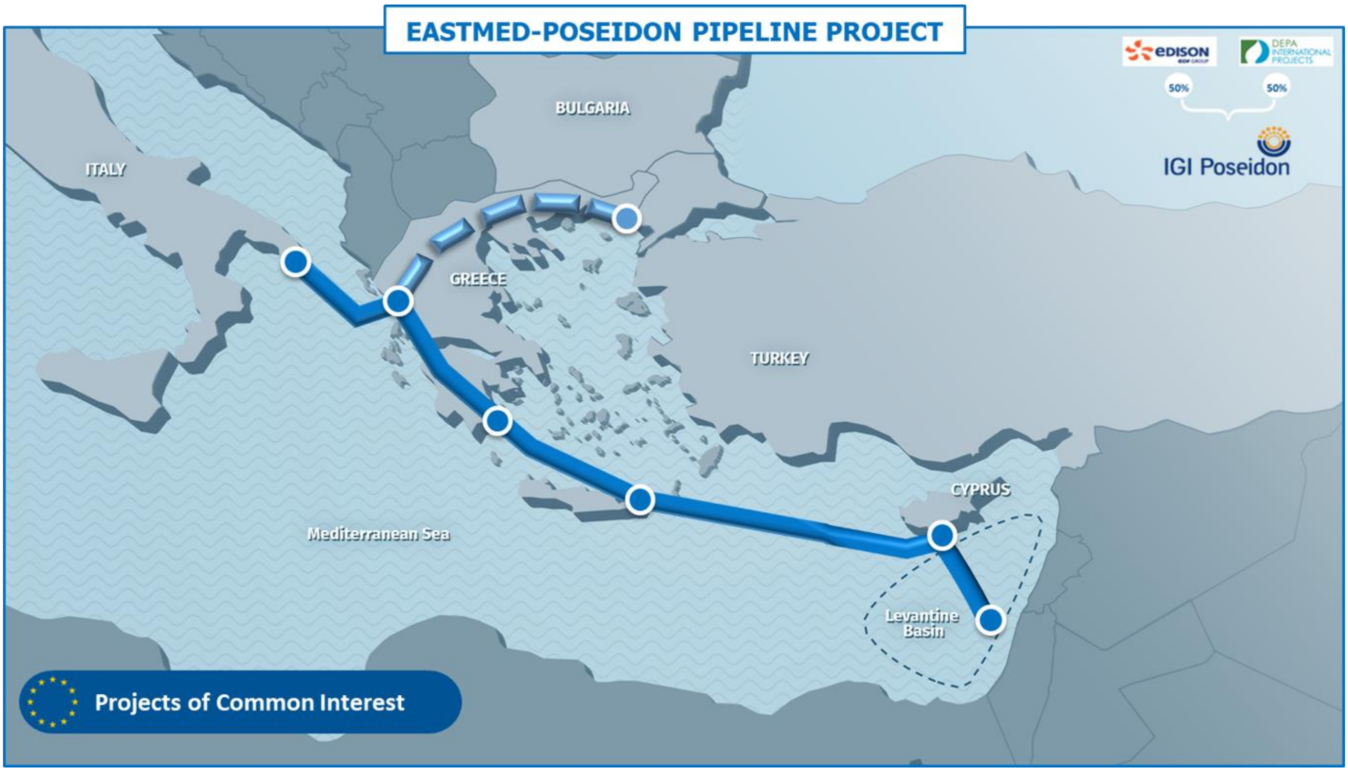
PROJECT:

EastMed Pipeline Project



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Abbreviations

See Document Map.

9 IMPACTS ASSESSMENT

9.1 Methodology

9.1.1 Statutory Requirements

According to the provisions of MD 170225/2014 (HGG B' 135/2014), this section describes and assesses potential important impacts that may be induced by the Project to the physical, biological and social environments. For environmental parameters that are not expected to be affected by construction, operation and/ or decommissioning of the Project, as described in Chapter 6, then a simple reference is made that no impacts are expected and no further assessment is necessary for the specific parameter.

A distinction is made in relation to the Project phase, i.e. construction, operation and decommissioning phases. It is noted that due to the long life span of the Project the impacts for the decommissioning phase cannot be assessed accurately at this stage. Nevertheless, it is expected that impacts during the decommissioning phase will be similar to those of the construction phase (details are provided in Section 9.4).

In addition, both positive and negative impacts that the Project may cause to the environment are assessed. For assessed impacts, the following properties are recorded, based on the provisions of relevant national legislation (MD 170225/2014):

- *Likelihood*: provides an indication on the possibility of the impact to occur;
- *Extent*: impact area is defined (in relation to the geographical area) and/or the size of the affected population;
- *Intensity*: indicates the change in the value of the affected environmental variables and compares the new values with the statutory limits or sensitivity of the receptor;
- *Complexity*: impact is to be divided into direct or indirect (to describe the sequence of events) and making reference its components;
- *Typical periods*: frequency, duration and repetitiousness;
- Potential for prevention, avoidance, minimisation and reversibility;
- *Cumulative action*: with other impacts from the same project or impacts from other implemented or planned projects; and
- Transboundary character.

The following terms are used widely in this chapter, and it is deemed useful to clarify them here:

- Project Footprint, i.e. the area within which all necessary activities for the construction and operation of the Project take place. Specifically:

- during construction, the Project footprint includes the pipeline working strip (in the various widths described in Chapter 6) and all temporary facilities necessary for the system's construction, i.e. pipe yards and construction sites; and
- during operation, the Project footprint includes: the pipeline protection strip of 8 m width (4 m on each side of the pipeline axis) and all permanent facilities necessary for the system's operation, i.e. CS2/MS2-CS2/MS2 N, MS4/PRS4 and Heating Station, CS3 and the Line Valve Stations.

- Main Stations, i.e. all stations with potentially significant interactions with the environment (natural and socioeconomic), namely:
  - Crete Facilities (CS2/MS2-CS2/MCS2 N), i.e. the Compressor and Metering Stations of Southern Line (CS2/MS2) and Northern Line (CS2/MS2 N) located within the same plot, in the broader area of Atherinolakkos;
  - Megalopoli Facilities (MS4/PRS4 and Heating Station), i.e. the Metering (MS4) and Pressure Reduction (PRS4) Station and the Heating Station, located within the same plot, in the broader area of Megalopoli; and
  - Achaia Facilities (CS3), i.e. the Compressor Station located in the broader area of Achaia.

9.1.2 Standardisation of Impacts Assessment

When evaluating the potential impacts, an objective quantification of the impact is provided based on the criteria defined by legislation (see Table 9-1). However, given the nature of the resources, receptors and mechanisms, a degree of subjectivity that is related to the judgment of the study team is expected.

Initially, sensitive receptors are identified and an overview of the impact mechanisms resulting from the construction and operation of the Project is presented. It is noted that for some parameters (e.g. Landscape or Geology) the environmental resource, itself, can be considered a sensitive receptor. Then the potential impact is assessed and the impact statement provided.

The specific mitigation measures and management proposed for each of the impacts is presented in Chapter 10, i.e. the preventive and corrective measures proposed to avoid, prevent, reduce, minimise and, if possible, offset or compensate impacts. The measures also include monitoring and management to document, follow up and manage any potential negative and positive impacts.

9.1.3 Impacts Criteria and Properties

Table 9-1 summarises the assessment criteria of a likely impact.

Table 9-1 Impact Assessment Criteria

	Score				
	0 (low score)	0.25	0.5	0.75	1 (high score)
Likelihood (L)	Impossible	Rare	Likely	Probable	Certain
Extent (Ex)	Small (Limited to Project or resource footprint)	Medium (500 m from Project or resource footprint)	Large (1,000 m from Project or resource footprint)	Perimetric (3,000 m from Project or resource footprint)	Peripheral (>3,000 m from Project or resource footprint)
Intensity (I)	Zero	Low	Medium	High	Very High
Typical Times (D)	Instant	Short-term (0 - 1 year)	Mid-term (1 – 5 years)	Long-term (throughout the entire Project's life)	Permanent (even after Project's termination)
Reversibility (Potential of Impact Mitigation) (R)	Preventable	Avoidable	Reversible	Minimisable	Irreversible
Cumulative Action (C)	Impossible	Rare	Likely	Probable	Certain
Transboundary Character (T)	Impossible	Rare	Likely	Probable	Certain

Prepared by: ASPROFOS, 2022.

The proposed significance scoring system (Table 9-1) proposed above is supported by extensive literature and international practice (indicatively, the following are mentioned: (UNEP, 2010), (EPA, 2017), (DHI, 2009) (AGIP KCO, 2004), (EOH, 2015), (BFIS, 2009) (Pastakia & Jensen, 1998) (SIVEST (PTY) LTD, 2011).

The definition of the impact criteria, as per legislation is presented below.

9.1.3.1 Likelihood (L)

Likelihood (L) of an impact is defined as the degree of certainty of an effect to occur. It usually gets values from 0 (impossible to happen) to 1 (it will surely happen).

9.1.3.2 Extent (Ex)

The *Extent (Ex)* of an impact refers to the geographical area and / or the size of the affected population.

The *Extent* may be small or spot (that is, limited to Project footprint), medium or local (extending to 500 m from Project footprint), large or overt (to extend to 1,000 m from the Project footprint), perimetric (extending to 3,000 m from Project footprint), or peripheral (exceeding the larger study radius) depending on qualitative and quantitative data.

9.1.3.3 Intensity (I)

Intensity of an impact refers to the magnitude of the change, as well as its comparison with the relevant limit values where they are institutionalised or applied on the basis of international practices. Intensity includes / counts the sensitivity of a receptor, such as an endangered species of biodiversity or a protected cultural or natural monument. The intensity may be zero, low, moderate, high, or very high depending on the qualitative and quantitative data.

9.1.3.4 Complexity of Impacts

The complexity of an incidence is:

- The mechanism of appearance, i.e. whether this is a direct or indirect effect. If the impact is indirect, a description of the intermediate steps is made;
- On the components of the phenomenon, to distinguish the simple from the complex effects; and
- Dependencies of impact's intensity and extent to factors outside the Project, if any.

This criterion is evaluated qualitatively and is taken into account when quantitating other properties.

It is clarified that the complexity of the impact is taken into consideration during impact definition (as such, not included in Table 9-1). For example, potential impacts related to cultural issues include direct impacts (e.g. physical impact on unidentified resources) or secondary ones (accessibility nuisance).

9.1.3.5 Typical Times (D)

The Typical Times of an incidence are:

- Duration, i.e. the period within which impact takes place;
- Repeatability (or periodicity), i.e. the frequency of incidence; and
- Seasonality, i.e. the appearance of change of incidence depending on the season.

The duration of an impact can be instantaneous, short-term (1 year), medium-term (5 years), long-term (throughout the project), permanent (and after termination of the project). The remaining typical times are evaluated qualitatively and taken into account when quantitating the remaining properties, especially the duration.

Typical times of impacts from projects like the one investigated do not have essential periodic or seasonal characteristics; duration is its main characteristic (especially during the construction phase). Taking this into consideration and also for convenience (syntax and phrasing) purposes, the term "Duration" is used, to describe this criterion.

9.1.3.6 Reversibility (Mitigation Capacity) (R)

This criterion describes the potential for prevention, avoidance, reversal or minimisation.

In more detail, *Mitigation Capacity* includes:

- Prevention, i.e. dissuasion, measures during phase of the project to prevent the occurrence of the impact;
- Avoidance, i.e. the effort to maintain a distance from the impact mechanism or the impact itself during the project's operation phase;
- Reversal, that is, the partial or total cancellation of the mechanisms of effect or incidence itself, resulting in the corresponding degree of return to its original state. In other words, the ability of an affected resource to return to its original state before any impact on it by the proposed project or activity; and
- Minimising, that is, taking measures during the design and operation phase in order to reduce the characteristics of an impact that cannot be completely avoided, as far as practicable. Depending on the rate of reduction, it can be minimised, decreased or limited.

Lastly, it might be the case that an impact cannot be mitigated at all. In such cases, the most effective approach is to offset either financially (e.g. compensation) or in other ways (e.g. relocation).

Mitigation measures have been developed to find ways of addressing negative impacts and enhancing positive impacts. The key objective is to mitigate impacts to a level that is 'as low as reasonably possible - ALARP'.

A hierarchy of mitigation options is considered, with avoidance at the source of the impact as a priority and compensatory measures or offsets to reduce the impact significance as a last resort. The mitigation hierarchy is presented in Figure 9-1.

THE MITIGATION HIERARCHY FOR PLANNED PROJECT ACTIVITIES
Avoid at Source; Reduce at Source Avoiding or reducing at source is designing the project so that a feature causing an impact is designed out (eg, a waste stream is eliminated) or altered (eg, reduced waste volume).
Abate on Site This involves adding something to the design to abate the impact (eg, pollution controls).
Abate at Receptor If an impact cannot be avoided, reduced or abated on-site then measures can be implemented off-site (eg, noise or visual screening at properties).
Repair or Remedy Some impacts involve unavoidable damage to a resource. Repair essentially involves restoration and reinstatement type measures.
Compensate/Offset in Kind Where other mitigation approaches are not possible or fully effective, then compensation, in some measure, for loss or damage might be appropriate.

Source: ERM, 2020

Figure 9-1 Mitigation Options Hierarchy

It is reasonable that implementation of the Project can incur positive impacts. In this case, the mitigation measures are not applicable. On the contrary, enhancement measures could be assessed. However, adopting a conservative approach, the enhancement measures were considered zero so that the final score of the specific, positive, impact is not increased.

9.1.3.7 Cumulative Action (C)

A specific impact may have Cumulative Action with other impacts from the Project itself or from other projects or activities that have been developed or planned in the area.

Cumulative impacts arise when the effects of an action are added to or interact with other effects in a particular space within a certain time period and to a particular environmental receptor. According to IFC (IFC, 2013), cumulative effects are those that result from the sequential, gradual and/or combined effect of an action, project or activity when added to other existing, planned and/or reasonably anticipated future projects. For practical reasons, the identification and management of cumulative impacts are limited to those results that are generally recognised as important on the basis of scientific data and/or interests of the affected communities.

The Cumulative Action of a potential impact is calculated on the basis of its probability of acting synergistically. Therefore, it has the corresponding rank with the probability (see section 9.1.3.1).

9.1.3.8 Transboundary Character (T)

The Transboundary Character (T) refers to impacts occurring beyond the national borders of the country either due to the transfer of an influential element (such as waste) beyond the above-mentioned borders or because of an instrument which is of a transboundary nature and is affected (such as atmospheric emissions). The Transboundary Character of a possible impact is calculated on the basis of its probability of acting internationally. Therefore, it has the corresponding ranking with the probability (see section 9.1.3.1).[1]

9.1.4 Significance of Environmental Impact (SEI)

The overall assessment and evaluation of a potential impact is determined by the degree of Environmental Impact Significance (SEI). The SEI is divided into the following categories:

- Negligible: all the factors examined suggest that the project has no effect on the environmental resource;
- Minor: the factors under consideration suggest that there will be little impact on the environmental resource, but it will be reversible in a short term;
- Moderate: the factors under consideration suggest that there will be some impact on the environmental resource, but it will be reversible in a medium term;
- Major: the factors under consideration suggest that there will be significant impact on the environmental resource, but it will be reversible in a medium or long term; and

[1] It is clarified that the specific criterion is related to the Espoo Convention. The Espoo Convention sets out the obligations of the Contracting Parties to assess the environmental impact of certain activities at an early stage of project. It also defines a general obligation for countries to communicate and consult each other on all the major projects under consideration which may have an impact on the environment beyond their borders. The present ESIA does not constitute the Espoo Report.

- Extreme: the factors under consideration suggest that there will be a serious impact on the environmental resource, but it will be reversible in the long term or not at all.

If the effect is positive, it is coloured with shades of green, and if it is negative with shades of red, depending on its importance. Zero effect is not coloured.

Based on the above, an Assessment Matrix is prepared for each impact. Mitigation measures for each of the impacts are presented in Chapter 10. The score of the SEI classes is derived from the sum of the individual scores of the impact properties multiplied by a fixed coefficient[2] to bring the rating scale to 10. Table 9-2 is indicative.

Table 9-2 Impact Significance Classification.

Score (*)	Significance	Description
9.1 - 10	Extreme	The factors under consideration suggest that there will be a serious impact on the environmental resource, but it will be reversible in a long-term or not reversible at all.
7.6 – 9	Major	The factors under consideration suggest that there will be a significant impact on the environmental resource, but it will be reversible in a medium or long term.
5.1 – 7.5	Moderate	The factors under consideration suggest that there will be some impact on the environmental resource, but it will be reversible in a medium term or will have overall limited implications for the processes, mechanisms and other features of the resource.
2.6 – 5	Minor	The factors under consideration suggest that there will be little impact on the environmental resource, but it will be reversible in a short term or will not have overall significant effects on the processes, mechanisms and other features of the resource.
0 – 2.5	Negligible	All the factors examined suggest that the project has no effect on the environmental resource.
(*) The final score is computed by summing the scores resulting from each criteria and normalising to 10 (Score = Σ criteria * 10/7).		

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[2]This factor is defined as the quotient 10 (which is the maximum score) to 7 (which is the total number of criteria) and is equal to 1.43 approximately.

9.1.5 Synthesis of Impact Assessment

A number of tables are included in this document to summarise each impact. An example of a template table is shown below (see Table 9-3).

Table 9-3 SEI Score

<table>
<tr><td>S/N SEI</td><td colspan="2"></td><td rowspan="2">SEI for</td><td colspan="9" rowspan="2"></td></tr>
<tr><td>Project Phase</td><td colspan="2"></td></tr>
<tr><td rowspan="2">Impact</td><td rowspan="2">Mechanism</td><td rowspan="2">Locations</td><td colspan="7">Criteria/ Impact Properties</td><td rowspan="2">SEI (Sum criteria X 10/7)</td><td rowspan="2">Comments</td></tr>
<tr><td>(L)</td><td>(Ex)</td><td>(I)</td><td>(D)</td><td>(R)</td><td>(C)</td><td>(T)</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Prepared by: ASPROFOS, 2022.

9.1.6 List of Impacts

The table below presents the lists of impacts identified and the specific section where each impact is described. Note that the specific mitigation measures required for management of these impacts are presented in Chapter 10.

Table 9-4 List of Impacts

Parameter	Segment	Section	Impacts
Natural Environment			
Climatic characteristics (construction phase)	Onshore / Offshore	9.2.2.4	Temporary increase in greenhouse gas emissions
Climatic characteristics (operation phase)	Onshore / Θαλάσσιο	9.3.2.4	*Change in Greenhouse Gas Emissions
Landscape and morphological characteristics (construction phase)	Onshore	9.2.3.1.2	Landscape Modification from Pipeline Construction
Landscape and morphological characteristics (construction phase)	Onshore	9.2.3.1.3	Disturbance to Viewers by Temporary Facilities
Landscape and morphological characteristics (operation phase)	Onshore	9.3.3.1.2	Landscape Modification from PPS (incl. restored temporary facilities)
Landscape and morphological characteristics (operation phase)	Onshore	9.3.3.1.3	Disturbance to Viewers from Permanent Facilities

Parameter	Segment	Section	Impacts
Landscape and morphological characteristics (operation phase)	Offshore	9.3.3.1.2	Seabed morphology (Bathymetry) modification
Geological, Tectonic and Soil characteristics (construction phase)	Onshore	9.2.4.1.2	Activation of geohazards
Geological, Tectonic and Soil characteristics (construction phase)	Onshore	9.2.4.1.3	Soil erosion
Geological, Tectonic and Soil characteristics (construction phase)	Onshore	9.2.4.1.4	Soil compaction
Geological, Tectonic and Soil characteristics (construction phase)	Onshore	9.2.4.1.5	Soil pollution
Geological, Tectonic and Soil characteristics (construction phase)	Onshore	9.2.4.1.6	Reduced Soil Productivity
Geological, Tectonic and Soil characteristics (construction phase)	Offshore	9.2.4.2.2	Potential Activation of geohazards
Geological, Tectonic and Soil characteristics (construction phase)	Offshore	9.2.4.2.3	Sediments diffusion
Geological, Tectonic and Soil characteristics (construction phase)	Offshore	9.2.4.2.4	Potential activation of sediments pollution
Air quality (construction phase)	Onshore / Offshore	9.2.10.2	Temporary increase of dust emissions
Air quality (construction phase)	Onshore / Offshore	9.2.10.3	Temporary exhaust emissions to the atmosphere (NOx, PM2.5, SO2,VOCs,CO, HAPS)
Air quality (pre-commissioning phase)	Onshore / Offshore	9.2.10.3	Temporary exhaust emissions to the atmosphere (NOx, PM2.5, SO2,VOCs,CO, HAPS)
Air quality (operation phase)	Onshore / Offshore	9.3.10.2	Emissions from Compressor Stations
Acoustic environment (construction phase)	Onshore	9.2.11.1	Impact on Acoustic Environment during Construction– Onshore
Acoustic environment (pre-commissioning phase)	Onshore	9.2.11.4	Impacts on Acoustic Environment during Pre-commissioning – Onshore
Acoustic environment (operation phase)	Onshore	9.3.11.3	Impacts on Acoustic Environment during Operation – Onshore
Electromagnetic fields (construction phase)	Onshore / Offshore	9.2.12.2	No impact is assessed
Electromagnetic fields (operation phase)	Onshore / Offshore	9.3.12.2	No impact is assessed

Parameter	Segment	Section	Impacts
Water resources (construction phase)	Onshore	9.2.13.1.2	Changes in the morphology of SWS (rivers)
Water resources (construction phase)	Offshore	9.2.13.2.3	Changes in the morphology of SWS (rivers)
Water resources (construction phase)	Onshore	9.2.13.2.4	Impacts on the quality of water resources
Water resources (construction phase)	Offshore	9.2.13.2.5	Impacts on the quality of Coastal Water Systems
Water resources (construction phase)	Onshore	9.2.13.2.6	Impacts on the availabilityof surface waters
Water resources (construction phase)	Onshore / Offshore	9.2.13.2.7	Accidental pollution (SWS)
Water resources (construction phase)	Onshore	9.2.13.3.2	Impact on the quality of Groundwater Systems
Water resources (construction phase)	Onshore	9.2.13.3.3	Impact on the availability of Groundwater Systems
Water resources (construction phase)	Onshore	9.2.13.3.4	Accidental pollution (GWS)
Water resources (operation phase)	Onshore	9.3.13.1.2	Accidental pollution (SWS)
Water resources (operation phase)	Onshore	9.3.13.2.2	Accidental pollution (GWS)
Wave Conditions - Oceanographic Characteristics - Coastal Mechanics (construction phase)	Offshore	9.2.14.4.1	Modification for Coastal Dynamic Balance
Wave Conditions - Oceanographic Characteristics - Coastal Mechanics (operation phase)	Offshore	9.3.14.5	No impact is assessed
Project's Vulnerability to Risks of Serious Accidents - Geohazards (construction phase)	Onshore / Offshore	9.2.15	No impact is assessed
Project's Vulnerability to Risks of Serious Accidents - Geohazards (operation phase)	Offshore	9.3.15.2.2	Gas cloud at the sea surface after pipeline failure (:leak / rupture).
Project's Vulnerability to Risks of Serious Accidents - Geohazards (operation phase)	Onshore	9.3.15.2.3	Jet Fire would cause damage and escalation
Project's Vulnerability to Risks of Serious Accidents - Geohazards (operation phase)	Onshore	9.3.15.5	Jet Fire would cause damage to the pipeline

Parameter	Segment	Section	Impacts
Biological environment			
Natural Environment (construction phase)	Onshore	9.2.5.2.1	Habitats/ Vegetation loss
Natural Environment (construction phase)	Onshore	9.2.5.2.2.1	Fauna Habitats loss for Golden jackal (*Canis aureus*)
Natural Environment (construction phase)	Onshore	9.2.5.2.2.1	Fauna Habitats loss for Wolf (*Canis lupus*)
Natural Environment (construction phase)	Onshore	9.2.5.2.2.2	Fauna Habitats loss for Otter (*Lutra lutra*)
Natural Environment (construction phase)	Onshore	9.2.5.2.2.2	Fauna Habitats loss for Fishfauna
Natural Environment (construction phase)	Onshore	9.2.5.2.3.1	Fauna species loss for Small mammals
Natural Environment (construction phase)	Onshore	9.2.5.2.3.2	Fauna species loss for Bats
Natural Environment (construction phase)	Onshore	9.2.5.2.3.3	Fauna species loss for Reptiles
Natural Environment (construction phase)	Onshore	9.2.5.2.3.4	Fauna species loss for Amphibians
Natural Environment (construction phase)	Onshore	9.2.5.2.3.5	Fauna species loss for Macro-invertebrates
Natural Environment (construction phase)	Onshore	9.2.5.2.4.1	Disturbance of Fauna - Golden jackal (*Canis aureus*)
Natural Environment (construction phase)	Onshore	9.2.5.2.4.1	Disturbance of Fauna - Wolf (*Canis lupus*)
Natural Environment (construction phase)	Onshore	9.2.5.2.4.2	Disturbance of Fauna - Otter (*Lutra lutra*)
Natural Environment (construction phase)	Onshore	9.2.5.2.4.2	Disturbance of Fauna - Fishfauna
Natural Environment (construction phase)	Offshore	9.2.5.3.1	Habitat/Flore species loss (deepwater section)
Natural Environment (construction phase)	Offshore	9.2.5.3.2	Habitat/Flore species loss (nearshore section)
Natural Environment (construction phase)	Offshore	9.2.5.3.3	Impacts on Marine Invertebrates
Natural Environment (construction phase)	Offshore	9.2.5.3.4	Impacts on Marine Fish species

Parameter	Segment	Section	Impacts
Natural Environment (construction phase)	Offshore	9.2.5.3.5	Impacts on Marine turtles
Natural Environment (construction phase)	Offshore	9.2.5.3.6	Impacts on Marine mammals
Natural Environment (construction phase)	Offshore	9.2.5.4	Impacts to Biodiversity during SPT
Natural Environment (construction phase)	Onshore / Offshore	9.2.5.5	Impacts on Avifauna during Construction – Onshore/Offshore
Natural Environment (construction phase)	Onshore / Offshore	9.2.5.6	Impacts on Protected Areas - Natura2000 Sites
Natural Environment (construction phase)	Onshore / Offshore	9.2.5.6	Impacts on Protected Areas - Wildlife Refuges
Natural Environment (construction phase)	Onshore / Offshore	9.2.5.6	Impacts on Protected Areas - National Parks
Natural Environment (operation phase)	Onshore	9.3.5.2.1	Habitats/ Vegetation loss
Natural Environment (operation phase)	Onshore	9.3.5.2.2.1	Fauna Habitats loss for Golden jackal (*Canis aureus*)
Natural Environment (operation phase)	Onshore	9.3.5.2.2.1	Fauna Habitats loss for Wolf (*Canis lupus*)
Natural Environment (operation phase)	Onshore	9.3.5.2.2.2	Fauna Habitats loss for Otter (*Lutra lutra*)
Natural Environment (operation phase)	Onshore	9.3.5.2.2.2	Fauna Habitats loss for Fishfauna
Natural Environment (operation phase)	Onshore	9.3.5.2.3	Disturbance of Fauna - Golden jackal (*Canis aureus*)
Natural Environment (operation phase)	Onshore	9.3.5.2.3	Disturbance of Fauna - Wolf (*Canis lupus*)
Natural Environment (operation phase)	Onshore	9.3.5.2.3	Disturbance of Fauna - Small Mammals
Natural Environment (operation phase)	Onshore	9.3.5.2.3	Disturbance of Fauna - Fishfauna
Natural Environment (operation phase)	Onshore	9.3.5.2.3	Disturbance of Fauna - Avifauna
Natural Environment (operation phase)	Onshore	9.3.5.2.3	Disturbance of Fauna - Reptiles

Parameter	Segment	Section	Impacts
Natural Environment (operation phase)	Onshore	9.3.5.2.3	Disturbance of Fauna - Amphibians
Natural Environment (operation phase)	Offshore	9.3.5.3.1	Impacts on Marine Habitats by the operation of the offshore pipeline
Natural Environment (operation phase)	Offshore	9.3.5.3.2	Impacts on Marine Invertebrates – Nearshore /Deep water sections
Natural Environment (operation phase)	Offshore	9.3.5.3.3	Impacts on Marine Fish – Nearshore/Deep water sections
Natural Environment (operation phase)	Offshore	9.3.5.3.4	Impacts on Marine Reptiles – Nearshore/Deep water sections
Natural Environment (operation phase)	Offshore	9.3.5.3.5	Impacts on Marine Mammals by the operation of the offshore pipeline
Natural Environment (operation phase)	Onshore / Offshore	9.3.5.4	Impacts on Protected Areas - Natura2000 Sites
Natural Environment (operation phase)	Onshore / Offshore	9.3.5.4	Impacts on Protected Areas - Wildlife Refuges
Natural Environment (operation phase)	Onshore / Offshore	9.3.5.4	Impacts on Protected Areas - National Parks
Anthropogenic environment			
Spatial Planning - Land uses (construction phase)	Onshore	9.2.6.1.1.3	Changes in Land Uses
Spatial Planning - Land uses (construction phase)	Offshore	9.2.6.1.2.2	Fishing areas restrictions
Spatial Planning - Land uses (construction phase)	Offshore	9.2.6.1.2.3	Indirect nuisance of aquaculture development and/ or fishing activity
Spatial Planning - Land uses (construction phase)	Offshore	9.2.6.1.2.4	Increase in marine traffic
Spatial Planning - Land uses (operation phase)	Onshore	9.3.6.1.1.2	Direct Changes in Land Use
Spatial Planning - Land uses (operation phase)	Onshore	9.3.6.1.1.2	Indirect Changes in Land Uses
Spatial Planning - Land uses (operation phase)	Offshore	9.3.6.1.2.2	Marine traffic (berthing) restrictions
Structure and functions of anthropogenic environment - Community Health & Safety (construction phase)	Onshore	9.2.6.2.1.1	Increased pressure on health care

Parameter	Segment	Section	Impacts
Structure and functions of anthropogenic environment - Community Health & Safety (construction phase)	Onshore	9.2.6.2.1.2	Increased transmission of infectious diseases
Structure and functions of anthropogenic environment - Community Cohesion	Onshore	9.2.6.2.2.1	Break of urban fabric continuity
Structure and functions of anthropogenic environment (operation phase)	Onshore	9.3.6.1.1.1	Break of urban fabric continuity
Cultural heritage (construction phase)	Onshore / Offshore	9.2.6.3.2	Direct physical damage
Cultural heritage (construction phase)	Onshore / Offshore	9.2.6.3.3	Secondary Degradation or Damage
Cultural heritage (construction phase)	Onshore	9.2.6.3.4	Nuisance to visitors access
Socioeconomic Impacts - Economy & Employment (construction phase)	Onshore / Offshore	9.2.7.2.2	*Employment opportunities (direct and/ or indirect)
Socioeconomic Impacts - Economy & Employment (construction phase)	Onshore / Offshore	9.2.7.2.3	*Economic impact of taxes, fees and local transactions
Socioeconomic Impacts - Economy & Employment (construction phase)	Onshore / Offshore	9.2.7.2.4	Economic impact on agricultural sector / income
Socioeconomic Impacts - Economy & Employment (construction phase)	Onshore / Offshore	9.2.7.2.5	Economic impact on fishing sector/ income
Socioeconomic Impacts - Economy & Employment (construction phase)	Onshore / Offshore	9.2.7.2.6	Economic impact on tourism sector/ income
Socioeconomic Impacts - Economy & Employment (operation phase)	Onshore / Offshore	9.3.7.1.2	*Employment opportunities (direct and/ or indirect)
Socioeconomic Impacts - Economy & Employment (operation phase)	Onshore / Offshore	9.3.7.1.3	*Economic impact of taxes, fees and local transactions
Socioeconomic Impacts - Economy & Employment (operation phase)	Onshore / Offshore	9.3.7.1.4	Economic impact on agricultural sector / income
Socioeconomic Impacts - Economy & Employment (operation phase)	Onshore / Offshore	9.3.7.1.5	Economic impact on fishing sector/ income

Parameter	Segment	Section	Impacts
Socioeconomic Impacts - Economy & Employment (operation phase)	Onshore / Offshore	9.3.7.1.6	Economic impact on tourism sector/ income
Deriving Development Trends from the Project	Onshore / Offshore	9.3.7.3.2	*Development Trends at National Level
Deriving Development Trends from the Project	Onshore / Offshore	9.3.7.3.3 9.3.7.3.4 9.3.7.3.5 9.3.7.3.6	*Development Trends at Regional Level
Technical Infrastructure (construction phase)	Onshore	9.2.8.1.1	**Road Network** • Increasing traffic • Traffic delays • Traffic regulation • Increase in accident probability • Damage to road infrastructure
Technical Infrastructure (construction phase)	Onshore	9.2.8.1.2	**Railway Network** • Subsidence • Train service interruption
Technical Infrastructure (construction phase)	Onshore	9.2.8.1.3	Potential small increase in air transportation
Technical Infrastructure (construction phase)	Onshore	9.2.8.2.1	Increasing wastewater for disposal in WWTPs
Technical Infrastructure (construction phase)	Onshore	9.2.8.2.2	Increased solid waste for disposal in landfills
Technical Infrastructure (construction phase)	Onshore	9.2.8.3.1	Potential damage to the watering & irrigation network
Technical Infrastructure (construction phase)	Onshore	9.2.8.3.3	Potential damage to the telecommunication network
Technical Infrastructure (construction phase)	Onshore	9.2.8.3.4	Temporary reduction of energy production in photovoltaics
Technical Infrastructure (construction phase)	Onshore	9.2.8.3.6	Temporary water supply interruption
Technical Infrastructure (construction phase)	Offshore	9.2.8.1.4	• Potential Damage to existing infrastructure • Disturbance to vessels and fishing shelters
Technical Infrastructure (operation phase)	Onshore	9.3.8.1.1	Limited Increasing traffic

Parameter	Segment	Section	Impacts
Technical Infrastructure (operation phase)	Onshore	9.3.8.2.1	Wastewater generation
Technical Infrastructure (operation phase)	Onshore	9.3.8.2.2	Solid waste generation
Technical Infrastructure (operation phase)	Onshore	9.3.8.3.5	*Positive impact in national energy infrastructure such as Poseidon Pipeline and PPC Powerplant in Megalopoli
Technical Infrastructure (operation phase)	Offshore	9.3.8.1.4	Potential Damage of existing cables
Correlation to man-made pressures on the environment (construction phase)	Onshore	9.2.9.3	Πιθανή ανάγκη ή/και απόρριψη αδρανών υλικών
Note: *Positive impact			

9.2 Construction Phase

9.2.1 Introduction

The present section provides the impact assessment and evaluation for impacts (negative or positive ones) that could be induced by the project construction and pre-commissioning phase. Mitigation measures are presented in the corresponding sections of Chapter 10.

9.2.2 Climatic and Bioclimatic Characteristics

9.2.2.1 Methodology Overview

This section assesses and evaluates the possible effects on the microclimate and bioclimatic characteristics of the Study Area, the possible increase of hot and gaseous mass emissions with changes in the thermal capacity, as well as the climatic effects of the greenhouse gas emissions of the Project. Table 9-5 outlines the main sources of impact, potential impacted resources and receptors as well as the factors influencing the current baseline condition and those related to the Project.

In general, the impact assessment methodology described in section 9.1 is followed.

Table 9-5 Key Issues for Assessment - Climate and Bioclimatic Characteristics (Construction Phase)

Sources of Impact/ Risk	• Temporary increase of greenhouse gas emissions (CO_2) from the use of internal combustion engines (IC) for earthworks, excavation works, vehicle, ship traffic.
Potentially Impacted Resources and Receptors	• Atmospheric environment (increase in global warming potential)
Special Baseline Conditions that Potentially Influence Impacts/Risks	• The PPC plant in Atherinolakkos which is close to the CS2/MS2-CS2/MS2N Compressor and Metering Stations.
Project Factors that Potential Influence Impacts/Risks	• Type and quantity of mechanical equipment (e.g. generator, floating cranes, excavators, compressors for hydraulic testing, etc.) vehicles and vessels.
References	• The amount of fuel is provided in detail at Technical description of the Project (see Chapter 6). • Baseline (Section 8.2)

	• Impact Assessment:Section 9.2.10: Air Quality, describes the air pollution of the Project. • Mitigation Measures are provided in Section 10.2.2

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In the following paragraphs, potential impacts from construction of the Project are described and assessed.

9.2.2.2 Change in Microclimate and Bioclimatic Characteristics

For the evaluation of microclimate and bioclimate, changes in parameters concerning[3] temperature, rainfall, humidity, wind and the deforestation of forest areas are examined. During project construction only a few limited and targeted vegetation cuts will take place, so changes in microclimate characteristcs are not expected due to the Project proposed. In addition, all machinery used during the construction phase will be internationally certified for their operation. Therefore, no impact on bioclimatic features is assessed for the Project construction.

9.2.2.3 Cold or Hot Gas Emissions

Due to the nature of the Project (construction of a natural gas pipeline and accompanying facilities), no hot or cold gas emissions are expected during the construction phase.

9.2.2.4 Temporary Increase in Greenhouse Gas Emissions

This section assesses and evaluates potential greenhouse gas emissions during the construction phase of the Project. The following Table 9-6 shows the potential impact, the causal mechanisms and potentially affected receptors.

Table 9-6 Temporary Increase in Greenhouse Gas Emissions (CO_2) –Impact Mechanisms, Potentially Affected Receptors during the Construction Phase

Possible Impact	Impact Generating Mechanisms	Potentially Affected Resources/Receptors
Temporary increase in greenhouse gas emissions	Use of IC engines • Earthworks • Excavation works	• Atmospheric environment

[3]https://www.metlink.org/fieldwork-resource/microclimates/#microclim

Possible Impact	Impact Generating Mechanisms	Potentially Affected Resources/Receptors
	• Vehicle and ship traffic • Hydrotest/ Pre-commissioning	

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9.2.2.4.1 *Impact Generating Mechanisms (Use of IC engines)*

During the construction phase of the Project, the only source of greenhouse gases is the exhaust gases that will be emitted by good transport and construction works due to vehicles, ships, machinery and pre-commissioning activities. Detailed reference about exhaust gases is presented in section 9.2.10. According to the technical description of the Project (Chapter 6), the following Table 9-7 shows fuel consumption and expected CO_2 emissions.

Table 9-7 Fuel consumption during construction phase and expected CO_2 emissions

	Onshore Section (Diesel)	Offshore Section (MGO)	Pre-Commissioning Equipment[4] (Diesel)	Total
Fuel consumption (tn)	405,600 *	101,630	16,850	524,080
CO_2 emissions (tn)	1,282,376**	152,215***	45,600***	1,480,191****

*480,000 m^3 * 0.845 m^3/ tn (fuel density) = 405,600 tn
**Molecular weight: $C_{12}H_{23}$ = 12*12+23*1 = 167
Partial weight C = 12*12 = 144
C to $C_{12}H_{23}$ mass ratio = Partial weight C / Molecular weight: $C_{12}H_{23}$ = 0.862
C to total fuel mass ratio = 405,600 tn * 0.862 = 349,738t
Molecular weight CO_2 = 44
Partial weight C = 12
Mass of CO_2 in the exhaust gas = C ratio in total fuel mass * Molecular weight of CO_2 / Partial weight C = 1,282,376 t
***Source: IGI,2021
**** The construction phase will take about three years. Annually, the expected CO_2 emissions will be 1,480,191t/3 = 493,397t

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9.2.2.4.2 *Affected Resources/Receptors (Atmospheric Environment)*

- Temporary Increase in Greenhouse Gas Emissions

[4] Including the hydrotest

The construction phase will last about three years, so the annual emissions will be around 493,397 tons of CO_2 (see Table 9-7). According to the European Environment Agency,[5] the Greek greenhouse gas emissions in 2019 were 85.6 million tons of CO_2 equivalent and the transport sector accounted for approximately 20.82% of total national annual emissions. The projected greenhouse gas emissions during the construction phase will represent approximately 0.57 % of the total annual national emissions. Therefore, the impact is considered to be Low on the greenhouse gas balance in Greece.

It should be noted that vehicle and ship emissions are distributed along the overall route/footprint of the Project and will be locally limited and temporary. Exhaust emissions from the use of vehicles and ships associated with construction are considered to resemble those of normal vehicle traffic on municipal roads and ship traffic.

Emissions from construction works will be temporary, continuously moving along the working zone and the road network, at least during the construction of the pipeline. For the construction of permanent stations, the number of machines will be smaller. In any case, all equipment used shall be certified according to European standards.

9.2.2.4.3 Impact Assessment

Based on the above, the *Likelihood* of the impact is *certain* and locally (*medium*) limited. The *Intensity* of the impact on sensitive receptors (atmospheric environment) is *low* if we take into account the working time and the quantity emitted. The *Duration* is characterised as *mid-term* as the construction phase will last approximately three years. *Reversibility* is *minimisable*, considering the mitigation measures proposed in section 10.2.2. The *Cumulative Action* of the impact is considered *rare* (the PPC plant in Crete is at a distance of approximately 740 m from the CS2/MS2-CS2/MS2N Stations). The *Transboundary Character* of the impact exists from the properties of the gas itself (CO2 is moving upwards into the atmosphere due to the high temperature of the exhaust gases which makes them lighter than ambient air). However, due to the low volume of global CO2 emissions and the short duration of works, it is characterised as *rare*.

Based on the above and based on the criteria presented in Section 9.1 for greenhouse gas emissions during construction of the Project, the **SEI is considered as Minor.** Section 10.2.2 presents the proposed mitigation and management measures applicable to the impact.

[5] https://www.eea.europa.eu/data-and-maps/data/data-viewers/greenhouse-gases-viewer (Accessed on 30/11/2021)

9.2.2.5 Summary

The summary of the impacts on the climatic and bioclimatic characteristics during the construction phase is presented in the following table

Table 9-8 Summary of Impacts for Climatic and Bioclimatic Characteristics during the Construction Phase

S/N SEI			SEI for	Climatic and Bioclimatic Characteristics							
Project Phase	Construction										
Impact	Mechanism	Locations	Criteria/ Impact Properties							SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Temporary increase in greenhouse gas emissions	Use of IC engines (internal combustion engines) • Earthworks • Excavation works • Vehicle and ship traffic • Hydrotest/Pre-commissioning	Project Total	1.00	0.25	0.25	0.50	0.75	0.25	0.25	4.64 (Minor)	«-»

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9.2.3 Landscape and Morphological Characteristics

9.2.3.1 Landscape Characteristics

9.2.3.1.1 Methodology Overview

This section assesses potential impacts to the landscape in the Study Area and, in a much smaller degree, to seascape characteristics (mainly nearshore). Impacts may take place on a landscape resource, such as an area of high landscape value, or a sensitive receptor, such as frequently used roads or view kiosks. It is clarified that offshore seascape (view of or from deep waters) is not taken into consideration due to lack of any receptor perceiving any impact of the specific parameter during construction (practical absence of any viewers) and/ or operation (project shall be underwater, i.e. not visible)

Table 9-9 presents the key impact sources (or mechanisms), potentially impacted resources and (sensitive) receptors, the baseline and influencing factors associated with the Project on the landscape characteristics.

During construction phase the main impact source is the clearing of the entire working strip, along with any temporary facilities (e.g. pipe yards, construction sites, etc). As mentioned, the working strip has the following categories:

- Typical working strip, 38 m wide;
- Reduced working strip, 28 m wide; and
- Minimum working strip, 22 m wide.

Vehicle and equipment traffic related to the project construction shall take place; however, this traffic shall be limited, as mentioned in the technical description for the Project, to the existing road network and along the working strip.

It is clarified that during Project operation, an 8 m-width Pipeline Protection Strip (PPS) shall be kept clear of deep rooted species. Apart from this, the remaining working strip will be reinstated to its previous condition as much as possible. Although the final location of temporary facilities (e.g. construction sites) shall be determined by the contractor before construction starts, these facilities are usually established in agricultural areas, close to existing roads to facilitate accessibility, so that impacts are limited. In any case, these areas will be completely restored upon agreement with their landowner.

Temporary facilities that could interfere with Landscape characteristics include the landfall construction fronts (sites), and those in the permanent facilities. Permanent facilities that might interfere with Landscape characteristics include 20 small Line Valve Stations (i.e. BVS, SS, LS)[6], 3 Main Stations (main facilities), i.e. Crete Facilities, Compressor Station at Achaia, Metering & Regulation and Heating Station at Megalopoli, and the Operation and Maintenance Center. Construction sites for the Line Valve Stations will be located entirely within the working strip (and this is why they are assessed along with the entire pipeline construction). According to the design of the project, the construction sites for the Main Stations (and the O&M) will cover exactly the same area as permanent facilities themselves will be covering during operation phase.

It is noted that impacts on landscape are not influenced by the exact processes taking place within a specific facility (i.e. if the facilities include also a metering station or not). Current sitting (location and area morphology) and architectural (heights and configuration) characteristics of facilities related to the Project are the parameters influencing impacts on the specific resource from the Project.

Table 9-9 Key Considerations for Assessment - Landscape Characteristics (Construction Phase).

Impact/Risk Sources	• Construction Phase: Vegetation (and land) clearance and formation of working strip/ cofferdam and construction sites; Topsoil and subsoil stockpiling, pipeline installation, Erecting temporary or permanent facilities; Traffic and presence of project-related vehicles/ vessels/ machinery; Reinstating activities for trench, working strip and temporary facility plots.
Potentially Impacted Resources and Receptors	• Landscape and visual receptors (local inhabitants, commuters, by-passers, tourists, etc.) • Any nearby settlements and households.
Particular Baseline Conditions that are Potentially Influencing Impacts/Risks	• Areas including Forests or other woody vegetation • River Crossings • Quality (Sensitivity) for engaged landscapes • Sensitive receptor characteristics (quality of landscape, viewers, etc.) • Statutory protection of affected and/ or nearby landscapes
Project Factors that are Potentially Influencing Impacts/Risks	• Architectural characteristics of Project permanent facilities • Pipeline Working/ Protection Strip Width • Location for Project construction supporting temporary (pipe yards, construction sites) and permanent (Main Stations, i.e. Facilities at Crete, Megalopoli and Achaia) facilities • Construction schedule (duration and season/ timing) • Capacity to reinstate temporary cleared areas
References	• Baseline is provided in Section 8.3

[6] It is noted that type of Line Valve Station makes no difference for impact assessment. That is because, regardless specific operational services, every Line Valve Station has minimal (if any) interaction with environmental and social parameters. Additionally, many stations are located inside the same plot and/ or inside a Main Station.

	• Annex 9C - Baseline and impact assessment for landscape (incl. zone of visual impact from permanent stations and their photosimulations) • Mitigation Measures are provided in Section 10.3 • Photographic documentation is provided in Chapter 14 • Landscape Map is provided in Section 15.1.8

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According to MD 170225/2014, *changes in the image of the wider area, due to the project or activity, are assessed and evaluated*. Table 9-10 is relevant.

Table 9-10 Potential Impacts to Landscape

Potential Impact	Construction Phase	Operation Phase
Landscape Modifications (Changes)	X	X
Disturbance to Viewers	X	X

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Modification intensity is related to landscape value and its sensitivity, as detailed in Annex J.3 and summarized here below.

During baseline study, typical landscape types present in the wider project area were identified (see Section 8.3). Table 9-14 include the summary of typical landscape types -crossed by the pipeline-, their estimated sensitivity and value, and the assessment of the change intensity they are expected to undergo.

Landscape sensitivity is judged by the extent to which it can accept the change of a certain type and scale without any negative effects on its character (Χατζηστάθης & Ισπικούδης, 1995). Sensitivity varies according to basic features for space/landscape (e.g. land use, pattern, color, texture, shape, contrast, balance and scale), existing elements (pylons, structures, buildings, settlements), protection status (e.g. TIFK) and of course the type of development proposed. Based on work by Landscape Institute, LI, and the Institute of Environmental Management and Assessment, IEAM (Landscape Institute, LI, and Institute of Environmental Management and Assessment, IEMA, 2013), Table 9-11 summarizes landscape sensitivity classification.

Table 9-11 Determining Landscape Sensitivity

Sensitivity	Criteria
High	A landscape particularly distinct, including particular high aesthetic value considered sensitive to minor relative changes, e.g. within an institutionalized protected area or recognized as an important feature/ symbol in the area.
Moderate	A landscape of moderate, distinct, regional, or local value showing some particular features tolerant to some degree of change, e.g. a landscape of local significance.

Sensitivity	Criteria
Low	A very resistant or degraded landscape including low aesthetics, few distinctive features or remarkable features, and considered to be highly tolerant to change, e.g. an industrial area.

Based on (Landscape Institute, LI, and Institute of Environmental Management and Assessment, IEMA, 2013)

No statutory protected landscapes are crossed by pipeline corridors. Similarly, main stations are located outside protected landscapes. However, a set of TIFKs have been identified within the Study Area. Adopting a conservative approach, sensitivity of these TIFKs is considered high. Landscape value is presented in Table 9-12. The sensitivity for eachλε designated area has been assessed by using professional judgement and experience, and there is no defined boundary between impact levels.

Table 9-12 Landscape Value Classification

Value	Description
High	Large numbers of viewers and/or those with ownership interest and prolonged viewing opportunities such as residents and users of attractive and well-used recreational facilities. Quality of the existing view, as likely to be perceived by the viewer, is assessed as being high.
Moderate	Small number of residents and moderate numbers of visitors with an interest in their environment. Large numbers of recreational road users. Quality of the existing view, as likely to be perceived by the viewer, is assessed as being moderate.
Low	Small number of visitors with interest in their surroundings. Viewers with transientinterest not specifically focussed on landscape e.g. workers, commuters. Quality of the existing view, as likely to be perceived by the viewer, is assessed as being low.

Based on (Landscape Institute, LI, and Institute of Environmental Management and Assessment, IEMA, 2013)

Change intensity may be considered as low, moderate or high, depending on landscape sensitivity and landscape value (see Table 9-13).

Table 9-13 Determining Landscape Aesthetic Value Change (change intensity)

		Landscape sensitivity		
		High	Moderate	Low
Landscape value	High	High	High	Moderate
	Moderate	High	Moderate	Low
	Low	Moderate	Low	Low

A summary of estimated sensitivity, value and expected intensity for landscape change is provided in Table 9-14.

Table 9-14 Sensitivity and Value Estimation for Landscape Type Features and Change Intensity

Landscape types (number of sections crossed)	Sections*	Total length in landscape type (km)	Landscape Sensitivity	Landscape Value	Change Intensity
Agricultural Landscape (47)	CCS1-Peloponnese CCS2-West Greece CR-Inlet Short Onshore Megalopolis Branch	100.12	Low	Low	Low
Agricultural Plain Landscape (25)	CCS1-Peloponnese CCS2-West Greece	133.59	Low	Low	Low
Built Landscape (2)	CR-Inlet Short Onshore	0.06	Low	Low	Low
Coastal Agricultural Landscape(1)	CCS2-West Greece	0.29	Low	Moderate	Low
Coastal Mosaic for Agricultural and Natural Landscape (1)	CCS1-Peloponnese	2.15	Moderate	Moderate	Moderate
Coastal Rural Landscape (1)	CCS1-Peloponnese	0.02	Low	High	Moderate
Hilly Natural (Forest) Landscape (33)	CCS1-Peloponnese CCS2-West Greece Megalopolis Branch	29.42	High	High	High
Hilly Natural (Shrublands) Landscape (38)	CCS1-Peloponnese CCS2-West Greece Megalopolis Branch	142.17	Moderate	High	High
Karteri Marshland (1)	CCS2-West Greece	1.92	Moderate	Moderate	Moderate
Mosaic of Agricultural and Natural (Shrublands) Landscape (46)	CCS1-Peloponnese CCS2-West Greece	81.35	Moderate	Moderate	Moderate

Landscape types (number of sections crossed)	Sections*	Total length in landscape type (km)	Landscape Sensitivity	Landscape Value	Change Intensity
	Megalopolis Branch				
Mountainous Natural (Forest) Landscape (10)	CCS1-Peloponnese CCS2-West Greece	31.07	High	High	High
Mountainous Natural (Shrublands) Landscape (7)	CCS1-Peloponnese CCS2-West Greece	22.01	High	High	High
Nearshore Seascape (6)	CCS1-Peloponnese CCS2-West Greece CR-Inlet Short Onshore	10.10	High	High	High
Phryganic Landscape (2)	CR-Inlet Short Onshore	0.53	Low	Moderate	Low
Riparian Agricultural Landscape (5)	CCS1-Peloponnese CCS2-West Greece	1.72	Moderate	Moderate	Moderate
Riparian Natural Landscape (3)	CCS1-Peloponnese CCS2-West Greece	0.39	High	Moderate	High
Rural Landscape (7)	CCS1-Peloponnese CCS2-West Greece CR-Inlet Short Onshore	6.02	Low	Low	Low
Rodia Lagoon Wetland (1)	CCS2-West Greece	0.44	Moderate	Moderate	Moderate

* It is considered that the following documents support Landscape Impact Assessment:
Baseline, provided in Section 8.3 | Annex 9C - Baseline and impact assessment for landscape (incl. zone of visual impact from permanent stations and their photosimulations) | Mitigation Measures are provided in Section 10.3 | Photographic documentation is provided in Chapter 14 | Landscape Map is providedin Section 15.1.8

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More specifically, regarding construction phase, project construction includes preparing the working strip and permanent and temporary facilities parcels, earthworks, buildings works, equipment and machinery operation, as well as vehicle, vessel, equipment and personnel traffic. Of course, a dominant landscape modifying activity is vegetation removal.

Based on Chapter 6 (Section 6.4.2), project-related works that may cause significant impacts to landscape features include:

- Preparation of the pipeline working strip (mainly vegetation clearance)/ cofferdam;
- Installation of permanent project features, such as line valve stations, and compressor and metering stations;
- Building temporary Project features such as construction sites; and
- Traffic of project-related vehicles/vessels.

Taking into consideration landscape features, as detailed in relevant baseline section (8.3), and supported materials (e.g. Annex J.3; see Table 9-9 for detailed references list), the following impacts are described:

- Landscape Modification from Pipeline Construction; and
- Disturbance to Viewers from Temporary Facilities.

9.2.3.1.2 Landscape Modification from Pipeline Construction

Construction works shall involve some limited, local, physical modifications to general landscape unity. These may be visible from a significant distance to construction site points.

According to results in the landscape baseline study (see Section 8.3), landscape in the project area mostly comprised continuous landscape units of agricultural areas (~41%), mainly due to intensively cultivated plains including:

- Molai and Achaia in Peloponnese Section (to the South and North, respectively);
- Agrinio, Arta/ Preveza, and Margariti (in general. but mainly to the West Segment in the study area)in Western Continental Greece; and
- Plains in Western Continental Greece that are more extended than plains crossed in Peloponnese.

Natural landscape also constitutes a significant part of the study area landscape; however, out of the total 40% of the natural landscape, 29% is shrublands (mainly hilly 25%) and 11% is formed by forests. Landscapes characterized as a Mosaic of Agricultural and Natural (Shrublands) Lands cover almost 14% of the whole study area.

Significant impacts to landscape are related to its characteristics, sensitivity, ability to absorb modifications to its unity, and its value.

Previous elements for typical landscape types identified as being affected by the project are summarized in Table 9-14. Section 9.2.3.1.1 presents an overview of assessment criteria, while a detailed analysis is presented in the relevant Annex (Annex J.3). In general, Artificial and Agricultural Landscapes are characterized by low sensitivity, as these landscapes can easily absorb modifications that may be induced to them during the specific phase of the project. On the other hand, *Natural* landscape types, or landscapes associated to specific features (i.e. wetlands, marshlands) have moderate or even high sensitivity as the break in the continuity of landscape characteristics cannot be easily absorbed. As far as landscape value is concerned, those landscapes frequently used (viewed) by the community (e.g. seascapes, coastal landscapes) or those having a peculiar, distinctive characteristic (e.g. riparian landscapes) usually imply greater value.

In forested landscapes, changes are difficult to be absorbed.

Areas with mild slopes or annual crops, or intense human activity can easily absorb landscape changes. On the contrary, in densely vegetated areas, any vegetation removal might lead to significant visual differences and become noticeable, thus reducing landscape ability to absorb them.

In addition to typical landscape types, Landscape of Outstanding Natural Beauty (TIFK) were identified in areas crossed by the pipeline and where construction works including potential landscape alterations will be carried out. These include: (i) TIFK "Parapotami Alfeiou" (Alfios' Tributaries) (AT1011011) (Figure 9-3) and (ii) TIFK "Ekvoli Acheronta and Nekromanteio" (R. Acheronta Estuary and Necromancer) (AT3010051) (Figure 9-4). Every other TIFK is located outside the areas where construction works will be carried out and it is judged that their characteristics will not be affected at all. As shown in Figure 9-3 and Figure 9-4, particular areas inside TIFKs crossed by the pipeline are characterized by agricultural lands, grasslands and/ or low shrublands which, although being part of the TIFK (a fact that sets feature sensitivity as high), involve significantly great capability to absorb changes.

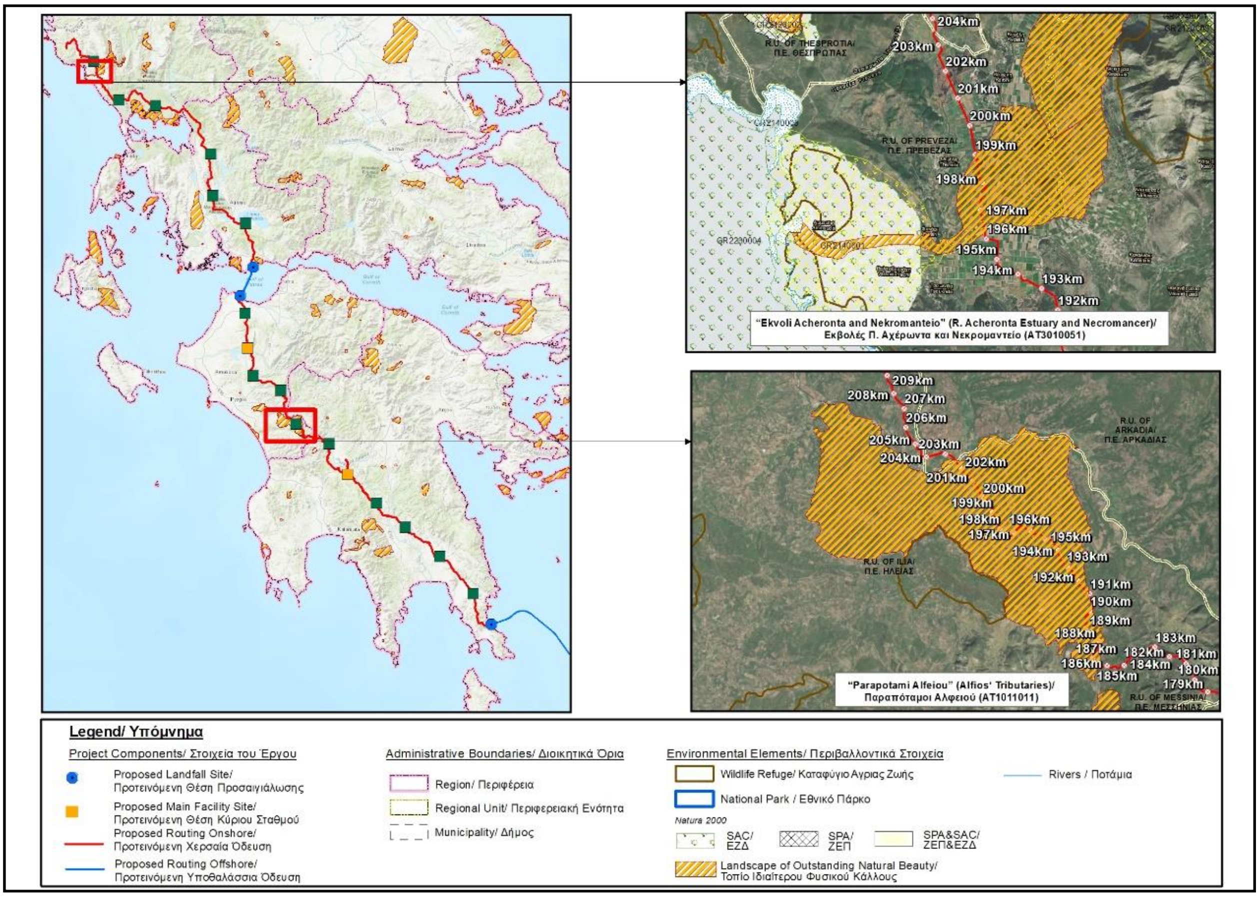

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Figure 9-2 Engagement of TIFKs.

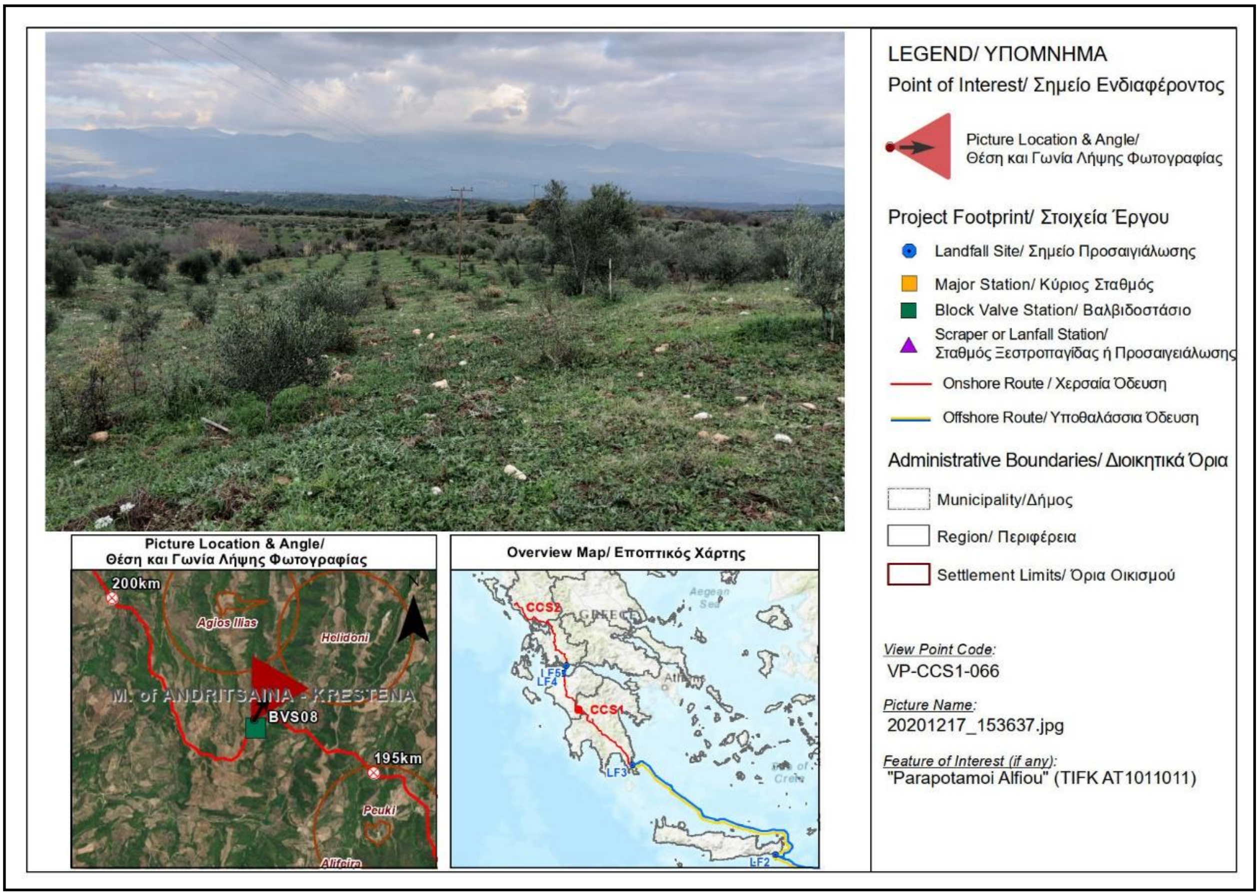

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Figure 9-3 Characteristic landscape in "Parapotami Alfeiou" TIFK (Alfios Tributaries) (AT1011011) (CCS1-KP197, VP-CCS1-066).

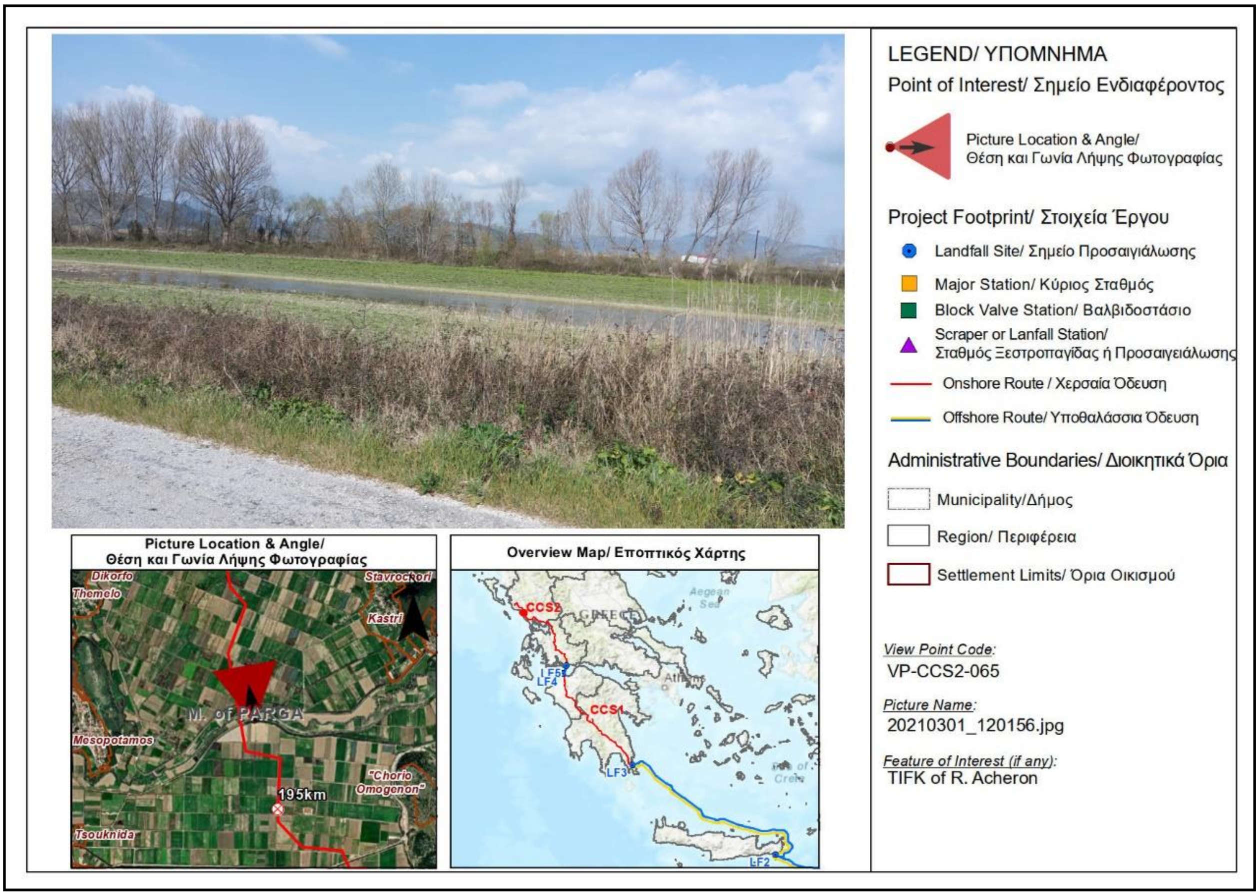

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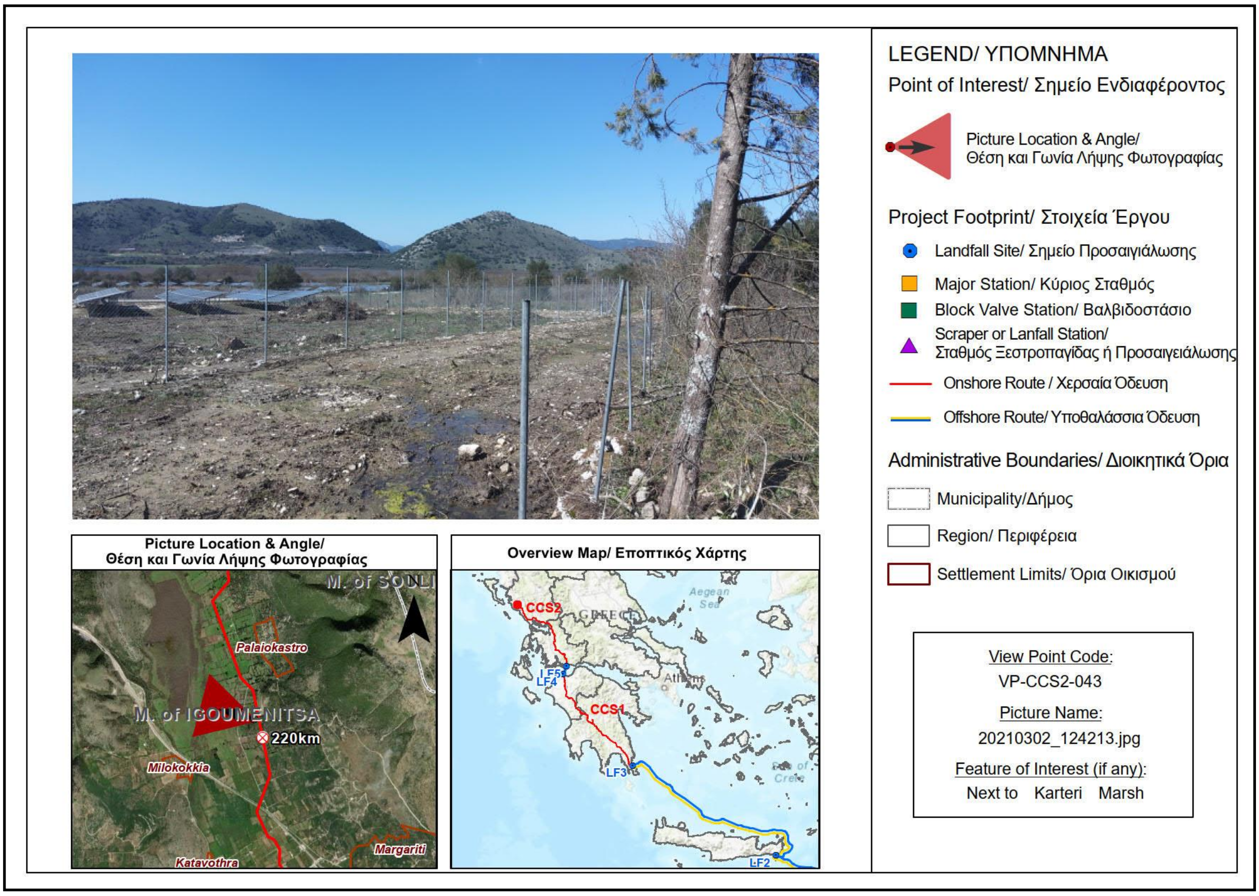
Figure 9-4 Characteristic Landscape in "Ekvoli Acheronta and Nekromanteio" TIFK (R. Acheronta Estuary and Necromancer) (AT3010051) (CCS2-KP196, VP-CCS2-065).

Breaking unity of landscape features results from losing trees or shrubs in the forest or forested areas (also natural landscapes in general). In mountainous areas, this break is even more visible than in natural hilly areas due to greater differences in altitudes and slopes. Intrusion is more evident in forest areas (trees) than in shrubs (bushes). Low height in bushes allows for a smoother view integration with the view line, e.g. ground background. Colouring perceived in such landscape results from the combination of a sclerophyllous vegetation green and a ground-floor brown; hence allowing for a higher absorption capacity (working strip is more easily confused with the ground floor). Tree loss mainly occurs on mountain forest landscapes where they are located (see Table 9-14). Shrub and grassland loss may also cause a discontinuity of landscape features for mosaics in hilly natural and agricultural areas, to a much lesser extent where such features are identified (see Table 9-14). In most cases, the value for such landscapes increases, not by the large numbers of viewers, but due to the fact that the quality of natural areas is considered as "high" by most people; this is especially the case of forest areas.

On the contrary, the other landscapes, with intense anthropogenic activity (built landscapes, agricultural landscapes, etc.), are considered to have very limited sensitivity and impact is negligible (if any at all). These are landscapes having great absorption capacity, given already fragmented continuity for view line and/or existing elements (e.g. buildings, warehouses) that look like (in a very generic sense) construction works to be performed by the project. In most cases, value for such landscapes is reduced, not by small numbers of viewers, but due to lacking attractive landscape features.

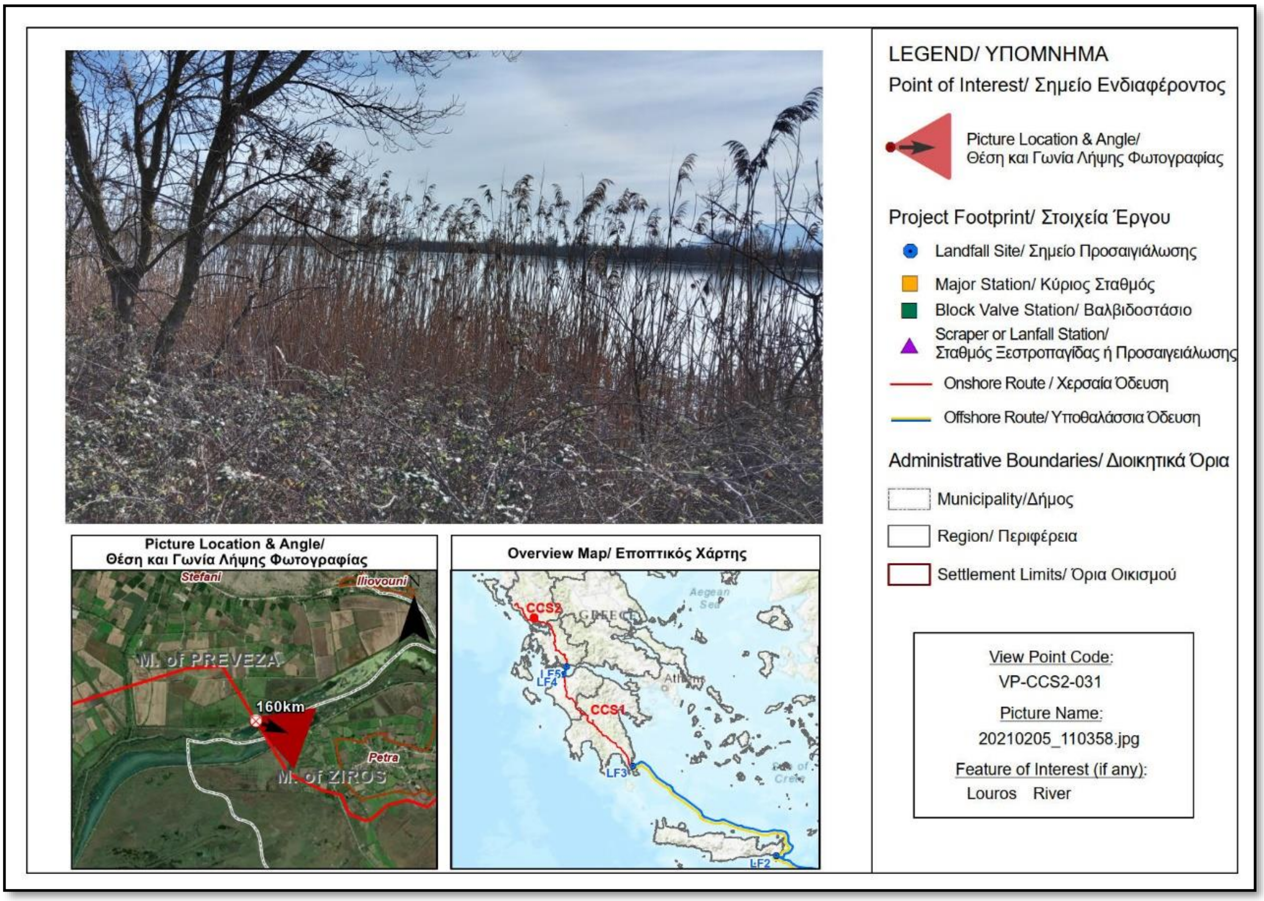
Seascapes are very sensitive due to the fact that in their open view line (horizon) any modification is unobstructedly perceived by any sensitive receptor. Even more important, seascapes are usually highly valued because of large numbers of viewers, who consist (in high percentage) of owners/users of summer houses and/or tourists (and touristic industry professionals). Coastal landscapes have similar assessment; however, sensitivity and value highly depend on a specific feature for each coastal landscape. For example, coastal rural landscape, which may host scattered touristic development, is much more highly valued by local community than the coastal agricultural landscape, which does not support any increased sensitivity drivers.

