increase in population in the same areas, especially during the decade 1991-2001. The increase in population and the expansion of industrial and commercial activities, were not accompanied, by the planning of the development of the settlements of West Attica, resulting in intense environmental and social problems (anarchic and arbitrary construction, environmental pollution, low level of provided social services, etc.).

Population distribution by sex and aging groups

The population of the Regional Unit of West Attica consists of 50.90% of men and 49.1% women according to the census of 2011 (Figure 5.8). This ratio almost conforms to the National ratio of the population.

With reference to population aging ratio, for West Attica (see also Figure 5.9):

- The child population (0-14 years) represents about 18% of the total population
- Members of the productive age (15-64years) constitute 68% of the total population
- The elderly (65+ years) represents about 14% of the total population

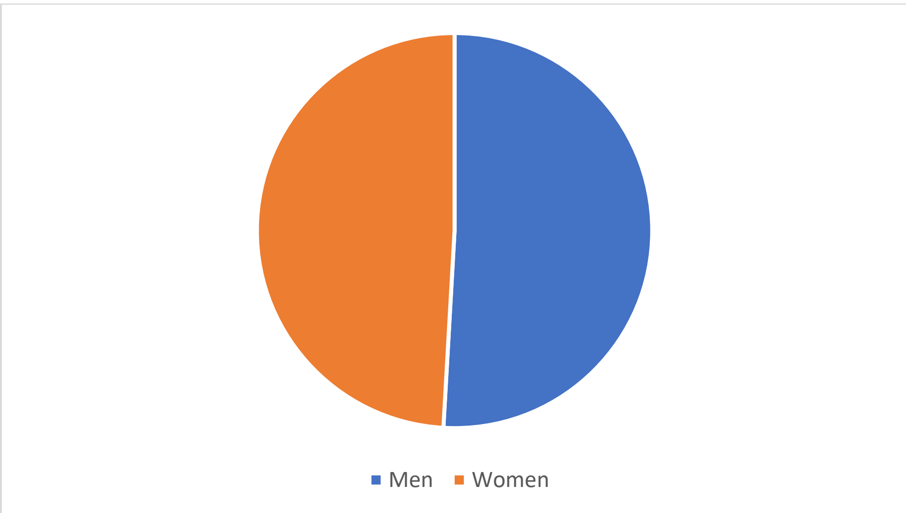


Figure 5.8: Population Distribution by genre in West Attica Region

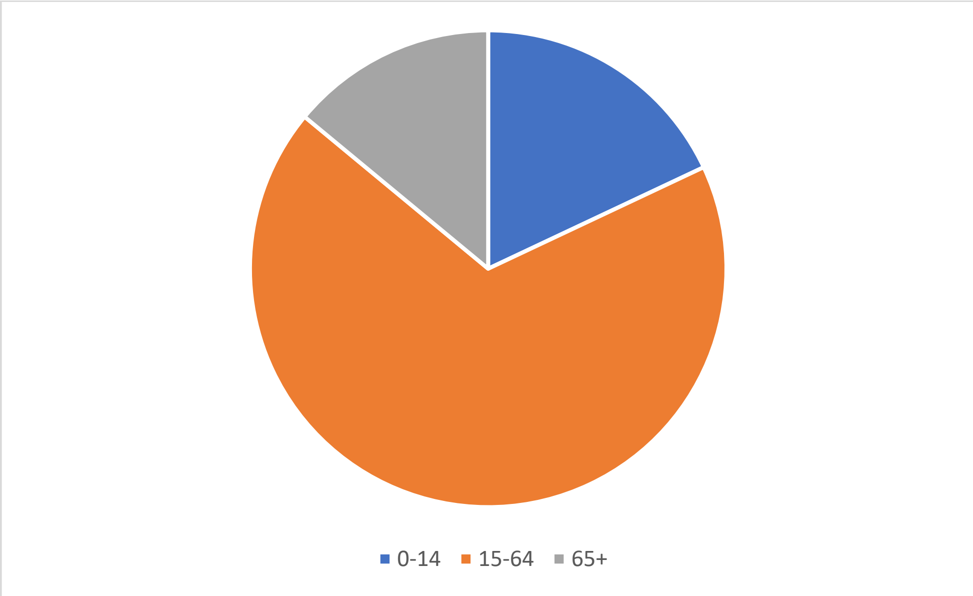


Figure 5.9: Population Distribution by age in West Attica Region

5.5.2 Structure of productive activity in the local community

Unemployment

The structure of the population into active and inactive does not differ significantly from municipality to municipality and is escalated as follows:

- Economically active population: 51%
- Economically inactive population: 48%

Economically active population by group of branches of economic activity

According to data processed by the Hellenic Statistical Authority, by 2011, the active workforce of Attica was as follows: Of a total of 1,824,900 of residents of working age, 1,325,900 were employed, while 499,000, a total of 27.3%, were unemployed.

Furthermore, 18,452 of the population were involved in the primary sector of activity (agriculture or mining operations), 139,108 were involved in the secondary sector (processing/manufacturing), and the rest, 1,168,340, were involved in construction and providing services.

The economically active population of West Attica is employed as follows:

- 6.78% in Industrial Activities
- 17.97% in Construction Activities
- 47.69% in Agriculture.
- 9.46% in Trade
- 18.10% in all other activities

More specifically, in the adjacent municipality of Elefsis, the structure of the workforce is presented at Table 5.2:

Table 5.2: Structure of Elefsis Workforce

Field of work	**Total**	**Employers**	**Self-employed**	**Employees**
Agriculture	667	62	324	174
Mining	31	1	2	28
Processing	3195	106	163	2897
Electricity/Gas/Water	29	1	1	27
Construction	1172	54	101	1013
Trade	1637	363	392	830
Food Industry	368	79	13	263
Transportation/Communication/Storage	844	25	86	730
Real Estate	646	48	49	545
Public Services/Defense	715	3	5	701
Education	197	11	15	171
Healthcare	209	5	18	186
Other services	265	14	43	207
Undefined	1489	24	68	556
Total	**11464**	**796**	**1280**	**8328**

Over time, the highest concentration of the number of employees in West Attica is presented in the tertiary sector, which contributes a very large percentage to GNP and employment. The tertiary sector accounts for 87.7% of regional GNP. Also, according to ELSTAT Reports [ELSTAT, 2021] on employment, the tertiary sector in the Attica Region employs more than 80% of employees. In terms of the sectoral structure in the tertiary sector, a significant contribution of trade / tourism is recorded.

In addition to trade, other important sectors of the services sector are financial services, transport and ICT, health and social services. This high concentration of services is because the headquarters of most companies in Greece are located in Attica, for reasons of proximity to public administration and decision-making centers but also due to the high concentration of research and educational institutions.

The secondary sector is also important in the Attica Region. The size of the industry is high as most of the Greek industrial plans are found in the Attica region. The manufacturing sector in Attica is dominated by "low - medium technology" sectors, such as the food - beverage industry, metal products, chemical - pharmaceuticals, textiles and shipyards, where productivity growth is mainly based on the acquisition of new technology and substituting work with it, but competitiveness is largely about product innovation.

At the same time, developing industries are ICT, microelectronics and their related applications [ELSTAT, 2021]. Approximately 113 production zones have been established in Attica, which include the Industrial Zones and Parks. The largest concentration of productive activities is located in Thriasio Pedio. Especially in West Attica, the municipalities of Aspropyrgos, Elefsis, Salamis etc. gather important large heavy industries of the country in the sectors of oil refining, shipyards, metallurgy and chemical industry.

Also, a significant number of industrial facilities are related to the construction sector, such as the concentration of metal frame and paint processing units recorded in many areas of Western Attica, the concentration of ready-mixed concrete production units in Ano Liossia, etc.

However, the recession that has affected both the construction sector and other sectors, has affected the concentration of these industrial activities as there have been several cases of business closures, transfer of all or a significant part of productive activity to areas outside Athens and / or outside the country.

The primary sector is respectively an important pillar for the development of Attica. The agricultural activities are located mainly in Megara, while the dynamic sectors are recorded floriculture, vegetables, viticulture and fishery products and aquaculture. In

West Attica, capital-intensive greenhouse units are concentrated, and an important part of primary production is viticulture, olive growing and vegetable growing.

5.6 Industrial/Commercial Environment of the Study Area

Adjacent to the northeast border of the Shipyards, the Octopus Relocation Services P.C facilities are developed. 250m to the northeast the freight forwarder and logistics provider Orphee Beinoglou International Forwarders S.A. is found.

Some 400m to the east, Private Sea Marine Services S.A. is located, a company providing advice and services on all aspects of the yachting industry, from operational management and sales, to charter, new builds, refits, berthing and marine services. 500m to the east the Greek Petroleum Industry Site (oil refinery) is developed. Also, in the west edge of the site, the Elefsis Refugee and Immigrants Camp was built during the 2015 European migrant crisis. The Camp now accommodates refugees from Ukraine (300 people approximately).

Finally, 300m to the west a Base Transceiver Station (BTS) is located.

The main features of industrial/commercial environment in the immediate and wider study area are illustrated in Figure 5.10.

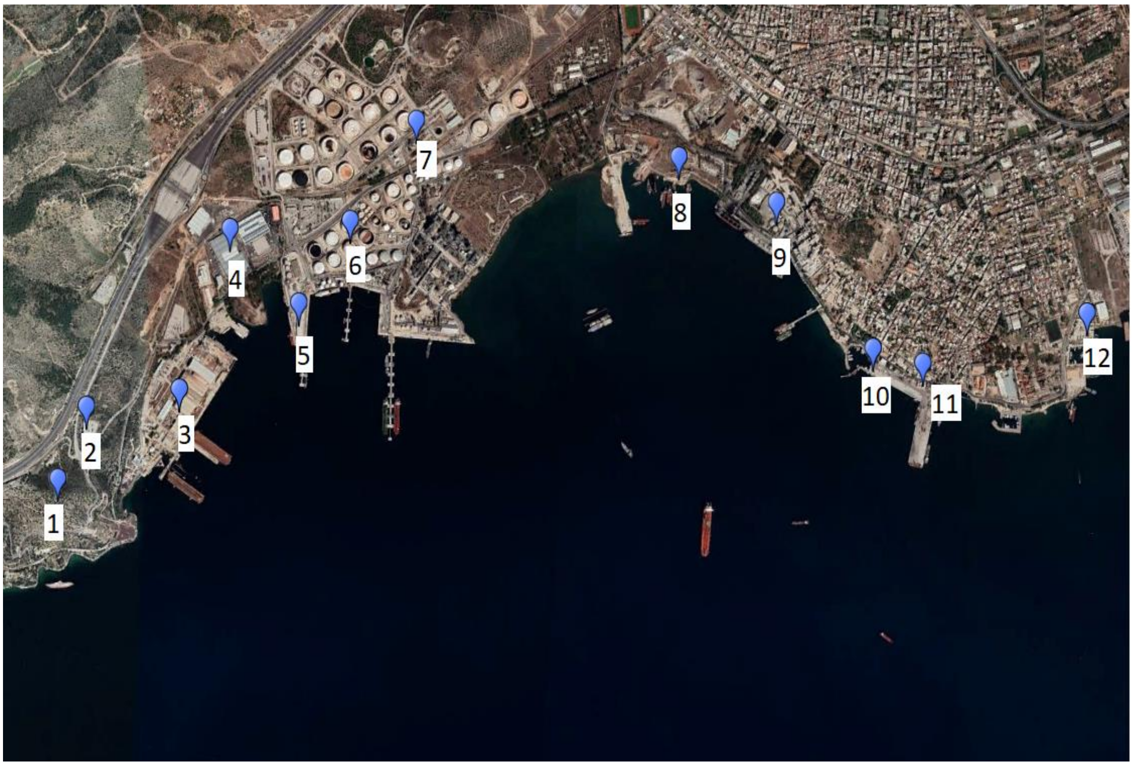


Figure 5.10: Main features of the industrial/commercial environment

Legend:

1. GSM STATION
2. ELEFSIS REFUGEE AND IMMIGRANTS' CAMP
3. **ELEFSIS SHIPBUILDING & INDUSTRIAL ENTERPRISES**
4. ORPHEE BEINOGLOU INTERNATIONAL FORWARDERS
5. PRIVATE SEA MARINE SERVICES
6. HELLENIC PETROLEUM INDUSTRIAL SITE OF ELEFSIS
7. HALYVOURGIKI HELLENIC STEEL INDUSTRY S.A
8. SMALL SHIP REPAIRING FACILITY
9. TITAN CEMENT CO.
10. MERKAN
11. PORT AUTHORITY OF ELEFSIS
12. PRO MARINE YARD ELEFSIS

5.7 Infrastructure

5.7.1 Transportation Network

Road Network: The site is adjacent to the Olympia Odos (designated as E94) and specifically to A8 Elefsis - Megara - Corinth highway.

Starting from Elefsis, the Olympia Odos motorways follow the Gulf of Corinth to the Rio–Antirrio bridge and the city of Patras, and along the Ionian Sea coastline, in future down to Tsakona (near Meligalas) in the southwestern Peloponnese where it will intersect with the Moreas Motorway.

Shipyards are directly accessible by the old country road Megaron-Perachora and the Old National Road Athens - Corinth.

The road network of the area, through Attiki Odos (Motorway A6: Elefsis - Athens International Airport) provides easy access to the Eleftherios Venizelos Athens International Airport, 56km to the east.

Attiki Odos outlines a huge arc from its western end (junction with the Athens-Corinth National Road at the height of Elefsis), to its eastern end, at the entrance of the International Airport "Eleftherios Venizelos" and its southeastern end (Kaisa). Attiki odos has drastically improved the traffic conditions, in the whole wider area of the capital.

a) From Elefsis to A / D "Eleftherios Venizelos" 36 minutes

b) From Elefsis to the National Road Athens - Thessaloniki 17 minutes

Railway Network: The area of the Shipyards is served partiallly by the Piraeus, Athens and Peloponnese Railways Line and mainly by the suburban line.

The Athens Suburban Railway, also known as Proastiakos Athens is a commuter rail service that connects the city of Athens with its metropolitan area and other regions beyond Attica, including Corinthia, Boeotia, Euboea and Achaea.

Ports: 3km to the east, the port of the city of Elefsis is one of the busiest in the gulf. The latter, is hosting several other large ports, including those of Aspropyrgos, Piraeus, Perama and Salamis. Especially the port of Elefsis, shows significant activity. It is important to point out that from Elefsis port, along with the other 9 private ports of coastal industrial facilities, the total volume of goods transported is 2.5 times higher than those transported from the port of Piraeus.

Figure 5.11: Elefsis Port

Air transport: The main passenger-freight airport is the international airport "Eleftherios Venizelos", as a hub of national, European, and intercontinental importance, while additional services can be provided in exceptional cases by the airports of Elefsis, Dhekelia and Pachi Megaron.

5.7.2 Water Supply

Most of the West Attica region is covered by the Athens Water Supply and Sewerage Company (EYDAP S.A.) water network. In addition to the areas covered by EYDAP with its own management, it also provides water to municipalities in the rest of Attica that take over its management. Note that, part of West Attica is not yet covered by EYDAP water.

The project site is directly connected to the EYDAP S.A. network. There is no groundwater extraction or use, while sea water is used for the firefighting network.

Overall, there is little health risk anticipated as the water quality is ideal for human consumption since, EYDAP supplies 4 million people with drinking water, according to monitoring records kept until 2021.

5.7.3 Electricity Supply

In terms of energy infrastructure, PPC's electricity network is the main service network, covering most of the consumer needs. In Attica there are two power plants of PPC, the station of Agios Georgios in Keratsini and the station of Lavrion.

While the Shipyards are connected to the local electrical grid, managed by the Public Power Corporation (PPC), through 10 substations, there are also generators installed in case of emergency. The electrical grid runs for over 5,000 meters inside the facility and includes both high and low voltage networks. The total annual consumption goes up to 20,000 MWh/year.

More information about the electricity network of the Shipyards is given in the Baseline Report (Chapter 3).

5.7.4 Municipal Waste Management Facilities

There is no waste management facility within the borders of the complex or in the immediate area of the project.

The Prefecture of Attica is currently served by a controlled waste disposal site, accepting more than 5,500 tons per day, on the borders of the municipalities of Ano Liossia and Aspropyrgos. The fact that in this area, during their entire operation, modern methods of landfilling have never been applied, results in the pollution of the underground aquifer of the Thriasio field in a large scale.

5.7.5 Wastewater Facilities

The drainage of urban wastewater in the West Attica Basin is carried out by the primary, secondary and tertiary collectors' network, under the responsibility of EYDAP, from which the local Municipalities have taken only the responsibility for the construction of the tertiary network. Problems in the operation of the network are created by blockages, construction failures and leaks. Causes of blockages are, among others, the illegal connections from various Municipalities and other public bodies of water collection wells (rainwater) to sewage pipes.

Within the wider study area, there are 3 fully operating Sewage Treatment Plants namely Vilion, Thriasiou and Megaron Plants.

A very important infrastructure for the protection of the Saronic Gulf and the immediate study area, is the Wastewater Treatment Plant (WTP) of Psyttalia. Its facilities have been developed in Akrokeramos, (Pre-treatment) and in Psyttalia (First stage Sedimentation, Sludge Treatment and Biological Treatment B Phase). They have a capacity of 5,600,000 units of equivalent population (e.p.). The final recipient of the treated wastewater is the inland Saronic Gulf. The final discharge is led to the submarine transport and diffusion system consisted of two submarine pipelines.

The operation of the first phase of WTP of Psyttalia back in 1994, brought the gradual improvement of the water quality of the Saronic Gulf. With the operation of phase B, about 95% of the pollutant load was removed. After the operation of the sludge drying unit produced by the WTP, the issue of wastewater treatment of most of the basin is successfully addressed.

In the Elefsis Shipyards a Biological Treatment Unit has been installed for treating the sewage coming from the sanitary areas of the employees. More details are given in Chapter 3: Baseline Report

5.7.6 Rainwater Drainage

The wider study area (West Attica) faces significant problems with rainwater drainage. The problem is exacerbated by the lack of technical works in streams and torrents in the area, which has led to catastrophic and deadly floods in the recent past (e.g., Mandra floods in 2017).

Nevertheless, in the intervention area there is a sufficient rainwater drainage system, as described in more detail in Chapter 3: Baseline Report.

5.7.7 Other Networks

In terms of telecommunications, Attica (and the project area) is served by a fixed telephony network that is constantly being upgraded. In addition, it has full coverage of mobile networks, broadband network and digital TV.

In terms of energy infrastructure, PPC's electricity network is the main service network, covering most of the consumer needs. In Attica there are two power plants of PPC, the station of Agios Georgios in Keratsini and the station of Lavrio.

The natural gas network is constantly expanding to cover more and more areas of mainland Attica, without, however, having penetrated to a large extent in domestic consumption, especially in West Attica.

5.8 Land acquisition and involuntary resettlement

IFC’s Performance Standard 5 recognizes that project-related land acquisition and restrictions on land use can have adverse impacts on communities and persons that use this land. Involuntary resettlement refers both to physical displacement (relocation or loss of shelter) and to economic displacement (loss of assets or access to assets that leads to loss of income sources or other means of livelihood) as a result of project-related land acquisition and/or restrictions on land use [IFC, 2012].

Resettlement is considered involuntary when affected persons or communities do not have the right to refuse land acquisition or restrictions on land use that result in physical or economic displacement. This occurs in cases of (i) lawful expropriation or temporary or permanent restrictions on land use and (ii) negotiated settlements in which the buyer can resort to expropriation or impose legal restrictions on land use if negotiations with the seller fail [IFC, 2012].

The development of the project under study is not expected to cause any issues related to land acquisition or involuntary resettlement of any population. Generally, land acquisition is not expected to be an issue since the ownership of the land is crystal clear. On the other hand, the special legislation that applies to Shipyards, ensures the transfer of ownership of the seashore to the new owner.

As far as it concerns involuntary resettlement, the new project does not involve any resettlement at all. All works and activities (including construction/rehabilitation and operational ones) will take place within the boundaries of the installation (industrial zone). The nearest settlements (Diodia and Makriammos) will not be affected at all.

5.9 Indigenous people

IFC Performance Standard 7 recognizes that “Indigenous Peoples, as social groups with identities that are distinct from mainstream groups in national societies, are often among the most marginalized and vulnerable segments of the population” [IFC, 2012]. Indigenous peoples, also known as first peoples, aboriginal peoples or native peoples, are ethnic groups who are the original settlers of a given region, in contrast to groups that have settled, occupied or colonized the area more recently. Groups are usually described as indigenous when they maintain traditions or other aspects of an early culture that is associated with a given region.

Indigenous Peoples are particularly vulnerable if their lands and resources are transformed, encroached upon, or significantly degraded. Consequently, Indigenous Peoples may be more vulnerable to the adverse impacts associated with project development than non-indigenous communities.

<u>In the wider area of the project and within the Prefecture of Attica in general, no Indigenous Peoples are located, so there is no case that the project may cause any impact to such populations</u>.

5.10 Man Made Impact on the Environment

5.10.1 General

For the wider area of West Attica, human pressures upon ecosystems through the misuse of resources, pollution and resource over-exploitation, are the main threat to ecosystems and potentially our wellbeing within those ecosystems [Karageorgis et al, 2020a, Toumbos et al., 2017]. Growth was connected to the industrial spread, reaching its peak in the early 2000's. Since then, a retardation has been observed. Heavy industries, such as two oil refineries, wood/rubber plastics, chemicals and petrochemicals, production of petrol derivatives, iron and steel production, machinery, transport, warehouse and logistics, scrap metals reuse, along with two of the largest shipyards of Greece (<u>including Elefsis shipyard</u>) operate in the broader area. A military airfield, with depots and storage tanks at west, is included in the brownfield profile of the area.

Some agricultural land and livestock/poultry farming units also operate from past years. The biggest landfill of Attica Prefecture is situated at the northeastern boundary of Thriassion Field. The modern unit has replaced an older uncontrolled landfill that operated until 2007 without a background membrane. The waste leakages proved to be contaminated by organic and inorganic substances. Evidently, the economic growth occurred under unsustainable conditions with lack of infrastructure. Additionally, unauthorized dumping of industrial by-products and the placement of any type of junkyards (used tires, car recycling etc.) has further degraded the environmental conditions.

Obviously, there is a constant interaction between natural and man-made environment. It is a fact that, in the area of Elefsis Shipyards, there is a human impact on the natural environment to a very large extent but not irreversible which means that the geo-capacity in the study area still has the ability to react. The anthropogenic environment is steadily developed on the coast while the inland is still intensely rural. Although there is an expansion of human influence, in recent years there is stability and shrinkage of industrialization in the region. Consequently, despite the fact that the population is growing in the region, it does not seem to be followed by the same deterioration of the environment, while it is a fact that the largest industrial facilities of the country operate in Thriassian Plain.

5.10.2 Atmospheric Pollution

The main anthropogenic sources of air pollution in the wider study area can be distinguished in total in three main categories: the industrial activity, energy production and means of transport. A fourth category, that of central heating of buildings, may added but which however concerns mainly the the city of Elefsis.

As presented in Chapter 3, there is an improvement of air quality in the wider study area during the last years, especially with respect to Sulfur Dioxide and Nitrogen Oxides. The period considered, coincides with the economic and financial crisis in Greece. Although the natural environment has been spoiled from industrialization, during in the last years, a number of interventions and the stricter enforcement of the Environmental Legislation with respect to industrial operation, have contributed to the improvement of the atmospheric pollution in Thriassian Plain. However, there are no data published for local atmospheric conditions e.g., in the vicinity of an industrial plan.

5.10.3 Soil Pollution

The study area is regarded as one of the most arid urban regions in Europe; its climate regime, influenced by the intense urbanism of the four recent decades, is featured by moderate warming, wind speed and direction changes and multiple extreme events (see also Chapter 3). The multi-component industrial rise since 1960, though following a declining trend to date, has determined drastic changes in the use of land, which has led to environmental degradation and a potential impact on the local climate regime, expanding in the adjacent areas. As a result of the aridity, the soils are of low quality as reflected by poor vegetation, which makes the need for sustainable land management mainly focused on soil water maintenance and the further prevention of landscape degradation Makri et al., [2022].

The overall remark from the few published studies about the soil pollution in Thriassion Plain [Makri et al., 2022] is the existence of high levels of metals that locally have a native contribution from the bauxite formations. Metal and oil industries are evidently the core polluting sources. There is not a clear trend, since the mentioned studies do not correspond to common sampling locations, though they are in the defined study area of Thriassion Basin. About biota, the environmental indices are useful guides of the contaminants’ fate in the soil system and toxicity to live tissues.

5.10.4 Marine Environment

The Saronic Gulf has been an important pole since ancient times of human activity with main centers the Gulf of Elefsis and the port of Piraeus. Forming a closed bay with particular important place, as it is located near the area of Athens, the Saronic Gulf includes the industrial zones of Elefsis and the port of Piraeus.

Oil industries in Thriassion Plain as well as shipping activities in Elefsis Bay are potential pollutants of hydrocarbons and metals of the groundwater and the seawater, respectively. In total, the Thriassion Basin accumulates a variable of activities, such as oil refineries, shipyards, urban areas and national highways. This is reflected in PAH diagnostic ratios, which, in total, indicate mixed fuel and coal combustion sources. In general, pollution in the broader Saronikos Gulf, is comparable to other heavily industrialized regions worldwide [Makri et al, 2022].

Huge damage has been inflicted to the Bay of Elefsis over the 20-year period between 1960 and 1980 by directly discharging into the sea raw toxic waste, organic cargo and oils. The Central Sewerage Pipe also added to this, as it was estimated that 20% of the total sewage and waste passing through it reached the Bay of Elefsis. The Pipe, as of November 1994, does not flow into the Gulf, but instead goes through another pipeline and the liquid wastes are sent to Biological Treatment Plant of Psyttalia for primary processing.

In recent years, there has been a slow but noticeable improvement to the environment of the Bay of Elefsis [YPEN, 2017, Makri et al, 2022]. Throughout the Bay, phosphoric residue, inorganic nitrogen (nitrates, nitrites and ammonia), BOD_5 and COD have been reduced, all while there is an increase in clarity of the waters as well as the dissolved oxygen.

Direct result of this improvement is the fact that in recent years the quantity and biodiversity of fish have increased in the wider area of the Elefsis Bay (e.g., red mullet, hake, etc.). Also, since 1993 there have been no recorded cases of mass mortality events of fish.

The microbiological quality of the waters of the coastal zones of the Bay of Elefsis is satisfactory, in recent years, meeting both the permissible and the desired limit of the applicable legislation. The same goes for the visually evaluated parameters, which also present a better picture. Indicative of the general improvement of the sea is that in 2003, according to the relevant decision of the Ministry of Health, the beach of Elefsis was deemed safe for swimming (unfortunately access to most of the beach is not possible due to industrial and port facilities).

The improvement of the area is a result of the following factors:

- The quantity of industrial waste has been reduced by 70% since 1980, with a corresponding reduction to the pollution load.
- Several industries have installed waste treatment plants.
- The number of decommissioned ships decreased significantly (1980: 45, 1982: 435, 1995: 60, 1996: 51, 1997: 70, 1998: 144, 1999: 123, 2000: 94, 2001: 63).

However, during the summer months, the Bay of Elefsis shows stratification of the water and the dissolved oxygen below the depth of 20m is significantly reduced, creating conditions that can hardly sustain life at those depths (previously at such depths the dissolved oxygen was close to zero). Eutrophication is particularly prevalent in the areas of Aspropyrgos and Nea Peramos, although in recent years it has declined. The improvement, especially in the area of Nea Peramos, has been impressive.

The problem is still acute at the seabed, where significant improvement is difficult. Seabed sediments show high concentrations of organic carbon (TOC), heavy metals and oils.

It is estimated that the environment in the Bay of Elefsis will improve even more in the coming years, provided that Psyttalia Plant will keep operating normally and that the industries of the area will continue to sufficiently manage their waste streams.

6. CONSTRUCTION/REHABILITATION (C/R) PHASE

6.1 General

Hereinafter, there is a description of works and tasks, prior to the commencement of Shipyards' Operation. The analysis includes necessary stages for rendering the Shipyard, not only operational, but also environmentally and socially viable. Furthermore, administrative issues, including buildings legalization and necessary permits, are also covered in this section.

According to ONEX BPL, the implementation schedule of the described works is estimated at 12-24 months in order to achieve full functionality of the Shipyard.

6.2 Buildings/Structures

6.2.1 Asbestos Removal

As it was mentioned in Chapter 3, asbestos cement sheets are present in several buildings and other structures within the Shipyard area. Asbestos is used mainly in roofing sheets and wall cladding and requires immediate removal. It is estimated a total surface of 39,000m^2, including roofs and walls, is covered by asbestos cement material. According to its specifications, 1m^2 of that material weights approximately 16kg. Consequently, from the main buildings alone, a total quantity of 6,25 tons of asbestos should be removed.

As it was also mentioned in Chapter 3, a portion of asbestos is also present in some of the ISOBOX buildings and on outdoor sheds. This amounts to an additional area of approximately 500m^2 covered by asbestos sheets, corresponding to 80 kg of asbestos

In general, it is estimated that a total surface of approximately 40,000m^2 of asbestos cement sheets, corresponding to almost 7tn of asbestos containing material (ACM), should be removed during construction/rehabilitation phase.

Asbestos removal will be performed according to "Asbestos Waste Management Plan" presented in Chapter 13.

6.2.2 Buildings without Permits

According to the list of buildings presented in Chapter 3, some **46** structures, appear not to have the necessary permits. The latter are issued by the competent Town Planning Authority, which operates under the supervision of the Municipality of Elefsina.

The above structures can be divided into 3 categories:

- 39 ISOBOX (Containers) – Temporary Structures mainly used for servicing employees, as toilets, and temporary warehouses.
- 6 Sheds and Shelters (metallic)
- 1 Concrete structure building (Warehouse of construction materials)

ONEX should initiate the process of issuing the necessary permits. Hereinafter, a short description of permitting process, along with a time schedule and cost is presented.

According to the Greek Town Planning Law N. 4067/12 as amended and in force (see also Chapter 2), the entirety of the Shipyards area, including all buildings and temporary structures should be assessed and licensed as one entity. That means, all not-legal buildings must be incorporated to the existing Shipyard Building Permit.

The whole process includes, among others:

- Engineers' fees
- Drawing of an updated Topographic Map of the Facility (including all new features)
- E/M Assessment
- Architectural study for every structure
- Static Assessment for every structure
- Passive Fire Protection Assessment

- Technical - Explanatory Memorandum/Assessment

It is estimated a total cost of 600.000€ and the time needed fluctuates between 6 and 12 months, including the procedures of the appropriate studies and the issuance of the final building permit.

6.3.3 Petrol Station

ONEX's intention is to re-operate the existing Petrol Station (see also Chapter 3). The station may provide with liquid fuels (diesel and unleaded gasoline) various machines and vehicles owned by the Shipyards (forklifts, cranes, trucks, bucket transport machines, etc. electricity generators etc.). The fuels may also serve construction site machinery, under the condition that the site has been set for the needs of the Shipyards (e.g., for construction/remediation or other technical activities, within the boundaries of the Shipyard).

Any other use or sale of fuels for equipment not owned by ONEX is strictly forbidden, according to the current National Legislation.

The legislative framework for licensing of the Petrol Station is set mainly by JMD No. 37776/2645 (OG 1882B/30-05-2017): "*Defining terms and conditions of establishment and operation of private gas stations for the service of vehicles and construction machinery (privately owned or contracted in any form with the owner or private service station), but also other operational needs of all kinds construction sites, mines, quarries and other temporary operating facilities as well as any other necessary details*".

The proper licensee is issued by the Transport and Communications Authority of the Prefecture of West Attica.

<u>Certificates required</u>:

- For metal tanks according to standard EN 12285 or equivalent.

- Plastic tanks require a certificate according to EN BS 13121-3 or BS 4994, or equivalent.
- For electrical installations certificate in accordance with the ELOT HD 384 Facilities, in compliance with the European Directives 2014/34/EU and 1999/92/EC.
- For the safety basin, hydrostatic tightness control test is required, accompanied with a relevant certificate from a competent Engineer, describing in detail the technical method of inspection and the basin capacity
- For liquid fuel pipelines a hydraulic test control is required in accordance with applicable National and European standards, Regulations accompanied with a relevant certificate from a competent Engineer, describing in detail the technical method by which the test was performed.
- Fire Protection Certificate, issued by the Competent Fire Protection Services, in accordance with the relevant fire protection legislation. The validity of the fire protection certificate is issued after conduction and approval of a Fire Protection Assessment Study and lasts for 5 years.

Other Requirements

- General Petrol Station layout
- Electromechanical installation plan
- Tank Designs and layouts
- Technical Essay describing in full detail the mechanical and electrical parts of the installation, including the anti-explosive zones and the relevant measures for protection against explosions.

Repairing/Maintenance

It should be mentioned that, prior to licensing procedure, tanks and pumps should be maintained properly in order to be certified. Repairing and maintenance works may include:

- Pumping fuel-rust-water residues from the bottom of the tanks
- Washing - Cleaning the tank with water jet
- Tank ventilation
- Gas Free Certificate
- Inspection - Repair of any cracks-leaks
- Sandblasting tank cleaning
- Implementation of Epoxy based primer on tanks
- Paint primed tank surfaces with epoxy resins.
- Laminating tanks
- Preparation of Volumetric Tables.

Timeline and Cost

Repairing works are expected to be completed within a **15-days** period.

The timeline for issuing the relevant license is estimated in **60 days** from submission of all the certificates and assessments/plans to the Competent Authority.

The total cost for repairing & maintenance works and licensing is estimated up to **50.000€**.

6.3 Port Facilities

Hereinafter, there is a summary of the basic tasks required for the maintenance and repair of port facilities so as to be operational. Bearing in mind the immense magnitude of the project, it is obviously impossible to list all the details of the relevant works in the context of an ESIA and it's out of the scope of the current assessment. However, the most important of those works are mentioned and especially those related to the production of waste.

6.3.1 Pier Repairing

This short technical description concerns the works that will be performed on the pier No. 2 of the Elefsis Shipyards. The attached figure shows the workspace located at the western end of the shipyard quay wall (Figure 6.2 and Drawing ENV-02 in the Appendix). It is noted that the repairing works and the complete static assessment of the pier have been assigned to an independent engineer (Dr. I. Sahinoglou, Civil Engineer, Port Specialist).

It is important to mention, that the works on the pier will require the installation of a temporary construction site. The latter will be fully removed after the completion of works.

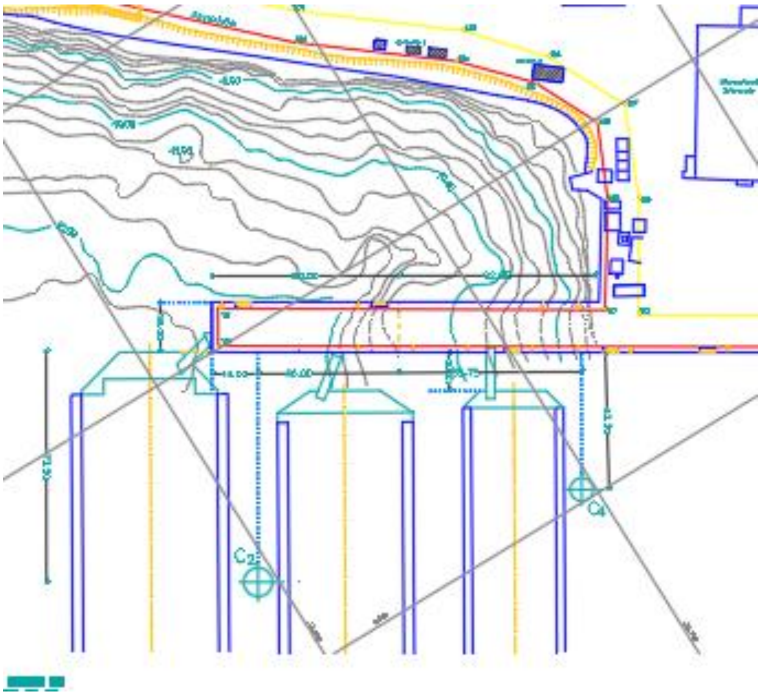


Figure 6.2: Pier Location

The exact dimensions of the pier are

- Width = 16 m
- Length = 123 m

The depths at which the pier rests are large and for this reason it lies on metal piles filled with reinforced concrete.

A brief work description is presented below and consists of the following stages:

A. Examination of the current situation and recording of the magnitude of the static issues
B. Demolition of the superstructure and reinforcement of the metal casing of the poles with a new plate around the perimeter and at a depth that is affected by the ripple.
C. Construction of a new superstructure with quality concrete C30/37 and reinforced with reinforcement S500C.
D. Construction of the necessary manholes, canals and the base of the crane bridge that supports the Floating Tanks.
E. Installation of the necessary equipment (bolts, rings, bumpers, etc.) and electrical - mechanical infrastructure on the pier.

If required, it is possible to extend the pier to the west (approximately 30 m) so that it fully supports the three existing Floating Tanks.

The cost of the project is estimated to amount **to 5,000,000 €**. It will mainly include concrete constructions with a volume of 4,500 m^3.

6.3.2 Floating Tanks Repairing & Maintenance

As it was mentioned in Chapter 3, all three floating tanks require maintenance and repair works, before being operational again, including:

- Mechanism & equipment repair & maintenance
- Rolling works
- Immersion - lift control
- Painting works
- Installation of cathodic protection

- Water jet cleaning

The exact degree of repairs and maintenance works will be defined by engineering specialists, after the finalization of administrative procedures for the transfer of the Shipyards ownership to ONEX. Those specialists should prepare a detailed assessment of the current status of the tanks, along with expected costs and timeline.

Depending on the repairs needed carving, cutting and shaping works of the tank plates and cast irons works will be performed. Other works include metal equipment items assembling, welding etc.

Raw material used for floating tanks repairing/maintenance may include:

- Metal sheets
- Ferrous materials of various types & shapes
- Cast iron
- Spare parts for machinery
- Welding items
- Cables
- Pipes
- Electrical instruments
- Paints
- Equipment for cathodic protection including power panels connected to the control unit of the installation, silicon iron anode beds and reference units

All materials and equipment will be provided by certified companies in Greece or abroad.

It should be mentioned that the appropriate repair and maintenance works can be performed (to an extended degree) by the competent Shipyards personnel.

6.3.3 Shipbuilding Bed & Cranes Repairing & Maintenance

The general condition of the Shipbuilding Bed is acceptable. No significant or large-scale repairing, or maintenance works are required. Only some local impurities and rust should be removed, prior to the commencement of Shipyard operation.

Cranes are also in good condition and regular maintenance works will be sufficient for their efficient operation.

6.4 Fire Fighting Equipment

The permanent firefighting network consists of approximately 71 fire-nets, containing equal fire-hoes. Many of them require maintenance. The total cost is estimated at **15,000€**.

The pumps of the firefighting network are generally in good condition and properly maintained. Nevertheless, after an autopsy the piping network of the facility requires maintenance and cleaning.

Fire alarm system is in place but requires maintenance and certification. The total cost is estimated at **3,000€**.

According to our inspection, the following fire extinguishers are situated within the shipyard area:

- Dry powder Extinguishers: 157
- CO_2 Extinguishers: 74
- Foam Extinguishers: 15
- Roof Extinguishers: 20

TOTAL: 246

Almost the entirety of those firefighting means requiring recharging, prior to operation commencement. According to market values the respective cost is estimated at **15,000€**.

Finally, there are over 30 firefighting equipment stations containing:

- Axes
- Crowbar
- Shovel
- Two Lenses
- Certified fireproof blanket 1.5 × 1.5
- Two protective helmets
- Two certified individual masks with filter.

Currently, there is no need for replacing, but all equipment should be re-checked prior to the operation commencement.

A total amount of almost **33,000€** is required for firefighting equipment maintenance and certification and the respective time needed should not surpass **30 days of work**.

It should be mentioned that in the total cost is not included any replacement of pipes, should that prove necessary. A thorough E/M study is required for the complete assessment of the firefighting piping network condition, which is out of the scope of the current ESIA.

6.5 Electrical – Mechanical (E/M) Installations

The thorough examination of the condition of all E/M installations requires a special assessment and it is out of the scope of the current ESIA. That E/M study will be a part of the building permit requirements, as mentioned in par. 6.2 and it has been included in the total cost.

However, ENVITERRA's associate, Mr. Mastrogiannis, Mechanical Engineer, performed an autopsy and recorded a significant part of the installations. The respective drawings and tables are given in the Appendix.

A point of concern is the condition of the several networks described in Chapter 3, par. 3.6. The exact degree of repairs, maintenance or even replacement works will be defined by engineering specialists, after the finalization of administrative procedures for the transfer of the Shipyards ownership to ONEX. Those specialists should prepare a detailed assessment of the operational status of the networks, along with expected costs and timeline.

6.6 Waste Removal & Management

6.6.1 General

In general, every collection and transport of wastes from the facility should be performed by properly licensed company, according to Greek Law.

More specifically:

Non-Hazardous Waste (NHW): The Company must be registered in the Hellenic Digital Waste Registry (DWR), for the specific EWC code, and possess an insurance contract (against environmental damage) also for specific EWC codes.

Hazardous Waste (HW): The Company should possess a Special License for collection and transport of hazardous wastes, issued by the YPEN in which the specific EWC codes are reported. Licensed companies have full responsibility for the organization of the collection equipment and transport vehicles, their suitability for waste transportation, their safe delivery to legally operating companies for further recovery or disposal operations or for cross-border transportation (Ministry of Foreign Affairs Circular 129043/4345 / 8-7-2011). The Company should also be registered in the Hellenic DWR.

Also, when transporting hazardous waste within the country, wastes are accompanied by identification documents that may also be available in electronic form and which contain the appropriate data set out in Annex IB to Regulation (EC) No 1013/2006/EC. The identification forms, as defined in no. 10 of JM 13588/725/2006, must be kept for at least 12 months (no. 20, par. 2, Law 4024/2012).

For the packaging of HW, the requirements of ADR regulation apply. Necessary condition for safe packaging is the classification of waste, in terms of its hazard, in class and UN number.

6.6.2 Sandblasting Waste (EWC: 12 01 17)

According to the most recent annual waste report (2021), sandblasting waste status is presented in Table 6.1 (see also Chapter 3):

Table 6.1: Sandblasting Waste Status & Quantities

EWC Code	Description	Quantity Stored at 31/12/2021 (t)	Year Storage has started
12 01 17	Waste of blasting material other than those mentioned in 12 01 16 (i.e., non-hazardous)	3.701,48	2015

As a sandblast material, mainly slag coming from Fe-Ni Industry is used. A typical chemical and mineralogical composition of sandblast material are presented in Tables 6.2 & 6.3.

Table 6.2: Typical Sandblast Material (slag) Chemical Composition

Compound	% w/w
FeO	38,8
Fe_2O_3	0,76
CaO	3,73
SiO_2	32,74
Al_2O_3	8,32
Mn_3O_4	0,44

Compound	% w/w
MgO	2,76
Ni	0,1
Co	0,02
S	0,18
C	0,11

Table 6.3: Typical Sandblast Material (slag) Chemical Composition

Mineralogical Phase	% w/w
Chromite ($FeCr_2O_4$)	**5**
Anorthite ($CaAl_2Si_2O_8$)	**20**
Magnesite (Fe_3O_4)	**4**
Fosterite (Mg_2SiO_4)	**7**
Failite (Fe_2SiO_4)	**50**
Christovalite - Tridymite (SiO_2)	**9**

Used sandblast from all storage areas (1, 2, 3) should be collected by properly licensed company, as described above. Small portions of the waste are also present in several areas of the Shipyard, other that the storage areas. The competent collection & transportation company should provide all the necessary means for safe collection and transportation (closed trucks, lifting machinery, vacuum cleaners etc.) all certified for the specific waste collection and transport. The Company is also responsible to inform the Shipyards' administration for the final re-use or disposal of the waste (according to D or R codes) and make the appropriate statement to the DWR.

It should be mentioned that used sandblast may be reused in cement industry, mainly as substitute for pyrite (Fe_2O_3) in the raw material. Most of the companies dealing with this type of waste, may directly transfer all waste quantities for immediate reuse, depending on the demand.

For the collection and transport of used sandblast an average cost of 200.000 euros is estimated. The respective timeline for the removal of the entirety of the waste will be 5 working days.

6.6.3 Solid petroleum products (EWC: 16 07 08 *)

Solid petroleum products will be managed as HW. Consequently, collection and transport should be carried out by a Company possessing the appropriate HW collection-transportation license that includes EWC 16 07 08*.

As mentioned in Chapter 3, petroleum wastes were initially gathered next to their production place (e.g., at the piers) within metallic bins and containers. Then waste transported to the respective storage area, often together with their means of storage. As it is shown in Figures 3.16 and 3.17, waste must be collected and removed together with metallic bins and containers, since those means of storage are ruined. contaminated and cannot be reused.

Another point of concern is that, in storage area 2 (Figure 3.17) currently there is an overflow of the underground storage tank and water contaminated with oils is present on the top of the concrete floor. Despite the fact that the water cannot escape to soil (due to the concrete floor and the protective wall around it), it must be pumped and transported to a special facility for management as a hazardous waste.

All containers for temporary storage of petroleum products must be replaced by new, certified ones, prior to the re-operation of the Shipyards and placed next to the floating tanks or at the piers (see Figure 6.3).

Figure 6.3: Petroleum Waste Temporary Storage Bin

6.6.4 Electrical & Electronic Equipment (EWC: 20 01 36)

EEEW collection and transportation is conducted according to the provisions of "Alternative Waste Management", as defined in Chapter 2. The Shipyards operator should address a Collective System (PRO), licensed for the specific waste type, and declare the quantity and the EWC code of the waste via an on-line application. The PRO is responsible to provide a properly licensed vehicle (certified for transporting the specific EWC code), along with the competent personnel, for collection of the Electrical & Electronic Equipment on site. The operator then will receive the relevant certificate, indicating waste quantities delivered and the final fate of those waste.

The only cost associated with Electrical & Electronic Equipment management is that for the transporter (about 100 per truck).

The Operator is responsible for declaring all the quantities delivered (in annual basis) on the DWR.

For compliance with Alternative Management Regulations, the Shipyards' operator should acquire special bins for future collection of those wastes (Figure 6.4).

Figure 6.4: Bin for temporary storage of Electrical & Electronic Equipment Waste

6.6.5 Lead Batteries (EWC: 16 06 01*)

Lead batteries collection and transportation is also conducted according to the provisions of "Alternative Waste Management". The Shipyards operator should address a Collective System (PRO) licensed for the particular waste type. PRO will send a licensed transporter to weight and collect the use batteries. Then the waste will be transfer for further management (recycling) in properly licensed facilities.

The Operator is responsible for declaring all the quantities delivered (in annual basis) on the DWR.

Note that, because lead batteries are mostly recycled, the Shipyards will be remunerated (up to 1€ per piece) for delivering used batteries.

For compliance with Alternative Management Regulations, the Shipyards' operator should acquire special bins for future collection of those wastes (Figure 6.5).

Figure 6.5: Used batteries recycling bin

6.6.6 Mixed Packaging Waste (EWC: 15 01 10* / 15 01 06)

As it was stated in Chapter 3, most of the packaging waste stored in the respective storage area are considered HW (15 01 10*) and they should be managed accordingly. According to DWR statistics, more than 50 Companies only in West Attica, are licensed for transporting those waste.

Packaging waste stored may derived from different products, such oils. Lubricants and paints. A thorough separation of different packaging should take place, prior to removal.

It should be mentioned that transport was estimated to cost up to 200 €/tn i.e., a total cost of **1000€** for almost 5tn of hazardous packaging.

According to the most recent YPEN report [YPEN 2021], packaging waste that contains residues or is contaminated with hazardous substances, end-up in recovery operations.

The small portions of NHW packaging waste (15 01 06) will be transported as described above for the other streams of NHW.

6.6.7 Mixed Municipal Waste (EWC: 20 03 01)

As it was mentioned in Chapter 3, mixed municipal waste is temporarily stored in a designated open area (Figure 3.21). According to our autopsy, almost all of the waste are non-biodegradable (see also Chapter 3). That is the reason that no smells or leachate production has been observed.

Those waste will be managed as non-hazardous waste. Collection and removal will take place from a properly licensed Company for collection/transportation of the specific EWC code. According to DWR statistics, there are more than 130 licensed companies for the specific waste code only in West Attica.

Since the largest portion of the waste are considered recyclable, they should be transferred to a Recycling Materials Sorting Center (RMSC – Figure 6.6). Those are licensed facilities where, by combining methods of mechanical - manual sorting, mixed non-hazardous solid waste or groups of materials are separated. The secondary materials exported from a RMSC are more marketable (clean) than if these materials were promoted directly on the market, due to the additional sorting - packaging. In this way, the standards set by the industry for the recycling of materials can be achieved.

More than 10 RMSCs are activated in the broader area of West Attica. Thus, the cost for transporting 100 tn of mixed municipal waste is not expected to exceed **1500€** (approximately 15€/tn, according to current market prices).

Figure 6.6: Recycling Materials Sorting Center (RMSC)

6.6.8 Iron & Steel Waste (EWC: 17 04 05)

As for the rest NHW, those waste should be removed by a properly licensed Company. Note that, the Operator may receive up to **500€/tn** upon deliverance of those waste.

The Operator is responsible for declaring all the quantities delivered (in annual basis) on the DWR.

6.7 Remediation/Rehabilitation Works

6.7.1 General

Because of the continuous storage of waste on several Shipyards areas (see Chapter 3), an intervention is necessary for rendering the Shipyards environmentally safe, prior to commencement of the new operating status. The main areas of concern are:

- Areas and/or structures used for the temporary storage of waste and their surroundings

- Other open areas of the facility, that wastes have been escaped and contaminated the topsoil
- Storehouses that contain hazardous materials (such as paints, oils, lubricants etc.), that spills or water intrusion has been observed

All areas of interest are illustrated in Drawing ENV-05 in the Appendix. Note that asbestos removal is separately examined in paragraph 6.2.1.

6.7.2 Sandblasting Storage Areas & Surroundings

After the removal of all used blast sand from the storage areas 1 & 2, as described in par. 6.6, the surroundings should be also cleaned. Note that, as it shown in Figures 3.13 and 3.14, for storage areas 1 and 2, the problem is minimized because all blast sand escaping from the storage in on the top of concrete floor. That waste can be easily removed by industrial vacuum-cleaner, during the collection of the stored blast sand. The relevant equipment will be provided from the Licensed Company that will appointed to the collection/transport of the waste.

Figure 6.7: Industrial Vacuum Cleaner

Storage Area 3 (outdoor – next to the municipal waste pile – Figure 3.15), is also situated on top of concrete floor. The bulk of the waste will be removed as described in par. 6.6. Due to the fact that the pile of blast sand is next to the municipal waste pile, great care should be taken so as not to mix any blast sand with the municipal waste during removal.

When the blast sand is removed, the concrete floor should be examined for possible inconsistencies that may have led to contact of waste with clean soil. If any cracks are found, the floor should be removed along with the underlying soil. If no cracks are found, the total area of the concrete floor will be carefully cleaned be an industrial vacuum-cleaner.

In general, sandblast waste is well known to possess a very small adhesive potential. That is due to the fact that its mass contains mainly metal oxides (see Tables 6.2 & 6.3) that cannot escape under water effect. This is the main reason for considering blast sand as a NH material/waste.

Blast sand can be found, in small portions, in several places within the facility, mainly next to locations that sandblasting was actually performed (e.g., piers, floating tanks – Figure 6.8). All these areas are on top of concrete floor and no contact with soil is possible. An industrial vacuum-cleaner will be used for the removal of those waste piles. Once more, after removal, the concrete floor should be examined for any inconsistencies and undergo maintenance if necessary.

Figure 6.8: Blast sand found on pier

6.7.3 Solid Petroleum Products Storage Areas & Surroundings

Both solid petroleum products storage areas are located on top of concrete floor. There is also a safety basin around the storage area, and any leakage cannot escape even when the underground tank overflows. Thus, the sufficient removal of waste as described in par. 6.6.3, will minimize the problem. Also, any liquid or semi-liquid waste along with leachate will be pumped and transfer from the appointed Licensed Company.

Points of concern after the removal of the bulk of the waste are:

- Careful examination of the concrete floor for any disruption
- Empty the underground collection tank and conduct any maintenance work needed to be safe and operational

If any inconsistency of the floor is observed, immediate action should be taken to remove concrete and the underlying soil to avoid any contamination. A sampling borehole should be established in order to assess the contaminant migration to the underlying soil.

It is recommended, that the concrete floor should also be cleaned and maintained or even substituted with a new one, if necessary, prior to any future use. There are several materials that may be used for that purpose, most of them based on nanotechnology. A prerequisite for the successful implementation of any cleaning agent is the thorough cleaning from any petroleum residues.

6.7.4 Mixed Municipal Waste Storage Area & Surroundings

After removal of waste from the particular area, the concrete floor should be examined for any disruption. Another point of concern is also to spot any leachate production, not visible with the pile of waste at place.

As described for the other waste areas, if any inconsistency of the concrete floor is observed, the exposed topsoil should be examined for any contamination. If, indeed, there is a contamination event, the same process described for sandblast storage area 3 will be initiated.

6.7.5 Packaging Waste Storage Area

Although the particular area is also on top of concrete floor, there is an intrusion of water. After removal of waste, all the water must be pumped and treated as potentially contaminated. The floor must be examined for inconsistencies and if any, measures described above for other waste streams should be implemented.

Since the shed used for temporary storage is open from one direction and it is exposed to rainfall and wind, it is not recommended as a storage area for the future operation and a close protected area/storehouse should be assigned for that purpose.

6.7.6 Other Waste Storage Areas

Areas accepting lead batteries, iron & steel waste and EEEW are expected to undergo a thorough cleaning for any residues, after the removal of the respective waste. All the floors should be examined after waste removal and repaired if damaged.

Especially regarding EEEW, their temporary storage in an outdoor area, even on top of concrete floor, must be avoided in the future.

6.7.7 Materials Storage Areas

Materials areas (chemicals, oils, lubricants, paints) need to be examined carefully for water intrusion. Since they will continue to be used as warehouses, those buildings must be emptied and maintained properly. The sources of water intrusion must be located.

Moisture can be found in water vapor, condensation, and in or on the fabric of a building and can cause damp resulting in problems such as staining, mold growth, mildew and poor indoor air quality. The common sources of moisture in buildings include:

- Condensation.
- Penetrating damp.
- Leakage from pipes, tanks, drains
- Rising damp.
- Building defect, e.g., lack of adequate roof space ventilation, faulty retrofit installation, application of paint or plaster that affects the breathability of the building element

Since no leakage was observed, it is assumed that water intrusion is probably due to a building defect or penetrating damp. A static engineer should thoroughly assess the condition of the buildings and initiate the proper measures.

Finally, during inspection and temporary removal of materials, all expired materials (if any) must be detected and managed properly (as waste or returning to the producer).

6.7.8 Other Works

Drainage network channels should be carefully cleared of any foreign objects, vegetation, and waste. The latter, after proper separation, will be removed according to their nature (e.g., plastics, paper, iron, vegetation etc.).

A traffic assessment should also be conducted and implemented, according to the current legislation (see also Chapter 3).

Finally, ATEX certification is necessary for any infrastructure/equipment that is about to operate in specific environments with explosive atmospheres (e.g., electrical panels and lights present in hazardous materials storage areas or in production buildings). (ATEX DIRECTIVE 2014/34/EU on the harmonization of the laws of the Member States relating to equipment and protective systems intended for use in potentially explosive atmospheres)

6.8 Installation of new features/activities

Except shipbuilding and ship repairing, the new operator is about to install new activities including:

- Conversions and improvements of merchant ships to reduce environmental footprint (carbon emissions) according to the regulations of the International Maritime Organization (IMO), through installing scrubbers and ballast water treatment units.
- Implementing new technologies (nanotechnology) in materials production
- Producing information technology (IoT) systems for ships

6.8.1 Ballast Water Treatment (BWT) Installation

ONEX BPL indicates that Ballast Water treatment units will come ready for installation and no production or pre-fabrication line will be situate at the Shipyards' area.

Installation of a BWT Unit during dry docking is more common than during sailing, as it allows for modifications of most systems without substantial safety risks. The time spent at the yard is normally around two weeks, during which maintenance is performed on a variety of other systems as well. This generally leaves a maximum of ten days for installing the ballast water treatment system, which requires that most of the components are pre-manufactured.

Upon arrival to the shipyard, scrubber units must be properly stored in a designated area, as close as possible to the pier for easy transport.

Details on ballast water systems on ship are given in Chapter 8.

6.8.2 Scrubber Installation

As for BWT installations/units, scrubbers will come ready for installation and no production or pre-fabrication line will be situate at the Shipyards' area. Installation of the Scrubber Unit will take place during dry docking

Upon arrival to the shipyard, scrubber units must be properly stored in a designated area, as close as possible to the pier.

Details on the functioning of scrubbers on ship are given in Chapter 8.

6.8.3 New Materials

ONEX BPL contains researching, developing, producing and trading "smart" materials for all kind of vessels. High-quality and environmentally friendly coating products, based on nanotechnology, add functionality and unique properties on marine structures or vessels.

Nanotechnology refers to the scientific discipline, which deals with very small structures, typically sized from 1nm to 100nm. Down to nanoscale, conventional materials develop unique physical (e.g., electrical or mechanical) and chemical properties, when exposed to external stimuli. That is how nano-products differentiate to existing conventional coatings: The near-infinitely small nanoparticles penetrate deeply into the application surfaces to “dress” their application substrates, ensuring the repulsion and protection of intruding factors effectively against abrasion, friction, corrosion or adverse weather conditions.

ONEX intends to provide new solutions aiming at the effectiveness, durability, and eco-friendliness:

- Coatings to prevent the development of marine biofouling even in static/ idle conditions,
- Anti-corrosion products for long-term protection t
- Thermal insulating coatings for energy saving in heat exchange applications.

Those materials will be developed by ONEX R & D Department and will be manufactured in co-operation with external laboratories and industrial plants. No manufacturing will take place within the facility’s borders.

6.9 Water & Energy Consumption

During C/R Phase, water will primarily be used for construction activities (pier repairing), drinking purposes and in toilets by construction workers and site employees.

As it was mentioned before, for pier repairing, concrete constructions (using a C30/37 quality concrete) with a volume of 4,500 m^3 will be required. According to cement technical specifications and common practice, for the composition of 1m^3 of concrete (C30/37) are required:

- 350kg cement
- 150kg of water

Based on the above composition, for the preparation of 4,500 m^3 of concrete, necessary for the foundation of the new superstructure, the amount of water needed is estimated at **675 tn (or 675 m^3)** approximately.

Other activities that engage the consumption of water include the periodic flushing of the area for purposes of dust reduction and several cleaning processes that require water. Nevertheless, since most of the areas of the Shipyards are covered, those quantities will be limited. An average of $2m^3$/day is estimated for a maximum 24 months period of C/R phase, thus the final consumption is calculated at **1440m^3**.

Consequently, total water consumption is not expected to exceed 2.200m^3 during the 2 years C/R phase.

There will be no need for use of water in toilets for the construction personnel, since their daily hygiene needs will be covered using a chemical toilet which will be placed inside the temporary construction site.

Water for drinking purposes will not be consumed by the public network during C/R phase. Drinking water needs will be covered with bottled water, under the responsibility of the Contractor.

All the water required during C/R phase will be provided by the Public Network (EYDAP). No water from other sources (such as boreholes or pits) in the wider area will be used. Thus, **no effects to the communities living in the proximity of the Shipyards area is expected.**

During C/R phase, energy required will be covered by fuel (diesel) consumption. A detailed assessment of consumption of diesel during the C/R phase is not possible at this stage, as it depends on a number of parameters (detailed technical characteristics of the individual projects, time planning of projects, construction techniques, composition of construction sites), which have not been identified and which are not the subject of the present ESIA.

6.10 Solid Waste/Useless Materials production

During the Construction/Rehabilitation Phase and after stored waste removal, there will be a stream of solid waste and useless materials produced. Details on these materials and solid waste to be generated (type, EWC codes, quantities, disposal method) are given in Table 6.4.

Note that waste already stored (e.g., sandblast, petroleum products etc.) are not included in this section, since they are expected to have been removed, prior to the commencement of any construction activity (see paragraphs 6.6 and 6.7).

Table 6.4: List of waste during construction/rehabilitation phase and proposed management

Type	EWC-CODE	Description	Quantity (tn)	Management
Waste from floating tanks and Ship-bed cleaning/maintenance	12 01 01	Ferrous metal filings and turnings	50	Temporary collection in bins and removal by licensed collection company
Waste from floating tanks and Ship-bed cleaning/maintenance	12 01 02	ferrous metal dust and particles	20	Temporary collection in bins and removal by licensed collection company
Waste from floating tanks and Ship-bed cleaning/maintenance	12 01 03	non-ferrous metal filings and turnings	10	Temporary collection in bins and removal by licensed collection company
Waste from floating tanks and Ship-bed cleaning/maintenance	12 01 04	non-ferrous metal dust and particles	20	Temporary collection in bins and removal by licensed

Type	EWC-CODE	Description	Quantity (tn)	Management
				collection company
Waste from floating tanks and Ship-bed cleaning/maintenance	12 01 13	welding wastes	30	Temporary collection in bins and removal by licensed collection company
Packaging from materials used for pier and concrete surfaces repairing	15 01 06	Cement and related materials Packaging	1	Removal by licensed collection company
Packaging contaminated with hazardous substances from materials used for pier and concrete surfaces repairing	15 01 10*	Chemical, lubricants and related materials Packaging	1	Removal by licensed collection company for HW
Concrete dismantling and demolition materials from port structures (pier, storehouses concrete floor)	17 01 01	Concrete	7000	Removal by licensed collection company for ECDW
Useless Cables from Storage & Production Areas, floating tanks, pier	17 04 11	cables other than those mentioned in 17 04 10	2	Removal by licensed collection company for ECDW
Soils removed together with sandblast	17 05 04	Soil and stones other than those mentioned in 17 05 03	Limited	Removal by licensed collection company for ECDW

Type	EWC-CODE	Description	Quantity (tn)	Management
Other construction and demolition waste	17 09 04	Mixed construction and demolition wastes other than those mentioned in 17 09 01, 17 09 02 and 17 09 03	Limited	Removal by licensed collection company for ECDW
Municipal waste from working personnel (during C/R phase)	20 03 01	Mixed municipal waste	Limited	Collected in bins of the local Municipality and transported by vehicles

The proper management of all those wastes is presented in Chapter 8.

6.11 Liquid Waste production

Liquid waste may occur during tank maintenance works including wash water, oily water from bilges and tank cleaning, and engine fluids such as oil, hydraulic fluids, lubricants, and anti-freeze.

Cleaning of machinery and vehicles will not take place inside the installation, so no rinsing water is produced. Losses of mineral oils generated during the lubrication of trucks and other equipment are not expected, as the maintenance and refueling of vehicles will not take place inside the facility, during C/R phase.

Another source of liquid waste may include the periodic flushing of the terrestrial construction front on the pier from rainwater.

During the C/R phase, the production of other streams of liquid waste is not expected, except in the case of an accident, which is examined in the following Chapters of this ESIA. The maintenance of any kind of motor equipment (vehicles, machinery) within the study area is prohibited. In any case, leakage restriction materials (e.g., sawdust) will be available on site and all oils and lubricants will be collected in containers and disposed of by licensed companies in accordance with applicable law (see above).

The daily hygiene needs of the construction staff will be covered by the use of a chemical toilet which will be placed inside the temporary construction site or by the already existing toilets in several Shipyards' buildings.

More details about liquid waste and their impacts are given in the next Chapter.

6.12 Emissions of air pollutants

6.12.1 General

During the C/R phase of the project, a series of activities will take place, which have the potential to produce dust, suspended particles and other gaseous pollutants. More specifically, the gaseous waste of the C/R phase is divided into the following categories:

- Dust and particles
- Exhaust gases of vehicles and machinery

The main sources of dust and particulate emissions during construction activities include:

- The collection and transport of waste from storage areas and other locations within the Shipyard
- The repairing works on floating tanks and shipbuilding bed
- The operation of the Construction Site set for pier repairing
- The handling, accumulation, storage and transport of materials and waste
- The routes of transport of materials and waste from trucks or vehicles to be managed.

The most adverse effect on the quality of the atmosphere is the release of dust, which also has a negative aesthetic effect. However, the short duration of the construction phase and the relatively limited use of machinery and vehicles make the impact medium, short-term and reversible.

Trucks that will be used for transporting equipment, materials and waste, are using diesel as a fuel. The main components of the gaseous pollutants emitted by this mechanical equipment concern:

- Carbon monoxide
- Sulfur dioxide
- Nitrogen oxides
- Volatile Hydrocarbons

In case of sandblast transport and clean-up (par. 6.7), dust and particles from sandblast, rich in metals, may be created.

The use of the above-mentioned vehicles does not require special permission and it rather limited. As for the effects on the atmosphere from the exhaust emissions of machinery and trucks, they will be limited due to the relatively small number of vehicles, while their movement and use will be limited to what is absolutely necessary. It is emphasized that the distance of the project from residential areas in combination with the satisfactory atmosphere of the area, ensure that the effects on the quality of the atmosphere during the C/R phase are negligible.

6.12.2 GHG emissions during C/R phase

Waste & Material transport

Hereinafter, the air pollution load from waste transportation may be calculated. In the following table, waste present on site (see also Chapter 3) along with the number of itineraries necessary for their removal is presented. It is assumed that for large waste loads (such as blasting material and wastes containing oil), trucks with an overall capacity of 24 tn will be used. For smaller loads, smaller trucks will be available.

Table 6.5: Quantities of stored waste per EWC-code & number of itineraries for their removal

EWC Code	Description	Quantity to be removed	Number of itineraries
12 01 17	waste blasting material other than those mentioned in 12 01 16	3.701,48	155
15 01 06	mixed packaging	0,50	1
15 01 10*	packaging containing residues of or contaminated by hazardous substances	5,50	1
16 06 01*	lead batteries	1,50	1
16 07 08*	wastes containing oil	159,36	7
17 04 05	iron & Steel	25,00	2
20 03 01	mixed municipal waste	100,00	5
20 01 36	discarded electrical and electronic equipment other than those mentioned in 20 01 21, 20 01 23 and 20 01 35	1,00	1
17 06 05*	Asbestos waste	7,00	7
		Total	180

The consumption of diesel oil for the execution of the above itineraries is calculated from the equation:

Total Diesel Consumption = No of Itineraries X Distance X Consumption/Km

- Number of itineraries = 180
- Average Distance = 20 Km
- Diesel consumption = 35 lit/100Km = 0,35lit/Km
- **Total diesel Consumption =180 x 20 x 0,35 = 1260 lit**

Emission factors per kilogram of fuel consumed, based on international and domestic literature, are given in Table 6.6.

Table 6.6: Emission Factors (Kg gas/Kg diesel)

Pollutant	CO	VOC	NO_x	SO_2	TSP
EF	0,049	0,025	0,017	0,006	0,014

Considering that the density of diesel oil is 0.8 kg/lit, emissions are calculated based on the equation:

Gas Emissions = Fuel Consumption X Fuel Density X Emission Factor

Especially for CO_2 released from the combustion of fuel oil, calculation method used is in accordance with the Regulation (EU) No 2066/2018 for the monitoring of greenhouse gas emissions.

Specifically, the emissions are calculating through the following equation:

Diesel CO_2 Emissions = NCV x EF x C x 10^{-3}

- C = Fuel Consumption (tn)
- NCV = Net Calorific Value (TJ/ Ktn)
- EF = Emission Factor for diesel (tn CO_2 / TJ)

Diesel CO_2 Emissions = 3183,05kg

In Table 6.7, gas emissions related to waste transport are illustrated

Table 6.7: Gas emissions from waste transport (kg) during C/R Phase

Pollutant	CO	VOC	NO_x	SO_2	TSP	CO2
kg emissions	49.39	25.20	17.14	6.05	14.11	3183.05

Considering raw materials that will be transported during the C/R phase, it is assumed a total number of 500 itineraries. The respective gas emissions (following the calculation method presented above) are illustrated in Table 6.8.

Table 6.8: Gas emissions from materials transport (kg) during C/R Phase

Pollutant	CO	VOC	NO_x	SO_2	TSP	CO2
kg emissions	137.20	70.00	47.60	16.80	39.20	8841.80

Construction Site

An estimation of the gaseous emissions that are expected to be produced at the C/R, considering a heavy construction site composition, is presented at Table 6.9.

Table 6.9: Estimation of total quantities of pollutants (in Kg) that will be emitted daily during the C/R phase of the project (worst case scenario)

Machine/ Vehicle	Quantity	NOx (Kg)	NM-VOC (Kg)	CH_4 (Kg)	CO (Kg)	NH_3 (Kg)	N_2O (Kg)	PM (Kg)	$PM_{2,5}$ (Kg)	SUM
Floating Crane	1	7.05	1.02	0.02	2.28	0.00	0.19	0.33	0.31	11.21
Towboat	1	8.30	1.20	0.03	2.69	0.00	0.22	0.39	0.37	13.19
Water pump	1	1.66	0.24	0.01	0.54	0.00	0.04	0.08	0.07	2.64
Thruster	2	9.13	1.32	0.03	2.95	0.00	0.24	0.43	0.40	14.51
Grader	2	6.64	0.96	0.02	2.15	0.00	0.18	0.31	0.29	10.55
Excavator	2	6.64	0.96	0.02	2.15	0.00	0.18	0.31	0.29	10.55
Excavator JCB	2	6.64	0.96	0.02	2.15	0.00	0.18	0.31	0.29	10.55
Air Compressor	2	6.32	0.48	0.01	1.07	0.00	0.09	0.16	0.15	5.28
Dumper	8	26.55	3.85	0.09	8.60	0.00	0.71	1.25	1.17	42.21
Loader	3	4.98	0.72	0.02	1.16	0.00	0.13	0.23	0.22	7.91
Concrete blender	1	0.71	0.10	0.00	0.23	0.00	0.02	0.03	0.03	1.12
Concrete press	1	0.71	0.10	0.00	0.23	0.00	0.02	0.03	0.03	1.12
Total	**26**	**82.33**	**11.91**	**0.27**	**26.65**	**0.00**	**2.20**	**3.86**	**3.62**	**130.84**

Although the quantities of pollutants produced are significant, it is estimated that they will be removed, without causing significant alteration in the quality of the atmosphere of the area. Even in case of calm, the concentrations of pollutants in the atmosphere are estimated not to exceed the permissible limits, provided of course that the relevant legislation is implemented for the permitted emissions from the engines of the machinery / vehicles of the construction sites (see Chapter 2 and Chapter 8). In addition, the operation of all machinery will not be simultaneous and therefore the actual emissions will be much lower than those expected.

6.13 Noise-Vibrations

During the C/R phase, the source of noise is mainly the repairing activities and the operation of the motorized equipment. However, the absence of settlements nearby, make the effect of noise almost negligible. The main victims of noise are the employees engaged in construction works. However, the noise effects are considered medium and temporary.

6.14 Electromagnetic Radiation

Due to the nature of the construction works, no emission of electromagnetic radiation is expected.

6.15 New permits/renewal of existing ones/Certifications

Prior to the commencement of the Shipyards operation, the following permits and certificates should be obtained:

- AET for reconstruction and new operation status, after conduction and approval of an ESIA (according to the national standards) from YPEN
- Renewal of the existing Occupational Safety Assessment and certification under OHAS 18001
- Port Authority Permit for the conduction of port-related works (pier, tanks) after conduction and approval of the appropriate port, static and E/M studies
- New building permit (see also par. 6.2)
- Renewal of ISO 9001:2015 Quality Management System Certificate

- Renewal of ISO 14001:2015 Environmental Management Systems Certificate

6.16 Planning and scheduling of individual works and construction stages and relevant costs

Hereinafter is presented an indicative budget for C/R phase. Note that the exact costs will be determined after the completion of several individual studies prepared by engineer specialists.

Table 6.10: Indicative budget for some critical C/R works

No	Description	Cost (€)
1	**Building Permit**	600,000
2	**Pier Repairing**	5,000,000
3	**Tank Repairing**	26,000,000
4	**Studies/Consultants (including certificates)**	1,500,000
5	**Waste Management (including asbestos)**	2,500,000
6	**Petrol Station**	50,000
7	**Firefighting Network & Equipment**	33,000
8	**Buildings & Equipment Maintenance**	4,000,000
TOTAL		**39,683,000**

Moreover, an indicative schedule and timeline of the proposed works is presented in Table 6.11.

Table 6.11: Indicative Schedule and timeline for C/R critical tasks

	MONTHS											
C/R Stage/task	2	4	6	8	10	12	14	16	18	20	22	24
Studies/Assessments												
Permits/Certificates												
Waste/Materials Removal												
Infrastructure repair/installation												

7. ENVIRONMENTAL & SOCIAL IMPACTS FROM CONSTRUCTION/REHABILITATION (C/R) PHASE

7.1 General

In order to assess the environmental impact of a project, the environmental parameters that are affected are first determined, then the caused changes in their quality are evaluated, and finally the minimization actions and the remedial actions of the possible expected negative effects are described.

In this Chapter, after a combined review of the elements of the current state of the environment (natural and social) and the project under consideration, an assessment and evaluation of the potential significant impacts expected from C/R phase (as described in the previous Chapter) is conducted. Also, the impacts for which special emphasis should be given are highlighted.

7.2 Impacts on climatic and bioclimatic characteristics

No impact is expected from the construction and rehabilitation of the specific project capable of causing any climate change both in the studied and in the wider area. In this phase of the project, only minor impacts on morphology will be performed, as described in Chapter 6. Consequently, no effect on bioclimatic parameters such as surface reflectivity, soil evaporation, etc. are expected.

The only impact expected is the exhaust gases and particulates from vehicles movement, for transportation of waste and materials, and other machinery utilizing diesel (e.g., during repairing works on the pier). Those impacts are described in par. 7.10.

7.3 Impacts on morphological and landscape features

No effects on the morphology of land are expected during C/R Phase of the Project.

Visual disturbance concerns an environmental - anthropogenic impact with a clearly subjective character and it is not easy to set commonly accepted rules for its size and magnitude. In any case, the effects of C/R phase on the landscape are expected to be rather low given that the geomorphology of the site is suitable for the reduction of visual disturbance (e.g., from the situation of a construction site). In fact, the area is hardly visible from any remarkable point of observation, such as settlements, archaeological sites, etc.

During C/R phase of the Project, it is expected that the embossed characteristics of the ground surface will not change, since no new constructions or installations (e.g., buildings) are expected to be established.

7.4 Impacts on geological, tectonic and soil characteristics

7.4.1 Impacts on Geological/Tectonic Characterstics

The type and scale of the C/R works, as described in Chapter 6, are not expected to bring about substantial changes in the geology of the area. Geological formations prevail throughout the project site (see also Chapter 4), cannot cause problems during the progress of the works on site. Based on the above, are not expected any geotechnical problems during this phase of the project.

The scale of the project is not expected to cause phenomena, such as earthquakes, landslides, or similar disasters, that expose people or property to danger.

7.4.2 Impact on Soil Characteristics

A common hazard for soils during earthworks is the leakage of fuels and lubricants from the mechanical equipment used (trucks, loaders, etc.). In addition, there is a risk of soil compaction from the movement of heavy vehicles, with consequent loss of basic soil properties. Nevertheless, most of the trucks and other vehicles are expected to move on paved roads and no interaction with soil is expected.

Another possible source of soil pollution is solid waste disposal i.e.:

- During C/R works on pier, floating tanks, ship-building bed, solid waste streams will be created.
- During stored waste transportation (including asbestos), there is always a case of an accident and subsequent escape of waste and sludges.
- During construction waste such as packaging of relevant materials (e.g., concrete) and from the municipal waste of the labor force may be created.

With the measures proposed in Chapter 8, this potential source of soil pollution during C/R phase is expected to be minimal.

During the progress of the construction works, deforestation or clearing of the area from shrubs, roots, etc. is not foreseen.

It is proven that the rainwater runoff of the road or other paved surfaces that receive significant traffic, contains high amounts of pollutants and in significant concentrations immediately after rain. These pollution loads may contribute to soil pollution and of course to the contamination of groundwater and surface water resources. The Shipyards are mainly covered by asphalt or cemented surfaces with the result that the underlying soil does not suffer from these effects. These effects concern the seawater, which is the recipient of these runoffs.

An important intervention to soil is expected only if contamination is observed after the removal of waste from several storage areas (concrete floor disruption – see Chapter 6). In that case soil it should be removed to an extend that it will be determined according to specific measurements (boreholes, sampling and analyses).

7.5 Impacts on Natural Environment

7.5.1 Impacts on Terrestrial Environment/Biodiversity

The immediate study area is a highly anthropogenically affected area, which has lost its physical characteristics due to long-term anthropogenic activities. Both terrestrial natural ecosystems and natural vegetation are almost absent, while habitats for important terrestrial species have not been identified (see also Chapter 4).

All the land sections of the examined project, concern interventions that will take place within the limits of the Shipyards area, they are developed on hard surfaces and the coverage of natural soil surfaces is not foreseen.

The general port activities that are developed within the Shipyards' area, have occurred for decades and have consolidated the above-mentioned characteristics of the terrestrial natural environment of the immediate area.

The largest part of the project area includes covered - hard surfaces (floors of piers and other port infrastructure, buildings, etc.), in which no vegetation grows, while any natural vegetation is spatially limited and concerns local plantings and phyto-technical configurations of urban type green, on unstructured - uncovered areas, without any particularly important ecological value.

Any effects that may be caused in the aforementioned areas of the natural environment, are mainly related to the installation of construction sites that will be required to support the repairing activities on pier, tanks, and the shipbuilding bed. Also, the operation of machinery and in general electro-mechanical equipment, along with heavy vehicles movement will also contribute to those effects.

The effects on the individual sectors of the terrestrial natural environment (ecosystems, habitats, flora and fauna) are expected to be small and relate to the general nuisance that can be caused by the construction works, mainly through the local deterioration of the quality characteristics of the atmosphere due to dust and air pollution and through the increase of existing noise levels. The duration of the effects will be limited exclusively during the construction works, and their duration will end immediately upon C/R phase completion.

Both the intensity and the extent of the effects that can be caused by the C/R phase in the individual sectors of the terrestrial natural environment, can be significantly mitigated by taking all the necessary prevention measures, within the framework of good construction practice as described in the next chapter.

7.5.2 Impacts on Marine Environment

During C/R phase, the main threats to marine environment are summarized below (see also Chapter 6):

- Waste derived from floating tanks repairing
- Waste derived from pier repairing
- Leaching of soil and materials during terrestrial C/R works and the increase of the sediment transport at sea
- Leakage of oil and lubricants from machinery used (both terrestrial and marine)

Wash water, oily water from bilges and tank cleaning, and engine fluids such as oil, hydraulic fluids, lubricants, and anti-freeze are among the waste liquids generated during repairing and maintenance of the floating tanks.

During the construction phase of the project, periodic flushing of the terrestrial construction front on the pier from rainwater may occur. These washes, which flow mainly on the surface, will end up in the sea area of the port, increasing to some extent the concentrations of suspended solids. These effects are expected to be small, short-term and reversible, as they will cease to exist after the completion of the C/R phase.

A significant impact may arise due to the possible outflow of petroleum products (fuels, lubricants) from construction machinery or fuel tanks that could degrade the marine environment of the Shipyards. By adopting good site practices these effects can be effectively managed (see Chapter 8).

The main pollutants produced during the C/R phase and which may affect the quality characteristics of the sea waters are the washes (rainwater runoff, surface washes and construction machinery) that carried dust or petroleum products (fuel leaks, used oils, etc.), construction waste (e.g., concrete residues which should not be disposed of directly in the environment to avoid contamination with suspended solids and their high pH), as well as sewage and other municipal waste from construction personnel.

From the movement of the construction vehicles and the operation of the machinery, there will be effects related to the leaching of pollutants from the surfaces where the construction works (on pier) will take place. The recipients of the washes will be burdened with the pollutants that are accumulated on the work surfaces and are carried away by rainwater. The recipient is the sea area of the Shipyard.

Finally, it should be noted, that no dredging or sediment removal activities are anticipated during C/R phase.

7.5.3 Impacts on protected areas (NATURA 2000 NETWORK)

The intervention area is located outside the boundaries of protected areas of the Natura 2000 Network (see Chapter 4) and no effects are expected.

7.6 Impacts on the Anthropogenic Environment

7.6.1 Spatial planning - Land uses

Since C/R works will be performed within the borders of the Shipyard, no effects are expected. Land uses are crystal clear (see Chapter 5) and no occupation of new land is foreseen at the time.

On the other hand, land value is expected to increase due to the re-operation of the Shipyard.

7.6.2 Structure and functions of the anthropogenic environment

During C/R works, no changes are expected in the spatial organization of the immediate and wider area, nor is there a possibility of breaking the unity of the urban tissue.

The only impacts that are recognized to occur, are related to the increase in vehicle traffic in the area of the Shipyards during C/R phase.

The increase in traffic, however, will be limited and will mainly concern:

- The transfer of raw materials and electro-mechanical equipment from their place of production/manufacture to the Shipyard
- The transfer of waste from the project area to the respective waste management sites
- The transfer and movement of labor related to construction activities

In order to limit the traffic risks in the area of the project, the provisions of the Greek Legislation on construction sites should be applied (see next Chapter and Traffic MP). However, any impact on settlements is substantially reduced due to the distance of the nearest settlements from the study area.

Note, that transport vehicles of materials, wastes and labor does not have to enter any settlement prior to their arrival to the Shipyard (direct access through National Roads – See Chapter 5).

Another important advantage of the site is the fact that it is located at a sufficient distance from points of tourist interest (see Chapter 5) and the traffic load of the immediate area is limited, even in the summer months.

7.6.3 Cultural Heritage

In general, the possible effects from C/R, in relation to the cultural heritage, may concern:

- The possible discovery of archaeological findings during the works
- The visual disturbance of cultural sites
- The possible degradation of the environment of the cultural sites due to the construction and operation of the Unit

No excavation works will take place during C/R please of the project. Thus, no underground archaeological findings are expected to be found or disturbed.

Due to the distance, the geomorphology and the existing anaglyph, the surrounding cultural monuments (see Chapter 5) has no visual contact with the site of the Shipyards. Also, due to the distance of the monuments from the Shipyard, no degradation of the local micro-environment of those sites is expected.

Therefore, the C/R phase of the project is not expected to have any impact on local Cultural Heritage.

7.7. Impacts on Socio-economic Environment

7.7.1 Affected Population

Given the distance of the residential areas from the immediate study area, but also their non-visual contact with the Shipyard, no negative effects are expected during C/R phase on the population of the wider area.

On the contrary, the proposed Project can be a demonstration project, regarding the Shipbuiliding Industry and the implementation of best environmental practices and can be a pole of attraction for schools, authorities and associations of the immediate and wider area.

7.7.2 Involuntary resettlement

The C/R phase of the project does not involve any resettlement at all. All works during C/R phase will take place within the boundaries of the installation (industrial zone). The nearest settlements (Diodia and Makriammos) will not be affected at all.

7.7.3 Indigenous people

As it was mentioned in Chapter 5, in the wider area of the project and within the Prefecture of Attica in general, no Indigenous Peoples are located. Consequently, there are no impacts expected with regard to such populations.

7.7.4 Local Economy

During the C/R phase of the project, the impact on the socio-economic environment of the immediate, but also of the wider area, is expected to be positive, including among others:

- The creation of a significant number of new jobs
- Development of new or stimulating existing activities related to the construction and shipbuilding/repairing sector.
- In addition to individual jobs, several companies will be employed directly or indirectly by the Operator, through the provision of services, raw materials, products etc.

In particular, at the C/R stage of the project, it is expected that there will be a need to create several new jobs for both labor and technical staff (machine-vehicle operators, craftsmen, etc.), as well as for specific scientific specialties (engineers, chemists, architectures, port specialists etc.). There will also be several needs for the supply of aggregates, ready-mixed concrete and other building materials, as well as equipment, of all kinds, provided from suppliers in the wider area. All the above are expected to contribute positevely to the local economic prosperity.

A positive effect is also expected with regard to the local hotel, catering and other similar sectors, by the seasonal and permanent staff that will be employed in the C/R phase of the project.

7.8 Impacts on Technical Infrastructure

The following impacts are expected:

- Burden on the local and regional road network of the immediate and wider area of the project, through the passage of construction machinery and vehicles transporting materials to the project site and waste to the final disposal/management sites. The traffic charge will be temporary. This effect is reversible with the application of appropriate traffic regulations.
- Energy and water, consumption is required during C/R phase. Energy and water demands will be covered by the existing Shipyard infrastructure. The construction of new networks will not be required to support the C/R phase, as the relevant needs will be fully met by the existing infrastructure networks.

In general, impacts are assessed as typical and expected for such projects, while their reference level will be purely local and limited to the immediate area of intervention. Impacts will also be partially reversible through the proper planning of the individual construction phases of the projects.

7.9 Cumulative Impacts

No substantial and permanent effects on the social and residential environment of the neighboring urban areas are expected from the C/R phase and the further development of the Shipyards' activities in relation to the already prevailing situation. Also, no additional pressures and disturbances to the anthropogenic environment are expected, given that they will be examined and measured on a regular basis, based on a specific environmental quality monitoring program. Such measurements relate to noise, traffic, air pollution and the quality of the marine environment, as analyzed in the respective chapters. According to the monitoring program results, the necessary measures can be taken whenever required.

The C/R phase of the Project is expected to have a positive impact on the local environment, due to the clean-up of the site from stored waste and to the removal of Asbestos Materials from buildings.

The project is also expected to have a positive impact on employment, due to the increase in labor demand, both during the construction phase of new projects, and mainly during the operation phase under conditions of increased port activities. The new positions that will be created concern both positions of workforce and specific scientific specialties. In addition to the direct increase in employment, there is also an indirect one related to the productive activity of domestic companies that provide services and products, both during the C/R phase of the project and during the operation of the Shipyards.

7.10 Impacts on Air Quality

During the C/R phase, the general potential effects on air quality, the intensity and probability of which vary, are:

- Emissions of gaseous pollutants from vehicles for the transport of materials and waste to and from the construction site
- Emissions of gaseous pollutants from the operation of C/R machinery
- Emissions of dust and particulate matter from the management (transport and temporary storage) of materials (construction materials, aggregates etc.)
- Emissions of particles containing asbestos fibers during dismantling and demolition works
- Emissions of particles containing several pollutants during collection and transportation of wastes from their storage areas

Regarding the dust produced by the C/R activities, it is known that the largest emissions of suspended particles (PM_{10}, $PM_{2.5}$) are mainly due to the pulverization and abrasion of the surfaces of the materials, due to the application of mechanical force on them, such as truck movements. Amounts of dust emissions from roads and unpaved surfaces vary widely, ranging from 1 kg / km / h to over 10 kg / km / h. In addition, about 270 kg of dust per acre and month of work is emitted from construction works.

Of the dust particles released during C/R works, those larger than 30 μm in size fall to the ground just a few meters away. The smaller ones, however, are carried away by the air and transported over considerable distances, affecting wider areas but to a limited extent as they dilute during transport.

A detailed assessment of the effects on the atmospheric environment from the C/R phase is not possible at this stage, as it depends on a number of parameters (detailed technical characteristics of the individual projects, time planning of projects, construction techniques, composition of construction sites), which have not been identified and which are not the subject of the present ESIA.

The determination of the exact data register of the C/R phase (e.g. types of machines, their actual operation time, construction schedules, sound power levels, etc.) will be conducted with the final choice of the Contractor and of course with the construction proposals that will be adopted in the context of the best implementation of the project. In particular, before starting any work, technical studies should be prepared, which will include at least:

- Final schedule for the C/R phase, divided in sub-projects (e.g., pier, tanks, shipbuilding bed)
- Exact locations of construction sites
- Main routes of heavy vehicles to and from the project area.

A rough estimation of the gaseous emissions that are expected to be produced at the C/R, considering the transport of materials and waste and a heavy construction site composition, is presented in par. 6.12.2.

Regarding asbestos removal and the potential air pollution, a detailed description of the necessary measures and techniques, along with the legislative framework is given in Chapters 2, 6 and 13.

Finally, regarding waste removal, the only waste stream that may cause significant airborne pollutants during collection and transportation is the used sandblast. Specific measures for mitigation of those impacts are described in the next Chapter.

7.11 Impacts from Noise & Vibrations

The noise generated during the C/R phase of the project, comes mainly from:

- The operation of the machinery on the construction site (pier) and on the tanks (during repairing process)
- The movement of heavy vehicles to and from the construction site
- The traffic from the movement of the construction site staff.
- The movement of heavy vehicles transporting waste

The size of the noise nuisance depends on a number of parameters i.e., the type and extent of the construction site and the types of machinery used as well as the required quantities of materials. It also depends on the period of operation of the individual construction site facilities and the R/C phase as a whole.

The degree of noise disturbance depends on the distance of the site from the receiver, on the reflection of the sound, on the existence or not of natural and artificial obstacles, on the meteorological conditions and on the type of soil surface between the construction site area and the receiver.

The reduction of noise outside the boundaries of the site depends, among other things, on the atmospheric conditions and decreases with the increase of humidity, while it has a "bell" type dependence from temperature (maximum at a certain temperature value and lower for smaller or higher values). However, the effect of meteorological factors and atmospheric absorption over short distances (less than 50m) is generally small.

The type of surface between the site and the receiver (sound propagation area) can be generally distinguished in two types: on "hard" surfaces that reflect sound such as sidewalks, pavements and generally water surfaces and on "soft" sound-absorbing surfaces, such as lawns and crops. In case of Shipyards, mainly “hard” surfaces are present around noise sources. Various empirical models (e.g., DELANY, BAZLEY) allow the evaluation of sound reduction and reflective characteristics of the soil by introducing the parameter "flow resistance", which characterizes the acoustic behavior of the soil at all frequencies.

As it happens with air pollution (see par. 7.10) from C/R phase, a detailed assessment of the effects on the acoustic environment is not possible at this stage, as it depends on a number of parameters (detailed technical characteristics of the individual projects, time planning of projects, construction techniques, composition of construction sites), which have not been identified and which are not the subject of the present ESIA. Nevertheless, specific measures for noise control and reduction are proposed in the next Chapter.

In general, the impact on the acoustic environment from the C/R phase of the project is generally reversible, as it can be mitigated by taking appropriate protection measures consisting of the use of new models of machinery and vehicles of strict noise emission standards, the construction of anti-noise curtains, if necessary, the careful selection of heavy vehicles route etc. (See also Chapter 8).

7.12 Impacts related to Electromagnetic Fields

Based on the nature of C/R phase, no electromagnetic fields are created and thus no impacts are expected.

7.13 Impacts on Waters

7.13.1 Terrestrial Surface Waters

During C/R phase, no intervention is expected in site's drainage network. No alteration of the natural anaglyph is going to take place. Consequently, water drainage on site is not expected to be affected at all.

No other terrestrial surface water bodies are located within the immediate or the wider area of the project and thus no impacts from C/R phase are expected.

Finally, no terrestrial surface waters sources are about to be used for covering the needs of C/R phase, since the necessary water will be provided by EYDAP network.

7.13.2 Groundwaters

The main threats for groundwater during C/R phase are summarized below:

- Excavation works that may reach an underlying aquifer
- Escape of liquid waste to uncovered soil surfaces

No excavation works are expected during C/R phase. The only possibility that excavation may be needed is at the waste storage areas in case that (after waste removal) the concrete floors present disruptions and contamination has escaped to underlying soil. Even in that case, no more than 2-3m of soil excavation is expected and based on the geological characteristics of the study area, it is unlikely that any groundwater aquifer will be reached.

Liquid waste may reach the soils and subsequently the groundwater, via the following routes:

- Leakage of oils and lubricants in case of an accident involved heavy vehicles
- Leakage of liquid waste/sludges pumped from the storage tank of Petroleum Waste area
- Leaching of soil and construction materials during construction works (e.g., during heavy rain or during wetting of surfaces for reducing dust)

All those potential impacts are managed via the appropriate mitigation measures presented in the next Chapter.

It should be also noted that no groundwater sources will be used for C/R purposes, since all water needed will be provided by EYDAP network.

7.13.3 Sea Water

Those impacts are examined in par. 7.5.2: Marine Environment. It should be noted that seawater is also used for firefighting purposes, as described in Chapters 3 and 6.

7.14 Natural - Anthropogenic Disasters

7.14.1 Natural Disasters

The following natural catastrophic events are anticipated with respect to works conducted on port facilities:

a. Meteorological and Climate Change Related

- Thunders
- Extreme Precipitation
- Storms
- Extremely windy conditions

- Floods
- Extreme (high or low) temperatures
- Sea level rise

b. Geological

- Earthquakes
- Landslides
- Soil subsidence

In general, the Elefsis Shipyard, is not considered vulnerable to significant risks from potential extreme weather conditions and/or climate change effects, and the potential risks will not have catastrophic consequences for the C/R activities.

The location of the Shipyard is well protected from almost all direction of winds and ripples. The Shipyard's facilities are not directly affected by extreme rainfall and floods, because they are located along the coastline of Elefsis, so as not to be directly affected by the rainwater drainage of the upstream areas, resulting in any surface runoff. The latter is drained directly and efficiently to the sea, in a relatively short time.

Obviously, during the initial installation of the facilities back in early '60s, parameters such as rising sea level, the morphology of the seabed and its geological structure etc., have been taken into account, based on national and international regulations and guidelines. No major disasters, as a result of extreme weather conditions, have been reported during the lifetime of the Elefsis Shipyards.

Other potential climatic hazards, such as strong winds, high temperatures, heat waves or droughts, can be addressed by existing and new installations and by the design of new projects, allowing heating, and in particular cooling facilities, to be adequate for dealing with extreme temperatures.

Finally, as it was mentioned in Chapter 4, within the intervention or the wider study area there is no zone that is in significant hazard from the sea level rise.

According to the EU strategy, it is necessary to design resilient infrastructure to protect against climate change, to adapt existing infrastructure to climate change and provide guidelines so that investments and infrastructures may become resilient to climate change. The main objectives of this policy are to "adapt" to climate change by increasing the resilience of projects and improving the "impact" on them, mainly by reducing greenhouse gas emissions, so that new major projects are less vulnerable to climate change risks and other related extreme conditions.

All the necessary measures for mitigating the effect of those disasters are analyzed in Chapter 8.

7.14.2 Anthropogenic Disasters

Accidents or disasters during C/R appointed to human factors, are summarized below:

- Construction Site hazards relating to equipment and materials handling
- Major sea pollution event during tank repairing
- Accidents due to the increase of traffic, involving heavy vehicles transporting materials and waste
- Accidents during management of hazardous or special waste on site (including asbestos)
- Terrorist actions and vandalism
- Fires and explosions related to flammable and/or explosive construction materials

All the above hazards are anticipated implementing the measures described in the next Chapter.

7.15 Impact Assessment in Tabular Form

In this section, the potential impacts that the C/R phase of the project may have on the natural and anthropogenic sub-sectors are assessed in tabular form. That illustration focuses mainly on the following environmental impact properties:

- Probability of occurrence
- Extent, with reference to the geographical area and / or the size of the affected population
- Intensity, with reference to the magnitude of the change
- Characteristic times (duration, repetition)
- Possibilities of prevention, avoidance, reversal or minimization
- Collaborative or cumulative action with other effects from the project itself or from other projects or activities that have been developed or planned in the area.

The following color scale is used to display the different environmental impact properties:

Propability of occurrence
Not Possible 0
Low Possibility 1
Large Possibility 2

Direction
Positive Direction: +
Negative Direction: -
Neutral: 0

Intensity
Weak Effects 0
Medium Effects 1
Strong Effects 2

Magnitude
Small 1
Large 2

Timescale

Short Term 1
Medium Term 2
Long-term 3

Reversibility

Completely Reversable 0
Partially Reversable 1
Not Reversable 2

Collabotation/Cumulativity

No Collaboration 0
Collaboration 1

Potential Impact Sector – C/R Phase	Propability of occurrence	Direction - Intensity	Magnitude	Timescale	Reversibility	Collabotation
Climatic and bioclimatic characteristics	1	-1	1	1	0	1
Morphological and landscape features	1	0	0	0	1	0
Geological/tectonic characteristics	0	0	0	0	0	0
Soil characteristics	1	-1	1	1	1	1
Terrestrial environment/biodiversity	1	-1	1	1	1	1
Marine environment	2	-	2	2	2	1
Protected areas	0	0	0	0	0	0
Spatial planning - land uses	0	+1	0	0	0	0
Structure and functions of the anthropogenic environment	0	+1	0	0	0	0
Cultural heritage	0	0	0	0	0	0
Affected population	0	+1	1	2	0	0
Local economy	0	+2	2	2	2	2
Indigenous people	0	0	0	0	0	0
Involuntary resettlement	0	0	0	0	0	0
Technical infrastructure	0	0	0	0	0	0
Correlation with other anthropogenic impacts/pressures	1	-1	1	1	1	1
Air quality	1	-1	1	1	1	1
Noise & vibrations	1	-1	1	1	1	1
Electromagnetic fields	0	0	0	0	0	0
Terrestrial surface waters	1	-1	1	1	1	1
Groundwaters	1	-1	1	1	1	1
Sea water	2	-2	2	2	2	1

8. ENVIRONMENTAL & SOCIAL IMPACTS MITIGATION MEASURES FOR CONSTRUCTION/REHABILITATION (C/R) PHASE

8.1 Methodological Approach

This chapter contains a detailed description of the measures proposed to be taken in order to address the expected environmental impacts from the C/R phase of the project under study, as those recorded in Chapter 7.

The measures proposed herein aim at the prevention and avoidance, the reduction of the intensity and the extent as well as at the restoration of the environmental effects that may be caused by C/R phase.

8.2 Climatic – Bioclimatic Characteristics

No impact on the climatic and bioclimatic characteristics of the study area is expected during C/R phase of the project and therefore it is not proposed to take specific measures beyond the general measures related to the reduction of energy consumption and the more efficient use of energy.

8.3 Morphological and Landscape features

During the C/R phase, effects on the morphological and landscape characteristics are expected which will be temporary, provided that the following measures are implemented:

- Follow the rules of good construction practice, regarding the temporary deposition and general management of both aggregates and other construction materials as well as those that will result from the demolition, dismantling and cleaning works (piers and floating tanks respectively)
- Construction sites and work sites should be kept clean with the regular collection of municipal-type waste and all kinds of rubbish.

- No parking of construction site vehicles will take place outside the designated construction sites, during their non-operation.
- After the completion of the C/R works, the permanent and temporary construction site facilities, machinery and materials should be removed and the area, should be fully restored.

8.4 Geological, Tectonic and Soil Characteristics

8.4.1 Geological/Tectonic Characteristics

Based on what was mentioned in Chapter 7, no special measures are foreseen.

It should be noted that all aggregates needed (mainly for works on pier) will be provided from legally operating quarries in the broader area.

8.4.2 Soil Characteristics

The maintenance of the motorized equipment will not take place in site, but in designated installations outside the study area (e.g., workshops in the wider area) and therefore there will be no necessity for managing lubricants or oils. Also, no washing of motor equipment will take place in site and therefore no rinsing water will be produced which may contaminate the soil.

In the event of an unforeseen situation or accident, which is usually accompanied by the leakage of toxic waste (e.g., fuel, lubricants or tar), responsible for dealing with it is the Operator of the construction site who will receive all the necessary measures for the cleaning of the area and the implementation of appropriate anti-pollution practices. Indicatively, the use of adsorbents such as sand, wood chips or special geotextiles is critical after the escape of such liquid waste. Disposal of those waste will be made in accordance with the Instructions and Legislation for the disposal of HW.

The same measures will be implemented during waste collection and transport. Especially for sandblast, asbestos and petroleum waste, in case of an accidental release, immediate response must be anticipated.

To limit any particulate matter leakage that may result from construction works, it is recommended that activities should be avoided during heavy rainfall.

The temporary deposition of materials resulting from the construction works inside the construction site that will either be reused, or their final disposal will be done outside the construction site facility, should be conducted in such a way that will not cause corrosion and leaching.

Solid waste that will result from the activities of C/R staff, will be separated into recyclable (paper, aluminum, glass) and non-recyclable. The waste will be placed in designated bins and will be disposed of periodically in the proper waste disposal areas (urban or recyclable) of the relevant Municipality under the responsibility of the construction site Operator and always in collaboration with properly licensed collectors/transporters.

Solid waste related to used equipment, end-of-life vehicles, batteries or any other waste that falls under the alternative management legislation (see Chapter 2), will be collected in a special area and will be delivered only to specially licensed companies for further management.

Incineration of any solid waste inside or outside the area of works is strictly prohibited.

The existence and operation of sanitary facilities for the service of employees involved in C/R works should be ensured. It is proposed to install at least one chemical toilet per twenty people on the construction site.

8.5 Natural Environment

8.5.1 Terrestrial Environment/Biodiversity

The effects of the C/R activities on the individual elements of the terrestrial natural environment (ecosystems, habitats, flora and fauna), concern fauna (mainly avian fauna), due to the increase of noise levels and the concentrations of suspended particles (dust) from the operation of the machinery and the construction site equipment in general, the earthworks and the transport of the construction materials and waste.

Therefore, no specialized measures are proposed to prevent or limit the effects in terrestrial environment and biodiversity, other than those mentioned in sections 8.10 and 8.11 (see below) and concerning the atmospheric and acoustic environment.

8.5.2 Marine Environment

A. <u>Floating Tank Repairing</u>

During floating tank repairing works, the following equipment should be available at all times:

- Floating dam
- Chemical dispersant
- Absorbent barrier
- Absorbent towels
- Absorbent pads
- Absorbent shutters
- Adhesive wigs
- Chemical dispersion system
- Skimmer weir
- Abstentions
- Shovels

- Wire brooms
- Life jackets
- Cordless radios
- Rakes
- Floating dam anchorage set
- Meditation bags
- Bags with sawdust

Prior to the repairing works commencement, a floating dam will be situated for the protection of any leakage of waste into the sea. All liquid waste will pump out and transferred on land for further management. Solid waste will be manually collected and transferred on land, where, after separation they will also managed according to their origin. It is strictly forbidden the disposal of any waste in the municipal wastewater network or to a natural water receiver.

All materials used during repairing works must be suitable for use in the marine environment and must not contain substances subject to restrictions on their circulation and use, such as compounds of mercury, arsenic, cadmium and organotin, as well as other chemicals in accordance with the requirements of the legislation as applicable.

During works at sea, a motorboat suitable for decontamination works (sinking/recovery/towing of a floating dam of sufficient capacity, recovery – storage of petroleum products, spraying of chemical dispersants etc.) will be kept in immediate readiness and fully manned with the specialized crew.

The vessels that may be used for the needs of the tank repairing, must carry throughout the works the signals and lights provided by the International Regulation for the Prevention of Conflicts at Sea (IRPCS).

When repairing is finished and before the floating tank is lowered, cleanup of the dock floor should be completed. Washing of the dock floor with water is not an adequate cleanup technique and should not be performed [Oregon DEQ, 2017]. Boatyard personnel should maintain records of each tank cleaning. If an area is inaccessible to a front-end loader or mechanical sweeper, work crews should use portable blowers, vacuums, shovels or brooms to complete the cleanup of blast abrasives and other solid pollutants. Prior to lowering the dry dock, straw bales, filters and absorbent materials must be removed from the dock floor, transported to land and treated as HW.

More details about Contingency Plan, regarding sea pollution, are given in the next Chapters for Operational Phase.

All the other measures referring to marine environment & sea water protection during C/R phase are also implemented for the protection of surface waters and are analyzed in par. 8.13.

8.6 Anthropogenic Environment

8.6.1 Structure and functions of the anthropogenic environment

As it was mentioned in Chapter 7, distance of the study area from urban centers, settlements, and other structures of the man-made environment along with the direct access of the Shipyards via National Roads, significantly reduces any adverse effects on the spatial organization of settlements in the area.

In any case a series of measures will be applied:

- During the C/R phase, the road traffic around the Shipyards should not be obstructed
- Prohibition of parking of wheeled vehicles that serve the needs of the project in areas outside the construction site or outside the Shipyards facilities
- It is preferred that C/R phase would be conducted in a period of reduced tourist activity (October – April)

It is emphasized that the measures described below (par. 8.10 and 8.11) regarding the mitigation of the effects of air pollution and noise, are also applied to the anthropogenic environment of the wider study area. In addition, the following measures are proposed in case of need:

- Appropriate traffic management in case of transit of trucks within the boundaries of settlements (not possible).
- The transport of raw materials, E/M equipment and waste to take place, as far as possible, during off-peak hours, especially during the tourist season, to further reduce the traffic load.
- Placement of information boards regarding the execution of works
- Appropriate road signs
- Prohibition of passing trucks within the boundaries of settlements during quiet hours
- Strict implementation of the speed limit
- In case of an accident involving vehicles used during the C/R phase (waste trucks, other heavy automobiles etc.), responsible for immediate intervention is the Operator, which must clean the road and collect all materials and liquids that may have been dispersed. In this case as well, if cleaning works are required on the road surface of the local road network, the installation of appropriate signs throughout the area of the collection works is considered necessary.

8.6.2 Cultural Heritage

Given those mentioned in Chapters 5 and 7, no special measures are required, other than those imposed for the structure and functions of the anthropogenic environment (par. 8.6.1).

8.7 Socio-economic Environment

As analyzed in Chapter 7, the socio-economic effects of the C/R phase will be only positive and therefore no measures are foreseen to prevent, mitigate, rehabilitate or compensate for them.

In general, it is expected that the C/R phase will positively affect the social and economic characteristics of the wider region by increasing employment.

As mentioned in Chapter 7, during the C/R phase there will be an increase in working positions (direct and indirect). Every effort should be made to absorb labor force from the local Municipal Units, so that the positive impact in terms of employment (direct and indirect) is diffused primarily throughout the local economy.

8.8 Technical Infrastructure

As it was mentioned in Chapter 7, the only impacts related to technical infrastructure of the immediate and wider area during C/R phase refer to traffic increase. Consequently, the measures apply to general anthropogenic environment (par. 8.6) are also implemented for protection of Technical Infrastructure.

Note that no interventions are anticipated in local electricity and water networks during C/R phase of the project.

Local drainage network should be thoroughly cleaned prior to the commencement of the C/R phase, so that any runoffs flow smoothly and no overflows occur (see also par. 8.13).

8.9 Cumulative Impacts

As mentioned in section 7.9, no substantial and permanent effects on the social and residential environment of the neighboring urban areas are expected during the evolvement of the C/R phase of the project. All measures described in par. 8.6 are also apply in this case.

It is also important to control and monitor the individual environmental parameters, related to noise, traffic, air pollution and the quality of the marine environment during the C/R phase. That could be achieved through the implementation of the Environmental Monitoring Program described in the relevant Chapter for the operation of the Project.

8.10 Air Quality

From the analysis that took place in Chapters 6 and 7, the most important gaseous pollutants are dust, particles and exhaust gases emitted by the use of motor and mechanical equipment during C/R phase of the Project. Other critical sources of air pollution could be the collection and transfer of sandblast and asbestos.

Regardless any other mitigation measure, before the start of any C/R work, including waste removal, the Contractor of the project and the Collector/Transporter of the waste should prepare a detailed schedule of the individual phases, where time, place of execution of the works and the main routes of the heavy vehicles will be recorded. The full range of construction work should be covered, including the transport of all materials, equipment, and waste necessary during the C/R phase.

8.10.1 Dust & Particles

Hereinafter, the general mitigation measures regarding to the release of dust and particles during C/R phase are described:

- When transporting materials and solid waste, trucks should possess a protective cover for avoiding material leakage and dust release.
- Avoid overfilling materials and waste transporting trucks.
- Periodic monitoring and maintenance of access roads.

- It is recommended to use machines with exhausts facing away from the ground.
- Systematic wetting should take place, with a suitably shaped tank which covers both the loading points and the unloading points of the materials. The above measure does not apply on waste.
- Systematic wetting should take place, with a suitably shaped tank (filled with water by EYDAP network) that covers the access roads of the vehicles transporting materials and waste (mainly within the area of the Shipyard).
- Special care (e.g., increasing the rate and intensity of wetting) will be taken in the case of transport of brittle and incoherent materials for disposal in the area. That measure does not apply on asbestos transport.
- The lowest possible speed limit will be strictly observed, i.e., 30km/h for non-asphalt surfaces and 40km/h on national roads.
- The access roads of the transport vehicles, inside the Shipyards area, will be kept clean and in good condition, under the responsibility of the Operator.
- Machinery and motorized equipment should be handled carefully to avoid unnecessary works and movements
- On days when strong winds prevail, the above measures should be intensified while, the pace of works should be reduced.
- In case of increased dust emissions during C/R phase, the installation of windshields should be considered.

8.10.2 Exhaust gases

Hereinafter, the general mitigation measures regarding to the release exhaust gases during C/R phase are described.

- Any equipment use should be limited to the absolutely necessary, thus reducing the corresponding effects on the atmosphere.
- All motor equipment should be inspected and maintained at regular intervals, in accordance with international technical specifications and the National Legislation

- The adjustment of the engines should be such that the emission of gaseous and particulate pollutants does not exceed the quantities indicated the current legislation and particularly:
    - MD 316/2010 (OG 501 / B / 2012) "Adaptation of the Greek legislation, in the field of the quality of gasoline and diesel fuels, to the Directive 2009/30 / EC of the European Parliament and of the Council",
    - MD 77/2016 (OG 4217/B/ 2016) "Amendment of the MD 316/2010".
    - JMD 128/2016 (OG 3958/B/2016) "Harmonization of the Greek Legislation to the Directive (EU) 2016/802" on the reduction of the sulfur content of certain liquid fuels ".
- For each maintenance - adjustment work, the relevant record will be completed and signed by the maintainer and will be kept on file.
- Regarding vehicles and mainly transport trucks, they must be equipped with EU certificates, as provided by current legislation. In addition, it is necessary to check the vehicles so that they are in good condition and meet the manufacturer's specifications.

8.10.3 Asbestos Fibers

See par. 6.2.1: Asbestos Removal

8.11 Noise & Vibrations

The effects to the acoustic environment due to noise emissions during the C/R phase can be reduced by adopting the following mitigation measures. Note, that most of those measures are also apply to the mitigation of vibrations impacts.

- The Operator should study the layout of the individual construction sites and the operation of the machinery on the fronts of the works and plan the stages of construction, so as to cause the least possible nuisance due to noise pollution

- The location of the construction sites will be situated within the port zone of the Shipyards and close to the projects under study (pier, tanks).
- The rules of good construction practice should apply, regarding noise emissions, during the operation of the machines, the movement of the construction vehicles, etc.
- It is forbidden the use of construction equipment that does not bear the CE marking, does not state the guaranteed sound power level, and is not accompanied by an EC declaration of conformity.
- All machinery and equipment to be used in the construction phase, regardless of category and type, must be in good condition, meet the manufacturer's specifications and be properly and regularly maintained to minimize noise emissions.
- It is recommended to monitor the noise fluctuation during C/R phase so as to comply with the provisions of PD 1180/81 which poses the permissible noise limits (70 d(B) for industrial/construction sites). Thus, during the execution of the works, where possible, the Operator should surround, locally - in the form of mobile "fences" - the individual point noise sources.
- It is forbidden to carry out noisy works at night.
- A construction schedule should be drawn up for the project, listing the time, location and main routes of the heavy vehicles.
- During the day, emphasis should be given to the traffic planning of heavy vehicles so as not to create peaks with very high traffic loads and high noise levels.
- The movement of heavy vehicles outside the boundaries of the site during peak urban traffic hours, i.e., 8.00-10.00 am and 14.00-17.00 pm should be avoided where possible.

8.12 Electromagnetic Fields

Based on the nature of C/R phase, no electromagnetic fields are created and thus no impacts and mitigation measures are implementing.

8.13 Terrestrial & Marine Water Resources

For the protection of the water resources in general (terrestrial & marine), the following measures should be adapted:

- Land storage sites for aggregates and other terrestrial materials should be identified prior to the commencement of work and located at a sufficient distance from the seafront to reduce the possibility of transporting materials (e.g., due to rainfall) to the sea.
- Local drainage network should be thoroughly cleaned from any foreign materials, vegetation etc. so that no overflows may occur. That action is very critical for avoiding runoffs (possibly contaminated) to reach terrestrial or marine water sources.
- The stored quantities of materials for the needs of C/R phase should be limited to the absolutely necessary.
- In case of aggregates or other bulk construction materials stored in piles and for a long time, inside the construction site or in storage areas near the fronts of the works, they should be covered, especially on days with heavy rainfall and winds.
- The temporary deposition of materials for the C/R works should be done in a way that it will not allow erosion and leaching phenomena (shaping, covering with suitable plastic covers, etc.).
- Disposable materials and solid waste should be collected and transported at regular intervals and not left in their temporary storage areas for a long time.
- Chemical toilets should be installed for the sanitary needs of the construction site staff. It is proposed to install at least one chemical toilet per twenty people on each construction site.
- The washing and maintenance of machinery and motorized equipment will not take place on site
- Rainwater will be managed in such a way that it is not disposed of uncontrollably in the surrounding area, but only in the rainwater drainage network that passes

through the site. The water will be drained to the nearest suitable wells of the permanent local rainwater drainage system.

- It is strictly forbidden to dump all kinds of liquid waste, oils, fuels, sewage etc. on the construction site or on the broader Shipyard area. The management of used mineral oils will be done in accordance with PD 82/04 (OG 64/A/2004).
- The Operator of the construction site should take care of the good condition of the mechanical means. In order to protect water resources from leaks of mineral oils, fuels and other petroleum products from construction machinery, appropriate measures should be taken, in the context of good construction practice, such as good and regular maintenance of machinery and oil change in licensed facilities outside the Shipyards' area.
- In the event of fuel or mineral oil spills at the site and on the work fronts, adsorbent materials such as sand, straw or special geotextiles should be available and used immediately after the spill.
- Especially for adsorbent materials:
    - should be present in sufficient quantities to seek the adsorption and consequent retention of leaking fuels, lubricants or any other waste in liquid form
    - After use, those materials should be carefully collected and disposed of in accordance with the instructions and legislation for the disposal of hazardous waste.
    - The stored absorbent materials must be checked at regular intervals, whether they have absorbed increased amounts of moisture (e.g., from water leakage). In this case they should be replaced as soon as possible.

8.14 Disasters/Accidents/Extreme Conditions

8.14.1 Natural

Regarding the natural disasters that may occur during C/R phase, measures described in Table 8.1 should apply.

Table 8.1: Prevention and response measures to control natural disasters during C/R Phase

Type of Disaster	Reaction/Mitigation
Thunders	• Protection devices and alternative power supply should be available • Damage repair to facilities and equipment
Storms	• In-time cessation of affected activities • Damage repair to facilities and equipment
Extreme Temperatures	• In-time cessation of affected activities Anticipation for peak electricity demand coverage
Floods	• In-time cessation of affected activities Cleaning of port areas • Proper design of rainwater networks, where required • Evacuation of premises, removal of mobile equipment from the area expected to be flooded, water pumping, repair of infrastructure • Implementation of procedures provided • In the Marine Pollution Emergency Plan from petroleum and other harmful substances; and in the

Type of Disaster	Reaction/Mitigation
	Hazardous Substances Pollution Emergency Response Plan

8.14.2 Anthropogenic Disasters

Regarding anthropogenic disasters that may occur during C/R phase, measures described in Table 8.2 should apply.

Table 8.2: Prevention and response measures to control anthropogenic disasters/accidents during C/R Phase

Type of Disaster	Reaction/Mitigation
Explosion/Fires*	• All areas (indoor and outdoor) should possess the appropriate fire protection equipment • For the materials used the instructions provided in their safety data sheets (MSDS) regarding their handling and temporary storage, must be always followed
Release of toxic substances / pollutants	• Operation of safety systems according to the ISPS code (navigation accidents) • Preparation of Pollution Management Plan for asbestos release • Application of international regulations and port operation regulations e.g., International Maritime Dangerous Goods Code (IMDG Code)
Terrorist acts, sabotage, vandalism	• Installation of security systems • Training of security personnel

Type of Disaster	Reaction/Mitigation
	• Damage repair to facilities and equipment

*According to the literature, during tank repairing, most of the accidents are due to fires. In tanks, fires can spread quickly due to the flammable materials used as well as materials present in the tank itself, such as fuel, paints, gas, chemicals, and welding equipment. Flammable materials should be stored away from electrical equipment and placed in suitable containers and stored appropriately to prevent leakage and possible fire. Also, during repairs, the main cause of accidents is toxic gas explosions.

During tank repairing, all measures relating to ship repairing also apply. Those measures are further analyzed in Chapters 10 and 11.

9. OPERATIONAL PHASE

9.1. General

As mentioned in previous Chapters, the new owners plan for the operation of Elefsis Shipyards is based on the following pillars:

- Full utilization of the existing capacity of the facilities of the Elefsis shipyard, given its strategic geographical location and the growth it can achieve, changing the balance in the specific market of the Mediterranean.
- Reorganization of current activities (shipbuilding and ship repairing)
- Provision of additional services regarding modifications and improvements of merchant ships to reduce the environmental footprint (carbon emissions) according to the regulations of the International Maritime Organization (IMO), both through repairs (scrubbers, ballast water treatment etc.) and combining new technologies (nanotechnology) in production materials and IT (IoT) in ship systems.

Hereinafter follow fundamental information about the future activities of the Shipyard, in order to properly assess the expected environmental impact. That information comes mainly from the ONEX Business Plan, the current Shipyards' status and the relevant literature.

9.2 Ship Building

Ship Building Process will follow the fundamental steps of the previous activity. Those steps/procedures are adequately described in Chapter 3, par. 3.8.1. Furthermore, many of the processes described in the next paragraph for ship repairing (mainly those associated with waste production) are also apply to shipbuilding.

Elefsis Shipyards can build ships up to 200m long, which is the length of the shipbuilding bed. However, it is possible to increase the maximum length if necessary.