Assessment for the rest of engaged landscape types (presented in Table 9-14) lies somewhere in between. The Mosaics for agricultural and natural areas and Wetlands/Marshlands types (Figure 9-5/ Figure 9-6) are considered to adopt the most sensitive qualities of the landscape types they are formed. However, the sensitivitydiminishes by the influence of less sensitive elements of the wider area of these landscape types. Their assessment is the average of composing landscape types. Especially for protected areas in Marshlands and Wetlands, it has to be noted that protection conditions are not imposed by landscape characteristics. The landscape sensitivity of Marshlands and Wetlands was assessed on the basis of baseline landscape characteristics which is purely agricultural, slightly increased in order to take into consideration protection conditions in these areas. In other words, landscape sensitivity of Marshlands and Wetlands should be low, but adopting a conservative approach, it was increased.



Prepared by: ASPROFOS, 2022.

Figure 9-5 Karteri Marshland (CCS2-KP220, VP-CCS2-043).



Prepared by: ASPROFOS, 2022.

Figure 9-6 Rodia Lagoon Wetland (CCS2-KP160, VP-CCS2-031).

Taking into account the considerations previously discussed and following evaluation criteria presented in Section 9.1, impact assessment for construction activities on various identified landscape types may be performed as follows:

Impact *likelihood* during construction works is <u>certain</u>.

Impact *extent* might be considered as a precise project footprint. Depending on land cover, the working strip is formed at 38 m, in typical areas (e.g. annual agricultural crops), at 28 m, in tree crops and wooded vegetation (e.g. olive trees and bushlands) and at 22 m, in densely vegetated forest areas (see Section 6.4.2). However, due to the nature of a resource, i.e. landscape, changes to the project footprint may be visible from great distance and hence, impact extent has been considered to depend on landscape type. In general, the extent classification follows sensitivity classification in Table 9-14. Specifically, the extent was assessed as:

- *Medium,* for areas, where due to their characteristics, (e.g. colour, texture, uniqueness, aesthetics, etc.), maximum absorption potential is allowed or degraded landscapes are already present, i.e. agricultural areas (croplands or agricultural plain landscapes), artificial areas (built or rural landscapes), coastal rural or agricultural landscapes and phryganic landscapes
- *Large*, for landscapes where colour, texture and other features allow for an increased absorption potential, i.e. Agricultural and natural area mosaics, Karteri Marshland, Riparian Agricultural Landscape, Rodia Lagoon Wetland, Hilly Natural (Shrublands) Landscape;
- *Perimetric,* for landscapes whose features allow for minimum absorption capacity, i.e. landscape continuity of the landscape is very easily broken, i.e. Hilly Natural (Forest), Mountainous Natural (Forest), Mountainous Natural (Shrublands), Nearshore Seascape or Riparian Natural Landscape.

Impact *intensity* is related, as previously described and presented in Table 9-14 and annex (Annex J.3), to landscape sensitivity.

With regard to impact *duration*, a key factor determining impact duration is the time required to complete construction activities in a specific area and restore landscape to its former condition. Along the working strip, construction activities usually take up to 3 months per construction front to be completed; construction rates depend on morphology in the area and vary between 200 m and 600 m/day (Chapter 6). On *agricultural areas* (e.g. agricultural areas or plains with annual crops), restoration is considered to be immediate, as it will only require demobilizing construction equipment, cleaning working sites and returning topsoil to the working strip. This way, every practice and use that was in place prior to construction activities for the project would also apply immediately after topsoil reinstatement. It is clarified that even in case of agricultural areas (i.e. mainly tree crops, and to a smaller extent annual crops), reinstatement is quite fast. Usually, the planting scheme is quite wide (5x5 or 6x6), as such, few planting rows are affected whilst mitigation measures usually accelerate reinstatement (e.g. compensation for replanting of saplings instead of sowing seeds). On the contrary, in dense *forest or forested areas*, reinstatement will take place with natural or artificial reforestation, when needed, in the area including local species. For shrublands, reforestation is considered to take place naturally within five years. In forests, however, this reforestation will take longer, until vegetation has the same shape in order to provide the same texture to landscape. Therefore, depending on the landscape and the area extent, impact duration varies from *short-term* to agricultural landscapes (i.e. Agricultural, Agricultural Plain, Built, Coastal Agricultural, Phryganic Landscape, Rural, Coastal Rural, Coastal Mosaic for Agricultural and Natural Landscape, Karteri Marshland, , Agricultural and Natural Mosaics (Shrublands), Riparian Agricultural and Rodia Lagoon Marshland) to *medium-term* for other landscape types (i.e. Hilly Natural (Shrublands), Hilly Natural (Forest), Mountainous Natural (Forest), Mountainous Natural (Shrublands), Nearshore Seascape, Riparian Natural Landscape) (*long-term* impacts are assessed for forests and shrublands during operating phase).

With regard to *reversibility*, restoration of the working strip by replanting local natural species is able to *minimize* the effects and even to eliminate them (except for the pipeline protection strip analysed in the corresponding paragraph for operating phase – see Section 9.3.3) (i.e. Hilly Natural (Shrublands or Forest), Mountainous Natural (Shrublands or Forest), Riparian Natural Landscape). Especially for natural landscapes, the working strip, in collaboration with stakeholders, before and during the construction phase, may be configured to serve management purposes (e.g. fire protection strip). As far as other landscape types are concerned (Agricultural, Agricultural Plain, Built, Coastal Agricultural, Nearshore Seascape, Phryganic Landscape, Rural, Coastal Rural, Coastal Mosaic for Agricultural and Natural Landscape, Karteri Marshland, Agricultural and Natural Mosaics (Shrublands), Riparian Agricultural and Rodia Lagoon Wetland), impacts are completely *reversible* by implementing proper measures (see Chapter 10).

Regarding *cumulative* action in densely vegetated forest areas or other sensitive landscapes, i.e. Hilly Natural (Shrublands or Forest), Mountainous Natural (Shrublands or Forest), Nearshore Seascape, Riparian Natural Landscape, it could be considered that some cumulative fragmentation action of the landscape will be present in areas including an existing road network. In the present study, Mt. Arakynthos is the only area identified with such characteristics, i.e. largely unfragmented covered by dense vegetation with limited non-forest road network, but more may be present. In any case, the project completely avoids any of the areas recently declared as *Roadless Areas*[7]. Therefore, by adopting a conservative approach, cumulative action is considered as *probable*. Respectively for the other landscape types, cumulative action was considered to be of lesser probability, i.e. *likely*.

Transboundary character is deemed *impossible*, given the lack of transboundary areas with possible landscape modification.

Based on the above considerations and the criteria presented in Section 9.1, landscape modification during the construction of the project:

- For landscape types: Agricultural, Agricultural Plain, Built, Coastal Agricultural, Phryganic Landscape, Rural, Coastal Rural, Coastal Mosaic for Agricultural and Natural Landscape, Karteri Marshland, Agricultural and Natural Mosaics (Shrublands), Riparian Agricultural and Rodia Lagoon Wetland the **SEI is considered as Minor;**
- For compromised TIFKs, the only difference with the above landscape types that might be identified lies in their intensity, i.e. resource sensitivity given characterization of the area. However, specific areas in compromised TIFKs allow for maximum absorption capability given the fact that they are characterized as agricultural lands, grasslands and/or low shrublands. Consequently, the **SEI is considered as Minor**; and

[7] https://ypen.gov.gr/PressRelease

- For landscape types: Hilly Natural (Forest), Mountainous Natural (Forest or Shrublands), Nearshore Seascape, Riparian Natural, the **SEI is considered as Moderate**.

Chapter 10 presents proposed mitigation and management measures applicable to the impact.

9.2.3.1.3 Disturbance to Viewers from Temporary Facilities

The whole construction front, including the working strip and temporary facilities, i.e. pipe yards, construction sites, landfall construction sites, etc., will generally be observed by a range of viewers, including:

- Residents with prolonged viewing opportunities for their landscape setting;
- Outdoor workers (farmers etc.) with a moderate interest in their environment; and
- Visitors of vantage viewpoints, i.e. nature recreation-focused users and tourists that appreciate local visual amenity.

Receptors who will experience a change in their visual environment are generally likely to view construction activities from a distance, through scattered vegetation across gentle or undulating topography of plain areas along the Project corridor. Main visual impacts likely to be experienced during construction phase will be temporary and restricted to the construction period and will include:

- Construction vehicles, vessels and workers present in the area:
- Movement of construction machinery, barges, workers and large-scale construction equipment;
- Stockpiles (vegetation, topsoil, subsoil);
- Vegetation clearance;
- Earth works, construction and installation of Project elements (construction at landfall sites is highlighted);
- Lighting during nocturnal construction activities (if required) and site compounds; and
- Additional vehicular traffic generated by construction workers, material delivery and disposal along adjacent transport routes and associated traffic management.

Especially regarding light pollution in construction sites, this is mainly caused by an excessive use of lighting devices at night. Lights emitted by these devices could run through glass windows in residential houses close to the construction site thereby disturbing residents (Elsahragty & Kim, 2015).

Besides general impact on landscape by the pipeline construction described in Section 9.2.3.1.2, temporary facilities will pose more constant disturbance to landscape, thus causing above-mentioned visual impacts.

Specific locations for pipe yards and construction sites will be precisely identified by the EPCI contructors. Such facilities are usually located in agricultural, leveled areas close to existing infrastructure (artificial areas) including maximum absorption capacity; as such limited impact on the view quality. Therefore, disturbance to viewers is foreseen.[8]

Temporary facilities that will be located in areas including decreased absorption capacity are landfall sites. Construction at these locations will take approximately 6 months (Chapter 6). Most important, the view in specific sites is unobstructed due to the seascape.

The following figures (Figure 9-8 to Figure 9-7) include pictures of real case studies showing disturbance to viewers and seascape during shore-crossing construction activities.

Source: https://www.pomgrad.com

Source: https://www.nord-stream.com

Figure 9-7 Examples of Landfall Stations.

[8] In any case, Ar. 7 of L. 4014/2011 is applicable. Specifically, the article provides for the submission of a Technical Environmental Report (TEPEM) for facilities or works (e.g. construction sites, depositing sites, etc) that are defined by a project's technical design at a stage following the issuance of Environmental Terms Approval.

Source: EastMed Feasibility Study - Preliminary Design Report – Offshore (EM-620-20-PL-RPT-001, REV 2)

Source: Landfall and Shore Approach at Easington, UK.

Source: https://www.pomgrad.com

Figure 9-8 Examples of Shore Crossing Construction including Open-cut Activities.

Source: https://allseas.com/

Figure 9-9 Examples of Shore pulling Case Study.

Source: https://www.pomgrad.com

Figure 9-10 Examples of Seascape Intrusion during Construction Phase.

Table 9-15 Temporary Facilities potentially causing Disturbance to Viewers

Location	Temporary Facility Type	Landscape Type	Landscape Sensitivity	Landscape Value	Change Intensity
Crete Facilities	Main Facilities Construction Site	Agricultural Landscape	Low	Low	Low
LF2	Landfall Construction Site	Phryganic Landscape	Low	Moderate	Low
LF3	Landfall Construction Site	Coastal Mosaic for Agricultural and Natural Landscape	Moderate	Moderate	Moderate
Megalopoli Facilities	Main Facilities Construction Site	Mosaic of Agricultural and Natural Landscape	Moderate	Moderate	Moderate
Achaia Facilities	Main Facilities Construction Site	Agricultural Landscape	Low	Low	Low
O&M	Permanent Facility Construction Site	Agricultural Plain Landscape	Low	Low	Low
LF4	Landfall Construction Site	Coastal Agricultural Landscape	Low	Moderate	Low
LF5	Landfall Construction Site	Coastal Agricultural Landscape	Low	Moderate	Low
Specific locations for other temporary facilities such as pipe yards and construction sites are currently unknown. As such, TEPEM procedure shall be followed.					

Prepared by: ASPROFOS, 2022.

In order to assess disturbance to viewers, a set of sensitive receptors were identified. These include widely known venues in a broader area with a view to temporary facilities presented in Table 9-15, as a result of desktop studies and public consultation. These receptors are tabulated in Table 9-16. Other areas of touristic development and significant landscape value (such as R. Acherontas and Nekromanteio) are not considered as temporary facilities that may cause disturbance to viewers. It is noted that sensitive receptors of construction sites for permanent facilities (i.e. CS2/MS2-CS2/MS2N, MS/PRS4 & Heating Station, CS3) are assessed in the operation phase.

Impact intensity (disturbance to viewers) is assessed based on the methodology presented in Section 9.2.3.1.1, also taking into consideration distance of the receptor from compromised temporary facility.

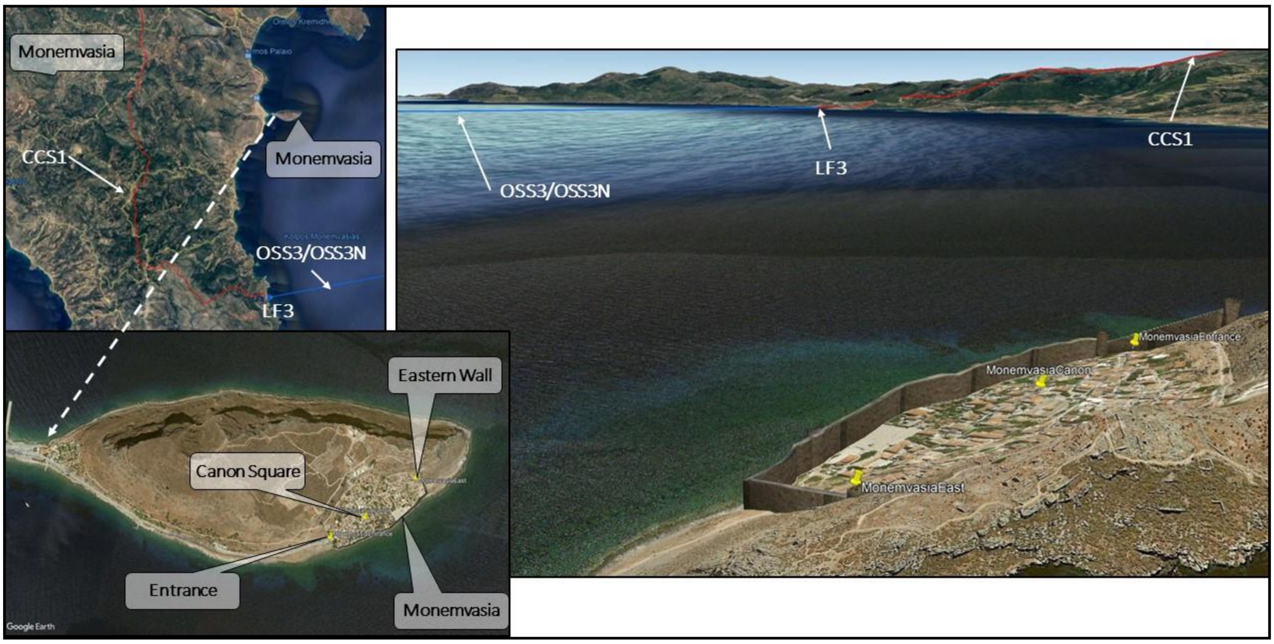
Table 9-16 Sensitive Receptors to Landscape Disturbance.

Name	Viewed Temporary facility	Distance from Project Footprint	Receptor Viewing Angle	Receptor Description	Receptor Sensitivity	Landscape Intensity of change	Intensity of disturbance to viewers
Monemvasia	LF3	9.5 km	View SW towards project footprint	Castle Town UNESCO Site	High	Moderate	High
Lakopetra	LF4	0.5 km	View W-NW towards project footprint	Touristic establishments in Kalamaki beach	High	Low	High

Prepared by: ASPROFOS, 2022.

These sensitive receptors are illustrated in the following figures, Monemvasia in Figure 9-11 and Lakopetra in Figure 9-12. Especially, for Monemvasia UNESCO site, three viewpoints of interest have been identified: one in the entrance of the castle town (in the parking lot), one in the area considered center most ("Canon" square) and at the easternmost limits of the protected site (Figure 9-11). Pictures taken from these points are presented in the following figures (Figure 9-13, Figure 9-14 and Figure 9-15).

It is noted that other sensitive receptors are located in proximity to the project footprint, namely: Karytaina (AT1011072) and Andritsaina (AT1011067) settlements in Peloponnese section and Mt. Varassova (AT2010026) and "Kalodiki Marshland of Parga" (AT3011025) in Western Continental Greece. These also could be considered as sensitive receptors, as described in Section 8.3 (8.3.2.5.1 - Landscapes of Outstanding Natural Beauty). However, no temporary facilities are located in a distance smaller than 5 km (broader study area) from these sites. In addition, LF2 and LF5, where temporary facilities are known to be located, have no sensitive receptors in a 5-km radius. This is the reason no disturbance to viewers is assessed.



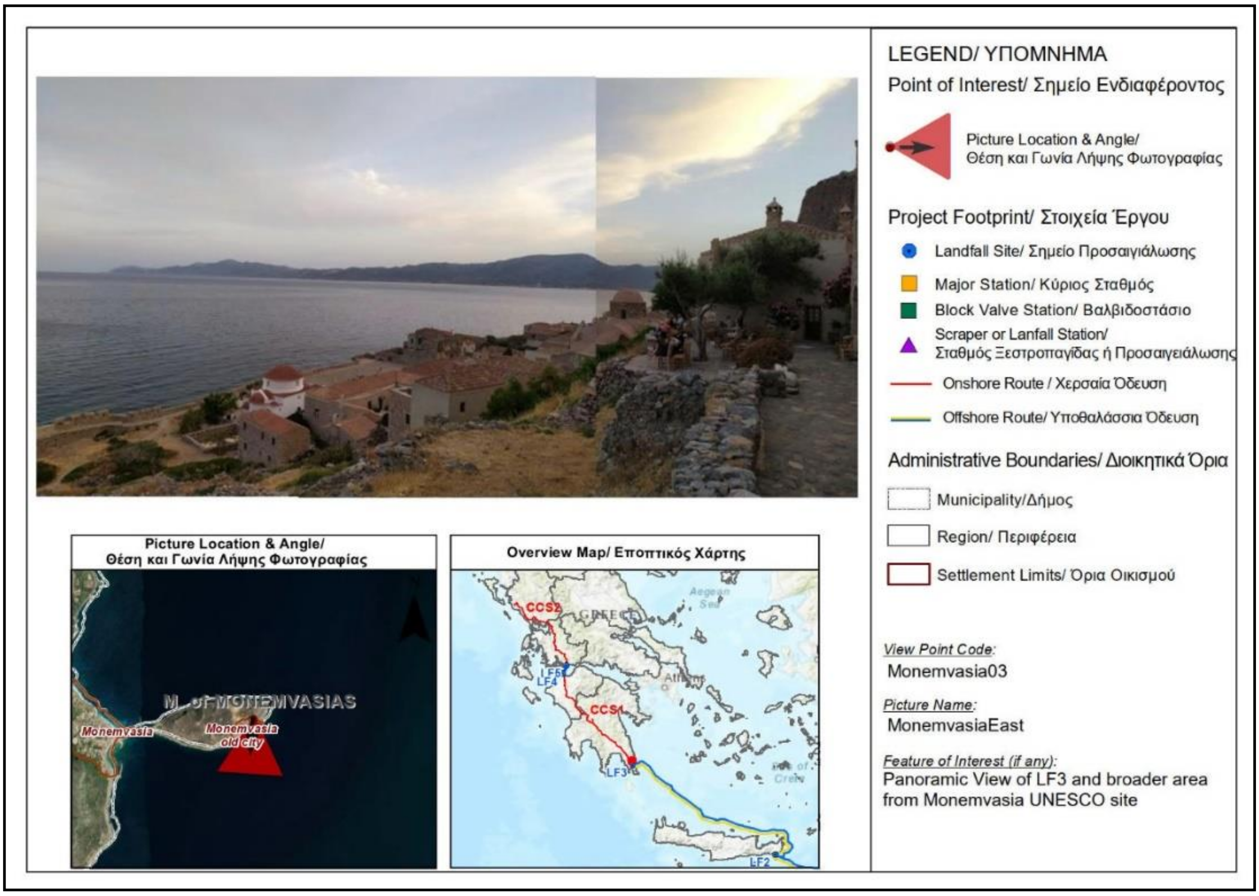
Prepared by: ASPROFOS, 2022. Base maps from Google Earth Pro.

Figure 9-11 Sensitive Receptors in Monemvasia UNESCO Site.

Prepared by: ASPROFOS, 2022. Base maps from Google Earth Pro.

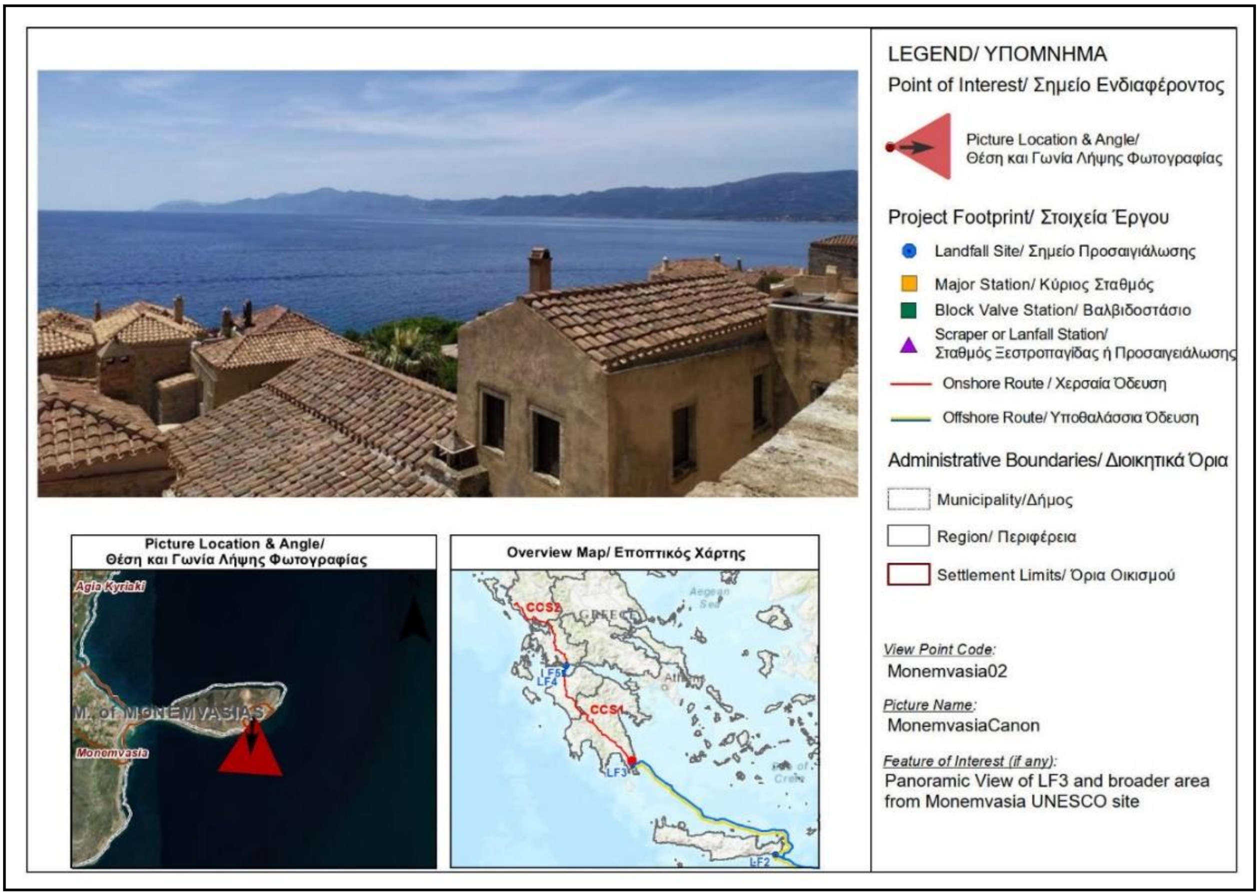
Figure 9-12 Sensitive Receptors in Lakopetra Touristic Development.

The following pictures illustrate landscape observed from these sensitive receptors.



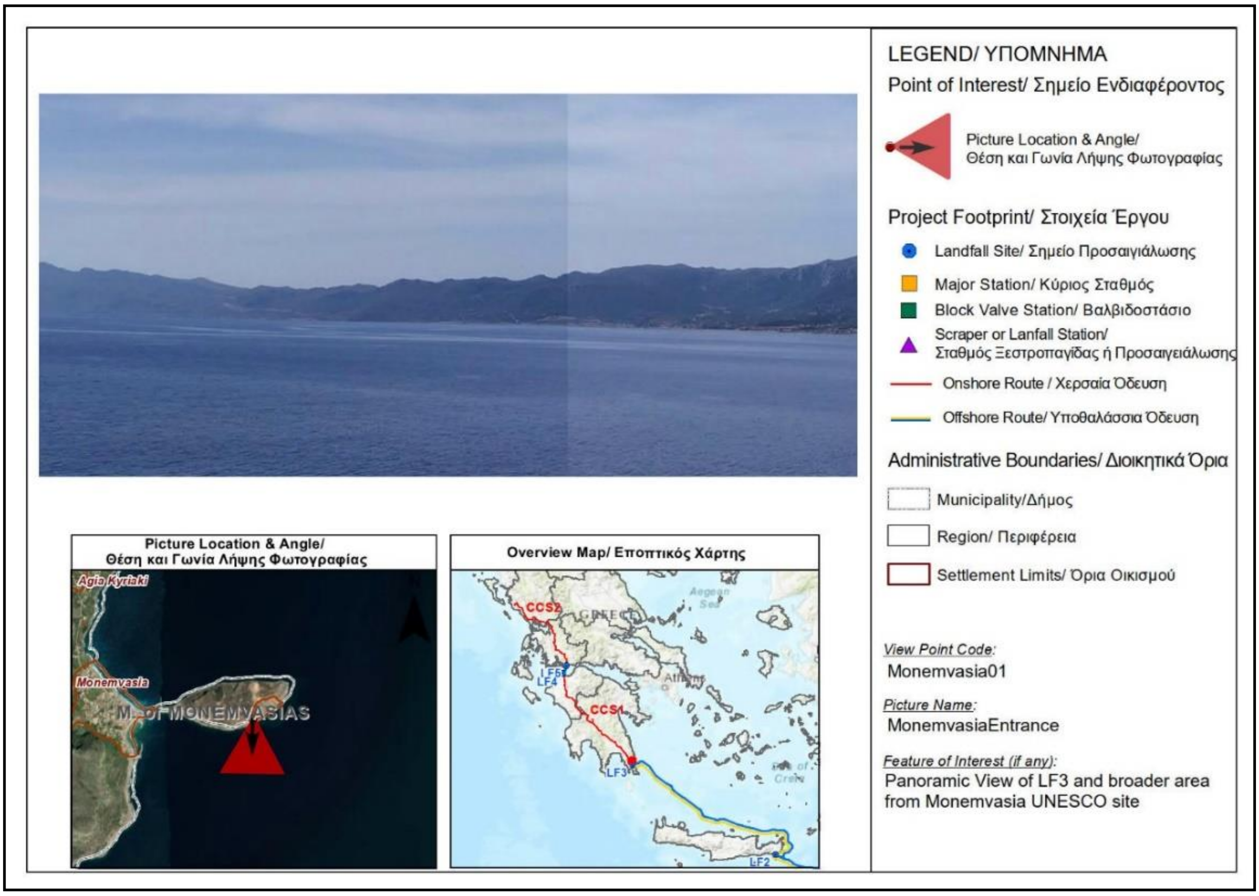
Prepared by: ASPROFOS, 2022.

Figure 9-13 View from Monemvasia Eastern Limit towards LF3.



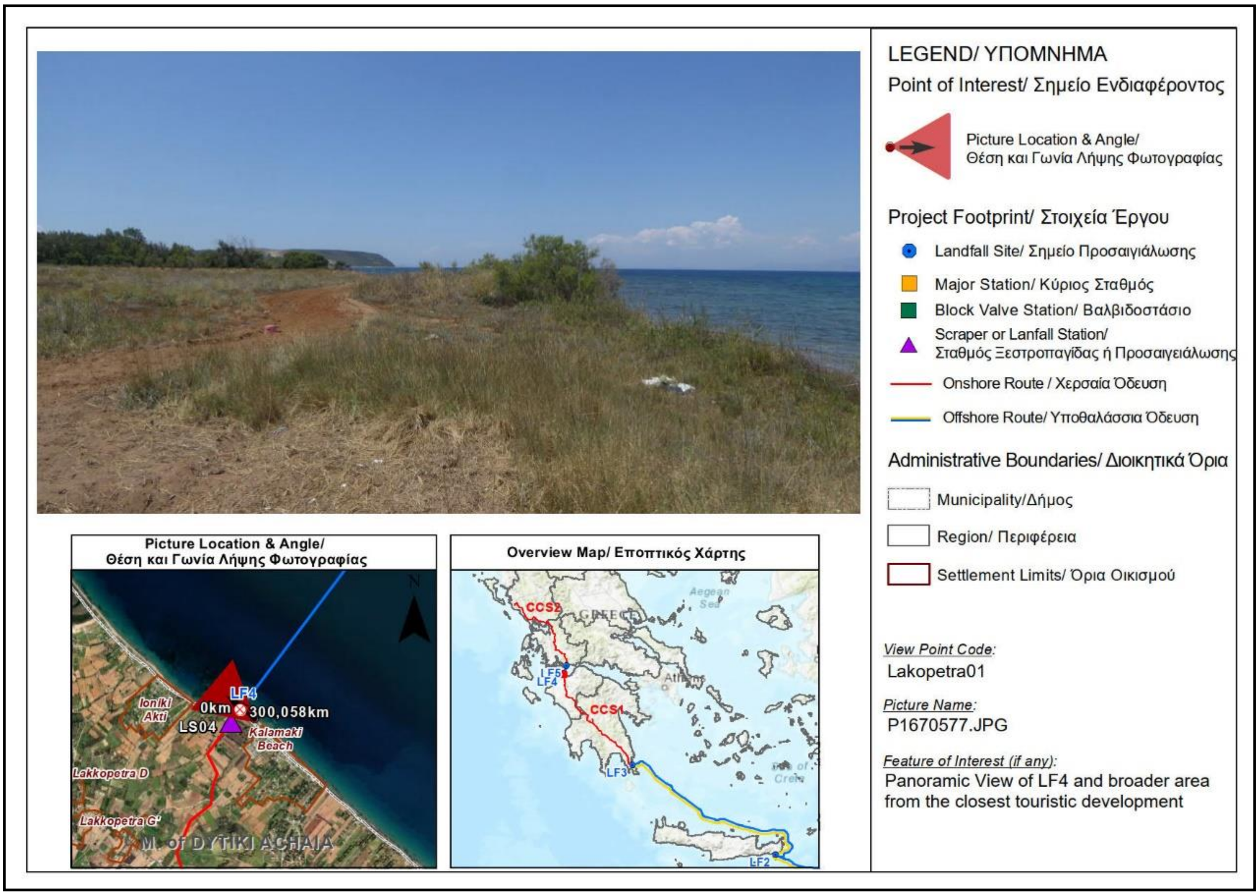
Prepared by: ASPROFOS, 2022.

Figure 9-14 View from Monemvasia Central Square ("the Canon") towards LF3.



Prepared by: ASPROFOS, 2022.

Figure 9-15 View from Monemvasia's Entrance (Parking lot) towards LF3.



Prepared by: ASPROFOS, 2022.

Figure 9-16 View from Lakopetra closest Touristic Development towards LF4.

Besides sensitive receptor values and duration of construction activities on a specific location, another important driver for impact on visual amenity is the distance between construction front and receptor.

Viewshed of sensitive receptors includes various characteristic landscape types, and specifically, Seascape and Coastal Mosaic for Agricultural and Natural Landscape (for Monemvasia) and Coastal Agricultural Plain (for Lakopetra) (Table 9-15). Most landscapes compromised might absorb intrusion imposed by construction activities, as previously described. However, Seascapes (and coastal viewshed in general) are very sensitive due to the fact that in their open view line (horizon) any modification is unobstructedly perceived by any sensitive receptor.

Monemvasia is located approx. 9.5 km from the construction site. The Landscape of Monemvasia already includes elements of artificial nature, such as small settlements (Agios Fokas, Kastela, Xifias) and scattered buildings, and most importantly, a road network. Hence, any modification for the pipeline working strip will be limited and similar to that of any other road construction (Figure 9-13, Figure 9-14 and Figure 9-15). On the other hand, Lakopetra landfall lies in plain agricultural areas, already hosting several dirt roads, but it is very close to the construction site. This increases perception of any modification to landscape (Figure 9-12).

Based on the above and on previous landscape impact analysis (9.2.3.1.2), the following may be concluded:

Impact *likelihood* during construction works is *certain*. Impact *extent* is considered *perimetric,* due to seascape and coastal view, as previously described. Impact *intensity* is high, according to Table 9-16. With regard to impact *duration*, construction at landfall sites will take approximately 6 months and upon completion of these works, immediate restoration is considered. Therefore, the impact is of *short-term* duration. With regard to *reversibility*, impacts are completely *reversible* including implementation of proper measures (see Chapter 10). Regarding *cumulative* action, by adopting a conservative approach, *probable* cumulative action is considered. *Transboundary character* is deemed *impossible*, given the location of sensitive receptors.

Based on the above and the criteria presented in Section 9.1, for disturbance to viewers by temporary facilities during construction activities for the Project, the **SEI is considered as Moderate.**

Section 10 presents proposed mitigation and management measures applicable to the impact.

9.2.3.1.4 Summary

The following table summarizes impacts to landscape characteristics during construction phase.

Table 9-17 Summary of Impacts to Landscape Characteristics during Construction Phase

S/N SEI			SEI for	Landscape							
Project phase	Construction										
Impact	Mechanism	Locations	Criteria/ Impact Properties							SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Landscape Modification from Pipeline Construction	• Preparing pipeline working strip/ cofferdam • Erecting (construction) permanent Project features, such as line valve stations and compressor and metering stations. • Building temporary Project features such as	• Agricultural Landscape • Agricultural Plain Landscape • Built Landscape • Coastal Agricultural Landscape • Phryganic Landscape • Rural Landscape	1.00	0.25	0.25	0.25	0.50	0.25	0.00	3.57 (Minor)	The impact is the same for every location. However, impact extent and/ or intensity is modified, depending on location (landscape type)
		• Coastal Rural Landscape • TIFK “Parapotami Alfeiou” (Alfios‘ Tributaries) (AT1011011) • TIFK “Ekvoli Acheronta and Nekromanteio” (R. Acheronta Estuary and Necromancer) (AT3010051)	1.00	0.25	0.50	0.25	0.50	0.25	0.00	3.93 (Minor)	
		• Coastal Mosaic for Agricultural and Natural Landscape • Karteri Marshland	1.00	0.50	0.50	0.25	0.50	0.25	0.00	4.29 (Minor)	

S/N SEI			SEI for	Landscape								
Project phase	Construction											
Impact	Mechanism	Locations	Criteria/ Impact Properties								SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)			
	construction sites. • Traffic of project-related vehicles/ vessels;	• Mosaic for Agricultural and Natural (Shrublands) Landscape • Riparian Agricultural Landscape • Rodia Lagoon Wetland										
		• Hilly Natural (Shrublands) Landscape	1.00	0.50	0.75	0.50	0.75	0.75	0.00		6.07 (Moderate)	
		• Nearshore Seascape	1.00	0.75	0.75	0.50	0.50	0.75	0.00		6.07 (Moderate)	
		• Hilly Natural (Forest) Landscape • Mountainous Natural (Forest) Landscape • Mountainous Natural (Shrublands) Landscape • Nearshore Seascape • Riparian Natural Landscape	1.00	0.75	0.75	0.50	0.75	0.75	0.00		6.43 (Moderate)	
Disturbance to Viewers		• Monemvasia Castle Town UNESCO site (view of LF3)	1.00	0.75	1.00	0.25	0.50	0.75	0.00		6.07 (Moderate)	Impact depends on the quality of a

S/N SEI			SEI for	Landscape							
Project phase	Construction										
Impact	Mechanism	Locations	Criteria/ Impact Properties							SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
by Temporary Facilities		• Lakopetra touristic establishments (view of LF4)									sensitive receptor or its proximity to a temporary facility. Exact location of every temporary facility (i.e. pipe yards and construction sites) is currently unknown, but impacts are expected to be smaller (TEPEM procedure shall be followed, if necessary)

9.2.3.2 Morphological Characteristics

Change induced during construction phase is permanent for the entire project operation lifetime (or even longer, depending on the decommissioning strategy) essentially with no modification to mechanisms or results for their action to seabed morphology. As such, morphology modification is considered to be permanent and with the same impact (continuous) for every project phase (construction, operation, decommissioning). Consequently, no distinction between construction and operation (or decommissioning) phases is necessary.

As such, impacts on morphological characteristics are described in Section 9.3.3.2.

9.2.4 Geological, Tectonic and Soil/Sediments Characteristics

9.2.4.1 Onshore Section

9.2.4.1.1 Overview

This section evaluates the potential impact on:

Activation of Geohazards.

Activation of geohazards can be induced by the excavation works, possible destruction of specific geological features (e.g. springs, caves) as well as by the pipeline installation. Specifically, the following categories of geohazards can be activated during the construction phase:

- Slopes stability;
- Strong ground motions;
- Mass Gravity Flow;
- Rock Fall;
- Liquefaction and Cyclic Softening of Soils;
- Landslides
- Impact on soil erosion
- Impact on soil compaction
- Impact on soil pollution
- Impact on reduction of soil productivity

Table 9-18 outlines the main sources of impact, the potentially affected resources and recipients as well as the influencing factors of the current situation and those related to the Project.

Table 9-18 Key Considerations for Assessment – Geological, Tectonic and soil

Sources of Impact/ Risk	Activation of Geohazards due to the following: • Preparation of working strip (removal of topsoil) • Temporarily disturbed land from construction. • Set up of temporary facilities (construction sites, marshalling yards, pipe yards. • Special crossings (i.e. rivers crossings, landfall crossings) • Site preparation and installation of Compressor Stations. Set up of the pipeline facilities. Backfilling and reinstatement of pipeline. Soil erosion due to • The removal of vegetation and the trenching activities on the mountain steep slopes and elevated areas Soil Compaction due to • Construction operations that require heavy machinery, especially if performed when soils are wet. Soil pollution.

	• Accidental pollution of soil during construction of the pipeline and the above ground facilities due to oils or hydraulic fluids spill from vehicles and machinery, surface run-off and sanitary waste from construction sites. Reduction of soil productivity due to • The construction of the pipeline, and specifically the works undertaken in the construction strip, despite the reinstatement of the land after pipeline construction, may have an effect on the ability of soil to perform its role in agricultural production, i.e. soil productivity.
Potentially Impacted Resources and Receptors	For Geohazard the recipients are referred to Annex 8M: • Table M-9 for landslides along CCS1 Section • Table M-10 for landslides along CCS2 Section • Table M-11 for liquefaction along CCS1 Section • Table M-12 for liquefaction along Megalopolis branch • Table M-13 for liquefaction along CCS2 Section • Table M-14 for Main Geohazards along the route OSS2/OSS2N • Table M-16 for Main Geohazards along the route OSS3/OSS3N • Table M- 18 for Main Geohazards along the route OSS4 For soil erosion the recipients are The steep slopes of mountains and elevated areas For soil compaction the recipients are • I Clayey and silty materials of the soil, mainly in a wet statewith the simultaneous action of large loads • Construction sites, pipe yards, marshalling yards For soil pollution the recipients are • The existing soils alongside the working strip, at temporarily facilities, at crossings (area equal to 17,876,960 m^2) where spill from construction machines is possible (This area corresponds to the occupied area from working strip, Main Stations, Construction Sites, Pipe yards, River Crossings, Landfall sites). • For reduction of soil productivity the recipients are the soils for agricultural areas and specifically in the construction strip
Special Baseline Conditions that are Potentially Influencing Impacts/Risks	Pipeline crossings probable contaminated soils (Megalopoli area, Atherinolakkos area)
Project Factors that are Potentially Influencing Impacts/Risks	The following factors of the project enhance the occurrence of geo-hazards • preparation of working strip • trench excavation • pipe-string and bending • trenching, lowering and laying • backfilling and reinstatement The following factors of the project enhance the occurrence of soil erosion • preparation of working strip

	• trench excavation The following factors of the project enhance the occurrence of soil compaction • trucks and heavy machinery that operate along the construction corridor and temporary project installations such as construction sites, pipe yards, marshalling yards The following factors of the project enhance the occurrence of soil pollution • The accidental spill from construction machines for preparation of working strip, trench excavation, pipe-string/bending, trenching, lowering /laying, backfilling • Pipeline crossings with probable contaminated areas The following factors of the project enhance the occurrence of soil productivity reduction. • The construction works along the pipeline at areas with exclusively agricultural character
References	In chapter 8.4.4, soils are presented . In section 8.4.5 and in Annex 8M , geohazards are analyzed.

Prepared by: ASPROFOS, 2022.

In the following paragraphs, a description and assessment of possible impacts from the construction and operation of the Project is made.

9.2.4.1.2 Impact on Geohazards

Geohazards are defined as features of the natural environment that represent a threat to the integrity pipeline system. Identification of the geohazards along the pipeline corridor is therefore greatly significant.

The impacts depend on many geological, geomorphological and geotechnical factors of the subsoil, surface and climatic conditions, such as soil type and grain size, mineralogical composition and stratification of rocks, rock disintegration process, morphological slope, the presence of groundwater in sediment deposits, the characteristics of rainfall or soil cooling.

Based on section 8.4.5, Table 9-19 presents the geohazards identified along the onshore section of the EastMed Pipeline Project, including the impact inducing mechanism and potential recipients/resources.

Table 9-19 Activation of Geohazards- Impact mechanism-Potential recipients/resources during the Construction Phase

Impact	Impact mechanisms	Potential recipients / resources
Activation of Geohards	• earthmoving, • excavation,	• Annex 8M

Impact	Impact mechanisms	Potential recipients / resources
	• circulation of vehicles, • accumulation of excavation materials, • accumulation of ground mantle, • creation of landslides, creeps • soil erosion • soil compaction	• Table M-9 for landslides along CCS1 Section • Table M-10 for landslides along CCS2 Section • Table M-11 for liquefaction along CCS1 Section • Table M-12 for liquefaction along Megalopolis Branch • Table M-13 for liquefaction along CCS2 Section

Prepared by: ASPROFOS, 2022.

Calculation of SEI

The affected resources from geohazard activation are the following:

- 26 locations concerning landslides susceptibility phenomena along the onshore section of pipeline (Annex 8M, table M-9, table M-10)
- 10 locations concerning liquefaction susceptibility along the onshore section of pipeline (Annex 8M, table M-11, table M-12, table M-13)

The *Likelihood* of the occurrence of geohazard activation is *Likely*, due to the multiple intersections of pipeline route, with geologically unstable areas. The *Extent* of impact is considered *medium* (500 m from Project or resource footprint). The *Intensity* of the impact on sensitive recipients is expected to be *Medium*. The *Duration* of the impact is expected throughout the construction period of the project, that is about 1- 3 years, so according to the proposed methodology it is characterised *Mid-term*. The possibility of dealing with the impact (*Reversibility* of the impact) is considered preventable and *Minimised.* The *Cumulative Action* of the impact is *Certain* as a number of parameters accelerate the creation of unstable slopes, such as high aquifer, seismic action, soil erosion etc. The *Transboundary Character* is *Impossible*.

Based on the above and based on the criteria presented in the Section 9.1, for activation of geohazards during the construction of the Project, the **SEI is considered as Minor** , according to Table 9-24

9.2.4.1.3 Soil Erosion

The soil structure varies along the pipeline corridor with the soil types. Along most of the route, soil has fairly good cohesion where soil structure provides for aggregate stability and reduces the likelihood of soil erosion. However, there are vulnerable sections, where the soil erosion risk is particular high due to the soil properties and topography. The removal of vegetation and the trenching activities on the mountain steep slopes may result in significant permanent soil erosion impacts unless properly managed and mitigated.

Table 9-20 Soil erosion- Impact mechanism-Potential recipients/resources during the Construction Phase

Impact	Impact mechanisms	Potential recipients / resources
Soil Erosion	• earthmoving, • excavation, • circulation of vehicles, • accumulation of excavation materials, • accumulation of ground mantle	the mountain steep slopes and elevated areas alongside the pipeline

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The affected resources from Soil Erosion are the mountain steep slopes and elevated areas alongside the pipeline, especially areas where soil sensitivity is medium or high.

<u>Calculation of SEI</u>

The *Likelihood* of the occurrence of soil erosion activation is <u>*Certain*</u>, due to the extended footprint of the project. The *Extent* of impact will be *Small*_(limited to project or resource footprint). The *Intensity* of the impact on sensitive recipients is expected to be <u>*Medium*</u>. The *Duration* of the impact is expected throughout the construction period of the project, that is about 1- 3 years, so according to the proposed methodology it is characterised <u>*Mid-term*</u>. The possibility of dealing with the impact (*Reversibility* of the impact) is considered <u>*Avoidable*</u>. The *Cumulative Action* of the impact is <u>*Likely*</u> as a number of parameters accelerate the creation of soil erosion due to the territorially existing eroded surfaces. The *Transboundary Character* is <u>*Impossible*</u>.

Based on the above and based on the criteria presented in the Section 9.1, for soil erosion during the construction of the Project, the **SEI is considered as Minor**, according to Table 9-24. Mitigation measures are reported in Section 10.2.3.

9.2.4.1.4 Soil Compaction

Soil compaction is observed when soil particles are pressed together, reducing soil porosity. Soil compaction can occur during most construction operations that require heavy machinery, especially if performed when soil is wet. Paticularly clay dominated soils are more susceptible to compaction.

As it is presented at Section 8.4.4 and Table 8-38 the soil structure varies along the pipeline route.

Table 9-21 Soil compaction - Impact mechanism - Potential recipients/resources during Construction Phase

Impact	Impact mechanisms	Potential recipients / resources
Soil Compaction	• circulation of heavy machines • circulation of vehicles	• Clayey and silty materials of the soil, mainly in a wet state with the simultaneous action of large loads • Construction sites, pipe yards, marshalling yards

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During construction of the pipeline, trucks and heavy machinery will drive and operate along the construction corridor. Regarding the *Duration* of the impact, taking into account that along the pipeline the duration is *Short* whilst at the temporary Project installations such as construction sites, pipe yards, marshalling yards it ranges from 1-3 years, the magnitude of impact varies from *Short term* to *Mid-term*. Specifically at pipe yards due to heavier equipment the effect is expected more significant.

The affected resources from Soil Compaction are the following:

- clayey and silty materials of the soil, mainly in a wet state with the simultaneous action of large loads
- Construction sites, pipe yards, marshalling yards

Calculation of SEI

The *Likelihood* of the occurrence of soil compaction activation is *Certain*, due to the of the wide existence of the parameters that contribute to the occurrence of the soil compaction. The *Extent* of impact will present *Small* (limited to project or resource footprint). The *Intensity* of the impact on sensitive recipients is expected to be *Medium*. The *Duration* of the impact is expected throughout the construction period of the project, that is about 1- 3 years, so according to the proposed methodology it is characterised *Mid-term*. The possibility of dealing with the impact (*Reversibility* of the impact) is considered *Minimizable.* The *Cumulative Action* of the impact is *Likely* as a number of parameters accelerate the creation of soil compaction due to the existing heavy machines at the study area . The *Transboundary Character* is *Impossible.*

Based on the above and based on the criteria presented in the Section 1.1, for soil compaction during the construction of the project, the **SEI is considered as Minor**, according to Table 9-24. Mitigation measures are reported in Section 10.2.3

9.2.4.1.5 Soil Pollution

According to the existing data the route is not passing through contaminated sites along the construction corridor,exept Megalopolis and Atherinolakkos area, yet undiscovered pollutants that may already be present in the soil from current or historical sources may also be encountered during excavation. This could potentially impact the construction workers' health via inhalation of dust or direct ingestion, the land drainage network and then groundwater via rain water surface.. Given the agricultural patterns, potentially elevated nitrate levels could be expected to occur in the pipeline route sections

Accidental pollution of soil during construction of the pipeline (along the construction corridor) and the above ground facilities could occur through accidental spillage of materials such as oils or hydraulic fluids from vehicles and machinery, surface run-off and sanitary waste from construction sites. However, any potential spillages will generally be of small quantities and localised in nature.

The magnitude of potential impacts due to existing soil contamination is small.

Overall, impacts of minor significance are anticipated to soil from potential contamination during construction from accidental spillages.

Table 9-22 Soil pollution- Impact mechanism-Potential recipients/resources during the Construction Phase.

Impact	Impact mechanisms	Potential recipients / resources
Soil Pollution	• The accidental spill from construction machines for preparation of working strip, trench excavation, pipe-string, bending, trenching, lowering /laying, backfilling • Pipeline crossings with probable contaminated areas	The existing lands along the working zone, in temporary installations, at intersections, occupy an area equal to 17,876,960 m2. Leakage from construction machinery is possible in this area (This area corresponds to the occupied area during construction phase, from working strip, Main Stations, Construction Sites, Pipe yards, River Crossings, Landfall sites).,

Prepared by: ASPROFOS, 2022.

<u>Calculation of SEI</u>

The affected resources from Soil Pollution are the following:

- The existing soils alongside the working strip, at temporarily facilities, at crossings, area occupy area equal to 17,876,960 m^2 where leakage from construction machines is possible

The *Likelihood* of the occurrence of soil Pollution activation is *Likely*, due to the extended footprint of the project. The *Extent* of impact will be present *Medium* (500m from project or resource footprint). The *intensity* of the impact on sensitive recipients is expected to be *Medium*. The *Duration* of the impact is expected throughout the construction period of the project, that is about 1- 3 years, so according to the proposed methodology it is characterised *Mid-term*. The possibility of dealing with the impact (*Reversibility* of the impact) is considered *Reversible*. The *Cumulative Action* of the impact is *Likely* because, along the construction corridor, yet undiscovered pollutants that may already be present in the soil from current or historical sources may also be encountered during excavation. The *Transboundary Character* is *Impossible*.

Based on the above and based on the criteria presented in the Section 1.1, for soil pollution during the construction of the project, the **SEI is considered as Minor**, according to Table 9-24. Mitigation measures are reported in Section 10.2.3.

9.2.4.1.6 Reduced Soil Productivity

The construction of the pipeline, and specifically the works undertaken in the construction strip, despite the reinstatement of the land after pipeline construction, may have an effect on the ability of soil to perform its role in agricultural production, i.e. soil productivity. .

Table 9-23 Reduced Soil Productivity Impact mechanism-Potential recipients/resources during the Construction Phase

Impact	Impact mechanisms	Potential recipients / resources
Reduced Soil Productivity	The construction works along the pipeline at areas with exclusively agricultural character	Agricultural areas , and specifically in the construction strip

Prepared by: ASPROFOS, 2022.

Calculation of SEI

The affected resources from" Reduced Soil Productivity " are the following:

- The soils for agricultural areas , and specifically in the construction strip.

The *Likelihood* of the occurrence of soil Pollution activation is *Likely*, . The *Extent* of impact will present *Small* (Limited to project or resource footprint). The *Intensity* of the impact on sensitive recipients is expected to be *Medium*. The *Duration* of the impact is expected throughout the construction period of the project, that is about 1- 3 years, so according to the proposed methodology it is characterised *Mid-term*. The possibility of dealing with the impact (*Reversibility* of the impact) is considered *Reversible*. The *Cumulative Action* of the impact is *Likely* because, along the construction corridor, several parameters unrelated to the project contribute to reduced soil productivity. The *Transboundary Character* is *Impossible*.

Based on the above and based on the criteria presented in Section 1.1, for "Reduced Soil Productivity" during construction of the Project, the **SEI is considered as Minor**, according to Table 9-24. Mitigation measures are reported in Section 10.2.3

9.2.4.1.7 Summary

The summary of the effects on Geological, Tectonic and Soil during the construction phase is presented in the table below.

Table 9-24 Summary of Impacts for Geological, Tectonic and Soil during the construction phase

S/N SEI			SEI for	Geological, Tectonic and Soil							
Project phase	Construction										
Impact	Mechanism	Locations	Criteria/ Impact Properties							SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Activation of geohazards	• earthmoving, • excavation, • circulation of vehicles, • accumulate of excavation materials, • accumulation of ground mantle, • creation of landslides, creeps • soil erosion • soil compaction	Presented at Annex 8M • Table M-9 • Table M-10 • Table M-11 • Table M-12 • Table M-13	0.50	0.25	0.50	0.50	0.75	1.00	0.00	5.00 (Minor)	
Soil erosion	• earthmoving, • excavation,	the mountain steep slopes and elevated areas	1.00	0.00	0.50	0.50	0.75	0.5	0.00	4.64 (Minor)	

S/N SEI			SEI for	Geological, Tectonic and Soil						
Project phase	Construction									
Impact	Mechanism	Locations	Criteria/ Impact Properties						SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
	• circulation of vehicles, • accumulation of excavation materials, • accumulation of ground mantle	alongside the pipeline									
Soil compaction	• circulation of heavy machines • circulation of vehicles	• Clayey and silty materials of the soil, mainly in a wet state with the simultaneous action of large loads • In Construction sites, pipe yards, marshalling yards	1.0	0.0	0.5	0.5	0.75	0.5	0.0	4.64 (Minor)	

S/N SEI			SEI for	Geological, Tectonic and Soil							
Project phase	Construction										
Impact	Mechanism	Locations	Criteria/ Impact Properties							SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Soil pollution	• The accidental leakage from construction machines for preparation of working strip,trench excavation, pipe-string ,bending,trenching,lowering /laying, backfilling • Pipeline crossings with probable contaminated areas	The existing soils alongside the working strip, at temporarily facilities, at crossings, area equal to 17,876,960 m^2 where leakage from construction machines is possible	0.5	0.25	0.5	0.5	0.5	0.5	0.0	3.93 (Minor)	
Reduced Soil Productivity	The construction works along the pipeline at areas with exclusively agricultural character	The soils for agricultural areas , and specifically in the construction strip.	0.5	0.0	0.5	0.5	0.5	0.5	0.0	3.57 (Minor)	

Prepared by (ASPROFOS, 2022)

9.2.4.2 Offshore Section

9.2.4.2.1 Overview

This section evaluates the potential impact on:

<u>Potential Activation of Geohazards</u>

Potential Activation of Geohazards can be induced by the excavation works at near coast areas, pipeline laying at offshore sections and during preparation of landfall crossings.

<u>Sediments Diffusion</u>

The sediments diffusion is created from a) the laying of the pipeline over the sea bottom and b) dredging operations at landfalls areas.

<u>Potential Occurrence of Sediments Pollution</u>:

Possible contamination of sediments can occur from accidental causes during construction phase.

Table 9-25 outlines the main sources of impact, the potentially affected resources and receptors as well as the influencing factors of the current situation and those related to the Project.

Table 9-25 Basic Issues for Assessment – Geological, Tectonic and Sediments

Sources of Impact/ Risk	<u>Potential Activation of Geohazards due to:</u> • Preparation of trench at near coast areas • Special crossings (landfall crossings) • Pipeline laying at offshore sections <u>Sediments diffusion due to:</u> The dredging construction activities at Landfall sites (nearcoast areas) <u>Potential activation of sediments polution during construction of the offshore pipeline due to:</u> • The accidental leakage of fuel from ships/vessels • The accidental escape of sanitary waste from ships/vessels • The accidental leakage of fuels, lubricants and chemicals at landfall sites
Potentially Impacted Resources and Receptors	<u>For Geohazard the receptors are referred toAnnex 8M, in particular:</u> • Table M-14 for Main Geohazards along the route OSS2/OSS2N • Table M-16 for Main Geohazards along the route OSS3/OSS3N • Table M- 18 for Main Geohazards along the route OSS4 <u>For sediments diffusion, the receptors are:</u> • All the sediments along the offshore pipelines • The near coast areas at Landfall locations

	For sediment pollution, the receptors are • All the sediments along the offshore pipelines
Special Baseline Conditions that are Potentially Influencing Impacts/Risks	• Seabed morphology which can lead to free span creation • Intersection of the pipeline with hydrates, pock marks
Project Factors that are Potentially Influencing Impacts/Risks	The following project activities of the Project enhance the occurrence of geo-hazards: • Preparation of trench at landfall locations • Intersection of the pipeline with hydrates, pock marks, active landslides and other existing geohazards • Free span creation and intervention techniques. The following factors of the Project enhance the occurrence of Sediments diffusion: • Excavation of trench at landfall locations • Preparation of cofferdams at LF4 and LF5 • Preparation at causeways at LF2 and LF3 • Anchoring of ships and vessels • Backfilling and reinstatement at landfall locations • Intervention techniques for normalization of free span. The following factors of the Project enhance the potential occurrence of sediments pollution: • The accidental leakage of fuel from ships/vessels • The accidental escape of sanitary waste from ships/vessels • The accidental leakage of fuels, lubricants and chemicals at landfall sites.
References	In section 8.4.5 nearcoast sediments of the Project are analyzed. In section 8.4.6 and in Annex 8M, geohazards are analyzed.

Prepared by: ASPROFOS, 2022

In the following paragraphs, a description and assessment of possible impacts from the construction of the Project is made.

9.2.4.2.2 Impacst from Potential Geohazards Activation

Geohazards are defined as features of the natural environment that can represent a threat to the integrity of submarine pipeline systems. The identification and risk analysis of geohazards are therefore of great significance. In most cases, these geohazards are manageable through standard engineering design and management techniques and therefore mapping of these serves to understand the nature of hazards that need to be managed and also to ensure that, should any be considered as a critical feature, is avoided or investigated in more detail to ensure proper project design and risk management so as to reach an acceptable level of residual risk.

Based on section 8.4.6, Table 9-26 presents the Potential Activation of Geohazards identified along the offshore section of the EastMed Pipeline Project, including the impact inducing mechanism and potential receptors/resources.

Table 9-26 Potential Activation of Geohazards - Impact Mechanism - Potential receptors/resources during Construction Phase

Impact	Impact mechanisms	Potential receptors / resources
Potential Activation of Geohazards	• Crossing with unstable submarine slopes, • Excavation at landfalls areas, • Crossing with liquefied soils • Crossing with high relief bedrock • Crossing with mud-volcanoes • Crossings with salt tectonics • Crossings with gas related hazards (Pockmarks,fluid seepage,Hydrates)	• Annex 8M • Table M-14 for Main Geohazards areas alongside the route OSS2/OSS2N • Table M-16 for Main Geohazards areas alongside the route OSS3/OSS3N • Table M-18 for Main Geohazards areas alongside the route OSS4

Prepared by: ASPROFOS, 2022

<u>Calculation of SEI</u>

The affected resources from geohazard activation are the following:

- 5 locations along the OSS2/OSS2N route, where they present mass transport deposits and 4 locations along the OSS2/OSS2N route, where they present possibility of slope instability (Annex 8M, Table M-14).
- 254 locations along the OSS3/OSS3N route, where they pass throw steep slopes, low stability slopes, seabed channels, rocky outcrops where they present possibility of slope instability (Annex 8M, Table M-16).
- 2 locations concerning areas with slope stability susceptibility along OSS4 route (Annex 8M, Table M-18).

The *Likelihood* of the occurrence of the potential geohazard activation is <u>*Rare*</u> due to the many intersections with existing geohazards. The *Extent* of impact will present <u>*Medium*</u> (500 m from Project or resource footprint). The *Intensity* of the impact on sensitive recipients is expected to be *Medium*. The *Duration* of the impact is expected throughout the construction period of the Project, that is about 1- 3 years, so according to the proposed methodology it is characterised *Mid-term*. The possibility of dealing with the impact (*Reversibility* of the impact) is considered *Avoidable*. The *Cumulative Action* of the impact is *Rare* as a number of parameters accelerate the creation of unstable slopes, such as, seismic action, etc. The *Transboundary Character* is *Rare* because there will be an effect on the accelerated geohazards during the construction phase of OSS2 section, at the maritime borders of the Project.

Based on the above and based on the criteria presented in the Section 9.1, for activation of geohazards during the construction of the Project, the **SEI is considered as Negligible**, according to Table 9-24.

9.2.4.2.3 Impact on Sediments Diffusion

The Sediments diffusion is created from a) the laying of the pipeline over the sea bottom and b) dredging operations at landfalls areas. For the sediments diffusion from dredging operations a Technical Report of Sediment Diffusion was prepared and presented at Annex 9D – Marine Sediment Dispersion Model.

Below the main points of the Technical Report of Sediment Diffusion are reported.

During dredging operations, sediment particles are removed from the seabed and released into the water column as Suspended Particulate Matter (SPM). The SPM forms a plume that is transported away from the dredging site by water mass circulation following a path that consists of 3 zones: (1) initial mixing, (II) near-field and (III) far-field. The behavior of the SPM plume depends on the following: (I) dredging characteristics, (II) sediment characteristics, (III) ambient characteristics, and (IV) site and discharge characteristics.

The most likely effects of dredging are: (I) the physical removal of substratum and associated plants and animals from the seabed, (II) the burial due to subsequent deposition of material, and (III) the enhanced turbidity and sedimentation as a result of dredging and disposal operations. Changes in Suspended Sediment Concentration (SSC), the parameter used in models to quantify the changes in turbidity, are generally considered as the most important.

SSC changes induced by dredging will only result in adverse environmental effects when the turbidity generated is significantly larger than the natural variation of turbidity and sedimentation rates in the area. Such natural variability can sometimes be substantial and may be caused by factors such as storms, wind-induced wave actions, river discharges and other local perturbations. Dredging activities often generate no more increased SPM than commercial shipping operations, bottom fishing or severe storms.

The calculations were performed for the minimum and maximum current velocities in the 4 sites of LF2, LF3, LF4 and LF5.The following conclusions emerge from these:

For sediments concentrations the values at various distances from the discharge location in the near field and the bottom layer are as follows:

- The distribution of sediment concentrations for the minimum current velocity are practically the same for all sites;
- At distances shorter than 100 m from the discharge location, the sediment concentrations for the maximum current velocity range from 106.0 mg/L to 111.8 mg/L. These values are higher than the corresponding values for the minimum current velocity that range from 115.3 mg/L to 173.7 mg/L; and
- Far downstream from the discharge location, for example at a distance equal to 1200 m from the discharge location, sediment concentrations for the maximum current velocity range from 63.8 mg/L to 75.0 mg/L; these values are higher than the corresponding value of 53.5 mg/L for the minimum current velocity.

For suspended sediment concentrations the values in the water column at various distances from the discharge location, are as follows:

- At distances shorter than 20 m from the discharge location, the suspended sediment concentrations for the maximum current velocity are lower than the threshold value of 35 mg/L for all sites. For the minimum current velocity, the corresponding concentrations are lower than the threshold value of 35 mg/L with the exception of the site LF5 at which the suspended sediment concentration is slightly higher than the threshold value (36.7 mg/L); and
- At distances longer than 50 m from the dredging location, suspended sediment concentrations range from 0.8 to 18.2 mg/L for the maximum current velocity, whilst for the minimum current velocity, the corresponding concentrations range from 0.0 mg/L (at sites LF2 and LF3) to 7.6 mg/L.

Moreover, it is noted that the duration of the potential impacts lasts as long as dredging takes place and the increased suspended sediment concentrations do not persist in the water column after the dredging procedure.

Based on Annex 9D, Table 9-27 presents the sediments diffusion identified along the offshore section of the EastMedPipeline Project, including the impact inducing mechanism and potential receptors/resources.

Table 9-27 Activation of Sediments Diffusion - Impact Mechanism-Potential Receptors/Resources during Construction Phase

Impact	Impact Mechanisms	Potential Recipients / Resources
Activation of Sediments Diffusion	• Excavation of trench at landfall locations • Preparation of cofferdams at LF4 and LF5 • Preparation at causeways at LF2 and LF3 • Anchoring of ships and vessels • Backfilling and reinstatement at landfall locations • Intervention techniques for normalization of free span	• All the sediments along the offshore pipelines • The near coast areas at Landfall locations

Prepared by ASPROFOS, 2022.

<u>Calculation of SEI</u>

The affected resources from Activation of Sediments Diffusion,are as follows:

- All sediments along the offshore pipelines; and
- Near coast areas at Landfall locations where the excavations will take place. Specifically from the Sediments diffusion model, it appears that at a distance equal to 1,200 m from the discharge location, sediment concentrations for the maximum current velocity ranging from 63.8 mg/L to 75.0 mg/L.

The *Likelihood* of the occurrence of sediments diffusion is *<u>Certain</u>.* The *Extent* of impact is considered *Large* (1,000 m from Project or resource footprint) according toAnnex 9D. The *Intensity* of the impact on sensitive receptors is expected to be *<u>Medium</u>*. The *Duration* of the impact is *<u>Short-term</u>*, because the increased suspended sediment concentrations do not persist in the water column and bottom layer after the dredging procedure. The possibility of dealing with the impact (*Reversibility* of the impact) is considered *<u>Minimizable</u>*. The *Cumulative Action* of the impact is*<u>Rare</u>,* as many parameters contribute to the propagation of sediment transport, such as other project, anchoring etc. The *Transboundary Character* is *<u>Rare</u>* because there will be an effect on the sediments diffusion during the construction phase of OSS2 section, at the maritime borders of the Project.

Based on the above and based on the criteria presented in the Section 1.1, for impact on sediments diffusion during the construction of the Project, the **SEI is considered as Moderate** according to Table 9-24.

9.2.4.2.4 Impact on Sediment Quality

During the Project construction phase, contractors will handle fuels, lubricants and chemicals at landfall sites that could be accidentally spilled and have the potential to have adverse environmental impacts. Risk assessments concerning impacts from un-planned events are presented in section 9.14.

In an accidental way, the disposal of sanitary waste from ships can occur, resulting in pollution of seawater and sediments.

The Table 9-28 presents the Potential Activation of Sediments Pollution along the offshore section of the EastMed Pipeline Project, including the impact inducing mechanism and potential receptors/resources.

Table 9-28 Potential Activation of Sediments Pollution - Impact Mechanism – Potential Receptors/Resources during Construction Phase

Impact	Impact mechanisms	potential recipients / resources
Potential Activation of Sediments Pollution	• Accidental leakage of fuel from ships/vessels • Accidental escape of sanitary waste from ships/vessels • Accidental leakage of fuels, lubricants and chemicals at landfall sites	• All sediments along the offshore pipelines • The near coast areas at Landfall locations

Prepared by (ASPROFOS, 2022)

<u>Calculation of SEI</u>

The affected resources from Potential Activation of Sediment pollutions are as follows:

- All sediments along the offshore pipelines; and
- The near coast areas at Landfall locations.

The *Likelihood* of the occurrence is <u>*Rare*</u>*.* The *Extent* of impact will present <u>*Peripheral*</u> (greater than 3,000 m from Project or resource footprint) The *Intensity* of the impact on sensitive receptors is expected to be <u>*Medium*</u>. The *Duration* of the impact is *Short-term.* The possibility of dealing with the impact (*Reversibility* of the impact) is considered <u>*Avoidable* </u>because a pollution is minimizable with appropriate dredging management measuresto ensure that no contaminated sediments (if present) are dispersed and to minimize turbidity. The *Cumulative Action* of the impact is <u>*Rare*</u>, as many parameters contribute to the sediment pollution, such as various ships etc. The *Transboundary Character* is <u>*Rare*,</u> only in case the vessel has a spill in the maritime borders of the Project.

Based on the above and based on the criteria presented in the Section 9.1, for sediments pollution during the construction of the Project, the **SEI is considered as Minor**, according to Table 9-24

9.2.4.2.5 *Summary*

The summary of the effects on Geological, Tectonic and sediments (offshore section) during the construction phase is presented in the table below.

Table 9-29 Summary of Impacts for Geological, Tectonic and Soil during Construction Phase (Offshore Section)

S/N SEI			SEI for	Geological, Tectonic and Sediment (Offshore Section)							
Project phase	Construction										
Impact	Mechanism	Locations	Criteria/ Impact Properties							SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Potential Activation of geohazards	• Crossing with unstable submarine slopes • Excavation at landfalls areas • Crossing with liquefied formations • Crossing with high relief bedrock • Crossing with mud-volcanoes • Crossings with salt tectonics	Presente d in Annex 8M • Table M-14 for Main Geohazards areas alongside the route OSS2/OSS2N • Table M-16 for Main Geohazards areas alongside	0.25	0.25	0.50	0.50	0.25	0.25	0.25	2.5 (Negligible)	

S/N SEI			SEI for	Geological, Tectonic and Sediment (Offshore Section)						
Project phase	Construction									
Impact	Mechanism	Locations	Criteria/ Impact Properties						SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
	• Crossings with gas related hazards (Pockmarks,fluid seepage,Hydrates)	route OSS3/OSS3N • Table M-18 for Main Geohazards areas alongside route OSS4									
Sediments diffusion	• Excavation of trench at landfall locations • Preparation of cofferdams at LF4, LF5 • Preparation at causeways at LF2, LF3 • Anchoring of ships and vessels	• All sediments along the offshore pipelines • The near coast areas at Landfall locations	1.00	0.50	0.50	0.25	0.75	0.25	0.25	4.64 (Minor)	

S/N SEI			SEI for	Geological, Tectonic and Sediment (Offshore Section)							
Project phase	Construction										
Impact	Mechanism	Locations	Criteria/ Impact Properties							SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
	• Backfilling and reinstatement at landfall locations • Intervention techniques for normalization of free span										
Potential activation of sediments pollution	• Accidental leakage of fuel from ships/vessels • Accidental escape of sanitary waste from ships/vessels • Accidental leakage of fuels, lubricants and chemicals at landfall sites	• All sediments along the offshore pipelines • The near coast areas at Landfall locations	0.25	1.00	0.5	0.25	0.25	0.25	0.25	3.21 (Minor)	

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9.2.5 Natural Environment

9.2.5.1 Methodology Overview

The key considerations for the assessment of impacts on biodiversity are summarised in the table below.

Table 9-30 Key Considerations for Assessment –Natural Environment

Sources of Impact/ Risk	• Onshore: ➢ Earthmoving, excavation and trenching (land take/habitat loss and fragmentation); ➢ Circulation of vehicles (collision risk and/ or disturbance of fauna species); ➢ Dust and exhaust gas emission (disturbance of species and habitat degradation); ➢ Noise generation (disturbance of species and habitat degradation); and • Offshore: ➢ Trenching/dredging, deposition and backfill (habitat loss and fragmentation); ➢ Circulation of vessels and pipelay barge (collision risk); ➢ Vessel effluents (disturbance of species and habitat degradation); ➢ Noise generation (underwater noise) (disturbance of species and habitat degradation); and ➢ Marine water and sediment pollution (disturbance of species and habitat degradation).
Potentially Impacted Resources and Receptors	• Onshore Habitats: mainly areas with natural habitats, e.g. Forests or Forested Areas (Bushlands, shrublands, macquis). Agricultural habitats to a much lesser degree. • Terrestrial fauna species: Species protected under national law, international conventions and globally or nationally threatened (CR/EN/VU) or restricted range, congregatory and migratory; • Offshore habitats: *Posidonia oceanica* meadows, benthic communities; and • Marine Species: Marine mammals and sea turtles, *Posidonia oceanica*, fish species and benthic species protected under national law, european regulations and european & international convention.
Particular Baseline Conditions that Potentially Influence Impacts/Risks	• Onshore: Shorelines at LF2 and LF3 with rocks and cobbles, at LF4 and F5 with sand. The terrestrial morphology varies along the route, consisting typically of mountainous or hilly natural areas (forests and forested areas) and hilly or flat areas with agricultural land; and • Offshore: Seabed morphology varying along the route. Nearshore section with *Posidonia oceanica* meadow on sand with presumably a

	weathered rock basement below some metres. From -40 m to – 2600 m there are various benthic communities and communities of muddy detritic bottoms, sandy muds, bathyal muds. Deeper than – 2600 m there are bathyal seabeds with bathypelagic ocean waters. The offshore routing takes into account and avoids all major geomorphologically complex areas likely sustaining high biodiversity along the corridors.
Project Factors that Potentially Influence Impacts/Risks	• Onshore: Specific techniques, topsoil removal, construction site management and waste management. Temporary footprint areas will be reinstated as per standard procedures; and • Offshore: Specific techniques used for trench excavations, pipelay vessel positioning and dredged sediment management. • Construction rate and duration
References	• Corresponding baseline on natural environment is provided in Section 8.5 supported by numerous Annexes (e.g. Annex 8D – Ecological status of main inland water bodies, incl. abiotic and biotic characteristics, Annex 8F – Basline study on Flora, Annex 8G – Baseline Study on Fauna, Annex 8H – Baseline study on Avifauna) • Appopriate Assessments are presented in Annex 9E • Mitigation Measures are provided in Chapter 10.2.5 • Protected Areas and ecological sensitivities Map is provided in Section 15.1.9

Prepared by: ASPROFOS, 2022.