Figure 9.1: Launching of Warship after building at Elefsis Shipyards

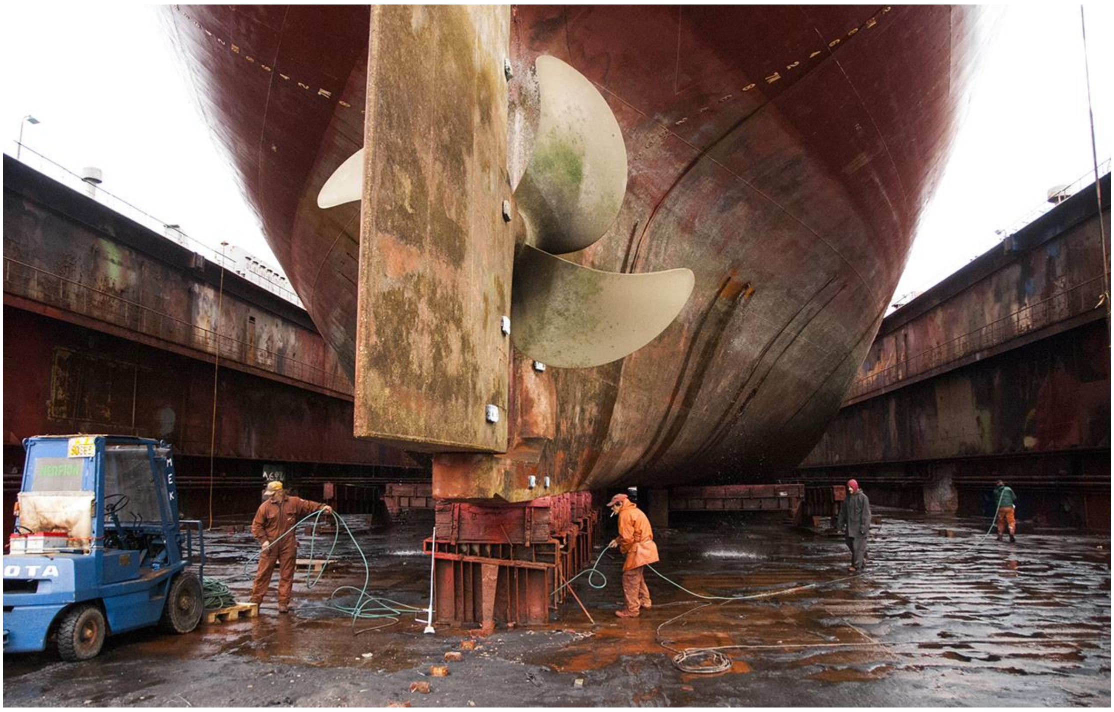


Figure 9.2: Ship repairing works

9.3 Ship Repairing

9.3.1 Ship Repairing Works Planned

According to their size, the Shipyard can accommodate 7 to 10 ships at the same time in the repair piers which are equipped with all the necessary nets and are served by cranes up to 40 tons.

Except from the fundamental ship-repairing processes described in Chapter 3, the following groups of work will take place, according to ONEX BPL.

It should be noted that, prior to any ship repairing activity, the vessel is moored, and works are performed on and inside the ships by the Shipyards' or private crews.

A. Steel surfaces preparation

Center & side tanks:

- Cleaning / de-mucking
- Scaffolding erections
- Washing
- Water and grit blasting
- Final cleaning and disposal

Main deck, wing tower decks, side walls:

- Cleaning / de-mucking
- Scaffolding erections
- Washing
- Water and grit blasting
- Final cleaning and disposal

B. Steel surfaces painting

- Painting of steel surfaces with two full coats and two stripe coats with epoxy paint.

C. Cathodic protection

- Inspection and repair of cathodic protection (ICCP) system.
- Ballast tank anodes renewal

D. Steel work renewal

- Inspection and repair of steel surfaces.
- Steel surfaces/equipment renewal

E. Piping inspection, renewals of following systems.

- Ballasting piping system
- Fire line system
- Sewage and G.W. piping system
- C. A. system
- A. V. piping system

F. Valves inspection / repairs

Inspect / repair of floating dock valves including reach rods where applicable.

G. Pump repairs

Following pumps to be disassembled, transported ashore, repaired, restored back in place. Upon completion all pumps to be tested.

- Ballast pumps
- Fire pumps
- F.W. pumps

H. Electrical works

- Motors: All motor to be dismantled and transported ashore. Motors to be dismantled, washed, varnished, baked and balanced. Reassembled with new bearing & tested.
- Various electric works
- Switchboards to be cleaned &. checked
- Various cables renewal

I. Deck cranes

Dock cranes to be checked & repaired according

J. Underwater hull steel repairs

Underwater hull steel repairs to be performed with the aid of diver group.

K. Additional works

- Emergency generator repairs
- Air compressors repairs
- Measuring deflection system repair
- Ballast tanks remote level indicator system installation.
- Side block mechanical drive repairs.

9.3.2 Main Ship Repairing Works associated to waste production

Some of the basic works performed, also associated to waste production, are further analyzed below [Oregon DEQ, 2017, OECD, 2010, US EPA, 2009, Kura et al., 2006]:

Metal working: Includes the cutting, pressing, boring, milling, grinding and assembly of metals and includes the use of cutting oils and lubricants to cool high-speed tools and high-temperature operation techniques. Solvents are frequently used to clean/degrease parts and tools prior to and after machining.

Thermal metal cutting: It is a process used to slice metal by using very high temperature techniques. The process typically includes oxyfuel gas cutting and plasma arc cutting. More recently, new techniques for metal cutting have been employed using laser and water jet technologies to better avoid distortions in the metal generated by the thermal cutting processes.

Welding operations: Once the steel plates have been cut into the desired shapes and sizes, they are welded together to build the structure of the vessel. Welding takes place at almost every area of the shipyard. Advanced techniques of laser welding are being developed to increase the accuracy, depth and range of welding, but this method is not yet in common use. The process involves bonding metal components together by heating adjacent surfaces to exceedingly high temperatures and fusing them together with molten filler. The adjoining areas are heated by an electric arc or gas flame and fused together with molten weld fill metal in the form of an electrode, wire or rod.

Metal grinding: Metal grinding is a type of mechanical process which uses an abrasive tool to grind a metal surface. Metal grinding requires electricity which generally is sourced from fossil fuel and therefore associated with GHG emissions. Metal grinding is carried out either in the shop or in outdoor work areas using portable handheld grinders.

Use of steel: By quantity, the most important material used in the construction of larger vessels is steel. From an environmental life-cycle perspective, shipyards share an indirect responsibility for minimizing the impact attributable to the steel used in the construction of ships. Steel production is among the world's most energy intensive industrial processes, and is generally associated with a number of environmental concerns, including the generation of large volumes of wastewater from cleaning and quenching operations, solid and hazardous wastes, emissions of various air pollutants and the generation of very large volumes of waste from mining activities [OECD, 2007, 2009].

Surface treatment: Surface treatment operations take place during ship construction, as well as during various ship maintenance and repair activities. These include operations such as the cleaning and coating of steel, cleaning of hulls, tanks and cargo areas and painting and paint removal.

Sandblasting (Abrasive Blasting): Abrasive blasting is a treatment technique that is used to prepare surfaces for coating and painting. The technique is used both in the construction of vessels and during ship maintenance and repair activities. For construction, blasting operations concern the ship 's piping, steel plates and other steel elements used in the structural assembly of the ship. During maintenance and repair activities, abrasive blasting is applied to the ship 's hull, and interior tanks and spaces, to clean the surfaces from contaminants such as old paint and coatings, rust, mill scale, dirt, and salts. The most common blasting technique is dry-abrasive blasting, which relies on compressed air to propel the abrasive material onto the surface at very high velocity.

Water blasting (jetting): It can be carried out by spraying water under pressure, which may be accompanied by a small number of solid particles that act as "activators" in order to clean the metal surfaces mainly from the paint coating.

Coating & Painting: Both the interior and exterior surfaces of ships are applied with protective coatings to preserve the steel, prevent corrosion, and to protect the hull from the build-up of marine organisms. They can be carried out using mechanical means (spray guns) or by manual means. Painting work also includes the preparation of surfaces mainly with the use of solvents.

The main waste streams associated with the aforementioned processes, are identified in the next paragraphs.

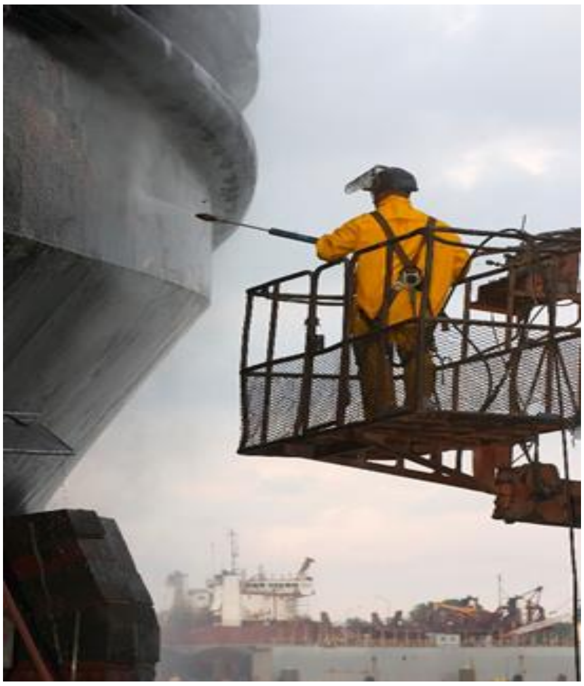
 

Figure 9.3: Painting & Sandblasting Processes

9.4 Additional Services/ modifications and improvements of merchant ships to reduce environmental footprint

9.4.1 Ballast Water Management (BWM)

A. <u>General</u>

The introduction of invasive aquatic species to new environments by ships has been identified as a major threat to the world's oceans and to the conservation of biodiversity. A multitude of marine species, carried either in ships' ballast water or on ships' hulls, may survive to establish a reproductive population in the host environment, becoming invasive, out-competing native species and multiplying into pest proportions.

The problem of invasive species carried by ships has intensified over the last few decades due to the expanded trade and traffic volume and, since the volumes of seaborne trade continue to increase, the problem may not yet have reached its peak. The effects in many areas of the world have been devastating. Quantitative data show that the rate of bio-invasions is continuing to increase at an alarming rate and new areas are being invaded all the time.

The spread of invasive species is now recognized as one of the greatest threats to the ecological and the economic well-being of the planet. These species are causing enormous damage to biodiversity and the valuable natural riches of the earth upon which we depend. Direct and indirect health effects are becoming increasingly serious and the damage to the environment is often irreversible. Moreover, significant economic impact occurs to industries that depend on the coastal and marine environment, such as tourism, aquaculture and fisheries, as well as costly damage to infrastructure.

Invasive aquatic species are introduced to new environments by ships mainly through ballast water or hull fouling.

While ballast water is essential for safe and efficient modern shipping operations, the multitude of marine species carried in it may pose serious ecological, economic and health problems. These include bacteria, microbes, small invertebrates, algae, eggs, cysts and larvae of various species.

Biofouling is also considered one of the main vectors for bioinvasions and is described as the undesirable accumulation of microorganisms, plants, algae and animals on submerged structures (especially ships' hulls). Studies have shown that biofouling can be a significant vector for the transfer of invasive aquatic species. Biofouling on ships entering the waters of Shipyards may result in the establishment of invasive aquatic species which may pose threats to human, animal and plant life, economic and cultural activities and the aquatic environment.

The potential for invasive aquatic species transferred through biofouling to cause harm has been recognized by the IMO, the Convention on Biological Diversity (CBD), several UNEP Regional Seas Conventions (e.g., Barcelona Convention for the Protection of the

Mediterranean Sea Against Pollution), the Asia Pacific Economic Cooperation forum (APEC) and the Secretariat of the Pacific Region Environment Programme (SPREP).

B. Guidelines for approval of ballast water management systems – D1, D2 (G8)

There are two ballast water management standards (D-1 and D-2). The D-1 standard requires ships to exchange their ballast water in open seas, away from coastal areas. Ideally, this means at least 200 nautical miles from land and in water at least 200 meters deep. By doing this, fewer organisms will survive and so ships will be less likely to introduce potentially harmful species when they release the ballast water. The D-2 standard specifies the maximum amount of viable organisms allowed to be discharged, including specified indicator microbes harmful to human health as follows:

- Less than 10 viable organisms per cubic metre greater than or equal to 50μm in minimum dimension.
- Less than 10 viable organisms per millilitre less than 50 μm in minimum dimension and greater than or equal to 10 μm in minimum dimension.
- Less than the following concentrations of indicator microbes, as a human health standard:
    - Toxicogenic Vibrio cholerae (serotypes O1 and O139) with less than 1 colony forming unit (cfu) per 100 mL or less than 1 cfu per 1 g (wet weight) of zooplankton samples
    - Escherichia coli less than 250 cfu per 100 mL; and
    - Intestinal Enterococci less than 100 cfu per 100 mL

From the date of entry into force of the BWM Convention, in 8/9/2017, all ships must conform to at least the D-1 standard; and all new ships, to the D-2 standard.

C. Overview of Ballast Water Treatment Technologies

BWM technologies could be defined as: procedures, activities and mechanisms which are able to reduce or eliminate all or part of risks associated with discharge of non-indigenous species in ships' ballast water.

BWM methodologies could be classified in many different ways. Technology, biology, capacity, costing, size, regions, regulations and many other parameters could be used to categorise various systems. A large number of BWM procedures, activities and mechanisms have been recommended, approved and made available to the marine industry. They have largely been classified according to the technology or technologies which they use to treat the Ballast Water. Groupings such as Mechanical, Chemical and Physical are very common.

Options being considered include:

- Mechanical treatment methods such as filtration and separation.
- Physical treatment methods such as sterilization by ozone, ultra-violet light, electric currents and heat treatment.
- Chemical treatment methods such adding biocides to ballast water to kill organisms.
- Various combinations of the above.

To treat and manage ballast water onboard ships, BWM technologies must conform to existing regulations. In addition, technologies must be able to operate within a diverse range of conditions. Therefore, a number of legislative, biological, operational and technical parameters are associated with this interaction. The testing protocols prescribed under the Convention ensure that the technologies take these into account.

D. <u>UV based treatment</u>

BWM systems based on UV treatment typically applies two treatment steps: filtration and UV treatment. During ballasting operations, both filtration and UV treatment is applied. After filtration, the ballast water is routed via UV chamber(s) to the ballast tanks. To avoid potential non-compliant ballast water discharge due to organism regrowth in the tanks, the ballast water is during de-ballasting treated with UV light again. The water by-passes the filter and gets pumped through the UV chamber before it is discharged.

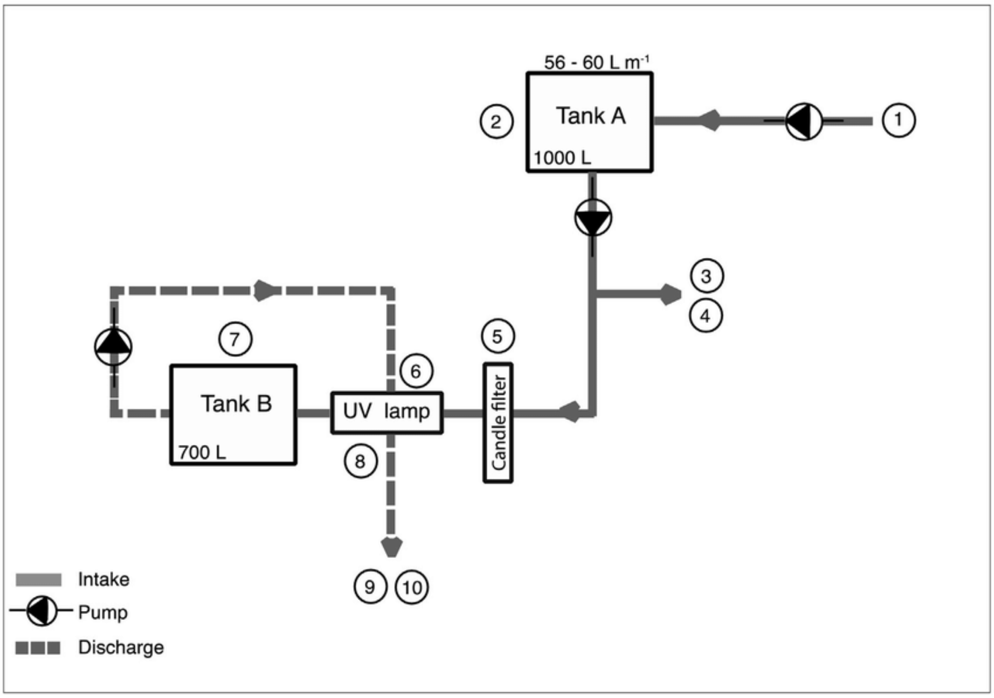


Figure 9.4: Filtration – UV radiation BWM system [Casas-Monroy et al, 2017]

The UV treatment uses either low pressure or medium pressure UV lamps to break down cell membranes and/or damage their DNA, which respectively kills the organisms or destroys their ability to reproduce, making them non-viable.

The percentage of non-viable or killed organisms in the water after treatment depends on the applied UV dose. The latter depends on the UV intensity (UV-I) and exposure time and is simply defined as the product between these two parameters. UV-I measures how much light (or energy) reaches a given measurement point. Most UV systems measure the UV-I, but the systems can vary considerably in terms of the UV lamp being used and the sensor setup. In particular, the distance between the sensor and the UV lamp influences the measured UV-I. For this reason, UV-I values shouldn't be used to compare systems.

Fortunately, another measurement called UV-transmission (UV-T), can be used to compare systems.

A more reliable UV performance measure UV-T measures the capability of UV light to penetrate water. When the UV-T is high, that is, close to 100%, the water is very clear. This means the UV light can penetrate deep into the water. When the UV-T is low, the water is not very clear, and the UV light can only penetrate the water for a limited distance. This means that the lower the UV-T a BWM system can treat and still meet the IMO and USCG discharge standards, the better the performance of the system.

E. Electrochlorination

Electrochlorination systems offer cost-effective solutions on high ballast-flow vessels with limited power availability. Electrochlorination describes the generation of hypochlorite from saltwater electrolysis. It can be divided into two main types: in-line and side-stream.

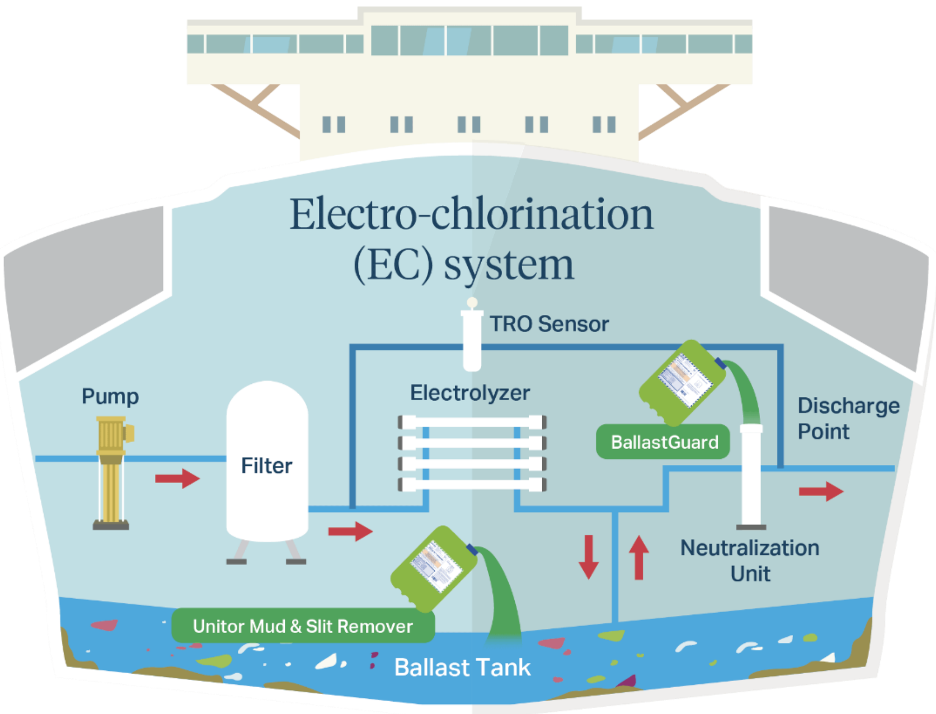


Figure 9.5: Electro-chlorination BWM system (https://www.wilhelmsen.com/marine-products/water-treatment-solutions/ballast-water-treatment)

Both types of electrochlorination typically combine mechanical filtration with treatment with chlorine, which is produced by an electrolysis unit.

For side-stream technologies, approximately 1–2% of total ballast water flows to the electrochlorination unit and is re-injected to the ballast water flow.

When compared with UV-based treatment systems, electrochlorination systems are considered more complex and require more components to be installed. Therefore, making the decision to install an electrochlorination system requires some considerations.

During electrochlorination, by-products like hydrogen gas, for example, are generated. Depending on the BWM system technology, hydrogen gas can be separated from the side-stream, diluted with air using small fans and ventilated out of the ship. This is important because hydrogen gas poses an explosion risk, and unfortunately there are a few examples of elctrochlorination BWM causing explosions onboard vessels.

Chlorine, which is widely used as a disinfectant, is highly toxic and corrosive in nature, which means it poses a hazardous risk to the crew and a long-term risk to ballast water tank coatings.

When determining the efficiency of electrochlorination systems, the salinity and temperature of the ballast water being treated should be considered. This is because the efficiency of the electrolysis unit when generating the disinfectants depends on these water quality parameters.

Generally, when salinity and temperature levels are low, additional voltage is required to generate the disinfectants, resulting in higher power consumption.

The electrochlorination systems work well for vessels operating in warmer, high-saline waters (such as the Mediterranean waters) where sufficiently dissolved salts are available. However, for vessels operating in fresh or low-salinity brackish waters, particularly in colder climates, electrochlorination technologies present some challenges. To compensate for the low salinity problems, vessels operating in these conditions might carry marine water or salt brine so that the electrochlorination systems work properly.

Using sea water or salt brine from the aft peak tank (APT) to compensate for low salinity of the ballast water can cause some problems. If the APT is continuously de-ballasted to feed the side stream electrolytic cells during cargo operations, trim control on the vessel while conducting cargo operations could be compromised. Furthermore, reserving tanks for high-saline water displaces cargo capacity, which in turn means lost income and makes some charter guarantees difficult to meet.

Before ballast water is discharged, chemical agents such as sodium thiosulfate, sodium bisulfite or sodium metabisulfite are prepared and injected to neutralize the remaining chlorine based active substances, measured as Treatment Residual Oxidants (TRO). This treatment is mandatory to avoid unauthorized excessive TRO discharges. The maximum allowable discharge of TRO concentration is 0.1 mg/L.

9.4.2 Deployment of BWM system on ship

Initial phase: During the initial phase, the supplier (ONEX) and owner need to agree about the scope of supply and the manner in which the project will be executed. The better the specification at this early point, the less risk there will be of mistakes later on in the project.

Pre-survey and vessel documentation review: To determine how and where to install a ballast water treatment system on the target vessel, as well as the required characteristics of the system, a feasibility study needs to be conducted by the owner, the supplier or an engineering company. This phase involves the collection and review of vessel documentation. As previously noted, no single system offers a perfect fit for all vessel types, and this review helps establish the vessel’s specific needs.

Onboard survey and 3D scanning: To prepare for installation, the supplier or the supplier's engineering partner conducts an onboard survey to identify the best possible location for the equipment and to gather information on ballasting operations. During the survey, it is important to determine if hatches are available for bringing system components on board. A report documenting the survey will provide a guide for the continued work.

Detailed engineering: In the detailed engineering phase, the supplier or engineering partner uses information from the 3D scan to draft a manufacturing drawing of all piping, supports and foundations necessary for a successful installation. The supplier or engineering partner also selects suitable materials for the piping and produces a complete list of the materials. During this phase, it is necessary to update the specific vessel documentation that will be submitted and approved by the classification society

9.4.3 Scrubbers

The IMO MARPOL regulations limit the sulphur content in fuel oil [IMO, 2020]. This means ships must use fuel oil which is inherently low enough in sulphur, or install an appropriate exhaust "alternative” method, in order to meet IMO requirements.

Refineries may blend fuel oil with a high (non-compliant) sulphur content with fuel oil with a sulphur content lower than the required sulphur content to achieve a compliant fuel oil. Additives may be added to enhance other properties, such as lubricity.

Some ships limit the air pollutants by installing exhaust gas cleaning systems, also known as “**scrubbers**”. This is accepted as an alternative means to meet the sulphur limit requirement. These scrubbers are designed to remove sulphur oxides from the ship's engine and boiler exhaust gases. A ship fitted with a scrubber can use heavy fuel oil, since the sulphur oxides emissions will be reduced to a level equivalent to the required fuel oil sulphur limit. By mid-July 2020, some 2,359 systems had formally been reported to IMO as an approved “equivalent method” by Administrations (Flag States).

Ships may also have engines which use alternative fuels, which may contain low or zero sulphur, for example liquefied natural gas or biofuels.

Operational Principle of Scrubber System

Exhaust gas streams are passed inside the scrubber where an alkaline scrubbing material is present to neutralize the acidic nature of the exhaust gasses and remove any particulate matter from the exhaust. The used-up scrubbing material is then collected with wash water which may be stored or disposed of immediately as the effluent. The cleaned exhaust is passed out of the system and into the atmosphere. The scrubbing material is chosen such that specific impurities like SO_x or NO_x can be removed by suitable chemical reactions.

For de-sulphurization purposes, marine scrubbers use lime or caustic soda such that sulphur-based salts are produced after treatment, which can be easily discharged as they do not pose a threat to the environment. Scrubbers may use sea water, fresh water with added calcium/sodium sorbents or pellets of hydrated lime as the scrubbing medium because of their alkaline nature.

To increase the contact time between the scrubbing material and gas, packed beds consisting of gas-pollutant removal reagents (such as limestone), are used inside the scrubbers. These packed beds they slow down the vertical flow of water inside the scrubbers and intensify the exhaust gas cooling and acidic water neutralization process. Scrubbers are designed to maximize the absorption of gasses passing through it.

Classification of Marine Scrubbers

On the basis of their operation, marine scrubbers can be classified as Wet or Dry scrubbers. Dry scrubbers employ solid lime as the alkaline scrubbing material which removes sulphur dioxide from exhaust gasses. Wet scrubbers use water which is sprayed into the exhaust gas for the same purpose.

Wet scrubbers are further classified into closed-loop or open loop scrubbers.

In **close looped scrubbers**, fresh water or sea water can be used as the scrubbing liquid. When Fresh water is used in closed loop scrubbers, the quality of water surrounding the ship has no effect on the performance and the effluent emissions of the scrubber.

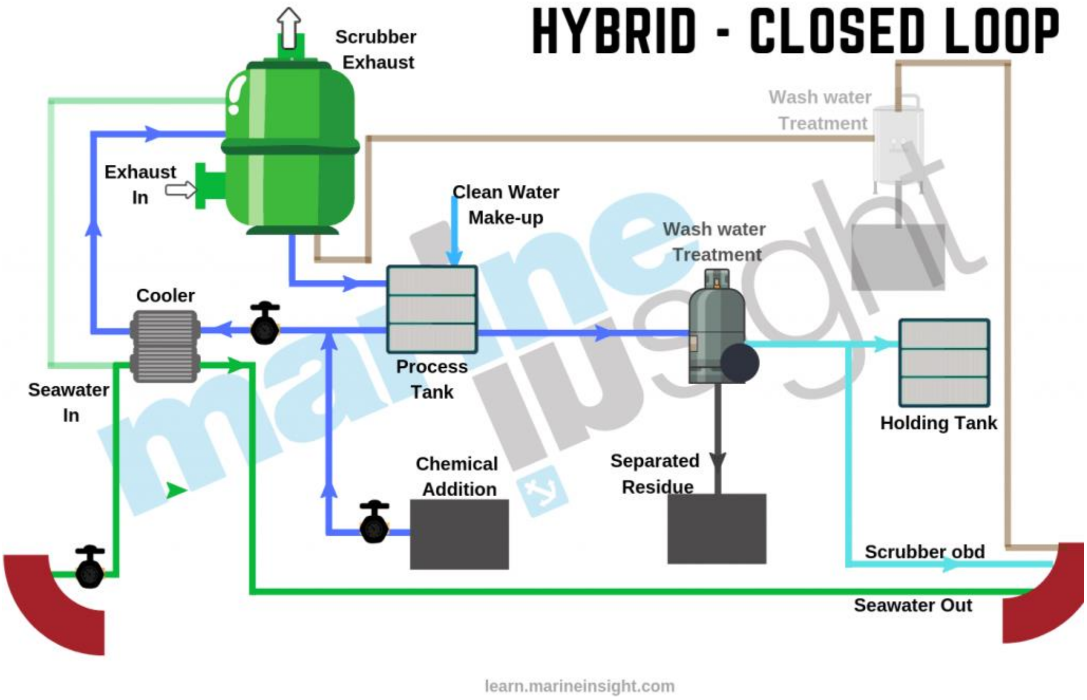


Figure 9.6: Principle of Open Loop - Hybrid Marine Scrubber (https://www.marineinsight.com/tech/scrubber-system-on-ship)

Open-loop scrubbers add water to the exhaust gas which turns sulphur oxides (SOx) to sulphates/sulphuric acid, before returning washwater to the sea. The washwater must meet strict criteria, including a pH of no less than 6.5. There are also strict limits on discharge of PAHs (Polycyclic Aromatic Hydrocarbons) and nitrates.

Hybrid scrubbers can utilize both closed and open running modes either at the same time or by switching between the two. Seawater hybrid scrubbers can be operated both in closed or open mode with seawater used as the scrubbing medium.

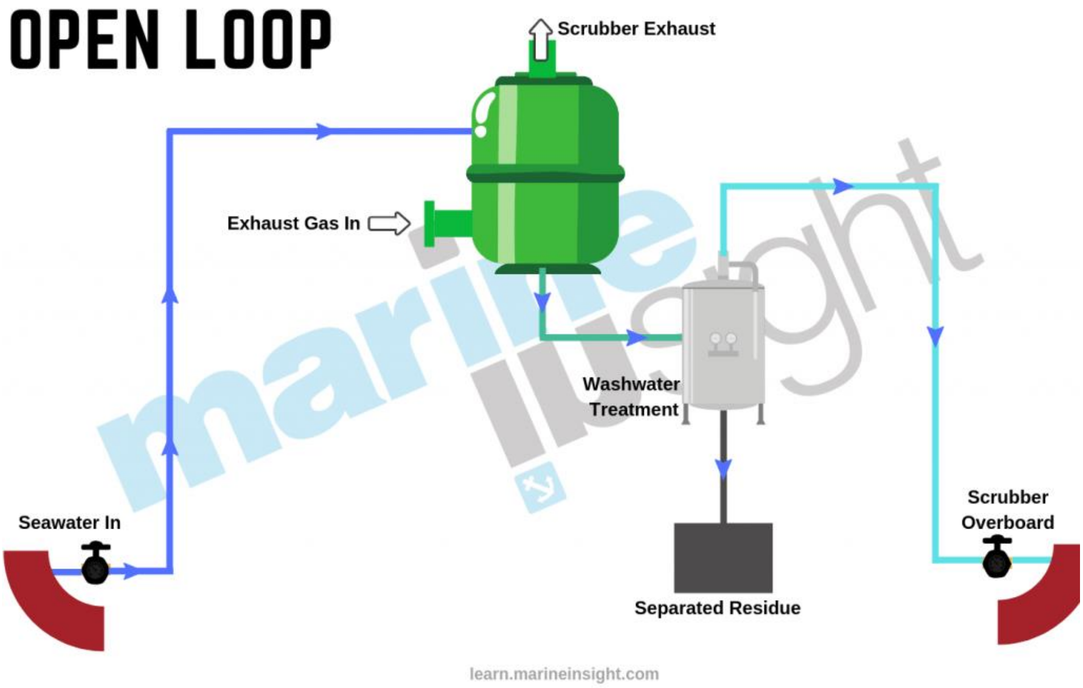


Figure 9.7: Principle of Open Loop Marine Scrubber (https://www.marineinsight.com/tech/scrubber-system-on-ship)

9.4.4 Deployment of Scrubber on ship

ONEX technical crew will go on board the vessel to evaluate the project, determine space requirements and logistical obstacles. Then, a 3D laser scanning of the spaces should be conducted to facilitate system modeling. After the 3D modeling, experts will complete the detailed design and mapped out a definitive process, manning plan and timeline for the removal of the existing exhaust silencers and the installation of the exhaust gas scrubbers within the set timeframe. Using the detailed design, ONEX specialists will be also able to prefabricate foundation structures in the company's workshop and ship the prefabricated material to the vessel in time for its arrival in the dry dock.

A riding crew will perform demolition and prepare the engine casing for the rigging and installation operations. Once the vessel is in the dry dock, ONEX will deploy technicians and technical managers to complete the project within the minimum - day dry-docking period. The team will install all scrubber tower sections. ONEX may provide two shifts with a minimum of two supervisors per shift to ensure that quality controls and safety standards are adhered to throughout the project.

9.4.5 Ship Waste Collection & Management Plan (SWCMP)

The procedures for the collection and management of waste of ships serviced in the Shipyards' area are described in detail in the *Ship Waste Collection and Management Plan (SWCMP) of Elefsis Shipyards* [Elefsis Shipyards, 2019]. A modified and updated version of the SWCMP has been submitted to the Competent Authority (Ministry of Maritime Affairs & Insular Policy) and is about to be approved within the next months.

The procedure is summarized as follows: Each ship collects the waste resulting from the maintenance-repair work carried out during their stay in the repair areas of the Shipyards temporarily and until their collection, in a container bin which is placed inside the ship or in the open space in front of the ship. Hazardous waste, recyclable waste and biodegradable waste are collected in separate bins.

Under no circumstances dumping of waste in bulk at the piers is allowed, while monitoring the filling of these bins and their immediate removal from the piers is responsibility of both the Operator of the Shipyards and the ship's captain.

Figure 9.8: Container for collection of Ship's repair waste

Figure 9.9: Ship waste collection (liquid)

Figure 9.10: Bins for collection of mixed municipal waste

For the HW, prior to their collection and removal, a chemical analysis of the waste received may be obligatory. Waste will be collected and removed by a properly licensed company for HW, as described in previous chapters. The latter company, upon transporting the waste should provide the Operator with the following:

- Receipt
- Waste identification forms
- Evidence for the final disposal of the received Waste

Liquid wastes are included in ANNEX I (Petroleum Waste) and ANNEX IV (Sewage) of the International Convention MARPOL 73/78 while solid waste included in ANNEX V (Waste) respectively.

Solid wastes belong in Category V of the MARPOL 73/78 as it has been amended and is in force, and are categorized as follows:

- CATEGORY A - Plastics
- CATEGORY B - Food Residues
- CATEGORY C - Household Waste
- CATEGORY D - Edible Oils
- CATEGORY E – Incinerator ash
- CATEGORY F - Operating waste
- CATEGORY G - Cargo residues
- CATEGORY H - Animal By-Products
- CATEGORY I - Fishing Equipment

Further analysis of the abovementioned waste in terms of expected quantities and ECW codes is illustrated in the following paragraphs.

9.5 Personnel

According to the new owner BPL, the expected employees throughout the projected period will be 1200-1500. The labor force during specific periods may exceed 2000. Private crews may also be employed for specific works, upon agreement.

Employments fees is the largest expense expected, exceeding 51% of the investment, for a planned 25-year period. ONEX is also expected to pay contributions to the insurance funds almost EURO 275 million euros, during the same period.

9.6 Water Consumption

The Shipyard is directly connected to the EYDAP network. The daily consumption, based on previous operation data (up to 2015), is estimated at an average of about **240 m^3/day** and is used for workers' hygiene, washing of equipment and accessories, ship watering, supply of fresh water to ships, water cutting, etc.

For the Fire Safety network and the service of the ships with non-drinking water, sea water is used, which is pumped from a pumping station that exists at the base of the big pier, perpendicular to the front of the Shipyard.

9.7 Energy Consumption

The current and the future Shipyard's needs are covered by the Public Power Corporation (PPC) network. Based on previous operation data, the electricity used in an average operational period reaches **20,000 MWh/year**. There are 10 power substations scattered throughout the facility (see Drawing ENV-02). Electricity is consumed mainly by welding machines and electric cranes.

It should be emphasized that there are power generators, utilizing diesel, that contribute to energy production in case of interruption of the electricity network.

9.8 Raw Materials

Raw materials include sheets, prefabricated ship sections, hardware of various types, shapes and quality, machinery and spare parts, thin sheets and molds, pipes of various diameters and quality of material, flanges, shrinkage and other components, electrical instruments, electrodes, industrial gases, paints and solvents.

The quantities of raw materials - auxiliary materials consumed depend on the workload. An indicative consumption is presented below based on 2010 data where the Shipyards were totally operational and on relevant literature:

- Plates 687,852 tn / year
- Cast irons 241,806 tn / year
- Pipes 4,139 m / year
- Welding items 20,393 tn / year
- Cables 19,527 m / year
- Colors 178,722 kg / year
- Timber 120 m^3 / year
- Sandblasting material 3,600 tn / year
- Sheets 4,500 t / year
- Electrodes 27,000 t / year
- Industrial gases (oxygen, acetylene) 180,000 l / year
- Solvents 22,000 l / year

9.9 Fuels

During the operation of the Shipyard, fuel is used only for the movement of vehicles, indoor heating and the use of power generators when necessary.

About 15 low-capacity diesel vehicles are available, which perform support work whenever needed. In addition, the Shipyard has 10 home type boilers for heating locker rooms and offices and for the production of hot water for use in bathrooms. All boilers are inspected and maintained on an annual basis by licensed companies and the corresponding checklist is issued.

The total consumption is estimated at 50.000 l/year.

9.10 Liquid Waste Production

9.10.1 Liquid waste from production process

Liquid waste is generated from the daily activities of the shipyards at the points shown in Table 9.1

Table 9.1: Sources of liquid waste during Shipyards' production process

Ships in Floating Tanks, Pier	• Water mixed with petroleum (slops) • Used mineral oils • Water with chemical detergents • Dissolution of reef colors
Workshops	• Sanitary waste • Water with chemical detergents • Water with petroleum products • Used mineral oils
Office buildings, locker rooms, ancillary buildings	• Sanitary waste

Other possible liquid waste sources are including:

- Oil spills from vehicles and other motorized equipment, in case of non-maintenance or accident
- Petrol Station Fuel tank losses
- Final disposal from wastewater treatment plant
- Rainwater runoff
- Sinking of ships in the port area and subsequent fuel disposal on sea

Some of the most important liquid waste streams are further analyzed below:

A. Water with petroleum products (EWC codes: 13 04 01 *, 13 04 03 *, 16 07 08 *)

That stream includes washing water for machinery and vehicles from garages and water containing petroleum residues from ship tanks (slops). This waste is collected in underground tanks for garages or portable tanks for waste from ship cleaning, separate from waste of different origin and composition.

B. Used mineral oils (EWC code: 13 02 06 *)

Lubricating oil waste comes from vehicles, cranes, machinery and ship repairs. They are collected in closed tanks in the individual sections or in metal barrels, which are stored in a covered, cemented area to protect the soil from any leaks. They are received by the approved Alternative Waste Management System for Lubricating Oils, accompanied by the special Identification Form - Certificate of Acceptance

C. Water with chemicals

Any liquid waste containing solvents, detergents, various chemicals and water is collected either in underground tanks in the individual sections or in portable tanks with care of the respective production departments while any chemicals in barrels are transported in a cemented area. This waste is in no way mixed with waste of different origins. They are then delivered to a company that has a license to collect and transport such waste.

D. Reef colors

The increased presence of ships in the Shipyard of Elefsis will result in an increase in the amount of dissolved reef colors at sea. Nevertheless, new reef paints are characterized by low levels of toxic substances. On the other hand, the new Operator is about to implement environmentally friendly materials for performing ship maintenance. Therefore, over the years, the dissolved quantities are expected to significantly decrease.

E. Sanitary waste

Municipal wastewater from staff hygiene areas is collected for treatment by the Biological Treatment of the facility as described in Chapter 3.

9.10.2 Liquid waste received from ships

Liquid wastes are included in ANNEX I (Petroleum Waste) and ANNEX IV (Sewage) of the International Convention MARPOL 73/78 while solid waste included in ANNEX V (Waste) respectively.

ANNEX I of MARPOL includes the following waste streams:

1. Ship ballast (dirty ballast).
2. Oil tanker cargo tank washes (slops).
3. Petroleum mixtures of engine rooms (bilge waters).
4. Heavy oil residues (sludges).
5. Cargo tank and hull washes.
6. Hazardous chemicals in bulk or mixtures or ballast containing such substances.

It is noted that ship dirty ballast is not accepted on land for treatment or disposal.

ANNEX IV (Sewage) includes sanitary waste. Those waste are coming from a variety of activities that take place on ships (toilets, laundries, cleaning, etc.) and are removed either by tanker vehicles or by direct disposal in the sewerage network and are taken for treatment to existing biological treatment facility.

9.11 Solid Waste Production

9.11.1 Solid waste from production process

Since the main shipbuilding and ship-repairing works are in fact the same as for the previous operation of the Shipyards, similar waste sources are expected (Table 9.2).

Table 9.2: Solid Waste Sources from Shipyards Operation

Source of Waste	Type of Waste
Floating Tanks, Pier	• Sandblasting sand • Petroleum sludges • Lint, sawdust, etc. materials contaminated with oil • Empty packages of paints and lubricants

Source of Waste	Type of Waste
	• Household waste
Outdoor space & indoor sandblasting machine	• Sandblasting sand • Empty paint packages
Workshops	• Scrap, grease, various metals, damaged components • Empty lubricant packages • Batteries & accumulators • Waste electrical & electronic equipment • Household waste
Office buildings	• Household waste • Paper/Cardboard • Mixed batteries

Regarding the respective EWC codes, the abovementioned waste may be categorized as follows:

- Metal scrap and similar waste: EWC code 12 01 01, 12 01 02, 12 01 03, 12 01 04, 12 01 13
- Packaging materials (cardboard, plastic, wooden pallets) EWC code 15 01 01, 15 01 02, 15 01 03, 15 01 04, 15 01 06
- Packaging materials contaminated EWC code 15 01 10*
- Indoor sandblasting waste, EWC code 12 01 17
- Indoor-Outdoor water blasting (jetting) waste 12 01 17
- Batteries and accumulators EWC codes: 16 06 01 *, 16 06 02 *, 20 01 33 *
- Electrical & Electronic Equipment EWC code 20 01 36
- Household waste, code EWC 20 03 01

9.11.2 Solid Waste received from ships

The following streams may be anticipated:

- Municipal Waste (NHW)
- Operational Waste (NHW)
- Special Waste (including HW)
- Operational Waste (including HW)

Municipal waste may include both biodegradable and recyclable waste. Operational Waste (NHW) may include repairing waste and cargo residues. According to previous records from Elefsis Shipyards, the Port of Piraeus [http://www.olp.gr] and the relevant literature, the EWC codes may found on waste received from ships are summarized in Table 9.3.

Table 9.3: EWC codes of waste may be received by ships in port facilities

EWC Code	Description
020101	sludges from washing and cleaning
020102	animal-tissue waste
020304	materials unsuitable for consumption or processing
080318	waste printing toner other than those mentioned in 08 03 17
120102	ferrous metal dust and particles
150102	plastic packaging
150104	metallic packaging
150107	glass packaging
170405	iron and steel
170604	insulation materials other than those mentioned in 17 06 01 and 17 06 03
190112	bottom ash and slag other than those mentioned in 19 01 11
190805	sludges from treatment of urban waste water
190812	sludges from biological treatment of industrial waste water other than those mentioned in 19 08 11
200101	paper and cardboard
200102	glass
200108	biodegradable kitchen and canteen waste
200125	edible oil and fat
200136	discarded electrical and electronic equipment other than those mentioned in 20 01 21, 20 01 23 and 20 01 35
200139	plastics
200140	metals
200199	other fractions not otherwise specified
200301	mixed municipal waste
200399	municipal wastes not otherwise specified

EWC Code	Description
080111*	waste paint and varnish containing organic solvents or other hazardous substances
080409*	waste adhesives and sealants containing organic solvents or other hazardous substances
090101*	water-based developer and activator solutions
090105*	bleach solutions and bleach fixer solutions
100114*	bottom ash, slag and boiler dust from co-incineration containing hazardous substances
120112*	spent waxes and fats
130310*	other insulating and heat transmission oils
130403*	bilge oils from other navigation
130508*	mixtures of wastes from grit chambers and oil/water separators
130702*	petrol
140602*	other halogenated solvents and solvent mixtures
150110*	packaging containing residues of or contaminated by hazardous substances
150202*	absorbents, filter materials (including oil filters not otherwise specified), wiping cloths, protective clothing contaminated by hazardous substances
160107*	oil filters
160213*	discarded equipment containing hazardous components other than those mentioned in 16 02 09 to 16 02 12
160305*	organic wastes containing hazardous substances
160504*	gases in pressure containers (including halons) containing hazardous substances
160506*	laboratory chemicals, consisting of or containing hazardous substances, including mixtures of laboratory chemicals
160507*	discarded inorganic chemicals consisting of or containing hazardous substances
160508*	discarded organic chemicals consisting of or containing hazardous substances
160601*	lead batteries
160708*	wastes containing oil
170503*	soil and stones containing hazardous substances
170603*	other insulation materials consisting of or containing hazardous substances

EWC Code	Description
170903*	other construction and demolition wastes (including mixed wastes) containing hazardous substances
180103*	wastes whose collection and disposal is subject to special requirements in order to prevent infection
180106*	chemicals consisting of or containing hazardous substances
200119*	pesticides
200121*	fluorescent tubes and other mercury-containing waste
200133*	batteries and accumulators included in 16 06 01, 16 06 02 or 16 06 03 and unsorted batteries and accumulators containing these batteries

According to statistical records provided by the current Administration of the Shipyards (also included to the SWCMP), the following waste were delivered during 2010 – 2017 period (Tables 9.4 & 9.5):

Table 9.4: Wastes delivered at Elefsis Shipyards from ships 2010 - 2013

EWC Code	Description	2010 (tn)	2011 (tn)	2012 (tn)	2013 (tn)
13 02 06*	Oils & Lubricants	7.0			
13 07 01*	Diesel fuel				26.7
16 07 08*	Slops	406.1	404.0	223	38.9
16 07 08*	Sludge	28.9	30	10.5	
17 04 05	Scrap		16.0		
20 03 01	Municipal Waste	527.4	437.2	200.4	30.0

Table 9.5: Wastes delivered at Elefsis Shipyards from ships 2014 - 2017

EWC Code	Description	2014 (tn)	2015 (tn)	2016 (tn)	2017 (tn)
13 02 06*	Oils & Lubricants	0.7			
13 04 03*	Bilge oils		15.6	276.0	245.1
13 07 01*	Diesel fuel			0.3	
15 01 06	Mixed Packaging			16.0	18.4
16 06 01*	Lead Batteries	65.0			

EWC Code	Description	2014 (tn)	2015 (tn)	2016 (tn)	2017 (tn)
16 07 08*	Petroleum Waste	92.2	6.0	28.8	89.6
20 03 01	Municipal Waste	59.9	36.3	36.3	59.4

9.12 Air Pollutants

The main sources of air pollutants during Shipyards' operation are summarized in Table 9.6.

Table 9.6: Sources and types of Pollutants produced during Shipyards' Operational Phase

Source of Air Pollutant	Type of Pollutant
Sandblasting - Painting (indoor complex & outdoor sandblasting area, Floating tanks)	PM, VOCs, PAHs, Heavy metals
Workshops (Heavy & Light Rolling Mill, Pipeworks, Carpentry)	O_3, PM, CO, NOx, SO_2, Pb, Metals
Chemical cleaners, adhesives and varnishes	VOCs
Prefabricated areas, Shipbuilding, Piers, Floating tanks	O_3, PM, CO, NOx, SO_2, Pb, Metals
Boilers and vehicles	CO_2, CO, NOx, SO_2, PM
Ships	CO_2, CO, NOx, SO_2, PM

Air pollutants may also be distinguished in terms of the process involved as follows (see also par. 9.3.2):

Thermal metal cutting: The composition of the pollutants from thermal metal cutting operations varies significantly with the metal being cut, as well as with its coating. Cutting of carbon steel, for example, results in the emission of iron oxides; galvanized steel forms zinc oxides; stainless steel forms chromium and nickel, and some metal alloys emit cadmium [OECD, 2009]. The fumes generated by thermal cutting are also affected by the coating on the metal alloy that is being cut. These coatings can contain a number of different heavy metals and organic compounds (see section: Coating and painting) that can add substantially to both the load and significance of the pollutants that are being emitted from the cutting process. In many cases, this source of pollutants is the largest environmental concern of the cutting process, and can lead to emissions of manganese, nickel, chromium, cobalt, and lead. These particulates can be deposited on surfaces around the work area, where they are prone to contribute to the shipyard 's stormwater pollutant loading.

Welding operations: Emissions from welding include GHG, toxic chemicals, and "criteria air pollutants" (CAPs) which include ozone (O_3), particulate matter (PM), carbon monoxide (CO), nitrogen oxides (NOx), sulphur dioxide (SO_2) and lead (Pb) [US EPA, 2008a, OECD, 2009]. Welding is a key source of hazardous air pollutants and a major environmental concern. Toxic fumes attributed primarily to welding activities include manganese and chromium. Other hazardous metals identified in welding fumes include nickel, cobalt, lead, carbon dioxide, carbon monoxide, nitrogen oxides and ozone [EPA, 1995, OECD, 2009].

Metal grinding: It is a type of machining process which uses an abrasive tool to grind a metal surface. This process discharges polluting PM into the atmosphere, both from the grinding tool and the substrate being ground. Pollutants are in the form of fugitive air emissions of metal dust and fumes, as solid waste and as metal dust and chips from waste grinding tools. Metal grinding requires electricity which generally is sourced from fossil fuel and therefore associated with GHG emissions. Metal grinding is carried out either in the shop or in outdoor work areas using portable handheld grinders. These particulates are released during the abrasion process and like other outside shipyard activities these grinding operations have the greatest potential for emitting pollutants to the environment, directly to the air and soil as well as to waterways through stormwater runoffs. Harmful pollutants are present in the abrasive tools and substrates in differing concentrations. Substrates may be significant pollutants, particularly if these are coated. Metal grinding materials such as grinding discs and grinding rocks are characteristically fabricated by attaching an abrasive element to a backing with chemical binders. Common materials for the abrasives in these tools are aluminum oxide, silicon carbide, and zirconium oxide. Less common components are manganese compounds, crystalline silica and zinc compounds [EPA, 2005b].

Surface treatment: It is considered among the most environmentally hazardous processes in the shipbuilding industry [OSHA, 2006]. Cleaning and coating activities use chemicals that include heavy metals, solvents, copper, and hazardous or flammable materials, and are associated with emissions of lead, PM, volatile organic compounds (VOCs), zinc and other air pollutants. Specific concerns can also be linked to the use of anti-fouling paints. These paints, which are used on the hulls of ships to prevent build-up of marine organisms, contain highly toxic compounds. Also, because anti-fouling paints can reduce, but not prevent, the build-up of marine organisms, ships are periodically docked for treatment, involving hull cleaning, paint removal and the application of new layers of paints, which in turn leads to further risk of environmental damage. In addition, the metal-based paints that are used to protect ship surfaces from corrosion can contain up to 30% heavy metals [OSHA, 2006].

Abrasive blasting: The most common blasting technique is dry-abrasive blasting, which relies on compressed air to propel the abrasive material onto the surface at very high velocity. This bombardment results in a breakdown of the abrasive materials, as well as of certain surface elements including rust and paint chips. This generates PM emissions, which constitute a major source of hazardous air pollutants. As abrasive blasting is most often done manually, the activity also poses significant health risks, both to those who conduct the blasting as well as to employees who work in the vicinity of the blasting areas. Blasting is also associated with elevated noise levels (see next paragraph) from sources such as air discharge, air compressors, impact of the abrasives, exhaust ventilation systems, and blasting cabinets [OSHA, 2006]. The number and significance of toxic air contaminants produced by the blasting depends on the materials that are used as abrasive agents as well as on the surface that is being blasted. These abrasives, which can be categorized as i) metallic, ii) slag (used in Elefsis Shipyards), iii) synthetic and iv) natural oxides, tend to vary with the blasting operation at hand. At Elefsis Shipyards only nickel slag is being used (see also Chapters 3 and 6). By using nickel slag, potential air pollutants may include arsenic, beryllium, amorphous silica, cadmium, chromium, cobalt, crystalline, silica, lead, manganese, nickel, silver, titanium, and vanadium.

Coating and painting: Coating activities use a number of chemicals that include heavy metals, solvents, copper and hazardous or flammable materials, and the activity emits a number of air pollutants including lead, PM, VOCs, and zinc. Solvents are also used to clean painting equipment such as spray guns, brushes, containers, and rags. Lead compounds, such as lead chromate and red lead tetraoxide, have been used extensively in marine paint to protect ship surfaces from corrosion. Nevertheless, those lead paints have been banned and no use of such material is anticipated.

9.13 Noise and Vibrations

Within the area of the Shipyards, sources of noise are located locally depending on the work that takes place and the equipment used on a case-by-case basis (sandblasting, water blasting, welding, hammering, chipping, etc.). Pneumatic hammers, gouging tools and chipping machines may be sources of significant noise exposure in shipyards.

According to previous experience and the corresponding literature [OSHA, 2009, OECD, 2010], the noisiest activities in the Shipyard include:

1. Hydro blasting 105 dB
2. Surface preparation/ sponge grit blasting 105 dB
3. Welding 100 dB
4. Painting of hulls using airless spray 60 – 70 dB

Many construction, maintenance, and repair activities are major sources of noise, particularly operations that involve metal working, the use of heavy equipment and vehicles, abrasive blasting, and chemical and mechanical paint removal. Such noise naturally affects the people who are engaged in the noise generating activity, as well as those located in the vicinity. Depending on the task at hand, workers in shipbuilding may be exposed to continuous sound levels of between 85 and 105 dBA. The highest levels of dBA exposure are experienced during welding, fitting and blasting activities [OSHA, 2009, OECD, 2010]. Without protection, exposure to such sound levels may lead to loss of hearing. There is hardly any information available as to what effect noise from shipyards has on the surrounding environment, and most evidence on sound effects is related to the noise made by ships during operations at sea (see section: Vessel noise).

Considering vibrations, low intensity ones result from the general operation of the Shipyard and mainly from the movement of heavy vehicles transporting raw materials, waste or personnel.

9.14 Electromagnetic Fields

The operation of the project is related to normal emissions of electromagnetic radiation and cannot adversely affect the existing levels of electromagnetic fields, both in the immediate and in the wider area of the Shipyards'. Electromagnetic radiation in the wider area is at low levels while the radiation emitted by port and shipyards activities is also at low levels.

10. ENVIRONMENTAL & SOCIAL IMPACTS DURING OPERATIONAL PHASE

10.1 General

In order to assess the environmental impact of a project, the environmental parameters that are affected are first determined, then the caused changes in their quality are evaluated, and finally the minimization actions and the remedial actions of the possible expected negative effects are described.

In this Chapter, after a combined review of the elements of the current state of the environment (natural and social) and the project under consideration, an assessment and evaluation of the potential significant impacts expected from operational phase (as described in the previous Chapter) is conducted. Also, the impacts for which special emphasis should be given are highlighted.

10.2 Impacts on Climatic – Bioclimatic Characteristics

10.2.1 General

The possible effects related to local changes of climatic parameters are expected due to:

- The production of heat and mass and energy emissions (mainly in the form of hot exhaust gases) derived from the operation of Shipyard's mechanical and motorized equipment
- The electricity consumption of electric cranes and equipment
- The fuel consumption of the small number of vehicles in the area as well as to the mooring of ships.
- The activities of the external crews that will perform the work within the Shipyards.

These changes concern the microclimate (and mainly the temperature and humidity) of the local area of the Shipyard.

The absence of interventions in the flow and concentration of surface and groundwater resources, ensures that the climatic and bioclimatic parameters of the project area, which are affected by the water cycle, will remain unchanged.

10.2.2 Impacts on Micro-climatic Characteristics

The special conditions that prevail in the workplaces of the Shipyards determine their microclimate. The microclimate can affect one or more people, indoors or outdoors. Factors associated with determining the local environment, that are not pathogenic under normal conditions, include temperature, humidity, and the speed or movement of air. However, those factors, when they exceed certain limits, they can have adverse effects on the efficiency and the general health of employees.

The temperature and relative humidity in the workplace depend on those of the external environment. Temperatures between 12◦C - 22◦C are recommended for a normal working climate. For heavy work the temperature must be kept low while for light work it can be maintained at higher levels. The relative humidity must be between 30% and 80% (high temperatures correspond to high relative humidity values and high temperatures to low relative humidity).

A key climatic factor is also the air movement and the direction and strength of the winds in the area. The speed of the air inside the workplaces should not exceed 1m/sec, which of course depends on the temperature and the relative humidity of the space.

For medium and high temperatures, the key role is played by the evaporation which is affected by the relative humidity of the indoor space and the air speed. In some activities, the microclimate must be adapted to the needs of production. Thus, e.g., when treating substances with hygroscopic properties, the relative humidity and temperature must be maintained within specified limits in order to achieve the desired perfect co-operation.

None of the Shipyard activities is expected to increase the temperature, humidity, etc. in the workplace. In addition, gaseous pollutant emissions (see also par. 10.10) are not pathogenic. Consequently, the relative impacts on the micro-climate are considered negligible.

10.2.3 Shipyards’ carbon footprint assessment

Methodology for estimating GHG emissions

In the context of recording the activities of the Shipyards, the greenhouse gas (GHG) emissions were estimated with the following steps:

1. Identification of natural resources related to port activities according to the main categories - have a significant impact on the greenhouse effect.
2. Choice of quantification methodology: The quantification method used is based on actual data on natural resource consumption
3. Collection of GHG-related activity data
4. Determination of greenhouse gas emission factors: according to the National Inventory Report for Greece [NIR, 2021]

The formula used to calculate greenhouse gas emissions is based on the amount of natural resource consumption per activity multiplied by the corresponding emission rate for conversion to CO_2 equivalent.

The identification of the main categories of the Greek inventory system is based on the application of the "Tier 1" methodology described in the IPCC Best Practices Directive [IPPC, 2000, IPPC, 2003], adopting the categorization of sources presented in Table 7.1 of the IPCC Good Practices Directive.

The methodology assesses the impact of different source categories on the level and trend of emissions. The basic categories are those which, when added together in descending order of magnitude, add more than 95% of the total emissions (level rating) or the stock trend in absolute terms. The main categories considered in case of Shipyards are:

- Indirect emissions due to electricity consumption
- Emissions from transport (materials and staff)
- Emissions of Shipyards activities under normal conditions

Indirect emissions: The Electricity provider of Elefsis Shipyards is the PPC. The energy mixture for PPC is presented in Table 10.1 [RES & Origin of Guarantees Manager, 2021].