9.2.5.2 Onshore biodiversity

9.2.5.2.1 Habitats, Vegetation and flora loss during construction phase

To minimize the impacts on the existing land use, but also to make the project's construction activities (and machinery movements) possible, a 38 meter wide working zone must be opened. Nevertheless, in sparsely vegetated forest areas (transitional woodland areas, moors and heathland) and in systematic tree crops, the working zone will decrease to 28 meters in width, aiming to mitigate impacts. In forest areas covered by lush vegetation, especially within protected areas, the working zone may be decreased even more and be limited to 22 meters, as described in detail in Section 6.4.2. Moreover, it may become necessary for the working zone to be expanded at the point where the project crosses with infrastructure or other points for safety reasons or on other administrative grounds.

The following table shows the estimated areas of natural vegetation temporarily cleared for construction purposes along the pipeline axis. The types of vegetation considered are based on Corine Land Cover database.

It is noted that habitats/ vegetation loss from the construction and operation of permanent facilities is presented in Section 9.3.5.

Table 9-31 Vegetation types temporary cleared along the working strip.

Ecosystem Type	Area (1000 m²)	%
Sparsely vegetated areas	1,90	0,01
Floodplain forests (Riparian forest/Fluvial forest)*	12,32	0,08
Inland and coastal saline marshes	25,97	0,16
Mediterranean coniferous forests	71,95	0,44
Fruit trees and berry plantations	158,68	0,97
Mediterranean deciduous forests	503,68	3,09
Mixed Forest	536,79	3,30
Transitional woodland-shrub	708,36	4,35
Grasslands	721,47	4,43
Arable land	1359,27	8,35
Complex cultivation patterns	1768,48	10,86
Agricultural areas with a significant cover of natural vegetation (Agroforestry areas)	2204,91	13,55
Olive groves	2237,12	13,74
Sclerophyllous vegetation	2892,19	17,77
Permanent crops	3073,92	18,89
Total area	16277,02	100,00
*The above listed area of affected floodplain forests (riparian forest/fluvial forest) is conservative, as it doesn't take into consideration the application of trenchless techniques in water bodies. The exact area of the affected floodplain forests (riparian forest/fluvial forest) will be estimated when the detail design of trenchless techniques will be finalized. As a result, the total area of ecosystem types affected will be less.		

Prepared by: ASPROFOS, 2022. Based on CLC, 2018.

As indicated in Table 9-31, almost 70% of the working strip is occupied by annual crops (52%) olive groves (14%) or other agricultural areas. Semi-natural and natural areas occupy the rest 30%, most of which is characterized by the typical sclerophyllous vegetation of Greece (macquis vegetation) (18%); Forests occupy, in total, 7%.

In terms of sensitivity, sensitive ecosystems are considered those which are ecologically sensitive and/ or rare in the landscape/broader area. These areas also have significant biodiversity values and provide many habitat features required by threatened and endangered plant and animal species.[9]

Sensitivity of an ecosystem depends mainly on the homeostasis of it. Homeostasis is the ability of ecological systems to maintain stable system properties despite perturbations. Properties of systems reflect the system as a whole and are not solely determined by the identity of the species in the system. Homeostasis is a common trait of complex systems. Negative feedbacks in these complex systems counteract the effect of perturbations that would otherwise cause the system to change. Resource constraints are a strong mechanism for inducing negative feedbacks. As a resource is overutilized in an ecological system, processes such as increased death rates and decreased birth rates dampen population increases, resulting in homeostasis. Resource constraints are not necessarily affected by changes in the environment and therefore may still operate even when other abiotic conditions change.[10] Based on the general characteristics of the identified ecosystems (see Table 9-31), the following may be noted:

Floodplain forests (Riparian forest/Fluvial forest) include benches along streams, gullies with intermittent or permanent creeks and fringes of lakes and ponds and sites with significant seepage. Such riparian ecosystems support also a wide rage of biodiversity and as such are considered very sensitive. **Mediterranean deciduous forests** are dominated by oak species and are present mainly in flat areas. They are typically very shrubby and provide important habitat for many birds, reptiles and mammals. Both ecosystem types have great homeostasis potential but need quite a long time to be reinstated naturally and are considered as rare in Greece. They are assessed as of very high sensitivity.

Mediterranean coniferous forests and **Mixed forests** are quite similar to the deciduous ones (in terms of ecological services) but occupy areas of more intense morphology; most importantly are considered very typical in Greece and/ or in the study area. **Sclerophyllous vegetation** and **Transitional woodland-shrub** are the most typical natural ecosystem type in the study area and Greece, in general. They consist mainly by macquis vegetation (evergreen broadleaved bushes) in various vegetation cover densities. These ecosystem types are assessed as of high sensitivity.

Grassland ecosystems are dominated by grass species and limited bushes or scattered trees. Large areas of grasslands have been lost to agricultural development. **Fruit trees and berry plantations**, **Olive**

[9] Government of British Columbia, Canada, 2003 - Sensitive Ecosystems Inventory oftThe Bella Vista – Goose Lake Range. Retrieved from gov.bc.ca, on 17/04/2022.
[10] **Invalid source specified.**

groves, and **Agroforestry areas** (Land principally occupied by agriculture, with significant areas of natural vegetation) consistute agricultural ecosystem types which although they are characterized by the anthropogenic pressures of cultivation they do support significant numbers of avifauna, reptiles and mammals species (in species and population numbers). Nevertheless, all these ecosystem types are very well adapted to anthropogenic presence and activity. These ecosystem types are assessed as of medium sensitivity.

Inland and coastal saline marshes are very important because of their natural rarity in Greece and because they support a wide diversity of organisms including food, shelter, and breeding sites for ducks, songbirds, fish, amphibian, and invertebrate species. However, the working strip does not include core areas of such ecosystems; that is the working strip goes at the edges of these areas which are mostly more related to agricultural lands, than marshlands and/ or wetlands. **Sparsely vegetated ecosystems** occur on sites where exposed bedrock or rocks limit the places where vegetation can grow. They include cliffs, rock outcrops and talus slopes with sparse shrub or grass/herb cover. Many of these ecosystems have coarse or shallow soils making them sensitive to disturbance. They provide important habitat for bats, snakes, and birds of prey nests. **Arable land**, **Complex cultivation patterns** and **Permanent crops** consistute agricultural ecosystem types which although do support some avifauna, reptiles and mammals (rodents) species they are very well adapted to the anthropogenic pressures. These ecosystem types are assessed as of low sensitivity.

Table 9-32 summarizes the sensitivity classification of the identified within the working strip ecosystem types and the criteria for their classification.

Table 9-32 Sensitivity of Ecosystem Types identified within the working strip.

Sensitivity	Criteria	Identified Ecosystem Types within the Working Strip
Very High	An ecosystem type of great rarity in national and/ or bioregional level supporting a wide diversity of organisms and ecological services (e.g. food, shelter, and breeding sites) for fauna species. These areas are the result of various abiotic parameters (e.g. morphology, hydrology, climate) interaction with limited, if any human intervention. They are characterized by a complex dynamic equilibrium between interactions of biotic and abiotic natural parameters which is very easily disturbed but very difficult mitigated. Although, the have great homeostasis potential, their integrity is very important for conservation purposes. They usually lay within an institutionalized protected area or are, on their own, characterized as protected area.	• Floodplain forests (Riparian forest/Fluvial forest) • Mediterranean deciduous forests

Sensitivity	Criteria	Identified Ecosystem Types within the Working Strip
High	An ecosystem of limited presence in national level, but more abudant in bioregional level supporting a wide diversity of organisms and ecological services (e.g. food, shelter, breeding, etc). Ecological sevices and sustainable mandmade development coexist in a dynamic balanced state. This equilibrium is easily disrupted but given the existing presence of human interventions changes are more easily mitigated. Their integrity is important for conservation purposes and their homeostasis potential could be affected, but not severily.	• Inland and coastal saline marshes • Mediterranean coniferous forests • Mixed forests • Sclerophyllous vegetation • Transitional woodland-shrub
Medium	Typical ecosystems in national level supporting a small diversity of organisms, but fully covering all of their ecological needs (e.g. food, shelter, breeding, etc). There is a dunamic equilibrium between natural environment and human development which is relevant easy to maintain. Homeostasis potential is great either due to long-term interactions between biodiversity (fauna and flora) and human development or given the adaptability of the biodiversity species present. They are still considered important for conservation purposes.	• Fruit trees and berry plantations • Olive groves • Agroforestry areas • Grasslands
Low	A very typical ecosystem, supporting small number of organisms, but fully covering their ecological needs (e.g. food, shelter, breeding, etc). Established dynamic equilibrium between natural environment and anthropogenic activities (e.g. agricultural activities) is very easily maintained through homeostasis mechanisms or species adaptability. They are of low importance for conservation purposes and/ or very easily reinstated.	• Sparsely vegetated areas • Arable land • Complex cultivation patterns • Permanent crops
Very low	Areas completely lost of their ecological services capacity, consisted either entirely by artificial areas and/ or degraded sites which support very limited species (number of species and population).	None identified within the working strip

Prepared by: ASPROFOS, 2022.

Key factor determining the duration of the habitats/ vegetation loss is the time required to complete construction activities in a specific area and restore vegetation to its former condition. Along the working strip, construction activities usually take up to 3 months per construction front to be completed; construction rates depend on morphology in the area and vary between 200 m and 600 m/day (Chapter 6). On areas of low, annual, vegetation, restoration is considered to be immediate, as it will only require demobilizing construction equipment, cleaning working sites and returning topsoil to the working strip. This way, every practice and use that was in place prior to construction activities for the project would also apply immediately after topsoil reinstatement. It is clarified that even in case of agricultural areas (i.e. mainly tree crops, and to a smaller extent annual crops), reinstatement is quite fast. Usually, the planting scheme is quite wide (5x5 or 6x6), as such, few planting rows are affected whilst mitigation measures usually accelerate reinstatement (e.g. compensation for replanting of saplings instead of sowing seeds). On the contrary, in dense semi-natural and natural areas, reinstatement will take place with natural or artificial reforestation, when needed, in the area including local species. For shrublands, reforestation is considered to take place naturally within five years. In forests, however, this reforestation will take longer, until vegetation has the same shape in order to provide the same texture to landscape.

Homeostasis, as previously discussed, allows the ecosystem to naturally restore to its former condition of dynamic equilibrium between all influencing parameters. This also includes natural vegetation and restoration of the working strip cleared for construction purposes. In most of the Mediterranean, Greek ecosystem types, natural vegetation is very typical and expected. Macquis associations (i.e. Mediterranena evergreen schlerophyllous vegetation) are characterized by strong coppicing capacity. Pines is the dominant coniferous species in Greece and more specifically P. halepensis are known for being photophyllous and their natural rehabilitation potential (given proper protection of reforestations). Deciduous or riparian forests are less easily reinstated through natural processes, or to be more accurate, take much longer to be fully and naturally reinstated. Tree crops reinstatement depends on the planting scheme and the type of tree crop (more details are provided in Section 9.2.6). Areas of annual species (agricultural or natural) and of low vegetation cover are expected to be fully reinstated either naturally (e.g. natural grasslands and sparsely vegetated areas or inland and coastal saline marshes) or through reinstatement of normal practices (e.g. cultivation practices in agricultural areas).

Impacts on habitats of european interest are assessed in the Appropriate Assessments' reports (Annex 9E). It must be noted, that such habitats could be found also outside the Natura 2000 Areas. However, none has yet to be identified during the desktop study performed for the ESIA. In order to identify habitats of european interest, outside the Natura 2000 Areas, preconstruction surveys have to be conducted, followed by implementation of site specific mitigation measures, as will be described in the Biodiversity Management Plan (see chapter 10).

Taking into account the considerations previously discussed and following the evaluation criteria presented in Section 9.1, impact assessment for construction activities on habitats, vegetation and flora species loss may be performed as follows:

Likelihood of the impact during construction works is *certain*. Due to the mechanisms inducing impact (vegetation clearance within the working strip), impact cannot be avoided.

Extent of the impact is directly related to the precise project footprint and the selected working strip. Vegetation clearance is going to be limited within the working strip and as such, it is assessed as *small.* Regardless of the land cover, the impact will be limited to the project footprint.

Intensity of the impact is linked to the ecosystem type's sensitivity, as discussed in Table 9-32. Floodplain forests (Riparian forest/Fluvial forest) and Mediterranean deciduous forests are assessed by *very high* intensity; Inland and coastal saline marshes, Mediterranean coniferous forests, Mixed forests, Sclerophyllous vegetation and Transitional woodland-shrub are assessed by *high* intensity; Grasslands Agroforestry areas (Land principally occupied by agriculture, with significant areas of natural vegetation) and tree cultivations are assessed by *medium* intensity; Sparsely vegetated areas and annual cultivations are assessed by *low* intensity.

The *duration* of the impact is associated with the period required for the restoration of vegetation prior to construction and, in particular, of the work zone's vegetation. More specifically, for areas of annual cultivations, grasslands and inland and coastal saline marshes, the duration of the impact is assessed as *instant* as it is not expected to go beyond construction completion. In semi-natural areas (i.e. Agroforestry areas, Sparsely vegetated areas, Sclerophyllous vegetation, Transitional woodland-shrub) and areas of systematic arboriculture (i.e. Fruit trees and berry plantations, Olive groves), the restoration of existing vegetation is expected to cover a period of 3 to 10 years; as such, duration is assessed as *medium-term*. Finally, in forests with lush vegetation (i.e. Mediterranean coniferous forests, Mediterranean deciduous forests, Mixed forests, and Floodplain forests) the natural restoration is expected to last from 10 to 15 years, as such, duration is assessed as *long-term*.

With regard to *reversibility*, it is assessed that by applying the appropriate mitigation measures per category of semi-natural and natural ecosystem types the impact footprint is *minimized* and limited to the working zone's width. Especially for the low sensitivity ecosystem types and the grasslands impact is essentially *reversed* (see Chapter 10).

Regarding *cumulative* action, no other projects or conditions were identified that could potentially interact with the Project and the loss of vegetation or habitats. However, for densly vegetated areas, i.e. forests and schlerophyllous vegetation, potential cumulative effect cannot be completely discarded; hence, cumulative action is assessed as *rare* for these types. For other types of ecosystems, the cumulative character of this impact is considered as *impossible*.

The *Transboundary Character* is *impossible* considering the nature of the potential impact.

Based on the above and the criteria presented in Section 9.1, habitats/ vegetation loss for areas classified as:

- Sparsely vegetated areas, Inland and coastal saline marshes, Mediterranean coniferous forests, Mixed Forest, Transitional woodland-shrub, Grasslands, Sclerophyllous vegetation, **SEI is considered as Minor**.
- Mediterranean deciduous forests, Floodplain forests (Riparian forest/Fluvial forest), **SEI is considered as Moderate**.
- Fruit trees and berry plantations, Olive groves, Agroforestry areas, **SEI is considered as Minor**.
- Annual cultivations (Arable land, Complex cultivation patterns, Permanent crops), **SEI is considered as Neglible**.

9.2.5.2.2 Fauna Habitat fragmentation

Fauna species habitat fragmentation is distinguished between terrestrial mammal species and freshwater species. Habitat fragmenetation for avifauna is not considered as reasonable, given the linear character of the project and the availability of habitats for most avifauna species. Impacts on avifauna species are assessed in Section 9.2.5.2.4.

9.2.5.2.2.1 Terrestrial Mammal species

Habitat fragmentation for terrestrial species may occur during construction (and partially maintained during operation) as result of the vegetation clearance to be performed along the pipeline working strip. The nature and effects of this fragmentation will vary depending on the type of vegetation cleared, as well as on the fauna potentially affected. Such impacts may be induced along the project footprint at sensitive areas (not along the entire route) for the biodiversity and in areas where the breach of isolation and the subsequent edge effects are most likely to affect fauna species.

Habitats fragmentation and disturbance of fauna species depends mainly on the duration of the construction in a specific location. Construction rate depends on the difficulties imposed by the baseline conditions, e.g. morphology, geotechnical issues, land uses, etc. Based on experience from other similar projects in dimensions constructed in Greece (i.e. with similar baseline conditions) the indicative construction rates (in terms of project progress) are:

- 400 m/day, in agricultural areas (in plain areas, 600 m/ day may be achieved)
- 200 m/day, in hilly or intense relief areas, of tree crops or natural vegetation
- 100 m/day, in mountainous areas, more often than not covered with natural vegetation (in rocky areas, 75 m/day or even smaller may be constructed).
- In special crossings, the rate is decreased, as per site requirements and construction method.

Another important factor is the duration of the fauna habitats' loss. This is based on the homeostasis of the habitat (ecosystem) which was discussed in the previous section (Section 9.2.5.2.1).

Based on the baseline data, the only fauna species that are anticipated to be significantly impacted are the jackal (*Canis aureus*) and the wolf (*Canis lupus*). Other mammals are less sensitive to habitat fragmentation or are not present in the study area.

- Golden jackal (*Canis aureus*)

The jackal can be potentially present in valleys, beside rivers and their tributaries, canals and lakes. Within the study area, such ecosystems can be found in Floodplaid forests, Rivers, Lakes, Agroforestry areas, Transitional woodland-shrubland, at Peloponesse section (for details see Section 8.5).

Table 9-33 Sensitive areas for the golden jackal.

Indicative location along project footprint – KPs of CCS1	Ecosystem type	Crossed?	Length crossed or Distance to the project (approx. in m)	Duration (indicative days)*
KP 0 – KP 30	Mosaic of natural areas (i.e. Sclerophyllous vegetation, Transitional woodland-shrub and Mixed forests) and agricultural areas (i.e. Arable land, Complex cultivation patterns and Olive groves)	Yes	20000	100
KP 94 – KP 97	Transitional woodland-shrub	Yes	500	3
KP 108 – KP 112	Transitional woodland-shrub	Yes	320	2
KP 117 - KP 123	Transitional woodland-shrub	Yes	2800	14
KP 125 – KP 127	Transitional woodland-shrub	No	750	n/a
KP 133 – KP 135	Transitional woodland-shrub	Yes	600	3
KP 138 – KP 145	Transitional woodland-shrub	Yes	1900	10
KP 1 – KP 4 (Megalopoli Branch)	Transitional woodland-shrub	Yes	3200	16
KP 162 – 165	Transitional woodland-shrub	Yes	1900	10
KP 167 – KP 185	Transitional woodland-shrub	Yes	4000	20
KP 187 – KP 203	Transitional woodland-shrub	Yes	7200	36
KP 204 – KP 205	Floodplain forests (Riparian forest/Fluvial forest)	Yes	400	2

Indicative location along project footprint – KPs of CCS1	Ecosystem type	Crossed?	Length crossed or Distance to the project (approx. in m)	Duration (indicative days)*
KP 216 – KP 218	Transitional woodland-shrub	Yes	200	1
KP 223 – KP 225	Transitional woodland-shrub	No	600	n/a
KP 233 – KP 240	Transitional woodland-shrub	Yes	2200	11
KP 246	Floodplain forests (Riparian forest/Fluvial forest)	Yes	300	2
KP 258 – KP 262	Transitional woodland-shrub	Yes	2600	13
KP 263 – KP 266	Transitional woodland-shrub	No	850	n/a
KP 274 – KP 278	Transitional woodland-shrub	Yes	1800	9
KP 280 – KP 281	Transitional woodland-shrub	Yes	100	1
* a construction rate of 200 m/day is assumed for all areas listed. n/a: not available. The project does not cross the specific area whilst the distance is significant enough, allowing to assume that no habitat fragmentation may be induced.				

Prepared by: ASPROFOS, 2022.

The jackal is known to be adaptable species, whenever the disturbance is temporary and short term and it does not change habitat quality and food availability. When the disturbance is long term, the species is expected to migrate from the area.

The jackal is not considered a priority species for the European Union and therefore it is listed on Annex V of the EU Habitats Directive. It is assessed as species of Least Concern by the IUCN and listed on Appendix III of CITES, showing a global increasing population trend. On the contrary, in Greece a recent view of the species status in the Red Data Book for Greek Vertebrates declares it as “Endangered” that is a taxon considered to be facing a very high risk of extinction in the wild due to the decline of its population and the fragmentation of its habitat.

Based on Table 9-33, the largest duration of construction activities performed on one given area (KP 0 – KP 30) is approximately 100 days during which intense construction activities, e.g. trenching and backfilling, may take please. However, these activities are expected to have an intermittent character; similarily, other activities of lesser nuisance (e.g. marking of working strip, reinstatement inspection, etc) may require up to one (1) year but are also of intermittent character. This is also assumed for Floodplain forests (Riparian forest/Fluvial forest) where special crossing techniques shall be applied. The preservation and restoration of safe and high productivity habitat is first priority for jackal conservation.

Taking into account the considerations previously discussed and following evaluation criteria presented in Section 9.1, impact assessment for construction activities on *Canis aureus* habitat loss may be assessed as follows: The *Likelihood* of the impact is considered certain. The *Extent* of the impact will be localised at the Project footprint thus is considered *small;* additionally, the pipeline length through areas where jackal habitat may be present (and consequently affected) is quite limited (approx. 30 km, in total). The *Intensity* of the impact is considered high. The Project will have an impact on the habitat during the construction phase, therefore, the *duration* is *medium-term* (see Section 9.2.5.2.1). Regarding *Reversibility*, impacts are mostly *reversible* after the implementation of the mitigation measures. The *Cumulative Action* of the impact is considered *rare* assuming unlikely the possibility that impacts from the EastMed Pipeline Project and from other projects or activities in the area can have a cumulative effect. The *Transboundary Character* is *impossible* considering the nature of the potential impact. Based on the considerations above, the impacts are **Minor.**

- Wolf (*Canis lupus*)

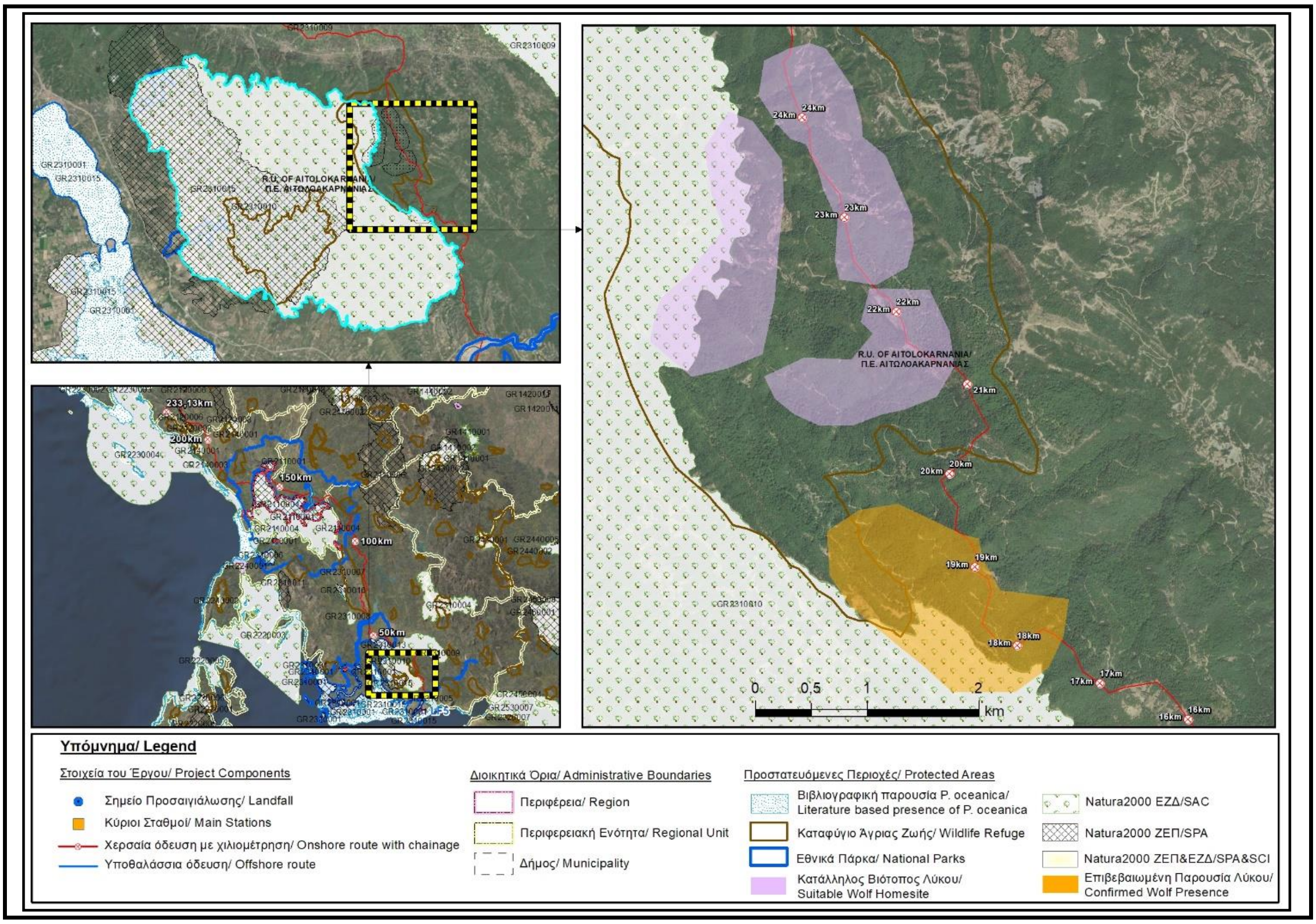
The wolf is more sensitive to habitat fragmentation.

Wolves are characterized by ecological plasticity due to their high mobility, relatively high reproduction potential and the opportunistic nature of their foraging techniques (Carroll et al., 1999). Yet, like any other mammal species, they need two basic elements to survive, reproduce and eventually to gradually disperse away from their territories: a) Safe reproduction areas where the years' offspring (wolf pups) are protected from natural predators, humans and dogs; b) Adequate food supply especially during the reproduction period. Wolves in Greece may move even 50 km per day while seeking prey, although daily distance travelled averages 12-25 km depending on wolf's sex and season (Iliopoulos, 2010). High mobility permits wolves to easily overcome movement obstacles like artificial lakes, or select the most suitable sites to cross rivers or other natural or human barriers as observed recently with the use of satellite telemetry (Iliopoulos et al, 2005, 2008, 2009, 2010, 2010b) . As a result, although the Project will have minimal impact on wolf regular movements, foraging and dispersal, the most stationary phase of the wolf pack annual cycle, that is the breeding period, could be affected from construction and operation phase.

The crucial factors regarding selection of home sites in wolves are avoidance of even low traffic forest roads, proximity to water sources and selection of less fragmented forest patches. Moreover, wolves are generally sensitive to disturbance close to home sites: even low use forest roads close to home sites or even trails may cause wolves to abandon an area if used by humans on foot during recreation activities and hunting, independently from vehicle use . The degree at which human disturbance may influence wolf home sites probably varies according to the environmental context: if a particular habitat is highly attractive, wolves can tolerate disturbance by humans, at least within some limits (Paquet et al. 1996). However, when the degree of disturbance increases wolves tend to ignore any favourable characteristic of the home site and abandon the area. Wolves generally avoid forest clear cuts and roads, but do tolerate intense disturbances, such as human presence for a short duration.

Dense forest areas unfragmented by human interventions are identified in the study area only in Mt. Arakynthos (R.U. of Aetoloakarnania). More specifically, as analyzed in the biodiversity baseline section, the wolf is present only in a small section, at Arakynthos Mountains between KP 17 to KP 25 (IP 2060 – IP2113) of the onshore pipeline, at the Western Continental Greece. This area seems to be part of the broader area of Wolve presence of Natura2000 site GR2310010 (*Mt Arakynthos and Llisoura Streights*) and connected to the wolve's habitats there. According to the Appropriate Assessment for Natura 2000 Area GR2310010, *Canis lupus* is sensitive to newly inducted disturbance in previously undisturbed areas, especially in relation to their homesite selection and can be temporarily displaced from the area. Permanent consequences can be them abandoning a previously highly suitable and traditionally selected area even if the disturbance ceases. The most crucial parameters that affect abandonment of homesites are the severity and duration of the disturbance. If time constraints are not met and wolves get disturbed during sensitive periods (April to August) they may abandon their litters/denning sites or try to move them elsewhere, risking injury and death of the pups.

Data collected during field works for the corresponding AA (see Annex 9E) were validated during the PIER Disclosure Meetings held in January 2022. These are visualized in Figure 9-17 and tabulated in Table 9-34.



Prepared by: ASPROFOS, 2022.

Figure 9-17 Wolf's presence in Mt. Arakynthos area.

Table 9-34 Sensitive areas for the Wolf.

Indicative location along project footprint – KPs of CCS2	Ecosystem type	Wolve's presence	Crossed	Length crossed or Distance to the project (approx. in m)	Duration (indicative days)*
KP 17.5 – KP 19	Mediterranean deciduous forests	Confirmed Wolf Presence	Yes	1785	18
KP 21 – KP 25	• Mediterranean deciduous forests • Mixed forests • Agroforestry areas	Suitable Wolf Homesite	Yes	3400	34

Indicative location along project footprint – KPs of CCS2	Ecosystem type	Wolve's presence	Crossed	Length crossed or Distance to the project (approx. in m)	Duration (indicative days)*
KP 22 – KP 24	• Mediterranean deciduous forests • Agroforestry areas	Suitable Wolf Homesite	No	300	
* a construction rate of 100 m/day is assumed for all areas listed.					

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During construction there could be some disturbance to the wolf population. However, the construction works, in each individual section, will be temporary in nature. The overall construction duration, including all sequential activities from site preparation up to trench backfilling in most of these areas will last up to about 1 year. However, construction front will remain active in the same location for no more than three (3) months, approximately. The area is classified as mountainous and as such, construction duration is assumed to be 100 m/day. Based on Table 9-34, the largest duration of construction activities performed on one given area (KP 21 – KP 25) is approximately 35 days of constant presence in the area including trenching and backfilling, for intense construction activities.

The wolf (*Canis lupus*) that became extinct in many countries of Central and Western Europe, is on the list of protected species under the Bern convention and a priority species below the 39° parallel in Greece, listed in Annex II of the Habitat's Directive. In Greece the wolf that was considered as a pest species until 1991, became extinct in the Peloponese in the late 1930's and has lost 30% of its former range during the last 20 years in the continental land. Since then, the species is protected by the Forest Code on Wild Fauna. The total Greek population is now roughly estimated to be at least between 500 and 700 individuals and its distribution range includes the central and northern mountainous and semi-mountainous parts of continental Greece. The main threats for the species are human-caused mortality, limited food resource availability, range fragmentation, reduction of ecological corridors, and lack of public support related to low awareness levels and to the negative perception of the wolf by some population groups (mountainous populations, hunters, livestock breeders etc.). Another parameter that was originally considered to be a threat, genetic pollution, is finally not so important, as results from dedicated studies. [11]

Taking into account the considerations previously discussed and following evaluation criteria presented in Section 9.1, impact assessment for construction activities on *Canis lupus* habitat loss

[11] Conservation of Canis lupus and its habitats in Central Greece (https://webgate.ec.europa.eu/life)

may be assessed as follows: The *Likelihood* of the impact is considered *certain*. The *Extent* of the impact will be localised at the Project footprint thus is considered *small;* additionally, the pipeline length through areas where wolf's habitat may be present (and consequently affected) is quite limited (approx. 5.5 km, in total). The *Intensity* of the impact is considered *very high*. The Project will have an impact on the habitat during the construction phase, therefore, the *Duration* is *medium-term* (see Section 9.2.5.2.1). Regarding *Reversibility*, impacts are mostly reversible, but adopting a conservative approach, are assessed as *minimizable* (see Chapter 10). The *Cumulative Action* of the impact is considered *rare* assuming unlikely the possibility that impacts from the EastMed Pipeline Project and from other projects or activities in the area can have a cumulative effect. The *Transboundary Character* is *impossible* considering the nature of the potential impact. Based on the considerations above, the impacts are **Minor to Moderate.**

9.2.5.2.2.2 Freshwater species

Habitat fragmentation for freshwater species may occur during construction (and partially maintained during operation) as result of the vegetation clearance in the riverbanks, potential modification of river bed itself and modification of the water flow regime.

Such impacts may be induced along the project footprint at river and shore crossings sensitive areas (not along the entire) for freshwater species.

The nature and effects of this fragmentation will vary depending on the following elements:

- Type of vegetation to be cleared (ecosystem at the river banks). Annual cultivations and in general shallow rooted species will be fully reinstated upon construction, whilst they are abundant along river banks within the study area. Details on habitat/ vegetation loss is provided in Section 9.2.5.2.1.
- Crossing construction method. Open cut includes construction mechanisms that impact morphological characteristics. It may also involve temporary modification of the water flow rate and route; nevertheless, open cut is a fast and cost-efficient construction measure, applicable for all location (in terms of geotechnical and constructability considerations). Trenchless methods do not affect the riparian system, but are strongly dependant to site geotechnical conditions (in terms of constructability) and are much more expensive and they also require more time and space to be completed.
- Duration of river crossing. Duration depends on the width and geotechnical conditions of the specific site and also by the construction method. Typically, for open cut river crossings, 2 months are adequate; for trenchless crossings, 3 months are considered typical for most case.

- Hydrological conditions of the water body at the time of construction. Depending on the exact scheduling of river crossing construction, flow rate and water quantity vary. For example, many rivers in Greece are of torrential character and are completely dry during summer.

Details on river crossing techniques are provided in Chapter 6 and Section 9.2.13.

Another important factor is the duration of the fauna habitats' loss. This is based on the homeostasis of the habitat (ecosystem) which was discussed in the previous section (Section 9.2.5.2.1).

Based on the baseline data, the freshwater species that are anticipated to be significantly impacted are the otter (*Lutra lutra*) and fishfauna.

- Otter (*Lutra lutra*)

It is anticipated that limited disturbance to freshwater mammal species, i.e. otter (*Lutra lutra*) shall be potentially induced. The distribution and the protection status is presented in Section 8.5. Specifically, otter is included in Annexes II and IV of EU Habitats Directive, Annex II of the Bern Convention and Annex I of CITES. Based on IUCN it is considered Near Threatened globally and Endangered in Greece.

The otter lives in wetlands. It is found mainly in rivers, streams, lakes, deltaic systems, estuaries and lagoons, as well as in irrigated areas (irrigation canals, rice fields) and in drainage canals and ditches. Otter has semi-aquatic habits. It swims with great comfort and ability, however it spends much of her time on land. It feeds mainly on fish as well as other aquatic animals (crabs, crayfish, frogs, water snakes, small mammals, birds, etc.). Its nesting area is always on land, but usually close to the water. Indicatively, in river habitats, where their living space is linear, the territory of an animal can extend up to 40 km along a riverbed, always depending on the availability of existing food. In Greece, in the lowlands and during the summer months, as many rivers dry up and most small wetlands dry up, otters move to less suitable habitats, such as coastal areas, canals, etc. The presence of fresh water is always necessary for the species'presence in an area. Table 9-35 summarizes the areas where otter may be present; these areas resulted from overlaying ecosystem types as identified by the ESIA team and the species distribution map of the Red Data Book for Greece as well as the fieldworks performed by HCMR in selected freshwater bodies (see Annex 8D).

Table 9-35 Sensitive areas for the otter.

Indicative location along project footprint – KPs	Ecosystem type of broader area	Engaged Water body	River crossing method	Total duration (indicative months)*	Potential for presence in wider river segment*	Habitat Suitability at surveyed site*
KP 103 (CCS1)	• Sclerophyllous vegetation	R. Evrotas	Open cut	2	Low	Suitable
KP 110 (CCS1)	• Agroforestry areas	R. Kardari (R. Evrotas tributary)	Open cut	2	n/a	n/a
KP 145 (CCS1)	• Agroforestry areas	Xerilas	Open cut	2	n/a	n/a
KP 202 (CCS1)	• Floodplain forests (Riparian forest/Fluvial forest)	R. Alfios	Trenchless	3	Confirmed	Very Suitable
KP 204 (CCS1)	• Floodplain forests (Riparian forest/Fluvial forest)	R. Erimanthos	Open cut	2	n/a	n/a
KP 248 (CCS1)	• Floodplain forests (Riparian forest/Fluvial forest)	R. Ladonas	Open cut	2	Confirmed	Very Suitable
KP 264 (CCS1)	• Agroforestry areas	R. Pinios	Open cut	2	High	Suitable
LF5	• Inland and coastal saline marshes	Landfall Site at R.U. of Aetoloakarnania (North coast of Patraikos Gulf)	Open cut	6	n/a	n/a
KP 9 (CCS2)	• Floodplain forests (Riparian forest/Fluvial forest)	R. Evinos	Trenchless	3	n/a	n/a
KP 37 (CCS2)	• Permanent crops	Lakes Trichonida and Lisimachia connecting channel	Trenchless	3	High	Suitable
KP 57 (CCS2)	• Arable land	R. Acheloos	Trenchless	3	Low	Suitable-Degraded
KP 105 (CCS2)	• Agroforestry areas	R. Amphilochia	Open cut	2	n/a	n/a
KP 125 (CCS2) & KP 127 (CCS2)	• Olive groves & • Fruit trees and berry plantations	R. Mandani	Open cut	2	n/a	n/a
KP 129 (CCS2)	• Fruit trees and berry plantations	R. Dipotamos	Open cut	2	Confirmed	Suitable

Indicative location along project footprint – KPs	Ecosystem type of broader area	Engaged Water body	River crossing method	Total duration (indicative months)*	Potential for presence in wider river segment*	Habitat Suitability at surveyed site*
KP 135 (CCS2)	• Complex cultivation patterns	R. Aracthos	Trenchless	3	Confirmed	Suitable
KP 160 (CCS2)	• Complex cultivation patterns • Inland and coastal saline marshes • Permanent crops	R. Louros	Trenchless	3	Confirmed	Very Suitable
KP 177 (CCS2)	• Complex cultivation patterns	R. Arethoua	Open cut	2	n/a	n/a
KP 196 (CCS2)	• Permanent crops	R. Acheron	Trenchless	3	High	Suitable
KP 199 (CCS2)	• Permanent crops	Kokitos River (Vouvos) - Irrigation channel (Tributary of Acheronta)	Open cut	2	High	Suitable

* as per HCMR. Details are provided in Annex 8D
n/a: not available

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Based on the work of Hellenic Zoological Society[12], the most significant problem for Otter is the destruction and degradation of wetland habitats. In particular, the drainage of wetlands, the destruction of riparian vegetation (eg burning of reeds, cutting trees, deforestation, etc.), the negative effects on their hydrological status (water pumping, etc.), hydroelectric dams (large or even small), river and stream alignment projects, are serious threats, which intensify in recent years and lead to the contraction of the spread of this species in Greece. In the long run, the effects of climate change, and in particular prolonged droughts, may have serious implications for Otter habitats. Also, water pollution with toxic and residual pollutants (from crop waste and leachate) is a potentially significant risk to the population of Otter, although in Greece, previous studies have not shown high concentrations of such hazardous pollutants (PCBs, Dieldrin, DDT etc). Indirectly, the non-toxic water pollution has a negative effect, which is associated with eutrophication phenomena in Greek wetlands and can lead to the reduction of fish and therefore the food of Otters. Intensive and / or

[12] https://icgf.myspecies.info/content/lutra-lutra

illegal fishing poses a similar problem. Finally, a smaller problem (although locally significant) is accidental mortality from fishing gear or passing cars on the roads. Killing by hunters is usually accidental. Other pressures include destruction of the riparian vegetation, sand extractions, drainage and embankment (rubble) of wetlands, land improvement and flood protection works, land reclamation.

The impacts could occur in water bodies where otter is present. Table 9-35 presents the preliminary identified areas of potential otter presence, but preconstruction surveys will take place to verify and/ or identify new sites hosting/ supporting otter. The species might temporarily stop using the riparian habitats affected by construction especially in case of open-cut techniques and even in case of trenchless techniques, depending on the distance to riparian vegetation.

Taking into account the considerations previously discussed and following evaluation criteria presented in Section9.1, impact assessment for construction activities on *Lutra lutra* habitat loss may be assessed as follows: The *Likelihood* of the impact is considered *certain*; however, this is conservative, given that presence of otter is not verified in the specific water bodies crossing points. The *Extent* of the impact will be localised at the Project footprint thus is considered *small*. The *Intensity* of the impact is considered *high*. The Project will have an impact on the habitat during the construction phase, therefore, the *Duration* is *medium-term*. Regarding *Reversibility*, impacts are in part *reversible* after the implementation of mitigation measures. The *Cumulative Action* of the impact is considered *rare* assuming unlikely the possibility that impacts from the EastMed Pipeline Project and from other projects or activities in the area can have a cumulative effect. The *Transboundary Character* is *impossible* considering the nature of the potential impact. Based on the considerations above, the impacts are **Minor.**

- Fishfauna

Table 9-36 summarizes the areas where fishfauna species considered globally or nationally threatened (CR/EN/VU) may be present; these areas resulted from available literature information (mainly the Red Data Book for Greece) as well as the fieldworks performed by HCMR in selected freshwater bodies (see Annex 8D). It is noted that for all these species, sensitive ecological period is the one during which spawining takes place; nothwithstanding that each species have different spawning period, for most freshwater species May is considered the most sensitive period.

Table 9-36 Threatened fishfauna species potential presence.

Indicative location along project footprint – KPs	Engaged Water body	River crossing method	Freshwater fish species potentially present
KP 103 (CCS1)	R. Evrotas	Open cut	• Anguilla anguilla • Pelasgus laconicus • Squalius keadicus • Tropidophoxinellus spartiaticus
KP 110 (CCS1)	R. Kardari (R. Evrotas tributary)	Open cut	• Pelasgus laconicus • Squalius keadicus • Tropidophoxinellus spartiaticus
KP 202 (CCS1)	R. Alfios	Trenchless	• Barbus peloponnesius • Pelasgus laconicus • Squalius peloponnensis • Valencia letourneuxi
KP 248 (CCS1)	R. Ladonas	Open cut	• Barbus peloponnesius • Salaria fluviatilis • Squalius peloponnensis • Telestes pleurobipunctatus • Tropidophoxinellus hellenicus
KP 264 (CCS1)	R. Pinios	Open cut	• Carassius gibelio • Salaria fluviatilis • Squalius peloponnensis • Valencia letourneuxi
KP 9 (CCS2)	R. Evinos	Trenchless	• Barbus peloponnesius • Luciobarbus albanicus • Mugilidae sp • Salaria fluviatilis
KP 37 (CCS2)	Lakes Trichonida and Lisimachia connecting channel	Trenchless	• Economidichthys trichonis • Gambusia holbrooki • Gobiidae sp • Luciobarbus albanicus • Scardinius acarnanicus
KP 57 (CCS2)	R. Acheloos	Trenchless	• Luciobarbus albanicus • Rutilus panosi • Valencia letourneuxi
KP 129 (CCS2)	R. Dipotamos	Open cut	• Atherina boyeri • Mugil cephalus • Mugilidae sp.
KP 135 (CCS2)	R. Aracthos	Trenchless	• Luciobarbus albanicus

Indicative location along project footprint – KPs	Engaged Water body	River crossing method	Freshwater fish species potentially present
			• Mugilidae sp • Valencia letourneuxi
KP 160 (CCS2)	R. Louros	Trenchless	• Anguilla anguilla • Cobitis arachthosensis • Cobitis hellenica • Caspiomyzon hellenicus (Eudontomyzon hellenicus) • Economidichthys pygmaeus • Gambusia holbrooki • Pelasgus thesproticus • Valencia letourneuxi
KP 196 (CCS2)	R. Acheron	Trenchless	• Anguilla anguilla • Knipowitschia milleri • Perasgus thesproticus • Telestes pleurobipunctatus • Valencia letourneuxi
KP 199 (CCS2)	Kokitos River (Vouvos) - Irrigation channel (Tributary of Acheronta)	Open cut	• Anguilla anguilla • Knipowitschia milleri • Perasgus thesproticus • Telestes pleurobipunctatus • Valencia letourneuxi

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Fishes habitat loss essentially refers to modification of the river bed and water regime. As such, in rivers crossed with a trenchless method, no impacts are expected.

Impacts on river morphology and hydrological regime are described in detail in Section 9.2.14. In summary, open cut methods require an open trench through the watercourse. The surface (river or stream bed) is then reinstated close to original condition after the trench is backfilled. As such, spawning locations may be affected. However, river crossing is very localized. With proper planning, construction works could avoid sensitive periods when habitat fragmentation could be imposed. In addition, all riparian characteristics will be reinstated. In more detail, habitat baseline characteristics will be gradually reinstated (see Section 9.2.5.2.1) banks morphological characteristics will be also gradually reinstated through natural hydrological mechanisms (sediments transportation, etc, see Section 9.2.13). Nevertheless, for fishfauna the riverbed topography and water regime are the critical characteristics and both will be fully reinstated to the baseline conditions after construction activities.

Open-cut technicques will have effects to fish species trying to access spawning grounds or moving between feeding resources. The impacts will be limited to those crossings that require modification of the course. Preconstruction surveys will take place at these sites to identify the fish species of conservation importance.

Taking into account the considerations previously discussed and following evaluation criteria presented in Section 9.1, impact assessment for construction activities on *fishfauna* habitat loss may be assessed as follows: The *Likelihood* of the impact is considered *certain*. The *Extent* of the impact will be localised at the Project footprint thus is considered *small*. The *Intensity* of the impact is considered *high*. The Project will have an impact on the habitat during the construction phase, therefore, the *Duration* is *short-term*. Regarding *Reversibility*, impacts are in part *preventable* after the implementation of mitigation measures (mainly careful scheduling). The *Cumulative Action* of the impact is considered *rare* assuming unlikely the possibility that impacts from the EastMed Pipeline Project and from other projects or activities in the area can have a cumulative effect. The *Transboundary Character* is *impossible* considering the nature of the potential impact. Based on the considerations above, the impacts are **Minor**.

9.2.5.2.3 Fauna species loss

The fauna species subject to loss (direct mortality, injury) are small terrestrial mammals, bats, reptiles and amphibians. It is considered that large mammals are agile enough to avoid construction activities and big enough for workforce to see them and manage them properly. Impacts on avifauna are discussed separately in Section 9.2.5.5.

9.2.5.2.3.1 Small mammals

Small mammals, like squirrels, hedgehoges etc. are subject to injuries or direct mortality by earthmoving activities. Moreover, mammals that hibernate in the ground are very sensitive in the period of their hibernation with high species loss rate in case they would be disturbed. More specifically, it is anticipated that the construction activities will have the following potential impacts:

- Direct mortality of the individuals, in case of destruction of their burrows.
- Direct mortality or injuries due to vehicle movement.
- Alterations to habitats from vegetation clearance, which would result to scarcity to food supply and/or make them more vulnerable to predators, due to the openings.

No small mammal of conservation importance according to IUCN (assessed in global and national level) was identified (e.g. *Spermophillous citelus*) (see Section 8.5). Nevertheless, given that this is based on literature review, in order to verify absence (or presence) of such species within the working strip, preconstruction surveys have to be conducted, followed by implementation of site specific mitigation measures, i.e. time restrictions in certain pipeline segments etc.

Regarding population dynamics, no records of large populations concentration within the working strip were identified during the baseline study. In any case there will be no effect on population level, because the loss will be limited to individuals, as documented through various similar projects constructed in Greece and in other countries.

What needs to be taken into consideration is that direct species mortality (due to burrows destruction or traffic) is expected but as experienced by other similar projects is very limited. What is more significant, in terms of species loss is the modification of small mammals huntability. Vegetation clearance within the working strip in many ecosystem types (but mostly on foresty, and bushlands ecosystems) could limit hiding places and increase visibility of small mammals during their movement (e.g. bushes). For example, ferrets trying to cross over the working strip (cleared from any vegetation) would be more visible to raptors and would have nowhere to avoid potential attack. Simultanuously, the same mechanism may work in favour of some species. For species such as *Microtus agrestis*, vegetation clearance could lead to increase of suitable habitats availability; alas, this still increases the species huntability.

Impact duration is related to two main factors: (i) the presence of impacts mechanisms and (ii) period required for reinstatement of vegetation/ habitat loss. It is obvious that the mechanisms shall stop immediately after construction completion, i.e. approx. 3 months per construction front or 6 months in the nearshore sections. However, vegetation loss may require more than 10 years to be fully reinstated, i.e. in forest ecosystems. Details are provided in Section 9.2.5.2.1. Most of the working strip is either agricultural lands or scelophyllous vegetation; as such, reinstatement would mostly be instant (for agricultural lands) or medium-term (for bushlands).

Biology, ecology and sensitive periods of small mammals is species' specific. For that a Critical Habitats Assessment shall be performed in order to identify potential habitats suitable for all endangered biodiversity species. This will update the baseline and inform the Biodiversity Management Plan which will specify mitigation measures per species or habitat. Typically, mating and breeding takes place in spring (April – May) so habitat/ species loss during this period would induce the most severe impact on biodiversity.

Taking into account the considerations previously discussed and following evaluation criteria presented in Section 9.1 impact assessment for construction activities on *small mammals* direct species loss may be assessed as follows: The *Likelihood* of the impact is considered *certain*. The *Extent* of the impact will be localised at the Project footprint thus is considered *small*. The *Intensity* of the impact is considered *moderate*; no species of conservation interest have been identified nor are expected (based on the RED BOOK OF THE THREATENED ANIMALS OF GREECE). Adopting a conservative but realistic approach (assuming that all affected habitats of small mammals are located within bushlands) the *Duration* is considered *medium-term*. Regarding *Reversibility*, impacts are in part *minimizable* after the implementation of mitigation measures for the minimization and / or avoidance of displacement. The *Cumulative Action* of the impact is considered *rare* assuming unlikely the possibility that impacts from the EastMed Pipeline Project and from other projects or activities in the area can have a cumulative effect. The *Transboundary Character* is *impossible* considering the nature of the potential impact. As a result the impact is considerate to be **Minor.**

9.2.5.2.3.2 Bats

Bats are mammals belonging to the order of Chiroptera. With their forelimbs adapted as wings, they are the only mammals capable of true and sustained flight. Bats winter in hibernation dens usually in caves for as much as six months. For temperate living bats, mating takes place in late summer and early autumn, births typically take place in May or June.[13]

Globally, the two most important habitats for bats are **forests and subterranean features** (i.e., caves, and mines). Although caves capture our attention as uniquely important for bats, forests are the most critical habitats for supporting local abundance and species diversity for bats at a global scale. Forests not only provide essential foraging habitats, but they also allow many bat species to roost in plant structures, such as hollows and cavities in standing and fallen trees, under bark, or in foliage. In the managed timber-production forests of Europe, Australia, and North America, historical silvicultural practices, such as removal of standing dead trees and even-aged management, have compromised forest value for bat diversity. **Agriculture** reduces bat populations through direct habitat loss and modification, as agricultural habitats present reduced foraging and roosting resources for most species. For insectivorous species, widespread use of insecticides and insect-resistant varieties of crops reduces foraging resources by reducing insect prey abundance, and can directly poison bats. Frutarian species are considered pests by the farmers. [14]

As far as threats is concerned, hunting and collecting animals (not performed in Greece) and urban development is not applicable for the investigated project. Bats that roost in caves are particularly

[13] Invalid source specified.
[14] Invalid source specified.

vulnerable to disturbance because they form large, concentrated aggregations. Large colonies of cave-roosting bats are relatively easy to locate resulting in disturbance (e.g., persecution, hunting, vandalism, etc.) or roost destruction (e.g., mineral extraction and mining). Mining and quarrying activities threaten bats by destroying subterranean habitats used for roosting as well as degrading or destroying surface habitats. Of particular concern is the global demand for limestone extraction, which typically occurs in karst regions with a high density of natural cave roosts. Bat roosts in natural caves are associated with high species richness of other cave organisms and can indicate high priority sites for biodiversity conservation in areas threatened by resource extraction. Destruction of inactive mines, either from intentional closure or renewed mining activities, is a major concern for habitat loss for bats globally (it is noted that none of these actions/ mechanisms are foreseen for the investigated project). Other threats include climate change, invasive species, pollution and transportation/ service corridors. Transportation and service corridors threaten biodiversity by serving as mortality sinks and by causing habitat loss and fragmentation. The scale and severity of the threat of roads to bats remains poorly investigated. Current evidence suggests that roads serve as a substantial source of mortality for many bat species and create barrier effects and fragmented habitats, increase levels of noise, light, and chemical pollution. These effects can lead to reduced foraging efficiency, lower reproductive success, and ultimately lower species diversity near roads.

As presented in the baseline chapter (8.5), several bat species can be found in several sections of the pipeline and especially along the edges of broadleaf deciduous woodland, riparian vegetation areas, Mediterranean and sub-Mediterranean shrublands, caves, pastures, tree cultivation fields, karst areas in low and moderate altitudes, riparian vegetation, abandoned buildings in the countryside etc. Nevertheless, based on available data[15] only two species of conservation interest (IUCN/ Greek Red List) may be present in the study area:

- *Nyctalus lasiopterus* (LC/VU), in the area of Amvrakikos Gulf (KP 100 – KP 130). The Giant Noctule hunts for its food in mixed and deciduous forests and wooded river valleys. The species is a tree-obligate species that prefers oak or beech trees, but they would also roost in pine trees if there are no other options.[16] It depends a lot on mature forests with old trees. The most important characteristics for any tree species is the cavities of their trunck where the species finds shelter in summer. Its winter shelters are probably crevices in the rocks. [17] Shelters of this kind have not yet been identified in Greece. The species participates in fission-fusion societies which vary in size, but studies show that each society has a social order and a territory in a specific group of

[15] RED BOOK OF THE THREATENED ANIMALS OF GREECE.
[16] **Invalid source specified.**
[17] **Invalid source specified.**

trees that are used for roosting and breeding[18]. The species has an observed active range of 2,500 km² which is one of the largest observed ranges for any bat species. The species is also known to increase its foraging range in response to different levels of potential food sources. The main threat to the species in Greece seems to be the loss of mature trees with cavities where it nests in spring and summer. Also, threats are water pollution and fires, especially in mixed forests. Birth takes place in June and the female gives birth to one or two young.[19]

- *Pipistrellus hanaki* (DD/VU), in Crete. Hanaki's Dwarf Bat is a recently described species, the Cretan populations are distinctive, forming a separate subspecies. Pipistrellus hanaki is considered here as Vulnerable because Crete is holding a large percentage of its global population and it is an endemic taxon which depends on threatened habitats such as oak and chestnut forests or thickets with old trees and wetlands. [20]

Bats colonies are not identified within the working strip, but their presence cannot be completely discarded. A pre-construction survey shall identify potential presence of such colonies and or individuals. Nevertheless, from the two species mentioned above, no habitats suitable for *Pipistrellus hanaki* have been identified in Crete. For *Nyctalus lasiopterus* presence is considered as possible especially in the mixed forests close to KP 110 – KP 115 and KP 120 – KP 125. Any direct affection resulting in the loss or injury of a bat is considered unlikely and only potential if a hibernation or daily refuge is affected while the individuals are inside. In any case it is not likely to impact bat species on population level, because the loss will be in individual level. Impacts are likely to occur mainly in terms of disturbance, mainly <u>destruction of tree roosts</u> (no buildings which can provide potential refuge are identified within the working strip). Of course, scheduling of construction activities, especially in forests/ forested areas (or close to caves if such are identified), so as to avoid mating and birthing periods (i.e. May – Semptember), as much as possible or implement other suitable measures (e.g. to discourage roosting within the working strip).

Taking into account the considerations previously discussed and following evaluation criteria presented in Section 9.1 impact assessment for construction activities on *bats* direct species loss may be assessed as follows: the *Likelihood* of the impact is considered <u>*likely*</u>. The *Extent* of the impact will be localised at the Project footprint thus is considered <u>*small*</u>. The *Intensity* of the impact is considered <u>*high*</u>. The Project will have an impact on the habitat during the construction phase, therefore, the *Duration* is <u>*short-term*</u>. Regarding *Reversibility*, impacts are in part <u>*minimizable*</u>, after the implementation of mitigation measures for the minimization and / or avoidance of displacement. The *Cumulative Action* of the impact is considered <u>*rare*</u> assuming unlikely the possibility that impacts from

[18] **Invalid source specified.**
[19] https://batslife.eu/item/nyctalus-lasiopterus/
[20] RED BOOK OF THE THREATENED ANIMALS OF GREECE.

the EastMed Pipeline Project and from other projects or activities in the area can have a cumulative effect. The *Transboundary Character* is impossible considering the nature of the potential impact. As a result the impact is considerate to be **Minor.**

9.2.5.2.3.3 Reptiles

In line with what discussed above for terrestrial mammals, the Project's key mechanisms potentially impacting reptiles during construction are the following:

- Preparation and excavation of terrain for the working strip and the facilities (temporary and permanent);
- Heavy vehicle traffic;
- Air, noise and vibration emissions from the construction front;
- Light emission from construction areas.

The vegetation clearing and subsequent excavation activities are anticipated to potentially result in direct mortality of reptiles. Furthtermore, increased vehicle traffic might give rise in losses of tortoises and snakes due to collisions. In general, the mechanisms are similar to those described previously (e.g. small mammals discussed in Section 9.2.5.2.3.1).

Based on the available data, the following species of conservation interest (IUCN/ Green Red List) might be present in the working strip:

- *Hellenolacerta graeca* (NT/VU), The Greek rock lizard is listed as Vulnerable because its range is restricted, its distribution is severely fragmented and there is a continuing decline in the amount and quality of its preferred habitat due to fires and the degradation of suitable rocky areas. It is endemic to the Peloponnese at altitudes below 1,400m asl. The species is found always in association with crevice-rich rocky surfaces and near substantial vegetation as it avoids high temperatures and bright sunshine. It is also often found near freshwater. The species is observed mainly on rocky surfaces with slits which it exploits as shelters. It climbs with great dexterity and in the micro-habitat it chooses, it makes sure that it is always close to vegetation and in places with relative humidity, while generally avoiding intense sunshine and high temperatures. The Greek lizard is also found in riparian forests, in streams or rivers where it moves between the rocks of the riverbed and climbes on the Platanus orientalis trees. Within the study area the species may be present in ecosystem types of Floodplain forests, Rivers, Lakes, Sparsely vegetated areas, Transitional woodland-shrub.
- *Testudo hermanni* (NT/VU). Hermann's tortoise is still fairly widespread in Greece, especially in lowland regions away from settlements. The species occurs across a broad range of

Mediterranean habitats, including heathlands, maquis, open forests, pasture lands and agricultural areas, with the exception of areas with very low (semi-desert) or very high (dense pine forest) vegetation. It also avoids intensively cultivated areas (citrus, mechanically cultivated olive groves, etc.) as well as areas of high altitude (over ~ 1,500 m in the Peloponnese). Hermann's tortoise is listed as Vulnerable because, despite its wide distribution, it faces a broad range of threats and most populations are declining. The most serious threat appears to be the intesification of lowland agriculture, which in combination with tourism and rampant exurban development in the coastal regions have rendered large parts of the lowlands unsuitable for the species. Increases in vehicular traffic have led to increasing losses due to collisions. Summer fires, which have been occuring at rising frequency, appear to have had devastating effects on many tortoise populations. Furthermore, the species has been overcollected in the past, both for international trade and for use as pets locally - these problems appear to be less severe today. Within the study area, the species may be present in ecosystem types of Agroforestry areas, Arable land, Agricultural areas, Grasslands, Transitional woodland-shrub.

- *Testudo graeca* (VU/LC). Immediately after waking from hibernation, the species mating instinct starts up. One or two weeks before egg laying, the animals become notably agitated, moving around to smell and dig in the soil, even tasting it, before choosing the ideal spot to lay the eggs.
- *Podarcis cretensis* (EN/VU). The species is widely distributed thus probable within the working strip, as well.

It is noted that *Dermochelys coriacea* (VU/CR), *Chelonia mydas* (EN/EN) and *Caretta caretta* (VU/EN) are assessed as marine reptiles.

As discussed for small mammals, vegetation clearance is the main mechanism to induced impacts to reptiles. This could induce both negative impacts (e.g. increase of reptile species huntability) but also positive impacts (increase of habitats availability). Nevertheless, it is not anticipated that the reptiles will use the openings after the vegetation clearance and while construction activities occur, because the working zone will have a lot of human presence, which discourage the species presence and thus reduces the risk of mortality. The use of the working strip as an access to construction site may however increase the risk of running over some individuals in cleared areas where construction has already finished. In any case there will be no effect on population level, because the loss will be in individual level. For all the above terrestrial species, the most critical period for reptiles is the hibernation (brumation) which typically occurs between November and February and nesting (May – June)[21] (see Section 8.5).

[21] https://animaldiversity.org/accounts/Testudo_hermanni/

The most likely impacts will be displacement and disturbance of the species due to clearing and excavation working activities and vehicle traffic at the facilities and the working strip. Machinery and equipment will also produce noise and vibration. Neverhtless, pre-construction survey should inform/ update the available baseline data to confirm presence/absence and provide information to define specific mitigation measures. In any case standard good practice for construction works will be implemented as part of the general management of the construction and will help avoid and minimise impact on fauna, in general.

Taking into account the considerations previously discussed and following evaluation criteria presented in Section 9.1, impact assessment for construction activities on *reptiles* direct species loss may be assessed as follows: the *Likelihood* of the impact is considered *certain*. The *Extent* of the impact will be localised at the Project footprint thus is considered *small*. The *Intensity* of the impact is considered *high*. The Project will have an impact on the habitat during the construction phase, therefore, the *Duration* is *short-term* since the mechanisms for reptiles loss will stop as soon as construction activities (huntability is not taken into consideration, since for most of the discussed species, ecosystem is not modified). Regarding *Reversibility*, impacts are in part *reversible* as no temporary displacement will occure after the end of construction activities and the after the implementation of mitigation measures for the minimization and / or avoidance of displacement. The *Cumulative Action* of the impact is considered *rare* assuming unlikely the possibility that impacts from the EastMed Pipeline Project and from other projects or activities in the area can have a cumulative effect. The *Transboundary Character* is *impossible* considering the nature of the potential impact. Based on the considerations above, the impacts are **Minor.**

9.2.5.2.3.4 Amphibians

Mechanisms for impacts on amphibians are the same as the ones discussed previously for reptiles.

The major difference is the habitat requirements of amphibians which includes as main characteristics increased presence of water. The habitat requirements of amphibians vary seasonally; therefore the distribution of resources across the landscape relative to the project can influence mortality. These resources are associated with refuge, mates, and prey that tend to be concentrated in distinct habitats that are patchily distributed . A common characteristic of these habitats is the proximity to water bodies. Although few rivers are crossed by the pipeline, the crossings are located in a very specific area of the water body. In case the crossings are overlapping with the areas hosting the resources previously described, some loss of individuals could occur.

As such, the main ecosystem types of Table 9-31 where amphibians presence should be expected are Floodplain forests (Riparian forest/Fluvial forest) and Inland and coastal saline marshes. Rivers is another feature where amphibians presence is highlighted. This is because for rivers crossing construction two main methods are applicable: open cut (the typical construction method) and trenchless technique (where essentially, no interaction with the water body takes place). Details are provided in 9.2.5.2.2.2 and 9.2.5.2.4.2 and of course, Chapter 6.

For the case of open-cut techniques which might include dewatering of local temporary ponds, amphibians can be impacted if species habitat is altered or the water flow and/ or other physicochemical characteristics are modified. This is a complex issue because of the seasonality of habitat requirements of amphibians. All these habitats required by amphibians are in water bodies or in proximity to water bodies and have the form of patches. In case construction activities disturb such patches,direct mortality of amphibians could be incurred.

In case of trenchless techniques, no direct effect in watercourses is expected to amphibians.

The identified amphibian species, based on literature review, are presented in Section 8.5. Based on the Greek red species list, the following amphibians of conservation interest (IUCN/ Greek Red List) have been recorded in the wider area of the project footprint:

- *Pelophylax cretensis* (EN/EN). Pelophylax cretensis is endemic to Greece. It occurs in the island of Crete, where it exhibits a highly fragmented distribution exclusively in the lower areas. Extensive degradation and habitat destruction, climatic alterations, human activities and the presence of invasive species are amongst the major threats to local populations. It usually lives in permanent or seasonal swamps and freshwater ponds, natural or artificial (eg drainage channels and biological treatment tanks), as well as in permanent or seasonal streams. No such ecosystems are identified within the project footprint.

Obviously, amphibians include a wide number of species, which conservation status is not yet assessed nor they have been recorded, through field survey, within the project footprint. A pre-construction survey focusing on the water-related ecosystem types (e.g. riparian forests/ areas, wetlands and marshlands) shall inform baseline and specify mitigation measurers per species.

In any case, no effect on population level is assessed, given that species loss will be in individual level.

Taking into account the considerations previously discussed and following evaluation criteria presented in Section 9.1, impact assessment for construction activities on *amphibians* direct species loss may be assessed as follows: the *Likelihood* of the impact is considered *certain*. The *Extent* of the impact will be localised at the Project footprint thus is considered *small*. The *Intensity* of the impact is considered *medium*. The Project will have an impact on the habitat during the construction phase, therefore, the *Duration* is *short-term*. Regarding *Reversibility*, impacts are in part *minimizable* and after the implementation of mitigation measures for the minimization and / or avoidance of displacement. The *Cumulative Action* of the impact is considered *rare* assuming unlikely the possibility that impacts from the EastMed Pipeline Project and from other projects or activities in the area can have a cumulative effect. The *Transboundary Character* is _impossible_ considering the nature of the potential impact. As a result the impact is considerate to be **Minor.**

9.2.5.2.3.5 Macro-invertebrates:

Following discussion on other aquatic species (Sections 9.2.5.2.2.2, 9.2.5.2.3.4 and 9.2.5.2.4.2), macro-invertebratets are vulnerable in case of open-cut techniques, including the elimination of any kind of temporary pond by drying it out. In such cases, macro-incertebrates can be highly impacted, due to alteration of species habitat, in relation mostly to water flow and other physicochemical characteristics of the aquatic ecosystem.

In case of trenchless crossing, no impact is expected to occur.

In any case there will be no effect on population level, because the loss will be in individual level.

The protection status of macro-invertebrates identified, by the literature review, is described at Section 8.5.

Taking into account the considerations previously discussed and following evaluation criteria presented in Section 9.1, impact assessment for construction activities on *macro-invertebrates* direct species loss may be assessed as follows:The *Likelihood* of the impact is considered _certain_ in case of open cut river crossings. The *Extent* of the impact will be localised at the Project footprint thus is considered _small_. The *Intensity* of the impact is considered _medium_. The Project will have an impact only during habitat modification, i.e. during the open cut construction of the river crossing, therefore, the *Duration* is _short-term_. Regarding *Reversibility*, impacts are _reversible_, after the implementation of mitigation measures. The *Cumulative Action* of the impact is considered _rare_ assuming unlikely the possibility that impacts from the EastMed Pipeline Project and from other projects or activities in the area can have a cumulative effect. The *Transboundary Character* is _impossible_ considering the nature of the potential impact. As a result the impact is considerate to be **Minor.**

9.2.5.2.4 Disturbance of fauna

Apart from habitat fragmentation discussed in Section 9.2.5.2.2 some fauna species may be disturbed and/ or temporarily displaced due to the construction activities inducing mainly noise generation from circulation of vehicles, earthmoving activities, blasting and/ or hammering etc. onshore and sediments transporation and hydrotesting for freshwater species (water bodies). Herebelow, a focus on the potential disturbance is given, but discussion presented in Section 9.2.5.2.2 is still applicable.

Areas where explosives migth be used during construction are summarized in Table 6-67.

As detailed in Section 9.2.11, noise levels are inversely proportional to the distance from the source. In general, doubling the distance from the source will reduce the levels by 6 dB (A). Therefore, supposing that noise measurements are taken at a distance of one meter from the emission source, the noise emitted at 100 dB (A) can be estimated to be perceived as about 53.5 dB (A) in a distance of (200) meters. As such, fauna species that might be present within this distance (and could be potentially affected/ disturbed by noise emitting activities) are considered as sensitive receptors.

Similarily, application of open-cut techniques at water bodies can increase downstream total suspended sediment through the trenching excavation, backfilling, installation of diversion structures, run-off from the working sites, discharge of water from testing or dewatering. Sediment suspension has the potential to negatively affect the river ecosystem by changing the riverbed habitat (smothering of the gravel bed) and by increasing turbidity (which results to less dissolved oxygen and light availability). These have the potentiality to affect fish gills and macro-invertebrates. On the contrary, trenchless techniques are likely to have no impacts on the aquatic environment, because no direct works would be undertaken within the water body.

It is evident that all disturbance inducing mechanisms are directly related to the duration of the mechanism itself. This means that as soon as the noise emitting activities stop the disturbance will end. Although sediments settlement can take few days, the overall duration is also relevant to the sediments suspending construction activities.

It is noted that small mammals, amphibians and reptiles, are characterized by site fidelity and are very local. Adopting a conservative approach it is assumed that disturbance will lead to direct loss and as such it is not assessed separately (but discussed in Section 9.2.5.2.3).

Based on the available data and mainly the "Red Book of the Threatened Animals of Greece", the following species may be present in 200 m from the working strip:

9.2.5.2.4.1 Terrestrial fauna

- Jackal (*Canis aureus*):

With regards to the jackal, there are 3 broader areas identified where the species could be present and disturbed by project related activities: KP 0 – KP 30, KP 95 – KP 120 and KP 250 – KP 270 (as detailed in Table 9-33). Construction phase will cause temporary disturbance on breeding jackal groups during spring and summer months. Establishment of temporary facilities (trench, artificial lighting, other installations) may limit suitability of the area for jackal habitat.

The jackal is an adaptable species, whenever the disturbance is temporary and short term and it does not change habitat quality and food availability. When the disturbance is longterm, the species would be expected to migrate from the area. In the case of the construction of the pipeline, the disturbance is anticipated to be short term.

Taking into account the considerations previously discussed and following evaluation criteria presented in Section 9.1, impact assessment for construction activities on *Canis aureus* disturbance is almost identical to the one for species habitat loss. The difference is the *Likelihood* of the impact which is considered *likely* and also the *Duration* of the impact which is considered *short-term*. In any case, the impact is assessed **Minor.**

- Wolf (*Canis lupus*):

As discussed in Section 9.2.5.2.2, the wolf is present only in a small section at Mt. Arakynthos, Western Continental Greece and the species is considered very sensitive to habitats modification and human presence. Nevertheless, analysis is almost identical to the one for species habitat loss. The dirrefence is the *Likelihood* of the impact which is considered *likely* and also the *Duration* of the impact which is considered *short-term*. In any case, the impact is assessed **Minor.**

9.2.5.2.4.2 Freshwater species

- Otter (*Lutra lutra*)

As discussed in Section 9.2.5.2.2, otter is present in few sections along the project footprint. Nevertheless, unlike habitat fragmentation, otter may be disturbed not only during open cut river crossings, but also during a trenchless crossing of a river. This is because the noise that will be emitted is the impact inducing mechanism, in both construction methods.

According to Table 9-35, construction of approx. 20 rivers' crossings might cause disturbance to otters, if otter is presence is verified, for 2 to 3 months.

In parallel, otter (and/or other freshwater species) might experience some disturbance due to sediments transportation downstream the river crossing location, in sites where the open cut technique is used. This disturbance is mainly due to water quality modification and mostly food availability, through indirect impacts to fish population (see next bullet). In both cases, disturbance mechanisms cease soon after the completion of construction activities and are completely reversible through natural mechanisms (sediments will be deposited and fish population shall recover from any temporary impacts).

Taking into account the considerations previously discussed and following evaluation criteria presented in Section 9.1, impact assessment for construction activities on *Lutra lutra* disturbance may be assessed as follows: The *Likelihood* of the impact is considered *likely*, given that presence of otter is not verified in the specific water bodies crossing points. The *Extent* of the impact will be localised at the Project footprint thus is considered *small*. The *Intensity* of the impact is considered *high*. The Project will disturb the species for as long as the specific construction activities take place at the specific location, therefore, the *Duration* is *short-term*. Regarding *Reversibility*, impacts are in part *reversible* after the implementation of mitigation measures. The *Cumulative Action* of the impact is considered *rare* assuming unlikely the possibility that impacts from the EastMed Pipeline Project and from other projects or activities in the area can have a cumulative effect. The *Transboundary Character* is *impossible* considering the nature of the potential impact. Based on the considerations above, the impacts are **Minor.**

- Fishfauna

As previously mentioned, trenchless river crossing techniques do not interact with fish populations at all. Open-cut technicques will have effects to fish species trying to access spawning grounds or moving between feeding resources. Furthermore application of open-cut techniques at water bodies can increase downstream total suspended sediment through the trenching excavation, bakfilling, installation of diversion structures, run-off from the working sites in the vicinity of the watercourses, etc. Table 9-36 summarizes the rivers were open cut might disturb fish species of conservation interest.

Sediment entrainment has the potential to negatively affect the river ecosystem by changing the riverbed habitat (smothering of the gravel bed) and by increasing turbidity (which results to less dissolved oxygen and light availability). These have the potentiality to affect fish gills and macro-invertebrates. In addition, an important increase of sediment in the water has the potential to be accompanied by a reduction on dissolved oxygen (DO), which can have a negative impact on the river species (different species have different oxygen requirements: while this can have an impact on some species or taxa, it can still can be negligible to others).

Different types of rivers would have different sensitivities to increased suspended solids depending on the existing background levels. In fact the fauna in the rivers is already an indication on the conditions of water turbidity, quality and water regime. That is, all rivers cope with certain fluctuation of turbidity associated to rains in the catchment areas (this is especially the case in the Mediterranean rivers where relevant changes can occur in short periods of time), therefore a specific peak of sediments in a specific river channel may have the potential to raise negative impacts in some rivers but would be negligible in some others. Similarily, the specific location of each river crossing along the river flow is also important; river segments in plain areas, close to the estuaries, are characterized by increased turbidity compared to uphill areas, in the mountains and/ or close to the springs.

On the contrary to open-cut techniqes, trenchless techniques are likely to have negligible impacts on the aquatic environment, because there are no direct works would be undertaken within the water body.

Taking into account the considerations previously discussed and following evaluation criteria presented in Section 9.1, impact assessment for construction activities on *fishfauna* disturbance is identical to the one presented for otter and is not repeated. Based on the considerations above, the impacts are **Minor**.

9.2.5.3 Offshore biodiversity

9.2.5.3.1 Impacts on Habitat/Flora species – Deep Water section

This section presents the impact on seabed habitat/flora species in the deep water section (WD > -40 m).

When designing the project crossings sensitive features were deliberately avoided. However, the nature and extent of the project make it impossible that the project footprint does not cross any sensitive features. The offshore Study Area intersects a number of bathyal habitats including soft bottom habitats characterised by coarse and fine sediments, mud or mixed bottoms.