Table 10.1 Energy Mix for PPC 2020 (source: RES & Origin of Guarantees Manager, 2021)

Fuel	Percentage
Lignite	10.92%
Coal	6.47%
Oil	7.33%
Natural Gas	40.04%
Cogeneration of Heat and Power (CHP)	1.29%
Fossil Fuels (unknown origin)	0.77%
Amount of Fossil Fuels	**66.82%**
Nuclear Power	4.42%
Hydroelectric Power	6.16%
Solar Power	8.68%
Wind Power	12.78%
Biomass	1.05%
Geothermal	0.09%
Renewable Energy (unknown origin)	0.00%
Amount of Renewable Energy	**28.76%**
Total Consumption: 37,066,922 MWh	

As it is illustrated in Table 10.1, 66.82% of the electricity provided is produced by fossil fuels (including natural gas), while 28,76% is produced by Renewable Energy Sources (RES). According to data available, Emission Factor (EF) for electricity is determined

Emission Factor = 468,26 g CO_2/KWh (1)

Direct Emissions: As it was mentioned in Chapter 9, diesel is the main fuel used for vehicles movement and boilers and a total consumption of **50,000 lit/year** is estimated (according to latest data).

Consequently, diesel consumption data are used to determine greenhouse gas emissions from road transport and heating. According to NIR 2021, the values used for CO_2 emissions due to diesel consumption are:

Net Calorific Value (NCV) = 43 TJ/kt

Emission Factor (EF) = 73,33 t CO_2 /TJ

EF diesel = 73,33 t CO_2 /TJ x 43 TJ/kt = 3153,19 t CO_2 / kt diesel or

EF diesel = 3,153 kg CO_2 /kg diesel

EF diesel = 2,68 kg CO_2/ lt diesel (2)

The energy consumption, based on previous operational data for the Shipyards, was assumed **20,000 MWh/year**. Consequently, the indirect emissions of the facility are calculated (1):

Indirect CO_2 emissions = 20,000,000 KWh/year x 468,26 g CO_2/KWh

Indirect CO_2 emissions = 9,720 tn CO_2/year (3)

Accordingly, diesel contribution for 50,000 lit annual consumption is calculated:

Direct CO_2 emissions = 50,000 lit/year x 2,68 kg CO_2/ lt

Direct CO_2 emissions = 134 tn CO_2/year (4)

None of the productive activities of the Shipyards emit any CO_2 emissions, at least in the order of magnitude of electricity and diesel consumption.

Eventually the total annual CO_2 emissions are estimated**:**

Total CO_2 emissions = 9,720 tn CO_2/year + 134 tn CO_2/year = 9,854 tn CO_2/year

That is an acceptable number compared, for example, with the relevant footprint of Piraeus Port, which amounts to 58,000 tn/year [PPA, 2019].

It should be noted that, in the future plans of ONEX, the development of RES installations around the Shipyards (Wind and Solar Energy Parks) is included. Thus, carbon footprint is expected to be significantly reduced within the next 5-years period.

10.3 Impacts on morphological and landscape features

10.3.1 Coast Morphological Characteristics

The transport of sediments transversely and parallel to the coast is a serious issue with significant geomorphological effects. Basically, the assessment of the balance of sediments in the part of the coast which is either problematic by nature or endangered by the natural phenomena, should be made.

Data for sediments transport along the coastal line of Elefsis Shipyards can be found in a Coastal Engineering Assessment conducted in the context of the previous EIA (2008), but also in the relevant literature, regarding the study area [Karabas et al, 2015, Maganaris, 2020].

According to the above sources, the most vulnerable part of the Shipyard is the southwest. The parallel transport of sediments is estimated at 5,000m^3 for 200m of coastal line, while the transversal transport is estimated up to 1,500m^3.

Those volumes are considered small to create any problems to the morphology of the Shipyards' coastline. Moreover, as it was mentioned in Chapter 4, the deeper sea currents of the inner Saronic Gulf do not favor the transfer of sea bottom materials. Therefore, no effects on coastal characteristics are expected.

10.3.2 Landscape Characteristics

The effects of the Shipyard operation on the landscape are expected to be rather low given that the geomorphology of the operation site is suitable for the reduction of visual disturbance. As it was mentioned in Chapter 7, the area is hardly visible from any remarkable point of observation, such as settlements, archaeological sites, etc.

During the Operation phase of the Project, it is expected that the embossed characteristics of the ground surface will not change, since all constructions/installations will follow the current form of the ground and any interventions will be limited to the necessary ones.

The activities related to the maintenance of the existing infrastructure, will improve the image of the Shipyard and have a positive impact on the landscape.

In addition, it is emphasized that, following the closure of the facility, dismantling and transfer works of the Complex parts will be carried out and restoration/rehabilitation works will take place, aiming at upgrading the landscape and restoring the original character (rural / grassland as the case may be) of the land.

Therefore, the impact on the topological and landscape characteristics of the area can be evaluated as negligible and reversible after the removal of the Complex (cease of operation). Finally, the impacts are strictly limited within the Complex boundaries.

In general, the possible negative effects that some of the existing activities may have on the landscape should finally be considered in the light of the fact that the landscape within the shipbuilding and repair zone is already formed in relation to the port industry and quite distorted and is now considered as "estabilshed". On the other hand, the effects of the construction of new or the renovation of existing infrastructure and buildings as well as the organization of outdoor parking spaces are expected to be positive in terms of the general landscape characteristics of the area.

10.4 Impacts related to geological, tectonic and soil characteristics

10.4.1 Impacts on Geological / Tectonic Characteristics

In general, in the study area, there are no special geological features or special geological horizons, such as springs, caves, etc., which could be affected by the operation of the Shipyard. No impact is expected, since the Shipyard operation is not expected to cause destruction, overlap or change of any unique geological or physical features.

10.4.2 Impacts on Soil

Some of the common threats on soil characteristics and quality, during Shipyards operation, are summarized below:

- Leakage of fuels and lubricants from the mechanical equipment used (trucks, loaders, etc.). In addition, there is a risk of soil compaction from the movement of heavy vehicles, with consequent loss of basic soil properties.
- Liquid waste leaks from the Biological Treatment Plant (e.g., tank leaks)
- Leaks/leachates from areas designated to the temporary storage of materials and solid waste.
- Dust deposition from the production process (ship – building, ship repairing)
- Uncontrollable solid waste deposition
- Leaks from fuel storage tanks (situated at the petrol station)
- Leaks as a result of accidents related to mechanical and motorized (e.g., trucks) equipment.
- Leaching of paved surfaces: It is proven that the rainwater runoff of the road or other paved surfaces that receive significant traffic, contains high amounts of pollutants and in significant concentrations immediately after rain, while gradually leaching the surfaces and reducing the concentration of pollutants. These high pollution loads contribute to soil pollution and of course to the pollution of groundwater and surface water resources.

- A project that disrupts the natural continuity of the soil and morphology, such as a road axis or a land port area, can disrupt the stormwater drainage system, causing flooding in the area. In order to minimize these effects, the design of each project should be accompanied by a complete hydraulic study, which will take into account the existing and planned rainwater network, both in terms of layout and drainage.
- Soil properties may be affected by the wetting of non-asphalt surfaces for reasons of limiting dust release (especially during summertime or in periods with augmented Shipyards activity).

All those impacts are mitigated or even eliminated by implementing the measures presented in the following Chapter.

10.5 Impacts on Natural Environment

10.5.1 Impacts on Terrestrial Environment/Biodiversity

The operation of the Shipyard will intensify, to some extent, the general environmental pressures currently exerted by the existing industrial activities in the broader area (see also Chapters 4 and 5). As it was highlighted in Chapter 4, there are no rare or protected species of flora and fauna or critical habitats. The immediate study area is a highly anthropogenically affected and both terrestrial natural ecosystems and natural vegetation are almost absent, while habitats for important terrestrial species have not been identified (see also Chapter 4).

Slight disturbance, temporary movement, and pressure of the natural corridors (without physical damage) of the existing vertebrate species is expected to occur, due to the human presence, noise, vibrations, exhaust gases and visual disturbance that the production activity will cause. This disturbance concerns, however, mainly the days on which work will be carried out, while the vertebrate endemic to the specific area is distinguished for their adaptability.

10.5.2 Impacts on Marine Environment

During Operational phase, the main threats to marine environment are summarized below:

- Leakage of waste derived from vessels repairing on the floating tanks
- Leakage of waste from shipbuilding activities
- Storm water runoff from the shipyard land facilities containing pollutants and hazardous substances
- Leakage of oil and lubricants from machinery used (both terrestrial and marine) due to accident
- Reef colors dissolution from ships during repairing processes
- Spill of petroleum waste due to an accident at sea
- Leakage or disposal of wastes from ships entering the facilities (such as bilge water and ballast water)
- Poorly treated wastewater from wastewater treatment plan that ends up at sea.
- Polluted Dust & Particulates coming from several shipbuilding/ship repairing activities, deposition to sea
- Disposal of solid and HW

All the streams of liquid and solid waste described in the previous Chapter, may cause significant damage to the marine environment if not properly managed. More information about the impacts on marine waters are given in par. 10.13.

If solid wastes are discharged at sea they may end up as marine debris, which in turn can threaten the life of marine mammals, fish, sea turtles, and birds. Although some solid waste generated by ships is landed ashore for disposal or recycling, much of it (estimated at between 75% and 85%) is incinerated at sea, with the resulting ash typically disposed into the ocean. Incinerated waste may or may not be toxic and efforts are consequently being made to make sure that the ashes do not meet the definition of hazardous waste. Efforts are also being made to improve waste management more generally in terms of source reduction, waste minimization, waste compression and recycling [IMO, 2022].

In general, even if the quantities of solid and hazardous wastes from shipping and ship repairing activities are typically small, their toxicity to sensitive marine organisms can be significant.

The appropriate management and mitigation measures for protection of the marine environment are presented in the following Chapters.

10.5.3 Impacts on protected areas (NATURA 2000 NETWORK)

It is emphasized that the area of the Shipyards is not part of areas of special importance for the fauna and flora and in addition is located outside NATURA areas or areas protected under the RAMSAR treaty (see also Chapter 4). Consequently, no effects are expected.

10.5.4 Impacts on Ecosystem Services

Regulating services

The Project does not consume freshwater (ground or surface) during its construction and/or operational phase. All the necessary water is provided by the Public Network.

Land is a vital provisioning service, providing the fundamental resources (e.g., soils, water, pasture) on which key local livelihood activities such as crop farming and livestock may depend. Nevertheless, no such activities are developed in the broader area of Shipyards for many years. On the other hand, no expansion of the facilities is expected, thus no occupation of land is anticipated.

Hunting of species is uncommon in area, particularly compared to in the past, owing to legal restrictions imposed by the State. None of the households in the broader area is expected on relying on wild animals for income generation and other purposes.

Finally, no activities that may be affected by the operation of the Shipyards are taking place in the broader coastal area of the project, such as fishing, aquaculture, underwater mining, etc. Therefore, no impact or change in the uses the local coastal and marine environment is expected.

The lack of forests or vegetative cover in the Project area limits the range of regulating services (including carbon absorption, erosion control, soil retention and retention of water). No groundwater use for any purpose is about to be performed during both C/R and Operation Phase.

Cultural Services

As it was described in Chapter 5, due to the distance, the geomorphology and the existing anaglyph, the surrounding cultural monuments (see Chapter 5) the Shipyards C/R and Operation is not expected to have any impact on Cultural Services

On the other hand, water cycling occurs on a limited basis within the Project area, due to the absence of perennial rivers and streams.

10.6 Impacts on the Anthropogenic Environment

10.6.1 Spatial planning - Land uses

The Shipyards will operate in area totally compatible in terms of land uses (industrial zone). No alterations or impacts in the spatial planning or land uses status are expected.

10.6.2 Traffic

The increase in traffic, during Shipyards' operation will mainly concern:

- The transfer of raw materials and electro-mechanical equipment from their place of production/manufacture to the Shipyard
- The transfer of waste from the project area to the respective waste management sites

- The transfer and movement of labor related to shipbuilding and ship repairing activities (both permanent employees and external crews)

It is noted that, any impact on settlements is substantially reduced due to fact that the Shipyards are accessible through National Roads and no passage through settlements is necessary.

Another important advantage of the site is the fact that it is located at a sufficient distance from points of tourist interest (see Chapter 5) and the traffic load of the immediate area is limited, even in the summer months.

Traffic increase could also create noise and dust pollution, but those effects are also reduced with the appropriate mitigation measures presented in the next Chapter.

10.6.3 Impacts on Navigation

The location of the Shipyards does not overlap with any existing navigation channels used for ferries. The facility, being within an existing Shipyard, will not add significantly to existing traffic or vessel movement. The vessels coming to the shipyard for repair and maintenance are not likely to create any navigational issues for other vessels moving in the broader area. However, the operator will ensure adequate planning of vessel arrival and will work with the Competent Local Authorities at an early stage to resolve any concerns and obtain support for vessel movements (see also Chapter 11).

10.6.4 Impacts on other anthropogenic activities

No activities that may be affected by the operation of the Shipyards are taking place in the broader coastal area of the project, such as fishing, aquaculture, underwater mining, etc. Therefore, no impact or change in the uses the local coastal and marine environment is expected.

Especially with respect to fishing activities, the broader coastal area (Elefsis Gulf) does not used from fisheries, due to its timeless use for industrial purposes. The only relevant impact to the fishing activities could be related to the broader impacts on fish themselves. Based on the measures proposed for the protection of the marine environment (see next Chapter) those impacts could be minimized.

10.6.5 Cultural Heritage

As it was stated for the C/R phase of the project, due to the distance, the geomorphology and the existing anaglyph, the surrounding cultural monuments (see Chapter 5) has no visual contact with the site of the Shipyards. Also, due to the distance of the monuments from the Shipyard, no degradation of the local micro-environment of those sites is expected.

Therefore, the Operational phase of the project is not expected to have any impact on local Cultural Heritage.

10.7 Impacts on Socio-economic Environment

10.7.1 Affected Population

As it was stated for the C/R phase, given the distance of the residential areas from the Shipyards, but also their non-visual contact with the facilities, no negative effects are expected on the population of the wider area.

10.7.2 Local Economy

The new operational status of the Shipyards, targeting on the upgrade and strengthening of the shipbuilding and repair zone of Elefsis, will contribute positively to the improvement of the socio-economic characteristics of the wider area of Elefsis and West Attica. A gradual recovery of the economic sector related to shipbuilding and repair activity is expected, due to the creation of a significant number of new jobs. for the specialized local staff of the region, which currently presents very high unemployment rates (see Chapter 5). Furthermore, apart from the permanent employees (1200 – 1500), some 500 – 800 external crews and specialized scientists, workers etc., will be occupied during periods with higher labor demands.

At the same time, it is expected that there will be opportunities for many industrial and craft units, suppliers etc., in the wider area that are directly or indirectly related to the shipbuilding and repair activity (materials suppliers, fuel suppliers, food suppliers, technical infrastructure producers etc.). An additional beneficial effect on the local economy will be the strengthening of the servicing sector since several companies and individuals will be employed indirectly by the Operator, through the provision of services (engineers, advocates, port specialists, accountants etc.)

In conclusion, the effects on the socio-economic environment are characterized as positive as it is estimated that there will be significant benefits for the local economy with the development of individual activities.

10.7.3 National Economy

Around 2010, Elefsis Shipyards were experiencing a prolonged and continuous decrease in turnover, as from the beginning of 2011 until the end of 2015 the turnover on merchant ships decreased by 75%. In addition to domestic pathogens, the source of the problem was the international economic situation, with the result that most shipyards in the world proceed with layoffs, availability, mergers, and shift work. Elefsis Shipyards decided not to follow these practices, estimating that the generalized crisis would not last more than 3 years.

In 2022, Elefsis Shipyards are burdened with obligations to the Greek State and the banks of the order of 450,000,000 euros. Through the judicially ratified settlement agreement, these liabilities are expected to be reduced to the level of 250 million and their repayment will be made in the long run (up to 100 annual installments). The consolidation business plan drawn up by ONEX includes investments of € 200 million over a 10-year period. At the same time, the creation of more than 2000 jobs and multiple benefits for the economy with indirect GNP growth of 0.5% is envisaged.

Revenues for the Greek State over a 10-year period are expected to exceed 500,000,000 euros and for insurance funds 300,000.0000 euro.

It is worth mentioning that the commercial part of the shipyard is already considered secured by the surplus customer force of ONEX, which can no longer be served by the shipyards of Syros (Neorion). With the completion of the investments, the company expects to carry out repairs on up to 150 vessels per year, while in terms of warship operations the goal is to build 2-3 ships per year, as well as to undertake repair work for the Navy and the 6th American Fleet.

10.7.4 Elefsis Shipyards Union

It is very important to note that the Board of Directors of the Elefsis Shipyards Workers' Union performed a vote, after a General Assembly that gathered almost 600 of the current employees, for the Rehabilitation Plan proposed by ONEX (see Appendix). The results were more than satisfactory, since almost 99% of the Union's employees voted in favor ONEX's plan.

As it was mentioned elsewhere, ONEX plans to maintain all currently occupied employees and almost double the labor force (1200 – 1500 permanent employees in total). It is estimated that a substantial amount of money (almost 25,000,000€ for the next 25-year period) will be spent in social security contributions, for both current and future employees.

10.8 Impacts on Technical Infrastructure

The planned activities of the Shipyards have a secured connection with the public service networks (electricity, water) and only in case of a significant increase of the activities some reinforcement or upgrade of the local infrastructure may be required.

The traffic increase during the Shipyards Operation will mainly burden the old National Road Athens – Corinth and, occasionally, A8 Elefsis - Megara - Corinth highway and Attiki odos (see also Chapter 4). The specifications of those roads are more than sufficient in order to accept the increase traffic load.

As it was mentioned in Chapter 3, although the internal road network is generally in good condition, a new comprehensive Traffic Impact Study (TIS) and/or a Traffic Impact Analyses (TIA) should be prepared by a competent traffic/transportation engineer.

The wastewater treatment plant within the borders of the facilities has been originally designed for treating up to 260m^3 of municipal wastewater, corresponding to 3,500 people (see also Chapter 3). Consequently, the capacity of the plant is more than sufficient for covering the needs of the future personnel (maximum 2,000 people) and no alterations or expansions are required (except of course the proper maintenance).

For industrial wastewater, there is no plan, at the moment, for an installation of a treatment plant within the borders of the Shipyards. All industrial wastewaters will be transferred to properly licensed facilities in the broader area. According to DWR records, there are at least 2 facilities capable of receiving those type of waste in West Attica, namely:

- Polyeco S.A.
- SUK Hellas Ltd.

In the future and in accordance with the Spatial Plan of the Local Municipality (see also Chapter 5), it will be investigated the possibility of Shipyards' connection with the domestic sewage network of the Municipality of Elefsis.

Finally, it considered essential the connection of the facility to the local fiber optic telecommunications network.

10.9 Cumulative Impacts

A cumulative impact is one deriving from combination or interaction with other impacts or chains of impacts from one or more individual projects within the same environmental system. In short, an impact is cumulative when, upon occurring within the same environmental compartment as other impact(s), the effects on that compartment are felt in conjunction. It is a combination of effects accumulating in the environment.

The main sources possible environmental degradation that may be cumulative with the Shipyards' impacts, in the area of influence of the Project, include the following installations (see also par. 5.6):

1. Private Sea Marine Services (Shipbuilding/Ship Repairing)
2. Hellenic Petroleum Industrial Site of Elefsis (Oil Refinery)
3. Halyvourgiki Hellenic Steel Industry S.A (Steel Indusrty)
4. Small Ship Repairing Facility (Ship Repairing)
5. Titan Cement Co. (Cement Industry)
6. Merkan (Sea Transports)
7. Olympia Odos Motorway

The possible negative cumulative impacts for the current Project (both C/R and Operation Phase) mainly refer to the following sectors:

- Air quality/Climatic and bioclimatic characteristics
- Soil characteristics
- Terrestrial environment/biodiversity
- Marine environment
- Noise & vibrations
- Groundwaters

The possible positive cumulative impacts for the current Project mainly refer to local economy and national economy. Positive impacts include the ability to recruit construction workers for future projects as a partial solution to retrenchment, and increased use of local goods and services (including labor).

10.10 Impacts on Air Quality

10.10.1 General

As it was analyzed in Chapter 9, numerous sources of air pollutants are expected during Shipyards Operational Phase. Those sources are direct (i.e., related to the production process itself) but also indirect (i.e., related to vehicles and ship movement, boilers functioning etc.).

The use of primers, paints, coatings, abrasive blasting, etc., may result in generation of particulate matter and dust. Conventional primers and paints contain solvents and pigments with heavy metals. Many solvents contain volatile organic compounds (VOCs) and/or Hazardous Air Pollutants (HAPs) which are known to cause cancer. Similarly coating application processes produce overspray which can contain heavy metals, particulate, and volatiles. Abrasive blasting can generate large quantities of dust containing high levels of toxic air contaminants, and potential exposure to dust and air contaminants is a primary health hazard.

10.10.2 E-PRTR & VOCs Data

A source of information about the anticipated air pollutants concentration could be the latest annual report for the European Pollutant Release and Transfer Register (E-PRTR), submitted by the Shipyards' administration in years of actual operation of the site (2014 - 2016).

According to Regulation (EC) No 166/2006 of the European Parliament and of The Council of 18 January 2006 "concerning the establishment of a European Pollutant

Release and Transfer Register and amending Council Directives 91/689/EEC and 96/61/EC", the operator of each facility that undertakes one or more of the activities specified in Annex I above the applicable capacity thresholds specified therein shall report the amounts annually to its competent authority, along with an indication of whether the information is based on measurement, calculation or estimation.

Indeed, the Shipyards' activities fall within the scope of the abovementioned Directive and are included in the activities mentioned at in Annex I: No 8(e): *Installations for the building of, and painting or removal of paint from ships, with a capacity for ships 100m long*.

The annual E-PRTR Reports for the years 2014 and 2016 were available from the Shipyards' Administration. Those reports are presented in the Appendix. According to those reports, there are no exceedances of the threshold limits.

However, those results have been recorded during limited operation of the Unit. Actual values, considering full operative capacity of the Shipyards, are expected higher.

Another source of information about the expected pollutants release is the solvents and paintings consumption reports (2013 & 2017) submitted by the Shipyards' Administration to YPEN, in the context of the JMD 11641/1942/2002 (OG 832 B / 2-7-2002) to comply with the provisions of Council Directive 1999/13/EC of 11 March 1999 of the European Communities "on the limitation of volatile organic emissions compounds (VOCs) due to the use of organic solvents in certain activities and facilities". Those reports are presented in the Appendix. However, as noted for the E-PRTR reports, quantities of solvents and paintings used may be underestimated, due to the lowered actual operation of the site.

10.10.3 Evaluation according to Emission Factors

Hereinafter, an estimation of the possible burdening of the atmosphere with pollutants is taking place, by utilizing Emission Factors (EFs) provided mainly by EEA and US EPA databases and the relevant literature [EEA, 2019, EPA 2005c, EPA, 2021]. The quantification of the air pollutants mass emitted is based on the selection of certain activities related to the Shipbuilding industry (e.g., surface treatment) for which emission factors are available.

For purposes of calculating the anticipated emissions, the emission factors are illustrated at Table 10.2. Note that the EFs refer to the worst-case scenario, i.e., no mitigation measures are implemented.

Table 10.2: Emission Factors for specific Shipyard processes

Type of Process	VOCs	PM_{10}	$PM_{2.5}$	TSP
Sandblasting/Abrasive Blasting	-	13 kg/tn*	1.3 kg/tn	27.0 kg/tn
Welding	-	27.5 kg/tn	23.9 kg/tn	45.1 kg/tn
Surface Treatment/ Painting	0.75 kg/tn	0.08 kg/tn	0.04 kg/tn	0.15 kg/tn
Metal Grinding	0.017 kg/m^{2}**	0.03 kg/m^{2}	0.01 kg/m^{2}	0.05 kg/m^{2}

*Units: Kg/tn of product (e.g., sandblast, paint etc., used)

** Units kg/m^{2} of shipbuilding/repairing area

When calculating the final emissions, the following assumptions are made:

1. Use of sandblast material (slag) 3,600 tn/year (according to full operation data – see Chapter 9)
2. Use of welding items 23,900 tn/year year (according to full operation data – see Chapter 9)
3. Use of paintings is estimated at 178tn (according to full operation data – see Chapter 9)
4. The surface of shipbuilding/repairing area is estimated at 250.000m^{2} (increased in relation to the surface provided in VOCs Reports – See Appendix).

Results (in annual basis) are presented in Table 10.3.

Table 10.3: Estimated annual air emissions (in tn) for certain Shipyards' processes and specific pollutants

Type of Process	VOCs	PM_{10}	$PM_{2.5}$	TSP
Sandblasting/Abrasive Blasting	-	46.8	4.68	97.2
Welding	-	657.3	571.2	1078.0
Surface Treatment/ Painting	133.5	14.2	7.1	26.7
Metal Grinding	4.3	7.5	2.5	12.5
SUM	**137.8**	**725.8**	**585.2**	**1214.4**

10.11 Impacts from Noise & Vibrations

An analysis of the noise impacts is presented below:

- The effects from the operation of the Shipyards on the acoustic environment are characterized as typical for the type and scale of the project and not important for the residential environment of the area, due to the long distance from settlements and other sensitive features of the anthropogenic environment (schools, care units, etc. see also Chapter 5).
- The effects due to noise from the daily activities of the project will not be significant, except in the area immediately adjacent to the occupation zone of the site.
- Any increase in noise levels due to the works will be limited in time and fully reversible after the completion of the works.

Lately, there is a growing focus on the potential implications from hydro-acoustic noise pollution generated by ships. However, this particular form of pollution and its adverse effects on the marine environment is not well understood, and the impacts can be very hard to detect. It is consequently an issue that shipbuilders and shipowners are probably largely unaware of. It is also considered to be an area in which legislation would be hard to introduce, let alone establish voluntary codes of conduct [US EPA, 2022].

A number of measures will be taken to minimize the effects of noise, which are further analyzed in the next Chapter

10.12 Impacts related to Electromagnetic Fields

Based on the processes involved in shipbuilding, ship repairing, and the other functions described in Chapter 9, no electromagnetic fields are created and thus no impacts are expected.

10.13 Impacts on Water Resources

The main threats for terrestrial waters (both surface and groundwater) and seawater are summarized as follows, based on the production of waste (liquid, solid and airborne) analyzed in the previous Chapter:

10.13.1 Urban waste from land & ships (Black & Grey Water) and land facilities

Urban wastewater from land activities and buildings are directly led to the Shipyards' wastewater plant. Urban wastewater from ships come from a variety of activities that take place on vessels (toilets, laundries, restaurants, cleaning, etc.). Blackwater is used to describe spills from sewage that originates from wastewater sources such as toilets and medical facilities. Greywater is non-sewage wastewater (and thus from lower risk sources) such as sinks, showers and laundry and cleaning activities [Copeland, 2008, OECD, 2010]. Because these wastewater streams are proportional to the number of people on ships, black and greywater management is a particular challenge for cruise and other passenger ships.

Blackwater sewage can, if untreated or inadequately treated, contain harmful bacteria, pathogens, viruses, and intestinal parasites. If discharged, this can cause bacterial and viral contamination of fisheries and shellfish beds and elevate public health risk from those food sources [Copeland, 2008]. Estimates put the amount of blackwater generated on cruise ships with a capacity of 2-3 000 passengers and crew members to between 100 000 and 115 000 lit/day [OECD, 2010].

Greywater constitutes by far the largest source of liquid waste generated by cruise and passenger ships, and like blackwater, can contain a number of polluting substances, including bacteria, detergents, oil and grease, metals, organics, petroleum hydrocarbons, nutrients, food waste, and medical and dental waste [Copeland, 2008, OECD, 2010]. Levels of pollutants in greywater may sometimes even exceed those found in untreated domestic wastewater [EPA, 2008b].

10.13.2 Liquid waste from ships (Bilge & Ballast Water)

As it was mentioned in the previous Chapter, they may include ship ballast, oil tanker cargo tank washes, petroleum mixtures of engine rooms, heavy oil residues, cargo tank and hull washes and hazardous chemicals in bulk or mixtures or ballast containing such substances. All those wastes, if not properly managed or in case of an accidental release onto land or sea may severely contaminate water resources.

Bilge water, comes from a number of different sources, including rainwater, seawater, and wastewater from the ships sewage system. Oil, fuel, antifreeze and other potential pollutants originating from the ships'engines, piping and fittings, and other operational machinery also often find their way to the bilge through leaks, condensation, evaporation and washdowns. The result of this collection of fluids is therefore a mixture containing water, oily fluids, lubricants, cleaning fluids, and other similar liquid waste forms. Due to their larger number of waste streams, bilge water accumulated on larger vessels can also contain, among other things, waste oil, fuel oil sludge, and cylinder oil [EPA, 2008b, OECD, 2010].

Because of the many polluting and toxic substances contained in bilge water, the discharge of untreated bilge water can cause significant harm to both fish and wildlife. If ingested, it may also pose health risk to people. Given the large scale of dumping of untreated bilge water, there are indications that the environmental damage from this source could even be worse than the damage caused by accidental oil spills [ENS, 2009].

Ballast Water (see also Chapter 9): One of the main concerns regarding intentional spills in shipping is the discharge of ballast water. Ballast water is used by larger vessels, such as tankers and bulk cargo ships, to maintain operational stability when these are operating empty or when carrying small loads. For example, after an oil tanker unloads its cargo, it will then fill its tanks with ballast water to ensure stability on the return trip. Before arriving at the next loading port, the tanker dumps the ballast to make room for its new cargo. Because the ballast water uses the same tanks as those used for transporting oil, it is typically referred to as dirty or "unsegregated" ballast water.

However, there are other environmental problems with the discharge of ballast water than those associated with oil and water mixtures from unsegregated ballast tanks. Dedicated tanks or not, ballast water also typically contains a variety of biological material, including plants, animals, viruses and bacteria. Every year, up to 10-12 billion tons of salt water is "moved" this way [EMEC, 2009], and the discharge of ballast water is thus a large-scale means of transporting non-native species to new environments.

New ship designs are currently being explored and tested with the aim of eliminating the conventional form of ballast-tanks, with consequent potential benefits to the environment [IMO, 2021]. This could provide some opportunities for innovative ship designs that would efficiently and economically deal with ballast water in compliance with the BWM Convention.

10.13.3 Petroleum waste leakage/oil spills

Shipping is the single largest source of oil and fuel spills into the oceans, representing almost 70% of the world 's total [Renilson, 2005, OECD, 2010]. Oil and fuel spills can occur either by accident or by intent. Accidental spillage can occur through accidents involving ships, during fueling operations, or during the loading and unloading of cargo. Intentional spillage typically occurs through some form of —operational dumping.

Contrary to public belief, roughly two thirds of all oil and fuel spills in shipping are caused not by accident but by operational dumping [Renilson, 2005] mainly through the discharge of bilge water.

The most known form of oil spill, and for which there are available statistics, are those that happen by accident. Spills of this kind are typically caused by ship collisions, onboard fires and explosions, or ship wreckage. The largest such oil spill ever to take place was in 1979 when the 288 000 DWT oil tanker —Atlantic Empress collided with another large ship in the Caribbean Sea. The Atlantic Empress eventually sank after burning for 14 days and led to the spill of 287 000 metric tons of oil (ITOPF, 2022).

The environmental impact of oil spills can be nothing short of devastating. The magnitude of the impact nonetheless depends crucially on the amount and type of oil that is spilled, the location of the spill, the time of the year, as well as on local sea and weather conditions [OECD, 2010]. The same variables also typically play a large role in how effective clean-up efforts will be, and thus the chances of minimizing the risk of lasting environmental impact. For this reason, major spills can sometimes be less damaging than smaller spills. Regardless, oil spills always cause extensive short-term damage to the environment. These effects typically include large-scale deaths of sea creatures as well as the poisoning and death of birds, mammals, reptiles and amphibians, if the oil reaches the shore. In the long run, oil spills may also contaminate or destroy the sensitive marine and coastal substrate. This can alter the food chain, interrupt the breeding process of animals, and lead to lasting changes, or disappearance, in population species. Oil spills can therefore also have severe long-term impacts on deep-ocean and coastal fishing, as well as on sea tourism.

10.13.4 Reef colors dissolution/Antifouling paints

For most of its life a ship is partly submerged in water, and as all other objects subjected to water in a marine environment, over long periods of time, ship hulls are prone to colonization by marine organisms and micro-organisms, such as algae, barnacles and mussels. This colonization, known as fouling, can cause increased drag on the hull and lead to increased fuel consumption. If not attended to, fouling can even lower the ship's maneuverability or cause damage to the hull. To prevent this from happening ship hulls are treated with anti-fouling materials which work to impede the build-up of marine organisms.

Some estimates suggest that the shipping industry saves substantial amounts of fuel by the use of antifouling coatings, thus leading to lower CO_2, SO_2 and NOx emissions [WBCSD, 2008]. However, to be effective, the anti-fouling paints usually contain a biocide, or toxin, which is designed to leach slowly into the marine environment to poison and stop marine organisms from settling. This process makes anti-fouling paints a source of significant environmental hazard.

One of the most popular anti-fouling paints was developed in the 1960s with the use of organotin compounds called tributyltin (TBT) and triphenyltin (TPT). These anti-fouling materials are highly toxic to marine life, and numerous studies have showed that organotin compounds can persist in water environments and sediments, leading to death and deformities across a variety of sea life including larvae, mussels, oysters and fish [WWF, 2006].

Apart from such direct harm, the compounds can also lead to significant damages in marine ecosystems as they enter into the wider food chain through bioaccumulation, which eventually can reach humans. Studies have also shown that organotin compounds are toxic in marine environments even at extremely low concentrations, and that they interfere with biological processes in a diverse range of species. Organotin also accumulates in whales and other sea mammals and disrupts the endocrine system of a range of invertebrates leading to sterility and death [WWF, 2006].

The environmental hazards associated with TBT and other organotin compounds have been known for many years, but countries have been slow to move towards a ban. The ban of organotin anti-foulants was first introduced in the EU, the US, and Japan in the

1980s for small vessels (below 25 meters) and several alternative anti-fouling paints have since become available. These initial bans were followed by the entry into force in September 2008 of the International Maritime Organization's (IMO) Convention on the Control of Harmful Antifouling Systems for Ships. Parties to this Convention agree to completely prohibit the use of organotin compounds, and to refuse entry into port to any ship painted with TBT.

It should be noted that, according to UNEP(DEPI)/MED WG.443/15. 2017. Draft Decision: Guidelines for Regulating the Dumping of Dredged Materials at Sea and the respective Italian, French and Spanish Regulations (see also Chapter 2), the TBT limit on sediments that may be safely dumped at sea is as low as 0,05 – 0,10 mg/Kg.

10.13.5 Rainwater runoff

Runoffs from the inland facilities of the Shipyards may pose a significant threat to both soil and water resources, especially seawater. Those streams may carry away significant quantities of pollutants, including petroleum and other type od solid and liquid waste.

Despite the fact that the drainage system of the Shipyard is considered adequate for managing the rainwater and storm water runoff, there is no adequate protection for the runoff end-up at sea. Two unground tanks for collection of oily waste are situated in the facilities for gathering polluted runoffs, mainly from areas that petroleum containing leachates may produced (petroleum waste storage area, warehouses etc. – see also Chapter 3). Nevertheless, there are no oil or grease separators for restrain the respective hazardous substances before entering seawater.

In this direction, in the next Chapter, the positioning of appropriate separators is proposed so as the seawater is fully protected from any contaminated runoff.

10.13.6 Processes of industrial wastewater management on site/Production wastewater

At the time, there is no industrial wastewater management facility within the boundaries of the Shipyard. Industrial wastewater is directly pumped on tanker vehicles and transported to properly licensed facilities for further treatment. There is always a hazard for accidental leakage of those wastewaters that may pose threat to both water and soil quality. That possibility may be eliminated implementing the measures described in Chapters 11 and 12.

As it was mentioned before (Chapter 9), many types of HW and NHW, derived from shipbuilding and ship repairing activities, may end-up on water bodies. Such spills may severely endanger the quality of seawater and the environment in general. The appropriate management methods for dealing with those waste streams is described in the following Chapters.

10.14 Natural - Anthropogenic Disasters

The Shipyards activities do not fall within the scope of application of the Directive 2012/18/EU "On the control of major-accident hazards involving dangerous substances" (SEVESO Directive) as incorporated in the Greek Law by JMD 172058/2016 "Defining rules, measures and conditions for treatment risk of large-scale accidents in facilities or units, due to the existence dangerous substances". Nevertheless, due to the magnitude of the project, the expected effects arising from the project's vulnerability to accidents or disasters are hereinafter being considered.

The revised Directive 2014/52/EU entered into force on 16 May 2017 and incorporated in the Greek Legislation with the JMD No. 1915 (OG 304/B/2018). The Directive states the need to assess the "expected significant negative impacts" of a project on the environment resulting from the project's vulnerability to risks of major accidents and / or natural disasters related to the project.

The main purpose of the current evaluation is to ensure that appropriate precautionary measures are taken, since the project under study is vulnerable to serious accidents and/or natural disasters with significant adverse effects on the environment.

The Vulnerability of a shipbuilding activity to serious accidents and/or disasters is a function of the impact, which can be described by sensitivity and exposure.

Sensitivity is defined by the degree to which an activity is affected by accidents and/or disasters.

Exposure is defined by the degree to which an activity is exposed or expected to be exposed to a serious accident or natural disaster. When at least one of the two conditions (sensitivity, exposure) is equal to zero, then there is no impact and consequently no vulnerability to serious accidents and/or disasters.

Adaptability is defined by the ability of a shipbuilding business to adapt, by its resilience to serious accidents and or disasters (autonomous adaptation), and by the effectiveness of measures taken to protect the activity from such phenomena. Vulnerability is defined as the degree to which an activity is vulnerable, or unable to cope with the adverse effects of related accidents or disasters. The greater the impact the greater the vulnerability of the activity, while the greater the adaptability the lower the vulnerability. The relationship between these terms is expressed by the following equation:

Vulnerability = Impact - Adaptability

Impact = Sensitivity x Exposure

The vulnerability of the activity is then assessed considering the above relationships and the criteria described below. Note that, in order for impact and adaptability to be assessed on the same scale, the square root of Impact (= Sensitivity x Exposure) is taken used.

Criteria taken into account in the evaluation:

- The existence of a truly affected sector/impact recipient.
- Human health and cultural heritage.
- The existence of a real route of transmission of the impact to the recipient.
- The potential for the impact to cause significant damage.

They are not taken into account in the evaluation:

- Accidents at work as related issues are addressed by relevant rules of safety and hygiene of employees.
- Events with low probability of occurrence and low impact.
- Local, transient, and reversible events.

In Table 10.4, grades of sensitivity, exposure, adaptation and finally vulnerability are categorized. In Table 10.5, the vulnerability of the project under study is evaluated.

Table 10.4: Categorization of grades of sensitivity, exposure, adaptation and vulnerability

Grade of sensitivity, exposure and adaption ability
Zero = 0
Low = 1
Low to Moderate = 2
Moderate = 3
Moderate to High = 4
High = 5
High to Very High = 6
Very High = 7
Grade of vulnerability
0 > Low ≥ 1
1 > Low to Moderate ≥ 2
2 > Moderate ≥ 3
3 > Moderate to High ≥ 4
4 > High ≥ 5
5 > High to Very High

Table 10.5: Vulnerability of the project to certain types of Disaster

Type of Natural Disaster	Impact		Adaptation ability	Vulnerability	Possible cause	Impacts	Explanation
	Sensitivity	Exposure					
Flood	2	2	3	ZERO (-1)	- Absence of flood protection in combination with the appearance of intense flood phenomena and extreme rainfall	- Soil pollution - Pollution of surface water and marine environment - Groundwater pollution - Impact on the structured environment - Human health	The activity is not part of any river basin and is not near rivers, streams etc., that led to flood events. They do not exist relevant reports for the area.
Sea level rise	4	4	3	LOW (1)	- Occurrence of floods phenomena - Eustatism	- Soil pollution - Pollution of surface water and marine environment - Groundwater pollution - Impact on the structured environment - Human health	Generally, sea level rise can be critical in the long-term as the quay walls have a fixed altitude and as the water level increase there is a bigger one flood risk. The so far recorded sea rise lever for the last 140 years is about 25 cm. At this rate there are not expected to be immediate impact on the activity The potential impact will not cause significant damage.

Earthquakes	4	3	4	ZERO (-0.54)	- Seismic episodes that do not covered by seismic protection of infrastructure	- Soil pollution - Pollution of surface water and marine environment - Groundwater pollution - Impact on the structured environment - Human health	Significant earthquakes are able to cause failure on the port project and on buildings installations. The environmental effects are related to the disposal/acquisition of materials and emissions in the context of its restoration. The potential impact will not cause permanent/significant damage in the specific environmental sectors. The measures adjustments include the implementation of the seismic regulation.
Storms	2	2	3	ZERO (-1)	- High intensity wind - Extremely high levels of rain - Many electric evacuations - Hail - Frost	- Release of gases into the atmosphere - Soil pollution from combustion residues and fire water - Groundwater pollution - Impact on the structured environment	There is no relevant history in the area of activity. The potential impact will not cause permanent/significant damage in any environmental sector.
Extreme temperatures	1	1	1	ZERO (0)	- Very high temperatures - Very low temperatures	- Impact on the structured environment	There is no relevant history in the area of activity. The potential impact will not cause permanent/significant damage in any environmental sector.

Subsidence	0	0	0	ZERO (0)	- Accompanying phenomenon - Territorial failure	- Soil pollution - Pollution of surface water and marine environment - Groundwater pollution - Impact on the structured environment	No effects from subsidence are expected in the activity area.
Landslide	0	0	0	ZERO (0)	- Accompanying phenomenon - Territorial failure	- Soil pollution - Pollution of surface water and marine environment - Groundwater pollution - Impact on the structured environment	No effects from landslide are expected in the activity area.
Fire	5	5	3	MODERATE (2)	- Failure in the production process of the installation - Failure in the production process of the neighboring facilities - Failure in the production process of the installation - Fire due to damage of high voltage conductors - Terrorism - sabotage	- Release of hazardous combustion gases - Soil pollution from combustion residues and fire water - Damages - Human health - Loss of forest area - Loss of flora and fauna species - Loss of agricultural land - Impact on the structured environment - Charge of atmosphere	Incident with fire in boat in port facilities or on the land facilities, apart from destruction of mater assets would have adverse effects on the atmospheric and marine environment. For this purpose, there is ensuring for the proper operation, use and maintenance of the safety and firefighting systems/equipment. The potential impact will not cause permanent/significant damage.

Tidal wave	4	4	2	MODERATE (2)	- Accompanying phenomenon - Territorial failure	- Soil pollution - Pollution of surface water and marine environment - Groundwater pollution - Impact on the structured environment	A related event would have primary (loss of material assets) and secondary consequences (marine pollution). Relevant risks have been taken into account in the design of the port project. Adjustment measures are limited. The potential impact will not cause permanent/significant damage.
Accident due to storage/handling of hazardous materials	3	3	4	ZERO (-1)	- Equipment failure - Incomplete maintenance of equipment - Employee error - Improper operation of the equipment - Seismic event facts - Leakage - Ignition	- Soil pollution - Pollution of surface water - Groundwater pollution	The main activity is not related to handling or storage of hazardous cargos. The only potentially dangerous substances in installation relate to ancillary first materials of the activity for the needs of the project.
Border with SEVEZO III facilities	5	5	2	MODERATE (3)	- Equipment failure - Incomplete maintenance of equipment - Employee error - Improper operation of the equipment	- Soil pollution - Pollution of surface water - Groundwater pollution - Impact on the structured environment	The nearest SEVEZO installation (Oil Refineries) is located at a distance of 500m from the facility so may increase the vulnerability in environmental risks of the facility under study. A type SEVEZO accident would expose the staff at risk with significant effects on its health. Environmental impacts could occur.

10.15 Health and Safety Risks

Ship repairing and maintenance requires a safe and healthy work environment. The potential impacts associated with shipyard operations include but are not limited to the following:

- Fall and trip hazards while boarding vessels for repair activities or structural failure of ladder or gangway
- Causing the worker to fall or workers getting struck by a moving cargo or material loads
- Fall from heights during works involving spray painting, blasting, steel-works repairs etc.
- Fire hazards due to leakages of flammable gases from faulty valves and cylinders
- Working in confined spaces can lead to hazards such as inadequate supply of air and lighting
- Toxic gases and metal fumes produced from hot works and its applications
- Potential injuries (particularly to eyes) during water jetting and cleaning that is used to dislodge surface particles
- Exposure to high noise levels, although for short term
- Workers such as painters, mechanics, electricians, welders, cutters, pipe fitters, etc. are all at risk of disturbing ACMs and so could potentially be exposed to asbestos fibers.

All the above hazards are confronted through the OHS plan described in the Chapter 15.

10.16 Impact Assessment in Tabular Form

In this section, the potential impacts that Operational phase of the project may have on the natural and anthropogenic sub-sectors are assessed in tabular form. That illustration focuses mainly on the following environmental impact properties:

- Probability of occurrence
- Extent, with reference to the geographical area and / or the size of the affected population
- Intensity, with reference to the magnitude of the change
- Characteristic times (duration, repetition)
- Possibilities of prevention, avoidance, reversal or minimization
- Collaborative or cumulative action with other effects from the project itself or from other projects or activities that have been developed or planned in the area.

The following color scale is used to display the different environmental impact properties:

Propability of occurrence
Not Possible 0
Low Possibility 1
Large Possibility 2

Direction
Positive Direction: +
Negative Direction: -
Neutral: 0

Intensity
Weak Effects 0
Medium Effects 1
Strong Effects 2

Magnitude
Small 1
Large 2

Timescale
Short Term 1
Medium Term 2
Long term 3

Reversibility
Completely Reversable 0
Partially Reversable 1
Not Reversable 2

Collabotation/Cumulativity

No Collaboration 0

Collaboration 1

Potential Impact Sector – Operational Phase	Propability of occurrence	Direction - Intensity	Magnitude	Timescale	Reversibility	Collabotation
Climatic and bioclimatic characteristics	1	-1	1	1	0	1
Morphological and landscape features	1	0	0	0	1	0
Geological/tectonic characteristics	0	0	0	0	0	0
Soil characteristics	1	-1	2	1	1	1
Terrestrial environment/Biodiversity	1	-1	2	1	1	1
Marine environment	2	-2	2	2	2	1
Protected areas	0	0	0	0	0	0
Spatial planning - land uses	0	+1	0	0	0	1
Structure and functions of the anthropogenic environment	0	+1	0	0	0	1
Cultural heritage	0	0	0	0	0	0
Affected population	0	+1	1	2	0	0
Local economy	2	+2	2	2	2	2
Indigenous people	0	0	0	0	0	0
Involuntary ressetelement	0	0	0	0	0	0
Technical infrastructure	0	0	0	0	0	0
Correlation with other anthropogenic impacts/pressures	1	-1	1	1	1	1
Air quality	2	-2	2	2	2	1
Noise & vibrations	1	-1	1	1	1	1
Electromagnetic fields	0	0	0	0	0	0
Terrestrial surface waters	1	-1	1	1	1	1
Groundwaters	1	-1	1	1	1	1
Sea water	2	-2	2	2	2	1

11. ENVIRONMENTAL & SOCIAL IMPACTS MITIGATION MEASURES FOR OPERATIONAL PHASE

11.1 General

In this Chapter, after a combined review of the elements of the current state of the environment (natural and social) and the project under consideration, an assessment and evaluation of the potential significant impacts expected from Operational phase (as described in the previous Chapter) is conducted.

11.2 Climatic – Bioclimatic Characteristics

No impact of the operational phase of the Project on the climatic and bioclimatic characteristics of the study area is expected. Therefore, it is not proposed to take specific immediate measures beyond the general ones related to the reduction of energy consumption and the more efficient use of energy.

On the other hand, there are some specific strategies/measures that the new owner may implement so as the future operation can contribute positively to the climate change phenomenon, through reduction of greenhouse emissions:

- Green energy production from a photovoltaic station in the broader area and installation of solar panels on the roofs of the buildings of Shipyards or in free spaces within the existing facilities
- All new infrastructure, buildings and facilities added in the future, should be energy efficient and of low energy consumption
- Replacing conventional Shipyards' vehicles (using diesel) with electric ones
- Providing electricity to ships, thus avoiding the use of their machines during their mooring in the Shipyards.

11.3 Impacts on morphological and landscape features

As it was analyzed in par. 10.3, no significant impacts are expected to morphological (both coastal & terrestrial) and landscape features of the immediate or the broader area, especially after the removal of the existing waste from Shipyards facilities.

The formation of slag or other waste large piles, especially in open spaces must be avoided. The appropriate synchronization of works must be achieved, so that the at least the bulk of waste can immediately be transported to a properly licensed facility, outside the boundaries of the Shipyard.

11.4 Impacts related to geological, tectonic and soil characteristics

11.4.1 Geological / Tectonic Characteristics

No impact of the operational phase of the Project on the geological or tectonic characteristics of the study area is expected. Therefore, it is not proposed to take any specific immediate measures.

11.4.2 Soil

As it was mentioned in par. 10.4.2, soil is vulnerable especially with respect to insufficient waste management and/or accidents related to waste leakage and disposal. Many of the mitigation measures are falling within the scope of the proper waste management in general and obviously also apply to other environmental and social sections.

In this context, the following mitigation measures are proposed:

- During ships docking, after the completion of the ship repair works and before the filling of the tanks with seawater, all the solid waste that has arisen should be removed from the tanks and the interior of the ships.

- During ships docking, the surfaces and the floors of the tanks should be cleaned at regular intervals and the resulting waste should collected in appropriate means and managed.
- In case of repair work on ships that have cargo tanks (e.g., tankers, L.P.G, O.B.O. etc.), these ships must be cargo free and have a Certificate of Exemption of Gaseous Gases (GAS FREE entry).
- Material used in shipbuilding/repairing (paints, solvents, coatings, varnishes, etc.) must not be discarded on the ground.
- All waste generated during the repair works should be delivered to the properly licensed collectors for further management
- Hazardous waste contaminated with residues of used paints, solvents, coatings, varnishes or other materials (e.g., empty paint containers, absorbent materials, fabrics, etc.), under the responsibility of the ship, will be collected separately. Their handling and temporary storage should take place according to materials safety data sheets (MSDS) and they will be disposed of as hazardous waste, in accordance with the provisions of JM 13588/725/2006 (OG 383/B/ 2006), through deliverance to a properly licensed company.
- Bulk materials should not be stored outdoors and temporary storage of raw materials and equipment (including metal parts for repair or resale) may be allowed in a designated area upon approval by the Operator of the Shipyards
- The Ship Waste Collection & Management Plan (SWCMP - approved by Ministry of Maritime Affairs & Insular Policy) should be implemented at all times.
- Ship solid waste will be collected in appropriate means (e.g., wheeled bins, bins-containers, garbage trucks, vessels, etc.) as specified each time in the approved SWCMP (see Chapter 12). The collection means will be received directly from the ships or will remain at the piers until the completion of the delivery of the waste from the ships and will be collected for transport and final management by an authorized contractor. At all stages of waste collection and transport care must be taken to avoid any pollution on land and sea.

- Petroleum waste will be collected directly from ships in tank vehicles and will be sent for pre-treatment and separation to a properly licensed facility.
- In cases where the solid non-hazardous waste of ships is collected by floating means (barge, etc.) there will be a designated space, within the facilities, for the transfer of waste from the floating means to land (e.g., garbage truck,) for transport to final disposal and/or to recycling facilities.
- All non-hazardous solid waste is collected, separated from the HW and delivered to a contractor, who must have a permit for the collection and transport of NHW waste. If this waste is delivered for disposal or recovery within the country, the AET of the final recipient must include the specific EWC codes for waste receipt and management/recovery.
- Under no circumstances, a pile of NW municipal waste should be created. All municipal waste should be collected in bins and, as soon as possible, transferred by to the proper facilities with responsibility of the local Municipality.
- Waste falling under the scope of Alternative Management (e.g., used batteries, tires, packaging etc., see Chapter 2), should be managed according to the provisions of the relevant legislation and under the supervision of the PROs.
- Hazardous waste should be collected and delivered by a contractor, who must have a permit for collection and transport of hazardous waste and a contract with the facility that will receive those waste (see also Chapter 2 for HW management legislation). If this waste is delivered for disposal or recovery within the country, the AET of the final recipient must include the specific EWC codes for waste receipt and management/recovery.
- Collection, transfer and, where appropriate, waste management operations must be carried out by properly and adequately equipped means of transport which must hold the permits and certifications required by applicable law (see Chapter 2).
- The use of oils containing polychlorinated biphenyls or triphenyls (PCBs or PCTs) is strictly prohibited.

11.5 Natural Environment

11.5.1 Terrestrial Environment

All the mitigation measures referred to soil protection (see par. 11.4.2), are also applicable for the protection of terrestrial environment. Additionally, in the context of the implementation of a relevant study of phyto-technical configurations for the entire area of the Shipyards, planting as well as the formation of urban green points, at the open spaces within the boundaries of the facility, is estimated to be an attraction for species of fauna (especially birds) of wider area and will improve to some extent the characteristics of the terrestrial natural environment.

11.5.2 Marine Environment

During the operation phase of all existing and planned facilities and infrastructure, within the Shipyards zone, the measures proposed in section 11.13 concerning the protection of water resources should be applied. Additionally, the following measures are proposed:

General Measures

- Control and monitor of the individual environmental parameters, related to the quality of the marine environment, through the implementation of the Environmental Monitoring Program (see detailed data in Chapter 12), in order to take appropriate and on time measures in case of there is an increasing trend on pollutants concentrations.
- In case of a marine pollution incident due to maintenance work during the operation of the project, the measures and procedures provided in the approved «*Plan for treatment of marine pollution from petroleum and other harmful substances*" (See Chapter 12) will be implemented immediately.
- For the entire maritime Shipyards zone, all the necessary technical means and equipment for dealing with oil pollution emergencies (floating dams, absorbent-dispersing substances, etc.) should be always available.

- All land facilities of the Shipyards must be kept as clean as possible from petroleum and/or other harmful substances, to avoid incidents of transport from any polluted runoff to the marine environment. For that purpose, it is important to install appropriate separators so as the seawater is fully protected from any contaminated runoff. More specifically, rainwater drainage in the land area should take place in open pipes, which will be covered on the work surface with grids and will be connected to a sedimentation tank. Before the runoff is discharged to the sea, oil/grease and sand separators should be installed at the outlet of the runoff system. The sludge that will settle in this tank and the materials collected by the separators should be treated as hazardous waste, under the following EWC Codes:
    - 13 05 01* solids from grit chambers and oil/water separators
    - 13 05 02* sludges from oil/water separators
    - 13 05 03 *interceptor sludges
    - 13 05 06* oil from oil/water separators
    - 13 05 07* oily water from oil/water separators
- Care should be taken not to dispose of materials used in shipbuilding/repairing activities (paints, solvents, coatings, varnishes, etc.) at sea.
- Measures mentioned in the MSDSs of all used materials during the shipbuilding/repairing works should be implemented especially in case of leakage due to accident (accidental release), as well as for their general handling.
- All paint residues, leftovers etc. must be removed from the dock before flooding.
- Pollutants and environmentally harmful materials must be frequently removed from docks, especially materials which can be moved by the wind or be mixed up with stormwater/rainwater.

Coating/Painting Activities

- Provision of curtains/ shrouds with durable material and of sufficient height during painting
- Antifouling paint with biocides should be avoided.
- Use of alternative non-toxic coatings, such as silicone-based, epoxy, and other low-friction paints should be considered.
- During application of antifouling paint, provision of a bounded area should be made to avoid accidental spillage into the waters. Any spillage will be treated with a suitable absorbent which would be disposed as HW.
- During removal of antifouling paint, the wash water should be segregated from non-contaminated water. Direct washing of residues into the waters should be avoided.

Sandblasting/Abrasive Blasting

- Blasting residues (abrasive sand and paint flakes) will be cleaned up immediately after the sand/hydro blasting activities to avoid washing into the sea water.
- All wastewater from repair activities will be immediately pumped to tank vehicles for removal.
- Floating curtains should be used to isolate the sea area between the floating tanks and the pier when sandblasting takes place in a floating tank

11.5.3 Limit Values for Marine Environment Protection

Dredging Material/Dredging Spoils

The limit values on the basis of which the characterization, classification and consequent permissible practices of dredging management is performed according to European Regulations is illustrated Tables 11.1, 11.2 and 11.3. (See also Chapter 2 and 13).

Table 11.1: Pollutant limit values based on characterization of dredging according to the Spanish Regulations. (Concentrations refer to the non-coarse fraction of the precipitate i.e., less than 2 mm and expressed in dry matter).

Pollutant	N.A. A (Action level A) Limit for marine deposition in specific areas	N.A. B (Action level B) Limit for marine deposition in case biological tests are performed	N.A. C (Action level C) Limit for performing biological tests
Hg (mg/kg)	0,35	0,71	2,84
Cd (mg/kg)	1,20	2,40	9,60
Pb (mg/kg)	80	218	600
Cu (mg/kg)	70	168	675
Zn (mg/kg)	205	410	1640
Cr (mg/kg)	140	340	1000
Ni (mg/kg)	30	63	234
As (mg/kg)	35	70	280
Σ 7 PCBs (mg/kg) [28, 52, 101, 118, 138, 153 and 180]	0,05	0,18	0,54
Σ 9 PAHs (mg/kg) [Anthracene, Benzo(a)anthracene, Benzo(ghi)perylene, Benzo(a)pyrene, Chrysene, Fluoranthene, Indeno (1,2,3-cd)pyrene, Pyrene and Phenanthrene].	1,88	3,76	18,80
TBT (mg Sn/kg) (DBT and MBT)	0,05	0,20	1,0

- Category A: The concentration of all pollutants is below the level of action A.
- Category B: The concentration of all pollutants is below action level B or action level C (only if biological characterization is performed and the results indicate negative toxicity).
- Category C: The concentration of one or more pollutants is above action level C or action level B in case biological characterization is performed and the results indicate positive toxicity). This material may not be disposed of (freely) at sea and is subject to restriction (underwater structure), processing or land management.