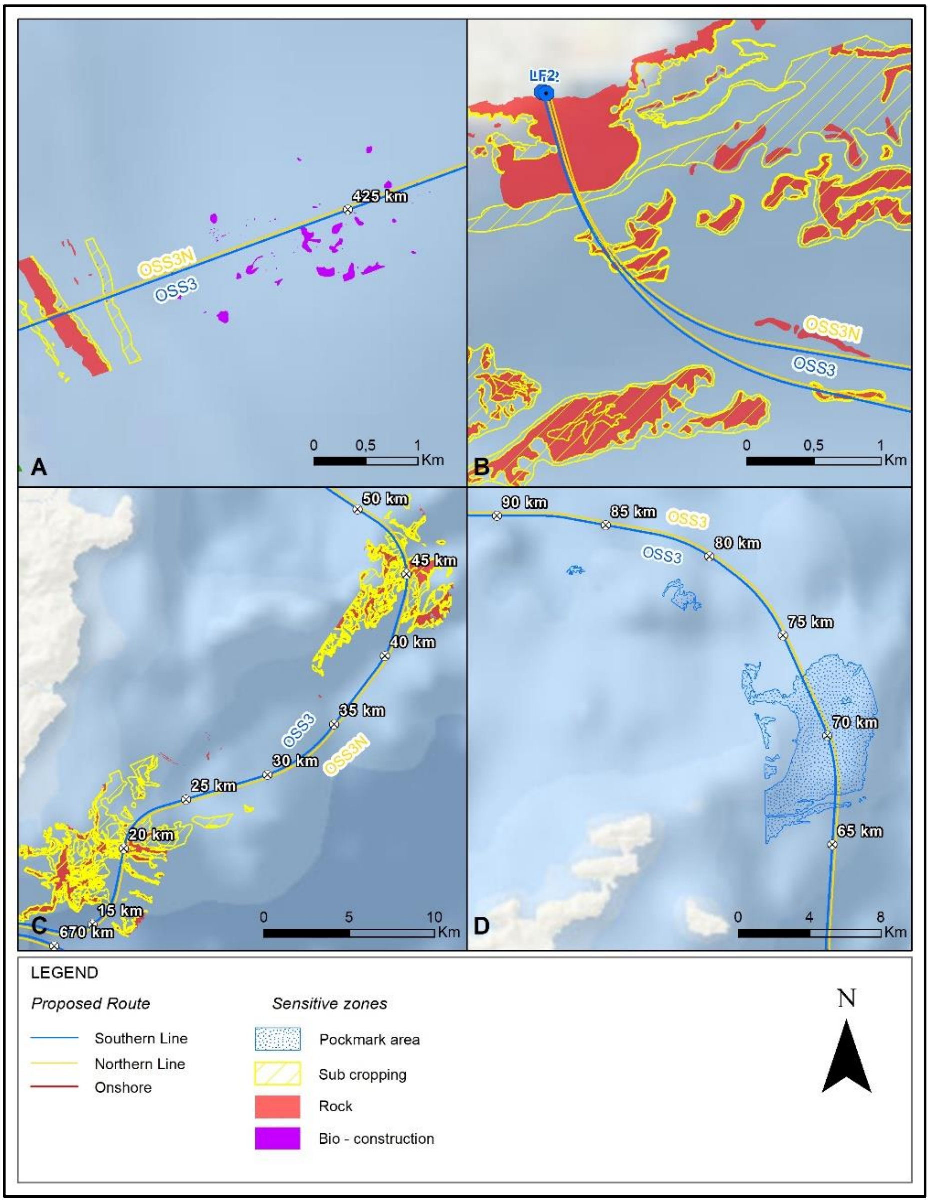
Table 9-37 below shows the total length of the pipelines and areas under the various types of habitat/benthos type. It is noted that the area of trench and cofferdam excavation is not considered (the impacts from this construction are further developed in the next Section (Section 9.2.5.3.2). As shown in table below, the vast majority (99%) of the offshore pipelines will affect soft bottom habitat with low biodiversity value.

Table 9-37 Habitat Loss due to the Offshore Pipeline (water depths greater than -40 m)

Section	Pipe Size (inch)	Length (m) on the offshore section	Total Area Occupied on the Seabed (m^2)	Fine Sediment (Mud/ Sandy-Mud)			Bioconstruction (Possible Corals, Rock, Pockmarks)		
				~ Length (m)	Surface Area (m^2)	% of Occupied Area	~ Length (m)	Surface Area (m^2)	% of Occupied Area
OSS2	26	390,448	257,696	390,100	257,466	99.9%	348	230	0.1%
OSS2N	26	390,448	257,696	390,100	257,466	99.9%	348	230	0.1%
OSS3	28	427,674	303,649	414,836	294,534	97.0%	12,838	9,115	3.0%
OSS3N	28	427,674	303,649	414,836	294,534	97.0%	12,838	9,115	3.0%
OSS4	46	13,990	16,368	13,990	16,368	100.0%	0	0	0%
Total	-	1,650,234	1,139,057	1,623,863	1,120,368	98.4%	26,373	18,690	1.6%

As can be seen in Table 9-37 for the OSS2/OSS2N and OSS4 route no major habitat constraints have been identified.

Regarding OSS3/OSS3N route, after a detailed analysis of the DMS and RMS reports revealed the following environmental sensitive zones (Figure 9-18):



Source: ERM, 2022

Figure 9-18 Potential Habitat Loss along the OSS3/OSS3N route

- In the continental slope of southeast Crete the route crosses rocky outcrops surrounded by subcrops with possible presence of Coralligenous assemblages. More in detail the total crosses area is 926 m^2 represented by 463 m^2 of rocky outcrops surrounded by subcrops by OSS3 and 463 m^2 of rocky outcrops surrounded by subcrops by OSS3N (Figure 9-18 Potential Habitat Loss along the - B).
- In the region of the Ptolemy trench the route crosses more rocky outcrops surrounded by subcrops with possible presence of Coralligenous assemblages. More in detail the total crosses area is 6,521 m^2 represented by 3,260 m^2 of rocky outcrops surrounded by subcrops by OSS3 and 3,260 m^2 of rocky outcrops surrounded by subcrops by OSS3N (Figure 9-18 Potential Habitat Loss along the - C).
- At the eastern tip of Crete the route crosses a pockmark area between -200 and -300 m WD. The total crosses area is 8,300 m^2 represented by 4,150 m^2 by OSS3 and 4,150 m^2 by OSS3N (Figure 9-18 Potential Habitat Loss along the - D).
- Along the continental shelf of southeast Peloponnese the route is in proximity with areas identified as hard substrate with probable presence of deep sea corals and coralligenous habitats (generally bioconstructions). The total habitat loss is 410 m^2 represented by 205 m^2 (289 m linear occupation) of bioconstruction by OSS3 and 205 m^2 of bioconstruction (289 m linear occupation) by OSS3N (Figure 9-18 Potential Habitat Loss along the - A).

Beyond the aforementioned sensitive zones, no significant direct interactions with hardgrounds were recorded.

The conventional pipeline installation method minimises the impacts on the seabed as the pipeline is simply laid on the seabed without need for excavation or any other construction activity on the seabed; the vessel positioning is dynamic (i.e. based on GPS) thus not requiring anchoring. However, according to the current design level, few areas along the pipeline may require some seabed intervention works to allow pipe installation and safe operation in order to overcome the irregularities met on the seafloor surface (e.g. freespan, hoverangs, bumps, etc.). The type of work and the methodology to be used will be assessed on a case-by-case basis in a more advanced phase of the Project. Such interventions will possibly lead to localised seabed disturbance and resuspension of sediment.

In summary considering the factors discussed above the following evaluations are made:

The *Likelihood* of the impact is _certain_. The *Extent* is considered _small_ and limited to the pipeline's footprint. The *Intensity* is considered _low_ as the magnitude of change on the seabed is limited in terms of area; moreover, the vaster portion of the pipelines will be laid on soft sediments where no sensitive habitats are identified. The *Duration* of the disturbances caused by the construction operations is limited to their duration (typical pipelay rates are on the order of 3 km per day). Once the offshore pipelines are installed, these will permanently be on the seabed causing very limited disturbance to the habitat (see Section 9.3.5 for impacts during operation). Therefore, *Duration is considered short-term*. With regard to *Reversibility,* the disturbance on the deep water habitats from the construction phase, is considered *minimizable*. *Cumulative Action* is considered to be *rare* considering unlikely the possibility that impacts from the EastMed Pipeline Project and from other projects or activities in the area can have a cumulative effect. The *Transboundary Character* is *impossible* considering the extent of the potential impact.

Based on the discussion presented above, the impacts on offshore marine habitats during construction are evaluated as **Minor.**

9.2.5.3.2 Impacts on Habitat/Flora species – Nearshore section

This section presents the impact on seabed habitat/flora species in the nearshore section (WD ≤ -40 m).

In the nearshore section, Project activities that will affect the seabed and marine habitat during construction are:

- The construction of cofferdam and trenching considering the scenario with a temporary wet storage in the vicinity of the trench for subsequent backfilling.
- Anchoring of the pipelay barge.
- Pipelaying and consequent seabed occupation from the end of the trench to -40/50m water depth.
- Other shore crossing activities

- Cofferdam, Trenching and Backfilling

The selected methodology for the shore crossing at the landfall locations is an open-cut construction method, a common technique where the nearshore section is trenched by a combination of dredging equipment (e.g. deeper sections by cutter suction dredger or trailing suction hopper dredger and shallower sections by pontoon-based backhoe) and the onshore section by common excavators to enable the pipeline to be pulled ashore at a required depth of burial. Dredging, pipeline handling and pulling implies the use of diverse dredging equipment like cutter suction dredger, trailing suction hopper dredger, etc. in cooperation with an S-Lay installation vessel for shallow waters and support vessels. The preparation of the shore-crossing implies several factors of disturbance on the seabed and nearby receptors. Key characteristics related to the open-cut construction at each landfall are presented in Table 9-38.

Table 9-38 Shore Crossing Technical Requirements at Each Landfall Area

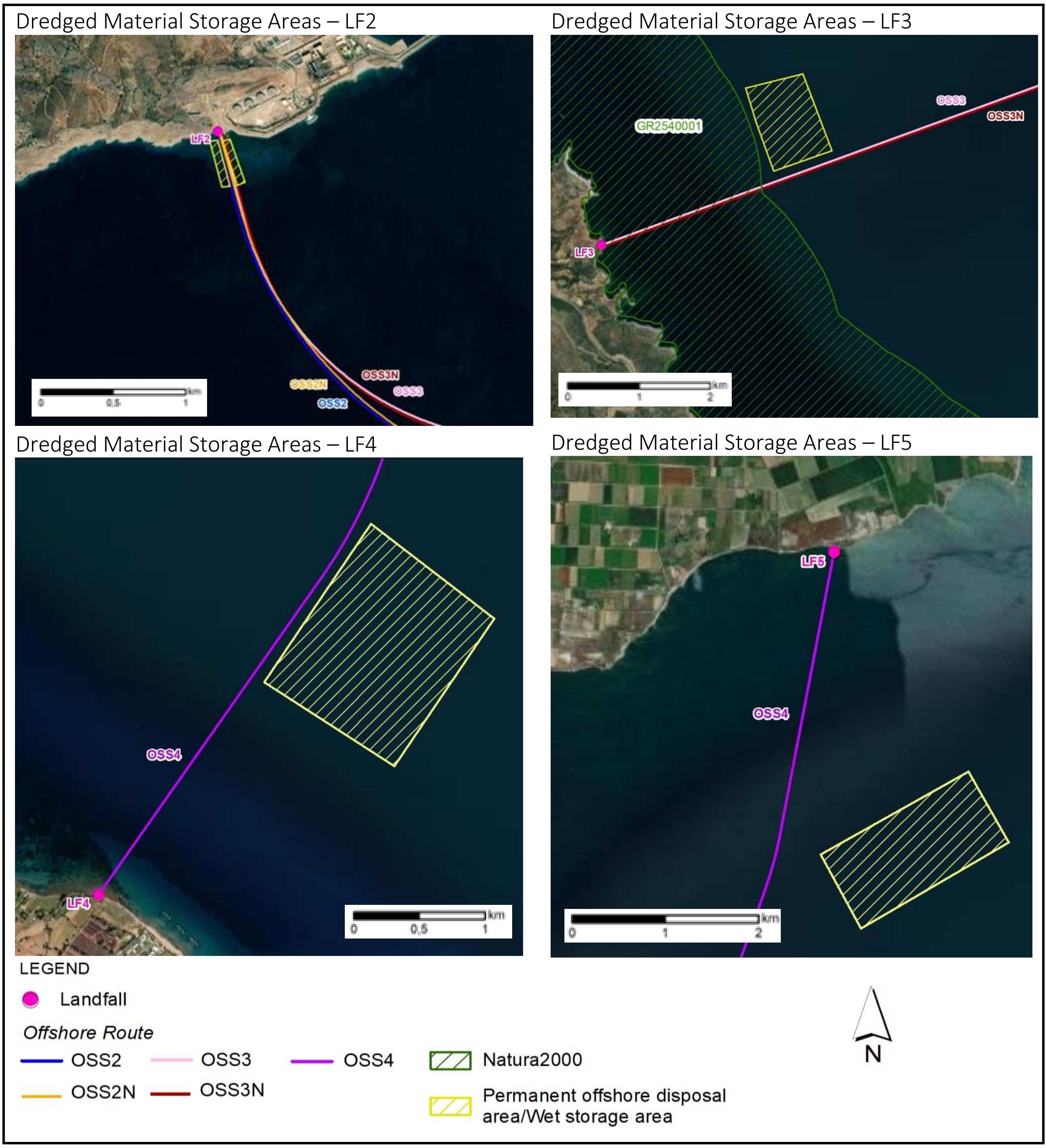
Landfall	Offshore Construction (Dredging and Pipelay)	Cofferdam Size	Nearshore Trenching
LF2 (Crete)	LF2 will accommodate 4 lines, i.e. OSS2 and OSS3 (Southern Line), OSS2N and OSS3N (Northern Line). All lines will be placed in one trench and thus shore crossing construction activities for Southern and Northern Lines will be performed in one construction campaign.	No use of cofferdam is necessary	• Length: 300m • Width: 50m • Depth: 2.5
LF3 (Peloponnese)	LF3 will accommodate 2 lines, OSS3 (Southern Line) and OSS3N (Northern Line). All lines will be placed in one trench and thus shore crossing construction activities for Southern and Northern Lines will be performed in one construction campaign.	No use of cofferdam is necessary	• Length: 600m • Width: 30m • Depth: 2.5m
LF4 (South Patras)	The trench will accommodate OSS4 pipeline and will have a total length of 1,200 m	• Length: 200m • Width: 21m • Depth: 5m	• Length: 1000m • Width: 15m • Depth: 3m
LF5 (North Patras)	The trench will accommodate OSS4 pipeline and will have a total length of 1,200 m	• Length: 200m • Width: 21m • Depth: 5m	• Length: 1000m • Width: 15m • Depth: 3m

Prepared by: Asprofos, 2022. Data from: IGI,2021

The proposed methodologies for the management fo the dredged material at each landfall are described below:

- The excavated material from the trench in LF2 will be “wet” stored at each side of the trench and re-used at a later stage for backfilling. This technique, named *side casting*, is largely used in similar projects and allows faster construction time.
- The excavated material from LF3, LF4 and LF5 constructions will be loaded on (split-hopper) barges and either “wet” stored at seabed in a temporary offshore storage site, or disposed in a selected offshore disposal site.

The proposed location for the temporary offshore storage areas for each landfall are shown in Figure 9-19.



Prepared by: Asprofos,2022. Data from: IGI Poseidon, 2022

Figure 9-19 Dredged Material Areas for each landfall location (LF2÷LF5)

- Anchoring of the Pipelay Barge

An anchor can affect the Posidonia oceanica meadow in various ways: (i) at the moment of anchoring – breaking the rhizomes on which it drops or over which it drifts before catching hold; (ii) while it is on the seabed – the chain in front of the anchor slips on the seabed because of hydrodynamism and the current and tears out the leaves; (iii) when it is raised – the anchor breaks the rhizomes to which it has become attached; in some cases it can tear out a whole block of ”matte”. When a leisure boat anchors (the anchor is dropped, stays down and is raised) an average 16 to 34 shoots of P. oceanica are torn out; this amount is made worse by the fact that the rhizomes are bared and the ”matte” becomes less cohesive (Δημαλέξης, Τζάλη, Πουρσανίδης, Κουρέτας, & Ζάννες, 2014).

At the present stage of design, the anchor pattern is not yet defined. The typical anchor pattern anticipates deployment of anchors in a semi-circular pattern in the fore and aft position, generally from its four corners. During pipelay, an anchor handling tug boat is used to run the anchors out in a pattern that allows the pipelay vessel to move itself ahead by hauling in wire on the forward winches while paying out wire on the aft winches. As pipelay continues, the tug boat(s) continually re-locate the anchors forward as necessary to allow the vessel to lay pipe without delays. Anchors are normally repositioned for every 1 km of pipeline laid. The position of the anchors could be as far as 1.5 km from the centreline of the vessel, depending on the water depth and pipelay vessel used.

In order to reduce the pressure of free anchoring and mooring in shallow meadows, seagrass-friendly moorings should be installed on meadow clearings, depending on the substrate. Indicatively, sand screws on sandy patches, dead weight moorings on large sandy patches, or grouted anchors on rocky patches. In meadows without clearings but with a well developed matte, a special ecological anchor device can be used (e.g. Harmony P anchors).

- Pipelaying and Consequent Seabed Occupation from the End of the Trench to -40/50m Water Depth

These impacts are discussed in the previous Section 9.2.5.3.1 that presents the habitat loss calculations for the pipelines laid from the end of the trench towards the offshore part.

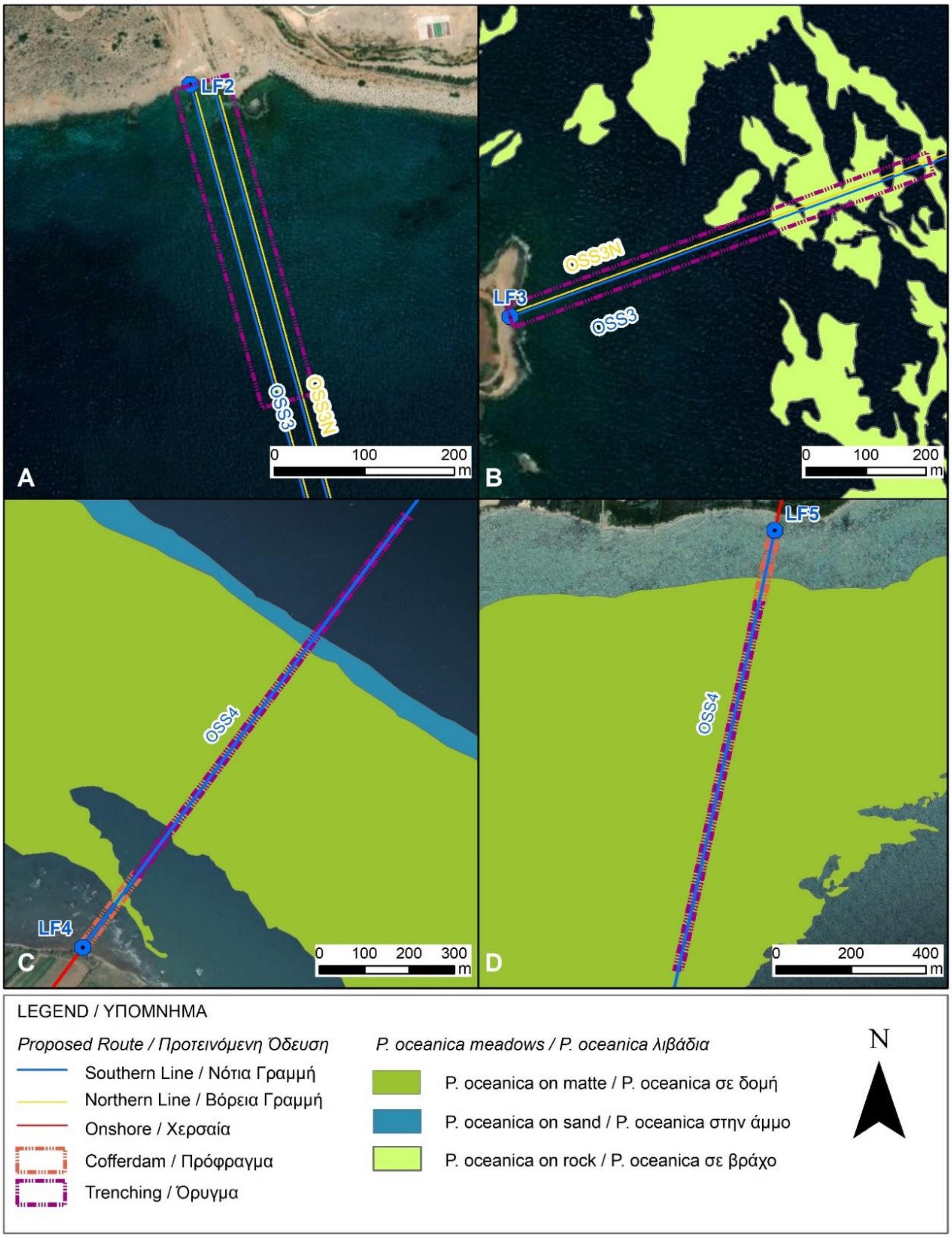
- Other shore crossing activities

Shore crossing activities can increase the coastal water load in re-suspended particles and in their turn re-suspended particles cause reduction in water quality by increased contaminant levels and/or reduction in water transparency. When water quality decreases this has a direct effect on Posidonia oceanica meadows.

Sea water quality impacts related to the re-suspension and dispersion of sediment is evaluated in Section 9.2.13 as **Minor** considering the limited volumes, durations and extent. Impacts on nearshore benthic habitats connected to this construction phase are also considered **Minor**.

The *Posidonia oceanica* bed is the most sensitive marine habitat directly affected by the Project in the nearshore area. *Posidonia oceanica* meadows are identified as a priority habitat type for conservation under the Habitats Directive (Dir 92/43/CEE). These underwater meadows provide important ecological functions and services and harbour a highly diverse community, with some species of economic interest. Current main threats to the habitat are related to: water and sediment enrichment (eutrophication), the disruption of the sedimentation/erosion balance along the coast and direct destruction by human modifications of the coastline, degradation by boat trawling and anchoring, salinity increase in the vicinity of water desalination facilities and the proliferation of invasive algal species (MANAGEMENT of Natura 2000 habitats * Posidonia beds (Posidonion oceanicae) 1120, 2008).

The *Posidonia oceanica* meadows was observed on the working strip at LF3, LF4 and LF5, based on the DMS surveys (Figure 9-20).



Prepared by: Asprofos,2022. Data from: IGI, 2021

Figure 9-20 Posidonia oceanica Coverage from DMS surveys

In adition, a visual inspection by Dr. Poursanidis and his team (TERRASOLUTIONS m.e.r.) took place based on collected material with the use of a Remote Operated Vehicle (ROV) by PLANET BLUE ROV SERVICES (PBRS) (Figure 9-21). Based on the results of TERRASOLUTIONS m.e.r. visual inspection of the ROV material shows:

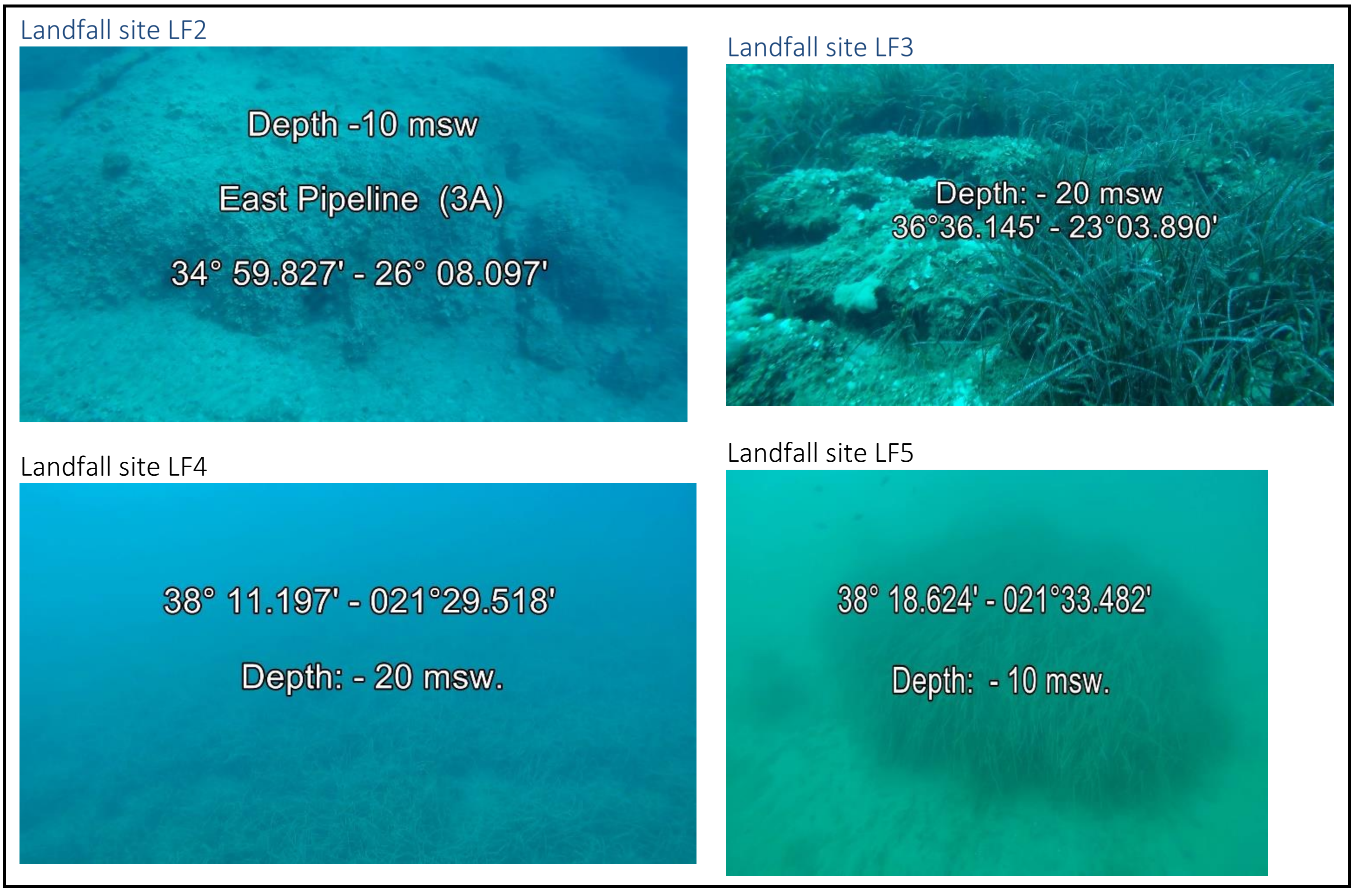
- Landfall site LF2: Neptune grass meadows does not occur in the area
- Landfall site LF3: Neptune grass meadows extends from 10m to approximately 30m depth. It is of good health status without any destruction by anthropogenic activities as the leaves are elongated, without any heavy load of epiphytes which is an indicator of good ecological status, at LF3.
- Landfall site LF4: Neptune grass meadows extends from 10m to approximately 25m depth. It is of good health status without any destruction by anthropogenic activities as the leaves are elongated with minor coverage by sediments and epiphytes. This is a typical situation in Patraikos gulf due to the nearby flow of rivers and the composition of the seabed which is mostly silt/clay.
- Landfall site LF5: Neptune grass patches occur at the shallow parts only. Their leaves are very heavy loaded by sediments and epiphyte growth indicating an ecosystem of low conservation value due to various anthropogenic pressures.

The following table provides information on the area (m^2) of Neptune grass meadows that are affected by the pipeline construction.

Table 9-39 *Posidonia oceanica* meadows (m^2) found within the Construction Area of the pipeline

Landfall site	Construction Area (m^2) – m^2	Affected area (m^2)	Status
LF2	15,000	0	n/a
LF3	18,000	5,242	good ecological status
LF4	19,200	8,964	good ecological status
LF5	19,200	16,506	low ecological status

Prepared by: Asprofos, 2022



Prepared by Asprofos, 2022. Data from PLANET BLUE ROV SERVICES (PBRS), 2021

Figure 9-21 Status of . Seagrass meadows at Landfall sites.

Except of *Posidonia*, the nearshore areas have typical and common flora species, i.e. Codium bursa, Cystoseira sp., Padina pavonica etc. (see relevant Tables at section 8.5 and Baseline Study at Annex 8F).

In summary considering the factors discussed above the following evaluations are made:

- The impacts from shore crossing on habita/flora species on LF2 during construction can be considered **Negligible**.
- At the site of LF3 the *Likelihood* of the event is *certain*, as a disruption on the seabed is inevitable for shore crossing construction. The *Extent* is considered *medium* as it is not limited to the Project footprint but could affect the vicinity of the work areas. In particular, the clearance of *Posidonia* is around 5,242 m^2 and anchoring, as well as re-suspension, can increase negative effects on the nearby seagrass and habitats. The *Intensity* is considered *very high* due to the good ecological status of the meadow and the fact that it is located within a protected area. The duration of the

impact with a conservative approach is considered _permanent_ since the meadow grows in hard substrata and such losses consider to be virtually irreversible. Regarding the *Reversibility*, impacts on nearshore habitats are considered to be _minimisable_ with appropriate mitigation measure. *Cumulative Action* is considered to be _impossible_, since the area is not under pressure by direct or indirect effluences by any type of anthropogenic activities. The *Transboundary Character* is _impossible_ considering the nature of the potential impact. Based on the discussion presented above, the impacts on marine habitats during construction in the nearshore environment are evaluated as **Moderate.**

- At the site of LF4 the *Likelihood* of the event is _certain_, as a disruption on the seabed is inevitable for shore crossing construction. The *Extent* is considered _medium_ as it is not limited to the Project footprint but could affect the vicinity of the work areas. In particular, the clearance of *Posidonia* is around 8,964 m^2 and anchoring, as well as re-suspension, can increase negative effects on the nearby seagrass and habitats. The *Intensity* is considered _high_ due to the good ecological status of the meadow. The *Duration* given the extremely slow growth rate of this species (1-6 cm yr-1) is considered _mid-term_. Regarding the *Reversibility*, impacts on nearshore habitats are considered to be r_eversible_ with appropriate mitigation measure (in some cases the phanerogam beds have even reached shoot densities equivalent to those prior to the installation of the pipeline (Badalamenti, Carlo, D'Anna, Gristina, & Toccaceli, 2006)). *Cumulative Action* is considered to be _impossible_, since the area is not under pressure by direct or indirect effluences by any type of anthropogenic activities. The *Transboundary Character* is _impossible_ considering the nature of the potential impact. Based on the discussion presented above, the impacts on marine habitats during construction in the nearshore environment are evaluated as **Minor.**
- At the site of LF5 the *Likelihood* of the event is _certain_, as a disruption on the seabed is inevitable for shore crossing construction. The *Extent* is considered _medium_ as it is not limited to the Project footprint but could affect the vicinity of the work areas. In particular, the clearance of *Posidonia* is around 16,506 m^2 and anchoring, as well as re-suspension, can increase negative effects on the nearby seagrass and habitats. The *Intensity* is considered _low_ due to the low conservation value due to various anthropogenic pressures. The *Duration* given the extremely slow growth rate of this species (1-6 cm yr-1) is considered _mid-term_. Regarding the *Reversibility*, impacts on nearshore habitats are considered to be r_eversible_ with appropriate mitigation measure (in some cases the phanerogam beds have even reached shoot densities equivalent to those prior to the installation of the pipeline (Badalamenti, Carlo, D'Anna, Gristina, & Toccaceli, 2006)). *Cumulative Action* is considered to be _propable_, since the area is under various anthropogenic pressures. The *Transboundary Character* is _impossible_ considering the nature of the potential impact. Based on the discussion presented above, the impacts on marine habitats during construction in the nearshore environment are evaluated as **Minor.**

9.2.5.3.3 Impacts on Marine Invertebrates – Nearshore /Deep water sections

This section presents the impact on marine invertebrates both in the deep water and in the nearshore section.

Project activities that will affect the marine invertebrates during construction are:

- Deep water
  - Pipelay and
  - Seabed intervention works
- Nearshore
  - The construction of cofferdam and trenching considering the scenario with a temporary wet storage in the vicinity of the trench for subsequent backfilling.
  - Anchoring of the pipelay barge.
  - Pipelaying and consequent seabed occupation from the end of the trench to -40/50m water depth.

For impact assessment evaluation the following invertebrate taxa are considered:

- Porifera
- Cnidaria
- Mollusca
- Anellida
- Crustacea
- Echinodermata and
- Bryozoa

These groups of invertebrates are mostly benthic or sessile species, with limited or no movement capacity, many of them being detritivorous or filter feeders, while only a few of them are active predators. Considering these characteristics and considering the source of impacts from Project construction, invertebrates living along the Project footprint or in its immediate surroundings will be impacted by the construction of cofferdam and trenching activities, anchoring and deposit of dredged material (temporary storage areas) in the nearshore, and pipelay activities and seabed intervention works offshore. These activities will lead to habitat loss, physical alteration of the seabed and loss of individuals. Moreover, increase in turbidity of the water and resuspension of sediment caused by construction activities both nearshore (trenching) and offshore (punctual seabed intervention works and pipelaying, with a minor intensity) will possibly result in an increased level of disturbance for sessile species.

The Baseline section (see Chapter 8, Section 8.5) summarises key species possibly present in the marine Study Area and therefore potentially affected by construction activities. The following sub-sections elaborate on each specific taxon.

- Impacts on Porifera

Based on the field visit conducted during the realization of ROV surveys, results revealed the presence of four (4) species of sponges in the nearshore section of the Study Area of LF2 with one of them included in Annex II of Barcelona Convention and five (5) species of sponges in the nearshore section of the Study Area of LF3 with one of them included in Annex II of Barcelona Convention. No sponge species were recorded in the nearshore section of the study area of LF4 and LF5. The baseline study did not reveal more species of sponges under any protection status, however, their presence in deeper habitats cannot be excluded. These colonial animals grow on sublittoral rocky areas and coralligenous environment at water depths ranging between -40 and -150 m. Offshore construction works (i.e. pipelay and seabed intervention works) will possibly cause disturbance due to an increase in water turbidity and even loss of individuals; nonetheless, the impact will possibly be limited to a few colonies and localized on the Project footprint.

- Impacts on Cnidaria

The cnidarians considered in the assessment of Project impacts belong to the Anthozoa class, including corals, cold water corals and sea pens. These sessile animals are known for being capable of producing calcium carbonate deposits that create new hard substrate and habitats for other species. Cold water corals can possibly be present where the geophysical surveys (RMS/DMS) revealed the presence of rocky outcrops or hardgrounds. Many species of cold water corals and sea pens are listed in the IUCN Red List and protected by the Barcelona Convention (Protocol SPA/BD). Some of these species, such as *Isidella elonagata* or *Funiculina quadrangularis*, could be present on soft bottoms (wide area of deep sea abyssal plains) from -500 m to deeper water depths. Based on the results of the baseline study the species of concern are:

- Mediterranean pillow coral (*Cladocora caespitosa*) – EN: hard coral found in shallow water from -5 to -40 m. It could be found on rocky seabeds between a few metres and 60 metres in depth.

- Smooth black coral (*Leiopathes glaberrima*) – EN: This coral is a very slow-growing species, with an estimated growth rate of less than 10 µm per year. Occurs on steep rocky terraces in areas that characterised by strong turbulent current. It grows at depths from 37m to 1,500 meters below sea level.
- Yellow tree cora (Dendrophyllia cornigera) – EN: Occurs in rocky substrates at depths greater than 60 m.
- Red coral (*Corallium rubrum*) – EN: listed in Annex V of EU Habitats Directive and Annex III of Bern Convention. Occurs on rocky seabottom with low sedimentation, typically in dark environments—either in the depths or in dark caverns or crevices. It grows at depths from 10 to 300 meters below sea level.Cockscomb cup coral *(Desmophyllum dianthus)* – EN: It occurs from the continental shelf (-200 m) down to the bathyal zone (-2,000 m) colonising hard substrates. The species could occur on rocky outcrops found along the pipeline corridor by the DMS;
- Bamboo coral (*Isidella elongata*) – CR and tall sea pen (*Funiculina quadrangularis*) – VU: found on deep, soft, muddy bottoms.

The detailed marine surveys carried out along the routes revealed the presence of outcrops providing a proxy of potential impacts on cnidarians typically found on rocks and bioconstructions. This category is found along only 13.72 km or a total surface area of only 0.96 ha over a total length of about 1,650 km and 113.9 ha of total seabed occupation (0.84%). More in detail during construction, all the offshore pipelines, individual loss and habitat loss are the probable impacts derived from the pipelay and seabed intervention works. However, considering the tridimensional structure of the pipelines, only a small section of the pipe's diameter will directly affect the area of the patch considered, reducing the surface (point of contact) of the colonies directly impacted by the pipelay.

Information regarding the presence of soft corals found on soft bottoms is difficult to estimate along the long section of soft bottom affected by the pipeline system (1,650 km for 113.9 ha). These species are generally found in facies with higher densities on muddy bottoms from -500 m to -1,000 m and beyond where, due to the ban on trawling (banned below -1,000 m), it is believed to be present in higher densities. For these species it is possible to highlight that the limited impact will be limited to only the exact location of the pipeline and that the total surface is extremely limited when compared to the overall areas these species are potentially present. In addition, it is worth noting that the pipelines will be indeed marked on the nautical charts and therefore, as happens with other marine infrastructure, its presence will reduce pressure from activities such as (above -1000 m) avoiding gear loss, accidents and pipeline damage in line with good practice in fishery and in compliance with notice to mariners.

- Impacts on Mollusca

In the Study Area of the Project, the biodiversity study highlighted the presence of many species of bivalvia and gasteropoda living in the sandy seabed of the nearshore area intersected by the Project footprint. Moreover, the baseline study reported the presence of 2 threatened species (IUCN Red List), namely *Pinna nobilis* (CR) and *Haliotis tuberculate* (VU). These species were not found during the realization of ROV throughout nearshore surveys at LF sites. However their presence could be found in *Posidonia* meadows, in sublittoral rocky outcrops and in coralligenous environments.

It is worth noting that the species *Pinna nobilis*, was well distributed at a variety of habitats throughout all Mediterranean ecoregions, at depths between 0.5 m and 60 m (Butler, Vicente, & de Gaulejac, 1993). Since 2016, as most Mediterranean populations have collapsed, the species has been declared Critically Endangered in the IUCN Red List of threatened species (Zotou, et al., 2020). Its presence along the pipeline route remains unknown but cannot be discarded.

- Impacts on Annelida

Marine segmented worms (polychaetes) are a wide group of invertebrates mainly living in the marine sediment or attached to the hard substrate. These animals can be found at all water depths and in all habitat types. The benthic community survey reported this group as the most abundant in the nearshore area, however, no threatened species were found. Considering their usual distribution, it is probable that annelid species will be disturbed during offshore pipelay works; nevertheless, these species are very resilient and adapted to live in extreme and disturbed conditions. The physical presence of the pipeline on the seabed and the increase in turbidity generated by pipelay and possible seabed intervention works will not have a relevant impact on marine segmented worms.

- Impacts on Crustacea

Crustaceans are diverse in form and live around the world in a variety of habitats. In the marine environment could be found living anywhere from shallow intertidal areas to the deep sea, however, no threatened species were recorded through the baseline study.

The Project mechanisms described above will have a negligible impact on the crustacean population, provided that all the species listed in the baseline will be marginally affected or not affected at all by trenching activities in the nearshore; moreover, these crustaceans are able to move away from the source of impact and avoid possible damage. Overall impacts on Crustacea are considered not assessed.

- Impacts on Bryozoa

No threatened species were recorded through the baseline study. Other species of bryozoans are likely to be found in coralligenous habitats and on rocks, from -10 to -20 m depth, but considering their wide distribution, impacts generated by the Project mechanisms described above are relevant.

Overall impact of the Project on Bryozoa is considered not relevant.

- Impacts on Echinodermata

In the baseline study, 4 species of protected Echinodermata (Barcelona and Bern Convention) are identified as possibly present in the Study Area of the EastMed Pipeline Project. One of them (*Paracentrotus lividus*) is listed as vulnerable in the Greek Red Book. None of them were identified during the ROV nearshore surveys. However, *Paracentrotus lividus* is commonly found in very shallow waters on rocky substrates and marine meadows of *Posidonia oceanica* similar to the nearshore area of LF2 and LF3. Similarly, *Centrostephanus longispinus* is possibly found in coralligenous and rocky outcrops from -40 m to -100/-150 m along the pipeline corridors. Other species of echinoderms not protected by any convention are possibly found along the Project footprint, both in the nearshore and offshore. Considering the impacts reported above and considering the low mobility of these species, the Project will possibly have some impact on echinoderms. The case study of the Gardanne pipeline in France (Bonhomme *et al.*, 2014) where ROV surveys revealed that the "artificial reef effect" provided by the pipeline structure itself increased the abundance of *Centrostephanus longispinus*, should also be noted.

- Summary

Based on the above, the *Likelihood* of the event is <u>*certain*</u>. The *Extent* is considered <u>*small*</u> as the impact is localised at the Project's footprint. The *Intensity* is <u>*medium*</u>, considering the possible impacts on deep water corals, endangered molluscs and echinoderms. The *Duration* of impacts is be considered equal to the duration of the construction phase; i.e. <u>*short-term*</u>. Regarding *Reversibility* is <u>*reversible*</u>, considering that marine invertebrates will possibly recolonise the impacted areas after the end of the construction phase. The *Cumulative Action* is considered to be <u>*rare*</u> assuming unlikely the possibility that impacts from the EastMed Pipeline Project and from other projects or activities in the area can have a cumulative effect. The *Transboundary Character* is <u>*impossible*</u> considering the nature of the potential impact.

Based on the discussion presented above, the impacts on marine invertebrates during construction evaluated as **Minor.**

9.2.5.3.4 Impacts on Marine Fish - Nearshore/Deep water sections

This section identifies and assesses the potential impacts that the Project could have on fish communities, both cartilaginous and bony species potentially present in the Study Area, during the nearshore/deep water construction phase.

Table 9-40 below shows the fish species of concern (based on protection status and/or conservation status on European and National level) supported by the results of the baseline study (Annex 8G).

Table 9-40 Important fish fauna of the nearshore (0-40m depth) and deep water offshore (>40m depth) zones, within the offshore regions that the pipeline crosses

Species	Common name	Region
Alopias vulpinus	Thresher Shark	South Aegean sea
Anguilla anguilla	European Eel	Patraikos Gulf
Balistes capriscus	Grey Triggerfish	Patraikos Gulf
Centrophorus granulosus	Gulper Shark	South Cretan sea
Carcharhinus plumbeus	Sandbar Shark	South Cretan sea, South Aegean sea
Carcharodon carcharias	Great white Shark	South Cretan sea, South Aegean sea
Carcharias taurus	Sand Tiger Shark	South Aegean sea
Cetorhinus maximus	Basking Shark	South Aegean sea
Heptranchias perlo	Sharpnose Sevengill Shark	South Cretan sea, South Aegean sea
Isurus oxyrinchus	Shortfin Mako Shark	South Cretan sea, South Aegean sea
Lamna nasus	Porbeagle	South Cretan sea, South Aegean sea, Patraikos Gulf
Mobula mobular	Giant Devil Ray	South Cretan sea, South Aegean sea, Patraikos Gulf
Mustelus punctulatus	Blackspotted Smooth-hound	Patraikos Gulf
Oxynotus centrina	Angular Roughshark	South Cretan sea, South Aegean sea, Patraikos Gulf
Prionace glauca	Blue Shark	South Cretan sea, South Aegean sea
Pomatomus saltatrix	Bluefish	Patraikos Gulf
Raja clavate	Thornback Ray	Patraikos Gulf
Rhinobatos rhinobatos	Common Guitarfish	Patraikos Gulf
Sciaena umbra	Brown Meagre	Patraikos Gulf
Scyliorhinus stellaris	Nursehound	Patraikos Gulf

Species	Common name	Region
Sphyrna tudes	Smalleye Hammerhead	Patraikos Gulf
Sphyrna zygaena	Smooth Hammerhead	Patraikos Gulf
Squatina squatina	Angelshark	Patraikos Gulf
Thunnus thynnus	Bluefin Tuna	South Aegean sea

Prepared by: ECOMED, 2022.

The Project's actiivites affecting fish communities during construction are:

- Trenching activity, cofferdam construction and pipelaying;
- Seabed intervention works;
- Anchoring of barges; and
- Temporary passage of different types of vessels.

The impacts resulting from the activities listed above can be identified as underwater noise, increase in water turbidity, habitat loss from dredging and pipelaying. Impacts on habitat (pelagic habitat degradation) due to water quality alteration due to dredging, discharges and accidental spills during construction are not assessed for these receptors taking into account that these impacts are evaluated as minor and are temporary.

The impacts on fish are described in detail in the following paragraphs.

- Impact from Underwater Noise

The project will generate low levels of sound, within a frequency band between 10Hz and 10 kHz,with increased noise levels during the use of thrusters during pipelaying and dredging. The levels of sound that are generated will be low compared to other anthropogenic noise sources such as seismic survey or marine piling. The combination of vessels which will operate during dredging and pipelaying and their characteristics are shown in the following table.

Table 9-41 Noise from Operating vessels in dredging and pipelaying

Phase	Ship/ Equipment	Number	Source Level (dB re 1 µPa at 1 m RMS)
Dredging	Backhoe dredger	1	186
	Trailer Suction Hopper Dredger	1	188
	Tug and barge	1	171
	Support vessel	1	188
Pipelaying	Tug	3	189
	Pipelay vessel	1	183

Phase	Ship/ Equipment	Number	Source Level (dB re 1 µPa at 1 m RMS)
	Pipe carrier	1	188
	Support vessel	1	188

Prepared by: Asprofos, 2022. Data from: NTUA, 2022

In the following table the effects thresholds as set out by (Popper, et al., 2014)[22] for shipping and continuous noise are presented.

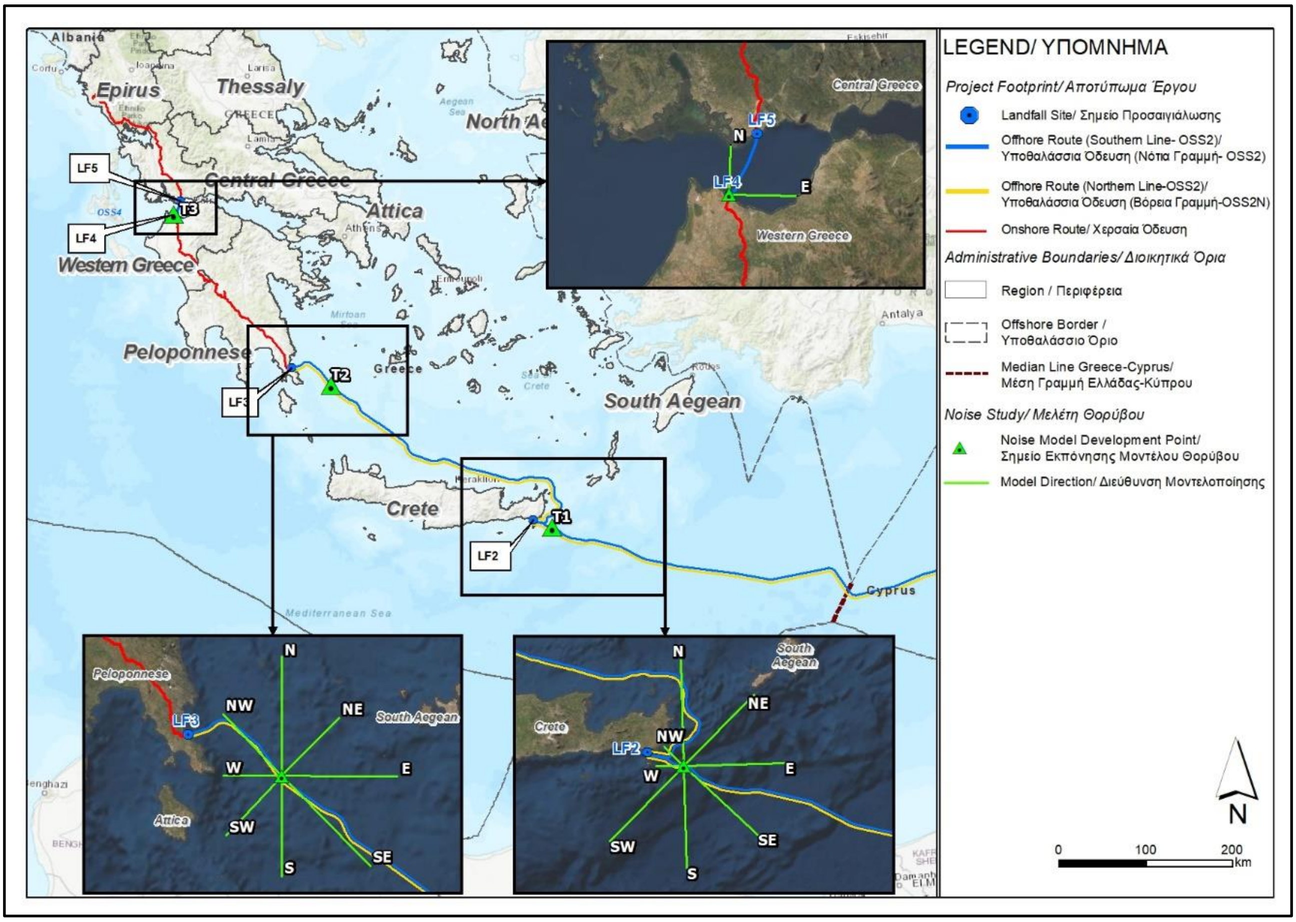
Table 9-42 Criteria for Onset of Injury to Fish Due to Continuous Sound

Type of fish species	TTS	Recoverable Injury	Mortality and potential mortal Injury
Fish: no swim bladder (particle motion detection)	(N) Moderate (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low
Fish: swim bladder is not involved in hearing (particle motion detection)	(N) Moderate (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low
Fish: swim bladder involved in hearing (primarily pressure detection)	158 dB RMS for 12h	170 dB RMS for 48h	(N) Low (I) Low (F) Low
Notes: RMS sound pressure levels dB are 1 µPa. All criteria are presented as sound pressure even for fish without swim bladders since no data for particle motion exist. Relative risk (high, moderate, low) is given for animals at three distances from the source defined as near (N), intermediate (I), and far (F).			

Prepared by: NTUA,2022. Data from: (Popper, et al., 2014)

In order to assess the distances at which the criteria for "mortality and potential mortal injury" and "recoverable injury" (which includes auditory injury) for fish are met, an Underwater Noise Model (ANNEX 9H) was performed at three sites (Figure 9-22).

[22] The guidelines define quantitative thresholds for three effects i) Temporary Threshold Shift (TTS), ii) Recoverable injury, iii) Mortality and potential mortal injury



Prepared by: Asprofos, 2022. Data from: NTUA, 2022

Figure 9-22 Bundle of transects

For fish, potential recoverable injury distances of up to 100 m from the source have been calculated, and temporary auditory impairment/auditory fatigue in the form of TTS is possible to up to 100 m based on the quantitative criteria in Table 9-42.

In general, pelagic, demersal and benthic species living close to the pipeline construction area are expected to move away temporarily from the source of disturbance and possibly return once the activities are completed. In some cases, opportunistic species may visit the areas with disturbed sediments in search of food as well.

- Increase in Turbidity and Habitat Loss from Dredging and Pipe-Laying

Resuspension of sediments and consequent increase in turbidity are considered the main impact that will affect fish fauna in the Study Area. They result mainly from seabed intervention works, pipelaying and anchor handling activities carried out mainly nearshore and, to a minor extent offshore during the construction phase.

The impact will mostly affect demersal and benthic species living close to the seafloor in *Posidonia oceanica* meadows and coralligenous habitats. Here juveniles and eggs, also belonging to pelagic fish and sharks, could be found (Chapter 8) and are considered vulnerable to an increase in sedimentation that may affect their life cycle. At the nearshore area where *P. oceanica* is the dominant environment (apart nearshore area at LF2), the magnitude of the impact on these is relevant as a consequence of the trenching activity crossing the meadows. Impacts due to habitat loss will however continue after construction. By proceeding offshore, the impact will not be relevant considering the conventional pipelay methodology.

Based on the considerations above, the impacts on marine fish fauna during the construction phase due to noise generation, dredging and pipe laying can be assessed as follows:

The *Likelihood* of the event is *certain*. The *Extent* is considered *small* with very limited effects near the dredging and pipelaying corridor and behavioural effects up to 100 m from the noise source. The *Intensity* is considered *low* in view of the low level of noise but precautionarily raised to *very high* when dealing with habitat loss. The *Duration* of impacts will be limited to the construction phase (*short-term*). Regarding the *Reversibility*, impacts on nearshore habitats are considered to be *minimisable* with appropriate mitigation measure. *Cumulative Action* is considered to be of low probability (considering the possibility that impacts from EastMed Pipeline Project and from other activities or ship traffic can have a cumulative effect). *Transboundary Character* is *impossible* considering the nature of the potential impact.

Based on the discussion presented above, the overall impact on fish fauna during construction is evaluated as **Minor.**

9.2.5.3.5 Impacts on Marine Reptiles (Sea Turtles)– Nearshore/Deep water sections

Sea turtle species of interest in the Eastern Mediterranean basin are the loggerhead turtle (*Caretta caretta*) (VU/MED LC) and *Chelonia mydas* (EN). Leatherback (*Dermochelys coriacea*) (VU) is also found in Greek seas, as a visitor but not often. These species are protected under Greek legislation and European and international regulations.

Greece hosts about 60% (3,000/yr) of the nests that occur in the Medirerranean. Green turtles do not nest in Greece, but are regularly occurring at sea, albeit at a much lower density than loggerhead turtles. However, during recent years sporadic nests of the species have been recorded south of Crete in the region of Messara bay (Margaritoulis & Panagopoulou, 2010).

Based on literature information one beach is known to be used for nesting by *Caretta caretta* within the study area of the Project, located at a distance of 50 m from the Landfall site LF3. In particular, based on the surveys carried out by Toulipa Gulimi Association, about 50 nests of the species are recorded annually in total at the beaches of Ag.Fokas (9% of the nests), Kastela (2%), the beach Xifias – Livadia (49%), and the consequent beaches Ambelakia – Astakos – Ag.Thekla (40%) (Archelon, pers. Communication), while for 2021 71 nests were identified (Toulipa Gulimi Association, pers. Communication). The beaches are located at 0.5, 1.6, 4.8 and 5.0 km from the landfall, respectively. More details are provided in section 8.5.

Regarding marine environment the sea turtle species *Dermochelys coriacea, Caretta caretta* and *Chelonia mydas* may be expected to be encountered within the deepwater offshore zone of the sea regions (South Cretan sea, South Aegean sea and Patraikos Gulf) that the pipeline crosses.

Underwater noise generation and potential collision with vessels during construction operations are considered the most relevant factors that disturb marine turtles. Habitat loss and especially disturbance to nesting beaches is another impact that needs attention. Artificial lights from the Project activities can disorient hatchlings and their ability to find the sea and are therefore potentially a notable threat.

- Generation of Underwater Noise

As refered above, the project will generate low levels of sound, within a frequency band between 10Hz and 10 kHz, with increased noise levels during the use of thrusters during pipelaying and dredging. The levels of sound that are generated will be low compared to other anthropogenic noise sources such as seismic survey or marine piling. The combination of vessels which will operate during dredging and pipelaying and their characteristics are shown in the Table 9-41.

The softest sound that an animal can hear at a specific frequency is called the hearing threshold at that frequency. If an animal is exposed to sound below the threshold of hearing, the animal cannot hear the sound. The animal can hear sounds that are above its threshold without impairment until a certain combination of intensity and duration is reached. Above this limit, the animal's threshold of hearing may be temporarily or permanently worsened. When this happens, sounds must be louder in order to be detected. If the threshold returns to near normal levels after some period of time, this condition is called a temporary threshold shift or TTS. If the threshold does not return to near normal levels, the effect is called a permanent threshold shift or PTS. PTS can occur as a result of repeated occurrences of TTS, or it can occur as a result of a single exposure to a very intense sound.

Sea turtles can detect sound, and their hearing is confined to lower frequencies, mainly between 60Hz – 1000Hz (Sam H. Ridgway et al., 1969) therefore and based on the above a frequency overlap is observed.

A preliminary discussion on the effects of anthropogenic underwater noises on sea turtles is presented below.

- Physical Damage:

There are no known studies addressing threshold shift in turtles. Possibly the best source of information is the study of Keevin and Hempen who propose using the safety range developed by Young (1991) as guidance. Using Young's safety range formula and converting back to sound pressure levels, a value of 240 dB re 1μPa @1 m is obtained for adult turtles (Thomas M Keevin and Gregory L. Hempen, 1997).

Given the above, the probability of an individual being injured is extremely low and could only happen if the turtle was too close to the ship for a long period. Threshold shift may occur if the turtle is continuously exposed over several hours to levels in excess of approximately 185 dB re 1 μPa. However, it is considered unlikely since the animal would need to swim parallel to the vessel within a range of less than about 200 m for several hours (Farrell, 2012).

- Behavioural Response:

McCauley (R.D. McCauley et al., 2000) conducted controlled exposure experiments on a loggerhead turtle and a green turtle to monitor behavioural response to approach by an airgun. They found two types of response: a) above a received airgun level of approximately 155 dB re 1 μPa2-s the turtles began to noticeably increase their swimming speed, and b) above a received airgun level of approximately 164 dB re 1 μPa2-s the turtles began to exhibit a more erratic swimming pattern, possibly indicative of their being in a distressed state.

Additionally, DeRuiter S. L. and Doukara K. L. conducted a visual observation study of 164 *Caretta caretta* individuals during a seismic survey of the Mediterranean Sea in the Algerian region (DeRuiter S. L. and Doukara K. L., 2012). They found that sea turtles stopped basking and dived in response to sound from the air gun. The average distance of sea turtles from the source was 130 m with a maximum distance of 839 m and therefore with relatively high exposure levels (estimated to be around 191 dB at 130 m and 175 dB at 839 m). The study concluded that acoustic disturbance may lead to interruption of normal behaviours (such as feeding or breeding) and avoidance, leading to displacement from the area and exclusion from critical habitats.

To assess in a more accurate way the distances at which the criteria for "mortality and potential mortal injury" and "recoverable injury" (which includes auditory injury) for sea turtles are met, an Underwater Noise Model (ANNEX 9H) was performed at three sites (Figure 9-22).

For marine turtles, potential recoverable injury distances of up to 100 m from the source have been calculated, and temporary auditory impairment/auditory fatigue in the form of TTS is possible to up to 100 m. .

- Collisions with Vessels

Sea turtles need to come to the sea surface at regular intervals to breathe and are therefore exposed to the risk of ship strikes. Moreover, sea turtles find it difficult to detect the direction of underwater sounds because of the sound propagation characteristics and the presence of several sound sources that tend to mask single, isolated sounds, such as those from an approaching outboard engine.

Body size also matters in avoiding a ship strike, as smaller animals are more agile in the water than larger ones. Furthermore, boat speed is likely to be a major cause of fatal ship strikes on sea turtles since they are generally not extremely fast swimmers (they usually cruise at around 1.4 to 9.3 km/h (Bennett, 2018). Hence, ship speed seems to be the key factor.

On this basis and taking into consideration that notable nesting beaches have been located at a short distance from the Landfall site LF3, although ship strikes are a minor cause of death, should not be ignored, as they are becoming increasingly common in breeding areas (Galil, Occhipinti-Ambrogi, & Gollasch, 2008).

- Habitat loss

According to the National Action Plan for the loggerhead turtle, one of the main objectives is the management of all its breeding habitats to ensure their viability in the future. As a result, all nesting beaches have to be preserved.

The construction work will not take place at beaches on which the species is breeding. However, in Landfall site LF3 the works for shore crossing may affect the hydrodynamics at the area or lead to sediment or other material movement and therefore indirectly affect the nesting beaches that are in short proximity to the Landfall site. The impact is mainly potentially expected due to the construction of cofferdam on rocky substrate at the landfall site and 600 m seawards, especially due to the fact that the beaches are small.

It the nearshore area where *P. oceanica* is the dominant environment (apart nearshore area at LF2), the destruction and deterioration of meadows may also affect the species and mainly the herbivorous green turtle (*Chelonia mydas*) that feeds on tender seagrass leaves. Thus, activities that may result in the fragmentation and/or loss of *P. oceanica* habitats will affect the green turtle as well. However, the spatial scale of the working area is highly localised and data indicate more frequent presence of adult green turtles in the south-eastern Aegean (Margaritoulis & Panagopoulou, 2010).

Based on the above, it is estimated that the potential for behaviour response is possible if the turtle is in close proximity (within a few metres) of the source (i.e. vessels used during construction).

- Artificial lights from the Project activities

Sea turtle hatchlings have an inborn tendency to move in the brightest direction. On a natural beach, the brightest direction is most often the open view of the night sky over, and reflected by, the ocean. Hatchlings also tend to move away from darkly silhouetted objects associated with the dune profile and vegetation. This sea-finding behavior can take place during any phase and position of the moon, which indicates that hatchlings do not depend on lunar light to lead them seaward. The apparent brightness and glare of artificial lighting along the coast or lights on boats can disorientate them and make them move toward the artificial light resulting in perish from exhaustion or predation.

Based on the baseline study (Section 8.5) this pressure is considered relevant only in the nearshore area of LF3 where shore crossing activitites will take place in a proximity with confermed sea turtle nesting beaches, although the landfall site does not represent a suitable spot due to the lack of appropriate sandy beach.

Based on the above, the Likelihood of the impact is <u>likely</u> except nearshore zone at LF3 where impact is <u>certain</u> considering that sea turtles are present in the vicinity of sources. The Extent of the impact will be <u>medium</u> near the dredging and pipelaying corridor with behavioural effects (including hatchling disorientation) up to 500 m from the working zone. The Intensity is <u>very high</u> considering the value of the receptor is very high, as it concerns species included in Annexes II of the Habitats Directive. The Duration is extended to all construction activities and therefore <u>medium-term</u>. With regard to Reversibility, the impacts are <u>avoidable</u> with the application of mitigation measures and compliance with protocols and code of conduct. Cumulative Action is considered to be of low probability, i.e. <u>likely</u> considering the possibility that impacts from EastMed Pipeline Project and from maritime traffic related to other projects or activities in the area can have a cumulative effect. The Transboundary Character is <u>rare</u> for the effects of noise propagation during pipelay in proximity to the Greek borders offshore.

Based on the discussion presented above, the impacts on sea turltes during construction both in deep water and nearshore section are evaluated as **Minor.**

9.2.5.3.6 Impacts on Marine Mammals – Nearshore/Deep water sections

Noise generation and potential collision with vessels during construction operations are considered the most relevant factors that disturb marine mammals.

Habitat (pelagic habitat) degradation due to water quality alteration caused by dredging and discharges during construction are not considered significant for these receptors, taking into account that these pressures are evaluated as low and are temporary.

- Generation of Underwater Noise

The project will generate low levels of sound, within a frequency band between 10Hz and 10 kHz, with increased noise levels during the use of thrusters during pipelaying and dredging. The levels of sound that are generated will be low compared to other anthropogenic noise sources such as seismic survey or marine piling. The combination of vessels which will operate during dredging and pipelaying and their characteristics are shown in the Table 9-41.

Marine mammals, given that they rely on sound for echolocation, detection of predators and prey, and communication within or between social groups, are considered the most sensitive species within the Study Area of the Project in relation to underwater noise.

The following table presents the most important marine mammal species (based on conservation and protection status) within offshore section.

Table 9-43 Important marine mammal species within the Offshore section

Species	Common name	Conservation Status (GL/EU)	South Cretan sea	South Aegean sea	Patraikos Gulf	Comments	Marine Mammal Hearing Group
Grampus griseus	Risso's Dolphin	LC/DD	-	x	x	The animal may be present in all geographical areas of deepwater or steep underwater relief along the pipeline route but sighting frequencies have been low. The recorded sightings occurred in depths between 200 –1,700 m and at 0.5 -32 km from the coast	High-frequency[23]

[23] TTS onset threshold (weighted SELcum) for HF cetaceans is 178 dB.

Species	Common name	Conservation Status (GL/EU)	South Cretan sea	South Aegean sea	Patraikos Gulf	Comments	Marine Mammal Hearing Group
Monachus monachus	Med. Monk Seal	EN/CR	x	x	x	During field surveys at Atherinolakos a Mediterranean Monk seal resting cave complex has been recorded approximately 1,300m east from the landfall site.	Phocid Carnivores in Water (PCW)
Physeter macrocephalus	Sperm Whale	VU/VU	x	x	-	The species has been observed along the Anadolu Submarine Canyon and the Finike (Anaximander) Seamount, which is far north from the project area. It is assumed that the animals feed on deepwater cephalopods thriving there. It was also observed far offshore the eastern coast of Crete.	High-frequency
Stenella coeruleoalba	Striped dolphin	LC/DD	x	x	-	The species is likely to inhabit at least all available waters above 450-500 m depth.	High-frequency
Tursiops truncatus	Common bottlenose dolphin	LC/VU(MED)	x	x	x	The most common species in coastal waters, also present along steep coasts with no continental shelf such as those in southern Crete although not as frequently encountered there as in shallow areas and plateau.	High-frequency

Prepared by: Ecomed, 2022. Source: 3rd National Report – Report on the Implementation of the Directive 92/43 / EEC, (Red Data Book of Threatened Animals of Greece, 2009) and (Cetaceans in Greece: Present status of knowledge, 2009). (National Marine Fisheries Service , 2018)

A preliminary discussion and assessment on the effects of anthropogenic underwater noises on the mammals is presented below.

- Physical Damage:

The softest sound that an animal can hear at a specific frequency is called the hearing threshold at that frequency. If an animal is exposed to sound below the threshold of hearing, the animal cannot hear the sound. The animal can hear sounds that are above its threshold without impairment until a certain combination of intensity and duration is reached. Above this limit, the animal's threshold of hearing may be temporarily or permanently worsened. When this happens, sounds must be louder in order to be detected. If the threshold returns to near normal levels after some period of time, this condition is called a temporary threshold shift or TTS. If the threshold does not return to near normal levels, the effect is called a permanent threshold shift or PTS. PTS can occur as a result of repeated occurrences of TTS, or it can occur as a result of a single exposure to a very intense sound.

It is generally accepted that received levels greater than 150 dB can lead to effects ranging from severe behavioural disruption to TTS and a temporary lowering of hearing sensitivity; levels greater than 170–180 dB are considered enough to cause PTS, which means permanent hearing loss, deafness and physical damage, including death in some circumstances (Richardson, Greene, Malme, & Thomson, 1995).

- Disturbance of Animal Behaviour:

Levels greater than 120 dB re 1μPa have been used and are commonly referred to as the "Level B Harassment" criterion (Richardson, Greene, Malme, & Thomson, 1995); however, the threshold for behavioural effects is uncertain. A commonly used set of criteria are the fixed thresholds of 75 and 90 dB_{ht} for all species as onset of mild and pronounced behavioural reactions, respectively. Taking the different elements into account, the 75 dB_{ht} threshold is considered a reasonably conservative and defensible estimator of the onset of behavioural disturbance in mammals.

Moreover, it should not be totally ignored or dismissed that marine mammals that may be present along the proposed route will have developed a level of tolerance to noise from vessels due to the existing noise levels within the eastern Mediterranean Sea (Section 8.11). In this regard, disturbances are likely to be of a similar magnitude as the disturbance from passing merchant (cargo, tanker, etc.) vessels.

Finally, it should not be ignored that noise from construction activities will be higher near LF sites and could potentially disturb and displace seals and coastal mammals from neighbouring waters.

To assess in a more accurate way the distances at which the criteria for "mortality and potential mortal injury" and "recoverable injury" (which includes auditory injury) for marine mammals are met, an Underwater Noise Model (ANNEX 9H) was performed at three sites (Figure 9-22).

The model considered the sensitivity of the auditory threshold shifts of hearing for the permanent threshold shift (PTS) which refers to permanent hearing damage and the temporary threshold shift (TTS) which is limited to auditory fatigue. Marine mammals that use the Study Area were divided into four groups according to their hearing capacity: a) the Low Frequency group (LF) contains all of the mysticetes, b) the High Frequency group (HF) which includes the most important marine mammal species within the study area (Table 9-43), c) the Very High Frequency (VHF) group (lists the *Phocena phocena* and *Kogia sima* that are vagrant and not regularly occurring in Cyprus waters) and no species in the Study Area fall in and d) the Phocid Carnivores in Water (PCW) group that includes the monk seal. The same classification was considered for the behavioural criteria.

Table 9-44 presents the distances at which the criteria for effects on marine mammals are met for the modelling locations. It should be noted that these are the distances from the source at which an animal would need to start swimming away from the noise source in order for the calculated SELcum to be lower than the criterion.

Table 9-44 Calculated Distances (in m) using the PTS and TTS Criteria for Marine Mammals

Marine Mammal Hearing Group	Calculated Distance for Adopted SELcum TTS Criteria, (m)	Calculated Distance for Adopted SELcum PTS Criteria, (m)
Low Frequency (LF)	<100	<100
High Frequency (HF)	<100	<100
Very High Frequency (VHF)	<500	<100
Phocid Carnivores in Water (PCW)	<100	<100

Prepared by: NTUA,2022. Data from: (Popper, et al., 2014)

Given the above, the probability for an individual to be injured is low and could only happen if it is too close to the source (<100 m) for a long period. PTS may occur if the individual is continuously exposed over several hours to levels in excess of approximately 170 dB re 1 μPa. However, though there is the potential for PTS very close to project activities, in reality it is unlikely that mammals will approach loud sound sources. Noise will affect a group of localised individuals over a short time without affecting the overall population.

In terms of behavioural reactions, the predicted noise levels from pipelaying activities meet the criteria at:

- A distance of 8.5 km from the source at the Nearshore modelling location; and
- 11 km at the Offshore modelling location.

- Collisions with Vessels

Vessel movements during construction activities have the potential to temporarily disturb marine mammals, and in some cases collisions may occur. In contrast to other species (e.g. sea turtles) mammals are highly mobile animals with acute sensory perception. Thus cetaceans should be able to avoid a ship by moving out of its path, provided it is detected in time. However, specific behaviours like feeding, resting or mating may reduce whales' attentiveness to environmental sounds (Abdulla & Linden, 2008).

According to the research and data of the Pelagos Cetacean Research Institute during the last decade (1997–2007), 1.4 sperm whales strand per year along Greek coasts. At least 70% of the stranded whales have clear propeller marks on their bodies and their deaths are likely to have been caused by collisions with large ships.

Vessels involved in the nearshore construction will move slowly and with caution considering the high precision of works to be carried out. The main vessels will be the pipeline installation vessel, such as an anchored pipelay vessel or a dynamically positioned pipelay vessel, cutter suction dredgers for trenching and dredging works in the nearshore section, tugs to assist anchored pipelay vessels. These vessels move slowly (3 km/day). Other vessels will be needed in construction activities, such as supply vessels to provide the material needed, crew change vessels to enable the crew shift, and pipe carriers especially during transit at cruise speeds that are normally in the order of 10-15 knots.

Based on the above, the *Likelihood* of the event is *rare* as impacts with vessels are rare but could occur, at Hellenic Trench IMMA adopting a conservative approach the impact is upgraded to *likely* considering that marine mammals are present in higher concentrations. The *Extent* of the impact will be *medium* along the Project footprint or vessel routes. The *Intensity* is *very high* considering the value of the receptor is very high, as it concerns species included in Annexes II of the Habitats Directive. The *Duration* is extended to all construction activities and therefore *short-term*. With regard to *Reversibility*, the impacts are *avoidable* with the application of mitigation measures and compliance with protocols and code of conduct (e.g. Marine Mammal Observer on the ship, Slow down to a speed lower than 10 knots within IMMA areas or in the presence of marine mammals etc). *Cumulative Action* is considered to be of low probability, i.e. *likely* considering the possibility that impacts from EastMed Pipeline Project and from maritime traffic related to other projects or activities in the area can have a cumulative effect. The *Transboundary Character* is *rare* for the effects of noise propagation during pipelay in proximity to the Greek borders offshore.

Based on the discussion presented above, the impacts on marine mammals during construction both in deep water and nearshore section are evaluated as **Minor.**

9.2.5.4 Impacts on Biodiversity during System Pressure Test (SPT) (Onshore/ Offshore)

Currently, two methods for System Pressure Test (i.e. precommissioining) are expected: the SPT Replacement Plan and the Hydrotest (details are provided in Section 6.4.7).

Specifically for hydrotest, there are two aspects of it that have potential ecological impacts: water abstraction from local water sources and discharge of hydrotest water after the end of hydrotesting.

It is noted that impacts from hydrotesting are discussed in Section 9.2.14, also.

Table 9-45 summarizes the hydrotest water abstraction river bodies. Based on Chapter 6, the same river bodies will be used as discharge location. The specific abstraction and discharging points are not identified yet, since they are depending on the EPC Contractor' s schedule, construction plan and most importantly specific terms imposed by the competent regional authorities. For this reason, EPC Contractor(s) for the hydrotest will obtain written approvals from local authorities regarding hydrotest water abstraction and disposal.

Table 9-45 Water Requirements for Hydrotest Sections

Pipeline Spread		Water Source	Approx. Volume Required (m^3)	Pipeline Section
From KP	To KP			
0	50	Evrotas	54,900	CCS1
50	100	Evrotas	54,900	CCS1
100	130	Evrotas	32,940	CCS1
130	150	Alfeios	21,960	CCS1
150	200	Alfeios	54,900	CCS1
200	250	Pineiakos Ladonas	54,900	CCS1
250	300	Pineiakos Ladonas - Pineios	50,500	CCS1
			18,451	OSS4
0	35	Evinos	38,430	CCS2
35	55	Water Canal of Trichonida	21,960	CCS2
55	70	Acheloos	16,470	CCS2
70	135	Arachthos & Louros	71,370	CCS2
135	200	Louros	71,370	CCS2
200	233	Louros & Acherontas	36,234	CCS2
0	4	Alfeios	492	Megalopoli Branch
4	9.8	Alfeios	713.4	Megalopoli Branch

Source: IGI Poseidon,2021

- Water abstraction:

The abstraction of water from water bodies can decrease water volume and flow, resulting to:

- Habitats deterioration
- Displacement of spawing habitats, due to decreased water level

- ➢ Entraintment of small fish, fish eggs and macro-inverterbrates

In any case, the abstraction, plus monitoring of water, will take place by the construction contractor - who will must have all the requiredacquire all necessary permits from the competent Authorities - .

The potential water sources used for water abstraction is presented in Table 9-45 (details are provided in Section 6.4.7) and as mentioned above all required permits will be issued. The abstraction of water will take place in volumes of small percentage in relation to the river flow. If the volumes of abstracted water are a small percentage in relation to the river flow (eg approximately 10%), then the impact from water abstraction is anticipated to be minor. On the other hand, due to big variability on river flows, there is a possibility the minimum ecological water flow conditions not to be met and the significance of the impact to be more moderate or even major.

In case sea water is used the location of the sea water abstraction should not be near the bottom of the sea, in order to avoid sediments suspension.

- Hydrotest water discharge:

The discharge of water could potentially have the following impacts:

- ➢ Temporarily increase in downstream flows which would lead to bank and substrate erosion.
- ➢ Physicochemical changes of the receiving water body.
- ➢ Toxicological impacts due to oxygen scavengers, corrosion inhibitors or biocides added to the water during hydrostatic testing.
- ➢ Cross-contamination with 'alien' species, especially in case of water from one specific river catchment is discharged in another river basin. However, it is important to note that in order to avoid such biological pollution, the same water body will be used for abstraction and discharge of the water to be used for hydrotesting, as much as possible.

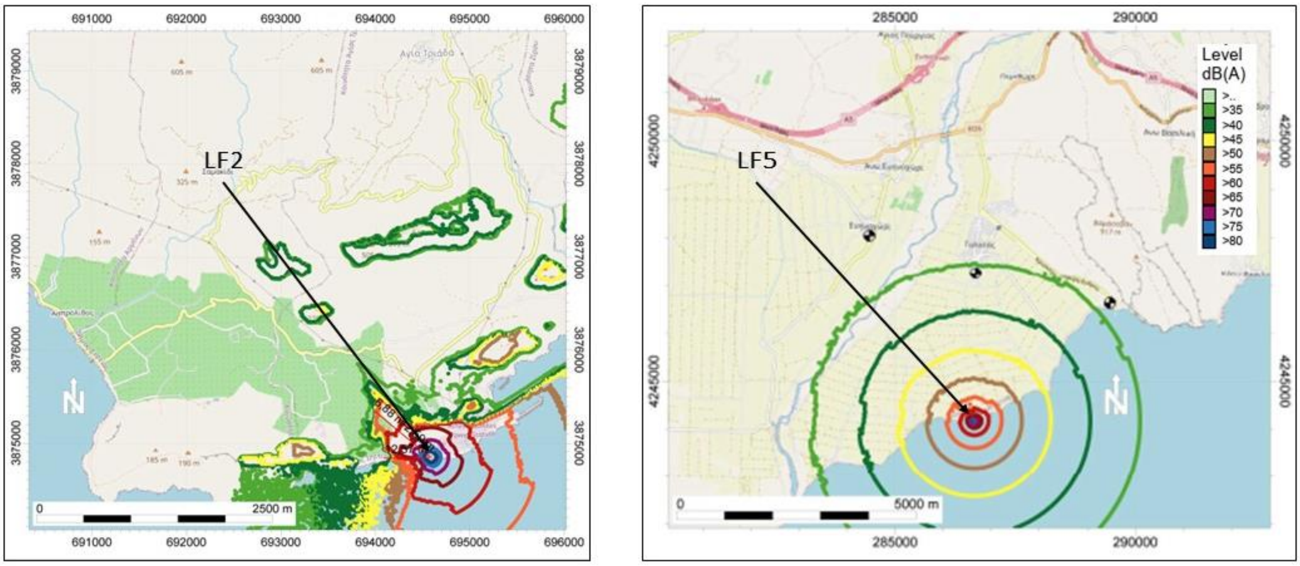
The abstraction, plus monitoring of water, will take place by the construction contractor - who will acquire all necessary permits from the competent Authorities

It is anticipated, that the hydrotest water will be very low level in toxicological parameters and all physicochemical parameters will be of the same quality as the baseline levels. The discharge will take place in low rates (a common practice is < 3 m^3/s).

Hydrotest water should be free of biocides and oxygen prior of discharge. If any additives have to be used, they will be included in the PLONOR list.

- Noise from compressors for System Pressure Test (SPT)

Regardless of the SPT method, as detailed in Section 9.2.14 noise emissions comes mainly from the operation of the compressors, pumps and power generator used to increase pressure inside the pipeline. A dedicated model study was elaborated for two indicative sites, i.e. LF2 and LF5 (see Annex 9G). As summarized in Figure 9-23 (and detailed in Annex 9G), in less than 500 m from the noise source, the noise level is approximately 55 dB(A).



Prepared by: ASPROFOS 2022. Data from (Noise propagation model during pre-commissioning phase, 2022)

Figure 9-23 Noise propagation during SPT for selected locations.

Based on Section 6.4.7.3, there will be approximately 50 onshore hydrotests which shall require approximately 7-10 days, each, 1 offshore hydrotest (for OSS4) which will require approximately 11 days. SPT for OSS2 and OSS3 will require a total of 60-85 days. During this periods, the compressors will operate, not continuously but with intervals of various intensity and hence noise generating.

Discussion on disturbance (due to noise) to onshore biodiversity is assessed in Section 9.2.5.2.4, whilst for offshore biodiversity in Section 9.2.5.3.

Taking into account the considerations previously discussed and following evaluation criteria presented in Section 9.1, impact on biodiversity during system pressure test may be assessed as follows: The *Likelihood* of the impact is considered *certain*; since the mechanisms cannot be avoided. The *Extent* of the impact will be localised at the Project footprint thus is considered *small;* water abstract/ discharge will be local, whilst proper discharge will not cause any impacts to the broader bed; noise shall be increased within 500 m from the noise source (compressors for SPT) and will not be constant. The *Intensity* of the impact is considered *high*. The Project will have an impact only during SPT activities, which will be in total less than 100 days for any section (although typically, it will take approx. 10 days). Regarding *Reversibility*, impacts are mostly reversible, but adopting a conservative approach, are assessed as *minimizable* (see Chapter 10). The *Cumulative Action* of the impact is considered *rare* assuming unlikely the possibility that impacts from the EastMed Pipeline Project and from other projects or activities in the area can have a cumulative effect. The *Transboundary Character* is *impossible* considering the nature of the potential impact. Based on the considerations above, the impacts are **Minor.**

9.2.5.5 Impacts on Avifauna

The Project's key activities potentially impacting birds during construction are the following:

- Preparation and excavation of the terrain before erection of temporary and permanent facilities;
- Preparation of the working strip excavation of the trench for onshore pipeline installation and the shore crossing section;
- Heavy vehicle traffic onshore and vessels in the nearshore section;
- Air, noise and vibration emissions from the construction front;
- Light emission from construction areas

The most likely impacts on bird species will be caused by displacement and disturbance of the species due to clearing and excavation working activities and the traffic of vehicles at the facilities and along the working strip. Machinery and equipment will also produce noise and vibration.

Most important ecosystem types for avifauna include riparian and lakeside areas; such areas provide feeding, roosting and nesting grounds of great variety for many species. Other also important ecosystem types for avifauna include: (i) complex arable lands and (ii) forest areas with large trees and openings. Complex arable lands, especially those in close proximity with water resources or with forest areas and pastures, provide for great different ecological services to avifauna, conditionally that lands are not intensively cultivated. Intensive cultivation does not allow avifauna species to perform necessary biological patterns (e.g. courtship, feeding, nesting, etc) either due to the everyday disturbance of agricultural acitivities or by conflict to agricultural concerns (e.g. crops infestation, reduction due to avifauna).

The Project does interfere with numerous *habitat types*, including riparian habitats or surface water and wetland. Especially for riparian ecosystems, the type of construction method used for the corresponding river is of essence to impacts assessment. As discussed in previous sections (Section 9.2.5.2.1 and 9.2.5.2.4.2) rivers crossing with open cut induce significant impacts on the morphology of the river banks, hence riparian ecosystems. On the contrary, trenchless techniques leave largely unaffected riparian ecosystems, alas they do require greater construction time and do not avoid noise activities. Nevertheless, trenchless river crossing is generally expected to induce no impacts to avifauna species. As detailed in Table 6-47 of Chapter 6, currently, trenchless river crossing is foreseen for:

- CCS1: R. Alfios (KP 202)
- CCS2: R. Evinos (KP 9), Water Canal Trichonida – Lisimachia (KP 37), R. Acheloos (KP 57), Artificial Concrete Irrigation Channel (KP 60), R. Arachthos (KP 135), R. Louros (KP 160), Tributary of River Louros (KP 162), Irrigation Ditch (KP 167), R. Acherontas (KP 196) and R. Vouvopotamos (aka R. Vouvos or R. Kokitos) (KP 200).

Discussion regarding *nuisance* on avifauna species is largely similar (if not identical) to the one presented for terrestrial and freshwater species altogether. Noise disturbing activities and dust generation are the same. This means that in a 500 m distance from the project footprint, no nuisance/ disturbance is expected. What needs to be noted is that some avifauna species nest or roost in specific ecosystem types, e.g. ground nests in agricultural areas, cliffs for raptors, all trees. Some species will protect their nests to the death or lose the breeding season if nest is destroyed.

Mitigation measures will include standard pre-construction surveys to verify the presence/absence of the species and the presence of nests or species using the areas for foraging or discouraging of nesting prior vegetation clearance along the working strip. Standard good practice for civil works will be implemented as part of the project execution plan which will minimise impacts and nuisances to the species (refer to mitigation measures under Section 10.2.5).

The marine environment offshore is used for feeding grounds by marine birds, however, due to the nature of the Project, construction impacts on feeding grounds or disturbances derived from the presence of the vessels and pipelay will be only marginal, especially in the offshore/open seas. The species most commonly found in the coasts off Greece within the entire Study Area are seagulls and shearwaters (Procellariidae). The most relevant nuisances would be derived from the trench and cofferdam construction located on the shore/nearshore.

Summarizing the available baseline data and assessing potential impacts to avifauna species, the following are noted:

- The richest habitats identified along the EastMed pipeline routing in Greece were the riparian and lakeside zones, the complex of non-intensively arable land in close association either with water resources (rivers, lakes) or with forest areas or pastures and the forest areas with large trees and openings.

- The total species number based on literature studies is 187 (whilst 165 species were observed in the study area). Raptors are amongst the most important species recorded in the area, with Levant Sparrowhawk (*Accipiter brevipes*), Black Kite (*Milvus migrans*), Greater Spotted Eagle (*Clanga clanga*), Short-toed Snake Eagle (*Circaetus gallicus*), Long legged Buzzard (*Buteo rufinus*), Marsh Harrier (*Circus aeruginosus*), Bonelli's Eagle (*Aquila fasciata*) and Peregrine Falcon (*Falco peregrinus*) been observed in certain areas along the pipeline during field work. Other species observed also in need of special attention include Ferruginous Duck (*Aythya nyroca*), Spoonbill (*Platalea leucorodia*), Glossy Ibis (*Plegadis falcinellus*), Little Egret (*Egretta garzetta*), Pygmy Cormorant (*Microcarbo pygmeus*), Dalmatian Pelican (*Pelecanus crispus*), Night Heron (*Nycticorax nycticorax*), Purple Heron (*Ardea purpurea*), White Stork (*Ciconia ciconia*), and various woodpecker species. Other species were observed along the pipeline routing and the broader study area and are not expected to be affected by the project activities as the route will pass underground to riparian and wetland areas, which are the main areas found to be used by the above species.
- The most important location identified within the study area (i.e. area with the greatest diversity and number of protected bird species) is the flood zone of the R. Louros – swamp of Rodia and the arable lands adjacent to them. This area is used throughout the year by a variety of birds (breeding, migration, wintering), while relatively close to the pipeline routing, in the swamp of Rhodia a large colony of Pygmy Cormorant (*Microcarbo pygmeus*), Spoonbill (*Platalea leucorodia*), White Egret (*Ardea alba*) and other herons was found. Although it is the most important place in terms of bird conservation, it seems that it will not be particularly affected since the pipeline will pass the R. Louros with trenchless method.
- On the contrary, one area that seems to be greatly affected is the Arethon river valley in the area of Myrsini Preveza. It is a narrow valley about 5 km long, which includes small plots of land with traditional hedgerows, scattered trees and shrubs and the riverbed of the river Arethon which maintains riparian woody vegetation with a dominant species of plane tree *Platanus orientalis*. This valley is important for a multitude of passerines with the most important species to be the Red-backed Shrike (*Lanius collurio*) and the Woodlark (*Lullula arborea*), but also various other species of birds such as White Stork (*Ciconia ciconia*), Eagle Owl (*Bubo bubo*), Levant Sparrowhawk (*Accipiter brevipes*), Nightjar (*Caprimulgidae*), Kingfisher (*Alcedinidae*) and various species of woodpeckers.
- Other very important areas are the old olive groves and the large shrublands with openings in various locations in the peripheral unit of Laconia, which are used by important species of passerines during breeding, such as Olive-tree Warbler (*Hippolais olivetorum*) and Rüppell's

Warbler (*Sylvia rueppelli*). The riparian zones (except of the Louros-Rodia area mentioned separately in the previous paragraph) along the entire length of the routing are equally important for several species of birds such as Levant Sparrowhawk (*Accipiter brevipes*), various species of woodpeckers, Eagle Owl (*Bubo bubo*), Nightjar (*Caprimulgidae*), Kingfisher (*Alcedinidae*) and many passerines. The community of birds of the agricultural lands consisted mainly of common species such as Crested Lark (*Galerida cristata*), Corn Bunting (*Emberiza calandra*), sparrow species, Nightingale (*Luscinia megarhynchos*), Blackbird (*Turdus merula*) and various crow species.

- The most important species on agricultural land is the Greater Short-toed Lark (*Calandrella brachydactyla*) which is likely to breed in some areas along the study area. however, these species are not expected to be affected by the project activities, unless these activities cross nesting sites. Another important species is Stone-curlew (*Burhinidae*) that nests in the ground in open barren areas with low vegetation, such as riverbeds with cobblestones. At the rivers Acheloos and Evinos the species nests in a short distance from the pipeline routing but it seems that it will not be affected since the pipeline will pass the rivers underground (trenchless). The same habitat is also used by the Little Ringed Plover (*Charadrius dubius*).
- The above highlights refer mainly to breeding species since the breeding season is the most critical and sensitive for birds. However, it should be noted that several locations of the pipeline routing are widely used by migratory species as stopover sites or by wintering species as feeding grounds. As illustrated in Figure 9-24, the project mostly avoids migratory corridors in Greece with the excemption of Patraikos Gulf and the western most migratory corridor, at the area of Amvrakikos Gulf. Migratory patterns differ for each bird species. Most migratory birds of Greece arrive in spring and spend the summer to breed, some winter and others are passage migrants, stopping in Greece briefly to rest and refuel before continuing on their journey. A very typical example is the flood zone of the river Louros and the swamp of Rodia, areas where the pipeline will pass underground, so the habitats will not be affected. In places where work will take place (drilling, etc.) is possible to form seasonal waterholes which are of great importance for several migratory species, such as the Ruff (*Philomachus pugnax*), Glossy Ibis (*Plegadis falcinellus*), Marsh Sandpiper (*Tringa stagnatilis*), Garganey (*Spatula querquedula*) and several others. In terms of wintering, several locations are very important, but one of the most typical examples is the plain north of Vigla at Amvrakikos, which is an important feeding area for several species of birds of prey. Trenching will take place, which may affect this area.

In conclusion, the main areas of consideration for the importance of avifauna found along the pipeline routing during field surveys in combination with the literature review are presented in Table 9-46. Species present in the area include species of conservation interest (e.g. CR/EN/VU according to IUCN or Greek Red Book Data) and/ or species (individual or categories) identified as potentially affected (according to the previous discussion). For most of the species included in Table 9-46, spring migration takes place between March and May, whilst autumn migration between September and October.

Table 9-46 Main areas of avifauna special interest along project footprint.

Area	Habitat	KP	Species present (special ecological sensitivity)
CCS1			
Agios Fokas (LF3)	Coastal zone with barren meadows and few dunes	0	Migratory species
SE Laconia	Old olive groves, areas with drystone terraces and some shrublands	8–87	*Hippolais olivetorum, Sylvia rueppelli, Emberiza caesia, Buteo rufinus, Circaetus gallicus, Hieraaetus fasciatus (Aquila fasciata), Bubo bubo,* Migratory species
R. Evrotas	Riparian zone at various locations with aquatic woody vegetation	101–129	*Leiopicus medius*, Migratory species
R. Evrotas springs	Riparian zone with aquatic woody vegetation in combination with arable land	128–129	*Caprimulgus europaeus, Alcedo atthis*, Migratory species
R. Alfios	Riparian zone with aquatic woody vegetation in combination with arable land	202–205	*Caprimulgus europaeus, Alcedo atthis*, Migratory species
Foloi area	Oak forest in combination with arable land with hedgerows, sparse shrubs and trees, shrublandsand pastureland	228 –235	Woodpeckers, *Ficedula semitorquata, Hippolais olivetorum*
R. Ladonas	Riparian zone with aquatic woody vegetation in combination with arable land	248	*Caprimulgus europaeus, Alcedo atthis*, Migratory species
R. Pinios	Riparian zone with aquatic woody vegetation in combination with arable land	263	*Caprimulgus europaeus, Alcedo atthis,* Migratory species
CCS2			
Estuary of R. Evinos (LF5)	Coastal zone with salt marshes	0	*Charadrius alexandrinus, Pluvialis apricaria*

Area	Habitat	KP	Species present (special ecological sensitivity)
R. Evinos	Riverbed with shrub and aquatic woody vegetation and cobble deposits	3 - 9	*Burhinus oedicnemus, Calandrella brachydactyla, Lanius minor*
Arakynthos	Oak forest with openings and shrubs	15 – 25	Woodpeckers, *Circaetus gallicus, Pernis apivorus, Gyps fulvus, Aquila chrysaetos, Circaetus gallicus, Accipiter brevipes, Bubo bubo, Caprimulgus europaeus*
Trichonida-Lysimacheia	Lakesite with reedbeds, ditches and arable land	30 – 45	*Ardea purpurea* (Avoidance of work at dense reebeds in large wetlands, during the breeding period (March - July), *Nycticorax nycticorax, Microcarbo pygmaeus, Circaetus gallicus,Alcedo atthis, Calandrella brachydactyla, Circus aeruginosus,* migratory waders and waterfowls, terns
R. Acheloos	Large area with cobblestone deposits from quarrying activity	56 – 58	*Burhinus oedicnemus*
Petalas	Shrublands with sparce trees (mainly oaks), pasturelands and arable land	63 – 73	*Hippolais olivetorum, Bubo bubo, Circaetus gallicus*
Retha area	Oak forest and shrublands in combination with openings, arable land and pastureland	111 – 117	*Circaetus gallicus, woodpeckers, Pernis apivorus, Caprimulgus europaeus, Lanius collurio, Lullula arborea, Accipiter brevipes*
Amvrakikos (from R. Arachthos to R. Louros)	Riparian zone with aquatic woody vegetation and wetland areas in combination with arable and barren land, wet meadows, pasturelands, tree thickets and hedgerows. Alluvial forest, reedbeds	135 – 168	Woodpeckers, herons, *Plegadis falcinellus (*Avoidance of work at flooded areas close to the Rodia swamp, during the breeding period (March-July)), *Platalea leucorodia* (Avoidance of work at flooded areas around the Rodia swamp, during the period April-May)*, Pelecanus crispus, Microcarbo pygmaeus, Himantopus himantopus, Glareola pratincola, Calidris pugnax and other waders, Aythya nyroca, Clanga clanga, Clanga pomarina (*Avoidance of work at rural

Area	Habitat	KP	Species present (special ecological sensitivity)
			areas, meadows and barren lands, west of the river Louros, during the breeding period (March - July), *Circaetus gallicus, Milvus migrans, Accipiter brevipes, Calandrella brachydactyla, Lanius minor, Ciconia ciconia, Ciconia nigra, Circus aeroginosus (*Avoidance of work at dense reebeds in large wetlands, mainly during the breeding period (March - July)), *terns, Alcedo atthis*
Arethon valley (Myrsini Preveza)	Narrow river valley with aquatic woody vegetation in combination with arable land, hedgerows and small shrublands	177 – 182	*Lanius collurio, Lullula arborea, Ciconia ciconia, Bubo bubo, Accipiter brevipes, Caprimulgus europaeus, Alcedo atthis,* woodpeckers
Lekatsa forest	Dense deciduous forest with few openings, shrublands and rocks	182–184	*Bubo bubo, Accipiter brevipes, Caprimulgus europaeus, woodpeckers, Pernis apivorus, Lanius collurio*
R. Acheron plain	Arable land, ditches and riparian zone with aquatic woody vegetation and reedbeds	193–200	*Calandrella brachydactyla, Lanius collurio*
Themelo Preveza	Wetland with aquatic woody vegetation in combination with arable and barren land, meadows and wet meadows	201–203	*Alcedo atthis*, herons
Kalodiki wetland	Swamps, shrublands, arable and barren land, hedgerows and pasturelands, ditches, tree and shrub thickets	211–215	*Aythya nyroca, Ciconia, Ciconia, Microcarbo pygmaeus, Circus aeroginosus, Lanius collurio,* herons, terns
Palaiokastro Thesprotia – Kaneta lake	Lakesite with reedbeds in combination with arable and barren land, hedgerows, pasturelands, scattered trees and shrubs	221–223	*Ciconia ciconia, Circus aeroginosus, Lanius collurio,* herons

Prepared by: NCC, 2021.

Prepared by: ASPROFOS, 2022. Data by: Hellenic Ornithological Society.

Figure 9-24 Correlation of the project with migration routes of birds.

Based on the consideration above, the impacts on avifauna and in particular to the areas and species of Table 9-46 during the construction phase is evaluated as follows:

The *Likelihood* of impacts is considered *likely*. The species can be affected by habitat loss and disturbance from construction activities both onshore and nearshore. The *Extent* is considered *medium* as impacts are related to noise/air/light emissions and habitat loss in the vicinity of the footprint. The *Intensity* of potential impacts is deemed *low* to *medium* considering the limited surface of onshore habitat loss and the magnitudes of air, noise and light impacts and also the fact that not all of the species listed in Table 9-46 are of conservation status. Regarding *Duration,* construction of the Project onshore will last up to 36 months maximum (for the permanent facilities areas) whislt, as discussed in the previous section, the pipeline itself will be constructed with a rate between 100 and 600 m/d; landfall construction will take about half a year (per LF site). Nevertheless, adopting a conservative approach, duration is assessed as *medium-term*. Regarding *Reversibility*, impacts are mostly reversible and even avoidabel, but adopting a conservative approach, are assessed as *minimizable*. The *Cumulative Action* is *rare* considering unlikely the possibility that impacts from EastMed Pipeline Project and from other projects or activities in the area can have a cumulative effect. The *Transboundary Character* is *impossible*. In summary, the impacts are evaluated **Minor**, as all necessary mitigation measures will be put in place (see Chapter 10).

9.2.5.6 Impacts on Protected Areas – Onshore/ Offshore

The pipeline crosses various protected areas. Following national categorization (L. 3937/2011 – HGG A' 60) Table 9-47 summarizes the engagement of the protected areas included in the national system with the investigated project. It is clarified that in Greece, the Natura 2000 Network covers all type of protected areas, so there are a lot of overlapping among Natura Areas, National Parks and Wildlife Refuges, as illustrated in Table 9-48.

Specifically for the Natura2000 sites, Appropriate Assessments have been prepared according to national and European legislation requirements, including performance of seasonal fieldworks, focusing on the protected features of each Natura2000 site. For the purposes of this chapter, a summary of impacts to Natura Areas, as analysed at the annexed Appropriate Assessments, is presented. Based on the fact that impacts are assessed, mainly, against the integrity of the protected feature of the site but, also, to other elements of the biodiversity of the Protected Area, as an integral component of the ecosystems that indirectly affect the conservation status of protected species, the assessed impacts are shown in the Table 9-49. More details are presented in the relevant annexes (see Annex 9E).

It is noted that before preparation of the Appropriate Assessments for potentially affected Natura2000 sites, a screening process was performed (see Annex 9E.1). The purpose was to identify if the project's construction and operation may result in potential impacts upon Natura2000 sites located in the broader area of the Project. Out of the 16 sites identified, 14 sites were assessed as potentially affected by the project resulting in the preparation of 14 Appropriate Assessments.

Out of the 14 Natura2000 sites for which Appropriate Assessment was performed, the most important interaction is identified in the following sites:

- SAC GR2540001. At the LF3, Posidonia beds* priority habitat (1120*) is going to be impacted for the shore crossing. For the shore crossing an area of approx. 600 m long and 30 m wide, including 8000 m^2 of this habitat, is going to be affected. Impact for the specific parameter (Posidonia beds habitat loss) is assessed as **Moderate.** Details are provided in Annex 9E.10
- SAC GR2310010. Wolf presence may be affected. Species suitable habitats may be impacted whilst construction activities may disturbe species presence. Impact for Wolf's habitat loss is assessed as **Moderate;** impacts for Wolf's disturbance is assessed as **Moderate,** also**.** Details are provided in Annex 9E.7

For the other types of protected areas involved with the project, i.e. Wildlife Refuges and National Parks, discussions held in previous sections are applicable. Nevertheless, in order to assess potential impact of the project on the integrity of these areas, an assessment matrix was prepared. The approach was to have a spatial analysis of the affected area within the specific site and the overall availability. It is assumed that the spatial analysis covers habitats and other ecological needs of the protected species mentioned in the Wildlife Refuges and/ or National Parks and also the anthropogenic pressures/ needs (especially in case of National Parks).

Regarding Wildlife Refuges, as illustrated in Table 9-50, almost all of the affected ecocystem types are engaged in a percentage < 1 % of the total available specific ecosystem type within the protected area. This means that the availability of a specific ecosystem type within the Wildlife Refuge is not severely impacted by the construction of the project. This is because impacts are assessed only in terms of habitats/ vegetation loss, as previously mentioned. In more detail, 8 records present <0.5 % and 6 records < 1 % of the total available specific ecosystem type within the protected area. Even in the 3 records that the affected ecocystem types are engaged in a percentage higher than 1 %, the percentage is, still, very small. More specifically:

- In K361 (Mt. Arakynthos area), affected Mixed forests represent 1.58% of the total available ecosystem type within the Wildlife Refuge, whilst Transitional woodland- shrub represent 2.35%.
- In K838 (Lekatsa area of M. of Zalogos), affected Agroforestry areas represent the 2.57% of the total available ecosystem type within the Wildlife Refuge.

Given the limited area affected, overall availability of the specific ecosystem types within the Wildlife Refuges and their characteristics (as discussed in Seciton 9.2.5.2.1), **no impacts on the integrity of the Wildlife Refuge areas are assessed.**

Regarding National Parks, Table 9-51 is informative. Adopting the same approach as described for Wildlife Refuges, no ecosystem type is impacted at a percentage higher than 0.5% but for the Permanent crops of ΕΠ10 (Amvrakikos Gulf). More specifically:

- In ΕΠ5 (Lagoons of Messolonghi-Aetoliko), almost the entire working strip (98.5%) passes through annual crops (Permanent crops - 97%, complex cultivations patterns - 1.5%, and arable land - 0.5%). The rest of the working strip crosses Sparsely vegetated areas (1%)
- In ΕΠ10 (Amvrakikos Gulf), most of the working strip (66%) crosses through annual cultivations (Permanent crops – 40%, complex cultivation patterns – 20% and arable land – 6%) whilst 16% through tree crops (Fruit trees and berry plantations – 8% - and Olive grooves – 8.5%). The rest of the working strip within ΕΠ10, is mainly characterized by typical Greek Mediterranean ecosystems, e.g. Agroforestry areas (5%) or Macquis (Sclerophyllous) vegetation (6%). Mixed forests are engaged for approx. 5% of the total working strip within the specific National Park; however, this corresponds to 0.18% of the total area of the specific ecosystem.

Given the limited area affected, overall availability of the specific ecosystem types within the National Parks and their characteristics (as discussed in Seciton 9.2.5.2.1), **no impacts on the integrity of the National Park areas are assessed.**

Table 9-47 Codes of Protected Areas.

Project Component	Site Code	Name	Spatial Correlation* (From KP-To KP)
National Parks			
CCS2	ΕΠ5	Messolonghi-Aetoliko Lagoon National Park, downstream and estuaries of Acheloos and Evinos rivers and Echinades islands (JMD 22306/2006, HGG D' 477/31-05-2006)	2 – 57
CCS2	ΕΠ10	Amvrakikos Wetlands National Park (JMD 11989/2008, HGG D'123/21-03-2008)	104 - 178
Natura 2000 Sites - Special Areas of Conservation			
OSS3/OSS3N	GR4320006	Voreioanatoliko Akro Kritis: Dionysades, Elasa kai Chersonisos Sidero (Akra Mavro Mouri – Vai – Akra Plakas) Kai Thalassia Zoni (Northeast Coast of Krite: Dionysades, Elasa and Sidero Peninsula (Peninsula Mavro Mouri – Vai – Peninsula Plakas) and Marine Zone)	60-61
OSS3/OSS3N	GR2540001	Ori Gidovouni, CHIONOVOUNI, Gaidourovouni, Korakia, Kalogerovouni, Koulochera kai Periochi Monemvasias Spilaio Solomou Trypa kai Pyrgos Ag. Stefanou kai Thalassia Zoni eos Akrotirio Kamili (Mountains of Gidovouni, Chionovouni, Gaidourovouni, Korakia, Kalogerovouni, Koulochera and area of Monemvasia Spilaio Solomou Trypa and Pyrgos Ag. Stefanou and Marine Zone to Akrotirio Kamili)	426 – 429
CCS2	GR2310001	Delta Acheloou, Limnothalassa Mesolongiou - Aitolikou, Ekvoles Evinou, Nisoi Echinades, Nisos Petalas (Delta of Acheloos, Lagoon of Mesologi - Aitoliko, Estuary of Evinos, Echinades Islands, Petalas Island)	2-6
CCS2	GR2310005	Oros Varasova (Mountain of Varasova)	5-7

Project Component	Site Code	Name	Spatial Correlation* (From KP-To KP)
CCS2	GR2310010	Oros Arakynthos kai Stena Kleisouras (Mountain of Arakynthos and Kleisoura Straits)	11 - 25
CCS2	GR2310009	Limnes Trichonida kai Lysimacheia (Trichonida and Lysimacheia Lakes)	37 – 38
CCS2	GR2110001	Amvrakikos Kolpos, Delta Lourou kai Arachthou (Petra, Mytikas, Evryteri Periochi, Kato Rous Arachthou, Kampi Filippiadas) (Amvrakikos Gulf, Delta's of Louros and Arachthos rivers (Petra, Mytikas, broader area, Arachthos Downstream, Filippiadas Plains))	135 – 160
CCS2	GR2120002	Elos Kalodiki (Kalodiki Marshland)	212 - 213
Natura 2000 Sites - Special Areas of Conservation & Special Protection Areas			
CCS1	GR2330002	Oropedio Folois (Plateau of Foloi)	227 - 228
Natura 2000 Sites - Special Protection Areas			
CCS1	GR2540007	Ori Anatolikis Lakonias (Mountains of East Lakonia)	20 – 23
CCS2	GR2310015	Delta Acheloou, Limnothalassa Mesolongiou - Aitolikou kai Ekvoles Evinou, Nisoi Echinades, Nisos Petalas, Dytikos Arakynthos kai Stena Kleisouras (Delta of Acheloos, Lagoon of Mesologi - Aitoliko, Estuary of Evinos, Echinades Islands, Petalas Island. Western Arakynthos and Kleisoura straits)	2-7
CCS2	GR2310013	Limni Lysimacheia (Lake Lysimacheia)	40-44

Project Component	Site Code	Name	Spatial Correlation* (From KP-To KP)
CCS2	GR2110004	Amvrakikos Kolpos, Limnothalassa Katafourko kai Korakonisia (Amvrakikos Gulf, Lagoon of Katafourko and Korakonisia)	159 – 160
CCS2	GR2120006	Eli Kalodiki, Margariti, Karteri kai Limni Prontani (Marshlands of Kalodiki, Margariti, Karteri and Prontani Lake)	212 – 213
Wildlife Refuges			
CCS1	K524	Pratagos – Aetofolia (Elikas -Agios Nikolaos)	18 – 19
CCS2	K361	Oros Arakynthos-Mataragkas-Gavalou	20 – 26
CCS2	K316	Petalas (Amfilochias-Kechrinias-Papadatou-Stanou)	60 - 74
CCS2	K728	Iera Moni Retha kai Iera Moni Longos Dimon Amfilogias, Menidiou, Inachou	113 - 120
CCS2	K838	Lekatsa Dimou Zalongou	181 – 184
CCS2	K599	Valtos Kalodikiou	211-213

* Spatial correlation refers to the overall relation of the project with the specific site and not to potentially affected and/ or crossed area. Details are presented in Table 9-48.

Prepared by: ASPROFOS, 2022.

Table 9-48 Engagement of protected areas with the investigated project during construction phase.

Site Code	Zone	Approximate KP (From KP-To KP)	Total Route length Intersected (km)	Total Area of Working Strip within protected area (km^2)	Total Area of Protected Site (km^2)	% of Protected site's area within the working strip	Overlapping (partial or complete)	Approximate Distance to Project Footprint (m)
ΕΠ5	Nature Reserve Zone in National Park (ΠΦ2)	5-7	-	n/a	83,016	n/a	GR2310005	550
	Nature Reserve Zone in National Park (ΠΦ3)	2.5-6.6	-	n/a	15,426	n/a	GR2310001 & GR2310015	180
	Peripheral Zone (ΠΠ1)	8.570-9.186, 39.331 - 56.647	1,639	0,016	37,116	0,04	GR2310009 & GR2310013	0
	Peripheral Zone (ΠΠ2)	39.331-56.647	17,316	0,660	190,515	0,35	GR2310009 & GR2310013	0
ΕΠ10	Zone C: Zone of Environmental Control	104.101-113.558, 114.198-134.853, 134.970-158.661, 160.419-161.623 165.153-166.792. 168.009-176.425	65,063	2,105	1522,696	0,14	-	0
	Zone B: Special Regulations Area	134.853-134.970, 158.661-159.602, 159.602-160.034, 160.034-160.419,	6,622	0,251	287,633	0,09	GR2110001 & GR2110004	0

Site Code	Zone	Approximate KP (From KP-To KP)	Total Route length Intersected (km)	Total Area of Working Strip within protected area (km^2)	Total Area of Protected Site (km^2)	% of Protected site's area within the working strip	Overlapping (partial or complete)	Approximate Distance to Project Footprint (m)
		161.623-165.153, 166.792-168.009						
	Zone A: Nature Reserve Zone in National Park	159.6-160	0,432	n/a	186,264	n/a	GR2110001 & GR2110004	0
	Zone A-1: Special Water Management Area	141-142	-	n/a	4,807	n/a	GR2110001 & GR2110004	730
GR4320006	n/a	60-61	-	n/a	394,158	n/a	-	780
GR2540001	n/a	426.792-428.689	1,897	0,057	390,517	0,01	-	0
GR2310001	n/a	2-6	-	n/a	356,413	n/a	GR2310015	75
GR2310005	n/a	5-7	-	n/a	14,750	n/a	ΕΠ5	700
GR2310010	n/a	11-18 23-25	-	0,000	133,031	0,00	Κ361	10
GR2310009	n/a	37.010-38.242	1,232	0,050	143,495	0,03	ΕΠ5	0
GR2110001	n/a	134.838-135.022, 159.632-160.024	0,575	0,003	601,556	0,00	ΕΠ10 & GR2110004	0
GR2120002	n/a	212.435-212.574	0,139	0,004	8,236	0,05	-	0
GR2330002	n/a	227.13-237.38	10,252	0,292	97,486	0,30	-	0

Site Code	Zone	Approximate KP (From KP-To KP)	Total Route length Intersected (km)	Total Area of Working Strip within protected area (km^2)	Total Area of Protected Site (km^2)	% of Protected site's area within the working strip	Overlapping (partial or complete)	Approximate Distance to Project Footprint (m)
GR2540007	n/a	20.46-22.41	1,954	0,057	377,883	0,02	-	0
GR2310015	n/a	2-7	-	n/a	443,644	n/a	GR2310001	75
GR2310013	n/a	40-44	-	n/a	22,731	n/a	ΕΠ5	290
GR2110004	n/a	159.632-160.024	0,392	n/a	231,859	n/a	ΕΠ10 & GR2110001	0
GR2120006	n/a	212.435-212.574	0,139	0,004	17,983	0,02	K599	0
K524	n/a	17.706-18.731	1,024	0,024	31,356	0,08	-	0
K361	n/a	20.269-25.891	5,622	0,124	15,722	0,79	-	0
K316	n/a	60.721-73.164	12,442	0,413	147,238	0,28	-	0
K728	n/a	113.363-116.867, 117.411-117.523, 118.084-118.734, 119.380-119.721	3,270	0,083	32,704	0,25	ΕΠ10	0
K838	n/a	181.734-182.891, 183.588-183.851	1,419	0,031	7,937	0,39	-	0
K599	n/a	211-213	-	n/a	3,971	n/a	GR2120002 & GR2120006	500

Prepared by: ASPROFOS, 2022.

Table 9-49 Impacts on Natura 2000 sites during construction phase.

Natura2000 site type & code	Relevant ESIA Annex	Spatial Correlation (IPs and corresponding KPs)	Length within site (km)	Threat	Receptor	Nature	Extent	Duration	Intensity	Value of the receptor	Frequency	Overall importance	Reversibility	Residual impact
SAC GR4320006	Annex9E.11	Intersection Point (IP) IP.2-A.14-33 + 7 km – IP.3-B.8-1 Kilometric Position (KP) 387 – 391	Site not crossed. Minimum distance approx. 0.8 km	Habitat loss etc.	Habitat types	Negative	No impact expected							
					Fauna	Negative	No impact expected							
				Loss of individuals	• Marine mammals • Sea turtles	Negative	Local	Short term	Low	High	Negligible	Low	Medium	Negligible
				Disturbance	• Marine mammals • Sea turtles	Negative	Local	Short term	Low	High	Negligible	Low	Medium	Negligible
SAC GR2540001	• Annex9E.10	• Intersection Point (IP) • TP.3-A.7-25.2+7.5km – LF3 • Kilometric Position (KP) • 426 – 428	2	Habitat loss etc.	1120*	Negative	Local	Long term	Low	High	Medium	Medium	Medium	Medium
				Habitat loss (Nesting sites)	*C. caretta**	Negative	Local	Long term	Low	High	Medium	Medium	Low	Low
				Habitat loss (Range, Marine habitat)	*M. monachus**	Negative	Local	Short term	Low	High	Low	Low	Medium	Negligible
				Loss of individuals	*C. caretta**	Negative	Local	Short term	Low	High	Low	Low	Medium	Negligible
				Loss of individuals (breeding popul.)	*M. monachus**	Negative	Local	Short term	Low	High	Low	Low	Medium	Negligible
				Disturbance	*M. monachus**	Negative	Local	Short term	Low	High	Low	Low	Medium	Negligible
SPA GR2540007	• Annex9E.12	• Intersection Point (IP) • 0112 – 0130 & • 0154 - 0156 • Kilometric Position (KP) • 19 – 22 • 26 – 27	2	Species habitat loss, deterioration, fragmentation	Birds	Negative	Local	Short term	Low	Medium	Low	Negligible	-	Negligible
				Loss of individuals	Birds	Negative	Local	Short term	Low	High	Low	Low	Medium	Negligible
				Disturbance	Birds	Negative	Local	Short term	Low	High	Low	Low	Low	Low
SAC GR2110001	• Annex9E.2	• Intersection Point (IP)	0.6	Habitat type loss, deterioration, fragmentation	92A0, 92D0, 3150	Negative	Local	Short term	Low	High	Low	Low	Medium	Negligible

Natura2000 site type & code	Relevant ESIA Annex	Spatial Correlation (IPs and corresponding KPs)	Length within site (km)	Threat	Receptor	Nature	Extent	Duration	Intensity	Value of the receptor	Frequency	Overall importance	Reversibility	Residual impact
		• 2578 - 2579 & • 2513-2514 • Kilometric Position (KP) • 159 – 161 & • 134 - 136		Species habitat loss, deterioration, fragmentation	• Fauna & • Conservation objectives	Negative	Local	Short term	Low	High	Low	Low	Medium	Negligible
				Loss of individuals	• Fauna & • species' Conservation objectives	Negative	Local	Short term	Low	High	Low	Low	Medium	Negligible
				Disturbance	• Fauna • species' Conservation objectives	Negative	Local	Short term	Low	High	Low	Low	Low	Low
SPA GR2110004	• Annex9E.3	• Intersection Point (IP) • 2578 - 2579 • Kilometric Position (KP) • 159 – 161	0.4	Species habitat loss, deterioration, fragmentation	• Birds • Cons. objectives	Negative	Local	Short term	Medium	High	Low	Medium	High	Low
				Loss of individuals	• Birds • Conservation objectives	Negative	Local	Short term	Low	High	Low	Low	Medium	Negligible
				Disturbance	Birds	Negative	Local	Short term	Medium	High	Low	Medium	Medium	Low
SAC GR2310001	• Annex9E.4	• Intersection Point (IP) • 2008 - 2020 • Kilometric Position (KP) • 3 – 7	Site not crossed. Minimum distance approx. 0.06 km	Habitat loss etc.	• 92D0 • Conservation objectives	Negative	Local	Short term	Low	High	Negligible	Negligible	-	Negligible
					• Fauna • species' Conservation objectives	Negative	Local	Short term	Low	High	Negligible	Negligible	-	Negligible
				Loss of individuals	• Fauna • species' Conservation objectives	Negative	Local	Short term	Low	High	Low	Low	Medium	Negligible
				Disturbance	Mammals	Negative	No impact expected							

Natura2000 site type & code	Relevant ESIA Annex	Spatial Correlation (IPs and corresponding KPs)	Length within site (km)	Threat	Receptor	Nature	Extent	Duration	Intensity	Value of the receptor	Frequency	Overall importance	Reversibility	Residual impact
SAC GR2310009	• Annex9E.5	• Intersection Point (IP) • 2153 – 2156 • Kilometric Position (KP) • 36 – 40	1.2	Habitat type loss, deterioration, fragmentation	Habitat types	Negative	No impact expected							
				Species habitat loss, deterioration, fragmentation	• Fauna • Species Conservation Objectives	Negative	Local	Short term	Negligible	High	Low	Negligible	-	Negligible
				Loss of individuals	• Fauna • Species Conservation Objectives	Negative	Local	Short term	Low	High	Low	Low	Medium	Negligible
				Disturbance	• Mammals • Species Conservation Objectives	Negative	Local	Short term	Low	High	Low	Low	Low	Low
SAC GR2310010	• Annex9E.7	• Intersection Point (IP) • 2044 – 2060 • 2065 – 2080 • Kilometric Position (KP) • 12 – 15 • 16 - 19	Site not crossed. Minimum distance approx. 0.01 km	Habitat loss etc.	Habitat types	Negative	Local	Short term	Low	High	Low	Low	Medium	Negligible
					Fauna	Negative	Local	Short term	High	High	Medium	High	Medium	Medium
				Loss of individuals	Fauna	Negative	Local	Short term	Low	High	Low	Low	Medium	Negligible
				Disturbance	Fauna	Negative	Local	Short term	Medium	High	Low	Medium	Low	Medium
SPA GR2310013	• Annex9E.6	• Intersection Point (IP) • 2156 – 2162 • Kilometric Position (KP) • 40 – 43	Site not crossed. Minimum distance approx. 0.3 km	Species habitat loss, deterioration, fragmentation	• Birds • Species Conservation Objectives	Negative	Local	Short term	Low	Medium	Low	Negligible	-	Negligible
				Loss of individuals	• Birds • Aythya nyroca • Species Conservation Objectives	Negative	Local	Short term	Low	High	Low	Low	Medium	Negligible
				Disturbance	• Birds	Negative	Local	Short term	Low	High	Low	Low	Medium	Negligible

Natura2000 site type & code	Relevant ESIA Annex	Spatial Correlation (IPs and corresponding KPs)	Length within site (km)	Threat	Receptor	Nature	Extent	Duration	Intensity	Value of the receptor	Frequency	Overall importance	Reversibility	Residual impact
SPA GR2310015	• Annex9E.8	• Intersection Point (IP) • 2008 – 2020 • Kilometric Position (KP) • 3 – 7	Site not crossed. Minimum distance approx. 0.06 km	Species habitat loss, deterioration, fragmentation	• Birds • Conservation Objectives	Negative	Local	Short term	Low	Medium	Low	Negligible	-	Negligible
				Loss of individuals	• Birds • Conservation Objectives	Negative	Local	Short term	Low	High	Low	Low	Medium	Negligible
				Disturbance	Birds	Negative	Local	Short term	Low	High	Low	Low	Low	Low
SPA/SAC GR2330002	• Annex9E.9	• Intersection Point (IP) • 1017 – 1073 • Kilometric Position (KP) • 227 – 237	10.2	Habitat type loss, deterioration, fragmentation	Habitat types	Negative	Local	Long term	Low	High	Medium	Medium	Medium	Low
				Species habitat loss, deterioration, fragmentation	Fauna	Negative	Local	Long term	Low	High	Medium	Medium	Medium	Low
				Loss of individuals	Fauna	Negative	Local	Short term	Low	High	Low	Low	Medium	Negligible
				Disturbance	Fauna	Negative	Local	Short term	Medium	High	Low	Medium	Medium	Low
SAC GR2120002	• Annex9E.13	• Intersection Point (IP) • 2703 – 2710 • Kilometric Position (KP) • 211 - 213	0.14	Habitat type coverage loss, deterioration, fragmentation	5420	Negative	Local	Short term	Low	High	Low	Low	Medium	Negligible
				Species habitat loss, deterioration, fragmentation	Conservation objectives for • *Elaphe quatuorlineata* • *Zamenis situla,* • *Testudo hermanni,* • *Testudo marginata*	Negative	Local	Short term	Low	High	Low	Low	Medium	Negligible
				Loss of individuals	Conservation objectives for • *Elaphe quatuorlineata*	Negative	Local	Short term	Low	High	Low	Low	Medium	Negligible

Natura2000 site type & code	Relevant ESIA Annex	Spatial Correlation (IPs and corresponding KPs)	Length within site (km)	Threat	Receptor	Nature	Extent	Duration	Intensity	Value of the receptor	Frequency	Overall importance	Reversibility	Residual impact
					• *Zamenis situla,* • *Testudo hermanni,* • *Testudo marginata,* • *Lutra lutra*									
				Disturbance	• Conservation objectives for • *Lutra lutra*	Negative	Local	Short term	High	High	Low	Medium	Medium	Low
SPA GR2120006	• Annex9E.14	• Intersection Point (IP) • 2703 – 2747 • Kilometric Position (KP) • 211 - 224	0.14	Species habitat loss, deterioration, fragmentation.	• Birds • Conservation objectives	Negative	Local	Short term	Medium	High	Low	Medium	High	Low
				Loss of individuals	• Birds • Conservation objectives	Negative	Local	Short term	Low	High	Low	Low	Medium	Negligible
				Disturbance	Birds	Negative	Local	Short term	Medium	High	Low	Medium	Medium	Low
					Aythya nyroca breeding population	Negative	Local	Short term	Low	High	Low	Low	Medium	Negligible

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Table 9-50 Impacts on Wildlife Refuges during contruction phase.

Wildlife Refuge Code	Coverage	Low Desnity built up areas/ Settlements	Permanent crops	Complex cultivation patterns	Agroforestry areas	Mediterranean coniferous forests	Mixed forest	Grasslands	Sclerophyllous vegetation	Transitional woodland-shrub
K316	1	2103,12	86806,75	70991,39	6301,34	n/a	n/a	114010,11	132725,33	n/a
	2	1692343,82	9776815,98	14994165,20	2485823,52	n/a	14910337,55	39097790,74	50883053,04	n/a
	%	0,12	0,89	0,47	0,25	n/a	n/a	0,29	0,26	n/a
K361	1	n/a	n/a	n/a	8042,15	64444,45	42176,31	n/a	n/a	9642,15
	2	n/a	n/a	n/a	853199,15	11131761,49	2677476,31	n/a	529266,52	410439,59
	%	n/a	n/a	n/a	0,94	0,58	1,58	n/a	n/a	2,35
K524	1	n/a	n/a	n/a	n/a	n/a	n/a	n/a	23917,05	n/a
	2	100715,07	n/a	396724,63	4770403,24	n/a	n/a	n/a	19227927,56	n/a
	%	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0,12	n/a
K728	1	n/a	n/a	n/a	15446,51	19907,72	25298,42	n/a	22728,44	n/a
	2	n/a	n/a	n/a	2177031,66	13860680,80	4973085,31	n/a	11598511,59	n/a
	%	n/a	n/a	n/a	0,71	0,14	0,51	n/a	0,20	n/a
K838	1	n/a	n/a	n/a	8580,08	n/a	n/a	n/a	22536,56	n/a
	2			43069,36	333254,93	94759,25	2833192,69		4099614,54	7290,27
	%	n/a	n/a	n/a	2,57	n/a	n/a	n/a	0,55	n/a
Notes: 1: Working strip area within specific ecosystem type (m²) | 2: Total ecosystem type within the Wildlife Refuge (m²).										

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Table 9-51 Impacts on National Parks during construction phase.

	ΕΠ5 Messolonghi-Aetoliko Lagoon National Park, downstream and estuaries of Acheloos and Evinos rivers and Echinades islands			ΕΠ10 Amvrakikos Wetlands National Park		
Ecosystem Type	Working Strip within specific ecosystem type (m²)	Total area of ecosystem type within the National Park (m²)	%	Working Strip within specific ecosystem type (m²)	Total area of ecosystem type within the National Park (m²)	%
Low Density built up areas/ Settlements	2478,76	4442927,66	0,06	6787,39	42983682,41	0,04
Arable land	3018,26	11696817,99	0,03	146973,37	115232187,04	0,13
Permanent crops	657287,21	148183867,91	0,44	955186,91	121939729,92	0,78
Fruit trees and berry plantations	n/a	2209889,91	n/a	188151,35	75986066,48	0,25
Olive gro crops	n/a	3003517,58	n/a	200832,44	74993123,95	0,27
Complex cultivation patterns	9162,63	33840887,35	0,03	442539,48	176646802,25	0,25
Agroforestry areas	n/a	838782,78	n/a	123214,62	94797509,89	0,13
Mediterranean deciduous forests	n/a	2135600,71	n/a	21829,13	61073976,63	0,04
Mixed forests	n/a	1399611,85	n/a	121989,24	67957283,40	0,18
Grasslands	n/a	11881819,58	n/a	7132,93	72269371,78	0,01
Sclerophyllous vegetation	n/a	44137838,50	n/a	140733,07	239855218,19	0,06
Sparsely vegetated areas	3951,65	25785478,04	0,02	n/a	3524102,62	n/a

	ΕΠ5 Messolonghi-Aetoliko Lagoon National Park, downstream and estuaries of Acheloos and Evinos rivers and Echinades islands			ΕΠ10 Amvrakikos Wetlands National Park		
Ecosystem Type	Working Strip within specific ecosystem type (m²)	Total area of ecosystem type within the National Park (m²)	%	Working Strip within specific ecosystem type (m²)	Total area of ecosystem type within the National Park (m²)	%
Inland and coastal saline marshes	n/a	10205838,67	n/a	259,26	146241000,73	0,00
Riparian areas	n/a	9957881,64	n/a	269,51	4415640,93	0,01

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9.2.5.7 Summary of impacts during construction phase

The following table summarizes the impacts during the construction phase. The mitigation measures are analyzed in chapter 10 of this ESIA.

Table 9-52 Summary of impacts during construction phase on Natural Environment (Onshore / Offshore biodiversity).

S/N SEI											
Project phase	Construction		SEI for		Natural environment						
Impact	Mechanism	Locations	Criteria/ Impact Properties							SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Habitats/ Vegetation loss	Earthmoving, excavation and trenching	Sparsely vegetated areas	1.00	0.00	0.25	0.50	0.50	0.00	0.00	3.21 (Minor)	See Section 9.2.5.2.1
		Mediterranean deciduous forests, Floodplain forests (Riparian forest/Fluvial forest)	1.00	0.00	1.00	0.75	0.75	0.25	0.00	5.36 (Moderate)	See Section 9.2.5.2.1
		Inland and coastal saline marshes, Grasslands	1.00	0.00	0.25	0.00	0.75	0.00	0.00	2.86 (Minor)	See Section 9.2.5.2.1
		Mediterranean coniferous forests, Mixed Forest	1.00	0.00	0.75	0.75	0.75	0.25	0.00	5.00 (Minor)	See Section 9.2.5.2.1
		Fruit trees and berry plantations, Olive groves, Agroforestry areas	1.00	0.00	0.50	0.50	0.75	0.00	0.00	3.93 (Minor)	See Section 9.2.5.2.1
		Transitional woodland-shrub	1.00	0.00	0.75	0.50	0.75	0.00	0.00	4.29 (Minor)	See Section 9.2.5.2.1

S/N SEI			SEI for					Natural environment		
Project phase	Construction									
Impact	Mechanism	Locations	Criteria/ Impact Properties						SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
		Annual cultivations (Arable land, Complex cultivation patterns, Permanent crops,	1.00	0.00	0.25	0.00	0.50	0.00	0.00	2.50 (Negligible)	See Section 9.2.5.2.1
		Sclerophyllous vegetation	1.00	0.00	0.75	0.50	0.75	0.25	0.00	4.64 (Minor)	See Section 9.2.5.2.1
Fauna Habitats loss for Golden jackal (*Canis aureus*)	Earthmoving, excavation and trenching	See Table 9-33."Sensitive areas for the golden jackal" (CCS1: KP 0 – KP 30 | KP 94 – KP 97 | KP 108 – KP 112 | KP 117 - KP 123 | KP 125 – KP 127 | KP 133 – KP 135 |KP 138 – KP 145 | KP 1 – KP 4 (Megalopoli Branch) |KP 162 – 165 | KP 167 – KP 185 | KP 187 – KP 203 | KP 204 – KP 205 | KP 216 – KP 218 | KP 223 – KP 225 | KP 233 – KP 240 | KP 246 | KP 258 – KP 262 | KP 263 – KP 266 | KP 274 – KP 278 | KP 280 – KP 281)	1.00	0.00	0.75	0.50	0.50	0.25	0.00	4.29 (Minor)	See Section 9.2.5.2.2.1

S/N SEI			SEI for	Natural environment						
Project phase	Construction									
Impact	Mechanism	Locations	Criteria/ Impact Properties						SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)	
Fauna Habitats loss for Wolf (*Canis lupus*)	Earthmoving, excavation and trenching	See Table 9-34 Sensitive areas for the wolf (CCS2: KP 17.5 – KP 19 | KP 21 – KP 25 | KP 22 – KP 24)	1.00	0.00	1.00	0.50	0.75	0.25	0.00	5.00 (Moderate)	See Section 9.2.5.2.2.1
Fauna Habitats loss for Otter (*Lutra lutra*)	Open cut crossing (excavation and trenching) of water bodies	See Table 9-35 Sensitive areas for the otter (CCS1: KP 103 KP 110 / KP 145 / KP 202 / KP 204 / KP 248 / KP 264 / LF5/ CCS2: KP 9 / KP 37 / KP 57 / KP 105 / KP 125 & KP 127 / KP 129 / KP 135 / KP 160 / KP 177 / KP 196 / KP 199)	1.00	0.00	0.75	0.50	0.50	0.25	0.00	4.29 (Minor)	See Section 9.2.5.2.2.2
Fauna Habitats loss for Fishfauna	Open cut crossing (excavation and trenching) of water bodies	See Table 9-36. Threatened fishfauna species potential presence (CCS1: KP 103 / KP 110 / KP 202 / KP 248 / KP 264 / CCS2: KP 9 / KP 37 / KP 57 / KP 129 / KP 135 / KP 160 / KP 196 / KP 199)	1.00	0.00	0.75	0.25	0.50	0.25	0.00	3.93 (Minor)	See Section 9.2.5.2.2.2

S/N SEI			SEI for	Natural environment							
Project phase	Construction										
Impact	Mechanism	Locations	Criteria/ Impact Properties							SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Fauna species loss for Small mammals	• Preparation and excavation of the terrain (working strip and facilities) • Heavy vehicle traffic • Air, noise and vibration emissions from the construction front • Light emission from construction areas	To be identified during pre-construction survey	1.00	0.00	0.50	0.50	0.75	0.25	0.00	4.29 (Minor)	See Section 9.2.5.2.3.1
Fauna species loss for Bats	• Preparation and excavation of the terrain (working strip and facilities) • Heavy vehicle traffic • Air, noise and vibration emissions from the construction front	• Forests and Forested Areas • Agricultural lands	0.50	0.00	0.75	0.25	0.75	0.25	0.00	3.57 (Minor)	See Section 9.2.5.2.3.2

S/N SEI										SEI for	Natural environment
Project phase	Construction										
Impact	Mechanism	Locations	Criteria/ Impact Properties							SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
	• Light emission from construction areas										
Fauna species loss for Reptiles	• Preparation and excavation of the terrain (working strip and facilities) • Heavy vehicle traffic • Air, noise and vibration emissions from the construction front • Light emission from construction areas	To be identified during pre-construction survey	1.00	0.00	0.75	0.25	0.50	0.25	0.00	3.93 (Minor)	See Section 9.2.5.2.3.3
Fauna species loss for Amphibians	• Preparation and excavation of the terrain (working strip and facilities) • Heavy vehicle traffic • Air, noise and vibration emissions	• Floodplain forests (Riparian forest/Fluvial forest) • Inland and coastal saline marshes	1.00	0.00	0.50	0.25	0.75	0.25	0.00	3.93 (Minor)	See Section 9.2.5.2.3.4

S/N SEI											
Project phase	Construction	SEI for	Natural environment								
Impact	Mechanism	Locations	Criteria/ Impact Properties (L)	(Ex)	(I)	(D)	(R)	(C)	(T)	SEI (Sum criteria X 10/7)	Comments
	from the construction front • Light emission from construction areas										
Fauna species loss for Macro-invertebrates	Preparation and excavation of the terrain (working strip and facilities)	Rivers crossed with open cut	1.00	0.00	0.50	0.25	0.50	0.25	0.00	3.57 (Minor)	See Section 9.2.5.2.3.5
Disturbance of Fauna - Golden jackal (*Canis aureus*)	Noise from construction activities	See Table 9-33. "Sensitive areas for the golden jackal" (CCS1: KP 0 – KP 30 | KP 94 – KP 97 | KP 108 – KP 112 | KP 117 - KP 123 | KP 125 – KP 127 | KP 133 – KP 135 |KP 138 – KP 145 | KP 1 – KP 4 (Megalopoli Branch) |KP 162 – 165 | KP 167 – KP 185 | KP 187 – KP 203 | KP 204 – KP 205 | KP 216 – KP 218 | KP 223 – KP 225 | KP 233 – KP 240 | KP 246 | KP 258 –	0.50	0.00	0.75	0.25	0.50	0.25	0.00	3.21 (Minor)	See Section 9.2.5.2.4.1

S/N SEI										SEI for	Natural environment
Project phase	Construction										
Impact	Mechanism	Locations	Criteria/ Impact Properties							SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
		KP 262 | KP 263 – KP 266 | KP 274 – KP 278 | KP 280 – KP 281)									
Disturbance of Fauna - Wolf (*Canis lupus*)	Noise from construction activities	See Table 9-34. Sensitive areas for the wolf (CCS2: KP 17.5 – KP 19 | KP 21 – KP 25 | KP 22 – KP 24)	1.00	0.00	1.00	0.25	0.75	0.25	0.00	4.64 (Minor)	See Section 9.2.5.2.4.1
Disturbance of Fauna - Otter (*Lutra lutra*)	• Noise at any river crossings with presence of otter • Sediments downstream of the crossing point, in case of open cut technique.	See Table 9-35 Sensitive areas for the otter (CCS1: KP 103 KP 110 / KP 145 / KP 202 / KP 204 / KP 248 / KP 264 / LF5/ CCS2: KP 9 / KP 37 / KP 57 / KP 105 / KP 125 & KP 127 / KP 129 / KP 135 / KP 160 / KP 177 / KP 196 / KP 199)	0.50	0.00	0.75	0.25	0.50	0.25	0.00	3.21 (Minor)	See Section 9.2.5.2.4.2
Disturbance of Fauna - Fishfauna	Sediments downstream of the crossing point, in case of open cut technique.	See Table 9-36. Threatened fishfauna species potential presence (CCS1: KP 103 / KP 110 / KP 202 / KP 248 / KP	0.50	0.00	0.75	0.25	0.50	0.25	0.00	3.21 (Minor)	See Section 9.2.5.2.4.2

S/N SEI			SEI for	Natural environment						
Project phase	Construction									
Impact	Mechanism	Locations	Criteria/ Impact Properties (L)	(Ex)	(I)	(D)	(R)	(C)	(T)	SEI (Sum criteria X 10/7)	Comments
		264 / CCS2: KP 9 / KP 37 / KP 57 / KP 129 / KP 135 / KP 160 / KP 196 / KP 199)									
Impacts to Biodiversity during SPT	• Water abstraction • Water discharge • Noise from SPT compressors/ pumps	Water abstraction and discharge locations	1.00	0.00	0.75	0.25	0.75	0.25	0.00	4.29 (Minor)	See Section 9.2.5.4
Impacts on Avifauna during Construction – Onshore/Offshore	• Preparation and excavation of the terrain before erection of temporary and permanent facilities • Preparation of the working strip excavation of the trench for onshore pipeline installation • Heavy vehicle traffic	see Table 9-46 "Main areas of avifauna special interest along project footprint"	0.50	0.25	0.50	0.50	0.75	0.25	0.00	3.93 (Minor)	See Section 9.2.5.5

S/N SEI			SEI for	Natural environment							
Project phase	Construction										
Impact	Mechanism	Locations	Criteria/ Impact Properties (L)	(Ex)	(I)	(D)	(R)	(C)	(T)	SEI (Sum criteria X 10/7)	Comments
	• Air, noise and vibration emissions from the construction front • Light emission from construction areas										
Impacts on Protected Areas - Natura2000 Sites	Main impacts are habitat and species loss, disturbance	Within the Protected Areas	As per analyses at the Appropriate Assessments (see relevant Annexes)								
Impacts on Protected Areas - Wildlife Refuges	Main impacts are habitat and species loss, disturbance	Within the Protected Areas	No impacts on the integrity of the protected areas given the limited area affected, overall availability of the specific ecosystem types within the Protected Areas and their characteristics								
Impacts on Protected Areas - National Parks	Main impacts are habitat and species loss, disturbance	Within the Protected Areas	No impacts on the integrity of the protected areas given the limited area affected, overall availability of the specific ecosystem types within the Protected Areas and their characteristics								
Habitat/Flore species loss	• Seabed intervention works • Pipelaying and seabed occupation	Deep water section	1.00	0.00	0.25	0.25	0.75	0.25	0.00	3.57 (Minor)	See Section 9.2.5.3.1

S/N SEI					SEI for	Natural environment				
Project phase	Construction									
Impact	Mechanism	Locations	Criteria/ Impact Properties							SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Habitat/Flore species loss	• Construction of cofferdam and trenching • Anchoring of the pipelay barge • Pipelaying and seabed occupation • Increased re-suspended particles in the water column	Nearshore section at LF3	1.00	0.25	1.00	1.00	0.75	0.00	0.00	5.71 (Moderate)	See Section 9.2.5.3.2
Habitat/Flore species loss	• Construction of cofferdam and trenching • Anchoring of the pipelay barge • Pipelaying and seabed occupation • Increased re-suspended particles in the water column	Nearshore section at LF4	1.00	0.25	0.75	0.50	0.50	0.00	0.00	4.29 (Minor)	See Section 9.2.5.3.2

S/N SEI			SEI for	Natural environment						
Project phase	Construction									
Impact	Mechanism	Locations	Criteria/ Impact Properties						SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Habitat/Flore species loss	• Construction of cofferdam and trenching • Anchoring of the pipelay barge • Pipelaying and seabed occupation • Increased re-suspended particles in the water column	Nearshore section at LF5	1.00	0.25	0.25	0.50	0.50	0.75	0.00	4.64 (Minor)	See Section 9.2.5.3.2
Impacts on Marine Invertebrates	• Seabed intervention works • Pipelaying and seabed occupation • Construction of cofferdam and trenching (nearshore) • Anchoring of the pipelay barge (nearshore)	• Deep water section • Nearshore section	1.00	0.00	0.25	0.25	0.50	0.25	0.00	3.21 (Minor)	See Section 9.2.5.3.3

S/N SEI			SEI for	Natural environment							
Project phase	Construction										
Impact	Mechanism	Locations	Criteria/ Impact Properties							SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Impacts on Marine Fish species	• Construction of cofferdam and trenching • Seabed intervention works • Anchoring of the pipelay barge • Temporary passage of different types of vessels	• Deep water section • Nearshore section	1.00	0.00	1.00	0.25	0.75	0.00	0.00	4.29 (Minor)	See Section 9.2.5.3.4
Impacts on Marine turtles	• Construction of cofferdam and trenching • Temporary passage of different types of vessels • Artificial lights from the Project activities	• Deep water section • Nearshore section at LF2, LF4 & LF5	0.50	0.25	1.00	0.25	0.25	0.50	0.25	4.29 (Minor)	See Section 9.2.5.3.5

S/N SEI			SEI for			Natural environment				
Project phase	Construction									
Impact	Mechanism	Locations	Criteria/ Impact Properties						SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Impacts on Marine turtles	• Construction of cofferdam and trenching • Temporary passage of different types of vessels • Artificial lights from the Project activities	Nearshore section at LF3	1.00	0.25	1.00	0.25	0.25	0.50	0.25	5.00 (Minor)	See Section 9.2.5.3.5
Impacts on Marine mammals	• Construction of cofferdam and trenching • Temporary passage of different types of vessels	• Deep water section • Nearshore section	0.25	0.50	1.00	0.25	0.00	0.50	0.25	3.93 (Minor)	See Section 9.2.5.3.6
Impacts on Marine mammals	• Construction of cofferdam and trenching • Temporary passage of different types of vessels	Hellenic Trench IMMA	0.50	0.50	1.00	0.25	0.00	0.50	0.25	4.29 (Minor)	

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9.2.6 Anthropogenic Environment

The construction and operation of the Project under study may have both temporary and permanent impacts on the anthropogenic environment. To minimize any possible interaction, it was first attempted to prevent the Project's proximity to built environment. However, the Project's nature as well as its extent render it impossible for it not to interact with the anthropogenic environment. Special measures must be taken to mitigate the impacts.

The key impacts on the anthropogenic environment are outlined and analyzed below. In particular, the following are assessed:

- The regional planning and the changes to the use of land as a result of the project's construction and operation;
- The structure and function of the anthropogenic environment, paying particular attention to the Community Health and Safety and Community Cohesion potential impacts;
- The cultural heritage potentially affected by the project's construction and operation

9.2.6.1 Regional planning - uses of land & sea

Since most local spatial plans for the areas which are crossed by the Project are missing, the entire Project footprint, was developed based on Corine Land Cover database (see Section 8.6).

Uses of sea are not yet determined for Greece. However, aquaculture areas and fishing areas are identified and potential impacts assessed (see Section 8.7.2.6).

During the construction phase, the existing uses of land will be impacted by the occupation and creation of the working zone, the earthmoving activities, the restoration works and the use-transportation of the required equipment. These activities shall lead only to temporary impacts, since the use of land will not change. Due to their temporary nature of the construction activities do not modify/ impact the Regional Planning; as such, impacts on regional planning during construction phase are not considered possible and are not assessed.

Similarly, for uses of the sea, i.e. aquaculture and fishing fields will be impacted by the presence and navigation of offshore construction vessels. These activities shall lead to temporary impacts, since the use of sea will not change.

9.2.6.1.1 Use of Land

Impacts to the use of land is expected as a result of the interaction between the working strip and the existing land uses.

Table 9-60 shows the key sources of impact, potentially impacted resources and receptors, baseline and project influencing factors associated to the impacts of the investigated project on uses of land.

Table 9-53 Key Considerations for Assessment – Use of the Land (Construction Phase).

Sources of Impact/ Risk	• Temporary land-take along the pipeline working strip, trenching and onshore pipeline installation and backfilling; • Establishment of temporary construction facilities (e.g. construction sites) • Land take for permanent facilities, mainly the Main Stations.
Potentially Impacted Resources and Receptors	• Owners and users of land affected by temporary land take. • Owners and users of land affected by permanent land take or land use restrictions. • Local communities • Local authorities (regional and municipal/communal).
Particular Baseline Conditions that are Potentially Influencing Impacts/Risks	• Existing morphology • Existing land uses within project footprint (incl. temporary facilities); • Based on analysis provided in Section 8.6.1.3, regarding the ratio of each land cover type within the study area in comparison to the total coverage of the specific land cover type in the entire Regional unit, the following are highlighted: ➢ Artificial Surfaces present the highest engagement ratio for the R.U. of Lasithi (Industrial or commercial units), Laconia & Arcadia (Road and rail networks) Aetoloakarnania (Airports) present the highest engagement ratio for the R.U. of Laconia, Arcadia ➢ Complex cultivation patterns present the highest engagement ratio for the R.U. of Ilia, ➢ Permanently irrigated land occupies present the highest engagement ratio for the R.U. of Achaia, ➢ Fruit trees and berry plantations present the highest engagement ratio for the R.U. of Arta

	➢ Inland marshes present the highest engagement ratio for the R.U. of Preveza and Thesprotia • Pipeline crosses 6 local spatial plans (SXOOAP of Lefki, Crete; SCOOAP of Monemvasia, Peloponnese, GUB of Agrinio, Aetoloakarnania, GUB of Louros, Preveza, SXOOAP of Zalongo, Preveza and GUB of Fanari, Preveza).
Project Factors that are Potentially Influencing Impacts/Risks	• Project footprint • Pipeline and project facilities construction • Construction schedule (duration and season) • **Project of National Importance and Project of Common Interest**
References	• Baseline is provided in Sections 5, 8.6 and 8.7. Information on technical infrastructure in 8.8. • Annex 9B • Mitigation Measures are provided in Section 10.2.6 • Land use and Socioeconomic Map is provided in Section 15.1.6 • Information on technical infrastructure (incl. traffic) is provided in Sections 8.8 (Baseline), 9.2.8 (Impacts assessment - construction) and 10.2.8 (Impacts assessment – operation).

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Table 9-54 summarizes the potential key impacts on uses of Land, due to the construction of the investigated project.

Table 9-54 Key Potential Impacts – Use of Land.

Potential Impact	Construction Phase
Changes in Land Use	X
Impact on Land Value	See Section 9.2.7

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It is clarified, that according to MD 170225/2014, assessment of the changes in Land Use as a result of the construction and operation of the Project is performed. This assessment includes direct, primary, changes expected as a result of the project and also indirect or secondary, likely to be induced as a result of the primary changes.

Additionally, no impacts are induced to Regional Planning provisions due to the temporary character of the construction phase.

9.2.6.1.1.1 Methodology overview during the construction phase – Uses of Land

The project's construction footprint intersects 21 different categories of existing land use. These categories were grouped as per their sensitivity, in order to create a standardized land use classification (Table 9-55). Sensitivity of the land uses group has been assessed based on the following characteristics of the land uses:

- Capacity to absorb temporary modification (change) of existing land uses,
- Project activities characteristics (mostly working strip width).

Sensitivity classification is carried out based on the ability of each land use type to return to its initial conditions upon completion of the Project and on the statutory framework for the protection and planning of the corresponding area.

Table 9-55 Categories of existing uses of land within the project's impact zone and Assessment of sensitivity of land use change during construction phase

CORINE Classification	Classification according to ESIA	Sensitivity	Justification
• Discontinuous urban fabric (CLC: 112) • Industrial or commercial units (CLC: 121) • Road and rail networks and associated land (CLC: 122)	Industrial - commercial zones	Zero	These are areas where the existing conditions are characterized by intense pressures of anthropogenic origin. They include Artificial Surfaces (e.g. road and rail networks) that, upon completion of construction, reinstatement shall be complete.
• Non-irrigated arable land (CLC: 211) • Permanently irrigated land (CLC: 212) • Pastures (CLC: 231) • Natural grasslands (CLC: 321) • Beaches, dunes, sands (CLC: 331) • Sparsely vegetated areas (CLC: 333) • Inland marshes (CLC: 411) • Salt marshes (CLC: 421)	Open spaces with little or no vegetation	Low	These are primarily areas for rural activities and grazing, which due to the nature of the vegetation type can quickly return to their initial conditions.

CORINE Classification	Classification according to ESIA	Sensitivity	Justification
• Fruit trees and berry plantations (CLC: 222) • Olive groves (CLC: 223) • Complex cultivation patterns (CLC: 242) • Land principally occupied by agriculture, with significant areas of natural vegetation (CLC: 243) • Transitional woodland-shrub (CLC: 324)	Sparsely vegetated forest areas and areas of systematic arboriculture	Medium	This category includes areas that are characterized by low vegetation cover or arboriculture of medium maturation period (<5 years).
• Broad-leaved forest (CLC: 311) • Coniferous forest (CLC: 312) • Mixed forest (CLC: 313) • Sclerophyllous vegetation (CLC: 323) • Water courses (CLC: 511)	Forested Areas	High	These areas include forests and forested areas (bushlands) of high sensitivity, since the maturation period and, consequently, their reinstatement requires more than 5 years.
	Forested Areas within protected site	Very high	Adopting a conservative approach, this class includes the same areas (forests and forested areas) which since they lay within protected areas, they are considered as potentially significant habitats for various species of fauna and birds.

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Finally, the assessment criteria of the extent and duration of the impact were adjusted to the technical description data and to the statutory protection measures, as presented above. Table 9-56 illustrates the assessment criteria of the extent and duration of the changes in land use during the construction phase of the investigated project.

Table 9-56 Adjustment of the extent and duration assessment criteria

	Rating				
	0 (low rating)	0.25	0.5	0.75	1 (high rating)
Extent of Impact (E)	Pointwise (Project or	Local (≤11 m from the Project or	Supra local (≤14 m from the Project or	Perimetric (≤19 m from the	Peripheral (>19 m from the Project or

	Rating				
	0 (low rating)	0.25	0.5	0.75	1 (high rating)
	resource footprint)	resource footprint)	resource footprint)	Project or resource footprint)	resource footprint)
Duration of Impact (D) (years)	Instant (during construction activities)	Short-term (≤1 duration)	Medium-term (1<duration≤10)	Long-term (10≥ duration)	Permanent (even after the Project's termination)

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9.2.6.1.1.2 Assessment of changes in land use during the construction phase

To minimize the impacts on the existing land use, but also to make the project's construction activities (and machinery movements) possible, a 38 meter wide working zone must be cleared. Nevertheless, in sparsely vegetated forest areas (transitional woodland areas, moors and heathland) and in systematic tree crops, the working zone may decrease to 28 meters in width, aiming to mitigate impacts. In forest areas covered by lush vegetation, especially within protected areas, the working zone may be decreased even more and be limited to 22 meters, as described in detail in Section 6.4.2. Moreover, it may become necessary for the working zone to be expanded at the point where the project crosses with infrastructure or other points for safety reasons or on other administrative grounds (as per national Technical Regulation - HGG B' 603/2012).

Duration of the construction depends on the difficulties imposed by the baseline conditions, e.g. morphology, geotechnical issues, land uses, etc. Based on experience from other similar (in size) projects constructed in Greece (i.e. with similar baseline conditions) the indicative construction rates (in terms of project progress) per construction activity are:

- 400 m/day, in agricultural areas (in plain areas, up to 600 m/ day may be achieved)
- 200 m/day, in hilly or intense relief areas, of tree crops or natural vegetation
- 100 m/day, in mountainous areas, which more often than not are covered with natural vegetation (in rocky areas, 75 m/day or even smaller length may be constructed).