Table 11.2: Pollutant limit values based on characterization of dredges according to the French Regulations (Concentrations refer to the non-coarse fraction of the precipitate i.e., less than 2 mm and expressed in dry matter)

Pollutant	Unit	N1	N2
TBT	μg/kg	100	400

Pollutant	Unit	N1	N2
PCB congener 28	μg/kg	5	10
PCB congener 52	μg/kg	5	10
PCB congener 101	μg/kg	10	20
PCB congener 118	μg/kg	10	20
PCB congener 138	μg/kg	20	40
PCB congener 153	μg/kg	20	40
PCB congener 180	μg/kg	10	20
Anthracene	μg/kg	85	590
Benzo[a]anthracene	μg/kg	260	930
Benzo[a]pyrene	μg/kg	430	1015
Benzo[b]fluoranthene	μg/kg	400	900
Benzo[k]fluoranthene	μg/kg	200	400
Benzo[g, h, i]perylene	μg/kg	1700	5650
Chrysene	μg/kg	380	1590
Indenopyrene	μg/kg	1700	5650
Phenantrene	μg/kg	240	870
Fluorene	μg/kg	20	280
Fluoranthene	μg/kg	600	2850
Naphtalene	μg/kg	160	1130
Pyrene	μg/kg	500	1500
Acenaphthylene	μg/kg	40	340
Acenaphthene	μg/kg	15	260
Dibenz[a,h]anthracene	μg/kg	60	160
Arsenic	μg/kg	25	50
Cadmium	μg/kg	1,2	2,4
Chromium	μg/kg	90	180
Copper	μg/kg	45	90
Mercury	μg/kg	0,4	0,8
Nickel	μg/kg	37	74
Lead	μg/kg	100	200
Zinc	μg/kg	276	552

- According to the provisions of the French Regulations, for the values of a parameter below level N1 the potential impact is considered in principle neutral or negligible, the levels being "normal" or comparable to the environmental background.
- Additional research may be required between level N1 and level N2 depending on the management choice and the degree to which level N1 is exceeded. Finally, exceeding the N2 level for any parameter requires additional research,

as, depending on the management options, significant environmental impacts may occur.

- It is noted that, even in case of exceedances of N2, the disposal of sediments at sea is not strictly prohibited. In each case, however, the number of exceedances found, the magnitude of exceedance, and the relevant toxicity of pollutants should be evaluated.

Table 11.3: Pollutant limit values based on characterization of dredges according to the French Regulations (Concentrations refer to the non-coarse fraction of the precipitate i.e., less than 2 mm and expressed in dry matter).

Pollutant	Unit	AL1	AL2
Arsenic	mg/kg	12	20
Cadmium	mg/kg	0,3	0,8
Chromium	mg/kg	50	150
Chromium (VI)	mg/kg	2	2
Copper	mg/kg	40	52
Mercury	mg/kg	0,3	0,8
Nickel	mg/kg	30	75
Lead	mg/kg	30	70
Zinc	mg/kg	100	150
Anthracene	μg/kg	24	245
Benzo [a] anthracene	μg/kg	75	500
Benzo [a]pyrene	μg/kg	30	100
Benzo[b] fluoranthene	μg/kg	40	500
Benzo [k] fluoranthene	μg/kg	20	500
Benzo[g,h,i]perylene	μg/kg	55	100
Crysene	μg/kg	108	846
Indenopyrene	μg/kg	70	100
Phenantrene	μg/kg	87	544
Fluorene	μg/kg	21	144
Fluoranthene	μg/kg	110	1494
Naphtalene	μg/kg	35	391
Pyrene	μg/kg	153	1398

There are two thresholds, AL1 and AL2, for each parameter under consideration (chemical element or priority substance according to 2008/105/EC), which have been selected with specially designed weighted criteria.

The classification of chemical levels is based on the development of chemical hazard ratios (HQCs), which take into account the importance of the pollutant, the number of priority elements/substances exceeding the AL1 and AL2 limits and the magnitude of these exceedances. The evaluation approach is based on the principle of "weight of evidence" and not "pass / fail". The final evaluation of the quality of the sediments, some of the priority substances of which exceed the AL1 level, is checked by a series of ecotoxicological tests. However, for exceeding the AL2 limit, free discharge into the sea is not permitted.

For marine water, the respective limit values are presented in par. 11.3.2.

11.6 Anthropogenic Environment

11.6.1 General

During the operation phase of the projects, the negative effects that may be caused on the anthropogenic environment are mainly related to the burden of the atmospheric and acoustic environment of the immediate and broader area, due to the increase of the existing levels of emitted pollutants and noise. The intensity and scale of these effects can be significantly mitigated if appropriate prevention, containment, and response measures are taken. Therefore, no specialized measures are proposed, other than those mentioned in paragraphs 11.10 and 11.11 and concerning mitigation of the effects on the atmospheric and acoustic environment, during the operation phase of the Shipyards.

11.6.2 Spatial planning - Land uses

The project under study is developed within the boundaries of the Port Zone of the Shipyards and during its operation, no effects are expected to the land uses and the spatial planning of the wider area. It is noted that due to the scale of the project, the planned land uses of the broader area (under the responsibility of the local Municipality) should consider the general functions, activities and services that will take place within the Shipyards Zone.

11.6.3 General provisions for the anthropogenic environment of the broader area

Hereinafter, the measures proposed to be taken to prevent and/or mitigate possible effects that may be caused by the operation of the Shipyards on the general functions of the man-made environment (as those described in previous chapters) of the broader area, are listed.

- Take the necessary hygiene and safety measures in the workplace, in order to prevent accidents and to reduce the consequences for the staff.
- Ensure the existence and operation of suitable and adequate sanitary facilities for the service of the public and the crews.
- Ensure the safe passage and the smooth mooring of ships from any restrictions during the operation of the Shipyards.
- Implement fire protection measures, to deal with any occurrence of fire from the operation of machinery and general electromechanical equipment that will be used during the individual activities within the Shipyards Zone.
- Possess an operative permanent firefighting network, approved by the relevant Fire Service, and adequate portable firefighting and fire safety equipment, in all infrastructure and facilities, to deal with emergencies that may cause serious accidents and environmental damage.
- The facilities should possess the appropriate light day and night signage, to avoid creating problems and/or accidents, according to the instructions of the Lighthouse Service of the Greek Navy.
- Provide all the appropriate lifesaving and protection means against maritime hazards. Those means should be regularly inspected for proper operation and undergo the necessary maintenance.

For dealing of traffic increase due to operation of the Shipyards, the mitigation measures proposed for C/R phase (par. 8.6.1) are also apply for Operational Phase. Once more, the need of a detailed Traffic Impact Study (TIS) and/or a Traffic Impact Analyses (TIA) should be prepared by a competent traffic/transportation engineer.

11.7 Socio-Economic Environment

According to the analysis performed in par. 10.7, the effects of the operation of the Shipyards on the socio-economic environment are characterized as positive, as it is estimated that there will be significant benefits for the local economy with the development of individual activities, but also to the national economy with improvement of relevant indices.

Therefore, no relevant measures are proposed to prevent, mitigate or limit the effects of the Shipyards to socio-economic environment of the broader area, other than those referred in sections 11.6, 11.8, 11.10 and 11.11 of the current Chapter, concerning the anthropogenic environment, technical infrastructure and the quality characteristics of the atmospheric and acoustic environment respectively.

11.8 Technical Infrastructure

Bearing in mind the analysis performed at par. 10.8, no specific measures are foreseen for road, electricity, water, drainage, and telephone networks. The only measures refer to:

- The proper maintenance and monitoring of the local wastewater treatment plan.
- The connection of the facility to the local fiber optic telecommunications network.

Especially for the sewage treatment plant, periodical maintenance is required to ensure biological treatment process is running as designed and there are no malfunctions with the risk of anaerobic process resulting in the formation of methane gas and toxic fumes. More specifically, a typical maintenance program will include:

- Observe that the treatment unit is operating normally and there are no alarms displayed (1/per day)
- Check that sludge flows through the sludge return hose (by air lift) when the air blower is running (1/per day)
- Check a smell of the unit. If the unit is smelling, it is most probably that aeration is not working, and treatment process has changed to anaerobic (1/per day)
- If the chemical dosing system is in use, check the chlorine content in the effluent water regularly (1/per week)
- Test sludge content in activation chamber to ensure that sludge content is within acceptable limits (1/per week)
- Check that there is no obstruction in the aeration piping and in the air distributors (1/per month).
- Check that there is no obstruction in the overflow between the aeration chamber and the settling chamber (1/per month).
- Check that there is no obstruction in the overflow between the settling chamber and the disinfection chamber (1/per month).
- Check that there is no obstruction in the venting line (1/per month).
- Inspect the tank's external and internal coatings for corrosion (1/per month)
- Inspect the static condition of the tanks (1/per month)
- Empty and clean the unit (1/year).
- Make sure that the unit is well ventilated and there is enough fresh air in the chamber so that the person who is about to go inside avoid inhaling toxic fumes and suffocation.
- Make sure that the wastewater is led to a proper holding tank (hull tank or collection tank) during shutdown or maintenance break.
- Perform the maintenance for the components of the unit according to the component maintenance program.

11.9 Cumulative Impacts

As mentioned in previous chapters, no substantial and permanent effects on the residential environment of the neighboring urban areas are expected from the operation and further development of the Shipyard activities in relation to the already prevailing situation.

Regarding the measures for the prevention of any effects that the Project may cause in the anthropogenic environment of the broader area, in addition to those mentioned in section 11.6, the following are proposed:

- To control and monitor the individual environmental parameters, related to noise, traffic, air pollution and the quality of the marine environment, through the implementation of the Environmental Monitoring Program (see detailed data in the respective Chapter), in order to take measures on time whenever required.
- For each new development, within the boundaries of the Shipyard, all the necessary measures should be taken so that both its construction and operation do not constitute a source of nuisance in the man-made environment of the area.

11.10 Air Quality

11.10.1 Measures during specific processes

Sandblasting/Abrasive Blasting/Metal Grinding

The sandblasting work of individual ship parts should be performed, as far as possible, in closed suitably designed areas which will be protected with appropriate systems (e.g., bag filters). For that case, there is a designated structure (Building no 30 – Drawing ENV-02) were controlled sandblasting & painting processes are taking place. The building is equipped with bag filters and an adequate ventilation system. Prior to the commencement of works, filters and ventilation system must be checked and maintained properly. During normal operation, bag filters should be replaced at least once per year. Bag filters content (slag) and replaced bag-filters must be treated as waste assigned to the EWC codes:

- 12 01 17 waste blasting material other than those mentioned in 12 01 16
- 15 02 02* absorbents, filter materials, including oil filters not otherwise specified, wiping cloths, protective clothing contaminated by hazardous substances
- 15 02 03 absorbents, filter materials, wiping cloths and protective clothing other than those mentioned in 15 02 02

In the exceptional case of outdoor sandblasting the following measures are proposed:

- The equipment used must have a necessary mobile dust removal system. (e.g., sandblasting equipment with parallel suction of particle emissions).
- No outdoor sandblasting will be performed under severe weather conditions, especially when strong winds prevail.
- Wherever possible, the use of protective shields should be implemented

Other measures for the mitigation of air pollutants derived from sandblasting process include the application of alternative methods such as:

- wet-abrasive blasting
- hydro-blasting
- blasting with dry ice pellets
- vacuum blasting
- ultra-high-pressure water blasting

All the above alternatives can reduce the amount of dust and potential pollutants. Smaller cleaning operations could also be done with thermal, chemical, and mechanical stripping to avoid the use of abrasive blasting altogether.

Coating/Painting

Coating/Painting operations should also be performed in the designed closed areas (Building no 30 – Drawing ENV-02) and avoid, as far as possible, working outdoors. As it was stated above for sandblasting, adequate filters and ventilation system should be in place. The designated building is equipped with activated-carbon filters that should be checked and maintained properly. The replacement of filters, according to the manufacturer, should be carried out twice (2) a year, under full operational conditions. It is also proposed that the frequency of measurements for VOCs and other substances will be twice (2) a year and preferably before replacing the filters with simultaneous execution of painting works, in order to capture the emission of gases in the worst-case scenario (see also next Chapter).

It should be noted, that according to MD 36060/1155/E.103/OG 1450B/14-6-2013), that incorporates the IPPC Directive (2010/75/EE) to the national legislation, for certain coating/painting activities <u>that may not to be carried out indoors</u>, competent environmental authority <u>may allow noncompliance</u> of the installation emissions with requirements set out, provided that the operator proves in principle that such compliance is not possible by technical and economic point of view and that they are used the best available techniques (BATs). Indeed, in the case of the Shipyards, due to the size of the treated objects (ships) it is impossible to perform coating, painting, and similar activities indoors at all times.

In cases that coating/painting operations are performed outdoors the following BATs should be implemented:

- Use of scaffolding with plastic cover
- Fume hoods equipped with activated carbon filters will also apply
- Gas emissions will be monitored through measurements at the output of the filters (see also next Chapter).

The use of new generation antifouling products is also strongly recommended as a BAT. Today, a number of effective anti-fouling systems are available which do not contain TBT. These include organotin-free anti-fouling paints, and biocide-free non-stick coatings that have an extremely slippery surface to prevent fouling from occurring, and which make surfaces easier to clean when fouling does occur. There are also certain nanotechnology-based products for anti-fouling protection that are more effective and more environmentally friendly that traditional anti-fouling systems. Note also, that ONEX will include in the future services of the Shipyard, the design and production of eco-friendly antifouling materials, that could be directly used for ship repairing and shipbuilding works.

When possible, substitution of traditional solvent-based paints with low-VOC or solvent-free paints or non-chemical treatments is proposed. Nevertheless, several limitations on their application and also economics need to be considered [Nordic Shipyards, 2017]. In practice, substitution can be difficult, even impossible. Also, cross-media effects and life cycle need to be carefully assessed. If surface treatment is done with good quality and proper methods and paint, unnecessary docking and surface treatment is avoided overall

The Shipyards are obliged by law to record, in annual basis, the quantities of solvents and paints used.

Welding/Thermal Metal Cutting Operations

Those operations will be mainly performed in the designated buildings of Heavy and Light Rolling Mill, in the Pipe-Shop and Machine-Shop (Buildings No 25 and 29 – Drawing ENV-02). Those structures are equipped with capture and collection systems for welding and other fumes. There is in place a system including ventilators and ducts leading the fumes to a bag filter. Prior to operation, the fumes capture system must be properly maintained. During normal operation, bag filters should be replaced at least once per year. Bag filters content and replaced bag-filters must be treated as waste assigned to the EWC codes:

- 15 02 02* absorbents, filter materials, including oil filters not otherwise specified, wiping cloths, protective clothing contaminated by hazardous substances
- 15 02 03 absorbents, filter materials, wiping cloths and protective clothing other than those mentioned in 15 02 02

With respect to greenhouse gases, welding consumes large quantities of electricity, hence shipyards can minimize their GHG footprint by obtaining their electricity whenever possible from renewable energy sources, or sources that do not consume fossil fuel.

11.10.2 Asbestos and ACMs

Another potential health hazard is exposure to asbestos containing materials (ACMs). Particular attention should be given to refurbishment of vessels constructed before the 1980's. Those vessels generally contain asbestos and ACMs in floors, walls, ceiling panels, fire insulation, heat insulation, lagging, electrical cables, gaskets, etc. Workers and the adjacent community will be at high risk to asbestos exposure during repair and maintenance of those ships, which is known to be a Category 1 carcinogen.

It is recommended that, any work dealing with ACMs on ships should be performed under the supervision or subcontracted to an EAK (Demolition/Removal Asbestos Licensed Company)

11.10.3 General Measures

Other general mitigation measures regarding air pollution include:

- It is strictly forbidden to burn any kind of materials (tires, used mineral oils and cables, packaging, etc.) in the area of the Shipyards
- All vessels mooring at the Shipyards should be free of toxic and explosive gases and present all the necessary certificates by entering the area. More specifically, all procedures should be implemented for (a) avoiding any

explosion or other dangerous situation, ensuring that "gas-free for hot work conditions" are maintained throughout the stay of the ships for repairs (b) avoiding any leakage of substances that may cause harm to human health and the environment.

- The sandblasting material (e.g., slag) loading operations should be synchronized and monitored to avoid emissions of dust and particulate matter.
- Promote the supply of three-phase power to the ships during their stay at the Shipyards, as well as to the crews on ships or at the piers, with the aim of reducing the use of engines and consequently of gaseous pollution (Shore Side Electricity).
- All vehicles used must have a valid certificate of compliance with the respective limits of gaseous pollutants (Exhaust Control Card), which must be always displayed, in accordance with current national legislation.
- Promote the replacement of conventional vehicles (using diesel) with eco-ones (electric, Eco Buses etc.) in order to reduce greenhouse gas emissions from general land transport within the facilities.

11.10.4 Limit Values for specific pollutants

For VOCs emissions and solvents consumption, the limit values illustrated in Table 11.4, should apply. Note that there is a special reference for Shipbuilding when coating activities cannot be carried out under certain conditions (e.g., indoors).

Table 11.4: Thresholds and emission limit values for VOCs (source: IPPC Directive)

Process & limit for solvents used (tn)	Threshold (Solvent consumption threshold in tn/year)	Emission limit values in waste gases (mg C/Nm^3)	Fugitive emission limit values (percentage of solvent input) – Existing Installations	Special Provisions
Surface cleaning using compounds specified in Article 59(5). (> 1)	1—5, > 5	20 20	15 10	(1) Limit value refers to mass of compounds in mg/Nm^3, and not to total carbon.

Process & limit for solvents used (tn)	**Threshold (Solvent consumption threshold in tn/year)**	**Emission limit values in waste gases (mg C/Nm³)**	**Fugitive emission limit values (percentage of solvent input) – Existing Installations**	**Special Provisions**
Other surface cleaning/coating (> 2)	2—10 > 10	75 (1) 75 (1)	20 (1) 15 (1)	(1) Installations which demonstrate to the competent authority that the average organic solvent content of all cleaning material used does not exceed 30 % by weight are exempt from application of these values.
Coil coating (> 25)	-	50 (1)	10	(1) For installations which use techniques which allow reuse of recovered solvents, the emission limit value shall be 150.
Other coating, including metal, plastic, textile (5), fabric, film and paper coating (> 5)	5—15 > 15	100 (1) (4) 50/75 (2) (3) (4)	25 (4) 20 (4)	(1) Emission limit value applies to coating application and drying processes operated under contained conditions. (2) The first emission limit value applies to drying processes, the second to coating application processes. (3) For textile coating installations which use techniques which allow reuse of recovered solvents, the emission limit value applied to

Process & limit for solvents used (tn)	Threshold (Solvent consumption threshold in tn/year)	Emission limit values in waste gases (mg C/Nm³)	Fugitive emission limit values (percentage of solvent input) – Existing Installations	Special Provisions
				coating application and drying processes taken together shall be 150. (4) Coating activities which cannot be carried out under contained conditions (such as shipbuilding, aircraft painting) may be exempted from these

For the rest of air pollutants, the limit values presented in Chapter 4 (Atmospheric Environment) apply (according to Directives 2008/50/EC, 2004/17/EC as amended and in force).

Table 11.5: Limit Values for Human Health Protection

Pollutant	Limit value	Average period	Permissible exceedances in a calendar year
Carbon Monoxide (CO)	10 μg/m³	Maximum daily average of 8 hours	Not applicable
Nitrogen dioxide (NO_2)	200 μg/m³		18 times
	40 μg/m³		Not applicable
Ozone (O_3)	120 μg/m³	Maximum daily average of 8 hours	25 days per calendar year on average in 3 years
Sulphur Dioxide (SO_2)	350 μg/m³	1 h	24 times
	125 μg/m³	24 h	3 times
Suspended Particulates ($PM_{2.5}$)		1 year	Not applicable
Suspended Particulates (PM_{10})	50 μg/m³	24 h	35 times
	40 μg/m³	1 year	Not applicable
Lead	0,5 μg/m³	1 year	Not applicable
Benzene (C_6H_6)	5 μg/m³	1 year	Not applicable
Arsenic	6 ng/m³	1 year	Not applicable
Cadmium	5 ng/m³	1 year	Not applicable
Nickel	20 ng/m³	1 year	Not applicable

Pollutant	Limit value	Average period	Permissible exceedances in a calendar year
PAHs	1 ng/m^3 (as bezo-pyrene)	1 year	Not applicable

11.11 Noise & Vibrations

As it was stated in Chapter 4, the maximum permissible noise limit emitted to the environment by the Shipyards activity is presented in the following table and is measured at the limit of the property on which the installation is located.

Table 11.6: Maximum Permissible Noise Values Based on PD 1180/81 as amended and in force

No	Type of Area	Noise Limit Value dB (A)
1	Industrial under law/Shipyards	70

The general measures for protecting the acoustic environment during Shipyards Operation is presented below:

- Noise emission is reduced if working under the dock edge is possible.
- Use noise shields where possible.
- Proper training of machinery operators should take place, in order to avoid activities that cause unnecessary noise.
- Supply of electricity to moored ships to reduce the use of ship engines.
- Avoid the simultaneous use of noisy machinery and performance of noisy activities
- Conduct noise measurement and identify significant noise sources and potential sensitive receptors in the vicinity and reduce noise when necessary (see also Chapter 12).
- Obey occupational health and safety limits for noise. Use personal protective equipment when needed.
- All motors, pumps and compressors will be provided with acoustic enclosures and rubber paddings as noise control measures.

- All machinery and equipment will be provided with adequate maintenance to ensure reduction of unwanted noise from loose components.
- High noise generating activities will not be carried out during nighttime to avoid disturbance.
- Additional free space plantings should be implemented
- The Operator will also explore the possibility of a vegetative belt along the boundaries of the Shipyard to reduce noise reaching the immediate project area.
- Develop methods for exploring and measuring the hydro-acoustic noise pollution generated by ships (see Chapter 10, par. 10.11).

Especially for vehicles movement on land, the following measures should be implemented:

- Observance of low-speed limits of vehicles and especially of heavy vehicles (~ 40 Km/h) and strict control of the application of the rules of the Road Traffic Code
- Strict observance of the specifications of the current legislation, regarding the allowed noise levels of vehicles and machines.
- During the day, emphasis should be given to the design of the movement of heavy vehicles so as not to create peaks with very high traffic loads and high noise levels. The goal should be to evenly distribute the traffic load during the day.

11.12 Electromagnetic Fields

According to the analysis presented in Chapter 10, no specific mitigation measures are proposed.

11.13 Water Resources

11.13.1 General

All measures described in par. 11.5.2 “Marine Environment” apply also for water resources i.e., terrestrial surface waters and groundwater. Additional measures may include:

- Regular inspections of the underground tanks that collect leakages from warehouses. All waste should be pumped directly to tank vehicles and transfer to properly licensed facilities for further treatment as HW.
- Regular clean-up of underground tanks and removal of sludges. Those waste will be treated as HW.
- Carry out periodic inspection and cleaning of the rainwater network and the provided oil purifiers.
- Oily residues and entrails from the wells should be collected and disposed of at regular intervals.
- In case of fuel leaks on concrete or on soil, adsorbents will be always available and used such as sand, wood chips or special geotextile immediately after the escape. Such materials will be available on site for immediate intervention.
- All the above waste will be collected in special bins and delivered to a specially licensed body for further management, in accordance with the existing legislative provisions (Law 2939/2001/OG 179 A, PD 82/2004/OG 64 A).
- Machinery / vehicle components end-of-life vehicles as well as other waste that is subjected to alternative management (see above) and can pollute groundwater, will be collected in special areas and delivered to licensed body for further management.
- The temporary storage of bulk waste in open areas, even in sheds should be avoided.

Further detailed information about waste management is given in Chapter 13.

11.13.2 Limit Values

For Groundwater protection, the limit values presented in Table 11.7 apply.

Table 11.7: Limit Values of certain pollutants for the protection of Groundwater quality [MD 1811/2011/OG 3322B'/30-12-2011]

Pollutant	Limit Value
NO_3^-	50 mg/l
Active pesticide substances	0.5 μg/l
pH	6,5-9,5
Conductivity	2500 μS/cm
As	10 μg/l
Cd	5 μg/l
Pb	25 μg/l
Hg	1.0 μg/l
Ni	20 μg/l
Cr (total)	50 μg/l
Al	200 μg/l
NH_4^+	0.5 mg/l
NO_2^-	0.5 mg/l
Cl^-	250 mg/l
SO_4^{-2}	250 mg/l
Trichloroethylene + Tetrachloroethylene	10 μg/l

For Surface water (terrestrial and marine) the limit values presented in Table 11.8 apply.

Table 11.8: Limit Values of certain pollutants for the protection of Surface Waters (terrestrial and marine) quality [MD 51354/2641/E103/OG 1909B'/08-12-2010]

Pollutant (P: Priority Pollutant)	Freshwater (acute) (μg/L)	Freshwater (chronic – annual value) (μg/L)	Saltwater (acute) (μg/L)	Saltwater (chronic – annual value) (μg/L)
Aldrin (P)	3.0	—	1.3	—
Alkalinity	—	20000	—	—
alpha-Endosulfan (P)	0.22	0.056	0.034	0.0087
Arsenic	340	150	69	36
Bacteria	—	—	—	—
beta-Endosulfan (P)	0.22	0.056	0.034	0.0087
Cadmium (P)	1.8	0.72	33	7.9
Carbaryl	2.1	2.1	1.6	—
Chlordane (P)	2.4	0.0043	0.09	0.004
Chloride	860000	230000	—	—
Chlorine	19	11	13	7.5
Chlorpyrifos	0.083	0.041	0.011	0.0056
Chromium (III) (P)	570	74	—	—
Chromium (VI) (P)	16	11	1,100	50
Copper (P)	—	—	4.8	3.1

Pollutant (P: Priority Pollutant)	Freshwater (acute) (μg/L)	Freshwater (chronic – annual value) (μg/L)	Saltwater (acute) (μg/L)	Saltwater (chronic – annual value) (μg/L)
Cyanide (P)	22	5.2	1	1
Demeton	—	0.1	—	0.1
Dieldrin (P)	0.24	0.056	0.71	0.0019
Endrin (P)	0.086	0.036	0.037	0.0023
Guthion	—	0.01	—	0.01
Heptachlor (P)	0.52	0.0038	0.053	0.0036
Heptachlor Epoxide (P)	0.52	0.0038	0.053	0.0036
Iron	—	1000	—	—
Lead (P)	65	2.5	140	5.6
Malathion	—	0.1	—	0.1
Mercury (P)	1.4	0.77	1.8	0.94
Methoxychlor	—	0.03	—	0.03
Mirex	—	0.001	—	0.001
Nickel (P)	470	52	74	8.2
Nonylphenol	28	6.6	7	1.7
Parathion	0.065	0.013	—	—
Pentachlorophenol (P)	19	15	13	7.9
pH	—	6.5 – 9	—	6.5 – 8.5
Polychlorinated Biphenyls (PCBs) (P)	—	0.014	—	0.03
Selenium (P)	—	---	290	71
Silver (P)	3.2	—	1.9	—
Sulfide-Hydrogen Sulfide	—	2.0	—	2.0
Toxaphene (P)	0.73	0.0002	0.21	0.0002
Tributyltin (TBT)	0.46	0.072	0.42	0.0074
Zinc (P)	120	120	90	81
4,4'-DDT (P)	1.1	0.001	0.13	0.001

11.14 Anthropogenic & Natural Disasters

Depending on the emergency, the following measures should be implemented:

Fire (see also par. 11.5.7)

- Alarm signal
- Immediate notification of ONEX directors/managers and evacuation of premises
- Control for any trapped workers
- Immediate intervention with appropriate firefighting means
- Closing of doors
- Immediate removal of any flammable materials

- Fire service inclination and cooperation with fire brigades
- First Aid Call, if required

Flood

- Evacuation of workplaces
- Movement of personnel to safe places
- Checking the physical and mental condition of employees and providing emergency assistance where required
- Call all the necessary assistance services (Civil protection, Fire Service etc.)

Earthquake

- Evacuation of workplaces
- Movement of personnel to safe open places
- Checking the physical and mental condition of employees
- Emergency Assistance should be provided where required
- Call all the necessary assistance services (Civil protection, Fire Service etc.)
- In case of fire after the earthquake, fall the procedures described above

Extreme weather conditions (rising temperatures, thunderstorms, etc.)

- Evacuation of workplaces
- Movement of personnel to safe open places
- Checking the physical and mental condition of employees and providing basic assistance where needed
- Call all the necessary assistance services (Civil protection, Fire Service etc.)

Accident due to the handling / storage of dangerous substances

- Immediate shutdown of the unit
- Collection of substances in appropriate collection media
- Cleaning of ambient areas

- Placement of used cleaning materials in specially marked bins

11.15 Occupational Health & Safety (OHS)

During the operation phase of the Shipyards, the potential effects on Health & Safety are mainly due to accidents caused by the operation of machinery and vehicles and the handling of dangerous materials and waste.

In any industrial area there are risks to the health and safety of employees or third parties. For this reason, only people who are employed or possess an entry permit in general should be present at the premises. Every person on the site must fully comply with the general principles and safety rules. Special attention should be paid to the operators and drivers of machines and vehicles, as many accidents are due to violation of the rules of operation of that equipment.

<u>Note that ONEX, prior to the commencement of the Shipyards' operation, should</u>:

- Review and update the existing Occupational Health & Safety Assessment (see also Chapter 3) according to the national legislation (PD 85/91, 397/94, 105/95, 16/96, 17/96 etc.).
- Obtain certification according to OHSAS 18001
- Lights and electrical panels in places with high risk of explosion should comply with ATEX 2014/34/EU regulation

An extensive OHS Management Plan for dealing with OHS hazards for both C/R and Operation phases is illustrated in Chapter 15.

12. ANALYSIS OF ALTERNATIVES

12.1 General

A necessary part of the ESIA process is the consideration of alternatives to the proposed project activity. Analysis of alternatives to the project is undertaken in order to select the most environmentally friendly, technologically feasible and financially viable option. For the proposed project, the following alternatives have been considered and analyzed:

- No project scenario (Zero Solution)
- Abolition of Shipyards and their conversion to other port use
- Alternative locations
- Environmental & Social Factors

In the present study it is not possible to initially distinguish and evaluate alternatives to all the activities under consideration included in the ESIA. The reason is that all activities and projects refer to a wide range of Shipyards' operations over the last 60 years, while for the individual Shipyards operational features, complete alternatives have been considered in the past and the best solution from an environmental point of view has been selected each time. Furthermore, some of the activities performed within the area of interest are unambiguously linked to specific functions and needs and therefore it is not possible to consider alternatives at least in terms of their size and location.

12.2 No project scenario (Zero Solution)

During the Zero Solution, the Shipyards will operate under the current conditions, but without the necessary investments to be made for the upgrade and expansion of infrastructure that is critical for the future and the development of all shipbuilding activity. Furthermore, the environmental problems (e.g., storage of hazardous waste, asbestos materials etc.) will remain unsolved.

Therefore, the zero solution leads to the further devaluation of Elefsis Shipyards and does not offer development opportunities, especially with regard to the employment of specialized personnel in the wider area of Elefsis and West Attica, which are traditionally engaged in shipbuilding and ship repairing.

12.3 Abolition of Shipyards and conversion to other port use (e.g., coastal shipping)

This alternative is more unfavorable from an environmental point of view as the whole area does not have the necessary network (mainly road) to support a larger scale of freight and passenger traffic. After all, such a solution would require extensive reconstruction in both port and offshore projects and is therefore not considered to be environmentally friendly.

12.4 Alternative Locations

For the optimal choice of the location of the Shipyards, the following parameters were examined:

- Existence of access roads
- Distance from the nearest settlements
- Housing traditional settlements, areas of cultural value
- Land use
- Bounded archeological sites and zones
- Distances from the basic infrastructure networks
- Environmental protection areas and special environmental protection programs (NATURA, RAMSAR, ecological resources of trans-European importance, etc.)
- Possibility of effects in tourist areas

Considering the above parameters, the location of this activity is considered excellent given that:

- It is located in an industrial area with no limitations regarding land and coastal use
- It is located in a relatively remote area, outside the boundaries of settlements, archeological sites and nature protection areas, away from utilities, tourist facilities and other anthropogenic activities that could be affected by its presence. In the wider area (radius 1km) there are mainly industrial facilities that are not expected to be affected by Shipyards' operation
- There is very limited visual contact of the Unit from the road network but also from other areas of interest, such as the nearest archaeological site
- It has easy access, as it is adjacent to the National & Provisional Roads
- It is located far from the tourist development areas of the island and the operation of the Unit under location cannot affect the respective areas even during the summer months.

12.5 Size

As it was mentioned in Chapters 1 and 3, the project under consideration includes the following basic operative features:

- Construction (Shipbuilding) of commercial vessels, warships, and any vessel with a total capacity of up to 100,000 Deadweight tonnage (DWT).
- Transformation and repairs of any vessel with a total capacity of up to 300,000 DWT.

According to ONEX BPL and based on its experience on relevant projects in Greece (e.g., Neorion Shipyards in the island of Syros), the needs of the corresponding market will be sufficiently met by the existing shipbuilding and ship repairing capacity of Elefsis Shipyards. A smaller capacity may not be able to meet needs that would arise during peak periods and increased demand. Larger capacity would also require larger quantities of raw materials and a considerable amount of re-construction works (e.g., larger shipbuilding bed), thus increasing the overall environmental footprint.

12.6 Environmental and Social Factors

The project is located within an existing facility which has been developed and operating under strict environmental terms for many decades. The C/R phase will require certain interventions to the existing infrastructure, but those are considered minimal comparing to the alternative of constructing a new Shipyard from zero (e.g., to another location).

As it is thoroughly analyzed in previous Chapters, the benefits of project under study for the local economy are directly related to the jobs created by the restart of the largest Shipyard of the country, as well as the direct and indirect development of many sectors related to shipbuilding, shipping, coastal shipping, waste management, supply of materials and services etc. Furthermore, the project will not lead to any disturbance of the local community (including the local fishing activities), and therefore the location is suitable as per environmental and social criteria.

13. ENVIRONMENTAL & SOCIAL MANAGEMENT PLAN (ESMP) - ORGANIZATION

13.1 Environmental and Social Policy Principles

13.1.1 General Environmental and Social Commitment

Environmental and social policies are fundamental to ensuring the proposed Project (Elefsis Shipyards) does not unnecessarily harm the environment, public health or vulnerable communities. In this framework, the owner of the Project (ONEX) is committed to:

1. Possess and implement an environmental and social management system that ensures environmental and social risks are identified and assessed at the earliest possible stage of project design (ESIA)
2. Adopt measures to avoid or where avoidance is impossible to minimize or mitigate those risks during implementation (C/R and Operational Phase)
3. Monitor and report on the status of those measures during and at the end of implementation.
4. Provide adequate opportunities for the informed participation of all stakeholders in the formulation and implementation of the Project.

13.1.2 Environmental Policy Principles

ONEX is committed to meet the following environmental and social principles during the implementation of the Project (C/R and Operational Phase).

Compliance with the Law

The Project will be in full compliance with all applicable domestic and international environmental law, including IFC Standards.

Conservation of Biological Diversity

Project shall be implemented in a way that avoids any significant or unjustified reduction or loss of biological diversity or the introduction of known invasive species.

Climate Change

The project shall not result in any significant or unjustified increase in greenhouse gas emissions or other drivers of climate change.

Pollution Prevention and Resource Efficiency

Project shall be implemented in a way that meets applicable international and domestic standards for maximizing energy efficiency and minimizing material resource use, the production of wastes, and the release of pollutants.

Lands and Soil Conservation

Project will be implemented in a way that promotes soil conservation and avoids degradation or conversion of productive lands or land that provides valuable ecosystem services.

Sea/Marine Conservation

Project will be implemented in a way that promotes sea conservation and avoids degradation of sea/water resources that provide valuable ecosystem services.

13.1.3 Social Policy Principles

Compliance with the Law

The Project will be in full compliance with all applicable domestic and international law (National Labor law, tax, law, ports and harbors, HSE law) including IFC Standards.

Access and Equity

The Project will provide fair and equitable access to benefits in a manner that is inclusive and does not impede access to basic health services, clean water and sanitation, energy, education, safe and decent working conditions, and land rights. The project should not exacerbate existing inequities, particularly with respect to marginalized or vulnerable groups.

Marginalized and Vulnerable Groups

The Project will avoid imposing any disproportionate adverse impacts on marginalized and vulnerable groups including children, women and girls, the elderly, displaced people, refugees, people living with disabilities, and people living with HIV/AIDS.

Especially regarding the existing Refugee and Immigrants Camp (see also Chapter 3), according to the new strategy of the Ministry of Migration and Asylum (migration.gov.gr), the number of refugee camps, throughout the country, is about to be reduced. The plan involves the creation of larger, more properly organized refugee camps and the closure of smaller ones. In this context, under the responsibility of the Ministry, the Refugee Camp within the Shipyards area of influence, is about to be relocated. Nevertheless, no specific timeline for the relocation has been notified yet.

ONEX has not submitted any official request for camp relocation. On the contrary, ONEX will continue to support the camp until its relocation will be carried out. ONEX is committed that, even if the camp has not been relocated until the C/R Phase of the Project has begun, it will take all the necessary measures for the protection of refugees and the mitigation and/or elimination of any effects.

Human Rights

ONEX shall respect and where applicable promote international human rights.

Gender Equality and Women's Empowerment

During Project implementation, both women and men will have equal opportunities to participate, receive comparable social and economic benefits and do not suffer disproportionate adverse effects during the development process.

Core Labour Rights

ONEX shall meet the core labor standards as identified by the International Labor Organization and the domestic legislation.

Public Health

Project shall be implemented in a way that avoids potentially significant negative impacts on public health.

Physical and Cultural Heritage

Project shall be implemented in a way that avoids the alteration, damage, or removal of any physical cultural resources, cultural sites, and sites with unique natural values recognized as such at the community, national or international level. Project will also not permanently interfere with existing access and use of such physical and cultural resources.

13.2 Environmental and Social Management Plan (ESMP) & Environmental and Social Management System (ESMS)

This Section introduces the Environmental and Social Management Plan (ESMP) Framework and the strategy for developing and implementing the Environmental and Social Management System (ESMS) of the Elefsis Shipyards Project.

The ESMP Framework is an integral part of the ESIA as it is a policy setting document for ONEX and its contractors and represents a commitment towards environmental and social sustainability applied to the Project's entire life cycle. The ESMP Framework is an overarching document developed in accordance with the Project Environmental and Social (ES) policies, with the commitments included in current Environmental and Social Impact Assessment (ESIA) and, more broadly, with the Greek regulatory framework relevant to the Project as well as with the ES Standards that apply to the Project. These include the IFC Performance Standards (IFC PS) and IFC General and Sector Specific Environmental, Health and Safety (EHS) Guidelines (see also Chapter 2).

A key objective of the ESMP is to "operationalize" the ES (as well as occupational health and safety) commitments and mitigations as identified in the ESIA to ensure that the Project (including construction, operation, and decommissioning) is undertaken in a way to minimize the negative impacts on the physical, biological, and social environments in the Project-affected area.

More specifically, the ESMS will:

- Establish environmental and social management standards that comply with or surpass Good International Industrial Practices (GIIP) and reasonable community expectations
- Adopt a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimize and restore ES impacts
- Develop and implement policies, plans and procedures to integrate ES aspects within the overall project management framework throughout its lifecycle
- Facilitate the implementation of management plans as defined by the ESIA for the avoidance, minimization, and control of ES impacts
- Inform Project personnel of their responsibilities with respect to ES issues and to monitor the manner in which those responsibilities are implemented
- Train project personnel, contractors, and community representatives, as necessary, in relevant environmental and social procedures, actions, and monitoring programs
- Establish a monitoring program to assess the effects of residual impacts on the environment and monitor the ESMS performance; and
- Provide for periodic system audits and identify corrective actions, if necessary, to reach the planned objectives.

The ESMS includes a set of associated Environmental and Social Management Plans (ESMPs) that will be prepared for addressing specific ES issues. The ESMPs provides details of the actions that will be taken by ONEX during the construction phase and, later during operations, to mitigate and manage Project's ES impacts and risks. This framework also outlines how the Project will monitor how external contractors will address and manage ES risks and impacts generated by their activities in line with the mentioned standards.

The ESMPs also includes tools for auditing and monitoring the Project's performance and communicating monitoring outcomes to stakeholders.

This ESMP framework will be subject to revisions before start of operations to encompass and consider any new information relevant to the management of ES impacts and risks. The purpose of this framework is to define:

- The scope of the ESMS during the construction and operation phases
- The standards applied to the Project ESMS during the construction and operation phases
- Responsibilities and commitments, for the implementation of the ESMS
- The framework for the definition and implementation of the mitigation measures applicable to the Project
- The framework for the definition, implementation, and management of the monitoring activities
- The framework for the review of the environmental and social performance and of the adequacy of the ESMS manual and Environmental and Social Management Plans (ESMPs).

Although ONEX will have full control and ultimate responsibility on the construction and operations of the Project, a number of contractors will be retained for carrying out different activities that will have to maintain their own ESMS and develop project specific ESMPs aligned with the provisions included in this ESMP Framework and in the ESIA developed for the entire Project.

In Elefsis Shipyards, all activities are certified according to the international standards of management, quality and environment ISO 9001:2015 (Quality Management) and ISO 14001:2015 (Environmental Management). Those certificates should be immediately updated by the new owner (ONEX).

Note that all mitigation measures described in Chapters 8 and 11 for C/R and Operation Phase are also applicable as part of the Environmental & Social Management Plan.

13.3 Specific Management Plans

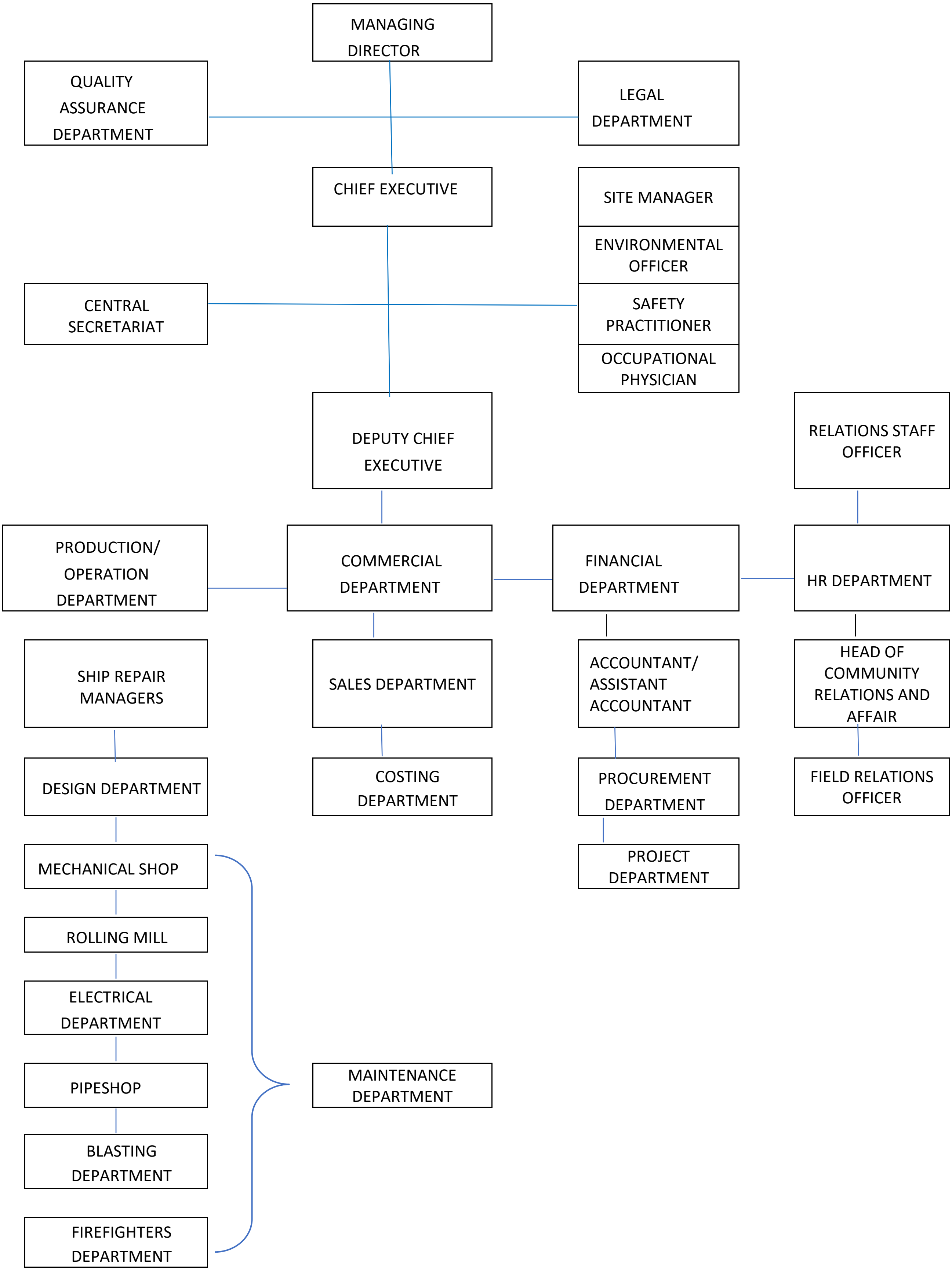
ONEX will develop a set of ESMPs and procedures consistent with their policies and commitments, addressing the environmental and social impacts and relevant mitigation measures identified in the ESIA for each component. The Environmental and Social Management Plans (ESMPs) that will be prepared and implemented for fulfilling the commitments undertaken by the Project are reported in the chapters below (14-29).

The ESMPs will be implemented across ONEX Project organization, including, contractors, subcontractors and primary suppliers over which ONEX has control or influence.

Each Management Plan will: provide the objectives of the document, the reference legal requirements, roles and responsibilities for its implementation, training programs to managers and employees commensurate with the tasks they are assigned, links to other management plans as necessary, a list of the mitigation measures, monitoring and reporting requirements, identify qualitative or quantitative Key Performance Indicators (KPIs) to be used to monitor the effectiveness of the mitigation measures identified during the impact assessment process, training requirements as needed.

13.4 Organizational Structure/Responsibilities

ONEX plan for the division of Manpower during the future operation of the Shipyards, is presented in the following diagram.


MANAGING DIRECTOR
QUALITY ASSURANCE DEPARTMENT
LEGAL DEPARTMENT
CHIEF EXECUTIVE
SITE MANAGER
ENVIRONMENTAL OFFICER
CENTRAL SECRETARIAT
SAFETY PRACTITIONER
OCCUPATIONAL PHYSICIAN
DEPUTY CHIEF EXECUTIVE
RELATIONS STAFF OFFICER
PRODUCTION/ OPERATION DEPARTMENT
COMMERCIAL DEPARTMENT
FINANCIAL DEPARTMENT
HR DEPARTMENT
SHIP REPAIR MANAGERS
SALES DEPARTMENT
ACCOUNTANT/ ASSISTANT ACCOUNTANT
HEAD OF COMMUNITY RELATIONS AND AFFAIR
DESIGN DEPARTMENT
COSTING DEPARTMENT
PROCUREMENT DEPARTMENT
FIELD RELATIONS OFFICER
PROJECT DEPARTMENT
MECHANICAL SHOP
ROLLING MILL
ELECTRICAL DEPARTMENT
PIPESHOP
MAINTENANCE DEPARTMENT
BLASTING DEPARTMENT
FIREFIGHTERS DEPARTMENT

14. SOLID & HAZARDOUS WASTE MANAGEMENT PLAN

14.1 C/R Phase

The relevant plan is presented in Table 14.1. Responsibilities for implementing the plan lie on Environmental Officer, Site Managers and the Contractor.

Table 14.1 C/R Phase Solid & Hazardous Waste MP

Type	EWC-CODE	Description	Quantity (tn)	Management
Waste from floating tanks and Ship-bed cleaning/maintenance	12 01 01	Ferrous metal filings and turnings	50	Temporary collection in bins and removal by licensed collection company
Waste from floating tanks and Ship-bed cleaning/maintenance	12 01 02	Ferrous metal dust and particles	20	Temporary collection in bins and removal by licensed collection company
Waste from floating tanks and Ship-bed cleaning/maintenance	12 01 03	Non-ferrous metal filings and turnings	10	Temporary collection in bins and removal by licensed collection company
Waste from floating tanks and Ship-bed cleaning/maintenance	12 01 04	Non-ferrous metal dust and particles	20	Temporary collection in bins and removal by licensed collection company
Waste from floating tanks and Ship-bed cleaning/maintenance	12 01 13	Welding wastes	30	Temporary collection in bins and removal by licensed collection company
Packaging from materials used for pier and concrete surfaces repairing	15 01 06	Cement and related materials Packaging	1	Removal by licensed collection company
Packaging contaminated with hazardous substances from materials used for pier and concrete surfaces repairing	15 01 10*	Chemical, lubricants and related materials Packaging	1	Removal by licensed collection company for HW

Type	EWC-CODE	Description	Quantity (tn)	Management
Concrete dismantling and demolition materials from port structures (pier, storehouses concrete floor)	17 01 01	Concrete	7000	Removal by licensed collection company for ECDW
Useless Cables from Storage & Production Areas, floating tanks, pier	17 04 11	Cables other than those mentioned in 17 04 10	2	Removal by licensed collection company for ECDW
Soils removed together with sandblast	17 05 04	Soil and stones other than those mentioned in 17 05 03	Limited	Removal by licensed collection company for ECDW
Other construction and demolition waste	17 09 04	Mixed construction and demolition wastes other than those mentioned in 17 09 01, 17 09 02 and 17 09 03	Limited	Removal by licensed collection company for ECDW
Municipal waste from working personnel (during C/R phase)	20 03 01	Mixed municipal waste	Limited	Collected in bins of the local Municipality and transported by vehicles

14.2 Operation Phase

Responsibilities for implementing the plan lie on Environmental Officer, Site Managers and the Contractor who must possess a permit for collection and transport of hazardous and/or nonhazardous waste, according to the applicable legislation (see also Chapter 2).

Monitoring will be performed mainly via regular inspections of waste storage and transfer sites and reporting during operation phase.

The Plan contains the following parts:

- Waste streams to be kept segregated (hazardous, inert, domestic etc.) preferably by relevant EWC codes.

- All wastes in transit shall be tracked by waste consignment note and documented.
- Workers to be trained in the handling, storing, and disposal of hazardous waste.
- Adequate provision of waste disposal containers at strategic locations around the site.
- All non-hazardous solid waste is collected, separated from the HW and delivered to a contractor, who must have a permit for the collection and transport of NHW waste.
- If NHW is delivered for disposal or recovery within the country, the AET of the final recipient must include the specific EWC codes for waste receipt and management/recovery.
- The management of HW will be done in accordance with the provisions of JM 13588/725 / 28-3-06 (OG 383 / B), 24944/1159 / 30-6-06 (OG 791 / B) and 8668 / 2-3-07 (OG/ B/2007) and only by a properly licensed contractor.
- Hazardous waste should be collected and delivered by a contractor, who must have a permit for collection and transport of hazardous waste and a contract with the facility that will receive those waste (see also Chapter 2 for HW management legislation). If this waste is delivered for disposal or recovery within the country, the AET of the final recipient must include the specific EWC codes for waste receipt and management/recovery.
- Measures mentioned in the MSDSs of all used materials during the shipbuilding/repairing works should be implemented especially in case of leakage due to accident (accidental release), as well as for their general handling.
- During ships docking, after the completion of the ship repair works and before the filling of the tanks with seawater, all the solid waste that has arisen should be removed from the tanks and the interior of the ships.
- During ships docking, the surfaces and the floors of the tanks should be cleaned at regular intervals and the resulting waste should collected in appropriate means and managed.

- In case of repair work on ships that have cargo tanks (e.g., tankers, L.P.G, O.B.O. etc.), these ships must be cargo free and have a Certificate of Exemption of Gaseous Gases (GAS FREE entry).
- Material used in shipbuilding/repairing (paints, solvents, coatings, varnishes, etc.) must not be discarded on the ground.
- All waste generated during the repair works should be delivered to the properly licensed collectors for further management
- Hazardous waste contaminated with residues of used paints, solvents, coatings, varnishes or other materials (e.g., empty paint containers, absorbent materials, fabrics, etc.), under the responsibility of the ship, will be collected separately. Their handling and temporary storage should take place according to materials safety data sheets (MSDS) and they will be disposed of as hazardous waste, in accordance with the provisions of JM 13588/725/2006 (OG 383/B/ 2006), through deliverance to a properly licensed company.
- Bulk materials should not be stored outdoors and temporary storage of raw materials and equipment (including metal parts for repair or resale) may be allowed in a designated area upon approval by the Operator of the Shipyards
- The Ship Waste Collection & Management Plan (SWCMP - approved by Ministry of Maritime Affairs & Insular Policy) should be implemented at all times.
- Ship solid waste will be collected in appropriate means (e.g., wheeled bins, bins-containers, garbage trucks, vessels, etc.) as specified each time in the approved SWCMP (see Chapter 18). The collection means will be received directly from the ships or will remain at the piers until the completion of the delivery of the waste from the ships and will be collected for transport and final management by an authorized contractor. At all stages of waste collection and transport care must be taken to avoid any pollution on land and sea.
- Petroleum waste will be collected directly from ships in tank vehicles and will be sent for pre-treatment and separation to a properly licensed facility.
- In cases where the solid non-hazardous waste of ships is collected by floating means (barge, etc.) there will be a designated space, within the facilities, for

the transfer of waste from the floating means to land (e.g., garbage truck,) for transport to final disposal and/or to recycling facilities.

- Under no circumstances, a pile of NW municipal waste should be created. All municipal waste should be collected in bins and, as soon as possible, transferred by to the proper facilities with responsibility of the local Municipality.
- Waste falling under the scope of Alternative Management (e.g., used batteries, tires, packaging etc., see Chapter 2), should be managed according to the provisions of the relevant legislation and under the supervision of the PROs.
- Collection, transfer and, where appropriate, waste management operations must be carried out by properly and adequately equipped means of transport which must hold the permits and certifications required by applicable law (see Chapter 2).
- The use of oils containing polychlorinated biphenyls or triphenyls (PCBs or PCTs) is strictly prohibited.

15. WASTEWATER MANAGEMENT PLAN

15.1 C/R Phase

The relevant plan is presented in Table 15.1. Responsibilities for implementing the plan lie on Environmental Officer, Site Managers and the Contractor.

Monitoring will be performed via daily site inspections and reporting under the responsibility of the aforementioned persons.

Table 15.1: C/R Phase Wastewater MP

Type	Description	Management
Liquid waste from tank repairing activities	Wash water, oily water from bilges and tank cleaning, and engine fluids such as oil, hydraulic fluids, lubricants, anti-freeze	• All materials used during repairing works must be suitable for use in the marine environment and must not contain substances subject to restrictions on their circulation and use, such as compounds of mercury, arsenic, cadmium and organotin, as well as other chemicals in accordance with the requirements of the legislation as applicable. • During works at sea, a motorboat suitable for decontamination works (sinking/recovery/towing of a floating dam of sufficient capacity, recovery – storage of petroleum products, spraying of chemical dispersants etc.) will be kept in immediate readiness and fully manned with the specialized crew • Availability of the following equipment ○ Floating dam ○ Chemical dispersant ○ Absorbent barrier ○ Absorbent towels ○ Absorbent pads ○ Absorbent shutters ○ Adhesive wigs ○ Chemical dispersion system

Type	Description	Management
		○ Skimmer weir ○ Abstentions ○ Shovels ○ Wire brooms ○ Life jackets ○ Cordless radios ○ Rakes ○ Floating dam anchorage set ○ Meditation bags ○ Bags with sawdust
Liquid waste from Pier Repairing	Periodic flushing of the terrestrial construction in front of the pier from rainwater.	• Local drainage network should be thoroughly cleaned from any foreign materials, vegetation etc. so that no overflows may occur. That action is very critical for avoiding runoffs (possibly contaminated) to reach terrestrial or marine water sources. • The stored quantities of materials should be limited to the absolutely necessary. • Disposable materials and solid waste should be collected and transported at regular intervals and not left in their temporary storage areas for a long time.
Municipal wastewater	Daily hygiene needs of the construction staff	• Chemical Toilets
Oil/Lubricants	Leakage of oil and lubricants from machinery used (both terrestrial and marine) (accident)	• Washing and maintenance of machinery and motorized equipment will not take place on site • The Operator of the construction site should take care of the good condition of the mechanical means. • In the event of fuel or mineral oil spills at the site and on the work fronts, adsorbent materials such as sand, straw or special geotextiles should be available and used immediately after the spill.
Oil/Lubricants	Leakage of liquid waste/sludges pumped from the storage tank of	• Responsible for dealing with it is the Operator of the construction site who will receive all the necessary measures for cleaning

Type	Description	Management
	Petroleum Waste area (accident)	of the area and the implementation of appropriate anti-pollution practices. Indicatively, the use of adsorbents such as sand, wood chips or special geotextiles is critical after the escape of such liquid waste. • Disposal of those waste will be made in accordance with the Instructions and Legislation for the disposal of HW (e.g., IFC approved facilities).
Liquid waste from construction site	Leaching of soil and construction materials during construction works (e.g., during heavy rain or during wetting of surfaces for reducing dust)	• Land storage sites for aggregates and other terrestrial materials should be identified prior to the commencement of work and located at a sufficient distance from the seafront to reduce the possibility of transporting materials (e.g., due to rainfall) to the sea. • The stored quantities of materials for the needs of C/R phase should be limited to the absolutely necessary. • It is strictly forbidden to dump all kinds of liquid waste, oils, fuels, sewage etc. on the construction site or on the broader Shipyard area. The management of used mineral oils will be done in accordance with PD 82/04 (OG 64/A/2004).

15.2 Operation Phase

Responsibilities for implementing the plan lie on Environmental Officer, Site Managers and the Contractor who must possess a permit for collection and transport of hazardous and/or non-hazardous waste, according to the applicable legislation (see also Chapter 2).

The Plan contains the following parts:

- Regular inspections of the underground tanks that collect leakages from warehouses. All waste should be pumped directly to tank vehicles and transfer to properly licensed facilities for further treatment as HW.
- All land facilities of the Shipyards must be kept as clean as possible from petroleum and/or other harmful substances, to avoid incidents of transport from any polluted runoff to the marine environment. For that purpose, it is important to install appropriate separators so as the seawater is fully protected from any contaminated runoff.
- Regular clean-up of underground tanks and removal of sludges. Those waste will be treated as HW.
- Measures mentioned in the MSDSs of all used materials during the shipbuilding/repairing works should be implemented especially in case of leakage due to accident (accidental release), as well as for their general handling.
- For the entire maritime Shipyards zone, all the necessary technical means and equipment for dealing with oil pollution emergencies (floating dams, absorbent-dispersing substances, etc.) should be available at all times.
- Carry out periodic inspection and cleaning of the rainwater network and the provided oil purifiers.
- Oily residues and entrails from the wells should be collected and disposed of at regular intervals.
- In case of fuel leaks on concrete or on soil, adsorbents will be always available and used such as sand, wood chips or special geotextile immediately after the escape. Such materials will be available on site for immediate intervention.
- All the above waste will be collected in special bins and delivered to a specially licensed body for further management, in accordance with the existing legislative provisions (Law 2939/2001/OG 179 A, PD 82/2004/OG 64 A).
- Machinery / vehicle components end-of-life vehicles as well as other waste that is subjected to alternative management (see above) and can pollute

groundwater, will be collected in special areas and delivered to licensed body for further management.

- The temporary storage of bulk waste in open areas, even in sheds should be avoided.

16. AIR POLLUTION MANAGEMENT PLAN

16.1 C/R Phase

16.1.1 Air pollution Sources

- Emissions of gaseous pollutants from vehicles for the transport of materials and waste to and from the construction site
- Emissions of gaseous pollutants from the operation of C/R machinery
- Emissions of dust and particulate matter from the management (transport and temporary storage) of materials (construction materials, aggregates etc.)
- Emissions of particles containing asbestos fibers during dismantling and demolition works
- Emissions of particles containing several pollutants during collection and transportation of wastes from their storage areas

16.1.2 Dust & Particles Management Plan

- When transporting materials and solid waste, trucks should possess a protective cover for avoiding material leakage and dust release.
- Avoid overfilling materials and waste transporting trucks.
- Periodic monitoring and maintenance of access roads.
- It is recommended to use machines with exhausts facing away from the ground.
- Systematic wetting should take place, with a suitably shaped tank which covers both the loading points and the unloading points of the materials. The above measure does not apply on waste.
- Systematic wetting should take place, with a suitably shaped tank (filled with water by EYDAP network) that covers the access roads of the vehicles transporting materials and waste (mainly within the area of the Shipyard).
- Special care (e.g., increasing the rate and intensity of wetting) will be taken in the case of transport of brittle and incoherent materials for disposal in the area. That measure does not apply on asbestos transport.

- The lowest possible speed limit will be strictly observed, i.e., 30km/h for non-asphalt surfaces and 40km/h on national roads.
- The access roads of the transport vehicles, inside the Shipyards area, will be kept clean and in good condition, under the responsibility of the Operator.
- Machinery and motorized equipment should be handled carefully to avoid unnecessary works and movements
- On days when strong winds prevail, the above measures should be intensified while, the pace of works should be reduced.
- In case of increased dust emissions during C/R phase, the installation of windshields should be considered.

16.1.3 Exhaust Gases Management Plan

- Any equipment use should be limited to the absolutely necessary, thus reducing the corresponding effects on the atmosphere.
- All motor equipment should be inspected and maintained at regular intervals, in accordance with international technical specifications and the National Legislation
- The adjustment of the engines should be such that the emission of gaseous and particulate pollutants does not exceed the quantities indicated the current legislation and particularly:
    - MD 316/2010 (OG 501 / B / 2012) "Adaptation of the Greek legislation, in the field of the quality of gasoline and diesel fuels, to the Directive 2009/30 / EC of the European Parliament and of the Council",
    - MD 77/2016 (OG 4217/B/ 2016) "Amendment of the MD 316/2010".
    - JMD 128/2016 (OG 3958/B/2016) "Harmonization of the Greek Legislation to the Directive (EU) 2016/802" on the reduction of the sulfur content of certain liquid fuels ".
- For each maintenance - adjustment work, the relevant record will be completed and signed by the maintainer and will be kept on file.

- Regarding vehicles and mainly transport trucks, they must be equipped with EU certificates, as provided by current legislation. In addition, it is necessary to check the vehicles so that they are in good condition and meet the manufacturer's specifications.

16.2 Operation Phase

The relevant plan is presented in Table 16.2. Responsibilities for implementing the plan lie on Environmental Officer, Site Managers and any Subcontractor involved.

Table 16.1: Operation Phase Air Pollution Management Plan

Source	Type of Air Pollutants	Management
Sandblasting/Abrasive Blasting/Metal Grinding	VOCs, PM_{10}, $PM_{2.5}$, TSP	• Performed, as far as possible, in the designated closed structure (Building no 30 – Drawing ENV-02) were controlled sandblasting & painting processes are taking place. The building is equipped with bag filters and an adequate ventilation system. • Prior to the commencement of works, filters and ventilation system must be checked and maintained properly. • During normal operation, bag filters should be replaced at least once per year. • Wet-abrasive blasting • Hydro-blasting • Blasting with dry ice pellets • Vacuum blasting • Ultra-high-pressure water blasting
Coating/Painting	VOCs, PM_{10}, $PM_{2.5}$, TSP	• Should be performed in the designed closed areas (Building no 30 – Drawing ENV-02) and avoid, as far as possible, working outdoors. • Adequate filters and ventilation system should be in place • The designated building should be equipped with

		activated-carbon filters that should be checked and maintained properly. • The replacement of filters, according to the manufacturer, should be carried out twice (2) a year, under full operational conditions. • The frequency of measurements for VOCs and other substances will be twice (2) a year and preferably before replacing the filters with simultaneous execution of painting works, in order to capture the emission of gases in the worst-case scenario • In cases that coating/painting operations are performed outdoors the following BATs should be implemented: 1. Use of scaffolding with plastic cover 2. Fume hoods equipped with activated carbon filters will also apply 3. Gas emissions will be monitored through measurements at the output of the filters 4. Use of new generation antifouling products • When possible, substitution of traditional solvent-based paints with low-VOC or solvent-free paints or non-chemical treatments is proposed
Welding/Thermal Metal Cutting Operations	VOCs, PM_{10}, $PM_{2.5}$, TSP	• Performed in the designated buildings of Heavy and Light Rolling Mill, in the Pipe-Shop and Machine-Shop (Buildings No 25 and 29 – Drawing ENV-02) • Prior to operation, the fumes capture system must be properly maintained.

		• During normal operation, bag filters should be replaced at least once per year • Obtaining electricity whenever possible from renewable energy sources, or sources that do not consume fossil fuel.
All Activities	VOCs, PM_{10}, $PM_{2.5}$, TSP	• It is strictly forbidden to burn any kind of materials (tires, used mineral oils and cables, packaging, etc.) in the area of the Shipyards • All vessels mooring at the Shipyards should be free of toxic and explosive gases and present all the necessary certificates by entering the area. More specifically, all procedures should be implemented for (a) avoiding any explosion or other dangerous situation, ensuring that "gas-free for hot work conditions" are maintained throughout the stay of the ships for repairs (b) avoiding any leakage of substances that may cause harm to human health and the environment. • The sandblasting material (e.g., slag) loading operations should be synchronized and monitored to avoid emissions of dust and particulate matter. • Promote the supply of three-phase power to the ships during their stay at the Shipyards, as well as to the crews on ships or at the piers, with the aim of reducing the use of engines and consequently of gaseous pollution (Shore Side Electricity). • All vehicles used must have a valid certificate of compliance with the respective limits of gaseous

		pollutants (Exhaust Control Card), which must be always displayed, in accordance with current national legislation. • Promote the replacement of conventional vehicles (using diesel) with eco-ones (electric, Eco Buses etc.) in order to reduce greenhouse gas emissions from general land transport within the facilities.

17. ASBESTOS MANAGEMENT PLAN

17.1 General

As it was mentioned in Chapter 3, asbestos cement sheets are present in several buildings and other structures within the Shipyard area. Asbestos is used mainly in roofing sheets and wall cladding and requires immediate removal. It is estimated a total surface of 39,000m^2, including roofs and walls, is covered by asbestos cement material. According to its specifications, 1m^2 of that material weights approximately 16kg. Consequently, from the main buildings alone, a total quantity of 6,25 tons of asbestos should be removed.

As it was also mentioned in Chapter 3, a portion of asbestos is also present in some of the ISOBOX buildings and on outdoor sheds. This amounts to an additional area of approximately 500m^2 covered by asbestos sheets, corresponding to 80 kg of asbestos

In general, it is estimated that a total surface of approximately 40,000m^2 of asbestos cement sheets, corresponding to almost 7tn of asbestos containing material (ACM), should be removed during construction/rehabilitation phase.

17.2 Demolition/ Removal of Asbestos Companies (EAK)

The legislative background for asbestos management, according to National Legislation, is illustrated in Chapter 2. Note that, there are special requirements for the establishment and operation of enterprises carrying out demolition and asbestos removal works from buildings and structures as well as maintenance, coating and encapsulation of asbestos and/or materials containing asbestos (JMD 4229/395/2013 – OG 318/B`/15.2.2013). The term Demolition/ Removal of Asbestos Companies (EAK) refers to companies that undertake asbestos management works, namely: a) EAK Type A: means those EAK dealing with any kind of work in all kinds of materials containing asbestos (friable and non-friable) b) EAK Type B: means those engaged in work only with non-friable asbestos-containing materials.

Some of the requirements for an EAK company, according to National Legislation, are presented below:

- The EAK must have the minimum equipment described in Annex II of Article 16 of the above JMD. When EAK do not work with independent bodies so as to obtain measurements for the level of exposure of workers to asbestos fibers during working activities, then the EAK must possesses the minimum equipment described in Annex III of Article 16 of this decision (Article 7).
- The EAK should possess, at least, Personal Protective Equipment (not classified elsewhere) referred to the Annex IV of Article 16 of this Decision relevant to the protection of workers against the risk of exposure to asbestos fibers (Article 8).
- EAK's personnel must be appropriately trained before performing asbestos management tasks. The training programs of EAK personnel are categorized according to their role in asbestos management tasks (employees, work supervisors, technical practitioners, technicians, managers etc.), and their experience in asbestos management tasks (initial training, periodical re-training etc.) (Article 9).
- Measurement of workers exposure to asbestos fibers during asbestos management operations is carried out either by the EAK themselves (if they possess the equipment listed in Annex III of Article 16 of this Decision) or by other bodies or laboratories with which the EAK has contracted (Article 10).
- The management of asbestos waste arising from asbestos management tasks is carried out: a) by EAKs, provided they are registered in the hazardous waste management agencies record kept by YPEN b) by independent bodies contracted with the EAKs and which are also registered in the aforementioned record (Article 10).
- The EAK must keep a) Record of workers exposed or likely to be exposed during their work to dust arising from asbestos or materials containing asbestos b) a record of the asbestos measurements results c) medical records of workers exposed to asbestos at work, d) Log of preventive inspection and maintenance procedures (Article 11).

17.3 Competent Authorities Involved

- Occupational Risk Prevention Center (KEPEK): Regional Directorate of SEPE (Labor Inspection Body) belonging to the Ministry of Labor and Social Security.
- Department of Environment of the Attica Region
- Town Planning Authority (Municipality of Elefsina)
- YPEN

17.4 Personnel Training

17.4.1 General

EAK's personnel must be appropriately trained before performing asbestos management tasks. The training programs of EAK personnel are categorized according to their role in asbestos management tasks (employees, work supervisors, technical practitioners, technicians, managers etc.), and their experience in asbestos management tasks (initial training, periodical re-training etc.).

The initial training program is mandatory for all those involved in asbestos management work. The staff of E.A.K. who has not been involved in asbestos management work for a period of twelve months or more is required to repeat the initial training program. E.A.K. must assess the training needs of the staff and provide periodic retraining programs at least every three years.

17.4.2 Certified Training Bodies

The bodies implementing the training programs, the places of their execution, the qualifications of the trainees, the thematic units, the time duration, the approval process of the programs and their execution control are specified based on the provisions of JMD 15616/398/3−8−2010 (OG B΄ 1340).

Those certified bodies/individuals include:

1. EAK safety practitioners who possess the qualifications provided for in the JMD 21017/84/2009 with proven experience of at least one year part-time, which cannot be less than 300 hours of total employment time, in removal or demolition works of asbestos materials.

2. Doctors who have the specialty of occupational medicine or have legally practice the duties of a safety physician.

3. Graduates of Universities or Technical Schools who have a proven experience in the field of OHS for at least 2 years

4. Teaching and research staff Universities, Technical Schools and non-profit Research Centers with proven educational experience and/or safety research experience in OHS regarding asbestos

17.4.3 Training Program/Contents

Desktop/theoretical training modules:

- Types, uses and dangerousness of asbestos materials
- Adverse health effects of workers from exposure to asbestos fibers
- Adverse health effects of workers from exposure to asbestos fibers
- Installation of the construction site
- Asbestos materials pouring techniques
- Personal Protective Equipment (PPE)
- Cleaning the work area after asbestos removal
- Work equipment
- Waste disposal
- Emergency situations
- Exposure of workers to hazards beyond asbestos fiber exposure
- Roles and responsibilities
- Work supervision – record keeping

- Measurements of the level of exposure of workers to asbestos fibers
- Written risk assessment – Work plan

Practical training modules

- Site Installation – Work Preparation
- Personal Protective Equipment (PPE)
- Working techniques
- Waste disposal
- Emergency situations
- Measurements of the level of exposure of workers to asbestos fibers

17.5 Asbestos Removal Process

The main steps necessary for ACMs removal, are summarized below:

- Preparation of a written Risk Assessment and Work Plan with detailed technical specifications according to autopsy.
- Submission for Approval of the work plan to the Department of Environment of the Attica Region as dictated by the current legislation for asbestos removal projects by the Competent Authorities. The assessment and approval of the work plan the Competent Authority is estimated to be completed in a period of 15-30 days
- Announcement of the appointment of a Technical Practitioner and an Occupational Physician for the project to the competent department of KEPEK.
- Notification of commencing of works to the competent department of KEPEK, and to any other interested party in accordance with the decision approving the work by the Department of Environment of the Attica Region.
- Removal of asbestos cement sheets in accordance with proper practices and current legislation. The facility should be closed during the works and any space under roof should be empty of products under the responsibility of the Shipyards owner.

- Sampling and measurements for the presence of asbestos in the air at the end of the work.
- Packaging and transport of asbestos materials to properly licensed facilities.
- Environmental cleaning and control after the end of the works by an independent body (accredited laboratory) for Issuance of Certificates of Cleanliness of the facility.
- All works will be carried out in accordance with current legislation and concern the removal of ACMs.
- Issuance of small-scale permit by the Competent Town Planning Authority, under the responsibility of the employer (ONEX).

17.6 Project Duration

According to ENVITERRA's experience from previous projects, the successful and safe removal of the estimated ACMs is expected to last at least 90 days of work.

Figure 17.1: ACM removal from similar surface

17.7 Written Risk Assessment - Submission and Approval of the Work Plan

Following the agreement with ONEX, a work plan and a written risk assessment will be prepared by the EAK, to be submitted to the competent authorities for approval. The compilation of the above will be done accordingly to proper practices, as dictated by the current legislation and the peculiarities presented by the specific project in order to minimize any inconvenience and allow Shipyards to be operational for other works.

17.8 Removal of asbestos cement sheets

All work will be undertaken by certified asbestos works staff, and, during the works, an occupational medic and a Technical Practitioner will be present, as dictated by current legislation.

Asbestos building materials, such as asbestos cement, belong to the non-brittle asbestos materials. According to Greek and European guidelines of proper work practices the above materials do not require the creation of an airtight enclosure with negative pressure (NPU) or staff decontamination unit. Asbestos removal works may be carried out without the use of grinders, abrasive tools or compressed air.

Rechargeable power tools will be used for unscrewing. If loosening is not possible due to rust, handheld cutters will be used, the use of which will not cause damage to the asbestos cement or the release of asbestos fibers, since the cut is made between the screw head and the metal plate that works as a "nut" for fastening. Asbestos cement sheets are completely removed without breaking wherever possible.

Before starting the work of removing the asbestos cement sheets, the latter will be wetted with a special mixture of water and PVA (polyvinyl acetate) in order to bind any free fibers and to minimize the possibility of their suspension. During the works, a water hose will be available, connected to the existing water network, complete with a dispersion hose so that it is possible to wet the material to be removed where it is necessary and possible, but without creating wastewater contaminated with asbestos fibers. This way, the asbestos fibers are bound, and the possibility of their suspension is minimized. An industrial vacuum cleaner with special filters should also be used to clean floors, trusses, walls, and other surfaces from asbestos fibers.

After the dismantling of the asbestos sheets, a cleaning and collection of debris from roof that were observed during the autopsy inside the building will be carried out.

17.9 Equipment

In the Shipyards buildings, work at height is unavoidable for removing ACMs. For work at height, depending on the needs, the following equipment will be used:

- Special aluminum ladders
- Appropriately certified scaffolding
- Certified lifting equipment (e.g., lifts)
- Crane truck that will equipped with a staff transport basket.

In any case, the appropriate precautions should be taken to prevent the risk of falling, wherever the work must be carried out at a height.

The lashing straps will be firmly attached at a fixed point, depending on the equipment to be used for working at height. Where the height does not allow manual handling of loads, all movements of materials to and from the workplace will be done by crane.

During the dismantling of asbestos and cleaning the area, no entry is allowed to persons not employed in the project. The site will be properly marked and restricted before the start of works.

17.10 Packaging of asbestos materials

Whole and intact asbestos cement sheets will be removed, placed on pallets and wrapped in a double layer of heavy-duty polyethylene. Cargo fasteners (hoops, straps) will then be placed between the pallet and the waste material.

Alternatively, for smaller pieces and fragments, two colors of heavy-duty polyethylene bags with appropriate symbols should be used, in accordance with the current Legislation. The doubly packed waste material will be removed from the site and placed in big bags containing an inner nylon layer. The big bags will be placed on pallets and will be ready for transport.

17.11 Cleaning the area after the end of the dismantling work

During the works, all of the equipment and the entire working area will be kept clean. Type -H- Vacuum cleaners (suitable for asbestos), as well as wet cloths, should be used for cleaning.

After the ACMs are removed and all the waste and various tools and equipment are transported away from the workplace, the final cleaning and collection of the debris identified inside the buildings will take place. All bulk asbestos waste materials will be stored in two-color heavy-duty polyethylene bags with appropriate symbols, in accordance with National Legislation demands. The doubly-packed waste will be removed from the site and placed in big bags containing an inner nylon layer. All equipment used in the asbestos removal work will be thoroughly cleaned before being removed from the site.

17.12 Measurements for the issuance of a certificate of purity

After the completion of the works and the cleaning of the workplace, an independent accredited body (Plinios SA, knowledge-intensive company of NCSR Demokritos) will be called in to carry out air sampling and check the premises in order to confirm the complete removal and non-existence of any asbestos fibers in the atmosphere. The limit value of asbestos fiber concentration in air is 0.1 fibers/cm^3. In similar work using the same methodology, background air checks have shown that the actual fiber levels are below 0.001 fibers/cm^3 of air.

In case the inspections prove satisfactory, a "Clearance Certificate" will be issued. The documents will be distributed to the interested parties. There will also be monitoring of asbestos fiber accumulation while work is being carried out within the work area, as well as around it and in the construction site, to ensure that there is no leakage of asbestos fibers.

17.13 Transport of Asbestos Waste

All packages containing asbestos waste, after being hermetically sealed, will be initially transported and temporarily stored in a licensed storage facility of Hazardous Waste until they are sent abroad for final disposal as follows. Upon entering the facilities, the packaged waste will be weighed on the accredited scale and a balance sheet will be issued with the gross weight of waste and packaging.

The transfer of waste materials will be done by vehicles owned by the EAK, operated by specially trained for waste transportation drivers and holders of the ADR license, all according to ISO:28000 Security in Supply Chain. All vehicles should have a GPS tracking device, which will record the route they will follow, from the Shipyards' premises to the facilities without intermediate stops. In case of any emergency during the transfer, the EAK should immediately inform ONEX within 10 minutes about the incident and the measures required to deal with it.

The packaged waste will be loaded in a container and the container will be marked and certified by Accredited Certification and Inspection Body, for storage, packing and labeling.

Transfer of the container from the port to a port abroad where the final disposal will take place, should be conducted in accordance with the applicable Greek, European and international provisions, specifications, regulations and laws.

It should be noted that the EAK should have and demonstrate a License for Cross-Border Transport of Hazardous Asbestos Waste.

17.14 Personal Protective Equipment

The following equipment is mandatory:

- Battery powered filtration and air supply units combined with full face masks and P3 type filters.
- Half face masks with P3 type filters or P3 type filter masks.
- Goggles type mask type 5.
- Disposable coveralls (CE class 3, type 5) with built-in hood with elastic to seal around the face.

17.15 Final Disposal Procedures

Under the care of the EAK the following procedures will apply:

- Vouchers of Border Transfer of Shipyard waste should be issued by the Environmental Authorities where the final disposal will take place.
- The transfer from the project facilities to the facilities of the final disposal unit will be organized.
- All stakeholders in Greece and abroad will be coordinated.
- EAK should deliver a waste receipt certificate based on the balance sheet and a waste identification form, upon receipt.
- After the cross-border transfer and final disposal of the waste, EAK will provide ONEX with a certificate of final disposal of the waste in accordance with current legislation.
- The Department of Environment of the Attica Region, YPEN and any other co-competent authorities will be informed in writing about the start, transfer and completion dates of the works.

17.16 Final Disposal Site Specifications

As long as there is no certified/properly licensed asbestos disposal site in Greece, ACMs will be transferred to a **properly licensed facility abroad**. Some of the specifications of such a facility are described below:

Waste is stored in underground chambers under strict safety and quality criteria. The facility is completely isolated from the surface by a system of barriers (multi-barrier principle) and has absolutely no contact with groundwater. A long-term safety report prepared by experts in the field certifies that the underground disposal facility will remain safe for thousands of years.

Only non-organic, solid and non-gaseous materials are allowed to be stored. They might include products from waste incineration plants, or from the glass, metal or plastics industries and ACMs. Upon arrival, they are examined thoroughly to ensure that they are as described in the accompanying declaration. If the appropriate documentation is presented and a corresponding contract is in place, the waste is allocated to the various chambers of the disposal facility depending on its hazard potential. An entry is made in the land register documenting the waste. This provides evidence of which waste was stored when, where and by whom.

The underground disposal facility allows waste to be removed from the biosphere completely, so that it can no longer contaminate the air, soil or water.

One of facilities that may safely accept ACMs in located in Germany, and many EAKs from Greece are transporting asbestos there. (GSES GmbH Sondershausen, https://www.gses.de/underground-disposal.html)

17.17 Timeline and Budget

As it was mentioned in Chapter 3 a **90-day period** will be sufficient for the asbestos removal from Shipyards' Structures. Note that some of the buildings are high (> 5m), thus rendering removal and dismantling procedures more difficult.

In terms of cost, according to the Greek market today, a price of **25€/m^2** of ACM is expected. Thus, the final cost will amount to **1.000.000 €.**

18. SHIP WASTE COLLECTION & MANAGEMENT PLAN (SWCMP)

18.1 General

The MARPOL Convention 73/78 for the prevention and avoidance of pollution of the sea by ships and its implementation through European and Greek Legislation, require the delivery of waste and sewage produced on ships and cargo residues at port facilities where ships arrive.

The Shipyards are certified according to the standards ISO 9001:2015 and ISO 14001:2015 (update will conducted by ONEX), and the receipt and management of waste should follow the relevant procedures. Hereinafter, a detailed description of the procedures followed for the receipt of waste from ships is presented.

18.2 Waste Collection Procedure

1. Upon notification by the ship that he will enter the Shipyards for repairs or at the latest upon the arrival of the ship at the Shipyard facilities, the Supervising Engineer shall deliver to the ship's representative the information leaflets concerning the obligation to deliver waste and the facilitations for receipt, while after contacting the agent, a copy of the ship's waste declaration form is received (Annex V/Forms A & B respectively).

2. The Supervising Engineer informs the Operations Division (OD) for the needs of ship delivery of waste while the completed waste declaration form is sent by the Repair Sub-Directorate to the Head of Environment of the Shipyards, where an electronic Register and a physical file of the forms are kept.

3. The OD decides on the required collection equipment depending on the type and quantity of waste to be delivered, receives the waste properly separated and transports it to the temporary storage area. If among the delivered waste sanitary ones are included, it notifies a tank vehicle for their receipt.

4. With the care of the Group Safety & Compliance Division the Waste Receipt Certificate (Appendix II/ Form C) is completed, delivered to the ship's manager and notified to the EPA and the Production Directorate. Record of Certificates is kept in D.E.

5. The Head of Environment and the OD in collaboration with the Procurement/Subcontracting Department, take the appropriate actions to deliver the waste to a properly licensed company with which the Shipyard has a contract.

6. The OD receives any deficiency reporting forms (Appendix II/ Forms D) sent by the ships after their departure, records the reported deficiencies and sends a notification of the form to the departments involved, and keeps a record of these forms. A copy is also notified to the competent service of the MMAIP.

18.3 Petroleum Products

This type of waste (see also Chapters 10 and 11), with the care of the Head of Environment and the Procurement Department, is collected in portable bins, separated into liquid or solid petroleum waste, separated from wastes of different origin and composition, and kept clean of garbage etc. Wastes are kept for a short period of time, until they are handed over to a properly licensed company. Especially, lubricating oil wastes are received by the approved Alternative Lubricating Waste Management System, accompanied by the special Identification Form-Certificate of Acceptance of those waste. All data are also recorded in the DWR, and in the HW Book, and a file with the relevant documents is kept.

18.4 Solid Biodegradable Waste

They are delivered from ships, placed in collection bins and temporarily stored in a remote area of the Shipyard. From there, in a short period of time, they are removed by a licensed contractor and taken to a properly licensed landfill site. The relevant documents and quantities of the disposed waste are kept in a file and declared in DWR.

18.5 Sewage

Sewage is transported directly to a tank vehicle owned by a properly licensed company if the Shipyards have been notified on time by the ship. In exceptional cases, those waste may be accepted to the Shipyards' Biological Treatment Plant.

18.6 Waste falling under Alternative Management

If a ship possesses waste falling under the scope of Alternative Management, those are gathered in the appropriate bins or pallets (depending on the type of waste, e.g., EEEW, batteries etc.), under the responsibility of the Shipyards' personnel and delivered for management along with similar Shipyard waste, in accordance with the provisions of Alternative Management (see Chapter 2).

18.7 Special Waste

If there is a special type of waste for delivery, such as chemical or radioactive waste or ACMs, a contract is made with a properly licensed company and collection is performed by the specialized company's personnel, without any interference of Shipyards' staff.

18.8 Consultation of Stakeholders

Users of waste collection facilities and services (i.e., ship managers/captains):

- They are informed through forms about the available collection facilities
- Assess the services and means of collection provided to ensure satisfactory operation and to identify any malfunctions or deficiencies.
- At the same time, they can report any deficiencies to the MMAIP by completing the relevant form, which is then sent with the care of the Shipyard.

18.9 Equipment Technical Specifications

The technical specifications of waste receipt equipment already possessed by the Shipyards, is illustrated below.

Table 18.1: Pumps

Type	Model/Manufacturer	Supply	Maximum suction height	Maximum operating pressure	Pieces of Equipment
Diaphragmatic compressed air	M8 -WILDEN	283.9 l/min	6.4 m	8.6 bar	7
	M15 -WILDEN	350 l/min	6.4 m	8.6 bar	1
	T8 -WILDEN	618 l/min	6.4 m	8.6 bar	2
Diving electric	ABS JUMBO 84 ND	2280 l/min	40 m	4 bar	5

Table 18.2: Means for temporary storage of waste

Type of bin	Capacity (m^3)	Type		Pieces of Equipment
Open portable metal bucket (solid)	4,5	A1		4
Open portable metal bucket (solid)	2	A2		96

Table 18.3: Means for the temporary storage of petroleum waste

Type of bin	Capacity (m^3)	Type		Pieces of Equipment
Open portable bin (liquid/sludges)	3	B		12
Closed portable metallic bin (liquid)	7,2	Γ1		11
Closed portable metallic bin (liquid)	4,8	Γ2		15
Closed portable metallic bin (liquid)	21	Δ		4

18.10 Documents

Prior to the delivery of any waste, a number of documents are available for ship managers including:

- Information leaflets for incoming ships in Greek and English
- Waste declaration questionnaire for ship managers in Greek and English
- Waste receipt certificate
- Deficiency report form

Those documents are presented in Appendix II.

19. SEA POLLUTION CONTINGENCY PLAN

19.1 General

The purpose of the plan is to determine how to combat marine pollution from leaks and to describe the duties of the personnel involved in the prevention actions.

If, despite precautionary measures, there is an oil spill at sea, it must be handled as quickly as possible to reduce its spread, environmental damage and decontamination costs.

19.2 Possible Causes of Pollution

The main threats for sea pollution are summarized below (see also Chapters 10 & 11)

- Leakage from vehicles or machinery of the facility.
- Oil leak.
- Leakage from the ship at the connection points with the hoses.
- Explosion on the ship.
- Ship hull breach either from collision with another ship or due to grounding.
- Breakage of the flexible pipes.
- Sinking of the ship for any reason.

In case of leakage of any quantity of oil, the installation is obliged to take care of the containment of the spill in cooperation with the captains of the vessels involved -or the drivers of vehicles or machine operators- and to call the port authorities who will coordinate the entire decontamination operation in the area.

19.3 Organizing the Personnel for the Struggle against Pollution

Personnel involved

- Gate shift
- Facilities Manager

- Head of Environmental Protection
- Antipollution Team (APT)

1. Pollution detection

Pollution can be detected by any of the personnel of the Shipyards' operator, the crews of the hosted boats etc. The person in charge of the GATE should be informed, and by them the Facilities Manager or the Head of Marine Environment Protection.

2. Decision to Activate the Pollution Control Protocol

The decision to implement the marine Pollution Control Protocol, during work hours, is taken by the Facilities Manager or, in his/her absence, by the Head of Marine Environment Protection. If the pollution occurs outside normal working hours, then the person in charge of the gate of the Shipyard communicates by phone with the Facilities Manager, and they, in turn with the Head of Marine Environment Protection, and informs them about the extent of the pollution (estimate of the amount that has leaked) and the prevailing meteorological conditions (wind direction, ripple etc.) and after their approval by telephone, activates the pollution control protocol (PCP).

3. Organizational Chart of Anti-Pollution Team

The treatment of marine pollution requires special organization of the company's personnel in order to utilize every asset for confronting with the pollution incident.

For this reason, ONEX will organize an Anti-Pollution Team (APT). The APT employs operational teams under the responsibility of the Head of Environmental Protection.

These groups are organized without strictly adhering to the normal escalation of the administrative ranks and the number of members of each group may vary according to the requirements on a case-by-case basis. For that reason, the organization chart does not include the number of APT members.

4. Anti-Pollution Team Call Plan

This is applied in situations outside normal working hours, when most of the technical and administrative staff are not in the complex.

19.4 Gasoline or Lighter Products Leakage Protocol

Gasoline or lighter products have a low flash point, low average water solubility and high evaporation rate. Due to these properties a potential leak immediately carries the risk of fire or explosion. Their intense and fast evaporation can reach 96% in the 1st hour. The spread of these products is relatively small. In case of leakage of such products:

- The use of mobile phones and all devices that can cause sparks is prohibited.
- No measures are taken to limit the spill at sea, other than informing the Port Authority and the ships that move in the sea area, in order to limit the possibility of an explosion.
- The Police should definitely be notified, to quarantine the land area around the spill to avoid the creation of an explosion accident by passers-by and to facilitate the approach of people who are actively involved in dealing with the incident.
- The spill is left to disperse with the time
- The main engines and generators of all ships are ordered to be stalled, by the Competent Elefsis Port Authority, in order to prevent the random sparks which could cause combustion.
- The fire brigade is alerted to drop fire-retardant foam at dangerous spots.
- The personnel of the facilities who are exposed to the risk of explosion should either be removed from the spill area as soon as possible by using a diesel boat or protected in a sheltered and safe place as far as possible, without moving, in the event that there is no safe means of transporting them ashore.

19.5 Pollution Prevention Equipment and Assets

Below is an indicative list of useful equipment for dealing with sea pollutions.

- Floating Dam
- Chemical Scatterer
- Absorbent Dam
- Absorbent Towels
- Absorbent Pillows
- Absorbent Rolls
- Clothing Wigs
- Chemical Scattering System
- Skimmer Weir
- Fish nets
- Shovels
- Wire Brooms
- Lifejackets
- Wireless Radiophones
- Rakes
- Floating dam anchor sets
- Collection bags
- Sawdust bags

The new Shipyards' owner, prior to the commencement of the facility operation, should develop and certificate the Pollution Prevention Protocol in accordance with the specifications of the applicable national and international (e.g., IMO) legislation.

19.6 Dredging Management

Dredging MP is thoroughly examined in the next Chapter.

20. ASSESSMENT AND MANAGEMENT OF DREDGED MATERIAL

In the context of the Updated Guidelines for Management of Dredging Materials, of the decision IG.23 / 12 of the 20th Meeting of the Parties to the Barcelona Convention, 20-Dec-2017 (Updated Guidelines on Management of Dredged Materials, COP20 20-Dec-2017 - Decision IG.23/12) and the Spanish, French and Italian Guidelines (see also Chapter 2) and until the adoption of national legislative framework for the management of dredges, bottom excavation materials resulting from either port construction work projects or works for the restoration Shipyards functional depths, will be subject to an appropriate assessment of specific features in order to determine the best management option. Those features are presented in the following paragraphs.

It should be noted that according to ONEX Plan, there are no dredging activities necessary for the smooth operation of the Shipyards. Nevertheless, a comprehensive Management Plant should be conducted and executed if a need for dredging arises in the future.

20.1 Assessment of the characteristics and composition of the dredged material

20.1.1 Physical characterization

For all dredged material to be dumped at sea, the following information should be obtained:

- Quantity of dredged material (gross wet tonnage)
- Method of dredging (mechanical dredging, hydraulic dredging, pneumatic dredging, and application of BEP’s)
- Rough preliminary determination of sediment characteristics (i.e., clay/silt/sand/gravel/rock).

20.1.2 Chemical and biological characterization

In order to assess the capacity of the site to receive dredged material, both the total amount of material and the anticipated or actual loading rate at the dumping site should be taken into consideration. Chemical and biological characterization is also needed to fully assess the potential impact. Information may be available from existing sources, for example from field observations on the impact of similar material at similar sites, or from previous test data on similar material tested not more than five years previously, and from knowledge of local discharges or other sources of pollution, supported by a selective analysis. In such cases, it may be unnecessary to measure again the potential effects of similar material in the vicinity.

Chemical, and as appropriate biological, characterization will be necessary as a first step in order to estimate gross loading of contaminants, especially for new dredging operations. The requirements for the elements and compounds to be analyzed are set out in par. 20.6. The purpose of testing under this section is to establish whether the dumping at sea of dredged material containing contaminants might cause undesirable effects, especially the possibility of chronic or acute toxic effects on marine organisms or human health, whether or not arising from their bioaccumulation in marine organisms and especially in food species.

The following biological test procedures might not be necessary if the previous physical and chemical characterization of the dredged material and of the receiving area, and the available biological information, allows an assessment of the environmental impact on an adequate scientific basis.

However, suitable biological test procedures should be applied if:

- The previous analysis of the material shows the presence of contaminants in quantities exceeding the upper reference threshold in paragraph 34 (a) below or of substances whose biological effects are not understood,

- There is concern for the antagonistic or synergistic effects of more than one substance
- There is any doubt as to the exact composition or properties of the material, it is necessary to apply suitable biological test procedures.

These procedures, which should involve bio-indicators species may include the following:

- Acute toxicity tests
- Chronic toxicity tests capable of evaluating long-term sub-lethal effects, such as bioassays covering an entire life cycle
- Tests to determine the potential for bioaccumulation of the substance of concern
- Tests to determine the potential for alteration of the substance of concern.

Substances in dredged material may undergo physical, chemical and biochemical changes when deposited in the marine environment. The susceptibility of dredged material to such changes should be considered in the light of the eventual fate and potential effects of the dredged material. This may be reflected in the impact hypothesis and also in the monitoring programme.

20.1.3 Exemptions

Dredged material may be exempted from the testing if it meets one of the criteria listed below; in such cases, the provisions set below should be taken into account, after an initial sampling and testing proving that they are not contaminated.

- It is composed of previously undisturbed geological material
- It is composed almost exclusively of sand, gravel or rock
- It is suitable for beneficial uses and is composed predominantly of sand, gravel or shell.

In the case of Capital dredging projects national authorities may, taking into account the nature of the material to be dumped at sea, exempt part of that material from the provisions of the Guidelines, after representative sampling. However, Capital dredging in areas which may contain contaminated sediments should be subject to characterization in accordance with the Guidelines.

20.2 Decision making process

20.2.1 General

In case where, after exploring all possibilities of beneficial use of dredged materials, dumping operations at sea should be considered, it is recommended to select proper dumping sites to minimize the impact on commercial areas, key habitats, estuaries, and recreational fishery areas. This approach is a major consideration in resource protection.

In order to define the conditions under which permits for the dumping of dredged material may be issued, the National Authorities should develop on a national and/or regional basis, as appropriate, a decision-making process (Fig .1) for evaluating the properties of the material and its constituents, having regard to the protection of human health and the marine environment.

20.2.2 Criteria for Decision Making Process

Criteria may be described in the following terms:

- Physical, chemical and geochemical characteristics (e.g., sediment quality criteria)
- Application of beneficial use decision-making approach
- Biological effects of the products of the dumping activity (impact on marine ecosystems and estuary systems)
- Reference data linked to particular methods of dumping and to dumping sites

- Environmental effects that are specific to dumping of dredged material and are considered undesirable outside and/or in close proximity to the designated dumping sites
- The contribution of dumping to already-existing local contaminant fluxes (flux criteria)
- Mitigation measures during dumping operations

Criteria should be derived from studies of sediments that have similar geochemical properties to those to be dredged and/or to those of the receiving system. Depending upon the natural variation in sediment geochemistry, it may be deemed necessary to develop individual sets of criteria for each area in which dredging or dumping is conducted.

The decision-making process, with respect to the background natural baseline reference levels and to some specified contaminants or biological responses, may lay down a national upper and a lower reference threshold and action level, giving rise to three possibilities:

- Material which contains specified contaminants, or which causes biological responses in excess of the relevant upper threshold should generally be considered as unsuitable for dumping at sea, subject to confinement or/and treatment
- Material which contains specified contaminants, or which causes biological responses below the relevant lower threshold should generally be considered of low environmental concern for dumping at sea
- Material of intermediate quality should be subject to more detailed assessment before suitability for dumping at sea can be determined.

Data related to threshold levels from Mediterranean countries (Italy, France, Spain) are provided below (par. 20.7) and to the updated Guidelines for information purposes with the view to guide as appropriate the competent national authorities in the process of setting national threshold level values. It is recommended to review this Appendix on a regular basis to take into account global, regional and national relevant developments and adjust it accordingly

When the criteria and the associated regulatory limits cannot be met (case (a) above), the Competent Authority should not issue a permit unless detailed consideration, in accordance with Updated Guidelines, proves that dumping at sea is, nonetheless, the least detrimental option, compared with other management techniques. If such a conclusion is reached, ONEX, in collaboration with the Competent Authorities should:

- Implement a program for the reduction at source of pollution entering the dredged area, where there is a source that can be reduced by such a program, with a view to meeting the established criteria
- Take all practical steps to mitigate the impact of the dumping operation on the marine environment including, for example, the use of confinement (e.g., capping) or treatment methods
- Prepare a detailed marine environment impact hypothesis
- Initiate monitoring (follow-up activity) designed to verify any predicted adverse effects of dumping, in particular with respect to the marine environment impact hypothesis
- Issue a specific permit for each specific operation
- Report to the organization on the dumping which has been carried out, outlining the reasons for which the dumping permit was issued.

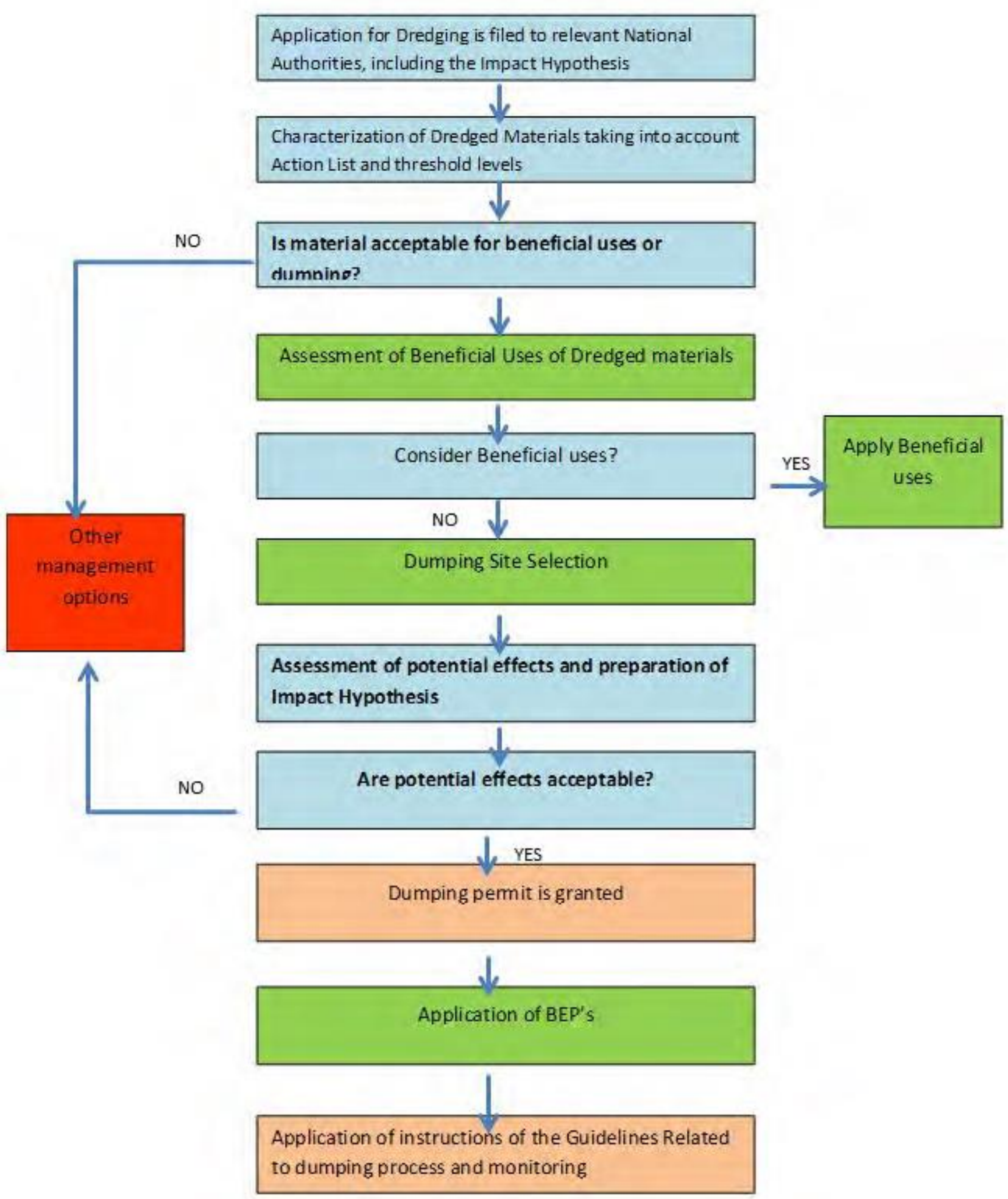


Figure 20.1: Decision making process of the Updated Guidelines

20.3 Dredged material sampling and analysis

20.3.1 Sampling for the purpose of issuing a dumping permit

For dredged material which requires detailed analysis (i.e. which is not exempted under abovementioned conditions), the following Guidelines indicate how sufficient analytical information may be obtained for the purpose of issuing a permit. Judgment and knowledge of local conditions will be essential in the application of these Guidelines to any particular operation.

An in situ survey of the area to be dredged should be carried out. The distribution and depth of sampling should reflect the size of the area to be dredged, the amount to be dredged and the expected variability in the horizontal and vertical distribution of contaminants. In order to evaluate the number of samples to be analyzed, different approaches might be retained.

The table that follows gives an indication of the number of sample sites to be used in relation to the number of m^3 to be dredged in order to obtain representative results, assuming a reasonably uniform sediment in the area to be dredged.

Table 20.1: No of Sampling Stations according to amount dredged

Amount dredged (m^3 in situ)	Number of stations
Up to 25000	3
from 25 000 to 100 000	4-6
from 100 000 to 500 000	7-15
from 500 000 to 2 000 000	16-30
> 2 000 000	extra 10 per million m^3

Core samples should be taken where the depth of dredging and the expected vertical distribution of contaminants warrant; otherwise, a grab sample is considered appropriate. Sampling from the dredger is not acceptable. Normally, the samples from each sampling site should be analyzed separately. However, if the sediment is clearly homogeneous with respect to sediment features (grain-size fractions and organic matter load) and expected level of contamination, it may be possible to analyze composite samples from adjacent locations, two or more at a time, provided care has been taken to ensure that the results give a justified mean value for the contaminants.

The original samples should be retained until the procedure for the issue of a permit has been completed, in case the results indicate that further analysis is necessary.

20.3.2 Provision of Input Data

The sampling scheme described above provides information for the purpose of issuing permits. However, the scheme can at the same time provide a suitable basis for estimating of total inputs and, for the time being in the current situation, can be considered the most accurate approach available for this purpose. In this context it is assumed that materials exempt from analysis represent insignificant inputs of contaminants and therefore it is not necessary to calculate or to report contaminant loads.

20.3.3 Parameters and methods

Since contaminants concentrate mainly in the fine fraction (< 2 mm) and even more specifically in the clay fraction (> 2 µm), analysis should normally be carried out on the non-coarse fraction sample (< 2 mm). It will also be necessary, in order to assess the likely impact of contaminant levels to provide information on:

- Grain size fractions (% sand, silt, clay);
- Load of organic matter;
- Dry matter (% solids).

In those cases where analysis is required, it should be mandatory for primary metal substances and arsenic. With respect to organochlorines, polychlorobiphenyls (PCBs) should be analyzed on a case-by-case basis in non-exempt sediments because they remain a significant persistent environmental contaminant. Other organhalogens should also be measured if they are likely to be present as a result of local inputs as indicated in the Action List Threshold Levels contained in Appendix 2 of the updated Guidelines and in par. 20.7.

In addition, the authority responsible for issuing permits should carefully consider specific local inputs, including the likelihood of contamination by PCB, PAH and TBT, as indicated in Appendix 1 of the updated Guidelines. The authority should make provision for the analysis of these substances as necessary.

National relevant authorities are the ultimate responsible for the application of national normalized and standardized methods for sampling and analysis of determinants. References include information that could be consider in this matter.

20.4 Best Environmental Practices (BEPs) during Dredging Activities

The applicability of BEPs is generally varying according to the particular circumstances of each dredging operation and it is clear that different approaches may then be appropriate. Generally, the objectives of BEPs are to:

A. Minimize the impacts of dredging operation on the marine ecosystems
B. Keep volume of dredged material minimal
C. Optimize dredging operations management through accurate survey systems
D. Improve sediment quality

Depending on the objective and taking into account local conditions, the proposed BEPs for Elefsis Shipyards project are illustrated in the following Table.

Table 20.2: BEPs for dredging activities

OBJECTIVE	CONSIDERATIONS	BEPs
A. Minimize the impacts of dredging	Minimizing the impacts in reducing the increase in turbidity and minimizing oxygen depletion	a. Use excavation tools /dredger heads appropriate to minimize turbidity b. Use silt screens/shields c. Minimize overflow by e.g., Recirculation of overflow water d. Use specially designed dredgers to dredge contaminated sediments e. Avoid the use of dredgers which introduce large amounts of suspended sediments into the water

OBJECTIVE	CONSIDERATIONS	BEPs
		column where this may lead to problems with oxygen depletion or contamination e.g. Agitation dredgers f. Avoid periods when dredging induced turbidity will lead to unacceptable reductions in oxygen levels due to high temperatures. g. Use of environmental grabbing equipment is recommended to ensure greater excavation accuracy, limit the escape of "loose" sediments during lifting and to minimize resuspended sediment.
B. Keep volume of dredged material minimal	In fluid mud areas: introduce the concept of Navigable depth based on: 1. Physical and chemical evaluation of the sediment (including rheometry and densitometry) 2. Full scale trials	Dredging only the amount of material required for maintaining a particular density level to allow navigation. This may require e.g. Continuous underway measurement of sediment density by using a nuclear transmission gauge or measurement of shear forces.
	In areas with sandy waves	Selective dredging of sand waves and other mobile sand structures
	Hydraulic engineering	Use of hydraulic structures to reduce sedimentation
	Accurate monitoring of dredged depths at an appropriate frequency	Accurate positioning systems e.g.: a. Microwave systems b. Radio wave technology c. Differential global positioning system (dgps) d. Apply rapid survey equipment e. Continuous measurement systems

OBJECTIVE	CONSIDERATIONS	BEPs
		f. Echo sounders g. Swath/multi beam systems
C. Optimization of dredging operations management through accurate survey systems	Availability of survey data on board	a. Online visualization of updated bathymetric charts, including topographic data, coastlines, deposit areas, dredge position, dredge head position b. Tidal information
	Process evaluation	a. Visualization/evaluation of dredged tracks/profiles/zones b. Dredging intensity chart c. In case of muddy material, sand and gravel: establish optimum overflow time by analysis of load diagrams
	Improve dredging process, through: 1. Effective dredging process control 2. Output improving techniques 3. Selective dredging techniques	a. Continuous on-line measurements and presentation e.g., of area, heading, speed of the dredgers and position of the suction head/buckets/cutter/backhoe/grab/ wheel b. Measurement of mixture velocity and concentration c. Measurement of macro production (load diagram) d. Hopper-measurement system monitoring the filling process e. Best suited suction head/cutters wheel/ backhoe/buckets f. Submerged dredge-pumps g. Degassing installations
D. Improve sediment quality	Improvement of sediment quality through an in-situ operation before dredging and after	a. Where relevant, increase sediment density by physical means e.g. Vibration or mechanical separation b. Hydro cyclones for separation of granulometric fractions

OBJECTIVE	CONSIDERATIONS	BEPs
	deposit and improvement of physical aspects (cohesion, consistency, density) of dredged material	c. Flotation d. Dewatering (under development) (consider potential problems with process water and associated contaminants e.g., re- circulation will reduce problems)
E. Issuance of Permits	General Measures	a. Dredging is recommended to be carried out in the period October - May, as during this period there is no clearly formed thermal bed, which could trap the suspended materials in the lower or upper layer. b. The drainage and other processing of the dredged material should be executed in a floating barge, the position of which will be determined after the approval of the Central Port Authority of Elefsis and the YPEN. c. The minimum distance of the vessel from the nearest shoreline should be 50m. d. The transfer to the area of temporary storage (see below) will be carried out after the completion of the drainage within the pre-defined Shipyards area in order to avoid any contamination spread. e. To reduce odors, the drained dredgers will be covered by a small amount of calcium oxide (CaO).

20.5 Monitoring of dredged material dumping operations

20.5.1 General

Monitoring of dredged material dumping operations is generally undertaken for the following reasons:

- To establish whether the dumping permit conditions have been respected - compliance monitoring - and consequently have, as intended, prevented adverse effects on the receiving area as a consequence of dumping
- To improve the basis on which permit applications are assessed by improving knowledge of the field effects of major discharges which cannot be directly estimated by a laboratory evaluation or from the literature
- To provide the necessary evidence to demonstrate that within the framework of the protocol the monitoring measures applied are sufficient to ensure that the dispersive and assimilative capacities of the marine environment are not exceeded, and so dumping operations do not cause damage to the environment and deteriorate good environmental status (ges).

20.5.2 Objectives

The purposes of monitoring are to determine contaminant levels in all sediments above the lower reference threshold in paragraph 34 (b) of the Guidelines and in bio-indicator organisms, and the biological effects and consequences for the marine environment of the dumping of dredged material and, ultimately, to help managers to combat exposure of organisms to dredged materials and associated contaminants.

20.5.3 Strategy

Monitoring operations are expensive since they require considerable resources both to carry out measurement and sampling programmes at sea and the subsequent analytical work on the samples. In order to approach the monitoring programme in a resource-effective manner, it is essential that the programme has clearly defined objectives, that the measurements made can meet those objectives, and that the results are reviewed at regular intervals in relation to the objectives.

Since the effects of dredged material dumping are likely to be similar in many areas, there appears to be little justification for monitoring all sites, particularly those receiving small quantities of dredged material. It would be more effective to carry out more detailed investigations at a few carefully chosen sites based on risk-based approach e.g. those subject to large inputs of dredged material) in order to obtain a better understanding of the processes and effects involved.

This is particularly the case for zones which present the same physical, chemical and biological characteristics, or nearly the same characteristics, for which there is strong presumptive evidence that the effects of dredged material dumping are similar, and it is very difficult to justify monitoring of all sites on scientific and economic grounds, particularly for those receiving small quantities of dredged material (e.g. less than 25,000 tons per year).

20.5.4 Monitoring

The dumping of dredged material has its primary impact at the seabed. Thus, although a consideration of water column effects cannot be discounted in the early stages of monitoring planning, it is often possible to restrict subsequent monitoring to the seabed.

Where it is considered that effects will be largely physical, monitoring may be based on remote methods such as side-scan sonar, to identify changes in the characteristics of the seabed, and bathymetric techniques (e.g. echo sounding) to identify areas of dredged material accumulation. Both these techniques will require a certain amount of sediment sampling to establish ground-truth. In addition, multispectral scanning can be used for monitoring the dispersion of suspended material (plumes, etc.) during the disposal operations.

Tracers may also be proved useful in following the dispersal of the dredged material and assessing any minor accumulation of material not detected by bathymetric surveys. Where, in relation to the impact hypothesis, either physical or chemical effects at the seabed is expected, it will be necessary to examine the benthic community structure in areas where the dredged material disperses. In the case of chemical effects, it may also be necessary to analyze the possible bio accumulation of pollutants (including fish).

The spatial extent of sampling will need to take into account the size of the area designated for dumping, the mobility of the dumped dredged material and water movements which determine the direction and extent of sediment transport. It should be possible to limit sampling within the dumping site itself if effects in this area are considered to be acceptable and their detailed definition unnecessary. However, some sampling should be carried out to aid the identification of the type of effect which may be expected in other areas and for scientific purposes.

The frequency of surveying will depend on a number of factors. Where a dumping operation has been going on for several years, it may be possible to establish the effect at a steady state of input and repeated surveys would only be necessary if changes are made to the operation (quantities or type of dredged material dumped, method of disposal, etc.). If it is decided to monitor the recovery of an area which is no longer used for dumping dredged material, more frequent measurements might be needed.

Information gained from field monitoring (and/or other related research) can be used to:

- Modify or, in the best of cases, terminate the field monitoring programme;
- Modify or revoke the permit;
- Serve as a basis to improve the permitting system refine the basis on which applications for permits are assessed.

20.6 Analytical Requirements for the Assessment of Dredged Material

According to the Guidelines, evaluations of dredged material are most efficiently conducted following a tiered process that begins with collecting existing relevant information, sediment chemistry data, and results from simple screening approaches. The evaluation then progresses, as needed, to more detailed assessments where information from multiple lines of evidence is collected to reach conclusions about contaminant exposure, effects and, ultimately, the risks posed by the disposal of dredged material into the sea. The term line of evidence is commonly used to refer to broadly-defined categories of information, physical, chemical and biological data, e.g. sediment chemistry, toxicity test data, and benthic community survey results.

The recommended sequence of tiers is as follows:

- The physical properties
- The chemical properties
- The biological properties and effects

At each tier it will have to be determined whether there is sufficient information to allow a management decision to be taken or whether further analysis is required. Further information determined by local circumstances can be added at each tier.

In the absence of appreciable pollution sources and if the visual determination of sediment characteristics leads to the conclusion that the dredged material meets one of the exemption criteria mentioned above, the material will not require further analysis.

Analysis should be carried out on the non-coarse fraction sediment (less than 2 mm).

<u>Tier I: PHYSICAL PROPERTIES</u>

In addition to the preliminary assessment of the characteristics of the sediments required by paragraph 19 of these Guidelines, the basic physical characteristics required are the amount of material, particle size distribution, other geotechnical attributes and mineralogical source and color of the sediment.

It is strongly recommended that the following determinations be carried out:

- Grain size analysis
- Percentage of solids (dry matter)
- Density/specific gravity
- Organic matter (as total organic carbon)

Tier II: CHEMICAL PROPERTIES

Primary group list: In all cases where chemical analysis is required, the concentrations of the following trace elements should be determined:

- Cadmium (Cd)
- Chromium (Cr)
- Copper (Cu)
- Lead (Pb)
- Mercury (Hg)
- Nickel (Ni)
- Zinc (Zn)

In certain cases, the analysis may also include other pollutants. In the case of mercury, special attention should be paid to speciation.

When examining the toxicity of contaminated dredged sediment, the analysis should be carried out also on the water phase. Lastly, the total organic carbon should be measured.

With regard to organic pollutants, the sum of PCB congeners IUPAC numbers 28, 52, 101, 118, 138, 153 and 180, should be analyzed. If local circumstances so require, the analysis should be extended to other congeners. The polycyclic aromatic hydrocarbons

(PAH) (sum of 16PAH or sum of 9 as a subgroup including at least the following, but not limited to: anthracene; benzo[a]anthracene; benzo[ghi]perylene; benzo[a]pyrene; chrysene; fluoranthene; indeno[1,2,3-cd]pyrene; pyrene; phenanthrene)) and the tri-butyl tin compounds (TBT) and their degradation products should also be measured.

As a minimum requirement, national action levels need to be established for the primary list above.

Secondary group list: Based upon local information on sources of contamination (point or diffuse sources) or historic inputs, other determinants may need to be measured for instance:

- Other chlorobiphenyls
- Organophosphorus pesticides;
- Organochlorine pesticides;
- Polychlorinated dibenzodioxins (PCDD);
- Polychlorinated dibenzofurans (PCDF);
- Petroleum hydrocarbons C10, C40
- Phthalates (DEHP and optionally - DBP/BBP)
- Tri-phenyl tin (tpht)
- Other anti-fouling agents

In deciding which additional individual organic contaminants to determine, reference should be made to existing priority substance lists, such as those prepared by the EU (as applicable).

Tier III: BIOLOGICAL PROPERTIES AND EFFECTS

In a significant number of cases the physical and chemical properties do not allow the biological impact to be measured directly. Moreover, they do not adequately identify all the physical disturbances nor constituents associated with sediments present in the dredged material.

If the potential impact of the dredged material to be dumped cannot be adequately assessed on the basis of chemical and physical characteristics, biological measurements should be made.

Toxicity bioassays

The primary purpose of the biological bioassays is to provide direct measures of effects of all sediment constituents acting together, taking into account their bioavailability. For ranking and classifying the acute toxicity of harbour sediments prior to maintenance dredging, short term bioassays may often suffice as screening tool:

- To evaluate the effects of the dredged material, bioassays for acute toxicity can be carried out with pore water, on elutriate or the whole sediment. In general, a set of 2-4 bioassays is recommended with organisms from different taxonomic groups (e. g. crustaceans, molluscs, polychaetes, bacteria, echinoderms), using species that are considered appropriately sensitive and ecologically relevant and methods have been standardized and validated;
- In most bioassays, survival of the test species is used as an endpoint. Chronic bioassays with sub-lethal endpoint (growth, reproduction, etc.) covering a significant part of the test species life cycle may provide a more accurate prediction of potential impacts of dredging operations, thus are recommended.

The outcome of sediment bioassays can be unduly influenced by factors other than sediment associated chemicals. Confounding factors like ammonia, hydrogen sulphide, grain size, oxygen content and pH should therefore be determined during the bioassays.

Guidance on the selection of appropriate test organisms, use and interpretation of sediment bioassays is given by e.g. EPA/CE (1991/1994) and IADC/CEDA (1997) or PIANC (2006) while guidance on sampling of sediments for toxicological testing is given by e.g. ASTM (1994).

Biomarkers

Biomarkers may provide early warning of more subtle (biochemical) effects at low and sustained levels of contamination. Most biomarkers are still under development but some are already applicable for routine application on dredged material (e.g. one which measures the presence of dioxin-like compounds - Murk et al., 1997) or organisms collected in the field (e.g. DNA strand/breaks in flat fish).