As mentioned, the Project's construction footprint intersects 21 different categories of existing uses of land, out of the total 27 included in the entire Study Area. [Airports (CLC: 124), Mineral extraction sites

(CLC: 131), Rice fields (CLC: 231) and Water Bodies (CLC: 512) are not included within any of the three typical working strips; Sea and ocean (CLC: 523) are by definition excluded by the assessment of land uses].

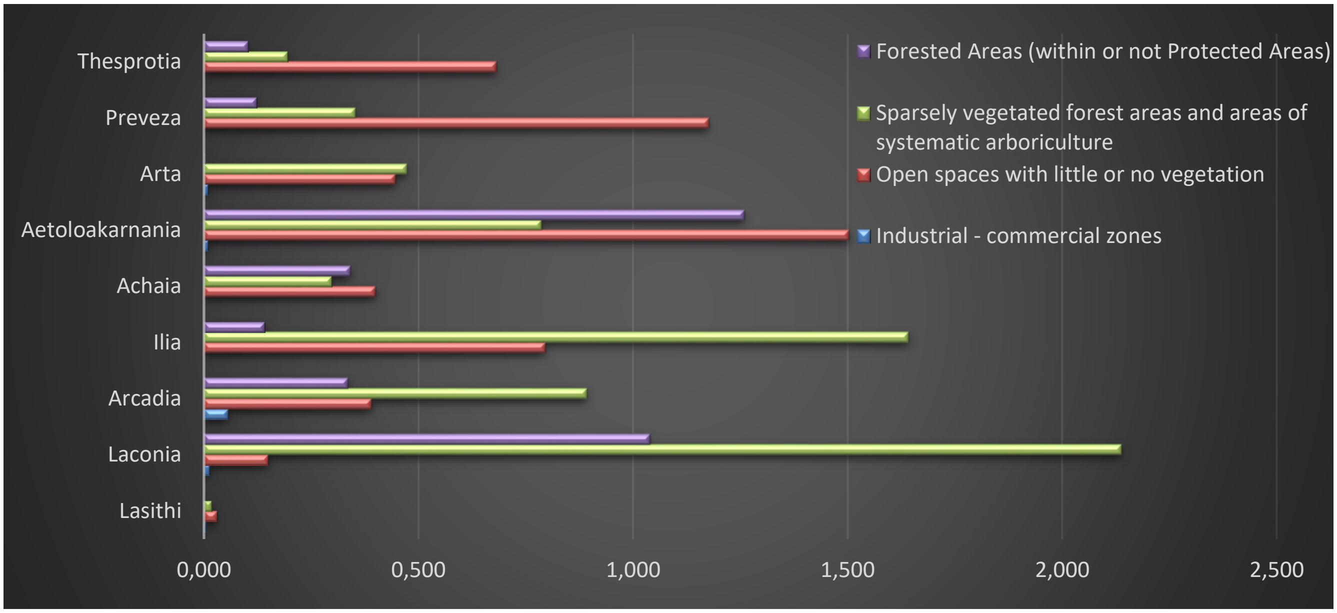
The pipeline's construction activities impact on a total of approx. 15,813 km² of land. Table 9-57 illustrates the areas impacted based on the use of land according to the working zone that must be created for each category of land use. Figure 9-25 illustrates the distribution of the various typical working strips per Regional Units (data per Municipalities is available at Annex 9B)

Table 9-57 Total extent of the working zone that must be created for each category of land use.

		Total Working Strip Area within each Land Use Type (in km²)		
CORINE Classification	Classification according to ESIA	22 m	28 m	38 m
Broad-leaved forest (CLC: 311)	Forested Areas (within or outside Protected Areas)	0.505	0.643	0.873
Coniferous forest (CLC: 312)		0.071	0.090	0.122
Mixed forest (CLC: 313)		0.488	0.623	0.848
Sclerophyllous vegetation (CLC: 323)		2.279	2.900	3.932
Water courses (CLC: 511)		0.005	0.006	0.008
Subtotal km²		*3.347*		
Vineyards (CLC: 221)	Sparsely vegetated forest areas and areas of systematic arboriculture	0.000	0.000	0.000
Fruit trees and berry plantations (CLC: 222)		0.138	0.175	0.238
Olive groves (CLC: 223)		1.739	2.210	2.994
Complex cultivation patterns (CLC: 242)		1.187	1.511	2.051
Land principally occupied by agriculture, with significant areas of natural vegetation (CLC: 243)		1.675	2.129	2.888
Transitional woodland-shrub (CLC: 324)		0.605	0.771	1.048
Subtotal km²			*6.796*	
Discontinuous urban fabric (CLC: 112)	Industrial - commercial zones	0.005	0.006	0.008
Industrial or commercial units (CLC: 121)		0.003	0.003	0.004
Road and rail networks and associated land (CLC: 122)		0.045	0.058	0.080
Airports (CLC: 124)		0.000	0.000	0.000

		Total Working Strip Area within each Land Use Type (in km²)		
CORINE Classification	Classification according to ESIA	22 m	28 m	38 m
Mineral extraction sites (CLC: 131)		0.000	0.000	0.000
Non-irrigated arable land (CLC: 211)	Open spaces with little or no vegetation	0.795	1.012	1.373
Permanently irrigated land (CLC: 212)		1.801	2.291	3.105
Rice fields (CLC: 213)		0.000	0.000	0.000
Pastures (CLC: 231)		0.103	0.131	0.177
Natural grasslands (CLC: 321)		0.452	0.574	0.778
Beaches, dunes, sands (CLC: 331)		0.032	0.041	0.055
Sparsely vegetated areas (CLC: 333)		0.022	0.025	0.030
Inland marshes (CLC: 411)		0.023	0.029	0.039
Salt marshes (CLC: 421)		0.010	0.012	0.017
Water bodies (CLC: 512)		0.000	0.000	0.000
Sea and ocean (CLC: 523)		0.000	0.000	0.001
Subtotal km²				*5.669*

Prepared by: ASPROFOS, 2022. Applicable working strip width per land use type marked grey. It is noted that the working strip does not extend equally on each side of the pipeline (see section 6.4). However, for the purposes of the impact assessment, it was considered as equally distributed.



Prepared by: ASPROFOS, 2022.

Figure 9-25 Distribution of Land Use (ESIA Classification) and Working Strips per Regional Unit.

Regarding land take by the construction of the Main Stations, dedicated construction sites shall occupy the exact boundaries of the station plot plan. As such, they are discussed in the corresponding section of operation phase (see Section 9.3.6.1.1)

Importance of changes to land use is assessed as being proportional to the ratio of each land cover type within the Study Area in comparison to the total coverage of the specific land cover type in the entire Regional Unit. Relevant is Table 9-58.

Table 9-58 Comparison of land use with the highest ratio of engagement within the study area and per typical working strip per Regional Unit.

	Regional Unit								
	Lasithi	Laconia	Arcadia	Ilia	Achaia	Aetoloakarnania	Arta	Preveza	Thesprotia
Corine Land Cover type code with the highest ratio of coverage within the entire Study Area compared to the corresponding land use coverage within the entire Regional Unit	121	122	122	242	212	124	222	411	411
Corresponding Classification as per the ESIA	1	1	1	3	2	1	3	2	2
22 m width									
Corine Land Cover type with the highest participation within the specific working strip	333	223	243	243	323	212	212	242	211
Corresponding Classification as per the ESIA	2	3	3	3	4	2	2	3	4
28 m width									
Corine Land Cover type with the highest participation within the specific working strip	333	223	243	243	323	212	212	242	211
Corresponding Classification as per the ESIA	2	3	3	3	4	2	2	3	4
38 m width									
Corine Land Cover type with the highest participation within the specific working strip	333	223	243	243	323	212	212	242	211
Corresponding Classification as per the ESIA	2	3	3	3	4	2	2	3	2

Notes:
Corine Land Cover types definition is provided in Table 9-57
1: Industrial - commercial zones
2: Open spaces with little or no vegetation
3: Sparsely vegetated forest areas and areas of systematic arboriculture
4: Forested Areas (within or outside Protected Areas)

Prepared by: ASPROFOS, 2022.

Corine Land Cover type with the highest ratio of coverage within the Study Area compared to the corresponding land use coverage within the entire Regional Unit" corresponds to the importance of each land use type for the specific Regional Unit. If the ratio is high, the total availability of the specific land use type in the entire Regional Unit may be impacted by its coverage within the typical working strips. As such, if the land use with the highest ratio is the same with the land use with the highest participation in the various typical working strips, then the land use availability to the local community will be affected.

Based on the table above (Table 9-58), it is evident that the availability of the land uses affected by the typical working strip is not affected by the project.

The changes in land use per assessment category are described in detail below.

- Industrial - Commercial zones:

During the construction phase, it is assessed that the working strip will require the temporary loss of about 0.092 km² of land characterized as industrial and/or commercial zone. It is assessed that the temporarily limited access to these areas does not result in significant impacts. This is because within such organized areas, numerous roads are present and as such deviations are expected to be feasible; nevertheless, commuters may be required to cover greater distance.

- Open spaces with little or no vegetation:

The impacts on open spaces with little vegetation can be distinguished in impacts on open spaces with one-year cultivation and in impacts on open spaces used for grazing. More particularly, Project's footprint causes a loss of:

- Approx. 4.478 km² of one-year cultivation. In these areas, the Project's construction is expected to be completed and the land to be restored within a calendar year from the beginning of construction works. Consequently, the loss of the seasonal agricultural production will primarily take place within one year and the land's restoration in the short term.
- Approx. 1.098 km² of grasslands and/ or grazing. Grazing usually takes place in a wide area and potential limited access to the pastures is expected to be instant, provided that alternative open spaces will be found in most cases in nearby areas. The stockbreeders with no access to the pastures will have to walk greater distances around the working zone, which could disturb the existing breeding practices. For this reason, mitigation measures must be implemented during construction phase (see Chapter 10).

- Semi-natural areas and areas of systematic arboriculture:

Under this category, the changes in land use result from the loss of agricultural land for arboriculture production in a zone of 28 m in total[24]. These permanent agricultures cover an area of about 6.025 km² within the pipeline's working zone and the land's productivity restoration may require several years. Depending on the species, some tree crops may require more than 5 years for achieving full production.

Semi-natural areas characterized by transitional woodland-shrub areas cover an area of 0.771 km², with natural restoration period estimated from 2 to 3 years.

- Forested Areas

In forests and forested areas (bushlands) with lush vegetation the working zone is decreased to 22 meters regardless of the sensitivity of the area (whether protected or not). As part of the preparatory works, the Project will require the deforestation of the lush forestry vegetation in an area of approx. 3.347 km². These areas' natural restoration is expected to take between 10 to 15 years. It is highlighted that no new roads are expected to be opened, especially in forests (however, the existing ones may have to be improved); the working strip will be operating as the main access road in remote areas.

Taking into account the considerations discussed and following the assessment criteria presented in Section 9.1 and the methodology specified in Section 9.2.6.1.1.1, the changes in land use can be assessed as follows:

The *Likelihood* of change to be caused during the construction phase is considered *certain*, since the existing use of land will be impacted by the clearance and occupation of the working strips, the earthmoving activities, the restoration works and the use/ transportation of the required equipment.

The *Extent* is determined by the possible modification to land uses in areas outside the designated working strip, as described in Table 9-56. Given that for no type of land use is impacted outside the working strip, the *extent* of the impact is considered <u>*pointwise*</u>.

The *Intensity* of the impact is linked to the area's sensitivity to the changes occurring, as detailed in Section 9.2.6.1.1.1. Industrial - Commercial zones are assessed of <u>*zero*</u> intensity; open spaces with little or no vegetation of <u>*low*</u> intensity; forests with sparse vegetation and areas with systematic arboriculture are characterized by <u>*medium*</u> intensity. Forests located outside protected areas are of <u>*high*</u> intensity,

[24] Working strip is not equally distributed on each side of the pipeline axis.

whereas the ones located within protected areas are characterized by *very high* intensity (see Table 9-55).

The *duration* of the impact is associated with the period required for the restoration of morphology prior to construction and, in particular, of the work zone's vegetation and topsoil (see Table 9-56). More specifically, for areas found in an industrial - commercial zone, areas with one-year cultivations and grazing land, the duration of the impact is assessed as *instant* as it is not expected to go beyond construction completion. In semi-natural areas and areas of systematic arboriculture, the restoration of existing uses is expected to cover a period of 3 to 10 years; as such, duration is assessed as *medium-term*. Finally, in forests with lush vegetation, the natural restoration is expected to last from 10 to 15 years, as such, duration is assessed as *long-term*.

With regard to *reversibility*, it is assessed that by applying the appropriate mitigation measures per category of land use, the impact footprint is minimized and limited to the working zone's width; especially for the Industrial and commercial zones, there are measures to avoid changes (see Chapter 10).

Regarding *cumulative* action, no other projects or conditions were identified that could potentially interact with the Project and change the land uses. Thus, the cumulative character of this impact is considered as *impossible*.

Transboundary character is deemed *impossible*, given the fact that land use is, per definition, of strictly national interest.

Based on the above and the criteria presented in Section 1.1, as specified in Section 9.2.6.1.1.1, changes in land uses for areas classified as:

- For Industrial - commercial zone, **SEI is considered as Negligible**.
- For Open spaces with little or no vegetation, **SEI is considered as Negligible**
- For Semi-natural areas and areas of systematic arboriculture, **SEI is considered as Minor**
- For Forests and Forested Areas, **SEI is considered as Minor**
- For Forests and Forested Areas, within protected areas, **SEI is considered as Moderate**

9.2.6.1.1.3 Summary of impacts during construction on Regional Planning – Uses of Land

The following table summarizes the impacts during the construction phase on Land Use.

Table 9-59 Overview of the impacts on Existing Land Use during construction phase.

S/N SEI			SEI for	Uses of the Land							
Project phase	Construction										
Impact	Mechanism	Locations	Criteria/ Impact Properties							SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Changes in Land Uses	• Temporary land-take along the pipeline working strip; • Establishment of temporary construction facilities (e.g. construction sites) • Land take for permanent facilities, mainly the Main Stations.	Industrial - commercial zones	1,00	0,00	0,00	0,00	0,25	0,00	0,00	1,79 (Negligible)	Artificial surfaces which reinstatement shall take place upon construction completion. Mitigation measures can be applied to completely avoid impacts.
		Open spaces with little or no vegetation	1,00	0,00	0,25	0,00	0,50	0,00	0,00	2,50 (Negligible)	Agricultural areas of annual crops or pastures, which can quickly return to their initial conditions. Mitigation measures can be applied to compensate for temporary impacts.
		Sparsely vegetated forest areas and areas of systematic arboriculture	1,00	0,00	0,50	0,50	0,75	0,00	0,00	3,93 (Minor)	Semi-natural areas or tree crops requiring few years to reinstate, due to the nature of the vegetation. Decreased working strip and

S/N SEI			SEI for	Uses of the Land						
Project phase	Construction									
Impact	Mechanism	Locations	Criteria/ Impact Properties						SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
											compensation can minimize impacts.
		Forested Areas	1,00	0,00	0,75	0,75	0,75	0,00	0,00	4,64 (Minor)	Forests and forested areas requiring some years to reinstate, due to the nature of the vegetation. Decreased working strip can minimize impacts. When located within protected areas, their importance is increased.
		Forested Areas within protected site	1,00	0,00	1,00	0,75	0,75	0,00	0,00	5,00 (Moderate)	

Prepared by: ASPROFOS, 2022.

9.2.6.1.2 Uses of Sea

9.2.6.1.2.1 Methodology overview during the construction phase – Uses of Sea

Impacts to uses of the sea are expected as a result of the interaction between the marine vessels navigating in the sea (nearshore or deep waters) and other vessels or users of the marine resources (mainly fishes).

As clarified in the Chapter 5 and 8, currently no spatial plan has been issued for the marine space in Greece. Only the Special Framework for Spatial Planning and Sustainable Development for Aquaculture (see Section 5.2.1.3.6) is in force whilst the corresponding SFSPSD for Marine Windfarms is under development (see Section 5).

Additionally, Marine Traffic as a land use is also taken into consideration (see also Section 9.2.8).

Table 9-60 shows the key sources of impact, potentially impacted resources and receptors, baseline and project influencing factors associated to the impacts of the investigated project on uses of the sea.

Table 9-60 Key Considerations for Assessment – Uses of the Sea (Construction Phase).

Sources of Impact/ Risk	• Navigation of Project vessels within fishing areas • Marine vessel traffic and use of Port Facilities • Offshore pipeline construction activities • Shore crossing and related construction at landfalls
Potentially Impacted Resources and Receptors	• Fishermen in the Study Area • Aquaculture units • Marine traffic/ routes • Port facilities
Particular Baseline Conditions that are Potentially Influencing Impacts/Risks	• Fishing activity in the area • Aquaculture development in the area • Oceanographic characteristics
Project Factors that are Potentially Influencing Impacts/Risks	• Project's footprint • Pipeline construction activity • Number of marine vessels and routes • Construction schedule (duration and season/ timing – High Touristic Season) ➢ Offshore construction rate, 2-3 km/day ➢ Landfall construction duration, approximately 6 months

	• Construction method (seabed intervention works causing sediments resuspension)
References	• Baseline is provided in Section 5, 8.6 and 8.7. Information on technical infrastructure in 8.8 • Mitigation Measures are provided in Section 10.2.6 • Land uses and Socioeconomic Map is provided in Section 15.1.6 • Information on technical infrastructure (incl. marine traffic, ports) is provided in Sections 8.8 (Baseline), 9.2.8 (Impacts assessment - construction) and 10.2.8 (Impacts assessment – operation). • Information on sediments transportation is provided in Annex 9.D, Section 9.2.3 (Soil/ Sediments) and Section 9.2.5 (Fish populations).

Prepared by: ASPROFOS, 2022.

Table 9-61 summarizes the potential key impacts on Uses of the Sea, due to the construction of the investigated project.

Table 9-61 Key Potential Impacts – Uses of Sea.

Potential Impact	Construction Phase
Fishing grounds restrictions	X
Indirect nuisance of aquaculture development and/ or fishing activity	X
Increase in marine traffic	X

Prepared by: ASPROFOS, 2022.

It is noted that fishing activities in deep (international or territorial) sea waters are not assessed given that fact that the construction progress rate is such (2-3 km/day) that no impacts on fishing areas is reasonable to be expected.

9.2.6.1.2.2 Fishing areas restrictions during construction phase

During the pipe-lay process, a navigational Safety Exclusion Zone is proposed of 2 km radius (1.1 nautical miles (NM)) centered on the pipe-lay vessel. The navigational Safety Exclusion Zone will be agreed with the relevant maritime authorities who will ensure that it is communicated to vessels in passage in the vicinity of the pipe-lay vessel. The pipe-lay vessel will be equipped with navigation lights, radar and radio communications. Due to the construction spread advancing along the pipeline route as the pipe is laid, regular consultation will be undertaken by the contractor with the appropriate marine authorities to inform them of the location of the construction spread. The marine authorities will then be responsible for informing marine traffic of the location of the pipe-laying activities and the position of the associated navigational Safety Exclusion Zone.

The Safety Exclusion Zone will imply that access to potential fishing grounds within this exclusion area will be temporarily limited. It also implies that it will be shifted as the pipeline is being laid.

Similarly, there will be construction activities (cofferdams, causeways, etc.) and associated safety exclusion zone defined temporarily during the construction of the pipeline in the nearshore section. The definitive width of the exclusion will be determined upon finalization of the project footprint at each landfall site. Based to the available data presented in Chapter 6, Table 9-62 was prepared.

Table 9-62 Summary of Cofferdam/Trench Dimensions

Landfall	Location	Pipeline Characteristics	Cofferdam Size			Nearshore Trenching		
		(number & diameter)	Length (m)	Width (m)	Depth (m)	Length of Trench (m)	Width (m)	Depth (m)
LF2	Crete	4 (2x26"/2x28")	n.a.	n.a.	n.a.	300	50	2.5
LF3	Peloponnese	2 (2x28")	n.a.	n.a.	n.a.	600	30	2.5
LF4	South Patras	1 (1x46")	200	21	5	1000	15	3
LF5	North Patras	1 (1x46")	200	21	5	1000	15	3

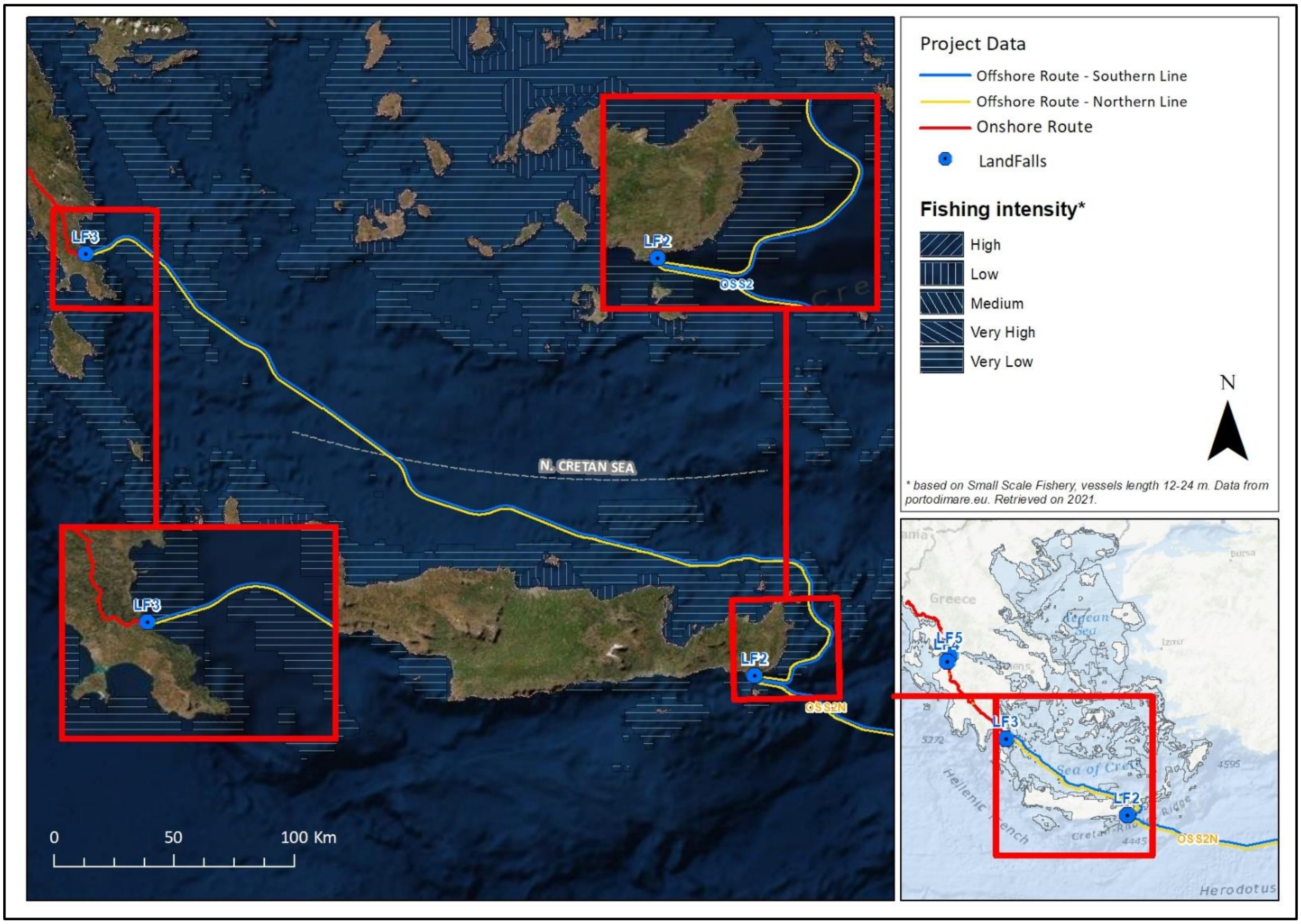
Source: IGI Poseidon, 2021

On top of this offshore footprint, the safety exclusion zone shall be also imposed. All exclusion zones will prohibit the access to people and vessels for the duration of the specific construction period. This may affect the mobility of fishermen in accessing traditional fishing areas. However, exclusion zone will be temporary and possibly small in comparison to the overall fishing areas.

As illustrated from the figures below, fishing intensity in the landfall sites is low or very low for all landfall sites (see Figure 9-26 for LF2 and LF3 and Figure 9-27 for LF4 and LF5). Special reference should be made to the fishing shelters located close to:

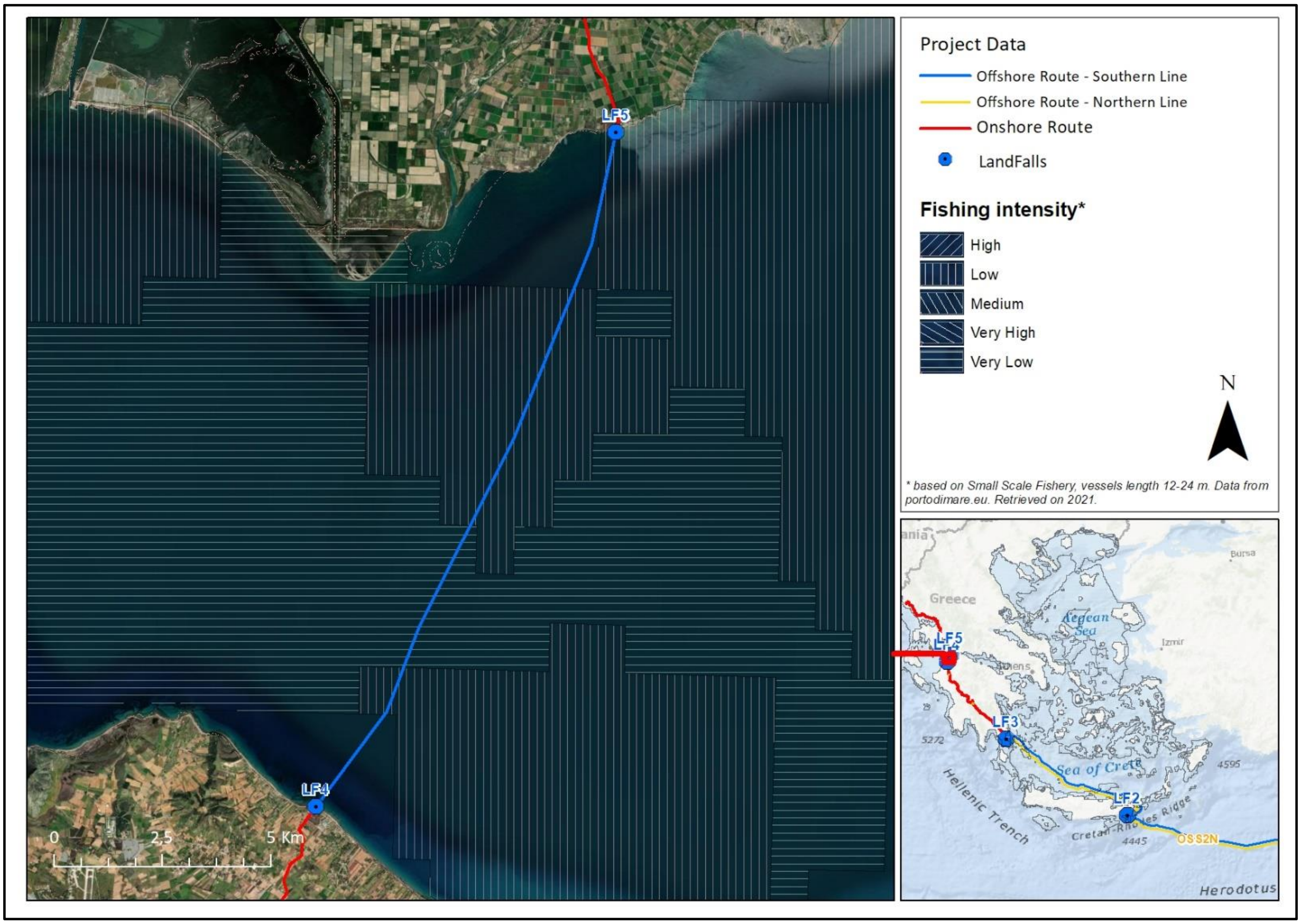
- LF2, namely Atherinolakkos and Goudouras fishing shelters at approx. 1 km to the NE and 4 km to the NW, respectively,

- LF3, i.e. Agios Fokas fishing shelter at approx. 700 m to the SE.



Prepared by: ASPROFOS, 2022. Data source: Maritime Spatial Planning for the protection and conservation of biodiversity in the Aegean Sea (www.marisca.eu). Details on fishing intensity are provided in corresponding sections of Chapter 8 (see Table 9-60).

Figure 9-26 Fishing intensity areas for LF2 and LF3.



Prepared by: ASPROFOS, 2022. Data source: Maritime Spatial Planning for the protection and conservation of biodiversity in the Aegean Sea (www.marisca.eu).

Figure 9-27 Fishing intensity for LF4 and LF5.

Regarding deep waters, section 8.7.2.6 provides indicative data regarding the fishing intensity. This is extrapolated from the quantities (or %) of the catches in a specific fishing area. Table 9-63 summarizes potentially affected fishing areas, both likely impacted and with potential limited interaction. A conservative approach is to consider that all potentially interacting fishing areas are equally affected; however, a more realistic approach would be to consider that the most likely engaged fishing areas are the ones directly affected by the project footprint, i.e. Crete (Kriti Island) and Patraikos Gulf.

Table 9-63 Potentially affected fishing areas.

Fishing area	Correlation to Project	Quantity of catches (in tonnes)	Percentage (%)
Total (Greece)		**70,182.5**	**100**
Subtotal (potentially engaged fishing areas)		**17,203.5**	**26**
Subtotal (most likely engaged fishing areas)		**4,165.14**	**7.5**
Coasts of Kefalonia, Zakynthos and Gulf of Patra	Gulf of Patras (aka Patraikos Gulf) is crossed by OSS4. LF4 & LF5 are located on the coasts of Patraikos Gulf. **Some interaction between the fishing area and the project could be expected**	4,164.0	5.9
Gulf of Laconia	OSS3 and LF3 are located outside the fishing area. **Limited interaction between the fishing area and the Project is expected**.	205.4	0.3
Gulf of Argolida and Saronikos Gulf	> 50 km distance. **Limited interaction between the fishing area and the Project is expected**.	6,068.0	8.6
Dodekanissos islands	OSS3 is located in the broader area. **Limited interaction between the fishing area and the Project is expected**.	2,880.2	4.1
Kyklades islands	OSS3 is located in the broader area. **Limited interaction between the fishing area and the Project is expected**.	3,884.7	5.5
Kriti island	OSS2 & OSS3, as well as LF2, are located in the broader area. **Interaction between the fishing area and the Project is expected**	1,142.0	1.6
Legend			
	Fishing areas closest to (and most likely to be impacted by) the project construction activities.		

Prepared by: (ASPROFOS 2021). Data from ELSTAT, *Marine Fishing Study with Motor Vessels: Year 2020*. Available at: https://www.statistics.gr/documents/20181/2cf94a83-1f2d-0447-1c1b-168627c39ed1.

It is reminded that potential impacts on aquaculture are discussed in Section 9.2.6.1.2.3.

The Project will result in the temporary loss of a small portion of fishing ground due to a safety zone of approximately 1 km radius that would be adopted to prevent interferences with marine users. However, no significant interferences with fishing activities are foreseen, mostly due to:

- The small size of the affected area;

- The short-term duration of the offshore activities in the areas used by small-scale fishermen (typically 1,5 - 3 miles from the coast) and large-scale fishermen (typically 3 – 12 miles from the coast);
- The availability of alternative fishing areas within the immediate vicinity of the Project area; and
- The temporary and insignificant loss of fisheries production
- Temporary nature of construction works, in general.

Taking into account the considerations discussed, and following the assessment criteria presented in Section 9.1, the assessment of the fishing areas restrictions can be assessed as follows:

The *Likelihood* of impact during construction works is *certain*. Regardless of any other criteria, it is certain that some (limited) restrictions will be applied within a small percentage of the overall specific fishing areas.

The *extent* of the impact is considered *local* given the fact that the restrictions shall be imposed only in the safety exclusion zone of 1 km around the pipelay vessels.

The *Intensity* of the impact has been related to the size of the fishing activity, fishing areas availability and fishing catches (indicative of the fishing significance in the specific fishing areas). Nearshore or deep water areas demonstrate the same low fishing intensity. Especially regarding deep waters, even if a more conservative approach is adopted, the intensity is small. As such, adopting a conservative approach, intensity is assessed as *medium*.

With regard to the *duration* of the impact, key factor determining the duration of the impact is the time required for completion of construction activities. In the landfall sites, the impact shall be more constant (approx. 6 months construction activities in the same place). For deep waters, the construction progress rate is estimated 2-3 km/day; as such, the construction front (the pipelay vessels) will not affect a specific marine area for more than few days. Regardless, all offshore construction works will be concluded within 1 year from their beginning; as such, the duration has been considered as *short-term.*

With regard to *reversibility*, the restrictions will be fully reversible once construction on a specific area is completed. However, measures to *minimize* impacts will be adopted for the duration of the construction phase. These are described in the corresponding section of Mitigation Measures (see Section 10).

Regarding *cumulative* action, although no offshore projects have been identified that could potentially be constructed simultaneously and impose fishing restrictions of their own, the possibility exists. As such, the cumulative character of this impact is considered as *likely*, adopting a conservative approach.

Transboundary character is deemed *impossible*, given that all fishing areas assessed are located within national territorial waters.

Based on the above and the criteria presented in Section 9.1, fishing areas restrictions during the construction of the project **SEI is considered as Minor.**

Section 10 presents the proposed mitigation and management measures applicable to the impact.

9.2.6.1.2.3 Indirect nuisance of aquaculture development and/ or fishing activity

Sediment suspension and consequent increased turbidity in the area may also raise an indirect impact to fishing grounds and consequently fishing activities. Although temporary, the increased turbidity could cause the fish population to move to other areas and as such decrease fishing efficiency and activity.

Sediments suspension is created partially from the laying of the pipeline to the sea bottom but mostly by any seabed intervention works, i.e. dredging operations at landfalls areas (or free spans correction). Details are provided in Section 9.2.3.

Regarding aquaculture development, no such farms were identified within the typical Study Area or in the broader area of the project (up to 5 km).

As previously presented, fishing activity in the area (deep waters and nearshore) is quite low, low or even very low. As such, limited indirect nuisance to fishing activity should be expected within the likely affected fishing areas (i.e. at Crete and at Patraikos Gulf). Sediments transportation cannot be completely avoided. Special techniques are already incorporated into the design of the Project and others can be added, to minimize sediments transportation (details are provided in Chapter 10). Sections 9.2.3 and 9.2.5 are also relevant, regarding impacts from sediments transportation to fish populations.

As documented in the sediments transportation model (Annex 9D), suspended sediments concentrations in the water column fall within the threshold value of 35 mg/L within 50 m from all intervention landfall sites (Table 9-64).

Table 9-64 Suspended Sediment Concentrations (mg/L) in the water column

Site	LF2		LF3		LF4		LF5	
x (m)	Max	Min	Max	Min	Max	Min	Max	Min
10	6.8	21.6	14.6	115.1	38.8	147.0	35.0	153.1
20	4.7	2.5	6.2	13.2	27.7	23.3	23.7	36.7
30	3.1	0.0	3.4	0.0	23.1	8.2	18.2	7.4
40	1.9		1.7		19.9	7.9	15.0	6.7
50	1.2		0.8		18.2	7.6	13.1	5.4
75	0.3		0.1		16.2	6.9	11.1	4.4
100	0.1		0.0		15.2	5.4	10.4	3.9
150	0.0				13.9	4.4	9.6	3.1
200					12.7	2.3	8.9	2.7
300					10.7	2.0	7.8	2.3

Prepared by School of Civil Engineering - National Tech Univ. of Athens on behalf of ASPROFOS, 2022

Moreover, it is noted that the duration of the potential impacts lasts as long as dredging (intervention works) takes place and the increased suspended sediment concentrations do not persist in the water column after the dredging procedure.

Similar to what was assessed for fishing areas restrictions (Section 9.2.6.1.2.2), taking into account the considerations discussed, and following the assessment criteria presented in Section 1.1, the assessment of the indirect disturbance of aquaculture development and/ or fishing activity can be assessed as follows:

The *Likelihood* of impact during construction works is *likely*. Regardless of any other criteria, it is certain that some sediments shall be resuspended and enter into the water column, for a short period. However, it is very unlikely that any sensitive receptor shall be impacted; no aquaculture development is present in the broader area of the project, not is the fishing intensity that significant as to consider likely to have indirect impact on fish populations (and consequently, fishing activity).

The *extent* of the impact is considered as *local* given the fact that the calculations verify limited transportation of sediments, being the main driver for indirect impacts on fishing activity.

The *Intensity* of the impact has been related to the size of the fishing activity, fishing areas availability and fishing catches (indicative of the fishing significance in the specific fishing areas) and also the presence of aquaculture development. Nearshore or deep water areas demonstrate the same low fishing intensity. Especially regarding deep waters, even if a more conservative approach is adopted, the intensity is small. Regarding aquaculture development, no such farms were identified. As such, intensity is assessed as *low*.

The rest of the criteria are identical to what was previously discussed (Section 9.2.6.1.2.2). Specifically:

With regard to the *duration* of the impact, key factor determining the duration of the impact is the time required for completion of construction activities. In the landfall sites, the impact shall be more constant (approx. 6 months construction activities in the same place). For deep waters, the construction rate is estimated 2-3 km/day; as such, the construction front (the pipelay vessels) will not affect a specific marine area for more than few days. Regardless, all offshore construction works shall have need concluded within 1 year of their beginning; as such, the duration has been considered as *short-term.*

With regard to *reversibility*, the restrictions will be fully reversible once construction on a specific area is completed. However, there are some measures to *minimize* impacts, for the duration of the construction phase. These are described in the corresponding section of Mitigation Measures (see Section 10).

Regarding *cumulative* action, although no offshore projects have been identified that could potentially be constructed simultaneously and impose fishing activity disturbance of their own, the possibility exists. As such, the cumulative character of this impact is considered as *likely*, adopting a conservative approach.

Transboundary character is deemed *impossible*, given that all fishing areas assessed are located within national territorial waters.

Based on the above and the criteria presented in Section 9.1, fishing areas restrictions during the construction of the project **SEI is considered as Minor.**

Section 10 presents the proposed mitigation and management measures applicable to the impact.

9.2.6.1.2.4 Marine Traffic

Project vessel movements will add to existing navigation and shipping traffic in the Project area potentially increasing marine traffic safety risks. Potential marine traffic risks during the construction phase are likely to include:

- Risk of vessel collisions;
- Restricted access to certain offshore areas; and
- Increased traffic along Project navigation routes and Port Facilities.

Based on the baseline data provided in Section 8.8, marine traffic in the southern part of Crete is relatively low. In the broader area in Peloponnese, marine traffic consists mainly of non-passenger ships like tankers and containers, which use the Elaphonisos strait in the southern part of Peloponnese. Ship traffic appears to be moderate and it concentrates mainly in two areas, near Elaphonisos strait and north of Heraklion (Crete). However, maritime traffic in the Patraikos Gulf is assessed as very high along the whole section of the pipeline route from LF4 to LF5, with the only exception of the nearshore areas.

Based on the data provided in Chapter 6 (Section 6.4.1.3 and 6.4.1.5), Astakos Port, at M. of Amphilochia, is very likely to be used as the Marshalling Yard[25], being active for 36 months. The number of pipe-supply vessels needed for continuous supply to the installation vessel has been estimated conservatively for PSV—DWCC of 2,500 tons and lay rate of about 5 km per day. It is estimated that 18 for OSS2/OSS2 N, 8 for OSS3/OSS3 N and 3 for OSS4 Pipe-Supply Vessels (DWCC of 2,500 Tons) shall be required to navigate from the Astakos Marshalling Yard to the pipelay vessels along the offshore section of the route, and back. According to Chapter 6 (Section 6.4.2) and the recently prepared relevant documentation[26], Table 9-65 was prepared summarizing ship routes (itineraries) for the construction of the entire EastMed Project.

[25] Indicatively, Heraklion, Thisvi, Patra and Piraeus might be alternative and/or additional ports.
[26] E780_00225-Ev80A-TDR-00224_1, IFR, 30-07-2021 -- Marshalling Yard Logistics Desktop Evaluation.

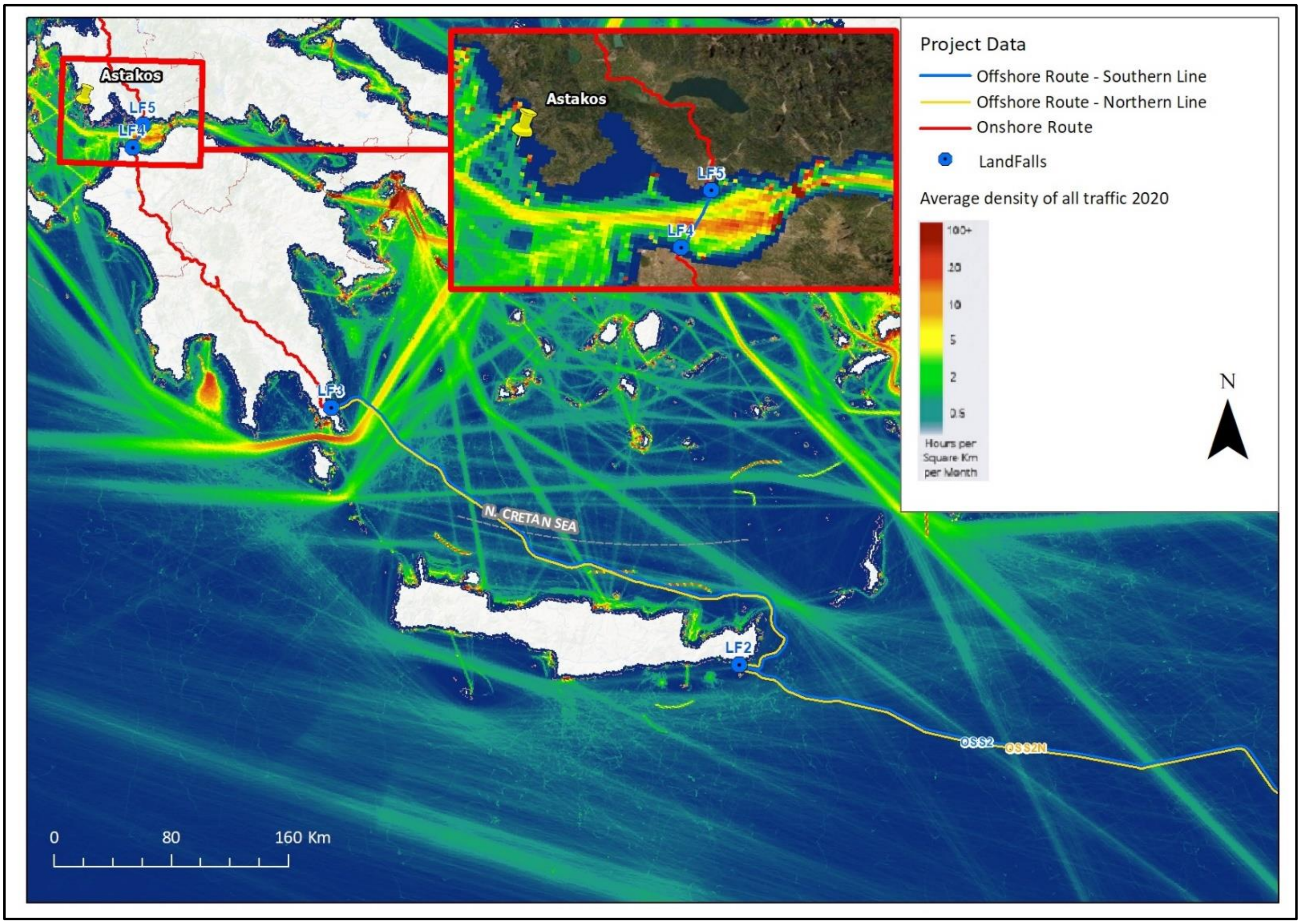
Table 9-65 Indicative vessels itineraries for EastMed Pipeline Project Construction.

Pipeline section	Total Joint Mass (tonnes)	Estimated No. shiploads needed to supply the full equipment to the installation vessel (indicative)	Estimated No. routes during the entire construction period	Pipeline section length (km)	Marine section construction duration (weeks)*
OSS2/OSS2 N**	1,363,672	546	1092	390x2=780	41
OSS3/OSS3 N**	846,258	340	680	430x2=860	45
OSS4	26,508	11	22	17	1

* Construction rate of 3 km/ day has been used (instead of 5 km/ day used for the vessels quantification). This would result in a more conservative approach, more appropriate for the impacts assessment. Additionally, a 10% contingency factor has been considered.
** Figures have been estimated proportionally to the available figures for the entire OSS1-OSS2. For the entire OSS1-OSS2, Total Joint Mass is 1,197,584 tn, the Estimated No. shiploads needed to supply the full equipment to the installation vessel (indicative) is 480, the Estimated No. routes during the entire construction period is 960, whilst the Marine section construction duration is 30-40 (weeks). Greek section of OSS2/OSS2 N is 390 km, whilst the entire OSS2/OSS2 N is approximately 685 km.

Prepared by: ASPROFOS, 2022. Data based on Chapter 6 (Sections 6.4.1.3, 6.4.1.5 and 6.4.2) and E780_00225-Ev80A-TDR-00224_1, IFR, 30-07-2021 -- Marshalling Yard Logistics Desktop Evaluation.

Based on the analysis of Table 9-65, the vessels itineraries are indicatively estimated in the order of 1092 for OSS2/ OSS2 N, 680 for OSS3/OSS3 N and 22 for OSS4 within a period of 41 weeks, 45 weeks, and 1 week, respectively. This corresponds, approximately, to 4 (3.8), 1 (0.45) and 1 (0.3) itineraries per day for OSS2/OSS2 N OSS3/OSS3 N and OSS4, respectively. Of course, there shall be also the navigation of the pipelay vessels for the same time periods. In any case, the number of increased marine routes, corresponding to the increase of the marine traffic cannot be considered as significant. This is especially so, if we take into consideration the current ships density in the Project's area (see Figure 9-28).



Prepared by: ASPROFOS, 2022. GeoServer Web Map Service on ows.emodnet-humanactivities.eu.

Figure 9-28 Vessels density.

Taking into account the considerations discussed, and following the assessment criteria presented in Section 9.1, the increase of the marine traffic can be assessed as follows:

The *Likelihood* of impact during construction works is *certain*. Regardless of any other criteria, it is certain that some (limited) increase in marine traffic shall be induced for the duration of the offshore construction activities.

The *extent* of the impact is considered as *peripheral* given the fact that the project related vessels shall be navigating at great distance from the project footprint.

The *Intensity* of the impact has been related to the number of vessels navigating for the needs of project's construction and the existing ships density. As discussed above, vessels traffic is very low (at least from the selected port facility towards the marine project footprint) for most of the engaged marine space; exception is the Patraikos Gulf where the density is higher due to the limited marine area and the increased marine traffic of Port of Patra. Nevertheless, taking into consideration the limited number of vessels itineraries (even in the Patraikos Gulf) per day, for the offshore construction duration of the project, intensity is assessed as *low*.

With regard to the *duration* of the impact, key factor determining the duration of the impact is the time required for completion of offshore construction activities, which according to the data presented in Table 9-65 all offshore construction works shall have been concluded within 1 year from their beginning; as such, the duration has been considered as *short-term.*

With regard to *reversibility*, the restrictions will be fully reversible once construction in a specific area is completed. Even before construction completion, safety issues regarding marine traffic increase can be completely avoided through proper navigation instructions by the competent authorities and other measures (described in the corresponding section of Mitigation Measures - see Section 10). As such, the impact is considered *avoidable.*

Regarding *cumulative* action, although no offshore projects have been identified that could potentially be constructed simultaneously and increase marine traffic on their own, the possibility is there. Nevertheless, the additional marine traffic due to the project is considered as minimal, as such, the cumulative character of this impact is considered as *rare.*

Transboundary character is deemed *likely*. It is only reasonable to acknowledge that by nature, marine traffic may include stakeholders (ships) of international flags even if they are navigating in national territorial waters.

Based on the above and the criteria presented in Section 9.1, increase in marine traffic during the construction of the project **SEI is considered as Minor.**

Section 10 presents the proposed mitigation and management measures applicable to the impact.

9.2.6.1.2.5 Summary of impacts during construction on Regional Planning – Uses of Sea

The following table summarizes the impacts during the construction phase to Uses of Sea.

Table 9-66 Overview of the impacts on the Existing Uses of Sea during construction phase.

S/N SEI			SEI for	Uses of the Sea							
Project phase	Construction										
Impact	Mechanism	Locations	Criteria/ Impact Properties							SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Fishing areas restrictions	• Navigation of Project vessels within fishing areas • Marine vessel traffic and use of Port Facilities • Offshore pipeline construction activities • Shore crossing and related construction at landfalls	• Fishing areas mainly of (i) Coasts of Kefalonia, Zakynthos and Gulf of Patra; (ii) Kriti island; and secondary of (iii) Gulf of Laconia, (iv) Gulf of Argolida and Saronikos Gulf, (v) Dodekanissos islands, and (vi) Kyklades islands	1.00	0.25	0.50	0.25	0.75	0.50	0.25	5.00 (Minor)	• Fishing intensity is low. • A safety exclusion zone of 1 km shall be enforced around the pipelay vessels.
Indirect nuisance of aquaculture development	• Offshore pipeline construction activities • Shore crossing and related	• Landfall sites and Fishing areas of (i) Coasts of Kefalonia, Zakynthos and Gulf	0.50	0.25	0.25	0.25	0.75	0.50	0.25	3.93 (Minor)	• No aquaculture farms in the broader area. Suspended sediments concentrations in the water column fall within

S/N SEI			SEI for	Uses of the Sea							
Project phase	Construction										
Impact	Mechanism	Locations	Criteria/ Impact Properties							SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
and/ or fishing activity	construction at landfalls	of Patra and (ii) Kriti island.									threshold values, just within 50 m from the project footprint (see Annex 9D).
Increase in marine traffic	• Navigation of vessels within fishing areas • Marine vessel traffic and use of Port Facilities • Offshore pipeline construction activities	• Ports used for the project	1.00	1.00	0.25	0.25	0.25	0.25	0.50	5.00 (Minor)	• Number of additional vessels per day is very small. • Ships density is very low; in Patraikos Gulf (of higher ships density), impact duration is only 1 week (i.e. in the deep water). • Ships with international flags may be affected. • Measures exist for reversion of any safety implications.

Prepared by: ASPROFOS, 2022.

9.2.6.2 Structure and functions of anthropogenic environment

9.2.6.2.1 Community Health & Safety

The presence of the Project could affect the health and safety of the communities along the pipeline route and close to main stations as a result of worker- community interactions. Project's construction comes with the risk of injury associated with construction activities and as such potential competition for access to health care resources and nuisance due to increased noise levels (details regarding noise are provided in Section 9.2.11 – Noise).

Table 9-9 shows the key sources of impact, potentially impacted resources and receptors, baseline and project influencing factors associated to the impacts of the investigated project on community and workers health and safety and consequently on local health care resources.

Table 9-67 Key Considerations for Assessment – Community Health & Safety (Construction Phase).

Sources of Impact/ Risk	• Presence of the construction workforce (sourced nationally and internationally) who through interactions with communities may be related with increased health risks. • The provision of health care for the workforce (both primary and secondary, i.e. hospital care) has the potential to affect access to health care for communities (due to competition for resources) with the potential for worsening health outcomes. • Community members could be involved in accidents leading to injuries if they enter areas where construction activities are being undertaken. • Changes to the environment due to increased noise, decreased air quality, waste and changes to the visual environment as a result of the Project may affect health and wellbeing (see relevant Sections).
Potentially Impacted Resources and Receptors	• Communities along the pipeline route. • Settlements close to compressor stations, logistic and construction sites. • Primary health care facilities in communities along the route and towns with hospitals in broader Study Area.
Particular Baseline Conditions that are Potentially Influencing Impacts/Risks	• Health care centres are located in larger settlements with villages being served by a health post with a doctor or nurse visiting on rotation (usually once a week). • However, there are settlements that do not have a health post, nor are visited by medical staff, whilst there is already increased pressure on the existing services. • Specialist health care facilities are provided to the residents of the study area by numerous health care facilities. Specifically in the Regional Units crossed by the pipeline, there are 20 Hospitals. Patra's hospitals support the population of the third biggest city in Greece; Heraklion (Crete) and Ioannina are not very far away

	from the Project area (approx. 20 km to the East, 30 km to the North and 40 km to the East, of the project , respectively) and are also included in the biggest cities of Greece. • COVID-19 pandemic is influencing mainly population centres. • All social groups have the same access to health care facilities.
Project Factors that are Potentially Influencing Impacts/Risks	• Location of project's construction supporting temporary (pipeyards, construction sites) and permanent (Main Stations, i.e. Facilities at Crete, Megalopoli and Achaia) facilities • Construction schedule (duration and season/ timing – High Touristic Season) • Number of workforce
References	• Baseline is provided in Section 5, 8.6 and 8.7 • Mitigation Measures are provided in Section 10.2.6 • Land uses and Socioeconomic Map is provided in Section 15.1.6 • Impacts assessment on air quality is provided in Section 9.2.10 and Mitigation Measures in Section 10.2.10. • Impacts assessment on acoustic environment is provided in Section 9.2.11 and Mitigation Measures in Section 10.2.11.

Prepared by: ASPROFOS, 2022.

Table 9-68 summarizes the potential key impacts on Community Health and Safety, due to the construction of the Project.

Table 9-68 Key Potential Impacts – Community Health and Safety.

Potential Impact	Construction Phase
Increased pressure on health care facilities	X
Increased transmission of infectious diseases	X
Environmental health (air quality and acoustic environment)	X (See Air Quality & Acoustic Environment)

Prepared by: ASPROFOS, 2022.

The origin of the workforce cannot be defined at the present phase. In case measures for infectious diseases are applicable in Greece (e.g COVID-19), they have to be applied (and, in case of an outbreak, even increased), to prevent any impact to (and by) the working force and the nearby communities.

Impacts are most likely to be experienced close to construction sites.

The final locations of pipeyards and construction sites shall be defined prior construction phase by the EPC Contractor(s). In any case they will be sited within agricultural, levelled areas, close to existing infrastructure (artificial areas), but at some distance from residential areas; as such limited interaction with residential areas is foreseen.

Temporary facilities whose location is identified at this stage are used for impacts assessment on Community Health and Safety. This impact assessment can be considered as basis/ similar for the other temporary facilities, as well.

According to Chapter 6, the active time of the temporary facilities is estimated to thirty (30) months. Specifically, the construction at the landfall sites will take up to 6 months whilst the construction at the Main Stations will take up to 36 months. All installations are of a temporary character and will be removed completely (including foundations) after the construction period. The entire area will be revegetated after demobilization of infrastructure. Main Stations construction sites is an exception, considering that the sites are located within the plots where the permanent facilities will be erected.

Table 9-69 Temporary facilities interaction with community health and safety – Closest residential areas and hospitals to temporary facilities.

Location	Temporary Facility Type	Average Staff (approx.)	Tentative facility's active time (Operational duration)	Closest residential area	Indicative distance to closest residential area	Closest Town (correlated to hospitals based on Table 8-24)	Indicative time (distance) to closest hospital
Crete Facilities	Main Station Construction Site	250	36 months	Goudouras	2 km	Ierapetra	45' (40 km)
LF2	Landfall Construction Site	50	6 months	Goudouras	3 km	Ierapetra	45' (40 km)
LF3	Landfall Construction Site	50	6 months	Agios Fokas	0.5 km	Molaoi	40' (38 km)
Megalopoli Facilities	Main Station Construction Site	250	36 months	Soulari	1 km	Sparta	28'' (43 km)
Achaia Facilities	Main Station Construction Site	250	36 months	Kato Velitses	1.5 km	Amaliada	45'' (35 km)
O&M	Permanent Facility Construction Site	250	36 months	Kalamaki	0.5 km	Patra	44'' (32 km)
LF4	Landfall Construction Site	50	6 months	Paralia Kalamaki	0.5 km	Patra	49'' (36 km)

Location	Temporary Facility Type	Average Staff (approx.)	Tentative facility's active time (Operational duration)	Closest residential area	Indicative distance to closest residential area	Closest Town (correlated to hospitals based on Table 8-24)	Indicative time (distance) to closest hospital
				(Kalamaki beach)			
LF5	Landfall Construction Site	50	6 months	Galatas	3 km	Messologgi	36'' (37 km)

Prepared by: ASPROFOS, 2022.

According to Table 9-69 four (4) construction sites are within one kilometer from a residential area. The Project will address impacts to these settlements through mitigation measures and management planning. However, it is not envisioned that these settlements will experience any additional impact over and above all other affected settlements. Table 9-15 also includes the closest towns, where based on Table 8-24, hospitals exist. Two (2) cities are supporting more than one construction sites, i.e. Patra and Ierapetra, with 3 and 1 hospitals, respectively.

9.2.6.2.1.1 Increased pressure on health care

The presence of a workforce along the pipeline route could be considered as likely to lead to increased pressure on the existing health care facilities in the broader study area and potentially decreased access to health care facilities/ support for local communities. This is particularly the case for communities experiencing increased pressure on the existing services due to the lack or limited local health care facilities. Any impact in access to health care facilities including longer waiting times is likely to be associated with worse health outcomes. This is a particular risk in the case of incidents involving multiple casualties, or patients from both the workforce and community where hospital level care is required or in the case of a disease epidemic. In any case, the number of workers, compared to the number of habitants within the study area, is not so significant.

Hospitals are the most likely to face an increased pressure on the existing services health facilities. This is due to a potential increase on health incidents (of the workforce) from the construction of the Project. It is highlighted that focus is given to hospitals for two main reasons: (i) official data are available and (ii) small incidents (cuts and bruises) that can be handled in a local health care unit/ health center are likely to be treated on the site, by the medical team of the EPC contractor(s).

The number of the workforce varies depending on the type of construction activity held on a specific area and it ranges between 50 and 250 (average presence of workforce). Pressure on health care may be induced by the workforce (related to the project), but also from tourists (not related to the project but potentially having cumulative impacts on the resource). This can be the case if the health care services are required during the peak tourist season. Nevertheless, during design and construction of health infrastructure, the presence of tourists is also taken into consideration whilst as previously mentioned, the number of workers in a specific location is not so significant. In any case, there could be additional health pressure in the health infrastructure of touristic areas (only in case of accidents).

Table 9-69 summarizes the proximity of the main regional hospitals to the Project's temporary facilities. As illustrated, only Patra and Ierapetra are likely to support more than one construction sites. Patra is the third biggest city of Greece and has three hospitals, fully operation and capable of handling any type of incidents. Ierapetra is the biggest town of Southern Crete (and R.U. of Lasithi) and forth biggest town of the entire Crete. Sitia, also hosting a hospital is at a distance of 40 km.

Based on a qualitative approach, in order to assess potential increased pressure on health care system, It must be taken into consideration the possibility of having at the same time the following conditions:

(i) Health related incident of such a significance as to require hospitalization of local workforce

(ii) Simultaneous hospitalization requirement for local workforce, local community members, tourists

(iii) Nearest health care facility does not include the speciality necessary for a given incident.

Although the above conditions may be satisfied at the same time, the possibility is very low. The increase of potential patients due to the workforce cannot be considered substantial enough as to stress significantly the health care capacity of the hospitals. Apart from the absolute number of the workforce (50 – 250), the said hospitals are included in the National Health Care System and are considered as adequate, in terms of beds and services, even if the extra load of tourists is added.

Apart from that, National legislation and also Best Industry Practice obliges the construction activities to be aligned with an approved Health and Safety Management Plan. Although, this does not eliminate possible serious injuries and accidents, it provides for a pre-determined set of measures and procedures to handle health emergencies. These include first aid seminars and presence of trained personnel on site, but most importantly measures to prevent and avoid serious injuries and accidents that would require hospitalization.

Taking into account the considerations discussed, and following the assessment criteria presented in Section 9.1 the assessment of the increased pressure on health care can be assessed as follows:

The *Likelihood* of impact during construction works is *rare*. Many conditions need to be satisfied at the same time so that the health care facilities are burdened, due to the presence of the workforce at a specific area.

The *extent* of the impact is considered as *peripheral* given the fact that the hospitals may be located at significant distance (outside the study area or even greater than 3 km away).

The *Intensity* of the impact is related to the sensitivity of the engaged health care facilities, i.e. the capacity they have to support potential increase of patients. All presented hospitals (to which the assessment is based) are included in the National Heal Care System and as such, its sensitivity is considered as *low*.

With regard to the *duration* of the impact, key factor determining the duration of the impact is the time required for completion of construction activities and consequently presence of the workforce in a specific area. Given that all construction works shall be completed within 3 years (36 months), duration has been considered as *mid-term*.

With regard to *reversibility*, the increased pressure on health care is directly related to the duration of the presence of the workforce on the specific area. As soon as the presence of the workforce will end, the impact will disappear. However, prior to that, there are a set of mitigation measures that are implemented to prevent, avoid and, of course, *minimize* the risk of incidents (injuries and accidents) that would result in the need of health care. These are described in the corresponding section of Mitigation Measures (see Section 10) and shall be detailed in the Health and Safety Management Plan.

Regarding *cumulative* action, it is possible that workforce hospitalization is required at the same time as tourists and members of local community being hospitalized. However, as previously discussed, these three conditions (hospitalization of significant numbers of workforce, tourists and local community) need to be satisfied at the same time, in order to have cumulative increased health care pressure. Thus, although possible, the cumulative character of this impact is considered as *rare*.

Transboundary character is deemed *impossible*, given the lack of transboundary areas with possible increase of health care pressure.

Based on the above and the criteria presented in Section 9.1, increased pressure on health care during the construction of the project **SEI is considered as Minor.**

Section 10 presents the proposed mitigation and management measures applicable to the impact.

9.2.6.2.1.2 Increased transmission of infectious diseases – COVID-19 pandemic

The presence of the workforce in the construction sites where interaction with nearby communities is possible might play a role to the transmission of infectious diseases. The profile of these diseases will be influenced by the existing health profile of communities along the route and that of the workers.

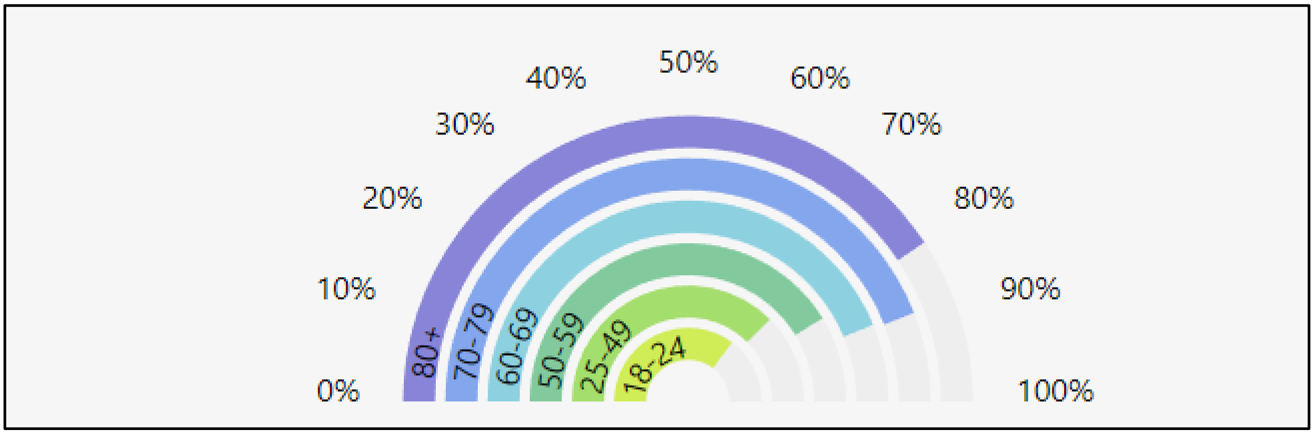
Over the past decade, globally, there has been a number of influenza or respiratory disease pandemics including SARS, Avian Influenza and the H1N1 Virus.

Other diseases that may be of concern include malaria (Greece implements a vector control programme annually but saw cases in 2011 for the first time since 1974, in Achaia and Ilia[27]), as well as vaccine preventable diseases such as measles and mumps, especially in vulnerable groups when vaccination coverage is lower.

More recently, SARS-CoV-2 coronavirus has triggered the ongoing global pandemic of coronavirus disease 2019 (COVID-19). COVID-19 transmits when people breathe in air contaminated by droplets and small airborne particles containing the virus. COVID-19 vaccines have been approved and widely distributed in various countries since December 2020. Other recommended preventive measures include social distancing, masking, improving ventilation and air filtration, and quarantining those who have been exposed or are symptomatic. Treatments include monoclonal antibodies, novel antiviral drugs, and symptom control. Governmental interventions include travel restrictions, lockdowns, business restrictions and closures, workplace hazard controls, quarantines, testing systems, and tracing contacts of the infected. According to the available data, as per January of 2022, 69% of the general population

[27] https://www.iamat.org/country/greece/risk/malaria

in Greece has been fully vaccinated (70.3% in E.U.)[28] (Figure 9-29). On a more detailed level, Table 9-70 presents vaccinations data per Regional Units of the study area.



Prepared by: GreeceInFigures.com. Source: ECDC Vaccine Tracker as cited in https://greeceinfigures.com (Retrieved on 28/02/2022).

Figure 9-29 Distribution of vaccinations per age group.

Table 9-70 Vaccinations per Regional Unit within Study Area.

Regional Unit	Vaccinated with 1 dose	Completely Vaccinated	Booster dose	Total vaccinations	%[1]
Achaia	222.683	210.090	139.272	555.383	60%
Aetoloakarnania	125.998	119.521	85.380	322.119	64%
Ilia	96.645	92.490	61.816	242.785	58%
Lassithi	65.367	63.527	41.198	159.449	73%
Laconia	56.714	55.267	38.220	142.985	61%
Arcadia	53.252	50.667	38.292	137.381	58%
Arta	46257	45.366	31.418	116.942	70%
Preveza	41.563	40.949	33.032	111.707	77%
Thesprotia	37.724	35938	23.011	92.924	72%

[1]: Data from https://covid19.gov.gr/covid-map-v5/, retrieved on 28/02/2022.
Prepared by: ASPROFOS, 2022. Data from https://emvolio.gov.gr/vaccinationtracker, retrieved on 28/02/2022.

[28] Dated on 18/01/2022. Retrieved on 28/02/2022 from https://www.iatronet.gr.

It is not possible to quantify the risk for an increase in transmission of COVID-19, or other infectious diseases, induced by the presence of workforce. Given the current global pandemic trend, the new means and measures for combating coronavirus, health risks shall be significantly decreased.

Vulnerable groups could be more affected due to their existing health profile; however, in Greece, all people have equal access to public health and the project does not interfere with the accessibility (in terms of road network) of health care infrastructure.

As far as the risk of increased transmission of COVID-19 from the workers interaction with local communities (e.g. during collaborations, services, facilities, socializing, etc.), national government sets specific rules and measures according to the pandemic status to prevent the spreading to which everyone need to comply; so shall the employees of the EPC Contractor(s).

It is clarified that specific H&S measures will be implemented in compliance with the applicable legislation (as in force at the time of the construction) and requirements.

Taking into account the considerations discussed and following the assessment criteria presented in Section 9.1, the assessment of the increased transmission of infectious diseases can be assessed as follows:

The *Likelihood* of impact during construction works is assessed as *likely*. People have been familiarized with the necessary protective measures, whilst government sets specific regulations according to the latest pandemic status, allowing everyday activities to continue. Nevertheless, the possibility for an increase in the transmission rate of COVID-19 is present.

The *extent* of the impact is considered as *peripheral.* Workers may commute between their residence and other places within local community, or even travel for short breaks to other places.

The *Intensity* of the impact is related to the sensitivity of the receptor. Obviously, all potential patient with COVID-19 sensitivity is of outmost importance considering the health and wellbeing of everyone; however, vaccination percentages in Greece is high, whilst one needs to take into consideration that any workers that could potentially come from abroad, shall also be vaccinated. As such, intensity is considered as *low*.

With regard to the *duration* of the impact, key factor determining the duration of the impact is the time required for completion of construction activities and consequently presence of the workforce.

Nevertheless, secondary impacts, may linger for a few more months. Even so, given that all construction works shall be completed within 3 years (36 months), duration has been considered as *mid-term*.

With regard to *reversibility*, the risk of increased transmission of COVID-19 is directly related to the duration of the presence of the workforce on the specific area and to the workforce compliance to national health regulations and COVID-19 related instructions. In other words, there is a set of mitigation measures that are implemented to prevent, avoid and, of course, *minimize* increased transmission of COVID-19 (and other infectious diseases) (i.e. the Health and Safety Plan). These are described in the corresponding section of Mitigation Measures (see Section 10).

Regarding *cumulative* action, it is possible that workforce presence may coincide with high tourist season. T Nevertheless, as previously mentioned, all people living, working, being present in Greece are obliged to comply with national COVID-19 instructions. Thus, the cumulative character of this impact is considered as *rare*.

Transboundary character is deemed assessed as *rare*. By definition, the pandemic is a transboundary issue. However, as previously pointed out, nowadays there are several mechanisms for controlling and combatting COVID-19 pandemic.

Based on the above and the criteria presented in Section 9.1, the risk of increased transmission of infectious diseases (incl. COVI-19) during the construction of the project **SEI is considered as Minor.**

Section 10 presents the proposed mitigation and management measures applicable to the impact.

9.2.6.2.1.3 Environmental health (air quality and acoustic environment)

The construction of the pipeline, line valves and Main Stations will result in changes to the physical environment, which has the potential to affect the health and wellbeing of communities.

Changes to the visual environment are likely to be minor and will mainly occur in forest or elevated areas where construction activities will be visible or will result in clearance of forest zones; details are provided in Sections 9.2.3 and 9.3.3 (Impacts on Landscape and Morphological Characteristics, during construction and operation phases, respectively).

The increase in dust is predicted to have a minor negative impact following mitigation but may still result in some increased annoyance and decreased wellbeing especially for residences closest to construction site e.g., less than 200 m from the construction and close to the Main Stations. In terms of decreased air quality over the long term, impacts are expected to be minor at the compressor station site and therefore are unlikely to result in a recordable increase in respiratory diseases in the population. Details are provided in Sections 9.2.10 and 9.3.10 (Impacts on Air Quality, during construction and operation phases).

The construction of the pipeline and the Main Stations is likely to result in some temporary increased noise, mainly for residents within 200 m of construction sites. This increase in noise is likely to result in some annoyance and decreased wellbeing for those closest to the construction activities. However, this is likely to be minimized due to the hours of working. Sleep disturbance is unlikely due to the proposed hours of operation. Details are provided in Sections 9.2.11 and 9.3.11 (Impacts on Acoustic Environment, during construction and operation phases).

Waste production as a result of the construction activities is unlikely to impact the health of communities along the route since the chances for communities to be exposed to waste will be minimal as it will be stored in fenced areas. Details are provided in Sections 9.2.8 and 9.3.8 (Impacts on Infrastructure – Environmental Infrastructure Systems).

9.2.6.2.1.4 Summary of impacts during construction on Community Health and Safety

The following table summarizes the impacts during the construction phase to Community Health and Safety.

Table 9-71 Summary of Impacts to Community Health and Safety during Construction Phase.

S/N SEI			SEI for	Community Health and Safety						
Project phase	Construction									
Impact	Mechanism	Locations	Criteria/ Impact Properties						SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Increased pressure on health care	• Presence of the construction workforce and interactions with local community. • The provision of health care for the workforce may lead to competition of local health care facilities. • Involvement of community members in accidents.	• Closest health care facilities (Hospitals).	0.25	1.00	0.25	0.50	0.75	0.25	0.00	4.29 (Minor)	The engaged hospitals are considered capable of handling the increased pressure even when considering potential additional health care load from workforce and tourists. Safety procedures induced not only by law, but also by Project's HSE policies, minimize risk of accidents/ injuries.

S/N SEI			SEI for	Community Health and Safety						
Project phase	Construction									
Impact	Mechanism	Locations	Criteria/ Impact Properties						SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Increased transmission of infectious diseases	• Presence of the construction workforce and interactions with local community.	• Residential areas close to Temporary facilities	0.50	1.00	0.25	0.50	0.75	0.25	0.25	5.00 (Minor)	Normality is emerging slowly but steadily.

Prepared by: ASPROFOS, 2022.

9.2.6.2.2 Community Cohesion

The term community cohesion refers to the quality of life with regard to the services provided, the breaking of urban fabric and the interactions between members of local communities and the project.

It describes the capacity to function and develop together, based on integration and the ability to manage nuisances to everyday life of community members due to project construction. Community cohesion has to be considered as a continuous process interweaving a broad background fabric of issues such as access to education and employment, poverty and social inequalities, social and cultural diversity, access to communication and information. A high level of community cohesion will imply respect for persons as individuals, sensitiveness to ethnic and social differences and a sense of being a permanent or temporary member of local community, on one hand, and accept presence and temporary nuisance from project related construction resources (workforce and activities).

The impact of the Eastmed Project on the quality of life is expected to be low and only during the construction phase, as a result of construction sites hindering to a certain extent the movement of the local population in the area.

Table 9-72 shows the key sources of impact, potentially impacted resources and receptors, baseline and project influencing factors associated to the impacts of the investigated project on community cohesion.

Table 9-72 Key Considerations for Assessment – Community Cohesion (Construction Phase).

Sources of Impact/ Risk	• Presence of the construction workforce (sourced nationally and internationally) who through interactions with communities may cause nuisance. • Land occupation by project related facilities • Construction activities stresses
Potentially Impacted Resources and Receptors	• Communities along the project footprint.
Particular Baseline Conditions that are Potentially Influencing Impacts/Risks	• Educational, social and economic level of engaged population • Experience from other (similar or not) development plans and projects • Current economic situation is impacting on the general feeling of anxiety and negativity. • Existing land uses, mainly on temporary facilities locations.
Project Factors that are Potentially Influencing Impacts/Risks	• Location of project's construction supporting temporary (pipeyards, construction sites) and permanent (Main Stations, i.e. Facilities at Crete, Megalopoli and Achaia) facilities

	• Construction schedule (duration and season/ timing – High Touristic Season) • Number of workforce
References	• Baseline is provided in Section 5, 8.6 and 8.7 • Mitigation Measures are provided in Section 10.2.6 • Land uses and Socioeconomic Map is provided in Section 15.1.6

Prepared by: ASPROFOS, 2022.

Table 9-73 summarizes the potential key impacts on community health and safety, due to the construction of the investigated project.

Table 9-73 Key Potential Impacts – Community Cohesion.