Field observations of benthic communities

In situ monitoring of benthic communities (fish, benthic invertebrates) in the area of the disposal site can provide important indications of the condition of marine sediments. Field observations give an insight into the combined impact of physical disturbance and chemical contamination. Guidelines on the monitoring of benthic communities are provided by e.g., the Paris Convention, 1992, ICES.

The need for supplementary information will be determined by local circumstances and may form an essential part of the management decision. Appropriate data might include: redox potential, sediment oxygen demand, total nitrogen, total phosphorus, iron, manganese, mineralogical information or parameters for normalizing trace metal data (e.g. aluminium, lithium, scandium).

20.7 Contaminant Action Levels and Threshholds

Hereinafter, the action levels and the threshold values adopted by Italy, Spain and France are illustrated. Below its table there is a description of the management alternatives, depending on the analyses results.

Table 20.1: Pollutant limit values based on characterization of dredging according to the Spanish Regulations. (Concentrations refer to the non-coarse fraction of the precipitate i.e., less than 2 mm and expressed in dry matter).

Pollutant	N.A. A (Action level A) Limit for marine deposition in specific areas	N.A. B (Action level B) Limit for marine deposition in case biological tests are performed	N.A. C (Action level C) Limit for performing biological tests
Hg (mg/kg)	0,35	0,71	2,84
Cd (mg/kg)	1,20	2,40	9,60
Pb (mg/kg)	80	218	600

Pollutant	N.A. A (Action level A) Limit for marine deposition in specific areas	N.A. B (Action level B) Limit for marine deposition in case biological tests are performed	N.A. C (Action level C) Limit for performing biological tests
Cu (mg/kg)	70	168	675
Zn (mg/kg)	205	410	1640
Cr (mg/kg)	140	340	1000
Ni (mg/kg)	30	63	234
As (mg/kg)	35	70	280
Σ 7 PCBs (mg/kg) [28, 52, 101, 118, 138, 153 and 180]	0,05	0,18	0,54
Σ 9 PAHs (mg/kg) [Anthracene, Benzo(a)anthracene, Benzo(ghi)perylene, Benzo(a)pyrene, Chrysene, Fluoranthene, Indeno (1,2,3-cd)pyrene, Pyrene and Phenanthrene].	1,88	3,76	18,80
TBT (mg Sn/kg) (DBT and MBT)	0,05	0,20	1,0

- Category A: The concentration of all pollutants is below the level of action A.
- Category B: The concentration of all pollutants is below action level B or action level C (only if biological characterization is performed and the results indicate negative toxicity).
- Category C: The concentration of one or more pollutants is above action level C or action level B in case biological characterization is performed and the results indicate positive toxicity). <u>This material may not be disposed of (freely) at sea and is subject to restriction (underwater structure), processing or land management.</u>

Table 20.2: Pollutant limit values based on characterization of dredges according to the French Regulations (Concentrations refer to the non-coarse fraction of the precipitate i.e., less than 2 mm and expressed in dry matter)

Pollutant	Unit	N1	N2
TBT	μg/kg	100	400
PCB congener 28	μg/kg	5	10
PCB congener 52	μg/kg	5	10
PCB congener 101	μg/kg	10	20
PCB congener 118	μg/kg	10	20
PCB congener 138	μg/kg	20	40

Pollutant	Unit	N1	N2
PCB congener 153	μg/kg	20	40
PCB congener 180	μg/kg	10	20
Anthracene	μg/kg	85	590
Benzo[a]anthracene	μg/kg	260	930
Benzo[a]pyrene	μg/kg	430	1015
Benzo[b]fluoranthene	μg/kg	400	900
Benzo[k]fluoranthene	μg/kg	200	400
Benzo[g, h, i]perylene	μg/kg	1700	5650
Chrysene	μg/kg	380	1590
Indenopyrene	μg/kg	1700	5650
Phenantrene	μg/kg	240	870
Fluorene	μg/kg	20	280
Fluoranthene	μg/kg	600	2850
Naphtalene	μg/kg	160	1130
Pyrene	μg/kg	500	1500
Acenaphthylene	μg/kg	40	340
Acenaphthene	μg/kg	15	260
Dibenz[a,h]anthracene	μg/kg	60	160
Arsenic	μg/kg	25	50
Cadmium	μg/kg	1,2	2,4
Chromium	μg/kg	90	180
Copper	μg/kg	45	90
Mercury	μg/kg	0,4	0,8
Nickel	μg/kg	37	74
Lead	μg/kg	100	200
Zinc	μg/kg	276	552

- According to the provisions of the French Regulations, for the values of a parameter below level N1 the potential impact is considered in principle neutral or negligible, the levels being "normal" or comparable to the environmental background.
- Additional research may be required between level N1 and level N2 depending on the management choice and the degree to which level N1 is exceeded. Finally, exceeding the N2 level for any parameter requires additional research, as, depending on the management options, significant environmental impacts may occur.
- It is noted that, even in case of exceedances of N2, the disposal of sediments at sea is not strictly prohibited. In each case, however, the number of exceedances

found, the magnitude of exceedance, and the relevant toxicity of pollutants should be evaluated.

Table 20.3: Pollutant limit values based on characterization of dredges according to the French Regulations (Concentrations refer to the non-coarse fraction of the precipitate i.e., less than 2 mm and expressed in dry matter).

Pollutant	Unit	AL1	AL2
Arsenic	mg/kg	12	20
Cadmium	mg/kg	0,3	0,8
Chromium	mg/kg	50	150
Chromium (VI)	mg/kg	2	2
Copper	mg/kg	40	52
Mercury	mg/kg	0,3	0,8
Nickel	mg/kg	30	75
Lead	mg/kg	30	70
Zinc	mg/kg	100	150
Anthracene	μg/kg	24	245
Benzo [a] anthracene	μg/kg	75	500
Benzo [a]pyrene	μg/kg	30	100
Benzo[b] fluoranthene	μg/kg	40	500
Benzo [k] fluoranthene	μg/kg	20	500
Benzo[g,h,i]perylene	μg/kg	55	100
Crysene	μg/kg	108	846
Indenopyrene	μg/kg	70	100
Phenantrene	μg/kg	87	544
Fluorene	μg/kg	21	144
Fluoranthene	μg/kg	110	1494
Naphtalene	μg/kg	35	391
Pyrene	μg/kg	153	1398

There are two thresholds, AL1 and AL2, for each parameter under consideration (chemical element or priority substance according to 2008/105/EC), which have been selected with specially designed weighted criteria.

The classification of chemical levels is based on the development of chemical hazard ratios (HQCs), which take into account the importance of the pollutant, the number of priority elements/substances exceeding the AL1 and AL2 limits and the magnitude of these exceedances. The evaluation approach is based on the principle of "weight of evidence" and not "pass / fail". The final evaluation of the quality of the sediments, some of the priority substances of which exceed the AL1 level, is checked by a series of ecotoxicological tests. However, for exceeding the AL2 limit, free discharge into the sea is not permitted.

20.8 Approaches to management/Alternatives

This section deals only with management techniques to minimise the physical effects of disposal of dredged material. Measures to control the contamination of dredged materials are covered in other sections of this Management Plan.

The following approaches will be implemented:

- The key to management lies in careful site selection and assessment of the conflict between marine resources, the marine environment and activities.
- To avoid excessive use of the seabed, the number of sites should be limited as far as possible, and each site should be used to the maximum extent possible without interfering with navigation (sand shoals formation).
- All measures should be taken to allow recolonization to take place once deposition stops.
- Effects can be reduced by ensuring, as far as possible that the sediments in the dredged material and receiving area, are similar. Locally, the biological impact may be further reduced if the sedimentation area is naturally subject to physical disturbance (horizontal and vertical currents). Where this is not possible, and the materials are clean and fine, a deliberately dispersive style of dumping should be utilised so as to limit blanketing to a small site.
- With capital and maintenance dredging, the material may be different in character to the sediments at the receiving site and re-colonisation may be affected. Where bulky material such as rock and clay are deposited, there may be interference with fishing activity, even in the long term.
- Temporal restrictions on dumping activities may have to be imposed (for example tidal and seasonal restrictions). Interference with fish or crustacean migration or spawning or with seasonal fishing activities may be avoided by

imposing a calendar for dumping operations. Trench digging and refilling activities may also interfere with migratory patterns and similar restriction measures are needed.

- Where appropriate, disposal vessels should be equipped with accurate positioning systems for example, satellite systems. Disposal vessels should be inspected, and operations controlled regularly to ensure that the conditions of the dumping permit are being observed and that the crew is aware of its responsibilities under the permit. Ships' records and automatic monitoring and display devices (e.g., black-boxes), where these have been fitted, should be inspected to ensure that dumping is taking place at the specified dumping site.
- Where solid waste is a problem, it may be necessary to specify that the disposal vessel (or dredger) is fitted with a grid to facilitate removal for disposal (or recovery) on land, rather than being dumped at sea.
- Monitoring is an essential component of management action (see par. 20.5).

21. HAZARDOUS MATERIALS MANAGEMENT

21.1 Gas Cylinders under pressure

In terms of safety, industrial pressurized gases can be divided into flammable/explosive (the burning of which creates a flame of high thermal power), and inert (used mainly to create an inert atmosphere).

Flammable/Explosive gases include:

- Oxygen (O_2)
- Acetylene (C_2H_2)

Possible causes of industrial gas accidents include:

- Explosion/ignition (flammable gases). The explosion may be due to:
    - Failure of the cylinder during use
    - Lack of necessary safety devices
    - Heat source near the cylinder
    - Smoking during work
    - Use of open flame near the cylinder (e.g., when welding) or performing high temperatures procedures nearby
    - Violent gas expansion due to valve failure (e.g., in case of fall).
- Dropping the cylinder during transport or when it is stored (let's not forget that the cylinder has a significant weight and can cause serious injury in the event of a fall).
- Lack of necessary PPE (e.g., if glasses with a suitable filter are not used, the flame light can cause severe damage to vision).

Checkpoints - Safety measures

In all cylinders, the following should be checked:

- The existence of the necessary labelling (next paragraph).
- The general condition of the cylinder. Severe oxidation, deformations (indicating past falls), crooked valves, etc. are sources of danger. Suspicious is also a freshly painted cylinder (as paint makes it difficult to read the labels and hides the flaws).
- The presence of a cap for the valve (the cylinder ALWAYS uses the cap when not in use). We also check if the screwing at the top of the cylinder is in good condition, otherwise the cap cannot be fitted.
- The storage space for. A special area away from the work area should be set up (especially if the company manages a large number of cylinders). This area should:
    - Be protected from the sun and heat sources.
    - Have fixed metal support frames for the cylinder equipped with chains of suitable strength to prevent falling.
    - Be accessible by the means of handling and transport (supplier vehicles, transport crane bridge, transport forklift, etc.).
- The means of transport and handling. Cylinders are transported from their warehouse to the workplace by mechanical means. Normally they are transported in a special basket that is hung on a crane bridge or attached to a forklift. In the case of a set of oxyacetylene cutting cylinders, those are transferred inclined, by a special trolley, to which they are chained.
- The temporary storage area when not in use since it must be away from heat sources, corridors for personnel/vehicles/materials etc.

Especially in flammable gas cylinders we examine:

- If there are heat sources or if high temperatures work is performed near the cylinders.

- If the necessary safety devices are present on the cylinder which include: A) Non-rotating valve and B) Flame trap (which usually also includes a non-rotating valve). At best there are both devices in order, but at least one is necessary. It should be noted that these devices cause some reduction in gas flow, especially when the gas in the cylinder is greatly reduced. However, this is not an excuse for not using them.

Labelling of gas cylinders

Cylinders have a characteristic colour depending on the gas they contain:

- Acetylene (Yellow)
- Oxygen (White)

The cylinders should also be marked with the following information:

1. Cylinder number
2. Owner name
3. Type of gas content
4. Operating pressure in atmospheres (at 150 C)
5. Date of last and next inspection & inspector stamp
6. YBET stamp for initial release
7. Content in Liters
8. Manufacturer's mark
9. Year of manufacture & construction number
10. Leakage calculation limit
11. Name - type of container material

12. Minimum wall thickness in millimetres

13. Empty cylinder weight in kilos

It should be noted that the labelling, maintenance, and periodic inspection of the cylinders is the responsibility of the supplier, who is usually also the owner of the cylinders. The responsibility of the company is limited to the inspection of the labelling.

21.2 Hazardous Materials Management

Labelling

The risks attached to handling of hazardous substances (products or wastes) include:

- Natural causes,
- Risks to health,
- Risks to the environment,

as they are presented in Annex I of Regulation 1272/2008/EE

Safety Data Sheets (MSDS)

MSDS (material safety data sheets) are sheets which contain important information for each hazardous material in relation to:

- Detailed hazards with respect to the environment, health and safety
- Firefighting measures
- Measures in case of accident
- Disposal method
- Transport and storage conditions
- Information on the label

- Method of use

Dangerous materials MSDSs should be available at all times.

Employees must study or properly informed by the competent personnel (safety manager).

<u>Handling - storage requirements</u>

Hazardous materials should be used in accordance with the specifications defined in the legislation and described in detail in the MSDSs.

Any hazardous material received by the facility must be transported and packaged in special specifications container.

Each package shall contain information concerning:

a. The name, address and telephone number of the suppliers

b. The nominal quantity of the substance or mixture in the package made available to the general public, unless otherwise stated

c. The product identification codes

d. Where appropriate,

   I. The risk pictograms;

   II. Identification words, e.g.: “Danger” and “Hazard”

   III. Hazard declarations, like

      (1) Harm to public health and the environment by destroying ozone in the upper atmosphere.

      (2) Toxic to aquatic organisms with long-term effects.

      (3) Combustible if exposed to air

IV. Appropriate safety sheets, e.g., Prevention: P210, Response: P377

V. Section for additional information

Storage areas must have measures against leakage due to packaging damage, failure to seal the package, falling, etc.

All storage areas must have equipment for managing leaks or spills e.g., absorbent pads and absorbent booms (dams) and/or sawdust, and collection tools (shovels, big bags), according to materials and depending on the appropriate neutralizing agents.

22. SOIL & GROUNDWATER MP

22.1 C/R Phase

The relevant MP for C/R phase is presented in Table 22.1. Soil & Groundwater MP is closely connected with Waste & Wastewater MPs.

Table 22.1: Soil & Groundwater MP (C/R Phase)

Source/threat	Action/Management	Responsible
Motorized equipment maintenance	• The maintenance of the motorized equipment will not take place in site, but in designated installations outside the study area (e.g., workshops in the wider area) and therefore there will be no necessity for managing lubricants or oils. • The operator of the construction site should take care of the good condition of the mechanical means. • Appropriate measures should be taken, in the context of good construction practice, such as good and regular maintenance of machinery and oil change in licensed facilities outside the shipyards' area.	• Environmental officer (ONEX) • Project manager (contractor)
Motorized equipment washing	• No washing of motor equipment will take place in site and therefore no rinsing water will be produced which may contaminate the soil.	• Environmental officer (ONEX) • Project manager (contractor)

Unforeseen situation or accident	• The use of adsorbents such as sand, wood chips or special geotextiles is critical after the escape of liquid waste.
	• Especially for adsorbent materials:
	  o Should be present in sufficient quantities to seek the adsorption and consequent retention of leaking fuels, lubricants or any other waste in liquid form
	  o After use, those materials should be carefully collected and disposed of in accordance with the instructions and legislation for the disposal of hazardous waste.
	  o The stored absorbent materials must be checked at regular intervals, whether
		• Environmental officer (ONEX)
		• Project manager (contractor)
		• HW management licensed contractor

Source/threat	Action/Management	Responsible
	they have absorbed increased amounts of moisture (e.g., from water leakage). In this case they should be replaced as soon as possible	
Waste collection and transport	• Conducted only by properly licensed companies/contractors under the supervision of ONEX's environmental officer. • In case of waste leakage or escape, immediate action must be performed as stated above.	• Environmental officer (ONEX) • Project manager (contractor) • HW management licensed contractor
Land storage sites for aggregates and other terrestrial materials	• Storage areas should be identified prior to the commencement of work and located at a sufficient distance from the seafront to reduce the possibility of transporting materials (e.g., due to rainfall) to the sea. • The stored quantities of materials for the needs of c/r phase should be limited to the absolutely necessary. • In case of aggregates or other bulk construction materials stored in piles and for a long time, inside the construction site or in storage areas near the fronts of the works, they should be covered, especially on days with heavy rainfall and winds. • The temporary deposition of materials for the c/r works should be done in a way that it will not allow erosion and leaching phenomena (shaping, covering with suitable plastic covers, etc.).	• Environmental officer (ONEX) • Project manager (contractor)
Temporary deposition of materials resulting from the construction works	• Those materials that will either be reused, or their final disposal will be done outside the construction site facility, should be managed in such a way that will not cause corrosion and leaching.	• Environmental officer (ONEX) • Project manager (contractor)
Solid waste that will result from the activities of c/r staff	• Waste will be separated into recyclable (paper, aluminum, glass) and non-recyclable. • Waste will be placed in designated bins and will be disposed of periodically in the proper waste disposal areas (urban or recyclable) of the relevant municipality under the responsibility of the construction site operator and always in collaboration with	• Environmental officer (ONEX) • Project manager (contractor) • NHW management licensed contractor

Source/threat	Action/Management	Responsible
	properly licensed collectors/transporters.	
Waste falling under the scope of alternative management	• Waste falling under the scope of alternative management (e.g., used batteries, tires, packaging etc., see chapter 2), should be managed according to the provisions of the relevant legislation and under the supervision of the pros.	• Environmental officer (ONEX) • Project manager (contractor) • Nhw management licensed contractor • Pro
Municipal wastewater	• Install at least one chemical toilet per twenty people on the construction site.	• Environmental officer (ONEX) • Project manager (contractor)
Local drainage network	• Should be thoroughly cleaned from any foreign materials, vegetation etc. So that no overflows and runoff may occur.	• Environmental officer (ONEX) • Site manager (ONEX) • Project manager (contractor)
Waste management practices	• It is strictly forbidden to dump all kinds of liquid waste, oils, fuels, sewage etc. On the construction site or on the broader shipyard area. • The management of used mineral oils will be done in accordance with pd 82/04 (og 64/a/2004).	• Environmental officer (ONEX) • Site manager (ONEX) • Project manager (contractor)

22.2 Operation Phase

The relevant MP for Operation phase is presented in Table 22.2. Soil & Groundwater MP is closely connected with Waste & Wastewater MPs.

Table 22.2: Soil & Groundwater MP (Operational Phase)

Source/Threat	Action/Management	Responsible
Solid Waste from Ships	• During ships docking, after the completion of the ship repair works and before the filling of the tanks with seawater, all the solid waste that has arisen should be removed from the tanks and the interior of the ships to appropriate means, according to SWCMP • During ships docking, the surfaces and the floors of the tanks should be cleaned at regular intervals and the resulting waste should collected in appropriate means and managed according to SWCMP. • The Ship Waste Collection & Management Plan (SWCMP - approved by Ministry of Maritime Affairs & Insular Policy) should be implemented at all times. • Ship solid waste will be collected in appropriate means (e.g., wheeled bins, bins-containers, garbage trucks, vessels, etc.) as specified each time in the approved SWCMP • The collection means will be received directly from the ships or will remain at the piers until the completion of the delivery of the waste from the ships and will be collected for transport and final management by an authorized contractor. • At all stages of waste collection and transport care must be taken to avoid any pollution on land and sea.	• Environmental officer (ONEX) • Site manager (ONEX) • Project manager (contractor) • Ship Manager

Source/Threat	Action/Management	Responsible
Solid Waste from shipbuilding/repairing	• Material used in shipbuilding/repairing (paints, solvents, coatings, varnishes, etc.) must not be discarded on the ground. • All waste generated during the repair works should be delivered to the properly licensed collectors for further management	• Environmental officer (ONEX) • Site manager (ONEX) • Project manager (contractor)
Hazardous Waste	• HW contaminated with residues of used paints, solvents, coatings, varnishes or other materials (e.g., empty paint containers, absorbent materials, fabrics, etc.), under the responsibility of the ship, will be collected separately. Their handling and temporary storage should take place according to materials safety data sheets (MSDS) and they will be disposed of as hazardous waste, in accordance with the provisions of JM 13588/725/2006 (OG 383/B/ 2006), through deliverance to a properly licensed company. • HW should be collected and delivered by a contractor, who must have a permit for collection and transport of hazardous waste and a contract with the facility that will receive those waste If this waste is delivered for disposal or recovery within the country, the AET of the final recipient must include the specific EWC codes for waste receipt and management/recovery.	• Environmental officer (ONEX) • Site manager (ONEX) • Project manager (contractor)
Materials Storage	• Bulk materials should not be stored outdoors and temporary storage of raw materials and equipment (including metal parts for repair or resale) may be allowed in a designated area upon approval by the Operator of the Shipyards	• Environmental officer (ONEX) • Site manager (ONEX) • Safety Practitioner (ONEX)
Petroleum Waste from Ships	• Petroleum waste will be collected directly from ships in tank vehicles and will be sent for pre-treatment and separation to a properly licensed facility.	• Environmental officer (ONEX) • Site manager (ONEX)

Source/Threat	Action/Management	Responsible
		• Project manager (contractor)
Municipal Waste/NHW	• Under no circumstances, a pile of NW municipal waste should be created. All municipal waste should be collected in bins and, as soon as possible, transferred by to the proper facilities with responsibility of the local Municipality. • In cases where the solid non-hazardous waste of ships is collected by floating means (barge, etc.) there will be a designated space, within the facilities, for the transfer of waste from the floating means to land (e.g., garbage truck,) for transport to final disposal and/or to recycling facilities.	• Environmental officer (ONEX) • Site manager (ONEX) • Project manager (contractor)
Waste falling under the scope of Alternative Management	• Waste falling under the scope of Alternative Management (e.g., used batteries, tires, packaging etc., see Chapter 2), should be managed according to the provisions of the relevant legislation and under the supervision of the PROs.	• Environmental officer (ONEX) • Site manager (ONEX) • Project manager (contractor) • PROs
Underground Tanks	• Regular inspections of the underground tanks that collect leakages from warehouses. All waste should be pumped directly to tank vehicles and transfer to properly licensed facilities for further treatment as HW. • Regular clean-up of underground tanks and removal of sludges. Those waste will be treated as HW. • In case of fuel leaks on concrete or on soil, adsorbents will be always available and used such as sand, wood chips or special geotextile immediately after the escape. Such materials will be available on site for immediate intervention.	• Environmental officer (ONEX) • Site manager (ONEX) • Project manager (contractor)
Rainwater Network	• Carry out periodic inspection and cleaning of the rainwater network and the provided oil purifiers.	• Environmental officer (ONEX) • Site manager (ONEX)

Source/Threat	Action/Management	Responsible
	• Oily residues and entrails from the wells should be collected and disposed of at regular intervals.	• Project manager (contractor)
Machinery / vehicle components end-of-life vehicles.	There are subjected to alternative management, will be collected in special areas and delivered to licensed body/contractor for further management	• Environmental officer (ONEX) • Site manager (ONEX) • Project manager (contractor) • PROs

23. BIODIVERSITY MANAGEMENT PLAN

23.1 C/R Phase

23.1.1 General

The effects of the C/R activities on the individual elements of the terrestrial natural environment (ecosystems, habitats, flora and fauna) are mainly attributed to the increase of noise levels and the concentrations of suspended particles (dust) from the operation of the machinery and the construction site equipment in general, the earthworks and the transport of the construction materials and waste.

The air pollution management plan, the soil/groundwater management plan and the noise mitigation measures are also applicable for mitigating any impacts to biodiversity. Additional measures and management options are illustrated below.

23.1.2 Habitats Protection

The following practices/measures apply

- No destruction or removal of the existing vegetation is anticipated
- Delimit the work areas (e.g., around the pier) to ensure that impacts are limited to this area.
- If possible, ONEX should endeavor to undertake construction activities immediately after the wet season.
- Transportation vehicles and other equipment should be cleaned thoroughly to remove sticking soils on wheels and other parts of the vehicle to avoid carrying propagules of the invasive species to the site.
- No construction materials (e.g., for pier construction) will be taken from the surrounding environment except from legally operating quarries in the broader area
- Ecological awareness training will be provided to all staff involved in the C/R phase

- For transporting materials, waste, machinery equipment etc., only existing paved roads will be used
- Prohibition of import of non-native species or hybrids in cases of implementing planting program.
- Improvement of habitat (vegetation) connections should be enhanced by conserving grasses and bushes that occur in the wider landscape.

23.1.3 Terrestrial Species Nuisance

- Access to workplaces only by on-site staff
- Night work should be limited, and the use of street lighting should be reduced.
- Restriction of vehicle and staff movements only within the workplace
- Maintain passages for species as much as possible along the construction areas
- During C/R phase, a noise monitoring plan should be implemented, and intervention measures should be taken in cases of excessive nose, in order not to disturb the fauna species of the area.
- Potential road kills of large mammals, reptiles and amphibians can be reduced by limiting speed to 30km/h at night and 40km/h during the day to enable drivers to brake as they cross the road.
- Vehicles should avoid use of full lights at night as this confuses animals while on road and increases chances of accidents.

23.2 Operation Phase

23.2.1 General

As for the C/R phase, the air pollution management plan, the noise management mitigation measures and the soil/groundwater management plan are also applicable for mitigating any impacts to biodiversity.

All the mitigation measures referred to soil protection (see par. 11.4.2), are also applicable for the protection of terrestrial environment. Additionally, in the context of the implementation of a relevant study of phyto-technical configurations for the entire area of the Shipyards, planting as well as the formation of urban green points, at the open spaces within the boundaries of the facility, is estimated to be an attraction for species of fauna (especially birds) of wider area and will improve to some extent the characteristics of the terrestrial natural environment.

23.2.2 Habitats Protection

The following measures/practices apply:

- Vegetation mosaics should be improved by planting trees to allow animal species to connect to other habitats in the area
- Encourage regeneration of plants in the open areas
- Operating vehicles should be cleaned thoroughly to remove sticking soils on wheels and other parts of the vehicle to avoid carrying propagules of the invasive species to the site.
- In case of invasion by invasive plant species during operation phase of the project, strategies for controlling the invasive plants should be devised such as uprooting the plants or use of herbicides, for controlling them (see also par. 23.3).
- Improvement of habitat (vegetation) connections should be enhanced by conserving grasses and bushes that occur in the wider landscape.
- Potential road kills of large mammals, reptiles etc. can be reduced by limiting speed to 30km/h at night and 40km/h at daytime to reduce impacts of accidents when vehicle collide on animals also the speed can give drivers lapsing period for braking.
- Vehicles should avoid use of full lights at night as this confuses animals while on road and increases chances of accidents.
- Raising awareness among ONEX staff on habitats in project AOI
- Support institutions with expertise in marine-coastal areas for the establishment and monitoring (five-year) of the status and trend of habitats and species within the area of direct influence

- Monitoring of major marine communities: Plankton, nekton, and benthos, fishes and description of marine fauna activities, at monitoring stations established
- Before the start of dredging (if performed) or construction activities, public entities with competence in the Area of Influence should be provided information on the activities to be carried out, working hours, and restrictions (if any) at least 1 week before starting works.

23.3 Invasive species management plan

23.3.1 Ballast Water

ONEX is necessary to act based on the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004 (BWM Convention), entered into force globally on 8 September 2017.

More specifically it should be verified the ballast water of the vessels entering the Shipyards complies with the ballast water management Standards (D-1 and D-2).

The D-1 standard requires ships to exchange their ballast water in open seas, away from coastal areas. Ideally, this means at least 200 nautical miles from land and in water at least 200m deep. By doing this, fewer organisms will survive and so ships will be less likely to introduce potentially harmful species when they release the ballast water.

The D-2 standard specifies the maximum amount of viable organisms allowed to be discharged, including specified indicator microbes harmful to human health.

For Vessels entering the Shipyards, those constructed after September 8, 2017, must comply with D-2 standard. Vessels constructed before September 8, 2017, must comply with D-1 standard.

It should be noted that, after 8 September 2024, all vessels should comply with the D-2 Standard. After that date, no vessel will be permitted to enter the Shipyards if it is not in compliance with D-2 Standard

All vessels entering the Shipyards must carry the following:

- A ballast water management plan, including a detailed description of the actions to be taken to implement the ballast water management requirements and supplemental ballast water management practices
- A ballast water record book recording:
  - when ballast water is taken on board
  - circulated or treated for ballast water management purposes
  - discharged into the sea
  - when ballast water is discharged to a reception facility and accidental or other exceptional discharges of ballast water
- An International Ballast Water Management Certificate (for ships of 400 GT and above) issued by or on behalf of the Administration (flag State) and certifies that the ship carries out ballast water management in accordance with the BWM Convention and specifies which standard the ship is complying with, as well as the date of expiry of the Certificate.

The Environmental Officer of the Shipyards should thoroughly check the validity of all the above plans and certificates and will also perform a visual inspection.

In the case of detecting a "non-conformity" with the requested documents, it is necessary to contact the Manager Director and the Chief Executive to receive specific instructions on how to proceed. If the executives ascertain that the vessel does not have the documentary support or guarantees of compliance with the standards, it will send a communication to the Maritime Authority, informing them of the event. Then governing actions should be performed by the competent Maritime Authorities.

23.3.2 Biofouling

General

As it was also stated in Chapter 9, biofouling is also considered one of the main vectors for bioinvasions and is described as the undesirable accumulation of microorganisms, plants, algae and animals on submerged structures (especially ships' hulls). Studies have shown that biofouling can be a significant vector for the transfer of invasive aquatic species. Biofouling on ships entering the waters of Shipyards may result in the establishment of invasive aquatic species which may pose threats to human, animal and plant life, economic and cultural activities and the aquatic environment.

IMO Resolution MEPC.207(62) contains Guidelines that recommend every ship have a Biofouling Management Plan and a Biofouling Record Book onboard. In and of themselves, these Guidelines are not mandatory. However, regular reference should be made to the latest requirements of individual States to determine the scope of implementation to ships entitled to fly the flag of that State, and to ships operating in their jurisdictional waters.

Actions

Prior to the entrance of any vessel to the Shipyards port area, the Environmental Officer should check that the vessel possesses a) a Biofouling Management Plan, b) a Biofouling Record Book.

Biofouling Management Plan

The Biofouling Management Plan should be specific to the vessel and be included in the vessel's operational documentation. Such a plan should address, at a minimum, the following:

i) Relevant parts of IMO Resolution MEPC.207(62) "2011 Guidelines for the Control and Management of Ship's Biofouling to Minimize the Transfer of Invasive Aquatic Species"

ii) Details of the anti-fouling systems and operational practices or treatments used, including those for niche areas

iii) Hull locations susceptible to biofouling, schedule of planned inspections, repairs, maintenance, and renewal of anti-fouling systems

iv) Details of the recommended operating conditions suitable for the chosen anti-fouling systems and operational practices

v) Details relevant for the safety of the crew, including details on the anti-fouling system(s) used

vi) Details of the documentation required to verify any treatments recorded in the biofouling record book (see below)

The biofouling management plan should be updated as necessary.

Biofouling Record Book

The biofouling record book is recommended to be maintained for each vessel to record details of all inspections and biofouling management measures undertaken on the vessel. This is to assist the shipowner and operator to evaluate the efficacy of the specific anti-fouling systems and operational practices on the vessel in particular, and of the biofouling management plan in general.

The record book could also assist the Environmental Officer to quickly and efficiently assess the potential biofouling risk of the vessel, and thus minimize delays to ship operations.

Information that should be recorded in a biofouling record book should include the following:

i) Details of the anti-fouling systems and operational practices used (where appropriate as recorded in the Anti-fouling System Certificate), where and when installed, areas of the ship coated, its maintenance and, where applicable, its operation

ii) Dates and location of drydocking/slipping including the date the ship was re-floated, and any measures taken to remove biofouling or to renew or repair the anti-fouling system

iii) Date and location of in-water inspections, the results of that inspection and any corrective action taken to deal with observed biofouling

iv) Dates and details of inspection and maintenance of internal seawater cooling systems, the results of these inspections, and any corrective action taken to deal with observed biofouling and any reported blockages

v) Details of when the ship has been operating outside its normal operating profile including any details of when the ship was laid-up or inactive for extended periods of time.

In the case of detecting a “non-conformity” with the requested documents, it is necessary to contact the Manager Director and the Chief Executive to receive specific instructions on how to proceed. If the executives ascertain that the vessel does not have the documentary support or guarantees of compliance with biofouling specifications, it will send a communication to the Maritime Authority, informing them of the event. Then governing actions should be performed by the competent Maritime Authorities.

24. EMERGENCY PREPARDENESS & RESPONSE (EPR) PLAN

24.1 Scope & Objectives

This Plan and the associated checklists included herein, outline the actions to be done in an emergency and should be used as a guide to assist in the management and appropriate response and minimize the effects of an emergency incident.

This plan can be used as a standalone document or in conjunction with other MPs as appropriate. Checklists referenced herein are available only in conjunction with this document.

The main oblectives of the EPR Plan include:

- Maintain core business functions during an incident, whilst minimizing the impact to clients and staff
- Immediate reporting on any incident
- Provide guidance for the effective management of information throughout an incident

24.2 Implementation & Responsibilities

This Plan is implemented through all activities of ONEX under the responsibility of the Chief Executive and all personnel involved respectively

Safety Practitioner is responsible for the issuance, distribution, and control of this plan.

24.3 Plan

24.3.1 General Guidelines

Any incident which relates to the operations of Shipyards during C/R and Operation phase or the operations of their clients and contractors shall receive an appropriate response led by a senior manager. Where necessary an incident management team will be mobilized. The size and makeup of the team will depend on the type of emergency.

Priorities in the following order are:

a) Personnel Safety

b) Environmental Protection

c) Damage Mitigation

An "emergency" exists when an incident occurs or is reported that has or may result in a serious risk to:

- The safety of personnel
- The environment
- The Property of the Shipyards

Emergency continues to exist until a) The report is proved to be false, b) The problem or problems are resolved.

The most probable way to receive an emergency report is via the telephone, either directly or indirectly from those impacted. Alternatively, the emergency may happen on site at Shipyards facility.

Depending on the nature of the emergency the initial call may be very brief with more information coming in later calls. It is important that as much detail as possible should be taken at the earliest opportunity in order that full support can be given.

The receiver of the call will note details of caller (name, gender, contact number etc.) and then transfer the caller to the appropriate Manager who will decide the actions that should be taken.

A Security threat must be taken seriously and reported immediately to Top Management. The Police should always be advised of any security threat.

24.3.2 Level of Response

Top Management will decide what level of response is required and who is to assist with the response. He should ensure that sufficient resources are mobilized as needed for the proper management of the incident.

In calling out personnel to form the Incident Management Team account should be taken of the potential development of the incident in order to ensure that adequate resources are available and that, if the response is to be protracted, periods of rest will be required for the Team.

24.3.3 Response Action Plans & Checklists

Basic Response Action plans have been created for use with type of emergencies that ONEX can be expected to be involved in.

1. Fires / Explosions
2. Spills / Releases (Oil – Chemicals)
3. Injury / Casualty
4. Fatality Checklist
5. Transportation Accident (Road, Marine, Air)
6. Natural Disasters
7. Critical Equipment Failures
8. Electric shock (electrocution)
9. Evacuation
10. Hazardous Waste Clean-up Procedure

24.3.4 Dealing with the Media

In the event of an incident involving ONEX there is an ever-increasing possibility that the media will be involved. It is important that they are dealt with in a professional manner to ensure they portray the Company as well-organized and as caring by having an Emergency Response Plan in place.

The Chief Executive and/or the Manager Director are the only persons authorized to deal directly with the media.

Preparation of Press Release

(a) An initial holding statement or press release should be prepared and issued as quickly as possible following an incident. This should be followed up with another statement as soon as possible, ideally within one hour, giving some basic information.

(b) The content of all release will be agreed by the Chief Executive, the Manager Director and Legal Department if required, the agreement of our insurers and legal adviser will be sought. In approving press release care should be taken to ensure where necessary/ required that client's approval is also given.

(c) In preparing press release care should be taken to ensure that information given is factual and will stand up if checked. Avoid speculation and subjective interpretation. Do not make optimistic claims when an emergency has still to run its course.

Guidelines for Writing Press Release

- Sift the raw material for the release (e.g., fax/notes from telephone conversation). Clearly mark good news/ bad news. Do not mark information which is sensitive or unconfirmed.
- Only use marked information for the release. Lead with the worst of the bad news (human casualties), balanced with the best of the good news (e.g. people safe/injured evacuated or rescued). Then build the next paragraph in a similar manner, possibly dealing with environmental damage (if relevant).
- Include the Company's priorities and plan of action (but details concerning people ALWAYS come first).
- Make sure each release can stand alone (e.g., do not talk about "accident" without being more specific).

- Decide whether the release will be used only in a reactive manner (i.e. a Response Statement) or whether it is to be used proactively (distributed to the media via fax, together with use on the telephone).
- Avoid technical terms. If this is not possible, explain the technical term.
- Beware of including information on cause (it may be necessary, but exercise extreme caution).

Press Release Checkpoints

- Have three key facts been included?
- Does the release answer the following points:
  - What happened?
  - Where?
  - To whom?
  - Casualties?
  - Actions being taken?
  - Company comment (attributed)?
  - Expression of regret?
  - Is the text free of technical terms and made up of simple, short sentences?
  - Ensure the release makes no comment on possible cause and no attempt to apportion blame.
- Is the release:
  - Timed?
  - Dated?
  - Numbered?
  - Does the release contain media response contact number?
  - Has the release been approved?

Press Briefings

In preparing for press briefings, the following points should be remembered:

- Is it in the Company's interest to hold a press briefing at this time?
- Is there fresh news to be communicated?
- Identify key points to be communicated.
- Identify and rehearse potentially difficult questions.
- Prepare press release.
- Identify personnel giving briefing.
- Identify topics/responsibilities of individual members of the briefing team, e.g., technical questions, etc.
- Spokesman to carry out initial introduction, including details of purpose / length of briefing.
- Spokesman to read prepared press release, which will include statement of regret.
- Ensure stated duration of briefing maintained.
- Wind up briefing by clearly stating only 2 more questions will be taken.
- Briefing team to leave on the answer to the second of these questions.

24.3.5 Interviews

Preparation for Interviews

In preparing for interviews the following points should be remembered:

- Identify two or three key points. These points should put people first, the environment second and everything else third. Try to get key points across twice in each interview.
- You must get across the operational priorities and Company's plan of action.
- Do not talk about money/cost in the early phase of an accident situation involving casualties.
- Always rehearse the difficult questions / sensitive issues before press briefings / interviews etc.
- Be prepared: expect to be challenged on past events!
- Do not attempt to defend Company by attacking / criticizing other parties.

- Be firm and precise. Avoid coming across as indecisive / uncertain. Do not use phrases such as 'I hope' / 'I think' / 'I believe' / 'I assume'.
- Be sure everyone is "singing the same song". Talk to your colleagues and key third parties before the interview/briefing.
- Never comment on the alleged comments of third parties.
- Beware of the 'Why?' question. Exercise extreme caution on issues relating to cause.
- Bridge from sensitive issues to areas more positive to the Company's interests.
- Avoid being drawn into / allowing interviewer to ask multiple questions. Interrupt if necessary to ensure individual questions are being answered.
- Do not hesitate to correct errors made during interviews/briefings.
- Be prepared to give reasons if key information is not available.

In addition to above, prior to agreeing / confirming any interview / press briefing the following points should also be addressed:

- Is it in your interests to grant an interview at this time?
- Which publication/program wants the interview?
- Live or recorded?
- What is known about publication/program style?
- Is the interview one-to-one or a panel format?
- If panel, who else to appear?
- Identify the most potentially difficult questions.
- Have three key points to be communicated been identified?
- Has an opening reply to the first question been prepared?

24.3.6 Training/ Exercise Requirements

Table 24.1: Training & Exercise Requirements applicable to the EPR

No	Type of Training	Description	Frequency
ERP1	ERP Initial and Refresher training	ERP Initial and Refresher training	On ERP introduction and when major changes made

ERP2	Tabletop Exercise (TTX)	Test the plan as a functional document and staff understanding (Will act as a Desk Check exercise)	Annually
ERP3	Full ERP exercise	May also include cooperation with relevant authorities	Annually

NOTE: All training, exercise / drills should be recorded, including the success of meeting the objectives and the lessons learned.

24.4. Response Action Plan & Checklist

In case of emergency the following services must be contacted immediately, communication that forms the emergency communication system:

24.4.1 Emergency telephone numbers

Ambulance: 166

Fire & rescue: 199

Police: 100

Site Manager (ONEX): To be declared

In any event of emergency PERSONNEL SAFETY is always the first priority.

24.4.2 General

ONEX Personnel is responsible for coordination and organization of emergency response on behalf of any contractor/subcontractor that ONEX may use for the execution of works.

ONEX Personnel is responsible for coordination arrangements with public and/or private emergency services. ONEX shall inform and liaise with all relevant authorities and public and/or private emergency services before the commencement of works.

24.4.3 Emergency Equipment

On-site Emergency equipment consists of:

- Radio (walkie talkie)
- Fire extinguishers
- First aid kit
- Emergency shower/Eye wash
- Shovels/buckets/vermiculite/HEPA vacuum
- Spill absorbent materials

On-site Emergency equipment will be located in prominent and easily accessible places. Field Supervisors/Foremen shall carry radios so as to communicate immediately in case of emergency.

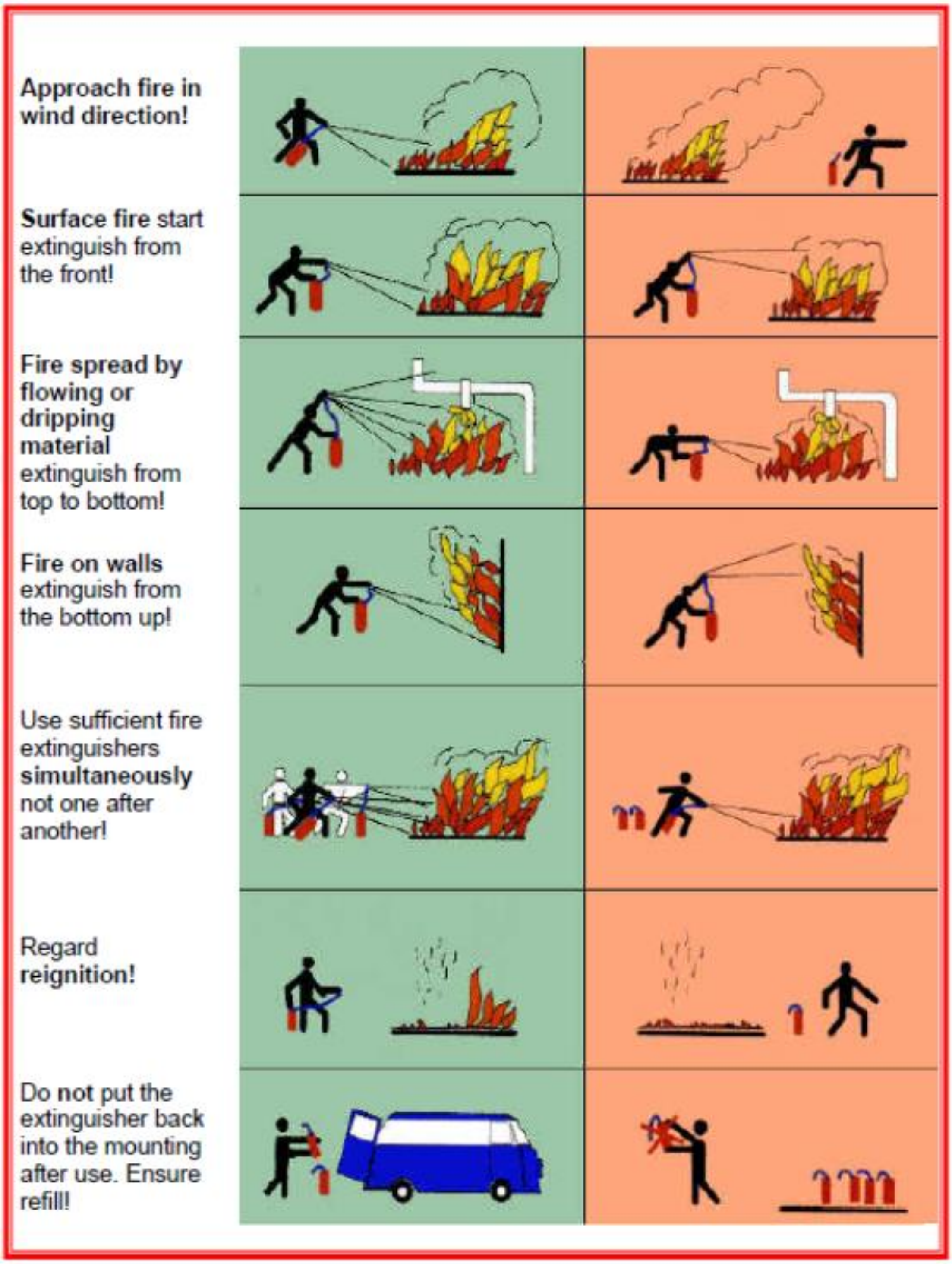
24.4.4 Fires / Explosions Checklist

DONE	ACTIONS/STEPS		RESPONSIBILITY
	1	Assess magnitude of current situation (identify # of injuries, casualties, # of individuals missing, exposures).	Field Supervisor
	2	Implement firefighting activities if possible according to instruction given on page 10 and according to ONEX's training to all personnel involved on site activities.	Field Supervisor
	3	Evacuate all personnel from building or site.	Field Supervisor
	4	Notify emergency services (Fire – Medical) and client representatives.	Field Supervisor
	5	Establish Incident Management Team (as appropriate).	• Safety Practitioner • Safety Physician
	5	Notify ONEXgroup Senior Management.	Field Supervisor
	6	Notify ONEXgroup Risk Management.	Field Supervisor
	7	Make transportation arrangements as appropriate.	Field Supervisor
	8	Take steps to protect, recover company property as safe to do so.	Field Supervisor

	9	Implement next of kin procedures.	Overall Project Manager
	10	Implement Business continuity plan.	Field Supervisor
	11	Make external notifications. Develop press release, if needed.	Overall Project Manager
	12	Establish Communications From/ to Scene: Radios, Telephones.	Field Supervisor
	13	Facilitate Investigation initiation.	• Safety Practitioner • Safety Physician

Project Based Control Measures
1. In case of fire use dry powder extinguishers accordingly. (see picture below)
2. All ONEX personnel (On site managers and foremen) that are going to be present during repacking and drainage works are well trained on firefighting activities. A firefighting training will be provided to client representatives and to all workers/ subcontractors involved during the works.
3. ONEX will keep on site all appropriate fire extinguishers according to the equipment list of the work plan.
4. See the emergency evacuation plans for every work site
5. Emergency response equipment shall be available at all times

Fire control / correct extinction with fire extinguisher



24.4.5 Spills / Releases (Oil – Chemicals) Checklist

DONE	ACTIONS/STEPS		RESPONSIBILITY
	1	Assess magnitude of current situation. Identify material and quantity released. Control source, if safe to do with available resources.	Field Supervisor
	2	Establish situation status: quantity spilled/recovered, direction of travel, forecasted conditions.	Field Supervisor
	3	Establish immediate tactical priorities and initiate (e.g. source control, containment, etc.). 1. People 2. Environment 3. Property	• Field Supervisor • Safety Practitioner • Safety Physician
	4	Establish Incident Management Team (as appropriate).	• Safety Practitioner • Safety Physician
	5	Notify ONEXgroup Senior Management and client representatives.	Field Supervisor
	5A	Notify ONEXgroup Risk Management.	Field Supervisor
	6	Make external notifications. Develop press release, if needed.	Overall Project Manager
	7	Identify additional resources required.	Field Supervisor
	8	Make transportation arrangements: To/From scene.	Field Supervisor
	9	Establish Communications to Scene: Radios, Telephones.	Field Supervisor
	10	Facilitate Incident Investigation initiation.	• Safety Practitioner • Safety Physician

Any spillages, including near-miss incidents, which may give rise to an environmental pollution incident, shall be contained and removed immediately. Such cases should be encountered with the mobilization of emergency response equipment, including chemical spill kits, which should be placed at prominent places on site.

Project Based Control Measures
SPILL RESPONSE EQUIPMENT 1. **Spill absorbent equipment** 2. **Shovels/Brooms/Rakes,** in case of ground contamination to remove contaminated portion 3. **UN approved packaging** All above items are going to be present on-site at all sites.

24.4.6 Injury / Casualty Checklist

DONE	ACTIONS/STEPS		RESPONSIBILITY
	1	Notify on site personnel/ On site managers/ Foremen	Field Supervisor
	2	Assess magnitude of current situation. (Identify # of injuries, casualties, # of individuals missing).	Field Supervisor
	3	Assess potential for emergency to escalate; additional injuries, etc.	Field Supervisor
	4	Establish immediate tactical priorities (e.g. first aid saving life techniques)* In case of first aid follow instructions as per page 13.	Field Supervisor
	5	Provide on-scene medical support, as appropriate.	Field Supervisor/ EOSH expert
	6	Notify client representatives.	Overall Project Manager
	7	Determine Emergency Transportation Needs: Air/Water/Land.	Field Supervisor
	8	Establish Incident Management Team (as appropriate).	EOSH expert
	9	Notify ONEX group Senior Management.	Field Supervisor
	10	Notify ONEX group Risk Management.	Field Supervisor
	11	Make external notifications. Develop press release, if needed.	Overall Project Manager
	12	Identify additional resources required.	Field Supervisor
	13	Implement next of kin procedures.	EOSH expert
	14	Establish Communications to/from scene.	Field Supervisor
	15	Facilitate Accident Investigation initiation.	EOSH expert
Project Based Control Measures			

*First aid training All ONEX personnel (On site managers and foremen) that are going to be present during repacking works are well trained on providing first aid to any injured person. This first aid forms the on-site medical emergency procedures. Apart from that, ONEX will keep on site first aid kits. In the next three pages are described three basic first aid techniques – on site medical emergency procedures that may save life.
In case of injury, minor incidents shall be treated on-site. **In case of major injuries, immediately call ambulance for transportation of victim to nearest hospital.**

24.4.7 Fatality Checklist

VICTIMS NAME		COMPANY	
DATE REPORTED		TIME REPORTED	
PERSON REPORTING FATALITY Contact No			
LOCATION OF INCIDENT			
DESCRIPTION OF INCIDENT			
OTHER PERSONS INVOLVED/ WITNESS			
SCENE OF INCIDENT PRESERVED BY			
MEDICAL PROCEDURES SUPPLIED BY			
TIME POLICE NOTIFIED & NAME OF CONTACT			
INCIDENT RESPONSE ACTIVITIES ON SITE			
TIME RESPONSE INITIATED			
PRESS STATEMENT PREPARED			
NEXT OF KIN NOTIFIED AND FAMILY SUPPORT INITIATED (AS APPROPRIATE)			

ARRANGEMENTS FOR TRANSPORTATION OF BODY		
INCIDENT INVESTIGATION COMMENCED		
INVESTIGATION TEAM NAMES	Team Leader	
	Support	
	Support	
TRAUMA COUNSELLING PROVIDED	Responders	
	Colleagues	
	Person finding body	
WORK RELATED INCIDENT	Interviews	
	Photographic Evidence	
	Drug & Alcohol test	

24.4.8 Transportation Accident (Road, Marine, Air)

DONE		ACTIONS/STEPS	RESPONSIBILITY
	1	Establish situation status: # of people injured, missing etc. Obtain names, detailed information.	Field Supervisor
	2	Assess potential for emergency to escalate; additional injuries, etc.	Field Supervisor
	3	Establish immediate tactical priorities and initiate. (E.g. stabilize scene, rescue, first aid, decontamination, etc.) • Notify local authorities and client representatives. • Dispatch personnel to site if appropriate. In case of spillage use all appropriate PPE before commencing cleaning activities. • Contact Coastguard (Marine) • Contact Police	Field Supervisor
	4	Arrange medical support as appropriate.	Field Supervisor/ EOHS expert
	5	Establish Incident Management Team (as appropriate).	EOHS expert
	6	Notify ONEX Senior Management.	Field Supervisor

	6A	Notify ONEX Risk Management.	Field Supervisor
	7	Make external notifications. Develop press release, if needed.	Overall Project Manager
	8	Determine Emergency Transportation Needs: Air/Water/Land.	Field Supervisor
	9	Identify additional resources required.	Field Supervisor
	10	Implement next of kin procedures.	EOHS expert
	11	Establish Communications to/from scene.	Field Supervisor
	12	Facilitate Accident Investigation initiation.	EOHS expert

Project Based Control Measures

The following equipment will be available on the vehicles which will transport hazardous waste in case of emergency:

- Fire extinguishers CO_2/ dry powder/ foam
- First aid kit
- Warning triangles/ cones/ tape
- Signs with classes and UN numbers
- Spades – shovels
- Full body protection overalls
- Half face breathing apparatus
- Neoprene gloves
- Absorbent materials
- Empty UN approved packaging media

The trucks convoy will be escorted by specialized personnel of the **licensed contractor that will be responsible for emergency response**. This document's emergency procedures apply for the transportation as well.

Truck cabin crew shall be in constant contact with ONEX personnel with mobile phones or radio.

In all cases, packages containing the hazardous waste will be secured upon loading with straps and belts.

Training on emergency response procedures shall be provided to the truck drivers based on the SOP-105 regarding inland transportation. Copy of this document shall be delivered to all drivers involved in the transportation procedure. The training includes emergency response on the following cases:

- Medical emergency procedures (as described in section 3 of ERP)
- Fire emergency procedures (as described in section 1 of ERP)
- Spill response emergency procedures (as described in Section 2 of ERP)

- Accident/injury emergency procedures (as described in Section 3 of ERP)

Licensed Contractor Personnel is responsible for coordination and organization of emergency response on behalf of any contractor/subcontractor that ONEX may use for the execution of works. Licensed Contractor Personnel is responsible for coordination arrangements with public and/or private emergency services.

24.4.9 Natural Disasters

DONE	ACTIONS/STEPS		RESPONSIBILITY
	1	Assess magnitude of current situation potential danger to personnel, plant and equipment.	Field Supervisor
	2	Assess potential for escalation.	Field Supervisor
	3	Determine possible escape strategies.	Field Supervisor
	4	Establish Incident Management Team (as appropriate).	EOHS expert
	5	Assign responsibility to the Incident Management Team.	National Project Operational Coordinator
	6	Notify ONEXgroup Senior Management and client representatives	Field Supervisor
	6A	Notify ONEXgroup Risk Management.	Field Supervisor
	7	Make external notifications. Develop press release, if needed.	Overall Project Manager
	8	Implement Spill Response activities if needed.	Field Supervisor
	9	Implement Business Continuity plan if needed.	Field Supervisor
	10	Implement next of kin procedures.	EOHS expert
	11	Continue assess situation recommend strategies to reduce impact on people and equipment.	Field Supervisor
	12	Establish communications between –IMT and Site Response Teams.	Field Supervisor
Principal Causes of Disasters			
• Rain and wind storms • Floods • Biological agents (micro-organisms, insect or vermin infestation) • Earthquakes • Sea Level Rise			

24.4.10 Critical Equipment Failures

NOTE: Response Checklist for Spills/ Release or injury may be used in conjunction with this checklist as necessary.

DONE		ACTIONS/STEPS	RESPONSIBILITY
	1	Analyze the Incident and estimate the level and type of response required "?"	Field Supervisor
	2	Stop any operations that are compromised unless a back-up system is immediately available.	Field Supervisor
	3	Notify ONEXgroup Senior Management and client representatives	Field Supervisor/ National Project Operational Coordinator
	3A	Notify ONEXgroup Risk Management.	Field Supervisor
	4	Make external notifications. Develop press release, if needed.	Overall Project Manager
	5	Identify any additional resources required.	Field Supervisor
	6	Establish Communications to/from scene.	Field Supervisor
	7	Facilitate Accident Investigation initiation.	EOHS expert
Project Based Control Measures			
Take full account of the following: • The manufacturer's recommendations • The intensity of use • Operating environment (e.g., the effect of temperature, corrosion, weathering) • User knowledge and experience • The risk to health and safety from any foreseeable failure or malfunction			

24.4.11 Electric shock (electrocution)

DONE		ACTIONS/STEPS	RESPONSIBILITY
	1	Notify on site personnel/ On site managers/ Foremen	Any person
	2	Immediately notify electrician in order to shut down the relative power line. Do NOT touch any person still trapped in the circuit.	Field Supervisor/ Foreman / Any person

	3	If the casualty is moved from danger, check for person's response and pulse. Start mouth to mouth and compressions technique if there is no pulse. Call for ambulance.	Field Supervisor/ Foreman
	4	Notify client representatives and any local authority required to be present.	National Project Operational Coordinator
	5	Assess magnitude of current situation. (Identify # of injuries, casualties, number of individuals missing).	Field Supervisor
	6	Assess potential for emergency to escalate; additional injuries, etc.	Field Supervisor
	7	Establish immediate tactical priorities (e.g. stabilize scene, first aid, etc.). In case of first aid follow instructions as per page 13.	Field Supervisor
	8	Determine Emergency Transportation Needs: Air/Water/Land.	Field Supervisor
	9	Establish Incident Management Team (as appropriate).	EOHS expert
	10	Notify ONEXgroup Senior Management and Risk Management.	Field Supervisor
	11	Make external notifications. Develop press release, if needed.	Field Supervisor
	12	Identify additional resources required.	Field Supervisor
	13	Implement next of kin procedures.	EOHS expert
	14	Establish Communications to/from scene.	Field Supervisor
	15	Facilitate Accident Investigation initiation.	EOHS expert
Project Based Control Measures			
• Liaison with client representatives to agree diversions or safe clearance distances and any other steps needed. • Do not work alone. Do not walk around site premises without prior approval. • All personnel will be briefed during the training session concerning the potential electrical hazards.			

24.4.12 Evacuation

DONE	ACTIONS/STEPS		RESPONSIBILITY
	1	Analyze the Incident and estimate the level and type of response required. "?"	Field Supervisor

	2	Maintain open communications with Onsite contract manager or respective nominee.	Field Supervisor
	3	Obtain full personnel list of involved Personnel.	Field Supervisor
	4	Arrange reception support at evacuation destination.	Field Supervisor
	5	Notify ONEXgroup Senior Management and client representatives	Field Supervisor/ National Project Operational Coordinator
	5A	Notify ONEXgroup Risk Management.	Field Supervisor
	6	Make external notifications. Develop press release, if needed.	Overall Project Manager
	7	Identify any additional resources required.	Field Supervisor
	4	Establish Incident Management Team (as appropriate).	EOHS expert
	5	Assign responsibility to the Incident Management Team.	EOHS expert
	8	Make decision on what response to make to the emergency. Dispatch personnel if appropriate to support those Evacuated (Away team).	National Project Operational Coordinator
	10	Implement next of kin procedures.	EOHS expert
	11	Establish communications between –IMT and Away Teams.	Field Supervisor

24.4.13 Hazardous Waste Clean-up Procedure

The hazardous Waste clean-up procedure will be activated in the event of a spill which may rise from any accident or any of the above cases. The following actions / steps will be followed.