Potential Impact	Construction Phase
Break of urban fabric continuity	X

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Impacts related on community cohesion are very closely related to impacts on community health and safety (see Section 9.2.6.2.1). As such, information presented there is also applicable. In short, the following are noted:

- Origin of the workforce has yet to be established.
- Impacts are most likely to be experienced close to construction sites.
- The final locations of pipeyards and construction sites shall be defined prior construction phase by the EPC Contractor(s). In any case it is expected that they will be sited within agricultural, levelled areas, close to existing infrastructure (artificial areas), but at some distance from residential areas. Construction sites that are known are the ones related with the construction of main facilities and other characteristic locations (i.e. Landfalls) which are presented in Table 9-15.
- The active time of the temporary facilities will be thirty (30) months. Specifically, the construction at the landfall sites will take up to 6 months whilst the construction at the Main Stations will take up to 36 months.

9.2.6.2.2.1 Break of urban fabric continuity

Pipeline route is mainly located in remote areas, away from urban fabric. Some exceptions are applicable mainly in the lowlands (in agricultural and coastal areas) and the crossings with existing road network.

The final locations of pipeyards and construction sites shall be defined prior construction phase by the EPC Contractor(s). In any case, it is expected to be sited within agricultural, levelled areas, close to existing infrastructure (artificial areas), but at some distance from residential areas; as such limited interaction with residential areas is foreseen. As such, potential break in the unity of urban fabric is more likely to be possible close to the construction sites (even though they are usually located in areas with limited interaction with urban fabric).

As summarized in Table 9-74, almost all currently available construction sites lay outside artificial surfaces. LF2 is an exception located on the borders of the Power Plant of Atherinolakkos industrial area.

Table 9-74 Temporary facilities land use type.

Location	Temporary Facility Type	Closest residential area	Indicative distance to closest residential area	CORINE Land cover type (approx. % of total area)
Crete Facilities	Main Station Construction Site	Goudouras	2 km	• 323 - Sclerophyllous vegetation (4%) • 223 - Olive groves (96%)
LF2	Landfall Construction Site	Goudouras	3 km	• 333 - Sparsely vegetated areas (100%) • 121 - Industrial or commercial units (50%)
LF3	Landfall Construction Site	Agios Fokas	0.5 km	• 243 - Land principally occupied by agriculture, with significant areas of natural vegetation (100%)
Megalopoli Facilities	Main Station Construction Site	Soulari	1 km	• 243 - Land principally occupied by agriculture, with significant areas of natural vegetation (100%)
Achaia Facilities	Main Station Construction Site	Kato Velitses	1.5 km	• 211 - Non-irrigated arable land (70%) • 242 - Complex cultivation patterns (30%)
O&M	Permanent Facility Construction Site	Kalamaki	0.5 km	• 212 - Permanently irrigated land (100%)
LF4	Landfall Construction Site	Paralia Kalamaki (Kalamaki beach)	0.5 km	• 212 - Permanently irrigated land (100%)

Location	Temporary Facility Type	Closest residential area	Indicative distance to closest residential area	CORINE Land cover type (approx. % of total area)
LF5	Landfall Construction Site	Galatas	3 km	• 421 - Salt marshes (100%)

Prepared by: ASPROFOS, 2022.

Adopting a worst-case scenario, construction sites along the pipeline route shall be located on discontinuous urban fabric. It is clarified that usually construction sites and pipeyards are located on agricultural lands (given cheaper rent and available utilities and accessibility); nevertheless, for impacts assessment the conservative approach is opted. Discontinuous urban fabric is used to describe urban structures and transport networks, which are inextricably associated with vegetated areas and with bare surfaces being present and occupying significant surfaces in a discontinuous spatial pattern. The impermeable features like buildings, roads and artificially surfaced areas range from 30 to 80 % land coverage.

On the other hand, one may argue that the addition of a construction site (artificial surface) on a discontinuous urban fabric could act cumulatively. In discontinuous areas (of artificial areas in various percentages), addition of temporary (or permanent) construction sites could be considered as aggregating to other artificial areas. This acts in favour (not as a negative impact) regarding urban fabric continuity.

Construction sites (currently known or not yet identified) have a specific layout and configuration, whilst measures can be applied in order to best fit these in the surrounding environment (e.g. fencing, screening of storage areas, etc.). In addition, they are usually located in empty spaces/ areas and upon agreement with the owner (usually private or municipal ownership). It is clarified that construction sites are subject to permitting procedure (including traffic connection permit); as such, their siting is verified, approved by local town planning authorities in order to ensure unobstructed continuity of urban activities.

Taking into account the considerations discussed, and following the assessment criteria presented in Section 9.1, the assessment of tensions between local community and the workforce can be assessed as follows:

The *Likelihood* of impact during construction works is *rare*. Although the risk cannot be excluded, most often, construction sites are located in areas away from continuous urban fabric (or even discontinuous) whilst there are various mechanisms in place to ensure continuity of existing urban conditions.

The *extent* of the impact is considered as *local* given the fact by definition, breaking of urban fabric continuity will be limited to the area occupied by the construction site.

The *Intensity* of the impact is related to the quality of artificial surface (urban fabric) that is temporary broken. Given that, even when adopting a conservative approach, the areas where construction sites shall be located will be characterized as discontinuous urban fabric, the intensity is considered as *low*.

With regard to the *duration* of the impact, key factor determining the duration of the impact is the time required for completion of construction activities and consequently presence of the workforce in a specific area. Given that all construction works shall be completed within 3 years (36 months), duration has been considered as *mid-term.*

With regard to *reversibility*, the breaking of urban fabric continuity is directly related to the duration of the presence of the construction sites in the specific area. As soon as the construction sites are removed, so shall the impact. However, prior to that, there are a set of mitigation measures that are implemented to *avoid* this impact (mainly through proper design and site selection for the construction sites) (see Section 10 for details).

Regarding *cumulative* action, the cumulative character of this impact is considered as *likely*.

Transboundary character is deemed *impossible*, given the lack of transboundary areas with presence of construction sites.

Based on the above and the criteria presented in Section 9.1, break of urban fabric continuity during the construction of the project **SEI is considered as Negligible.**

Section 10 presents the proposed mitigation and management measures applicable to the impact.

9.2.6.2.2.2 Summary of impacts during construction on Community Cohesion

The following table summarizes the impacts during the construction phase to Community Cohesion.

Table 9-75 Summary of Impacts to Community Cohesion during Construction Phase.

S/N SEI			SEI for	Community Cohesion							
Project phase	Construction										
Impact	Mechanism	Locations	Criteria/ Impact Properties							SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Break of urban fabric continuity	• Land occupation by project related facilities.	• Temporary construction sites.	0.25	0.00	0.25	0.50	0.25	0.50	0.00	2.50 (Negligible)	The final locations of pipeyards and construction sites shall be defined prior construction phase by the EPC Contractor(s). In any case they will be sited within agricultural, levelled areas, close to existing infrastructure (artificial areas), but at some distance from residential areas; as such limited interaction with residential areas is foreseen and impacts can be avoided.

Prepared by: ASPROFOS, 2022.

9.2.6.3 Cultural heritage

This Section assesses the impacts caused by the Project in Greece on cultural heritage resources, during construction phase.

As a part of the Project's options appraisal, route refinement, and final assessment, the Project has sought to avoid, minimize and mitigate impacts on the cultural heritage environment. This Section presents an assessment of potential impacts to the cultural heritage environment.

Table 9-76 outlines the key sources of impact, the potentially impacted resources and receptors, including baseline and Project influencing factors associated with impacts of the Project on cultural heritage sites.

Table 9-76 Key Considerations for Assessment – Cultural Heritage (Construction Phase).

Sources of Impact/ Risk	• Ground/ seabed disturbing activities, including land-clearing and site preparation activities associated with Project facilities, • Excavation techniques of the pipe trench/ cofferdam, • Establishment of working strip and other temporary facilities such as construction sites and pipeyards • Pollution (mainly dust) and vibration from blasting, hammering, and the movement of vehicles, equipment and personnel. • Construction duration
Potentially Impacted Resources and Receptors	• Cultural heritage resources located close to the Project
Particular Baseline Conditions that are Potentially Influencing Impacts/Risks	• Presence of declared cultural heritage sites • Presence of identified cultural heritage sites • Areas of high potential for presence of unknown cultural heritage resources • Currents velocity and direction for the offshore section
Project Factors that are Potentially Influencing Impacts/Risks	• Project's footprint • Pipeline construction activity • Construction schedule (duration) • Crossing method • Project of National Importance
References	• Baseline is provided in Section 5, 8.6.3 • Annex 8E • Mitigation Measures are provided in Section 10.2.6 • Cultural Heritage Map is provided in Section 15.1.7 • Impacts on landscape are discussed in Section 9.2.3.

Prepared by: ASPROFOS, 2022.

Mechanisms and their potential impacts on cultural heritage resources, during construction phase, are presented and analyzed in Table 9-77.

Table 9-77 Mechanisms Potential Impacts - Cultural Heritage.

	Construction Activity/ Mechanism		
Potential Impact	Plot preparation / Earthworks (soil rehabilitation, pipeline trench excavation, road upgrading, pipeline repair, etc.), Seabed intervention works (dredging, free span engineering, etc), Erection works	Traffic of vehicles, equipment and personnel, Vessels navigation	Machine and Equipment Operation
Direct physical damage to resource	X	X	X
Secondary degradation or damage to the resource due to vibrations	X	X	X
Nuisance to resource visitors	X	X	X

Prepared by: ASPROFOS, 2022.

9.2.6.3.1 Methodology Overview

The criteria used to evaluate sensitive receptors are presented in Table 9-78. Table 9-79 summarizes possible sensitive receptors, which according to the baseline are located within the Study Area. Specifically, the list of possible sensitive receptors is presented per Regional Unit and includes resources located at a distance of 200 m from the central axis of the pipeline and identifies the sites at a distance of less than 50 m.[29]

The extent of the impact is related to the distance of the sensitive receptors, which in turn is related to the type of impact. In specific:

[29] These threshold values of distances were used in other similar projects and are considered typical distances for Impact Assessment.

- for all natural impacts (physical nuisance, vibrations, pollution, etc.), potential sensitive resources are the cultural heritage resources located within 200m from the pipeline central axis (extent considered as local), onshore and offshore;
- for other impacts (nuisance to visitors, environmental impact, etc.), potential sensitive receptors are the resources located up to 500 m from the pipeline central axis. Adopting a conservative approach, all marine cultural heritage resources are considered accessible to visitors.

The intensity of the impact is related to the protection status of the cultural heritage resource and its importance to local community. Specifically, the importance of the sensitive receptor is linked to its validation by national authorities, i.e. whether it is a declared resource or not. As such, if a cultural heritage resource is a declared archaeological site (by national authority), its sensitivity (and thus impact's intensity) is high. For areas/ resources that have not been declared by national authorities but are known for their high cultural heritage potential, sensitivity is lowered. For areas/ resources that based on literature review have a high cultural heritage potential, sensitivity is further lowered.

Similarly, if the resource is not declared by national authorities, but considered as such by local community. If the resource is of documented importance to local community (e.g. an undeclared by National Authorities but important for local community intangible cultural heritage resource such as villages' old square) sensitivity is high, but decreased if there is no relevant validation (based on literature review and/ or stakeholder engagement activities).

Table 9-79 summarizes the cultural heritage resources that may be potentially affected, highlighting the ones located within 50 m of the project footprint.

Table 9-78 Criteria for Assessing Sensitive Receptors/ Adjustment of Methodology Criteria - Cultural Heritage.

	0 (low rating)	0.25	0.5	0.75	1 (high rating)
Extent of Impact (E) is related to the distance of sensitive receptors	Peripheral (>1000 m from the Project or resource footprint)	Perimetric (≤1000 m from the Project or resource footprint)	Supra local (≤500 m from the Project or resource footprint)	Local (≤200 m from the Project or resource footprint)	Pointwise (located within 50 m from the Project or resource footprint)
Intensity (I) is related to the importance of the resource	n/a	Low Resource of identified (not declared) importance by Local	Medium Resource of identified (not declared) importance by Local Authorities	High Recognized as of importance for the local community	Very high Declared (national and/ or international)

	0 (low rating)	0.25	0.5	0.75	1 (high rating)
		Community or Areas of high cultural heritage potential based on literature review.			

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Table 9-79 Possible Sensitive Receptors - Cultural Heritage.

A/A	Code	Name	Source	Status	Type	Distance (m)	KP
Regional Unit of Laconia							
1	CH-LAK-001	Sklavohori	1	Declared	AS	93	0
2	CH-LAK-086	Cave cavities - ancient quarry	1	Declared	M	92	1
3	CH-LAK-079	Cave abyss "Makria Lakka"	1	Declared	M	151	4
4	CH-LAK-024	Elliniko	1	Declared	R	150	10
5	CH-LAK-028	Church of Agios Georgios	1	Declared	R	112	12
6	CH-LAK-033	"Lira"*	1	Declared	R	27	14
7	CH-LAK-073	Church of Agios Andreas	1	Declared	R	73	14
8	CH-LAK-087	Cave in Agios Andreas*	1	Declared	M	3	15
9	CH-LAK-009	Mitropoli	1	Declared	AS	24	23
10	CH-LAK-062	Location 'Tsilia'	2	Not Declared	M	173	70
11	CH-LAK-067	«Sofronis Gorge»	2	Declared	M	153	95
Regional Unit of Arcadia							
1	CH-ARK-003	Agios Konstantinos, Soulari	2	Not Declared	M	119	138
2	CH-ARK-001	OSE Leontari Arcadia Preserved Station	2	Declared	M	122	141
3	CH-ARK-005	Veligosti	2	Not Declared	M	93	145
4	CH-ARK-002	OSE Tripotamos Preserved Station	2	Declared	M	154	147
5	CH-ARK-010	Archaeological site of Kyparissia	2	Declared	AS	140	164
6	CH-ARK-008	Location 'Perivolia (Moreas)'	2	Not Declared	M	146	9
Regional Unit of Ilia							
1	CH-ILI-002	Cave in the Castle	3	Not Declared	M	192	239

A/A	Code	Name	Source	Status	Type	Distance (m)	KP
Regional Unit of Aetoloakarnania							
1	CH-AIT-015	Archaeological site in the area of Stratos (ancient city of Stratos)	2	Declared	AS	197	60
2	CH-AIT-005	"Pyramid" of Lepenos (abyss)	3	Not Declared	M	180	70
Regional Unit of Arta							
1	CH-ART-003	Antiquities of 'Sykoula	2	Not Declared	M	93	127
Regional Unit of Preveza							
1	CH-PRE-006	Roman Aqueduct of Nikopolis	2	Declared	M	33	162
2	CH-PRE-011	« Roman Olive Press, Strongyli - Arapospita »	2	Declared	M	26	166
3	CH-PRE-012	Acheron River	2	Declared	M	0	202
Regional Unit of Thesprotia							
1	CH-THE-002	Located antiquities	2	Not Declared	M	143	204
Marine Cultural Heritage Resources							
1	T4699	Located antiquities	3	Not Declared	M	120	15 (OSS3/ OSS3 N)
2	T3003	Plane wreck	3	Not Declared	M	400	135 (OSS3/ OSS3 N)
3	T3004	Plane tail	3	Not Declared	M	400	135 (OSS3/ OSS3 N)
4	T3512	Wreck and related debris	3	Not Declared	M	300	345 (OSS3/ OSS3 N)
5	T3485	Possible Wreck	3	Not Declared	M	300	360 (OSS3/ OSS3 N)
6	T4121	Wreck	3	Not Declared	M	100	395 (OSS3/ OSS3 N)
7	T4115	Wreck	3	Not Declared	M	500	395 (OSS3/ OSS3 N)
8	LF4_Canon	Possible Canon	4	Not Declared	M	250	0 (OSS4)

A/A	Code	Name	Source	Status	Type	Distance (m)	KP

Notes
- **Source:** 1: SXOOAP - M.E. Monemvasia | 2: Ephorate of Regional Unit | 3: Ephorate of Palaeoanthropology and Speleology | 3: DMS for OSS3/OSS3 N (IGI002_FM05_WE2_Greece Area Underwater Target_20220217_B4.docx) | 4: DMS for OSS4 (00225-Ev41A-TDR-00080-3)
- **Status:** AS: Archaeological sites | M: Historically Preserved Monuments | R: Temples - Religious Sites
- Resources within 50 m from the project footprint are highlighted.
- * indicates areas to which a 50 m buffer zone is provided. As such, real distance is the one presented plus 50 m.

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It should be emphasized that the remoteness of cultural heritage resources, the subsequent impact assessment and the proposed mitigation measures are based on the specific project footprint. Based on the results of the Cultural Heritage Management Plan and the further consultation and study of the project, adjustments and optimizations of the layout may be induced, where possible as per the Cultural Heritage Management Plan Moreover, results from the dedicated Marine Survey (in case of additional findings), in collaboration with the Ephorate of Marine Antiquities may suggest route adjustments.

Relevant Project activities for the assessment of construction impacts include the preparation of the work area/land plots hosting the permanent and temporary installations, earthworks (including dredging and seabottom pipe laying activities that could lead to sediments suspension), construction of buildings, operation of machinery and equipment, as well as movement of equipment, vehicles and personnel.

According to the above mechanisms, the possible impacts that may occur during the construction phase are the following:

- Direct physical damage
- Secondary degradation or damage
- Nuisance to visitor access

Due to the nature of the construction activities, all cultural heritage sites, both underground and overground, terrestrial and marine, are at risk of direct natural effects, overground areas/ buildings/ wrecks are at risk of being degraded or damaged due to pollution or vibrations. Access to landscape and nature will be affected only at sites receiving visitors or users (i.e. not the marine cultural heritage resources).

It should be highlighted that a Cultural Heritage Management Plan shall be developed (in collaboration with the competent authorities) in order to manage unidentified at the moment cultural heritage resources (*chance findings procedure*) or define a procedure for protection of cultural heritage throughout the project's lifecycle.

9.2.6.3.2 Direct physical damage

Construction works in the Project area can cause direct physical damage to cultural heritage sites. In particular, construction site preparation works and soil nuisance activities such as removal of vegetation and topsoil, excavations, shaping of soil as well as the circulation of heavy machinery and vehicles in the work zone (onshore), or seabed intervention works, such as dredging for the shore crossing or free-span engineering solutions (offshore), may damage archaeological resources causing loss of their cultural and historical value.

Taking into account the considerations discussed and following the assessment criteria presented in Section 9.1 and the methodology specified in Section 9.2.6.3.1, direct physical damages to cultural heritage resources can be assessed as follows:

The *likelihood* of impact during construction works is considered to be *certain* as regards cultural heritage resources found within project footprint.

The *extent* of the area of direct impact (i.e. the extent of direct damage) matches the exact footprint of the Project, and the extent of the impact is considered to be *pointwise*. It is noted that due to vibrations coming from construction works in the work zone, damage may be caused to cultural heritage resources found in the proximity of the Project's footprint by disrupting static integrity, therefore this shall be considered during the specific construction activity.

The *intensity* of impact on cultural heritage resources is linked to the listing status of the resource, i.e. whether it is a declared archaeological site/monument (see Table 9-78). For declared cultural heritage resources, the intensity is considered to be very high, while for non-declared cultural heritage resources the intensity is brought down to medium, depending on the available background information on the specific resource.

Regarding the *duration* of impact, taking a conservative approach, it is considered as *permanent* since it is going to affect the cultural and historical value of the resource, regardless of the likelihood of restoration.

Finally, regarding *reversibility*, it is feasible to *minimize* the impact by taking appropriate measures and working together with stakeholders before and during construction phase. Known cultural heritage sites were avoided in the FEED phase to the maximum possible extent, while the opinion of the Ephorates was taken into consideration by the FEED Engineer in the selection of the pipeline route. As documented in Annex 8J.3, resulting from the Scoping Phase, out of the total 29 sites mentioned in the official reply of the competent authority, for 19 (65%) the distance has been increased, as requested, for 7 (24%) no direct engagement is recorded (distances greater than 500 m), whilst for 3 (10%) although the distance is decreased or crossing is unavoidable, design of the project has taken such measures as to avoid impacts (see Chapter 10) (details are provided in Annex 8J.3). Unknown archaeological sites, on the other hand, are likely to exist, but their presence may only be revealed by excavation activities (all of them to be supervised by archaeologists).

It is noted that no potential of *Cumulative action* and the *Transboundary character* is assessed for this impact (no impacts are assessed on the same resources from other projects nor to resources of other countries).

Based on the above and the criteria presented in Section 1.1 and specified in Section 9.2.6.3.1, direct damage to cultural heritage resources during the construction of the project for:

- Cultural heritage resources, declared at National Level, found within project footprint, **SEI is considered as Moderate**;
- No impact is foreseen to other type of resources, since they are not located within the project footprint (e.g. non declared).

9.2.6.3.3 Secondary Degradation or Damage

Aboveground portions of cultural heritage sites are subject to secondary impacts from air pollution (mainly dust onshore and sediments offshore) and vibration caused by the operation of machinery, heavy vehicle traffic, and high-impact activities such as blasting and machine-powered hammering. This might also be applicable for marine cultural heritage resources (if any in the proximity of the pipeline – the ones identified so far have been avoided by the current pipeline route), through the corresponding mechanisms, namely sediments suspension caused by the dredging of seabottom for the shore crossing or implementation of freespan engineering solutions (or even simply by the pipeline laying on the seabottom).

Depending on their structural condition, sites with standing or partially standing features, such as monuments, historic buildings, stone arched bridges, temples or architectural remains, may be at risk of degradation or collapse due to vibration (the same applies for marine cultural heritage resources to a smaller extent).

Air pollutants can also collect on the outer surface of structures in the form of dust and soot, causing discoloration and corrosion of building material. Stone structures are particularly sensitive to the corrosive effects of air pollution. Equivalent for the marine environment, sediments can be resuspended and transferred from offshore construction activities and deposited on top of wrecks or other marine antiquities.

Obviously, this impact depends on the distance of the resource from the construction activities. The closest to the construction activity the resource is, the higher the risk of degradation and/ or damage of the resource. It is noted that all resources located within 50 m from the project footprint, they have been considered as suffering direct, physical damage, instead of indirect impacts, related to degradation or damage. However, this is a conservative approach: physical damage cannot be restored, whilst damages from factors such as dust or vibrations are more easily managed (avoided, prevented, mitigated or even restored). Especially for the resources that are the most close to the project footprint, their state of preservation and structural integrity should be assessed prior to construction (if deemed necessary by the competent authorities). If necessary, sites will be braced, reinforced or covered to protect their condition.

Degradation or damages to cultural heritage sites associated with vibrations and shocks generated during the operation of equipment and machinery may be caused by:

- Discolouration and corrosion caused by the dust produced by pollution and equipment vibrations. Stone structures are particularly sensitive to the corrosive effects of air pollution.
- Collapse or degradation of resources caused by vibrations due to reduced static integrity. Stone arched bridges and caves are considered particularly sensitive resources as their static integrity may suffer by vibrations generated during works.

Taking into account the considerations discussed and following the assessment criteria presented in Section 9.1 and the methodology specified in Section 9.2.6.3.1, the secondary degradation or damage to cultural heritage resources can be assessed as follows:

The *Likelihood* of cultural heritage resources being degraded or damaged as a result of pollution or vibrations is considered to be *probable*. It is acknowledged that this is conservative because, nor dust or vibrations are likely to reach a resource located at 200 m with such an intensity as to induce damage or cause degradation; nevertheless, in impacts assessment, the conservative approach is always in favor of the protected feature.

The *Extent* is defined Table 9-78. Given that the pollution emitted and/ or the vibration generated by construction activities can extend outside the project footprint, the impact was considered *local*. Dust is expected to settle down in close distance from the source. Various studies and past consultations have revealed that a 200 m distance from a vibration source is adequate to safeguard structural integrity of a cultural heritage building (e.g. a cave or a stone bridge).

The *Intensity* of impact on cultural heritage resources is linked to the type of indirect damage caused and the protection status of the resource. Therefore, for declared cultural heritage resources (e.g. archaeological sites, historic buildings, stone bridges, temples or caves) intensity is considered to be *very high.* This is because even though stone structures are particularly sensitive to the corrosive effects of dust and the shock effects of static integrity, no significant amounts of dust or static problems are expected thanks to the implementation of appropriate measures. For non-declared resources, the magnitude is brought down to *low*.

Duration of the impact is assumed relevant to the pollutants/ vibrations generating factors, i.e. construction activities. The entire project construction will take up to 36 months; however, it is reasonable to assume that no construction front will remain active for a period longer that one (1) year[30]. As such, duration is assessed to be *short-term*.

Regarding impact *reversibility*, it is thought that the assessed secondary impacts can be managed through a wide range of mitigation measures, which depending on the available resources (cost/ time) and sensitivity of the cultural heritage resource can prevent, avoid, reverse impacts induced by pollution or vibrations. In general, these impacts are *avoided* through proper design refinement (site specific) in terms of techniques, protective measures, etc.

It is noted that no potential of *Cumulative action* and the *Transboundary character* is assessed for this impact. No impacts are assessed on the same resources from other projects nor to resources of other countries.

Based on the above and the criteria presented in Section 1.1 and specified in Section 9.2.6.3.1, potential degradation or damage to cultural heritage resources during the construction of the project for:

- Cultural heritage resources, declared at National Level, found within 200 m from project footprint, SEI is considered as Moderate;

[30] According to DESFA's specification and past (built in the recent past) projects, construction activities (incl. RoW topographical reinstatement) per specific front are completed within six (6) months from construction start.

- Cultural heritage resources, not declared at National Level, found within 200 m from project footprint, **SEI is considered as Minor**;

9.2.6.3.4 Nuisance to visitor access

A nuisance to visitors' access to cultural heritage resources may be caused by pollution and vibrations during construction works, as well as by the protective measures implemented, thus limiting accessibility (for tourists) or use of the resource (religious resources).

In some cases, Project activities may obstruct visitor access to cultural heritage sites. This impact is relevant mostly for important monuments, archaeological sites that receive visitors or important sites for local community. Depending on the site, this impact may affect tourists and researchers, but it is most likely to affect community users. An interesting example is various festivals (e.g. the festival Virgin Mary Assumption at 15th of August) or even more so the users of a temple potentially affected by construction activities.

All phases of Project activity may require the temporary blockage of roads or protective measures, such as the fencing off of cultural sites, which will block or limit visitation and use. This type of impact is most likely to occur during the construction phase, especially around roads close to temporary facilities and the working strip.

Accessibility, in terms of infrastructure and services, has not been assessed in the baseline of the cultural heritage. Adopting a conservative approach, all cultural heritage resources were considered as potentially accessible. Access of the cultural heritage resources that lay within 500 m of the project footprint was considered potentially affected by the construction of the project. Resources at greater distances were not considered as possibly interacting (at least regarding their accessibility) with the construction activities of the project.

Taking into account the considerations discussed and following the assessment criteria presented in Section 9.1 and the methodology specified in Section 9.2.6.3.1, the nuisance of visitors' access to cultural heritage resources can be assessed as follows:

The *Likelihood* of causing an impact in the course of construction works is considered to be *likely* for those cultural heritage resources found within 500m of the pipeline central axis. Especially, for those visitable resources that have been declared as archaeological sites/monuments or are important to local community (i.e. visitable resources of intangible cultural heritage), this likelihood is upgraded to *probable*.

The *Extent* of the impact is beyond project footprint up to 500m from the pipeline central axis and is therefore considered to be *supra local*.

Intensity of visitors' nuisance is linked to the recognition status and importance of the resource to the local community. Taking a conservative approach, intensity is considered to be *very high* for declared archaeological/historical monuments and for intangible cultural heritage resources, since movement may be restricted. For non-declared resources, intensity is reduced to *low*.

Duration of impact is considered to be *short-term* since visitors' nuisance is going to last for as long as construction works last in the specific cultural heritage site.

Regarding impact *reversibility*, it is thought that visitors' nuisance could be *prevented* by implementing appropriate measures.

It is noted that no potential of *Cumulative action* and the *Transboundary character* is assessed for this impact.

Based on the above and the criteria presented in Section 1.1 and specified in Section 9.2.6.3.1, nuisance to visitors' access to/ use of cultural heritage resources during the construction of the project for:

- Cultural heritage resources, declared at National Level, found within 500 m from project footprint, **SEI is considered as Minor**;
- Cultural heritage resources, not declared at National Level, found within 500 m from project footprint, **SEI is considered as Negligible**;

9.2.6.3.5 Summary of impacts during construction on Cultural Heritage

The following table summarizes the impacts during the construction phase to cultural heritage.

Table 9-80 Summary of Impacts to Cultural Heritage Resources during Construction Phase.

S/N SEI			SEI for	Cultural Heritage							
Project phase	Construction										
Impact	Mechanism	Locations	Criteria/ Impact Properties							SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Direct physical damage	Mechanical engagement due to: • Ground/ seabed disturbing activities, including land-clearing and site preparation activities associated with Project facilities, • Excavation of the pipe trench/ cofferdam, • Establishment of working strip and other temporary facilities such as construction sites and pipeyards	Declared resources at National Level (CH-LAK-009, CH-LAK-033, CH-LAK-087, CH-PRE-006, CH-PRE-011, CH-PRE-012)	1.00	1.00	1.00	1.00	0.75	0.00	0.00	6.79 (Moderate)	Presence of a cultural heritage resource along the project footprint (within 50 m)

S/N SEI			SEI for	Cultural Heritage						
Project phase	Construction									
Impact	Mechanism	Locations	Criteria/ Impact Properties						SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Secondary Degradation or Damage	Dust (and other pollutants) dispersion and/ or Shocks/vibrations due to: • Ground/ seabed disturbing activities, including land-clearing and site preparation activities associated with Project facilities, • Excavation of the pipe trench/ cofferdam • Establishment of working strip and other temporary facilities such as construction sites and pipeyards	Declared at National Level Resources (incl. Monuments, e.g. Stone arched bridges, Buildings and Caves) (CH-LAK-001, CH-ARK-010, CH-AIT-015) (CH-LAK-024, CH-LAK-028, CH-LAK-067, CH-LAK-073, CH-LAK-079, CH-LAK-086, CH-ARK-001, CH-ARK-002)	0.75	0.75	1.00	1.00	0.25	0.00	0.00	5.36 (Moderate)	Presence of a cultural heritage resource within 200 m from the project footprint.
		Not Declared, at National Level, resources (CH-LAK-062, CH-ILI-002, CH-AIT-005, CH-ARK-003, CH-ARK-005, CH-ARK-008, CH-ART-003, CH-THE-002, T4699, T3003, T3004, T3512, T3485, T4121, T4115)	0.75	0.75	0.50	1.00	0.25	0.00	0.00	4.64 (Minor)	

S/N SEI			SEI for	Cultural Heritage						
Project phase	Construction									
Impact	Mechanism	Locations	Criteria/ Impact Properties						SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Nuisance to visitors access	• Establishment of working strip and other temporary facilities such as construction sites and pipeyards	Declared resources at National Level (Table 9-79 and CH-LAS-003, CH-LAK-002, CH-LAK-066, CH-LAK-068, CH-LAK-004, CH-LAK-077, CH-LAK-081, CH-LAK-082, CH-LAK-007, CH-LAK-084, CH-LAK-085, CH-LAK-014, CH-LAK-023, CH-LAK-031, CH-LAK-032, CH-LAK-089, CH-LAK-039, CH-LAK-042, CH-LAK-051, CH-LAK-065, CH-LAK-059, CH-ARK-010, CH-ILI-006, CH-ILI-004, CH-ACH-003, CH-ACH-001, CH-AIT-003, CH-AIT-014, CH-AIT-001, CH-AIT-002, CH-ART-002, CH-PRE-009, CH-PRE-003, CH-THE-009, CH-THE-012, CH-THE-022, CH-THE-011)	0.75	0.50	1.00	0.25	0.00	0.00	0.00	3.57 (Minor)	Possible interference of the project and the accessibility to a resource.
		Not Declared, at National Level, resources	0.50	0.50	0.50	0.25	0.00	0.00	0.00	2.50 (Negligible)	

S/N SEI			SEI for	Cultural Heritage							
Project phase	Construction										
Impact	Mechanism	Locations	Criteria/ Impact Properties							SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
		(Table 9-79 and CH-LAK-055, CH-LAK-060, CH-ARK-009, CH-ILI-003, CH-ACH-002, CH-AIT-006, CH-PRE-005, CH-PRE-007, CH-PRE-004, CH-THE-008, CH-THE-015, CH-THE-017, CH-THE-025, CH-THE-003, CH-THE-004, CH-THE-006, CH-THE-005)									

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9.2.7 Socio-economic Impacts

9.2.7.1 Demographics

This section assesses the potential Project-related impacts on the demographics and local population characteristics at construction phase. Population dynamics in the project area are not relevant to the project. The staff working on construction of the project will stay for a limited time in the area, or such staff may come from the local population. Therefore, no impact is expected on demographics from the project's construction.

9.2.7.2 Economy - Employment

This section evaluates potential impacts on economy and employment, which are directly or indirectly linked to the Project.

The mechanisms likely to affect the local or regional (even national) economies of vulnerable receptors could be directly linked to the Project, but also indirectly. Table 9-81 shows the main impact sources on economy/ employment and the potential sensitive receptors related to the investigated Project.

Table 9-81 Key Issues for assessment – Economy/ Employment

Sources of Impact/ Risk	• Direct (mostly unskilled) and Indirect employment opportunities • Procurement of construction goods and services and Capacity building • Economic impact of taxes, fees and local transactions (positives) (supply of the necessary goods and services; indirect economic impact related to consumption driven by Project employees and the payment of taxes to the state). • Economic impact on rural income (Pipeline passing through agricultural and arable land) • Economic impact on fisheries (safety exclusion zone) • Economic impact on tourism (activities, noise and visual disturbance from construction works)
Potentially Impacted Resources and Receptors	• Local and Regional economy; in general, business and workforce in the study area • • Professional farmers • Professional fishermen • Tourist infrastructures (hotels, restaurants) mainly at areas near LFs • Residential areas along the pipeline route, in particular those located near temporary/ permanent facilities.
Special Baseline Conditions that are	• Availability of goods and services:

Potentially Influencing Impacts/Risks	• Structure of local/ regional economy. The services industry is a major employer at a regional level. In addition, several cities within a short distance to the pipeline corridor offer a full range of services. • The Tourism infrastructures (hotels, restaurants) in touristic areas along the pipeline route. • Education and skill levels providing capacity for local workforce to be engaged in the project construction/ operation. • Unemployment levels. This is of importance to local stakeholders since unemployment is significant in the Project affected regions (11.3% ÷ 21.6%) • Vulnerable groups: Seasonal Workers, Immigrants/ Refuges, Roma, Natural Disasters affected Population (wildfires, earthquakes, mainly in Peloponnese).
Project Factors that are Potentially Influencing Impacts/Risks	• Construction workforce. In total during construction will employ staff ranging from 3,600 to 5,700 persons, in accordance to Chapter 6 (Section 6.4.8). • Duration of construction. 36 months for onshore pipeline (in total), 6-8 months per landfall site, 30 months per offshore line. • Procurement of goods and services strategy • Project footprint
References	• Project's Compliance with Statutory Provisions (Chapter 5) • Technical description of the project (Chapter 6) • Baseline is provided in Section 8.7 • Baseline Information, Technical Infrastructures (paragraph 8.8) • Impact Assessment on Anthropogenic Environment (9.2.6) and Landscape (9.2.3) • Annex 9B • Mitigation Measures are provided in Chapter 10

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In the following paragraphs, a description and assessment of potential impacts from the construction of the Project is made. Specifically, the following impacts are assessed:

- Employment opportunities (Direct and/ or Indirect)
- Economic impact from taxes, fees and local transactions
- Economic impact on agricultural sector (income)
- Economic impact on fishing sector (income)
- Economic impact on tourism sector (income)

9.2.7.2.1 Methodology Overview

The most important factor/ mechanism for impacts on local or regional (or even national) economy is the engagement of local/ regional players in construction activities and procurement of goods or services. Additionally, employment opportunities shall arise (direct, especially for unskilled personnel; indirect for providers of services to the project, e.g. safety). In addition, taxes, fees and other local transactions payable by the project directly (taxes) or indirectly (consumption of workforce) shall have a positive impact on economy.

In general, the impact assessment methodology described in Section 9.1 is followed. However, impacts on economy during construction phase (and operation) are mostly positive impacts (taxes or fees payable to Local Administration Organizations, increase in consumption to local market or procurement of services from the local/ regional provides), whilst negative impacts are mostly related to break of some activities; however, these are easily mitigated (through minimization and/ or mainly compensation). As such, wording may be differentiated (e.g. prevent/ promote, avoid/ enhance, reverse/ develop, minimizable/ maximizable, irreversible).

It is obvious that the Project is related (to lesser or greater extent) to all productive sectors of economy as presented in the relevant chapter describing the baseline information (Section 8.7.2). The assessment of the local/ regional economy affected by the Project is done at the administration level of Regional Units, as there was no official data (Productive Sectors of the Economy) for those settlements/villages (sensitive receptors) close to the project's survey area. This does not affect the outcome of the assessment, since the data on Regional Units also arise from the productive and economic fabric of such settlements.

According to Section 8.7.2, the sector "Wholesale and retail trade, repair of motor vehicles and motorcycles, transport and storage, accommodation and catering services" traditionally holds the largest percentage (approximately 25%) in all Regional Units. The second largest sector is “Public administration and defense, compulsory social security, education, human health and social work activities" (about 20%). On the contrary, the contribution of three key sectors of the economy (a) Financial and insurance activities (b) Professional, scientific and technical activities, administrative and support activities, and (c) Arts, entertainment and recreation, household repairs and other services is very low (around 3% each). An important factor for local economy, considering that these are pastoral farming Regional Units, is the contribution of the “farming, forestry and fisheries" sector. The contribution of this sector is around 11.4%. Figure 9-30 is relevant (tabulated data per Regional Unit are presented in Annex 9B).

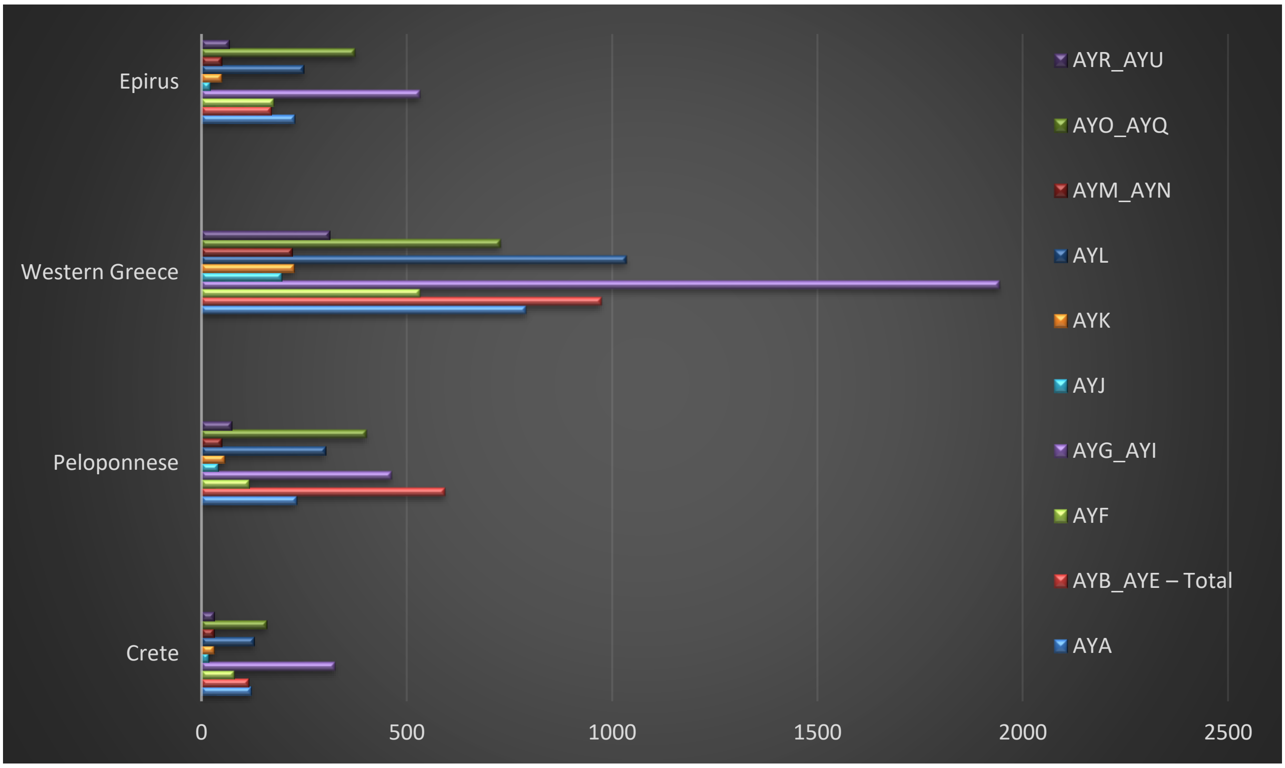
Table 9-82 codifies the Productive Sectors of the economy according to official data from ELSTAT.

Table 9-82 Codification of the productive sectors of the economy according to ELSTAT.

Code ESA 10[31]	Productive Sectors
AYA	Agriculture, Forestry and Fishing
AYB_AYE*	Mining and quarrying, energy processing, water supply, sewage treatment, waste management
AYF	Constructions
AYG_AYI	Wholesale and retail trade, repair of motor vehicles and motorcycles, transport and storage, accommodation and catering services
AYJ	Information and communication
AYK	Financial and insurance activities
AYL	Real estate management
AYM_AYN	Professional, scientific and technical activities, administrative and supportive activities
AYO_AYQ	Public administration and defence, compulsory social security, education, human health and social work activities
AYR_AYU	Arts, entertainment and recreation, household repairs and other services
* The official data of ELSTAT makes special reference to the manufacturing sector as it participates in a very large percentage in the entire productive sector AYB_AYE. Therefore here below (in the Regional Units) will follow the whole productive sector AYB_AYE and special reference will be made to the processing, as necessary.	

Prepared by: ASPROFOS, 2022. Data from ΕΛΣΤΑΤ

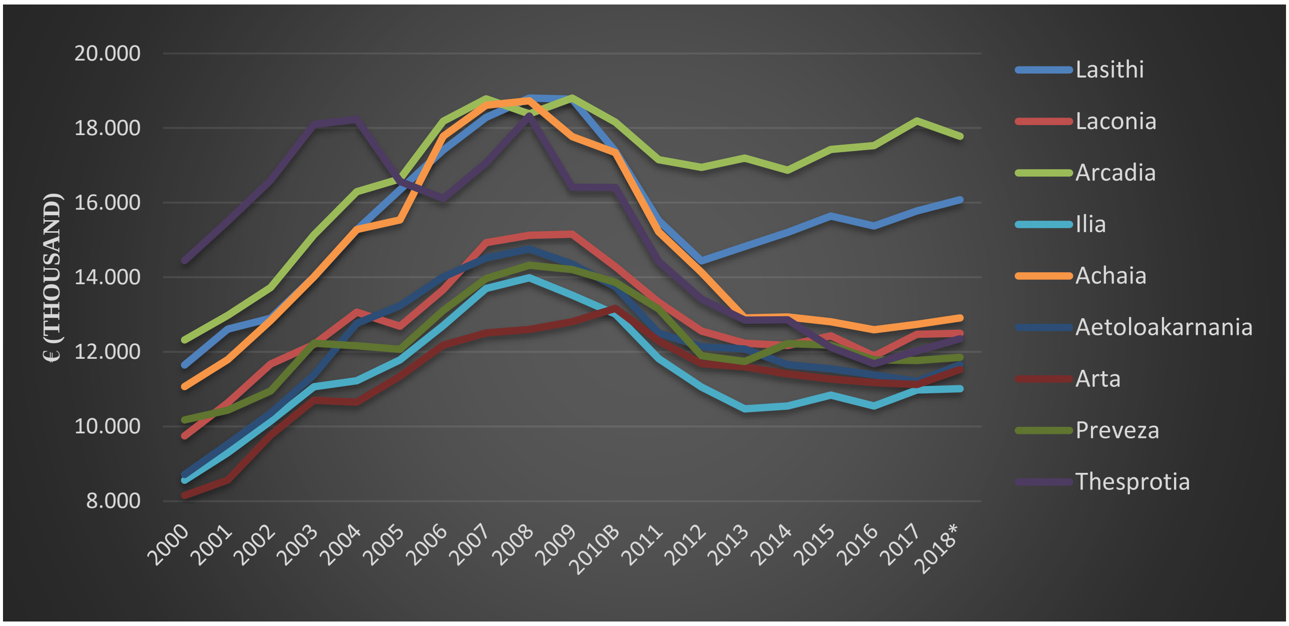
[31] https://www.statistics.gr/esa-2010



Prepared by: ASPROFOS, 2022. For details, see Section 8.7.2.2. Data from ΕΛΣΤΑΤ.

Figure 9-30 Contribution of Productive economic sector per Region.

Figure 9-31 shows the per capita gross domestic product per Regional Unit for the years 2000 to 2018 according to official ELSTAT data. On average, from 2000 to 2018 the Regional Unit of Arcadia has the highest gross domestic product per capita, followed by the Regional Unit of Lasithi. On the contrary, the Regional Unit of Arta and Ilia have the lowest ones.



Prepared by: ASPROFOS, 2022. Data from ΕΛΣΤΑΤ (2018 *Temporary data – B: timeline break).

Figure 9-31 Per capita Gross Domestic Product by Regional Unit (2000 – 2018).

Duration construction is also very important to assess impacts on economy (local, regional, direct, indirect, etc.). According to the information provided in Chapter 6 (see Section 6.4.1.1), duration of construction is estimated as follows:

- 838 km of an offshore pipeline will require approx. 30 months including pipe procurement, pre-lay activities and post-lay activities.
- 6-8 months per Shore crossing (nearshore section), including construction of landfall sites, pipeyards establishment, preparatory works (preparation of working strip, trenching, etc.), testing, LVS, etc.
- 548 km of the onshore underground pipeline will require approx. 36 months including construction sites and pipeyards establishment, preparatory works (preparation of working strip, trenching, etc.), testing, BVS, etc.

Another important aspect is the size of the construction workforce. Based on Chapter 6 (see Section 6.4.8.3), construction workforce is estimated as follows. **It is highlighted that these figures and accommodation locations are indicative:**

- For onshore pipeline construction including the temporary facilities for crossings, the estimated workforce varies from 1350 (mean) to 1500 (peak) persons, in total. It is assumed that construction of the pipeline will be separated in 3 spreads, and the estimated workforce per spread will be varying from 450 (mean) to 500 (peak) persons.

- For Main Stations (i.e. Compressors and Metering Stations) construction, the estimated workforce varies from 750 (mean) to 1800 (peak) persons, in total. For each main station, the mean workforce is estimated approx. 250 persons and the peak approx. 600 persons. These are expected to be accommodated in areas close to the Main Stations, e.g. broader residential area of Ierapetra (for CS2/MS2-CS2/MS2 N), broader residential area of Megalopoli (for MS4/PRS4 & Heating Station), and broader residential area of Varda or Amaliada or even Kato Achaia (for CS3).
- For Line Stations construction (15 BVS and 7 SS), the estimated workforce is 100 persons. This workforce could be divided in spreads i.e. if 2 spreads are working, then the estimated workforce will be 50 people per spread.
- For landfalls construction the estimated workforce varies from 180 (mean) to 200 (peak) persons, in total. For each landfall site, the mean workforce is estimated approx. 40 persons and the peak approx. 50 persons. These are expected to be accommodated in areas close to the Landfall sites, e.g. broader residential area of Ierapetra (for LF2), broader residential area of Monemvasia (for LF3), broader residential area of Kato Achaia (for LF4) and broader residential area of Messolonghi (for LF5).
- The vessel crews during construction of the offshore section varies from 1,200 (mean) to 2,100 (peak) persons.

In total during construction will employ staff ranging from 3,608 to 5,688 persons, in accordance to chapter 6 (par.6.4.8).

Worker hiring and procurement of materials will be managed by primary contractors but required to meet EBRD standards, EU requirements and IGI POSEIDON policies (e.g. on CSR)

Lastly, project footprint is also very important. As presented in Chapter 6, the working strip has the following categories:

- Typical working strip, 38 m wide
- Reduced working strip, 28 m wide
- Minimum working strip, 22 m wide,

It is clarified that due to the stage of Project development, there are a number of aspects of the Project yet to be defined that influence potential impacts on economy and employment. These include:

- The exact size of the pre-construction and construction workforce;
- Project's supply and procurement plan/ policies, CSR

- Location of temporary facilities. The main temporary facilities (for Main Stations) have been identified whilst for others (pipeyards and construction sites) that are indicated in Chapter 6, will be sited and permitted by the EPCI prior to construction begin.

9.2.7.2.2 Employment opportunities (Direct and/ or Indirect)

As a pipeline scheme, most of the economic and employment impacts from the Project can be expected to accrue during the pre-construction and construction phases. It is during this period that the Project will need to hire and accommodate workers and purchase goods and services, potentially resulting in positive impacts on the local communities.

Temporary employment during the construction phase includes people directly employed by the primary contractor for the preparation of construction sites (pre-construction phase) and construction of the pipeline and other project components (construction phase). Project construction also includes jobs supplying the goods and services needed to support the construction process, including food and transport services and support staff in construction sites, e.g. security or cleaning services. This is a direct impact on employment.

Employment figures for the construction stage are only preliminary at this stage and will be further refined during detailed design and following selection of an EPCI contractor(s). Current estimates of workforce size and the duration of work for the different Project components are provided in Section 9.2.7.2.1. In total during construction, project will employ staff ranging from 3,600 to 5,700 persons for an indicative duration of 36 months. Direct employment opportunities mainly refer to unskilled workforce. In similar projects, a 20-30% of the total workforce is unskilled labor, which results in an estimate of 900-1400 vacancies for unskilled labor.

In accordance with EU regulations regarding competition and procurement, the Project cannot preferentially hire Greek nationals for unskilled labor positions. However, incentives could be set in place.

As discussed in Section 9.2.7.2.1, the duration of employment for the construction workforce will be brief. The longest-term assignments will be for work on the Major Stations and to the landfall sites, for a smaller duration. The construction of the pipeline itself will be performed in a number of spreads (indicatively 3) which are expected to maintain a construction rate, relevant to the terrain morphology and construction difficulties. In any case, the presence of the pipeline construction spread in one specific location (favoring local workforce) is expected to be relatively limited. It is reasonable to assess (conservatively) that the duration within which workforce from a specific area (local workforce) will be interested/ cost-effective to work in a specific spread is approximately 1 year long.

Employment is currently a significant issue in Greece with 16% of the total population being unemployed nationally (see Section 8.7.2.3). In the Regions crossed by the pipeline, unemployment figures ranges from 21.5% (R. of Western Greece) to 17.5 (17.8% for R. of Epirus and 17.3% for R. of Crete) and to 11.3% (R. of Peloponnese).

Employment concerns are typically included in consultation of such large-scale projects. Questions relating to the number of local people expected to be employed by the project, but also negative questions targeting the perceived lack of benefits for local communities along the route are usually raised.

At both the national level and in some municipalities crossed by the pipeline, it is expected that there will be a moderate number of semi-skilled workers with experience, especially in the construction industry. Educational level is quite high, whilst the Sector of Construction, is also very important. In recent decades, Greece had several major infrastructure projects in the country, including construction of the Ionia or Moreas or Patra highways, Piraeus port upgrade, Marine cables installation, etc., all of which involved Greek companies and workers to varying extents.

Despite the presence of construction workers and contractors at both the national and municipal level in Greece, a large proportion of skilled positions on the Project will require specific technical experience in pipeline construction. Given the global nature of the industry, it is expected that international workers will fill a big part of skilled positions during pipeline construction.

The purchase of goods and services during construction may generate some local employment opportunities, mainly in nearby cities (Ierapetra, Monemvasia, Sparti, Molai, Megalopoli, Amaliada, Varda, Kato Achaia, Patra, Messolonghi, Amphilochia, Arta, Preveza, Parga, Igoumenitsa) and in settlements close to the construction sites. The Main Stations construction sites will be in place for approx. 36 months. It can be expected that each of these sites will employ unskilled and semi-skilled workers to provide housekeeping, security and transport services (numbers and positions not yet estimated). At a regional level, the services sector "Wholesale and retail trade, repair of motor vehicles and motorcycles, transport and storage, accommodation and catering services" employs the majority of people. Regions have relatively healthy "Public administration and defense, compulsory social security, education, human health and social work activities", "Constructions", "Agriculture, Forestry and Fishing" and "Real estate management" industries. As a result, people in the study area are likely to have relevant experience for support and service-related opportunities.

It is not known what percentage of food or supplies for the Project will be procured from Greek companies, but it can be expected that any associated job creation will mostly accrue in cities or large villages. The total amount of job creation associated with procurement is expected to be small.

Another important aspect concerning project's impacts on employment refers to the capacity building of the local workforce. Capacity building may include:

- Workforce Training. Gain of experience and training through participation in construction activities (direct employment) or engagement in procurement of goods/ services (indirect employment) that will be useful skills and reference for future jobs.
- Businesses Training. In addition to training and experience at the level of individual workers, the Project will also present an opportunity for Greek companies to participate in procurement of goods (e.g. components of pipeline construction) and services (e.g. catering of the workforce and/ or facilities management). Engagement of a business to the implementation (and operation) of such a significant project as EastMed allows for the possibility of capacity enhancement and strong reputational benefits.

When discussing impacts on economy and employment, another consideration should be identified vulnerable groups. This is because, one of such groups' main characteristics is the limited income sources available to them. Specifically within the study area, vulnerable groups in the employment context include seasonal workers, immigrants/ refugees, Roma and People affected by natural disasters (mostly wildfires). As detailed in Section 8.7.1.8,

- Immigrants/ refugees, in the study area, present the highest percentages in the Regional Units of Lassithi (12.93%), Laconia (11.6%) and Ilia (9.34%),
- Seasonal workers, in the study area, seasonal workers are primarily economic migrants and refugees working on primary sector (usually agriculture). The largest numbers are located in Achaia, Arta and Thesprotia. Moreover, literacy rates and access to government services are lower in this group, as well as their income levels compared to the average of the study area.
- Although Roma settlements exist in many areas near the study area, the presence of Roma within the boundaries of the study area is located in Western Achaia (Niforeika, Karamesineika), Agrinio (Kalivia, Lefka) and Messolonghi (Agios Georgios, Kokori, Perithori), as well as the seasonal presence of Roma land workers in the settlement of Goudouras in Lassithi.
- Regarding natural disasters, the geographical unit of Peloponnese has suffered a lot from consecutive wildfires (the last in summer 2021, affecting some of the settlements affected in past years as well). Regional Unit of Ilia (M. of Ancient Olympia), suffered the most, along with Regional

Units of Achaia (M. of Pyrgos), of Arcadia (M. of Gortynia, M. of Megalopoli) and to a lesser extent R.U. of Aetoloakarnania and of Arta. In addition, Greece lays in a seismogenic region, as such, communities are more or less accustomed to earthquakes (in terms of personal preparedness but also statutory preparedness). Earthquakes have been recorded in R.U. of Ilia, R.U. of Achaia and R.U. of Aetoloakarnania.

It is highlighted that women are not considered vulnerable group, since there are no gender discrimination incidents recorded whilst, more importantly, there are statutory provisions safeguarding equal opportunities and participation in decision-making and administration, in general, for all genders.

In summary, employment benefits will be relatively limited by the short construction period and relatively small number of positions open to unskilled workers. Workers with experience in construction, land clearing and the services industry are present in the study area and could benefit from some of the skilled and semi-skilled opportunities associated with the Project. Depending on how workers are recruited, employment opportunities for local communities may be most significant near construction sites – due to additional employment generated by procurement of services for construction site operation. However, detailed breakdowns of the number and duration of these positions are not yet available. Indirect employment benefits are expected from the overall engagement of the services sector, which will be significantly and positively affected by procurement and services provision to Project's construction related issues.

Taking into account the considerations discussed and following the assessment criteria presented in Section 9.1, the impact on employment opportunities (direct and/ or indirect) can be assessed as follows:

The *Likelihood* for the impact is considered *certain*, since many employment opportunities shall be created, for some of which local workforce will be selected (skilled or mostly unskilled).

The *Extent* is determined by the area to which employment opportunities will be available. Obviously, employment opportunities are not restricted to the project footprint; perhaps not even in the study area. The closer to the project footprint, the more direct employment opportunities will be created (for unskilled labor) whilst the further away from the project footprint, the greater indirect employment opportunities will be created (for procurement of goods/ services and support of such enterprises). As such, the *extent* of the impact is considered *Peripheral*.

The *Intensity* of the impact is linked to the number of jobs (direct and/ or indirect) that will be created and the total decrease of the unemployment percentage in the engaged Local Administration Organizations. However, the 17% unemployment (in average) of the engaged Regions, would be very much benefit from the additional jobs, no matter how relatively few (in numbers) and limited (in duration) they might be. As such, intensity of the impact is considered *medium*.

The *duration* of the impact is associated with the presence of the workforce within a specific area and the period during which goods and services shall be procured from the local (or regional) market; more simply, duration shall be associated with the time required for the completion of construction within a specific area. Construction in each landfall site (nearshore and coastal construction activities) shall be over within 6-8 months, corresponding to a *short-term* duration; however, the new opportunities and overall increase of economic activity in the broader area of the landfalls is reasonable to extend more than that. On the other hand, construction activities for the rest of the project components, i.e. pipeline (offshore and onshore) and Permanent Facilities (Major Stations, Line Valves, O&M), will be completed within 36 months, corresponding to a *mid-term* duration. As such, duration is considered to be *mid-term*.

With regard to *reversibility*, it is assessed that by applying appropriate measures, increase of direct and indirect employment opportunities is feasible. Although, EU regulations might restrict preferentially hiring of Greek nationals, incentives could be set in place. For these reasons, employment opportunities (direct and/ or indirect) is considered to be *maximizable*[32] (see Chapter 10).

Regarding *cumulative* action, more often than not, economic activity in one sector/ industry brings along positive impacts (economic development) on closely related (or not) sectors. More importantly, though, unemployment is usually an index that also National/ Regional Development Plans target to decrease. As such, it is *likely* that employment opportunities (direct and/ or indirect) will work along with other initiatives combatting unemployment in the study area.

Transboundary character is deemed *impossible*, by definition of economy (local/ regional and how this is interconnected to other regional areas and national jurisdiction).

Based on the above and the criteria presented in Section 9.1, impacts from employment opportunities (direct and/ or indirect) during the construction of the project **SEI is considered as Moderate (in a positive manner).**

[32] Given that the impact is a positive one, this classification is used instead of *minimizable.*

Section 10.2.7 presents the proposed mitigation and management measures applicable to the impact.

9.2.7.2.3 Economic impact from taxes, fees and local transactions

This section assesses and evaluates the potential economic impact of taxes, fees and local transactions during the construction phase of the project. The following Table 9-83 shows the potential impact, the Impacts Generating Mechanisms and potentially affected receptors.

Table 9-83 Economic impact of taxes, fees and local transactions– Impacts Generating Mechanisms, potentially affected receptors during construction phase

Possible Impact	Impacts Generating Mechanisms	Potentially affected resources / receptors
Economic impact of taxes, fees and local transactions	Supply of the necessary goods and services[33]	• Local/ Regional economy • National economy

Prepared by: ASPROFOS, 2022.

It is important to note that **the construction of the Project will contribute to the state income through the payment of taxes throughout its operation and paves the way for more large-scale investments in the country, whilst implementation of such large projects strengthens the confidence of investors in the prospects of Greece.**

The economic impact of Project construction will arise from the supply of the necessary goods and services. Additionally, another economic impact will be related to consumption driven by Project employees and the payment of taxes to the state.

The detailed information as regards the supplies requirements at construction phase is not yet available. In general, the required types of goods and services will include:

- Transportation, Providing of food and drink, catering, security services.
- Supply of vehicles and equipment used in construction works.
- Supply of construction materials including aggregates/sand, cement and building materials.
- Ships and equipment for construction.

[33] The generally acknowledged impact-causing mechanisms on the local economy linked to the project construction are both direct and indirect. The detailed identification of these mechanisms is not part of an ESIA nor is the data required available (e.g. the exact number of employees per specialisation, the necessary materials and specifications, etc.) in terms of the economic impact of taxes, fees and local transactions.

At this stage, it is not known which materials can be procured locally, therefore it is conservatively appreciated that the supply of most services (including transportation, laundry services, catering, etc.) will be assigned to Greek companies.

The economic impact of goods and services purchased will be primarily at regional or national level rather than at municipal level.

However, in local/ regional level, workforce is expected to spend some of their earnings in local market for leisure and/ or recreation. However, the economic impact of consumption driven by the Project's employees on local/ regional economy is expected to be limited due to the presence of relatively short construction period. Most importantly, usually recreational expenditures of workforce are rather low. Workforce shall be staying (most likely) near the population centers of the broader area and will be visiting surroundings centers during leisure time. These visits are expected to generate some income for local communities. In addition, any purchases (of project workforce) will primarily benefit local merchants, cafeteria owners and other business owners.

In short, while Project construction is expected to bring some economic benefits at regional and/ or local level, such benefits are expected to be quite limited because of the Project's short duration of employment of the required workforce. The supply of services (e.g. employment in hosting, catering and transport) will be the most likely source of economic impact at local/ regional level; however, the overall scale of impacts will be relatively limited.

Taking into account the considerations discussed and following the assessment criteria presented in Section 9.1, the impact on economy from taxes, fees and local transactions can be assessed as follows:

The *Likelihood* for the impact is considered *certain*, since at least some transactions shall take place.

The *Extent* is determined by the spatial distribution of the expenditures; considering that the nature of economy is not restricted to the area the transaction took place. For example, even in a local community, a modification in its economy will have effects on regional level. As such, the *extent* of the impact is considered *Peripheral*.

The *Intensity* of the impact is linked to the total value of goods, services, consumption exchanged between local/ regional economy and the Project. Presently, it is not known the exact value of goods or services that the project shall procure from local market, nor is the consumption of the local workforce. However, as discussed, and adopting a conservative approach, intensity of the impact is considered *low*.

The *duration* of the impact is associated with the presence of the workforce within a specific area and the period during which goods and services shall be procured from the local/ regional economy; more simply, duration shall be associated with the time required for the completion of construction within a specific area. Construction in each landfall site (nearshore and coastal construction activities) shall be over within 6-8 months, corresponding to a *short-term* duration; however, the new opportunities and overall increase of economic activity in the broader area of the landfalls is reasonable to extend more than that. On the other hand, construction activities for the rest of the project components, i.e. pipeline (offshore and onshore) and Permanent Facilities (Major Stations, Line Valves, O&M), will be completed within 36 months, corresponding to a *mid-term* duration. As such, duration is considered to be *mid-term*.

With regard to *reversibility*, it is assessed that by applying appropriate measures, increase of procurement of goods and services from local providers is feasible. Local consumption is not influenced by project activities. On the contrary, it is regulated by the local market and the needs of consumers; as such, it is not possibly influenced by the project. For these reasons, increase in cash flows from taxes, fees and local transactions is considered to be *maximizable*[34] (see Chapter 10).

Regarding *cumulative* action, more often than not, economic development in one sector/ industry brings along positive impacts (economic development) on closely related (or not) sectors. As such, it is *probable* that increase from taxes, fees and local transactions will allow other economic activities to be positively affected by the impact induced by the project.

Transboundary character is deemed *impossible*, by definition of economy (local/ regional and how this is interconnected to other regional areas and national jurisdiction).

Based on the above and the criteria presented in Section 9.1, impacts from increase in taxes, fees and local transactions during the construction of the project **SEI is considered as Moderate (in a positive manner).**

Section 10.2.7 presents the proposed mitigation and management measures applicable to the impact.

[34] Given that the impact is a positive one, this classification is used instead of *minimizable.*

9.2.7.2.4 *Economic impact on agricultural sector (income)*

This section assesses and evaluates the potential Economic impact on agricultural sector (i.e. income from farming and live stocking) during the construction phase of the project. The following Table 9-84 shows the potential impact, the Impacts Generating Mechanisms and potentially affected receptors.

Table 9-84 Economic impact on rural income – Impacts Generating Mechanisms, potentially affected receptors during construction phase

Possible Impact	Impacts Generating Mechanisms	Potentially affected resources / receptors
Economic impact on agricultural sector	Pipeline passing through agricultural and arable land	Professional farmers/ stock breeders

Prepared by: ASPROFOS, 2022

It should be noted that the impact is not different whether the cultivated land is owned by the farmer or rented.

The farming sector may experience a small-scale impact during construction phase. The value of the land may have some implications, and some agricultural activities (particularly associated with arboriculture) is likely to stop at the sites where the pipeline will be constructed.

The income of farmers cultivating lands from where the pipeline will pass, is going to be affected. Construction activities occupy specific areas, where no agricultural activities might be performed. Agricultural activities such as cultivating soil, planting, raising, and harvesting crops, rearing, feeding, and managing animals might not be able to be performed, depending on the site/ crop specific plan/ schedule. For example, it might be difficult to gather the crops because of construction works or even to prepare for next year (ploughing and cultivating the farmland). The reduction in farmers' income will affect local/ regional economy and possibly the administrative revenues (e.g. taxes).

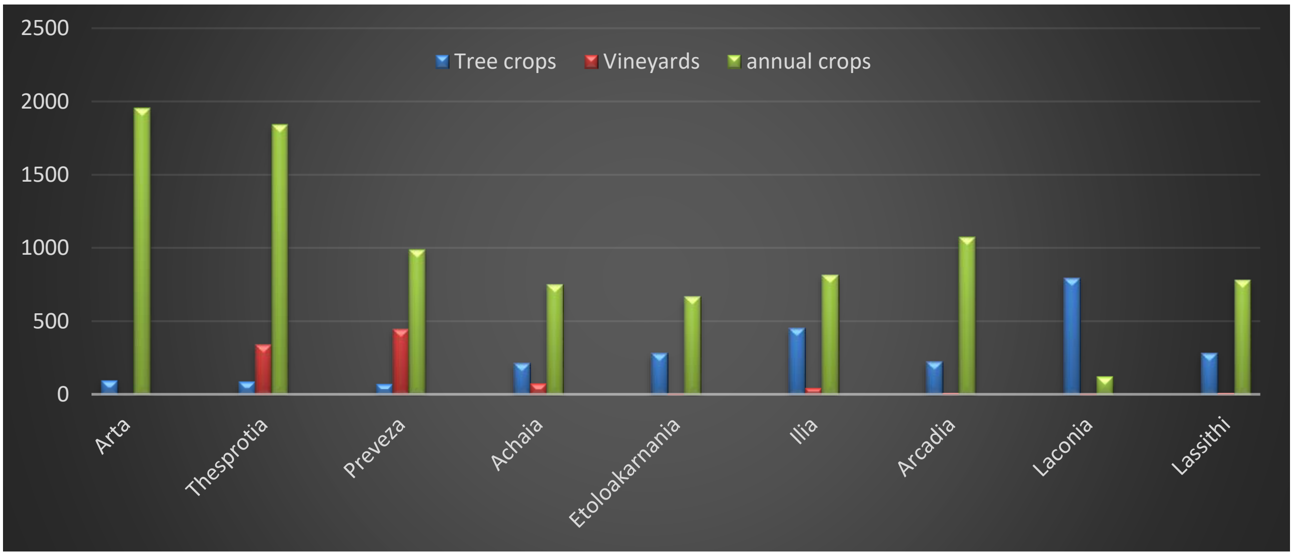
As the Project progresses, the working strip will pass between settlements and through agricultural areas. Main roads will remain open during the construction phase, but the working strip may temporarily sever tracks and farm trails between fields linking different land plots. This may result in farmers having to travel longer distances to access their fields.

Similarly, impacts to animal grazing activities during the construction phase result from farmers having restricted access to grazing land and/or farmers being temporarily unable to access grazing land due to the working strip. Animal grazing is usually undertaken over a wide area; therefore, farmers with restricted access will find alternative land in most instances. Farmers that are severed from their grazing land may have to walk long distances around the working strip, which will disrupt existing farming practices.

Farmers that have already been impacted by natural disasters (e.g. wildfires, see Section 9.2.7.2.2) are particularly sensitive to project impacts to land and crop production. At the same time, seasonal workers are also more vulnerable in terms of impact on agricultural sector; this is because most of them are employed in the agricultural sector.

With the exception of areas of difficult terrain in mountainous regions, construction will be completed and land reinstated within a calendar year. Consequently, the loss of seasonal agricultural production will predominantly be over a one-year period. The re-establishment of land productivity to the level prior to construction may take time, with permanent crop production taking longer to re-establish (olive and fruit trees take, indicatively, between 3 and 5 years to produce fruit and 6 to 10 years to reach full production; vines take up to 5 years to become re-established and reach full production).

As illustrated in Figure 9-32, annual crops is the dominant (by far) cultivated group for most of the engaged Regional Units. Tree crops play a more important role for Regional Units of Lassithi, Laconia, Ilia and Aetoloakarnania; based on available data and site surveys, these are mainly olive trees.



Prepared by: ASPROFOS 2022. Data from ELSTAT, *Annual Agricultural Statistical Survey* 2018. Available at: https://www.statistics.gr/el/statistics/-/publication/SPG06/-. Vineyards is a shallow rooted tree crop and this is why it is described separately.

Figure 9-32 Ration between tree crops, vineyards and annual crops.

Planting scheme is approx. 7x7 for olive trees[35]. This means that in a typical 28 m working strip (as defined for tree crops) 3 planted rows will be lost. As such, the exact number of roots lost depends on the length of the working strip within the specific plot.

Regardless of the exact number of trees to be lost or yield volume, as mentioned in the mitigation measures (see chapter 10), relevant compensations will be given to cover the loss of income of the people working in the agricultural sector (cultivations and live stocking).

Taking into account the considerations discussed and following the assessment criteria presented in Section 9.1, the impact on economy of the agricultural sector can be assessed as follows:

Likelihood for the impact is considered *certain*, since at least some transactions shall take place.

Extent is determined by the width of the working strip. In shallow rooted species (cultivations and pastures), this will be 38 m wide, whilst for tree crops 28 m. In any case, the *extent* of the impact is considered *Small*.

Intensity of the impact is linked to the total loss of agricultural activity and consequently income. This cannot be quantified within the framework of the ESIA but qualitative, Agricultural sector is important for the local and regional economy. As such, intensity of the impact is considered *medium*.

The *duration* of the impact is associated with the time for the crops to mature enough as to yield the same amount of crops as before construction. As discussed this can be up to 5 years (average). As such, duration is considered to be *mid-term*.

With regard to *reversibility*, a number of pipeline in Greece (and all over the world) have been constructed in agricultural lands applying for specific monetary measures (i.e. compensation for loss of present and future crops) preventing the impact itself. In fact, in times of market insecurity and financial uncertainty, many professionals prefer the cash flow ensured by the compensation plans of the Project Owner; in any case, compensation will allow affected people to replace any loss of income or activity (e.g. in case of tree-crops). For these reasons, impact on agricultural sector is considered to be *preventable* (see Chapter 10).

Regarding *cumulative* action, adopting a conservative approach it can be assessed as *rare.*

Transboundary character is deemed *impossible*, by definition of economy (local/ regional and how this is interconnected to other regional areas and national jurisdiction).

[35] https://www.mistikakipou.gr/fitefsi-elias/

Based on the above and the criteria presented in Section 9.1, impacts on agricultural sector (farming and livestock) during the construction of the project **SEI is considered as Minor.**

Section 10.2.7 presents the proposed mitigation and management measures applicable to the impact.

9.2.7.2.5 Economic impact on fishing sector (income)

This section assesses and evaluates the potential Economic impact on fishing sector during the construction phase of the Project. The following Table 9-85 shows the potential impact, the impacts generating mechanisms and potentially affected receptors.

Table 9-85 Economic impact on fisheries – Impacts Generating Mechanisms, potentially affected receptors during construction phase

Possible Impact	Impacts Generating Mechanisms	Potentially affected resources / receptors
Economic impact on the fishing sector	Safety Exclusion Zone	Professional fishermen

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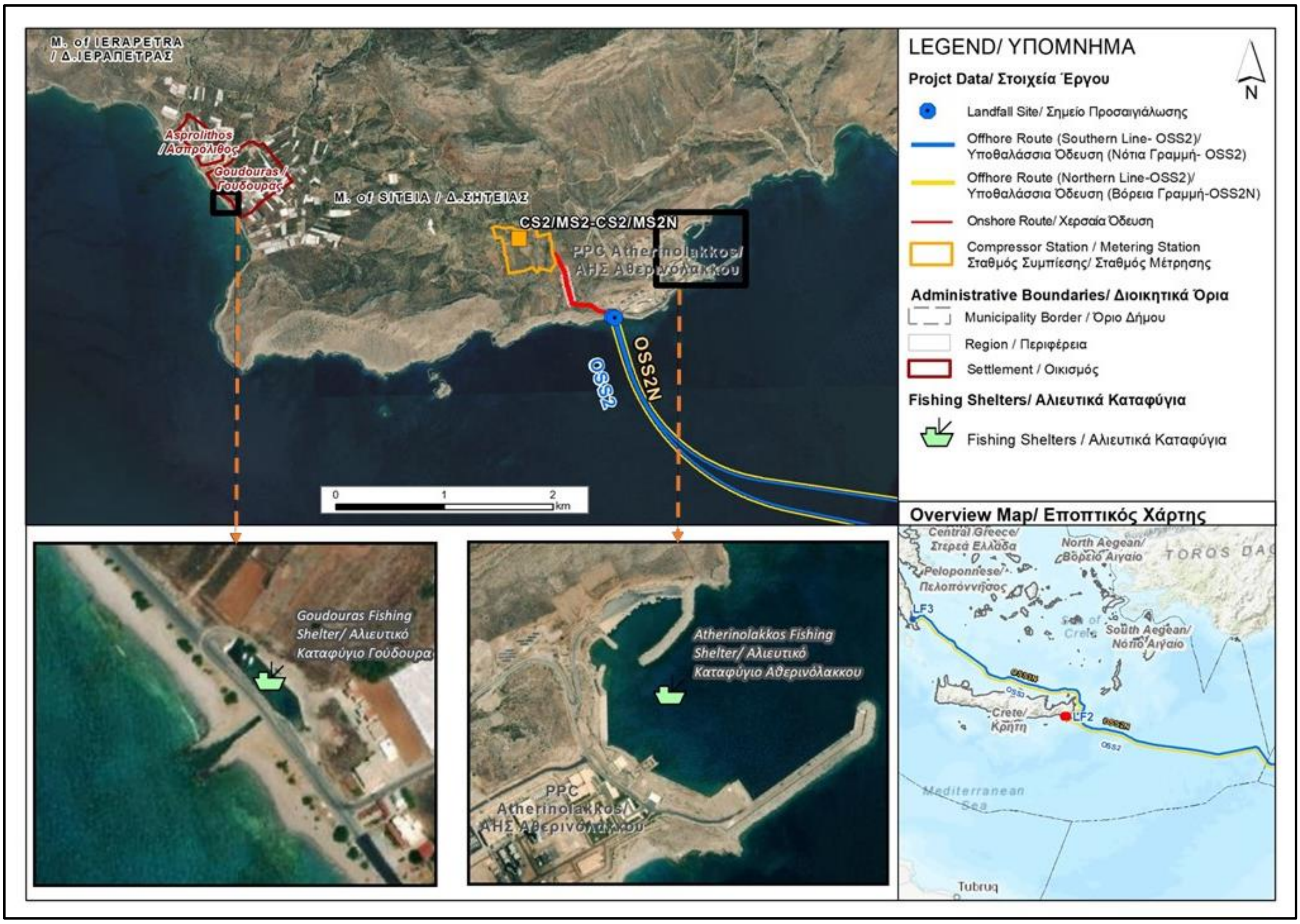
It is noted that this section should be read in coherence to Section 9.2.6.1.2.