DONE	ACTIONS/STEPS		RESPONSIBILITY
	1	Field Supervisor will make sure that the site is safe to work. (Either on site or off site).	Field Supervisor
	2	Analyze the Incident and estimate the level and type of clean-up response required.	Field Supervisor/ Foreman
	3a	Case 1. On site clean-up. Make sure that there are available all necessary spill response equipment as they are described in page 12, “Spills / Releases (Oil – Chemicals)”.	Field Supervisor/ Foreman/ Any trained person

	3b	Case 2. Off site clean-up. (Road accident most probably). Make sure that there are available all necessary spill response equipment as they are described in Page 19, “Transportation Accident (Road, Marine, Air)”. In case of road accident the Field Supervisor along with traffic police will isolate the accident area in order to create a site safe to work.	Field Supervisor/ Foreman/ Any trained person
	4	Wear all appropriate PPE: i.e. Half face mask with combination filters for organic vapors, helmet, coverall type 5, safety rubber boots, and nitrile or neoprene gloves.	Field Supervisor/ Foreman/ Any trained person
	5a	**In case of solid contamination:** ✓ Place tarpaulin on the ground away from the spill-spot. Place a pallet on top of that and an empty UN approved FIBC. ✓ Shovel the contaminated soil and place it directly into the new packaging media. ✓ When the biggest quantity has been removed there will be left only a thin layer of contamination on the ground. ✓ Add solvent on the remaining contamination and wipe the area. ✓ Dispose the contaminated materials with the waste generated from the spill clean-up. ✓ Seal the packaging media and place it in a safe place.	Field Supervisor/ Foreman
	5b	**In case of liquid contamination:** ✓ Spread the absorbent agent over the spill starting with the edges first. This will help to confine the spill to a smaller area. ✓ Spread enough absorbent agents over the spill to completely cover the liquid. There should be no free liquid. Use a spade to ensure that the liquid was completely absorbed by absorbent agent. ✓ Place tarpaulin on the ground away from the spill-spot. Place a pallet on top of that which will carry	Field Supervisor/ Foreman

		four UN approved open head steel drums. Place plastic bags into the drums and open/ place them properly. ✓ Shovel the contaminated absorbent agent and place in the polyethylene bag of the drum. ✓ When the biggest quantity has been removed there will be left only a thin layer of contamination. ✓ Add appropriate solvent on the remaining contamination and wipe the area. ✓ Dispose properly into the packaging media all contaminated materials with the waste generated from the spill clean-up. ✓ Seal polyethylene bag with gripper tool and place the lid and the ring on the top of the drum. Place the drums in a safe place.	
	6	All tools used in the clean-up need to be decontaminated with appropriate solvent.	Foreman
	7	All PPE will be considered as contaminated and will be disposed properly in UN approved drums or UN approved FIBCs (big bags).	Foreman

25. COMMUNITY HEALTH AND SAFETY PLAN (CHSP)

25.1 Scope & Objectives

This Plan contains the measures and actions necessary to prevent and counteract the risks and impacts on the health and safety of communities that may be affected throughout the project's life cycle.

The guidelines of the World Bank Group on Environment, Health, and Safety (MASS) or other internationally recognized sources have been used to identify appropriate measures to act on these risks and impacts.

The main objectives of the CHSP are:

- Propose measures to anticipate and avoid the health and safety risks of the potentially affected communities, both inside and outside the Shipyards.
- Establish mechanisms to assess the status of health and safety indicators of potentially affected communities.

25.2 Responsibilities

The Deputy Chief Executive in close co-operation with the Security Officer, Safety Practitioner, Environmental Officer, and the Occupational Physician will be responsible for implementing this plan.

25.3 Disclosure

This plan should be disclosed to the communities potentially affected by the project. Where complex health and safety aspects are presented at the different phases of the project, it may be desirable to hire outside experts to conduct an independent evaluation, helping to identify risks and impacts required by IFC's Performance Standard 1 that can be fed and strengthened during the project cycle.

25.4 Disease control

25.4.1 Vector cleaning and control

Both ONEX staff and project contractors, will perform the following:

i. Routine maintenance of all project areas and work fronts, order control, and cleaning. Accumulation of standing water and garbage deposits in the open air should be avoided. Check for clean and clear drains.

ii. Periodic maintenance (at least monthly) of the rainwater drains. During the rainy season (winter period), it should be weekly.

iii. Continue periodic inspections of bathrooms, dining room, and restrooms. Cafeterias should receive special attention on disinfection and general hygiene.

iv. Maintain periodic fumigation plan for vector control, at work fronts, warehouses, yards, and offices. The frequency will depend on the season of the year and the type of vector to be controlled.

v. Perform a monthly cleaning and disinfection of the areas outside the Port Terminal to promote cleaning through campaigns to sensitize workers not to use exterior spaces as bathrooms or landfills.

vi. Timely management of tanks, drums, and other containers or storehouses of hazardous and nonhazardous substances. Strict implementation of Hazardous Substances handling protocols and Hazardous Waste Management Plan (see Chapter 13).

25.4.2 Prevention and control of diseases in staff

Both ONEX staff and project contractors, will perform the following:

i. Training of staff in preventive measures and good health practices. The following topics should be addressed, with the schedule established by medical department:

- Ergonomic care training
- Cardiovascular health and EKG
- First Aid Workshop
- HIV - AIDS prevention
- Sexual and reproductive health
- Prevention of alcohol and drug use
- Awareness-raising to prevent gender-based violence.

ii. Execute the following preventive campaigns:

- Deworming campaign
- Vaccination campaign
- Active break campaign
- Diabetes prevention campaign

iii. Provide Medical care on-site (already existing)

iv. Medical follow-up through Pre- and Post-Occupational Health Forms, preventive, and special examinations.

25.4.3 COVID-19 Management Plan

Protocols concerning COVID 19

Precautions taken by the Shipyard in the context of implementing the provisions of the State to prevent the spread of coronavirus include the following:

Prior to the repair agreement of each ship, the shipping companies are notified of the terms and procedures that are implemented in Elefsis Shipyard in relation to the precautionary measures, which are obligatorily and include the following.

- Notification of the crew list and certificate of the Master of the ship to be repaired for the non-existence during the last 15 days of a medical incident between the crew.

- Notification of the port of arrival of the ship during the last 15 days.
- If from the above there is no reason to exclude the ship from the facilities of the Shipyard, the ship is informed about the implementation of the planned repair works.
- Upon arrival of the ship, a special unit that cooperates with the competent doctor, performs a medical examination of the crew.
- Before starting any work on the ship, the ship is disinfected by specialized personnel.
- On a 24-hour basis there is control and thermometry at the entrance and exit of the ship.
- Care is taken to minimize the contacts between the employees of the Shipyard and the crew in the absolutely necessary and always taking mandatory preventive protection measures (masks, gloves, antiseptics, etc.) by both the Shipyard workers and the ship's crew.

In addition to the above, the following measures concerning the facilities of the Shipyard apply:

- Checking and thermometry on a 24-hour basis of all individuals entering the Shipyard (employees, associates, visitors, etc.).
- Disinfection once a week of all areas of the Shipyard.
- Provision to employees and mandatory use of masks, gloves and other personal protective equipment.

25.5 Mobility and traffic impact control

The following provisions apply (see also Chapter 29):

- A Traffic Management Plan shall be implemented for any construction and operational traffic to reduce the potential for accidents (see also par. Traffic MP – Chapter 29).

- The main access road to Shipyards will be upgraded / tarred which will have a positive effect on local traffic.
- Temporary traffic control and diversion arrangements shall be provided at strategic points on local roads, where necessary.
- An effective journey management schedule shall be maintained to reduce the risk of accidents.
- A transportation and materials management system for safe transportation of equipment and materials to site shall be developed and implemented, to be included within the ESMS.
- The implementation of structural elements that allow universal accessibility (ramps, railings, emergency accesses, others) shall be designed and constructed by qualified professionals and shall be certified or approved by competent authorities or professionals.
- In the case of mobile equipment on public roads and other forms of infrastructure, precautions should be taken to prevent the public from being affected by incidents and injuries related to the operation of such equipment.
- Safe pedestrian steps will be situated in the areas surrounding the Shipyards entrance.
- Signs will be situated on the Shipyards access road, indicating the permitted speed limit for cargo vehicles.
- Traffic lights will operate, in the arrival and departure of vehicles in the Shipyards area.
- If more than 10 vehicles are expected to be in or out of the Shipyards, a traffic controller will be designated, which will monitor the progress of vehicles in groups of 5 units. All other units must remain on standby with the engine off.

25.6 Project infrastructure security

During both C/R and Operation phase, to ensure the reduction of possible safety risks, the following measures must be considered:

i. Inclusion of red belts or other methods of physical separation around the project site to protect the public from the main risks associated with hazardous material incidents or process failures, as well as noise, odor, and other emission-related inconveniences.

ii. Incorporating technical safety criteria and site selection to prevent accidents caused by natural hazards such as earthquakes, tidal waves, wind, floods, landslides, and fires. All buildings must be designed according to technical and design criteria based on site-specific hazards but not exclusively, seismic activity, soil stability, wind intensity, and other dynamic loads.

iii. Application of local and internationally recognized building codes and regulations to ensure that buildings are designed and built following good architectural and engineering practices, including fire prevention aspects and fire emergency plans.

25.7 General OHS impacts

The following provisions apply:

- Strict implementation of the OHS MP
- Modification, substitution, or elimination of hazardous conditions where possible
- Implement fire protection measures, to deal with any occurrence of fire from the operation of machinery and general electromechanical equipment that will be used during the individual activities within the Shipyards Zone.
- Possess an operative permanent firefighting network, approved by the relevant Fire Service, and adequate portable firefighting and fire safety equipment, in all infrastructure and facilities, to deal with emergencies that may cause serious accidents and environmental damage.
- Provide personnel with a Health and Safety orientation prior to early site preparation activities that addresses the safe operating and work execution plan
- Enforce the use of appropriate PPE at work site

- Specific identification of potential hazards to workers, particularly those that may be life-threatening
- Documentation and reporting of occupational accidents, diseases, and incidents
- Substances and task-specific training of personnel
- Emergency prevention, preparedness, and response arrangements including those for risks of fire and explosion.

25.8 Injury or harm to site workers/communities as a result of badly designed plant and construction/decommissioning management

The following measures apply:

- The designing, construction, operation, and decommissioning of the structural elements or components of the project to be in accordance with industry best practice.
- Use of competent personnel in design and construction.
- Design and construction to consider safety risks to third parties or Affected Communities as well as to project workers.

25.9 Community unrest and conflicts with influx of workers from different communities/backgrounds

The following provisions apply:

- An induction and education program outlining expected behavior standards for all site workers.
- The contractors shall also be required to develop a project-specific health plan for project management’s approval that will be implemented as part of the project ESMS.

25.10 Exposure of workers and communities to hazardous materials, noise & air pollution

The following provisions apply:

- Strict implementation of Hazardous Waste, Air Pollution and Noise MPs
- The potential for workers and communities to be exposed to hazardous materials or conditions to be modified, substituted, or eliminated.
- Deliveries and transportation of hazardous materials to be effectively managed to minimize exposure to workers and communities.
- Appropriate and legitimate waste disposal contractors to be used (see waste management plans).

25.11 Naval Traffic

The following provisions apply:

- Ensure the safe passage and the smooth mooring of ships from any restrictions during the operation of the Shipyards.
- The facilities should possess the appropriate light day and night signage, to avoid creating problems and/or accidents, according to the instructions of the Lighthouse Service of the Greek Navy.
- Provide all the appropriate lifesaving and protection means against maritime hazards. Those means should be regularly inspected for proper operation and undergo the necessary maintenance.

25.12 Swimming & Fishing Activities

Fishing and swimming restrictions are imposed by “Elefsis Port Regulation” (MD 699/B/27-3-1978) as amended and in force. More specifically:

1. Fishing by any means is strictly prohibited:

a) Inside the port (including shipyards area)

b) Within the usual course of ships, channels and the area of parallax or change of course of ships.

c) At a distance of less than five hundred (500) meters from any underwater structure or cable (sewer pipes, water pipes, underwater cables, telecommunications, electricity, docks etc.).

2. Swimming and/or sea bath is prohibited:

a) Inside the port (including shipyards area)

b) Within the usual course of ships, channels and the area of parallax or change of course of ships.

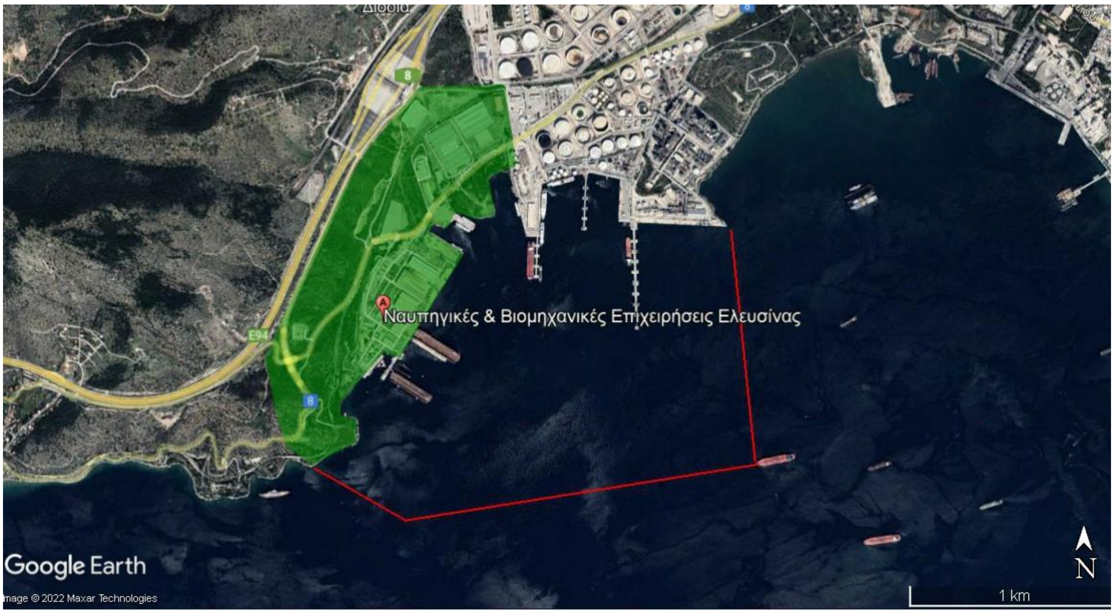


Figure 25.1: Area for swimming and fishing prohibition (From coastline to redline), according to "Elefsis Port Regulation" (MD 699/B/27-3-1978).

25.13 Security Issues

The site is relatively isolated and therefore proper security arrangements will be needed. Besides fencing the site, all storage areas will need to be secured. The security will also cover regular patrols to enhance the security of the workers.

Shipyards will be equipped with a modern communication and surveillance system comprising of:

- A system for the control and surveillance of the entire facility; this system will be centralized in the control room on Administration Building
- Supervision systems using security cameras and internal and external communication systems.

All gates will be controlled by security personnel at all times (day and night). A Security Manager will be assigned with the following duties:

- Management and coordination of security guards employed by the Project
- Management of security incidents which occur both on the Project site and outside the site

During its lifecycle, the Project will also minimize risks to the safety of local communities and Project employees by means of the implementation of coordination with local authorities and the local police, and the recruitment of security officers, in order to prevent criminality. A code of conduct will also be established for the attention of police forces and security officers to prevent the use of violence, coercion or intimidation.

The effective implementation of the security plan will also demand:

- The effective community engagement on security arrangements
- The involvement of other external stakeholders (i.e., police or local authorities) in any on or offsite security incidents and ensure that the appropriate incident response procedures are followed.

- Reassurance that all security personnel is fully trained and competent and not implicated in past abuses. Due diligence of security staff will be undertaken.
- Regular audits on the performance of security providers/officers.
- Regular training of security providers/officers on Human Rights.
- Security services to be procured and operated in line with the requirements of IFC PS2 and PS4 regarding occupational and community health, safety and security.

25.14 Ecosystem Services

From the analysis made in Chapters 8 and 10, no significant impacts are expected to ecosystem services. Nevertheless, all measures described in Biodiversity, Air Pollution, Wastewater, Solid/Hazardous Waste and Soil/Groundwater MPs are also applicable for the protection of ecosystem services.

26. OHS MANAGEMENT PLAN

26.1 General Measures/Responsibilities

On behalf of ONEX, the Safety Practitioner, the Occupational Physician, the Site Managers and the Environmental Officer are responsible for the implementation of the Plan. In cases that Subcontractors are involved in the implementation of technical works, they should appoint their own safety manager.

Some general safety rules, applicable to both C/R and Operation Phase are listed below, based on the current Legislation:

- No duty will be assigned to a person if he/she is not physically and mentally fit for it.
- All persons within the premises must wear a suitable safety helmet, with the exception of those being in offices, sanitary places, rest areas and cabins for trucks, loaders and vehicles. This requirement also applies to visitors.
- All people within the premises must wear appropriate shoes. The minimum safety requirement for footwear is to have a protective metal lining for the toes and the sole. This requirement also applies to visitors.
- Safe approach and exit must be ensured in all workplaces.
- All drivers and equipment operators must comply with the road marking of the complex area.
- All persons must comply with the instructions of the safety signage within the premises.
- Fires for heating purposes are not allowed.
- The consumption of alcohol in the premises is prohibited
- No person will start work if is not properly dressed. Employees are not allowed to wear light clothing, shorts and be naked from the waist up.
- No person is allowed to redefine, remove, modify, damage, destroy any marking or safety equipment.

- All staff are required to report any unsafe work situation and seek help if they are unable to control it themselves.
- Only authorized persons are allowed to operate Shipyards' equipment.
- Smoking is prohibited throughout the facility. Every visitor or driver entering the facility should be reminded that smoking is prohibited, regardless of the presence of warning signs.
- Every visitor or driver should enter the facility only from the main entrance.
- Never come in contact with materials with bare hands.
- When unloading trucks, stay away from the material storage area.
- When loading, pay attention to your position in the area for the risk of falling.
- Wash your hands carefully and thoroughly before eating.

26.2 Rules for Proper Operation and daily activities

The following measures apply:

- Proper signage of areas containing hazardous substances and waste
- Control the incoming raw materials, in order to ensure its most efficient operation and protection from damage.
- Carry out regular inspections of all intermediate materials to ensure the proper flow of materials and predict operation failures.
- Carry out regular inspections of the facilities in relation to their proper operation.
- Keep rooms, floors and platforms always clean and dry.
- The machinery of each unit should be monitored regularly by the shift manager when operating
- Carefully follow, and according to the specifications and instructions of the manufacturer, the maintenance of the machinery and fill in the appropriate forms/records for each machinery.
- Automatically record the hours and operating characteristics of each machinery and schedule its maintenance.

- There should be adequate ventilation and lighting in all places where people are moving and working.
- The moving corridors inside the facilities should be kept free at all times. In particular, doors that have been assigned as safety exits must not be locked or sealed at all times.

26.3 Personal Protective Equipment (PPE)

The use of Personal Protective Equipment (PPE) is mandatory for all employees without exception, throughout their work. Indicative PPE include:

- Helmet
- Safety Shoes
- Clothing Form
- Goggles
- Dust Masks and Filter Masks
- Glasses
- Ear Protection Equipment
- Gloves
- Suspension System for Work at Heights, etc.
- Waterproof

All PPE will be CE marked, and their use must be in accordance with the manufacturer's instructions.

Seat belts will be used when there is no other effective way to prevent falls. Masks or gloves will be used in activities that may damage the eyes or hands respectively.

All the means of protection used should always be in good condition, maintained, cleaned and stored with special care. Regular inspection for damage or defect of PPE will be carried out.

PPE will be issued to employees after signing the appropriate record. Each employee will have his personal card and receive his personal equipment signed by the Shipyards' storekeeper. The employees will take care of the hygienic and perfect condition of their personal equipment and report to the work manager possible defects.

Replacement of the personal equipment of the employees will be done by the storekeeper and only with the delivery of the used old equipment.

Visitors or suppliers will not be allowed to enter the workplaces as long as they do not have the Personal Protective Equipment required for area.

26.4 Training

Only professionals, possessing the relevant skills under the current national legislation can be involved in personnel and/or subcontractors training programs. The latter will be developed according to the requirements of the individual work/hazard anticipated for example: heavy machine operation, execution of work at height, hot cutting etc.

The Training Program will include lectures and campaigns that address issues such as the following:

- Personal protective equipment and collective protection equipment - Importance of their use in the prevention of occupational accidents
- Use of Personal Protective Equipment: gloves, mask, mask, apron, boots, ear protection (depending on duty).
- Accident Prevention (risk situations and events that may result in occupational accidents)
- Information on the risks posed by the management of corrosive and toxic substances.
- Pedestrian and Vehicular Safety Signage
- Safe behavior
- First Aid
- Ergonomics

- Sun Protection
- Health and Hygiene
- Respiratory and Hearing Protection

The training program will be executed preferably 2/year.

The details of personnel training program are also described in the Occupation Health & Safety Assessment, based on the standards set by the relevant Legislation. The assessment identifies the sources of risk and especially those that come from the management of HW, based, among others, on the MSDS of the substances. Indicatively, the following are mentioned:

26.5 Medical Monitoring of Employees

Symptoms most commonly seen in related industries are low back pain, headaches, respiratory problems, hearing loss, ringing in the ears and anxiety. Noise and respiratory problems are the major health hazards for employees and for this reason the company should provide (at least) annual audition tests to employees.

Other medical provisions will include vaccination against Tetanus, Hepatitis B and COVID-19.

Note that the Shipyard possesses a fully equipped First Aid/Medical Station and occupies a full-time doctor and nurses (see also Chapter 2).

26.6 Fire Safety

Regarding fire safety, the minimum requirements of the current legislation (also included in the approved Firefighting Assessment), include the following measures:

- Strict observance of the provisions of the current legislation for liquid fuel storage facilities of companies that are not companies trading in petroleum products (YA 28-6-1991 - Government Gazette 578/B/ 29-7-91 and PD 44/1987)

- Posting of signs in prominent places of the industrial area with fire prevention instructions and ways of action of the company staff in case of fire.
- Marking the location of firefighting materials and equipment, escape routes and emergency exits, especially for sheltered areas
- Existence of portable dry powder fire extinguishers 6kg type PA or other approved extinguishing material of equivalent extinguishing capacity in a ratio of 1 per 250m^2 of covered area and at least two (2) fire extinguishers per building
- The permanent firefighting network should be operational and maintained and water supply, in appropriate pressure, should be available at all times
- Thorough maintenance, regular inspection and control of electrical installations in accordance with the relevant regulations (e.g., ATEX)
- Prohibition of smoking and use of flame (matches, lighters, etc.) in dangerous places
- Removal from the outdoor areas of the Complex of all useless materials that can be ignited and their placement in safe areas, to avoid the transmission of fire.
- Continuous cleaning of all apartments, offices, corridors, courtyards, warehouses and outdoor space of the Complex and immediate removal of any flammable materials.

26.7 Special Measures for C/R Phase

The following measures apply:

- Workers will be trained on lifting and materials handling techniques.
- Good house-keeping practices will be implemented at site.
- Temporary fall prevention devices will be provided at necessary places and workers will be trained on use of personal fall arrest systems.
- Wearing appropriate PPE, such as safety glasses with side shields, face shields, hard hats, and safety shoes will be made mandatory.

- Specific PPEs such as respirators, clothing/protective suits, gloves and eye protection will be made available to workers engaged in specific jobs.
- A work permit system will be adopted wherein only trained workers equipped with necessary PPEs will be permitted to undertake hot jobs and electrical works.
- ONEX will ensure that all requirements under the national labor laws will be complied with (see also Chapter 2).
- The number of working hours for labor will not exceed the permitted requirements under the labor regulations.
- Adequate number of toilets will be provided at the construction site with separate arrangements for male and female workers.
- ONEX will ensure that no child labor will be engaged at the project site.
- ONEX will also provide grievance redressal mechanism for the workers.

26.8 Special Measures for Operation Phase

For operational phase of the Shipyards, the following OHS measures apply:

- A gangway, ramp or permanent stairway of not less than 20 inches walking surface, of adequate strength maintained in safe repair and securely fastened, shall be provided for access to vessels. Each side of such gangway or ramp shall have railing with a mid-rail.
- Scaffolding will only be erected, altered and dismantled under supervision of a competent person.
- Scaffolding will be constructed of sound, materials in good condition and properly stored when not in use
- Only authorized and trained personnel will operate the aerial work platform (such as cherry pickers).
- Safety harness will be worn and anchored to the basket guard rails. The Safe Working Load (SWL) will not be exceeded at any time.

- Compressed gas cylinders are commonly used in the ship repair industry for a variety of operations such as welding, cutting, bracing etc. Such gas cylinders will be used in a vertical position, unless specifically designed to be used otherwise. Cylinders will be fitted with residual pressure valves (nonreturn valves) to reduce the risk of back flow of water or other materials into the cylinder during use that might corrode it. Adequate safety precautions will be taken during handling, use, storage and transport of gas cylinders.
- All personnel required to enter a confined space will undergo confined space entry training. Personnel who have not undertaken this training are prohibited from entering a confined space. For any activity at
- Confined Space, the Permit-to-work will need to be obtained from the supervisor. It will be ensured that safe access and egress are provided into and out of the confined space. Where possible, testing of the atmosphere in the confined space prior to entry and continuous monitoring whilst work will be undertaken.
- Permit to work system will also be implemented for hot works, electrical works and works at height.
- Prior to initiation of hot works, it will be checked that there is no flammable material, gas or dry woodwork which could catch fire and those surfaces which have been in contact with hydrocarbons or toxic substances are completely clean.
- Before electrical work is performed, energized equipment will be guarded, de-energized, or appropriate PPE will be used to prevent worker exposure.
- During shot blasting/ grit blasting and chipping works, a blasting helmet will be used, equipped with silencers or other noise reducing devices to lower the noise level inside the helmet to less than 85 dB (A). The blaster will use suitable earplugs. Hearing tests will be carried out for all blasters before employment and at yearly intervals.
- A permit to work will be released to the workers before commencing the painting operation. Paints and solvents will be accompanied by a Safety Data

Sheet (SDS). Painters will use an approved type of airfed mask/PPE. Adequate ventilation will be maintained so that the space is gas free. This eliminates the danger of fire and paint intoxication.

- The PPE required will be specified either in the procedures or in the permit-to-work or both. Use of PPEs by all workers will be strictly enforced and closely monitored. All workers engaged in the ship repair yard with high noise will be provided with ear plugs and earmuffs as required.

26.9 Inspections and Performance Follow up (Monitoring)

Periodic inspections will be carried out on the work fronts to detect risk situations or risk behaviors, and to create the respective action plans to eliminate them. During the inspections, any changes in scope, conditions, risks, etc., with an impact on the risk assessment, must immediately be reported and the safety documents revised.

It is highlighted that the work fronts can be stopped in the event of detection of critical conditions such as:

- Performing a task without prior preparation of the respective Activity Risk Assessment
- Employees' exposure to serious and imminent risk conditions provided for in National legislation
- Absence of control/mitigation measures.

The stopped work front may only resume work after the adoption of the respective corrective action approved by the responsible for the stoppage.

The performance in occupational health and safety at ONEX facilities is based on preventive and reactive indicators described below, which are tools that can provide appropriate interpretations of past events and ensure the understanding of the organizational processes. Monitoring these indicators provides information that contributes to the continuous improvement cycle, with the ultimate goal of promoting the workers' safety and occupational health.

Reactive Indicators

- Frequency rate of accidents with no absence from work
- Frequency rate of accidents with absence from work
- Accident severity rate

Preventive Indicators

- Number of workers' outpatient care visits
- Number of attendances by category urgent/emergency and hospital admissions
- Number of training hours in occupational accident prevention programs
- Number of people trained as multiplying agents in disease prevention campaigns
- Number of vaccination campaigns, by disease category and immunized workers
- Number of Daily Safety Dialogues held
- Number of Daily Safety Dialogues hours held
- Number of performed health exams (considering periodic, admission, return to work and change function examinations)
- Percentage of examinations by type of legal requirement to change the normal range
- Number of outpatient care attendances of non-worker patients
- Investment spending in public health care appliances
- Spending cost with public health education campaigns
- Spending costs

26.10 Communication, Research and Analysis of Near Misses/Accidents

All occupational diseases and near misses/accidents must be reported and investigated to determine why they occurred, and to assess how to eliminate the generating causes and those that contributed to the fact. ONEX further communicates, notifies and registers such occurrences.

Importance is given to risk situations and events that may result in occupational accidents, reported as near misses to eliminate causes of future and eventual accidents arising from these situations or events.

27. ENVIRONMENTAL MONITORING PROGRAM (EMP)

For the needs of an efficient EMP in the individual environmental sectors, the following are proposed:

27.1 Water & Sediments/Dredging Material

The monitoring of water and sediments quality will be carried out on an annual basis during the period January - August. There will be two sampling campaigns, one during the winter-spring season and one during the summer season. Samples will be taken by 5 sampling points (the same as the previous monitoring program – see Chapter 4, par. 4.8.4). A total of 20 samples (10 water and 10 sediments) should be collected. The monitored parameters are illustrated in Tables 27.1 and 27.2.

Especially for sediments, the proposed sampling campaign is based on the requirements of the relevant European Regulations (Italian, French and Spanish) and the recommendations of UNEP(DEPI)/MED WG.443/15. 2017. Draft Decision: Guidelines for Regulating the Dumping of Dredged Materials at Sea.

It is proposed that sampling will be conducted by the competent personnel of the laboratory responsible for the analyses, under the supervision of the Shipyards' Head of Environmental Protection. Sampling process is described in detail on the abovementioned Regulations.

The minimum requirement for the collaborating laboratory is that it should be certified under ISO 17025: General requirements for the competence of testing and calibration laboratories.

The results of the above measurements will be notified to the competent authority without delay and will be kept in a special file within the installation, under the responsibility of the Head of Environmental Protection.

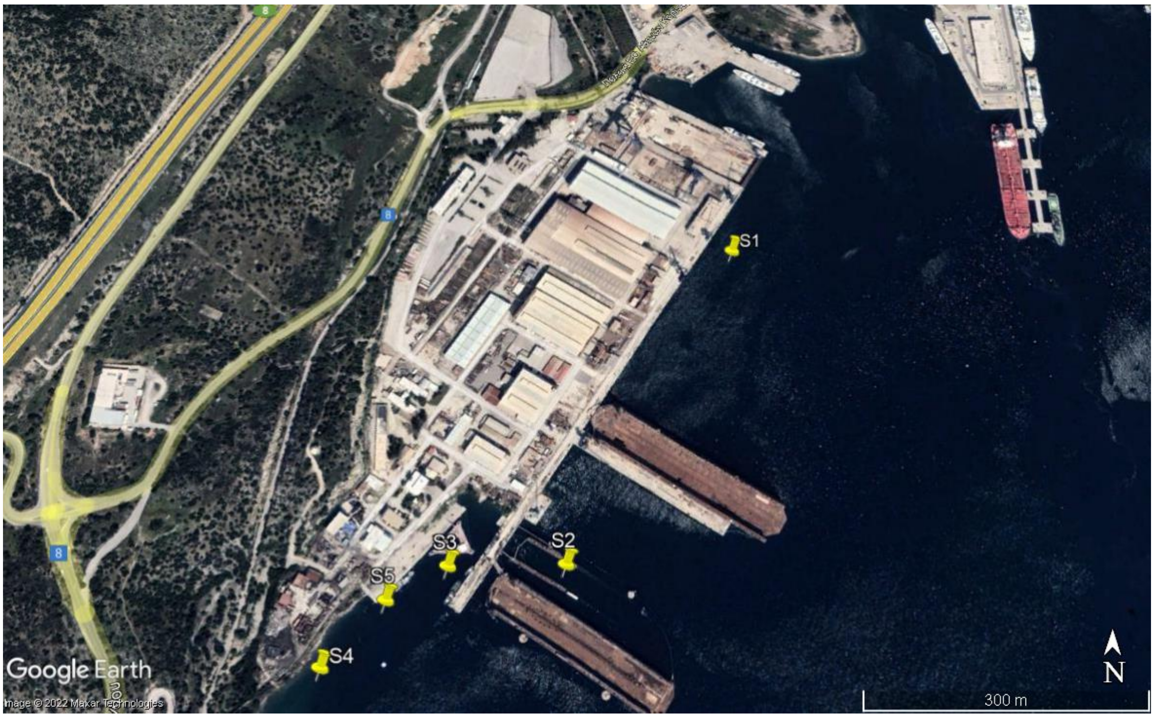


Figure 27.1: Sampling Points for Seawater & Sediment (S: Sampling Point)

Table 27.1: Proposed EMP for Seawater

No	Parameter	Monitoring Frequency
1	Temperature	2/year
2	pH	2/year
3	Conductivity	2/year
4	Salinity	2/year
5	Dissolved Oxygen	2/year
6	Turbidity	2/year
7	Coliforms (whole, Ecoli, enterococci)	2/year
8	PHAs	2/year
9	TBT	2/year
10	Heavy Metals (Ni, Pb, Cu, Fe, Cr, Zn, Cd, Hg, As)	2/year
11	Nutrients ((NH4-N, NO3-N, NO2-N, PO4-P)	2/year

Table 27.2: Proposed EMP for Sediments/Dredging Material

No	Parameter	Monitoring Frequency
1	Heavy Metals (Ni, Pb, Cu, Fe, Cr, Zn, Cd, Hg, As)	2/year

No	Parameter	Monitoring Frequency
2	Σ 7 PCBs (mg/kg) [28, 52, 101, 118, 138, 153 and 180]	2/year
3	Σ 9 PAHs (mg/kg) [Anthracene, Benzo(a)anthracene, Benzo(ghi)perylene, Benzo(a)pyrene, Chrysene, Fluoranthene, Indeno (1,2,3-cd)pyrene, Pyrene and Phenanthrene].	2/year
4	TBT (mg Sn/kg) (DBT and MBT)	2/year

27.2 Noise EMP

The basic principles of Noise EMP will be as follows:

- Measurements should be conducted according to ISO 11204:2010: "Acoustics — Noise emitted by machinery and equipment — Determination of emission sound pressure levels at a workstation and at other specified positions applying accurate environmental corrections"
- The frequency of measurements will be at least twice a year and with a duration of 24 hours.
- The measurements will be performed at 5 positions at a stable height of 1,20m (see Figure 12.2):
  - Position 1: Property limit near biological treatment facility
  - Position 2: On the pier, close to the floating tanks
  - Position 3: Property limit within parking spaces
  - Position 4: Against Shipbuilding Bed
  - Position 5: Shipyards Entrance
- The following noise indicators will be recorded / calculated:
  - Lday, Levening, Lnight, Lden
  - Quantitative indicators L1, L10, L50, L95, L99 as well as Lmax and Lmin during the 24 hour recording,

- Energy equivalent average 24-hour LAeq sound level (24h)

Figure 27.2: Sampling Points for Noise & Outdoor Air Quality Monitoring

Measurements should cover periods with normal activity of the shipyards (loading-unloading, sandblasting, etc.), but also the end of shifts - departure of employees.

An indicative equipment is presented in Figure 27.3.

Figure 27.3: Sound-meter for Industrial Applications

If from the implementation of the noise monitoring program, it appears that regulated limits (see Chapter 11) are exceeded, sound curtains will be installed, or any other sound protection measure deemed necessary. In this case, it is required to prepare a special technical study of sound protection for the noise protection of the broader area, which will be submitted by the project operator and will be approved by YPEN.

27.3 Air Quality EMP

Outdoor Air Quality

The basic principles of the Outdoor Air Quality EMP will be as follows:

- Measurements should be conducted according to ISO/TC 146 “Air quality”, or equivalent
- The frequency of measurements will be at least once per month and with a duration of 24 hours.

- The measurements will be performed at 5 positions at a stable height of 1,20m (see Figure 12.2 – same configuration with noise sample points):
  - Position 1: Property limit near biological treatment facility
  - Position 2: On the pier, close to the floating tanks
  - Position 3: Property limit within parking spaces
  - Position 4: Against Shipbuilding Bed
  - Position 5: Shipyards Entrance
- The air quality indicators that will be recorded are illustrated in Table 27.3.

Table 27.3: Proposed EMP for Outdoor Air Quality

Pollutant	Monitoring Frequency	Average period for comparison with limit values
Carbon Monoxide (CO)	1/month	Maximum daily average of 8 hours
Nitrogen dioxide (NO_2)	1/month	
	1/month	
Ozone (O_3)	1/month	Maximum daily average of 8 hours
Sulphur Dioxide (SO_2)	1/month	1 h
	1/month	24 h
Suspended Particulates ($PM_{2.5}$)	1/month	1 year
Suspended Particulates (PM_{10})	1/month	24 h
	1/month	1 year
Lead*	1/month	1 year
Benzene (C_6H_6)	1/month	1 year
Arsenic*	1/month	1 year
Cadmium*	1/month	1 year
Nickel *	1/month	1 year
PAHs*	1/month	1 year
VOCs	1/month	1 year

* Measurement on PM_{10} content

<u>Emissions will be measured and recorded through an EN 17025 accredited laboratory</u>.

The results of the above measurements will be notified to the competent authority without delay and will be kept in a special file within the installation, under the responsibility of the Head of Environmental Protection.

Indicative equipment for monitoring air quality is presented in Figures 27.4 & 27.5.

Figure 27.4: Voyager Set for VOCs Measurements

Figure 27.5: Equipment for Industrial Air Quality Monitoring

Indoor Air Quality

In buildings or structures where possible air polluting activities are taking place, a special EMP will be established. Those structures include (see Drawing ENV-02):

- Building no 30: Sandblasting / Abrasive Blasting / Metal Grinding / Coating / Painting
- Building No 25: Welding/Thermal Metal Cutting Operations
- Building No 29: Welding/Thermal Metal Cutting Operations

The indoor air quality indicators that will be recorded are illustrated in Table 27.4.

Monitoring Frequency is depending on the intensity of the works and may be modified accordingly (e.g., increase frequency if indoor air polluting processes are taking place more frequently).

Table 27.4: Proposed EMP for Indoor Air Quality

Pollutant	Indicative Monitoring Frequency**
Suspended Particulates ($PM_{2.5}$)	1/month
Suspended Particulates (PM_{10})	1/month
Lead*	1/month

Pollutant	Indicative Monitoring Frequency**
Benzene (C_6H_6)	1/month
Arsenic*	1/month
Cadmium*	1/month
Nickel *	1/month
PAHs*	1/month
VOCs	1/month

* Measured in the PM_{10} fraction

** Depending on the intensity of the works

27.4 Treated effluent EMP

Treated effluent from the Biological Treatment Plant was continuously measured through the former Shipyards' operation, with a frequency of 22 measurements per year/parameter (see also Chapter 3). The proposed EMP, according to the relevant legislation (MD 145116/2-02-2011 (OG 354B / 8-03-11) – See Chapter 2) is illustrated in Table 27.5.

Table 27.5: Proposed EMP for Treated Effluent

Pollutant/Parameter	Indicative Monitoring Frequency
pH	2/month
BOD	2/month
COD	2/month
Total Suspended Solids (TSS)	2/month
Oils	2/month
Cl^-	2/month
Dissolved oxygen	2/month
Detergents	2/month
Coliforms (whole, Ecoli, enterococci)	2/month
Nutrients ((NH4-N, NO3-N, NO2-N, PO4-P)	2/month

27.5 Waste EMP

Except from the measures described in Chapter 11, the Operator is obliged to record and keep all the relevant documents regarding all solid waste that may be generated at the facility, and which will be delivered to special licensed companies for further management, such:

- Waste under the provisions of the alternative management
- Hazardous Waste
- Asbestos and ACMs waste

Until 31/3 of each year, the annual report of the waste producer for the previous year will be prepared and submitted electronically on the special platform of DWR (http://wrm.ypeka.gr).

27.5 Natural Resources

For reassuring the rational consumption of the natural resources, electricity, water and fuel consumption should be monitored as presented in Table 27.6.

Table 27.6: EMP on the consumption of natural resources & energy

Parameter	Monitoring Scheme	Indicative Monitoring Frequency
Electricity Consumption	Measurements by Shipyard activity sector	2/year
Water Consumption	Measurements by Shipyard activity sector	2/year
Fossil Fuel Consumption (e.g., diesel)	Measurements by Shipyard activity sector	2/year

28. SOCIAL & HR MANAGEMENT PLAN

28.1 Stakeholder Engagement Plan

An extensive stakeholder engagement plan (SEP), containing the relevant Grievance Redressal processes, is presented in Appendix IV.

28.2 Corporate Social Responsibility (CSR)

The Shipyards, under ONEX management and administration, will develop plans for undertaking social responsibility activities in the communities within the vicinity of the project site (Municipality of Elefsis and Subregion of West Attica). Prior to the planning process, a needs assessment is required to be undertaken by a third party. Accordingly, based on this report, plans should be formalized. A budget should be allocated every year for the activities and accordingly, monitoring and impact evaluation should be undertaken to assess whether the activities initiated have achieved maximum outreach and value to the community members.

Note that ONEX implements CSR principles in other of its activities. The main pillars of ONEX's CSR strategy are summarized below:

- ONEX and its employees must obey Greek and EU laws and regulations.
- ONEX will conduct its activities in a socially responsible manner, respecting its employees and all relevant stakeholders.
- ONEX is committed to provide an attractive working environment for its employees.
- ONEX will assure open and clear communication between employees and management on all aspects of the working environment.
- ONEX will not allow bribery and/or any other forms of unethical business practice.
- ONEX supports the principles of free enterprise and fair competition.

- Employees should avoid conflicts of interests between their private dealings and their responsibilities towards ONEX.
- ONEX recognizes and respects the importance of protecting personal data

28.3 Human Resources and Labour Procedure and Plan

28.3.1 General

ONEX is managing human resources through the following methods:

- Managers implement fair HR policies and strategies with the support of dedicated HR.
- They use the performance management system to develop and evaluate their team's ability to build positive work relationships.
- They use training as a means of cultivating, motivating, and maintaining quality staff and promoting positive working relationships, acceptance of diversity and fair practices.
- All employees interact fairly with their colleagues. They are polite, honest and treat each other with respect and dignity.

28.3.2 Compliance with Laws, Rules and Regulations

ONEX and its employees are bound by the law. Compliance with all applicable laws and regulations must never be compromised. Additionally, employees shall adhere to internal rules and regulations as they apply in a given situation. Those internal rules are specific to ONEX and may go beyond what is required by the law. Senior Management will ensure that:

- All employees are aware of the internal rules
- No employee will be asked to do anything that would contravene internal rules
- Queries and concerns arising under this Code will be dealt with properly and may be addressed to the HRD.

28.3.3 Recruitment & Selection

General

The staffing policy and its implementation will be fundamentally aimed at matching the human resource with the strategic and operational needs of ONEX and ensuring the full utilization and continued development of employees. All aspects of the recruitment and selection of employees will be non-discriminatory and will afford applicants equal opportunity to compete for vacant positions.

The recruitment policy shall be applicable to all positions at all levels in the ONEX facilities both regular and contractual based unless otherwise specified.

Objectives

This policy is further based on the principles set out below. Human resource management in Elefsis Shipyards must:

- Be characterized by a high standard of professional ethics
- Promote the efficient, economic and effective utilization of employees
- Be conducted in an accountable manner
- Be transparent
- Promote good human resource management and career development practices, to maximize human potential
- Ensure that the ONEX's administration is broadly representative of the people, with human resource management practices based on ability, objectivity and fairness

Job Description Document

The Job Description Document including Person Specification shall set the criterion for selection. These documents shall be used to set out the duties of the job and the skills needed to fill it for advertisement purposes. For all replacement posts existing job description and person specification document shall be used. For all newly created posts, these documents shall be prepared and made available by the HRD in consultation with the concerned departments before recruitment process is initiated.

non-Eligibility

Following people shall not be eligible for employment at ONEX:

- Those who have been previously terminated or dismissed because of fraud and forgery from any organization.
- Those who have been convicted for major offences by the law enforcing agencies or have any criminal record.

The employees shall sign an undertaking in this respect. Misstatement in this respect shall be subject to disciplinary action leading to termination of services.

Nationality

All nationalities (including emigrants) will be eligible for employment against all positions in ONEX as long as the fulfil the typical criteria for the respective position.

Age Limit

ONEX shall not hire any person below the age of 18. Superannuation age shall be 60 years for all employees.

Physically Disabled & Handicap Persons

ONEX shall give adequate preference to disabled candidates by relaxing the minimum selection criteria. ONEX shall make efforts to recruit disabled and handicapped candidates and meet the regulatory requirements to fill the 2% quota for disabled and handicapped persons and as a social responsibility of the Authority.

Equal Opportunity

ONEX will ensure that its employment-related decisions are based on relevant qualifications, merit, performance and other job-related factors. ONEX will not tolerate unlawful discrimination relating to employment. Hiring, evaluation, promotion, training, development, discipline, compensation and termination decisions shall be based on qualifications and merit only. ONEX does not discriminate on the basis of race, colour, religion, age, gender, marital status, disability and ethnic origin.

Discrimination and Harassment

ONEX respects the personal dignity, privacy and personal rights of every employee and is committed to maintaining a workplace free from discrimination and harassment. Therefore, employees must not discriminate on the basis of origin, nationality, religion, race, gender, age, political loyalty or engage in any kind of verbal or physical harassment based on any of the above or any other reason. Employees who feel that their workplace does not comply with the above principles are encouraged to raise their concerns with the Administration. Employees should be particularly sensitive to actions or behaviors that may be acceptable in one culture but not in another. They should treat others with respect and avoid situations that may be perceived as inappropriate. Harassment can result in disciplinary action and may lead to dismissal.

Anti-Smoking Policy

Smoking is strictly prohibited in all outdoor working areas as a non-negotiable OHS measure. Furthermore, to protect and enhance indoor air quality and to contribute to the health and well-being of all employees, Shipyard Facilities shall be entirely smoke free. Smoking is prohibited in all of the enclosed areas within the Shipyard worksites, without exception. This includes, except common work areas, conference and meeting rooms, private offices, hallways, the lunchrooms, stairs, restrooms, employer owned or leased vehicles, and all other enclosed facilities.

Leaves and holidays

It is the policy of ONEX to provide its staff time to rest and reinvigorate. The purpose of this policy is to create provisions for employees to attend their recreational needs, health related issues and personal/domestic urgencies etc. However, Leave shall Not be claimed as a matter of right when the exigencies of service so require, the leave sanctioning authority may refuse the grant of leave already granted or change the nature of leave or re-call an employee before expiry of his leave period. All leaves should be applied on Leave Application Form

ONEX provides the following categories of leaves:

- National Holidays
- Annual Leave
- Casual Leave
- Sick Leave
- Maternity Leave
- Leave of absence/Leave Without Pay
- Paternity Leave
- Study Leave

Policy to deal with discrimination & harassment policy

ONEX does not tolerate any form of discrimination on the basis of race, religion, gender, color, ancestry, serious medical condition, ethnicity, age, or disability. ONEX believes that all employees are entitled to a workplace free of harassment and expects employees to treat each other and clients with courtesy and respect. Conduct which violates this policy includes, but is not limited to foul language, dirty jokes or comments pertaining to race, religion, sex, gender identify, color, national origin, age, or disability, regardless of whether the conduct was intended to offend or intimidate or not.

28.4 Contractors Management

28.4.1 Evaluation procedure

ONEX has developed a performance evaluation procedure, wherein contractors will be evaluated on the basis of:

- Labor working conditions
- Health and safety compliance
- Labor law compliances
- Suitability for the exercise of professional activity (depending on the activity under contract)
- Economic and financial adequacy (depending on the activity under contract)
- Technical and professional ability (depending on the activity under contract)
- Quality assurance standards and environmental management standards
- Certificate of tax compliance, issued by the Independent Public Revenue Authority (AADE)
- Certificate of social security compliance issued by National Social Security Agency (EFKA).

28.4.2 Exclusion

Reasons for exclusion of Contractors, according to the relevant EU and National Legislation, will include:

- Participation in criminal organization
- Active corruption/bribe, as defined in Article 3 of the Anti-Bribery Convention, which includes officials of the European Communities or of the Member States of the Union (OJ C 195, 25.6.1997)
- Fraud, to the detriment of the Union's financial interests within the meaning of Articles 3 and 4 of Directive (EU) 2017/1371

- Terrorist crimes or crimes related to terrorist activities, as defined, respectively, in Articles 3-4 and 5-12 of Directive (EU) 2017/541
- Money laundering or terrorist financing, as defined in Article 1 of Directive (EU) 2015/849 of the European Parliament and of the Council of 20 May 2015
- Child labor and other forms of trafficking in human beings, as defined in Article 2 of Directive 2011/36 / EU of the European Parliament and of the Council of 5 April 2011

ONEX will conduct periodic inspections and audits of contractors during the course of engagement to ensure that all regulatory requirements are complied with.

28.4.3 Evaluation of financial adequacy/credibility

The purpose of this process is to define the necessary steps in order to identify subcontractors/suppliers financial credibility, prior to co-operation

The procedure is applied by all departments in case the credibility control of the subcontractors / suppliers is deemed necessary. The objective is to achieve zero number of collaborations with non-credible companies and/or individuals.

28.4.4 Hiring/Assignment

The Competent Departments and the relevant Management Actions are illustrated in Table 28.1

Table 28.1: Competent Departments & Management for Hiring/Assignment

Competent department	Management actions
Procurement Department Projects department	Subcontractors, are asked to fill in the "company credibility form". The form is given for completion to all companies - subcontractors of any size
Procurement Department Projects department	They announce the results of the form to the financial department and integrate the form in a file where details of all the subcontractors cooperating with the company will be kept.

Competent department	Management actions
Procurement Department Projects department Financial Deepartment	Study and confirm the data that characterize the professional consistency and credibility of the subcontractor (contact with collaborating bodies - companies)
Procurement Department Projects department	Forward of the financial statements of the subcontractor in order to check their financial status.
Financial Department	Carries out the financial analysis of the data obtained by the subcontractors
Legal Department Procurement Department Projects department Financial Department	Decision making for cooperation with the specific subcontractor / supplier
Procurement Department Projects department Financial Department	In the event that more than one year has elapsed since the last financial data evaluation we will have to request them again from the subcontractor
Legal Department	Contract Assignment

28.4.5 Supervisor

The on-site supervisors and personnel will monitor key environmental and social performance indicators to ensure targets are met. They will monitor effectiveness of the mitigation measures and report the performance to the senior management and to the government agencies, as required.

The operations phase contractors will also be required to demonstrate how they will comply with all relevant legislation and industry good practice, and how they will implement the proposed mitigation measures. The contractors will monitor environmental and social performance to evaluate actual performance against its objectives.

Depending on the Project, ONEX will appoint a competent person (procurement technical, environmental etc. officer) as Supervisor. The supervision aims in particular, at the faithful fulfillment by the contractor of the terms of the contract related to a project, service or procurement, according to the rules of art, in order to meet its scope. The Supervisor has during the exercise of its duties all the rights and obligations recognized by the provisions of Law 4412/2016.

The supervisory tasks to be performed include in particular:

- Control of compliance with the contractual obligations of the contractor.
- Implementation control by the contractor of the project study,
- Implementation control by the contractor of the specifications and regulations, in order to ensure the expected quality of the project
- Control of compliance by the contractor of all kinds of safety and hygiene regulations
- Control of compliance with the specifications and assessments/studies for the protection of the environment
- The quantitative and qualitative recording and documentation of the project produced by the contractor, which includes in particular the control of the project log, the counting and measuring data, the requests of the contractor, etc.
- Monitoring the relationship between the contracted and executed physical object and informing the managing office about the progress of the project
- Control of the fulfillment by the contractor of the conditions for the partial payments on the basis of the produced project
- The management of all technical issues that arise during the construction of the project

The Contractor Obligations include:

- Provide all possible information to the Supervisor in relation to the project and in particular must provide him with complete copies of the Contract

Documents, his Bid Technique and the Contract, in order to be able to fulfill his duties.

- Ensure the smooth performance of supervision at construction sites where parts of the project are constructed and in general in all areas deemed necessary by the Management Service in accordance with paragraph 16 of article 138 of Law 4412/2016.
- Allow the Supervisor, to carry out inspections at the place of execution of the works or at the other places of production/delivery.
- Provide all necessary assistance to the Supervisor, so that the latter carries out its duties and in particular must:
    - Send to the Supervisor electronically the project calendar
    - Assist the Supervisor in any action for the monitoring and on-the-spot control of all the necessary data for the measurement of the quantities of the performed works
    - Assist the Supervisor in carrying out audits for the measurement of invisible works, for the control of the partial measurements and the final measurement, for the control of the payments submitted by the contractor.

28.5 Retrenchment Plan

The main pillars of an effective retrenchment plan include:

- Carry out an analysis of alternatives to retrenchment prior to implementing any dismissals.
- Ensure that all workers receive notice of dismissal and timely severance payments mandated by law and any outstanding back pay and social security benefits and pension contributions
- Where there are no alternatives to retrenchment, development and implementation of a retrenchment plan to be undertaken. The plan is to be based on the principle of non-discrimination and will follow consultation with

workers, their organizations, and, where appropriate, the government. It is to be compliant with collective bargaining agreements, legal and contractual requirements related to notification of public authorities, and provision of information to, and consultation with workers and their organizations.

29. TRAFFIC MANAGEMENT PLAN

29.1 General

A Traffic Management Plan is being developing with the aim of minimizing any disruption to local traffic related to Project activities and minimizing any traffic-related risks to the public.

Access to the proposed project site shall be via the existing road network (see also Chapters 3 and 5), which is understood to be in good condition. No improvement works will be carried out up to the site boundary.

A sufficient-road system is provided within the site boundary and shall service all the buildings, houses and installations, so as to meet traffic and other requirements of production, daily life, waste and material transport and firefighting. The road within the plant area is the urban type with concrete curbing and a general width of 7.5m.

Significant impacts on the road network are not anticipated given that the site is served by a major national motorway route. An assessment of the potential impacts on the transport network will be undertaken prior to construction, in order to consider current traffic flows at that time.

The Traffic Management Plan includes:

- Identifying vehicle routes, route planning and alternative routes
- Pre- and post- construction survey requirements
- Notification requirements for example:
  - Notifying the municipalities and police of all approved project transport routes
  - Notifying the public of temporary road diversions and closures
  - Requirements for a journey management system
- Driver requirements such as:
  - Sources of and number of qualified drivers required

  - Training and approval requirements for drivers
  - Hours of driving and rest periods
  - Security arrangements for drivers, vehicles and loads
  - Arrangements for driver communication with control points and vehicle
  - Equipment
  - Vehicle requirements
- Requirements for the diversion and closure of roads
- Emergency recovery of vehicles
- Traffic control procedures, including entering and exiting construction areas and the working strip
- Identifying emergency service vehicle parking areas.
- Identifying construction personnel parking areas
- Monitoring and reporting requirements.

29.2 MP description/responsibilities/monitoring

The Traffic Management Plan will be developed as part of a comprehensive Traffic Impact Study (TIS) and/or a Traffic Impact Analyses (TIA) that is being prepared by ONEX. Some of the core parts of an effective Traffic MP (applicable to both C/R and Operation Phase) is illustrated below:

Table 29.1: Traffic Management Plan

Identified Impact	Management	Responsibility
Risk of accidents and congestion	The main access road to plant will be upgraded / tarred which will have a positive effect on local traffic.	• Construction Contractor • Site Manager (ONEX)
	Temporary traffic control and diversion arrangements shall be provided at strategic points on local roads, where necessary.	• Construction Contractor • Site Manager (ONEX)
	An effective journey management schedule shall be maintained to reduce the risk of accidents.	• Construction Contractor • Site Manager (ONEX)
	A transportation and materials management system for safe transportation of equipment materials and waste to/from site	• Construction Contractor • Site Manager (ONEX) • Environmental Officer

Identified Impact	Management	Responsibility
	shall be developed and implemented, to be included within the ESMS.	
Injury/death/assets damage due to road traffic accidents and interference with other road users (market/commercial activities)	Traffic Impact Study (TIS) and/or a Traffic Impact Analyses (TIA) will include appropriate measures regarding community health and safety in line with IFC PS4 and HSE Guidelines. These will be updated and reviewed over the life of the project.	• Independent Traffic Expert
	ONEX will carry out a pre- and post-assessment of the roads that will be used during the project and develop a process that ensures overall safety, particularly along roads near communities.	• Independent Traffic Expert • Construction Contractor • Site Manager (ONEX)
	The main access road to the plant will be upgraded / tarred which will have a positive effect on local traffic	• Construction Contractor • Site Manager (ONEX)
	Temporary traffic control and diversion arrangements to be provided at strategic points on local roads, where necessary.	• Construction Contractor • Site Manager (ONEX)
	Effective journey management schedule, including materials management system for safe transportation of equipment, materials and waste to/from site be maintained to reduce the risk of accidents.	• Construction Contractor • Site Manager (ONEX) • Environmental Officer
	The use of appropriate and adequate signs shall be ensured.	• Site Manager (ONEX)
	Drivers and equipment operators shall be educated on safe driving and operation strategies.	• Site Manager (ONEX)
	All vehicles to be certified road-worthy (including fuelling) before being allowed to transport equipment, materials and personnel.	• Site Manager (ONEX) • Environmental Officer
	Vehicle drivers to be certified competent before vehicle movement is permitted.	• Site Manager (ONEX)
	Road load and speed limits to be observed.	• Site Manager (ONEX) • Safety Practitioner
	First Aid and Safety training will be provided to workers and Community Emergency Response Plans will be developed and	• Safety Physician • Environmental Officer

Identified Impact	Management	Responsibility
	tested including workers and nearby residents in the vicinity of Project-related traffic. These will include emergency response related to traffic accidents and potential releases of chemicals and other hazardous materials	
General Risks	Safe pedestrian steps will be situated in the areas surrounding the Shipyards entrance.	• Site Manager (ONEX) • Safety Practitioner
	Signs will be situated on the Shipyards access road, indicating the permitted speed limit for cargo vehicles.	• Site Manager (ONEX) • Safety Practitioner
	Traffic lights will operate, in the arrival and departure of vehicles in the Shipyards area.	• Site Manager (ONEX) • Safety Practitioner
	If more than 10 vehicles are expected to be in or out of the Shipyards, a traffic controller will be designated, which will monitor the progress of vehicles in groups of 5 units. All other units must remain on standby with the engine off.	• Site Manager (ONEX)
	In the case of mobile equipment on public roads and other forms of infrastructure, precautions should be taken to prevent the public from being affected by incidents and injuries related to the operation of such equipment.	• Site Manager (ONEX) • Safety Practitioner
	The implementation of structural elements that allow universal accessibility (ramps, railings, emergency accesses, others) shall be designed and constructed by qualified professionals and shall be certified or approved by competent authorities or professionals.	• Site Manager (ONEX) • Safety Practitioner
	The provisions of the Greek Legislation on construction sites should be applied	• Site Manager (ONEX) • Construction Contractor

Traffic Impacts and the effectiveness of the respective MP will be mainly monitored and documented through:

- Continued monitoring, reporting and documentation of any incidents.
- Site inspections during C/R and Operation Phase
- Reports documenting incidents and site inspection will be produced.

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APPENDICES