As discussed also in Section 9.2.6.1.2, during the construction phase, a safety exclusion zone of 2 km radius (1.1 nautical miles (NM), centered on the pipe-lay vessel) will be enforced around the pipelay vessels (i.e. for OSS2/OSS2N, OSS3/OSS3N, OSS4; see Section 6.4.2). The safety zones will prevent other ships from entering the waters around the construction work, and any leisure or commercial activities on the water, such as recreational diving or fishing, will be prohibited within this area. This will affect the mobility of fishermen in accessing traditional fishing areas. However, exclusion zone will be temporary and small in comparison to the overall fishing areas, while (apart from the nearshore sections), the installation of the offshore pipeline will not take long in every specific spot. The navigational Safety Exclusion Zone will be agreed with the relevant maritime authorities who will, in turn, ensure that it is communicated to vessels in passage in the vicinity of the pipe-lay vessel.

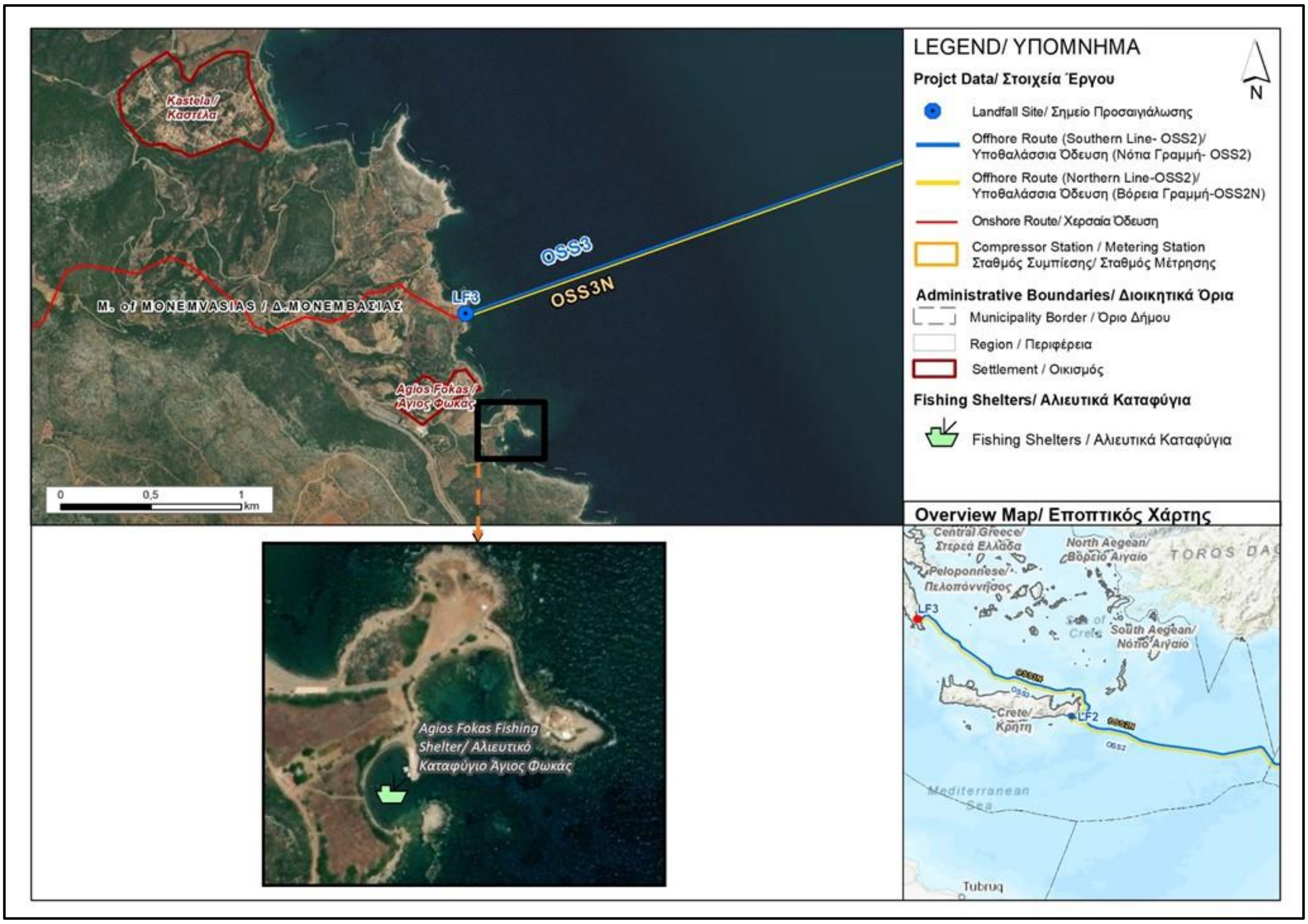
It is expected that the safety zones could be considered as affecting fishing activity in relation to the fishing locations. Fishermen will move to adjacent fishing areas. It should be noted that safety zones will be moving in line with the progress of the project and will not be stationary to restrain any particular area for long duration. In addition, the project will be short term.

The fishing shelters of Atherinolakkos and Goudouras are located in the LF2 area, at approx. 1 km to the NE and 4 km to the NW, respectively (see Figure 9-33); also, the fishing shelter of Agios Fokas, in the LF3 area, at approx. 700 m to the SE (see Figure 9-34). In addition, according to Section 8.7.2, there is fishing activity in the area of the Patraikos Gulf.



Prepared by: ASPROFOS, 2022.

Figure 9-33 Fishing Shelters at the area of LF2.



Prepared by: ASPROFOS, 2022.

Figure 9-34 Fishing shelter at the area of LF3.

As presented in Section 9.2.6.1.2, fishing intensity in the landfall sites is low or very low for all landfall sites. Fishing intensity was also discussed, concluding that adopting a conservative approach it is realistic to consider that the most likely engaged fishing areas are the ones directly affected by the project footprint, i.e. Crete (Kriti Island) and Patraikos Gulf (Table 9-63).

The Project will result in the temporary loss of a small portion of fishing ground due to a safety zone of approximately 2 km radius that would be adopted to prevent interferences with marine users, in general, including fishing sector professionals. However, no significant interferences with fishing activities are foreseen, mostly due to:

- The small size of the affected area;

- The short-term duration of the offshore activities in the areas used by small-scale fishermen (typically 1,5 - 3 miles from the coast) and large-scale fishermen (typically 3 – 12 miles from the coast);
- The availability of alternative fishing areas within the immediate vicinity of the Project area; and
- The temporary and insignificant loss of fisheries production.

As mentioned in Section 9.2.7.2.1, the contribution of "farming, forestry and fisheries" sector arises to local/ regional economy is 11.4% within the Study Area, whilst for most of the engaged Regional Units, the sector comes in the 3rd place of importance to local/ regional economy. Nevertheless, these are mainly agricultural (onshore related) activities. Regional Units and their corresponding importance of fishing sector are illustrated in Table 9-86.

Table 9-86 Importance of AYA "Agriculture, Forestry and Fishing" sector in the local/ regional economy.

Regional Unit	Average value (million €) between 2000 and 2018	Participation of AYA "Agriculture, Forestry and Fishing" sector	Ranking of importance for the local/ regional economy
Lasithi	121	12%	5
Laconia	141	13.86%	4
Arcadia	90	7%	5
Ilia	331	20.32%	1
Achaia	214	5.27%	6
Aetoloakarnania	246	10.7%	5
Arta	92	13%	5
Preveza	85	13.3%	4
Thesprotia	50	8.5%	5

Prepared by: ASPROFOS, 2021. Data from ΕΛΣΤΑΤ.

As presented in Section 8.7.2.6, the total catch of medium and coastal ranged fisheries decreased by 14.3% and their value decreased by 12.9% in 2020 compared to 2019; in detail[36]:

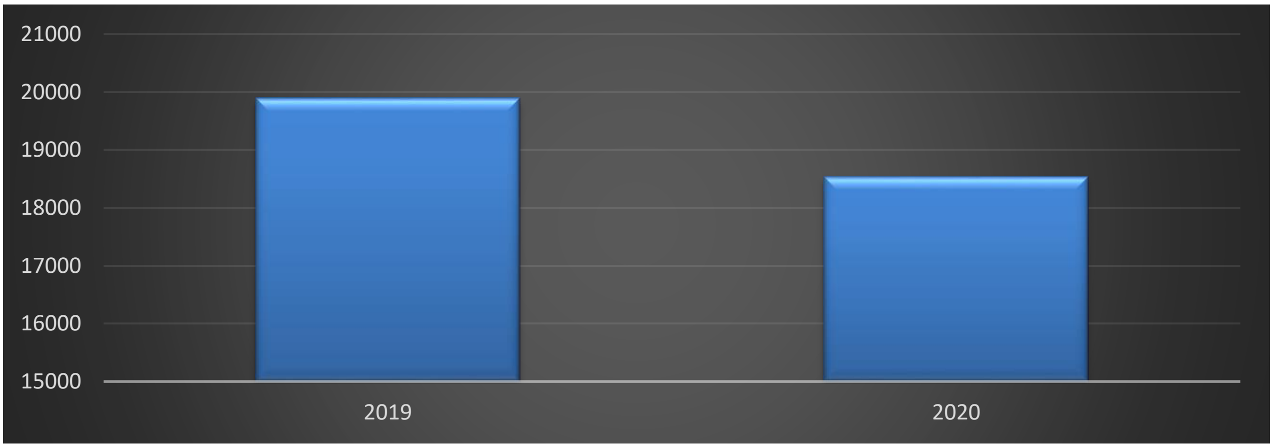
- In average fishing, the quantity and value of catches decreased by 18.0% and 13.8%, respectively, in 2020 compared to 2019. Specifically, in 2020 the amount of catches amounted to 43,085 tons

[36] Data from ELSTAT, *Marine Fishing Study with Motor Vessels: Year 2020*. Available at: https://www.statistics.gr/documents/20181/2cf94a83-1f2d-0447-1c1b-168627c39ed1

and the value at 101,074 euro, while in 2019 the quantity was 52,559 tons and the value 117,224 euro;

- In coastal fisheries, the quantity and value of catches decreased by 7.7% and 12.2%, respectively, in 2020 compared to 2019. Specifically, in 2020 the amount of catches amounted to 27,096 tons and the value at 137,116 euro, while in 2019 the quantity was 29,360.5 tons and the value 156,196 euro.

Regarding fishing related employment, the average annual employment in medium and coastal fisheries decreased by 6.8% in 2020 compared to 2019 (Figure 9-35).



Prepared by: ASPROFOS 2022. Data from **ELSTAT**, ***Marine Fishing Study with Motor Vessels: Year 2020*. Available at:** https://www.statistics.gr/documents/20181/2cf94a83-1f2d-0447-1c1b-168627c39ed1

Figure 9-35 Average annual employment (number of employees) in fishing.

Compensation measures for affected people will be as defined in the Land Acquisition Strategy and Livelihood Restoration Plan

Taking into account the considerations discussed and following the assessment criteria presented in Section 9.1, the assessment of economic impacts on fishing sector is very similar to the one for the fishing areas restrictions (Section 9.2.6.1.2).

The *Likelihood* of impact during construction works is *certain*. Regardless of any other criteria, it is certain that some (limited) impacts shall be applied within a small percentage of the overall specific fishing areas and as such, some impact on fishing sector of economy.

The *extent* of the impact could be considered as local since the restrictions shall be imposed only in the safety exclusion zone of 2 km around the pipelay vessels. However, given the nature of the receptor (economy) it is reasonable to conclude that repercussions will be more regional. As such, extent was considered *medium.*

The *Intensity* of the impact has been related to the size of the fishing industry and its importance to local/ regional economy. As assessed in Section 9.2.6.1.2 and supported also from the above discussion, nearshore and deep water areas demonstrate the same low fishing intensity indicative of the entire fishing sector. As such, intensity is assessed as *low*.

With regard to the *duration* of the impact, key factor determining the duration of the impact is the time required for completion of construction activities. All offshore construction works shall have need concluded within 1 year of their beginning; as such, the duration has been considered as *short-term.*

With regard to *reversibility*, as discussed for agriculture sector (Section 9.2.7.2.4) a number of pipeline in Greece (and all over the world) have been constructed applying for specific monetary measures (i.e. compensation for loss of present and future yields, proved to be induced by the project) preventing the impact itself. In fact, in times of market insecurity and financial uncertainty, many professionals prefer the cash flow ensured by the compensation plans of the Project Owner. For these reasons, impact on fishing sector is considered to be *preventable* (see Chapter 10).

Regarding *cumulative* action, although no offshore projects have been identified that could potentially be constructed simultaneously and impose fishing restrictions of their own, the possibility is there. As such, the cumulative character of this impact is considered as *rare.*

Transboundary character is deemed *impossible*, by definition of economy (local/ regional and how this is interconnected to other regional areas and national jurisdiction).

Based on the above and the criteria presented in Section 9.1, economic impact on fishing sector during the construction of the project **SEI is considered as Minor.**

Section 10.2.7 presents the proposed mitigation and management measures applicable to the impact.

9.2.7.2.6 Economic impact on tourism sector (income)

This section assesses and evaluates the potential Economic impact on tourism during the construction phase of the project. The following Table 9-87 shows the potential impact, the Impacts Generating Mechanisms and potentially affected receptors.

Table 9-87 Economic impact on tourism – Impacts Generating Mechanisms, potentially affected receptors during construction phase

Possible Impact	Impacts Generating Mechanisms	Potentially affected resources / receptors
Economic impact on tourism sector	Noise and visual disturbance (excavation works)	Tourist infrastructures (hotels, restaurants)

Prepared by: ASPROFOS, 2022

It is noted that this section should be read in coherence to Section 9.2.3.1, regarding impacts on Landscape.

Construction activities may impact local tourism (marine and terrestrial) mainly due to noise and visual disturbance, i.e. increase of noise, temporary degradation of aesthetic value, but also to the general construction activity, especially in touristic areas. More specifically, project construction includes preparation of the working strip/ causeway/ cofferdam and the permanent and temporary facilities parcels, earthworks, buildings works, equipment and machinery operation as well as traffic of vehicles, vessels, equipment and personnel.

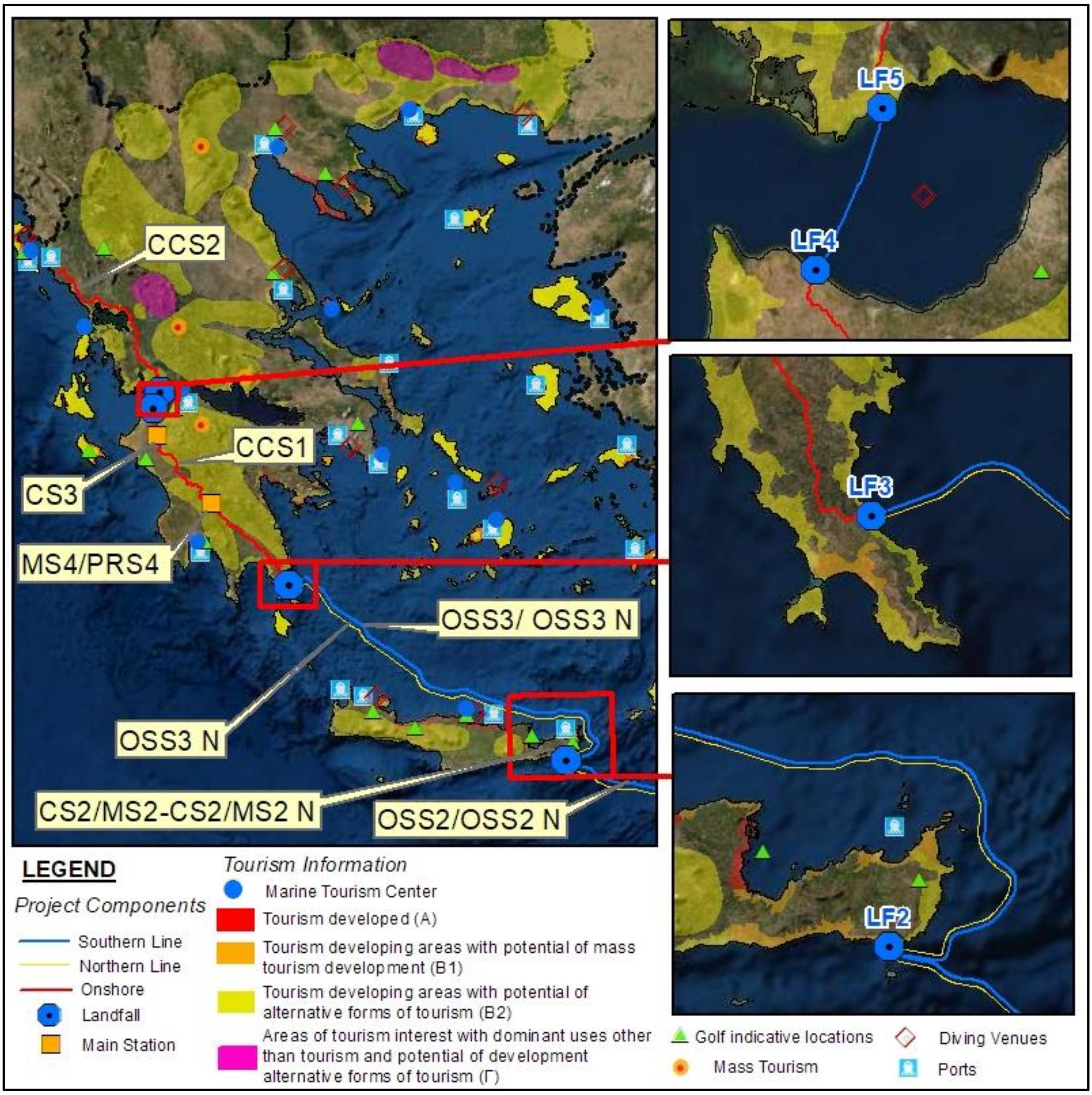
Description of the construction activities and impacts on landscape (visual disturbance) are provided in Section 9.2.3.1; impacts on acoustic environment (increase of noise) are provided in Section 9.2.11.

During construction phase, the most significant impacts are expected in the areas of the temporary facilities (please refer to discussion of Section 9.2.3.1). Specifically, touristic activity is expected in the coastal areas, near the landfall sites; especially the landfall sites with some touristic development. Based on site surveys and available data (Figure 9-36 and Sections 5.2.1.3.2, 5.2.2), the following are noted:

- Landfall site at Atherinolakkos, SE Crete (LF2). According to the Special Framework for Spatial Planning and Sustainable Development for Tourism, the landfall area is characterized as "Developing tourism with potential for mass tourism development (B1)". According to the SFSPSD for Tourism, the coastal area of LF2 is characterized as area with development potential for mass tourism (B1) (see Chapter 5). Nevertheless, the broader area is dominated by the adjacent power plant of Atherinolakkos. No touristic development was identified at present or planned.
- Landfall site at Agios Fokas, SE Peloponnese (LF3). According to the Special Framework for Spatial Planning and Sustainable Development for Tourism, the landfall area is characterized as "Developing tourism with potential for development of alternative forms of tourism (B2)". According to the SXOOAP of M. of Monemvasia (HGG GG 231/AAP/2013 & GG 252/AAP/2017), the area is characterized as "ΠΕΠΔ 6: "Coastal zone"", where (i) development of mild forms of tourism - recreation, (ii) the protection of the landscape and (iii) the prohibition of incompatible uses is foreseen. Nevertheless, very limited touristic development was identified in the Study

Area, i.e. in Agios Fokas; this was mainly buildings for what seems to be planned as bungalows, in various development stages, but non-active (i.e. abandoned building frameworks or abandoned completed compounds). However, Monemvasia (at 10 km to the North) is a significant, UNESCO site, touristic venue, whilst ecotourism paths are also recorded starting south of Agios Fokas.

- Landfall site at Lakopetra, NW Peloponnese (LF4). According to the Special Framework for Spatial Planning and Sustainable Development for Tourism, the landfall area is not characterized as priority area for tourism. However, numerous touristic development are active in the wider area, some of them of significant economic annual turnover. The broader area hosts numerous hotels, accommodation facilities, recreational/ touristic activities; hence, tourism sector is considered very important for the area.
- Landfall site at Evinochori, SE Aetoloakarnania (LF5). According to the Special Framework for Spatial Planning and Sustainable Development for Tourism, the landfall area is characterized as "Developing tourism with potential for development of alternative forms of tourism (B2)". Nevertheless, very limited touristic development was identified in the Study Area and specifically in Kalidhonos Bay; this was essentially two establishments on the beach, approx. 2 km to the east of the LF5.

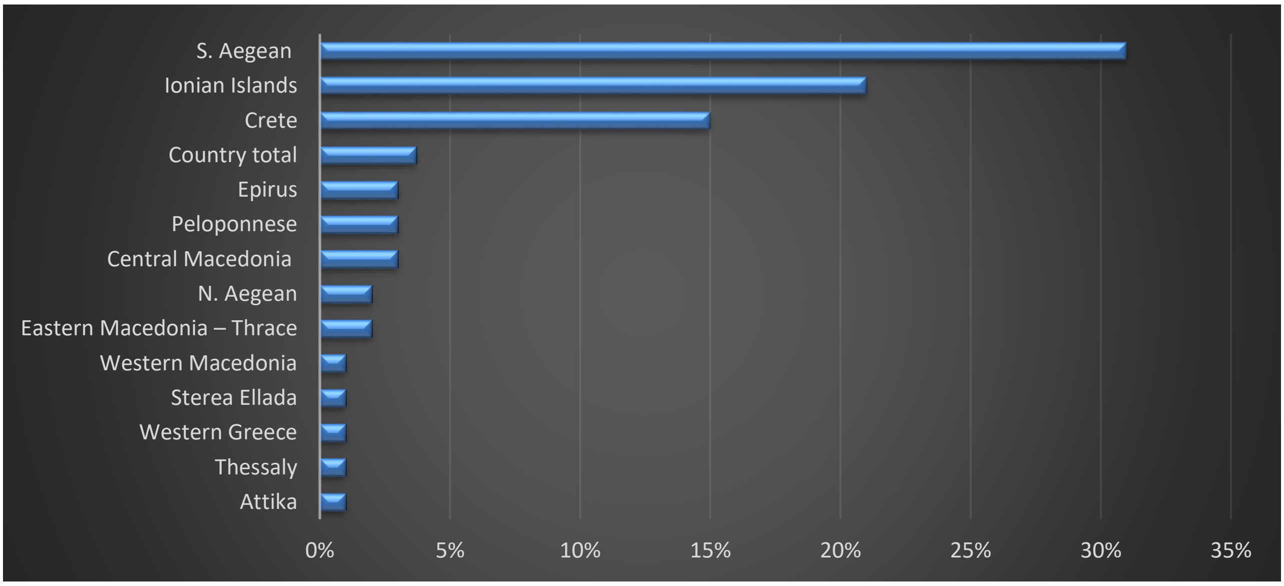


Prepared by: ASPROFOS, 2022. Data from Special Framework for Spatial Planning and Sustainable Development for Tourism (HGG B'1138/2009).

Figure 9-36 Tourism hotspots.

In the system of National Accounts, tourism is not reflected as an individual sector, as it is associated with a wide range of economic activities for the production of goods and services consumed by visitors to the same area. Its importance to local/ regional economy is extrapolated from the activities (sectors) that participate in the production-distribution of goods and services that compose the tourist expenditure (consumption).[37].

INSETE[38] estimated total tourism expenditure on regional level based on the distribution of incoming tourism revenues as reflected by the Bank of Greece Border Survey. These data are compared with the estimate of the GDP of each Region, taking into account the GDP of 2020 and the % distribution, based on 2018 data. Due to the approximate nature of the elements the picture that is drawn is primarily indicative (Figure 9-37). Annex 9B provided tabulated data on importance of tourism per Region.



Prepared by: ASPROFOS, 2022. Data as cited in (Ικκος & Κουτσός, 2021). Source: ELSTAT, BoG. Analysis by INSETE.

Figure 9-37 % GDP to which tourism expenditure corresponds.

As illustrated in Figure 9-37, tourism sector participates in the GDP of R. of Crete at 15%; for R. of Peloponnese and of Epirus at 3%; for R. of W. Greece at 1%.

Summarizing, regarding sensitive receptors:

[37] According to (Ικκος & Κουτσός, 2021) tourism, unlike most of the primary and secondary sector activities, is a horizontal activity and not a vertical one. That is, tourism is an activity that is limited by the demand for products and services, while the activities of the primary and secondary sectors are activities of production and supply of products. For example, the metallurgical industry is made up of metal product companies and the grain industry from agricultural grain companies. In contrast, tourism activity affects many sectors of the economy , such as transportation (e.g. air travel and bus transfer), accommodation (hotel or other), catering (restaurants or bars inside or outside the accommodation), entertainment (including visits to attractions) and in-store consumption. Thus, tourism is an activity that - anyway - concerns many different parts of the social and productive fabric of a country.

[38] Institute of Greek Tourism Confederation

- LF2 does not constitute sensitive receptor for tourism sector;
- LF3 lays in an undeveloped area but of a certain potential, given its statutory status, existing infrastructure/ venues and participation of tourism in local/ regional economy;
- LF4, although not of a statutory status, is the most developed touristic area identified;
- LF5 is completely undeveloped area from a tourism point of view; tourism is of low importance for local/ regional economy, but the area has statutory status for tourism.

Adopting a conservative approach, the three landfall sites LF3, LF4 and LF5 are considered sensitive receptors for tourism sector, as construction activities (as a whole) may have temporary nuisance on local tourism, especially if performed during peak season.

In respect to impact on tourism, it needs to be noted that proper scheduling of activities is of outmost importance. As documented in Section 8.7.8.2, tourism peak activity takes places from June to October (mainly between July and August). Apart from any compensation of income loss, construction activities, especially in coastal areas, can be scheduled so as to avoid, even partially, high tourist season, if required by authorities.

Taking into account the considerations discussed, and following the assessment criteria presented in Section 9.1, the impact on tourism sector can be assessed as follows:

The *Likelihood* for the impact is considered *certain*, since at least some disturbance/ nuisance shall take place.

The *Extent* is determined by the spatial distribution of the revenues from tourism, considering that the nature of economy is not restricted to the area the impact took place. As such, the *extent* of the impact is considered *Peripheral*.

The *Intensity* of the impact is linked to the contribution to the economy. Although from the previous discussion, it could be concluded that tourism sector is not important for the engaged regions, adopting a conservative approach (and taking into consideration expert judgement and local knowledge), intensity of the impact is considered *medium*.

With regard to the *duration* of the impact, construction at landfall sites will take approx. 6 months and upon completion of these works, restoration is considered immediate. Therefore, the duration of the impact is *short-term*.

With regard to *reversibility*, as for the previous impacts on economy, any income loss induced by project's construction will be compensated. In fact, in times of market insecurity and financial uncertainty, many professionals prefer the cash flow ensured by the compensation plans of the Project Owner. As such, impact on tourism sector is considered to be *preventable* (see Chapter 10).

Regarding *cumulative* action, taking into consideration the impact of recent COVID-19 restrictions, it is assessed as *certain*.

Transboundary character is deemed *impossible*, by definition of local economy.

Based on the above and the criteria presented in Section 9.1, impacts on tourism sector during the construction of the project **SEI is considered as Minor.**

Section 10.2.7 presents the proposed mitigation and management measures applicable to the impact.

9.2.7.2.7 Summary

The summary of the impacts on the Local Economy during the construction phase is presented in the following table

Table 9-88 Summary of Impacts on the Local Economy during the Construction Phase

S/N SEI			SEI for	Local Economy							
Project phase	Construction										
Impact	Mechanism	Locations	Criteria/ Impact Properties							SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Employment opportunities (direct and/ or indirect)	• Supply of the necessary goods and services • Local workforce engagement	• Population centres (cities or villages) close to temporary and permanent facilities • along the working strip	1.00	1.00	0.25	0.50	0.75	0.75	0.00	6.07 (Positive/ Moderate)	Direct employment involves mainly unskilled jobs for construction and procurement of goods and services. Indirect employment involves secondary jobs creation for the providers of goods and services. Capacity building is also should be also taken into consideration.
Economic impact of taxes, fees and local transactions	Supply of the necessary goods and services	In the entire study area	1.00	1.00	0.25	0.50	0.75	0.75	0.00	6.07 (Positive/ Moderate)	Supply of the necessary goods and services from domestic market will be significant; Services sector is the most important for local/ regional economy, whilst Construction

S/N SEI			SEI for	Local Economy						
Project phase	Construction									
Impact	Mechanism	Locations	Criteria/ Impact Properties						SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
											sector is also very important. Workforce consumption and expenditures on local market is also noted.
Economic impact on agricultural sector / income	Pipeline passing through agricultural and arable land	Along project footprint (onshore section)	1.00	0.00	0.50	0.50	0.00	0.25	0.00	3.21 (Minor)	Most of agricultural sector involves annual crops (or annual species in pastures). All impacts will be local but mid-term. However, compensation shall prevent any income loss.
Economic impact on fishing sector/ income	Establishment of an offshore safety exclusion zone	• OSS2/OSS2N • OSS3/OSS3N • OSS4 • (offshore section)	1.00	0.25	0.25	0.00	0.00	0.25	0.00	2.50 (Minor)	Fishing sector importance is low in the areas affected by the Project. A safety exclusion zone of 2 km shall be enforced around the pipelay vessels. Compensation could prevent any income loss.

S/N SEI			SEI for	Local Economy							
Project phase	Construction										
Impact	Mechanism	Locations	Criteria/ Impact Properties							SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Economic impact on tourism sector/ income	Noise and visual disturbance (Construction works)	• LF3 • LF4 • LF5	1.00	1.00	0.50	0.25	0.00	0.50	0.00	4.64 (Minor)	Tourism sector is developed only in the specific sites along the entire project, with few sensitive receptors. Impacts can be mitigated, through proper planning; compensation, if a loss of income close to the landfalls is substantiated due to the Project construction, could prevent any income loss.

Prepared by: ASPROFOS, 2022

9.2.7.3 Socio-economic Impact on Quality of Life

Project construction duration is short in order to have significant impact on the quality of life. As such, impacts on quality of life are assessed only in the operation phase (see Section 9.3.7.2), including also a small discussion for potential impacts during construction phase.

9.2.7.4 Deriving Development Trends from the Project

Project construction duration is short in order to have significant impact on the development trends of the engaged regions (and nation-wide). As such, potential impacts (negative or positive) on the development trends are assessed only in the operation phase (see Section 9.3.7.2), including also a small discussion for potential impacts during construction phase.

9.2.8 Technical Infrastructure

9.2.8.1 Land, Sea and Air Transport

In this section, possible impacts on land, sea and air transport are examined.

Existing transport infrastructures will be used, especially during construction phase, to transport workforce, equipment and materials. This infrastructure is generally considered to be sufficient for Project purposes. Table 9-89 outlines main impact sources, potentially impacted resources, recipients, as well as factors influencing current status and those related to the Project.

Table 9-89 Key Issues for Assessment – Land, Sea and Air Transportation

Impact/Risk Sources	• Potential impact on road network might be mainly caused by: ➢ Project vehicle usage (construction, transport, etc.), ➢ Construction of pipeline crossings including roads, ➢ Entry/exit traffic at construction sites; • With no integrated design measure, potential impact on railroad network might be triggered by trenchless crossing method. • Personnel and equipment mobilization might impact local air transport.
Potentially Impacted Resources and Receptors	• Road infrastructure, road network users, and local population might be affected by using existing road network and potential related impacts. • Railway infrastructure and train users might be affected by impact on railway network. • Airport users might be affected by impact on air transportation.
Special Baseline Conditions that are Potentially Influencing Impacts/Risks	• Existing road and marine traffic conditions during working days might have a cumulative effect.
Project Factors that are Potentially Influencing Impacts/Risks	• Heavy vehicles used as equipment transportation onshore • Heavy vessels used as for equipment transportation offshore
References	Chapter 8.8.1 analyses land, sea and air transport infrastructure within the project area.

Prepared by ASPROFOS, 2022

9.2.8.1.1 Road Network

As reported in the previous table, during pipeline construction, the following impact-causing activities are identified:

- Usage of construction and project vehicles;
- Construction of pipeline crossings; and

- Increasing traffic when entering and leaving construction sites such as the the sites for the main facilities and line valve stations.

Using Construction Vehicles

Construction vehicles and those used for transporting materials, goods and workers to pipe storage areas and construction sites will move alongside an existing road network. Increasing traffic is expected to be more noticeable near construction sites of stations.

Road users will mainly be impacted receptors. Potential receptor is a local population along supplying and transporting road freight routes. Road users might be temporary affected by road blockages in small nodes and local roads. Worksite traffic, particularly on isolated local roads, may also pose risks to pedestrians and cyclists as well as animals that are less familiar with high traffic and heavy vehicles. This is also the case when supplying and transporting routes need to cross construction sites of stations.

Source: https://troxoikaitir.gr, accessed on: November 2021

Figure 9-38 Example of Pipe Transport Vehicles

Increasing traffic may cause little raise in accident probability at road conjunctions, entry and exit points on construction sites, and narrow streets. In addition, it might lead to local traffic delays caused by duration of construction works. As main risk, this may also lead to inappropriate overtaking of construction-related slow-moving vehicles, thus posing a safety hazard to road users in locations where they are used to low traffic as evidenced by current data.

Traffic impacts on air quality, noise and habitats are analysed in corresponding chapters.

In general, road network conditions are good in areas where construction vehicles will be moving. However, road network attrition caused by heavy construction vehicles should be mentioned as a potential impact.

Impact duration will be limited and corresponding with time for construction works in each area.

Construction of Pipeline Crossings including Roads

Constructing crossings will require possible temporary traffic arrangements at these locations. These will vary depending on road ranking and transit method.

In general, motorway and main road crossings are performed by using perforation methods (no trenches), thus minimizing impact on traffic at a crossing. Increasing traffic and nuisance may be caused at locations for boring trenches, where all required construction site infrastructure, vehicles and equipment will be located.

Source: www.vshanabdrilling.com, accessed on: June 2018

Figure 9-39 Example of Construction Site Layout for Horizontal Directional Drilling

Crossings of secondary, tertiary road network, local roads, narrow roads and dirt roads, are generally built using an open cut method. This method requires traffic regulation, walkways, even temporary traffic interruption, until the pipeline is laid and road surface is restored.

Source: (ASPROFOS, 2021)

Figure 9-40 Example of Restoring Road Surface and Traffic immediately after Open cut

For wider roads, this interruption may be partial; traffic will continue, either on free lanes or metal panels placed at the excavation site.

Entry/Exit Traffic at Construction Sites

Permanent construction sites will be established at construction locations of stations. At entry and exit points, increasing traffic will take place; therefore current traffic will be burdened by additional transportation and construction vehicles. Left turns by large vehicles on two-way roads might increase the risk of road accidents. As part of project authorization requirements, relevant traffic studies will be prepared for relevant road management services to authorize corresponding roads. When working on a site safety signage will be installed at the entry-exit node.

In summary, impacts that might affect road network, are the following.

- Traffic disruption (caused by using existing road network or works for road crossings related to the pipeline), including associated nuisance to users during construction. More specifically, road users might experience:
  - Increasing traffic
  - Traffic Delays
  - Traffic regulation, as part of a traffic study
  - Possible increasing accidents
  - Damage to road infrastructure, as heavy vehicle transit may harm asphalt surface layer.

Impact on road network is *Certain* to occur, but its extent is expected to be *Small*. Impact *intensity* is characterized as *Low*. Impact is characterized as of *Short-Time duration* Impact *reversibility* is *Minimizable*. Impact *Cumulative Action* is *Rare*. *Transboundary Character* is not taken into account.

Based on the above and the criteria presented in Section 9.1, **SEI is considered as Minor.**

9.2.8.1.2 Railroad Network

According to project technical design, trenchless crossing methods will be implemented for every crossing including a railroad network. On both sides of railroad line, tunnels will be bored to accomodate underground pipes. During installation, the possible induced subsidence will be monitored in order to remain within permissible limits. Tunnels are expected to be restored within a short period of time after installation is completed.

If required by the Greek Railways Organization (OSE SA) during underground drilling train service might be halted for a limited period of time and in accordance with safety regulations.

In any case, authorization requires a passage permit to be obtained by the Railway Operator (OSE SA) for each crossing.

In summary, the impacts that may affect railroad network, are the following.

- Potential subsidence of existing railway line, due to trenchless method applied.
- Interrupting train service during construction works when deemed necessary, according to design schedule.

Impact on railway network is *Likely* to occur, but its extent is expected to be *Small*. Impact *Intensity* is characterized as *Low*. Impact is characterized of *short-term Duration*. Impact is *Reversible*. Impact *Cumulative Action* is *Rare*. *Transboundary Character* is not taken into account.

Based on the above and the criteria presented in Section 9.1, **SEI is considered as Minor**.

9.2.8.1.3 Airport Facilities

Air Transportation for Personnel and Equipment

During pipeline construction, using airport facilities for personnel, technicians, specialists and consultants involved in the Project will be required. Civil airports in the broader region already described in Section 8.8.1 will be used for these needs.

No airports are located within the Study Area boundaries; therefore, no impact is expected in their operations.

Project construction is expected to cause a small temporary increase in air transportation. Impact on air transportation is *Rare* to occur, but its *Extent* is expected to be *Large*. Impact *Intensity* is characterized as *Zero.* Impact is characterized of *short-term duration*. Impact is *Reversible*. Impact *Cumulative Action* is *Rare*. *Transboundary Character* is not taken into account.

Based on the above and the criteria presented in Section 9.1, **SEI is considered as Negligible**.

9.2.8.1.4 Port Facilities, Marine Traffic and Submarine Cables

9.2.8.1.4.1 Nearshore

During construction phase, the following impact is identified:

- Increasing traffic of construction vessels around major ports.

Although ports are not identified in the Study Area (LF2 / LF3), using existing ports in Crete (Heraklion) and Piraeus to transport construction materials towards storage areas is expected (see Section 8.8.1). Potential impact (increased maritime traffic in ports) is considered negligible as the number of ships is small, and duration will be short.

- Marine Vessel Wave Wakes:

As described in Section 8.8.1.2, two fishing shelters are registered adjacent to the Project, one at 900 m from LF2 site and one at 700 m from LF3 site.

During construction phase, potential disturbances may be caused by moving vessels taking part in construction works. In particular, ships carrying out operations and moving along the pipeline will create wakes that may cause pressure over nearby fishing shelters and small fishing boats.

Based on the above, the occurrence of impact on port facilities and nearshore marine traffic is *Rare*, but the impact is expected to be *Large*. Impact *Intensity* is characterized as *Low*. Impact is characterized of *short-term duration*. Impact is *Reversible*. Impact *Cumulative Action* is *Rare*. *Transboundary Character* is not taken into account.

Based on the above and the criteria presented in Section 9.1, **SEI is considered as Negligible**.

9.2.8.1.4.2 Deepwater

During construction phase the following strains on infrastructures are identified:

- Submarine Cable Crossing:

Pipeline systems OSS2/OSS2N and OSS3/OSS3N, as referred in Section 8.8.3, cross three submarine cables.

Construction activities have a potential to damage localised areas of existing infrastructure that will be crossed by pipelines OSS2/OSS2N and OSS3/OSS3N. However, where a pipeline crosses existing infrastructure such as cables, the contractor will agree with installation owners on design according to safety speculations and will implement elaborated design. Cable crossing design will ensure that:

- ➢ Necessary distance and isolation between the pipeline and the cable is maintained
- ➢ Cable operation will not be affected

Therefore, subject to implementing a convened crossing method for cable installation and advance dialogue with relevant authorities regarding potential conflicts, the impact on existing and planned infrastructure is assessed as negligible.

- Increased Traffic on Maritime Transit Corridors:

As presented in Section 8.8.3, the Project crosses a main marine transit corridor and a few of secondary importance (Figure 8-13) mainly in southern Aegean Sea. This is expected to put some strain on maritime traffic. If a safety exclusion zone required during construction works overlaps with a maritime transit corridor, restrictions on navigation will be set inside the overlapping section. As a result:

- ➢ A safety exclusion zone will extend on either side of the pipeline. The extent of this exclusion zone will be defined during subsequent project phases or indicated by relevant authorities and documented in the ESIA,
- ➢ A pipelaying working area and a surrounding safety exclusion zone will move progressively around laying vessel along with pipeline installation activities (rate 3 km/day),

The main maritime transit corridor is approximately a 45-km wide zone.

Based on the above, the occurrence of the impact on deepwater marine traffic and submarine cables is *Rare*, but it is expected to be *Large*. Impact *Intensity* is characterized as *Low*. *Duration* is characterized as <u>*short-term*</u>. Impact is <u>*Reversible*</u>. Impact *Cumulative Action* is <u>*Rare*</u>. *Transboundary Character* is not taken into account.

Based on the above and the criteria presented in Section 9.1, **SEI is considered as Minor**.

9.2.8.2 Environmental Infrastructure Systems

Environmental Infrastructure Systems play an important role in preserving and protecting the natural environment analyzed in section 8.8.2. Below, we analyze potential impact on these infrastructures caused by construction activities for the Project.

Table 9-90 Key Issues for Assessment – Environmental Infrastructure Systems

Impact/Risk Sources	• Wastewater will be generated by the following factors: ➢ Sanitary facilities in construction sites and vessels, ➢ Ballast water from construction ships, • Solid waste is expected from the following sources: ➢ Earthworks ➢ Construction works ➢ Consumables ➢ Offshore pipe laying
Potentially Impacted Resources and Receptors	• Wastewater Treatment Plants • Sanitary Landfill Sites
Special Baseline Conditions that are Potentially Influencing Impacts/Risks	Extensive local network of wastewater treatment plants and landfills
Project Factors that are Potentially Influencing Impacts/Risks	Production of liquid and solid waste during construction
References	Section 8.8.2 describes environmental infrastructure systems within the project area.

Prepared by ASPROFOS, 2022

9.2.8.2.1 Wastewater Treatment

Onshore

During construction phase, as described in Section 6.4.8, wastewater will consist of hydrotest water, “black” and “grey” water, hazardous liquid wastes (e.g. oils, solvents, etc.), run-off water from sealed surfaces and roofs, and cooling water from tunneling machines. Non-hazardous wastewater can be disposed to local WWTPs (presented in Section 8.8.2.1.1). Hazardous wastewater shall be disposed by an Authorized Waste Manager, according to legal provisions.

Offshore

Liquid waste discharge will come from ballast water, bilge water, deck drainage, grey water and sewage water. As described in Section 6.4.8, this shall be treated onboard and discharged into deepwater according to legal provisions (national legislation and MARPOL).

Conclusion

Overall, Impact on wastewater treatment infrastructure is *Certain* to occur and its *Extent* is expected to be *Large*. Impact *intensity* is characterized as *Medium*. Impact *Duration* is characterized as *Short-term*. Impact is *Reversible*. Impact *Cumulative Action* is *Rare*. *Transboundary Character* is not taken

Based on the above and the criteria presented in Section 9.1, **SEI is considered as Minor**.

9.2.8.2.2 Sanitary Landfill Sites

Onshore

Building an onshore pipeline and related stations is going to generate certain amount of waste, e.g. excavation waste, packaging materials, parts, consumables, etc. Non-hazardous waste may be disposed by municipality at landfill sites, in cooperation with competent authority.

Landfills within and near the Study Area will be affected to a limited extent by this pipeline construction.

Project stations will also produce amounts of solid hazardous and non-hazardous waste. Waste will be disposed of in accordance with applicable legislation and according to a specific Waste Management Plan. Non-hazardous waste will be deposited in landfills in the municipalities concerned.

Any hazardous waste produced shall be disposed to certified management bodies as provided by relevant legislation.

Offshore

Waste generated during construction for offshore pipeline sections will come from pipe laying activities. In particular, the following general waste categories are expected:

- Concrete waste includes waste welding flux that is inert
- Metal waste includes mainly metal turnings from pipe bevelling stations,
- General and domestic waste, related to general office and non-hazardous waste including personal protective equipment, domestic waste from dwelling quarters and food waste that was not separated at the source.

Conclusion

Impact on sanitary landfill sites is _Certain_ to occur and its *Extent* is expected to be _Large_. Impact *Intensity* is characterized as _Medium_. *Duration* is characterized as _Short-term_. Impact is _Reversible_. Impact *Cumulative Action* is _Rare_. *Transboundary Character* is not taken into account.

Based on the above and the criteria presented in Section 9.1, **SEI is considered as Minor**.

9.2.8.3 Water, Electricity and Telecommunication Networks

In this section potential impacts on water, electricity and telecommunication networks are examined.

The following table outlines the main sources of impact, potential impacted resources and receptors, as well as factors influencing current conditions and those related to the Project.

Table 9-91 Key Issues for Assessment – Water, Electricity and Telecommunication Networks

Impact/Risk Sources	• Crossings including sewage water, irrigation and telecommunication networks • Crossings including overground or underground telephone networks • Crossing including high-pressure natural gas pipeline
Potentially Impacted Resources and Receptors	• Local residents in case of interruptions in utility networks. • Implication with other natural gas pipelines
Special Baseline Conditions that are Potentially Influencing Impacts/Risks	• Crossing with the DESFA High Pressure Natural Gas Pipeline in Megalopoli broader area • Common route with IGI Poseidon High Pressure Natural Gas Pipeline (Poseidon Pipeline) and ending at the common Compressor Station in Florovouni
Project Factors that are Potentially Influencing Impacts/Risks	Project route has been optimized to avoid crossing renewable energy facilities.
References	Section 8.8.3 analyzes water, electricity and telecommunications networks within the project area.

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9.2.8.3.1 Watering and Irrigation Network

The construction of the pipeline at crossings of sewage water and irrigation networks will cause a temporary disruption to their operation. The ducts in these networks are uncovered and the pipeline is constructed to a sufficient depth from existing network to prevent potential damage.

Impact on watering and irrigation network is *Rare* to occur and its *Extent* is expected to be *Small*. Impact *Intensity* is characterized as *Medium*. *Duration* is characterized as *short-term*. Impact *Reversibility* is *Minimizable*. Impact *Cumulative Action* is *Rare*. *Transboundary Character* is not taken into account.

Based on the above and the criteria presented in Section 9.1, **SEI is considered as Minor**.

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Figure 9-41 shows the Pipeline crossing including existing sewage duct.

9.2.8.3.2 Electricity Transmission System

As previously mentioned, laying the pipeline in parallel to the high voltage grid must be avoided so as not to affect the downstream protection system for the pipeline. No impact from pipeline construction is expected.

9.2.8.3.3 Telecommunication Networks

Construction works are not expected to cause any damage to overground or underground telecommunication networks, unless accident failure is caused by incorrect calculations and registering for existing networks. In case of damage, it shall be properly restored by the contractor.

Impact on telecommunication networks is *Rare* to occur and its *Extent* is expected to be *Small*. Impact *Intensity* is characterized as *Medium*. *Duration* is characterized as *short-term*. Impact *Reversibility* is *Minimizable*. Impact *Cumulative Action* is *Rare*. *Transboundary Character* is not taken into account.

Based on the above and the criteria presented in Section 9.1, SEI is considered as Minor.

9.2.8.3.4 Renewable Energy Sources

As analyzed in Section 8.8.3, renewable energy infrastructure operates within the Study Area in various locations. The pipeline may pass through wind farms and in close proximity to photovoltaic stations and biomass units, without hampering their operation, since relevant parameters will be taken into account when designing in detail pipeline downstream protection. Near the pipeline strip, dust generation may impact photovoltaic stations. In these cases, temporary reduction of energy production is considered.

Impact on renewable energy sources is *Rare* to occur, and its *Extent* is expected to be *Small*. The Impact *Intensity* is characterized as *Low*. *Duration* is characterized as *short-term*. Impact is characterized as *Reversible*. Impact *Cumulative Action* is *Rare*. *Transboundary Character* is not taken into account.

Based on the above and the criteria presented in Section 9.1, SEI is considered as Negligible.

9.2.8.3.5 High Pressure Natural Gas Pipelines

As mentioned in Section 8.8.1.1.5, Megalopoli Branch crosses the DESFA High Pressure Natural Gas Pipeline “Ag. Theodori Public Power Corporation's Plant (PPC) at Megalopoli”.

New pipeline installation takes place in accordance with safety rules, thus maintaining required clearances between both pipelines. If required by applicable standards, a steel casing or reinforced concrete slabs shall be laid for protection.

In conclusion, no impact on operation of existing high pressure pipelines during construction activities is expected.

9.2.8.3.6 Water Abstraction Points

As analysed in Section 1.8.3.1.5 no water abstraction points are located within CS land plots, and only six (6) abstraction points (boreholes) are located within the working strip. In these cases, construction works may cause temporary water supply interruption.

Impact on water abstraction points is <u>*Rare*</u> to occur and its *Extent* is expected to be <u>*Small*</u>. Impact *Intensity* is characterized as <u>*Medium*</u>. *Duration* is characterized as <u>*short-term*</u>. Impact *Reversibility* is <u>*Minimizable*</u>. Impact *Cumulative Action* is <u>*Rare*</u>. *Transboundary Character* is not taken into account.

Based on the above and the criteria presented in Section 9.1, SEI is considered as Minor.

9.2.8.4 Impact Summary on Technical Infrastructures

Table 9-92 Summary of Impacts for Technical Infrastructure during Construction Phase

S/N SEI			SEI for	Technical Infrastructure							
Project phase	Construction										
Impact	Mechanism	Locations	Criteria/ Impact Properties							SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Road Network											
• Increasing traffic • Traffic delays • Traffic regulation • Increase in accident probability • Damage to road infrastructure	• Use of construction vehicles • Construction of pipeline crossings including national roads • Entry/exit traffic at construction sites	• Existing road network • Entry/exit traffic at construction sites	1.00	0.25	0.25	0.25	0.75	0.25	0.00	3.93 (Minor)	
Railway Network											

S/N SEI			SEI for	Technical Infrastructure							
Project phase	Construction										
Impact	Mechanism	Locations	Criteria/ Impact Properties							SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
• Subsidence • Train service interruption	• Trenchless crossing method • Safety regulations	Crossing including railway network	0.50	0.25	0.25	0.25	0.50	0.25	0.00	2.86 (Minor)	
Airport Facilities											
Potential small increase in air transportation	Use of airport facilities to transport expert personnel	Local airports	0.25	0.50	0.00	0.25	0.50	0.25	0.00	2.50 (Negligible)	
Port Facilities, Marine Traffic and Submarine Cables											
• Potential Damage to existing infrastructure • Disturbance to vessels and fishing shelters	• Increased construction vessel traffic around major ports • Marine Vessel Wakes	• Local ports • Offshore route	0.25	0.50	0.25	0.25	0.50	0.25	0.25	3.21 (Minor)	

S/N SEI			SEI for	Technical Infrastructure							
Project phase	Construction										
Impact	Mechanism	Locations	Criteria/ Impact Properties							SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
	• Increasing Traffic on Maritime Transit Corridors										
Wastewater Treatment											
Increasing wastewater for disposal in WWTPs	• Hygiene installations in construction sites • Ballast water	• Construction sites • Construction vessels	1.00	0.50	0.50	0.25	0.50	0.25	0.00	4.90 (Minor)	
Sanitary Landfill Sites											
Increased solid waste for disposal in landfills	Construction activities	Onshore and offshore section	1.00	0.50	0.50	0.25	0.50	0.25	0.00	4.29 (Minor)	
Watering & Irrigation Network											

S/N SEI			SEI for	Technical Infrastructure						
Project phase	Construction									
Impact	Mechanism	Locations	Criteria/ Impact Properties						SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Potential damage to the network	Crossing including watering and irrigation network	Onshore section	0.25	0.25	0.50	0.25	0.75	0.25	0.00	3.21 (Minor)	
Telecommunication Networks											
Potential disruption of the network	Construction works	Communication lines within working strip	0.25	0.25	0.50	0.25	0.75	0.25	0.00	3.21 (Minor)	
Renewable Energy Sources											
Temporary reduction of energy production in photovoltaics	Dust emission byconstruction works	Photovoltaic stations close to working strip	0.25	0.25	0.25	0.25	0.50	0.25	0.00	2.19 (Negligible)	
Water Abstraction Points											
Temporary water supply interruption	Construction works	Water abstraction points within working strip	0.25	0.25	0.50	0.25	0.75	0.25	0.00	3.21 (Minor)	

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9.2.9 Correlation to man-made pressures on the environment

9.2.9.1 Methodology Overview

Man-made pressures on the environment in the wider Project area have been recorded in Section 8.9 and can be categorized in the following sub-categories:

- Sources of Pollution or other Pressures on the Environment; and
- Exploitation of Natural Resources.

In short, the main source of impacts from the Project, is the clearance of vegetation of the project zone per each project phase for the onshore part and the exclusion zone for the offshore project's section respectively, as described in more detail in the following paragraphs.

As far as the offshore section, during the pipe-lay process, a navigational Safety Exclusion Zone will be agreed with the relevant maritime authorities who will, in turn, ensure that it is communicated to vessels in passage in the vicinity of the pipe-lay vessel. The pipe-lay vessel will be equipped with navigation lights, radar and radio communications. Due to the construction spread advancing along the pipeline route as the pipe is laid, regular consultation will be undertaken by the contractor with the appropriate marine authorities to inform them of the location of the construction spread. The marine authorities will then be responsible for informing marine traffic of the location of the pipe-laying activities and the position of the associated navigational Safety Exclusion Zone. This zone it is assumed that will cause a temporary nuisance to the fishing / shipping activities.

The working zone for each shore crossing, it is assumed to cause a temporary nuisance to the fishing/ shipping activities per each site.

Onshore section construction includes preparation of the working zone (working strip and temporary facilities such as pipeyards etc) and erection of the permanent and temporary facilities (eg project's station and construction sites). As discussed in Section 6.3.2.3 and presented in Table 6.11, the width of the working strip for construction of pipelines with ND 48'' and 46'' can be reduced to 22 m in forest and mountainous areas where there is usually no need for topsoil storage and to 28 m in areas with permanent plantations (with topsoil stripping), whilst for pipelines with ND 16'' the regular working strip (in open country and agricultural areas planted with annual crops) is 20 m which is reduced to 14 m in areas planted by permanent plantations and without topsoil stripping (forest areas). Clearing the working zone at construction phase will cause a temporary loss of vegetation and agricultural production that will need a proper restoration.

Table 9-93 presents the key sources (or mechanisms) of impact, the potentially impacted resources and (sensitive) receptors, the baseline and Project influencing factors associated with the Project on the characteristics of the man made pressures.

Table 9-93 Key Considerations for Assessment – Man made pressure Characteristics.

Sources of Impact/ Risk	• Industrial areas • Fishing activities: ➢ Rrestriction of fishing • Quarries of Aggregates: ➢ Transportation of aggregates • Deforestation of forest Areas: ➢ Vegetation clearance and formation of working zone • Water Resources: ➢ Rivers and watercourses crossings ➢ Water intake / discharge for hydraulic testing • Agricultural Crops: ➢ Loss of agricultural resources
Potentially Impacted Resources and Receptors	• For fishing activities the recipients are: ➢ The fishermen mainly at landfalls sites ➢ Fishermen at areas OSS3, OSS4 , OSS2 as referred to in subsection 8.9 • For quarries of aggregates the recipients are: ➢ The quarries along the route • For deforestation of forest areas the recipients are: ➢ The natural environment due to the forest vegetation clearance • For water resources the recipients are: ➢ The quality and quantity of water resources • For agricultural crops the recipients are: ➢ The land owners
Particular Baseline Conditions that are Potentially Influencing Impacts/Risks	• Characteristics of sensitive receptors (olive trees, vineyards etc.) • Statutory protection of affected areas (eg Natura sites)
Project Factors that are Potentially Influencing Impacts/Risks	• The following factors of the project correlate with the industrial areas: ➢ The vicinity with PPC installation • The following factors of the project correlate with the fishing activities: ➢ The extended construction schedule at landfalls locations • The following factors of the project correlate with the quarries of aggregates: ➢ The big quantity of aggregates consumed for the project • The following factors of the project correlate with the deforestation of forest areas: ➢ Width of Safety Exclusion Zone ➢ Vegetation clearance and formation of working zone ➢ Erection of temporary or permanent facilities; ➢ Reinstatement activities of trench, working strip and temporary facilities plots.

	➢ Location of project's construction supporting temporary facilities (pipeyards, construction sites) ➢ Construction schedule (duration and season/ timing) • The following factors of the project correlate with the water resources: ➢ The number of river crossings ➢ The quantity of water intake / discharge for hydraulic testing • The following factors of the project enhance the agricultural crops: ➢ Width of Safety Exclusion Zone ➢ Vegetation clearance and formation of working zone ➢ Erection of temporary or permanent facilities; ➢ Location of project's construction supporting temporary facilities (pipeyards, construction sites) ➢ Construction schedule (duration and season/ timing)
References	• Baseline is provided in Section 8.9 • Mitigation Measures are provided in Section 10.9

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9.2.9.2 Sources of Pollution or other Pressures on the Environment

9.2.9.2.1 Industrial Areas

In the wider region of the Project, organized reception areas of industrial companies have been avoided during routing survey thus only industrial / commercial zones of smooth operation can be found within the Study Area.

Table 9-94 presents the impacts from the industrial areas of the EastMed Pipeline Project, including the impact, inducing mechanism and potential receptors/resources.

Table 9-94 Impacts from industrial areas- Impact mechanism-Potential receptors/resources during the Construction Phase

Impact	Impact mechanisms	Potential receptors / resources
• Ambient air pollution and greenhouses emissions • Potential Release of pollutants into water or soil • Waste Generation • Energy use	• Type of operation • Industry location • Fuel consumption	Population, Ambient air, Water resources, Soil in the vicinity of the facilities.

Prepared by ASPROFOS, 2022

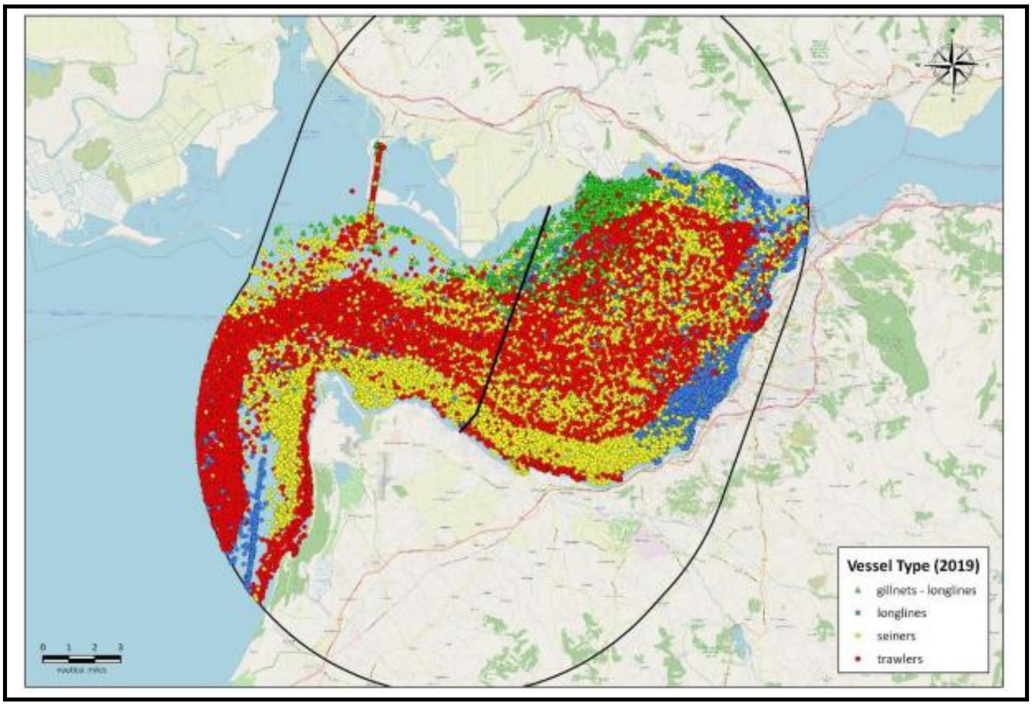
Affected Recipient Resources

On the one hand, the extremely reduced percentage of occupied area within the understudy project's region and on the other hand the smooth operation of the identified small industries, minimize to zero nuisance to the environment and the sensitive receptors.

The mechanisms and impacting parameters and the Affected Receptors are analyzed in sections 9.2.2 and 9.2.13.

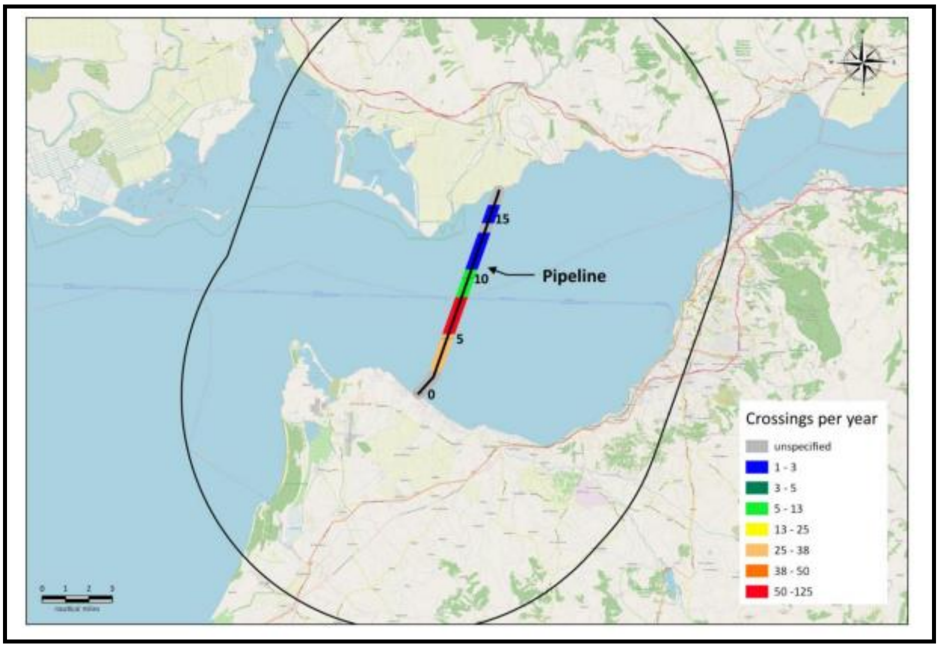
9.2.9.2.2 Fishing Activities

Based on the Fishing Study (E780_00225-Cv10A-TDR-00028_2, IFU, 26-04-2021), trawlers activity is quite dense close to the landfalls of the pipeline and at the segments between 0-10 km along OSS4 and 140-200 km along OSS3.



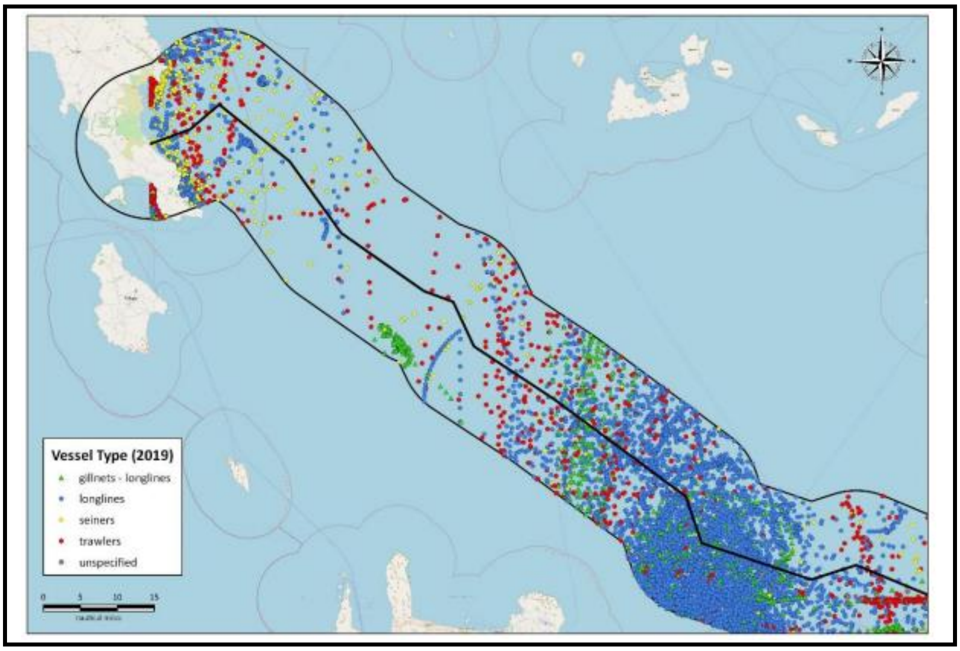
Source: E780_00225-Cv10A-TDR-00028_2, IFU, (Project FEED) 26-04-2021

Figure 9-42 Overview of Greek VMS fishing data_OSS4.



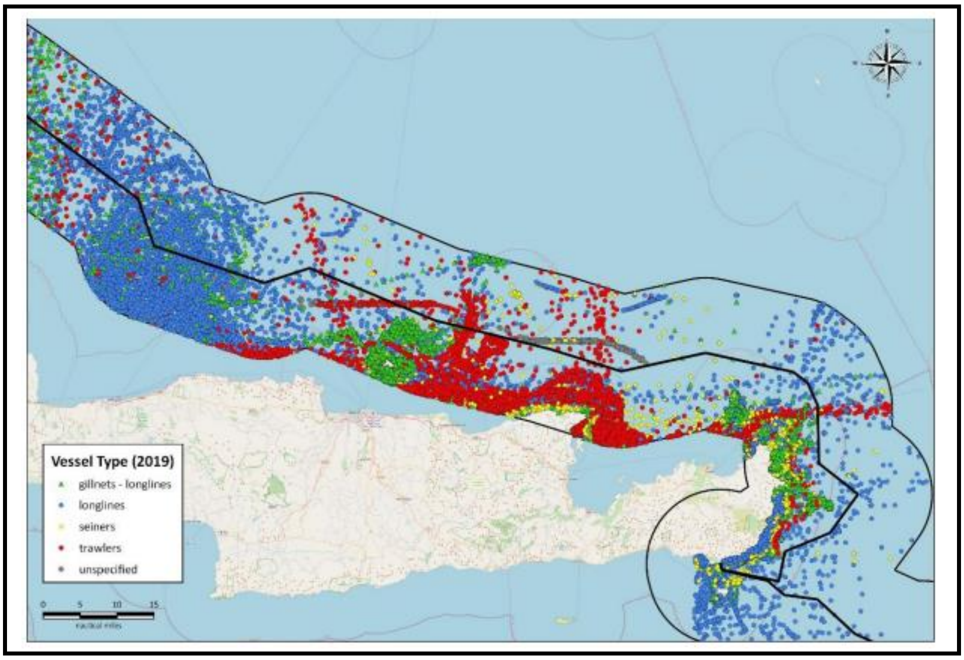
Source: E780_00225-Cv10A-TDR-00028_2, IFU, (Project FEED) 26-04-2021

Figure 9-43 Demersal trawler activity along OSS4.



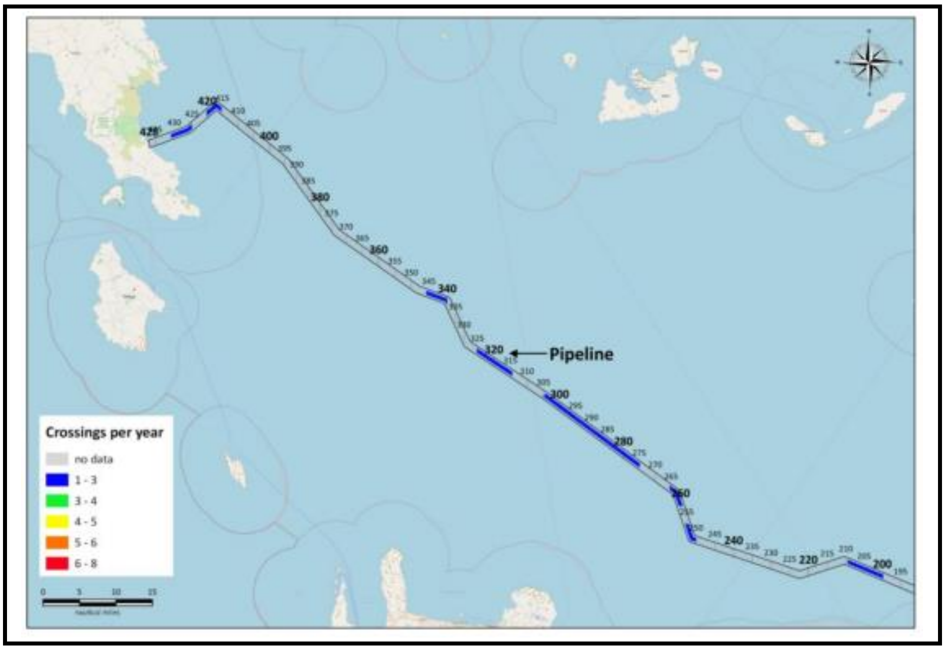
Source: E780_00225-Cv10A-TDR-00028_2, IFU, (Project FEED) 26-04-2021

Figure 9-44 Overview of Greek VMS fishing data_OSS3 (western part).



Source: E780_00225-Cv10A-TDR-00028_2, IFU, (Project FEED) 26-04-2021

Figure 9-45 Overview of Greek VMS fishing data_OSS3 (eastern part).

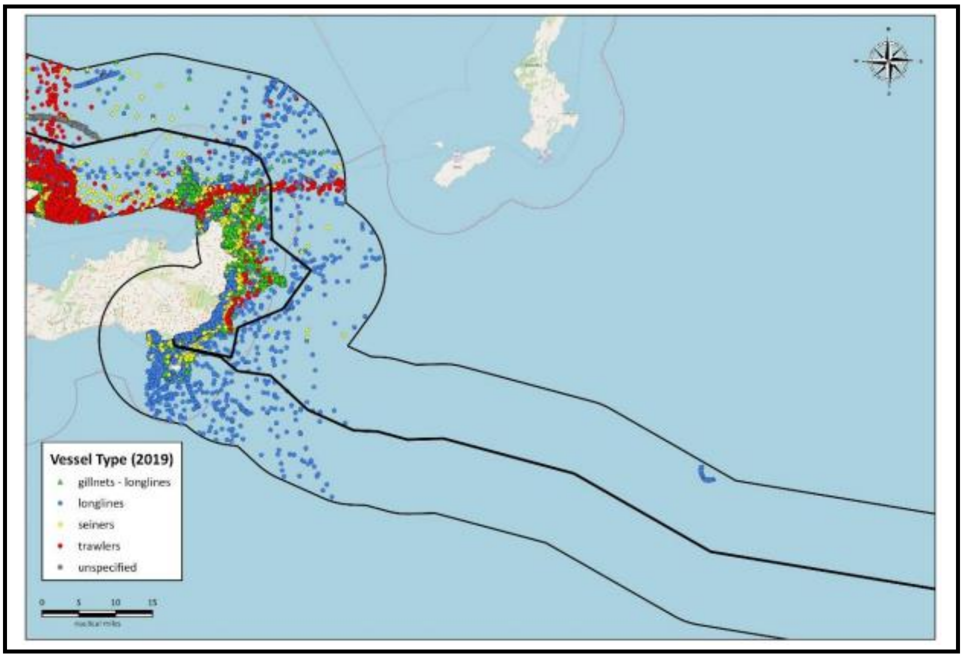


Source: E780_00225-Cv10A-TDR-00028_2, IFU, (Project FEED) 26-04-2021

Figure 9-46 Demersal trawler activity along OSS3 (western part).

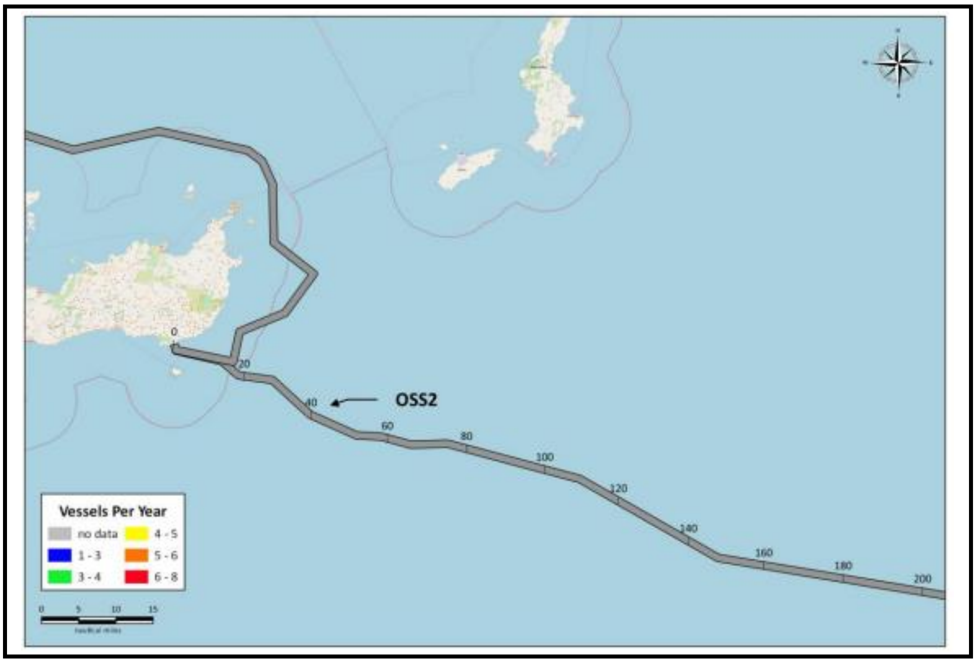
Source: E780_00225-Cv10A-TDR-00028_2, IFU, (Project FEED) 26-04-2021

Figure 9-47 Demersal trawler activity along OSS3 (eastern part)



Source: E780_00225-Cv10A-TDR-00028_2, IFU, (Project FEED) 26-04-2021

Figure 9-48 Overview of Greek VMS fishing data_OSS2



Source: E780_00225-Cv10A-TDR-00028_2, IFU, (Project FEED) 26-04-2021

Figure 9-49 Demersal trawler activity along OSS2

The mechanisms and impacting parameters and the Affected Receptors are analyzed in sections 9.2.7 and 9.3.7.

9.2.9.3 Exploitation of Natural Resources

9.2.9.3.1 Quarries of Aggregates

For backfilling works, suitable aggregates could be supplied from nearby quarry sites. Furthermore, the Construction Contractor, will manage the potential surplus of excavation materials in compliance with the national regulations.

Table 9-95 presents the impacts [39]on quarries and aggregates along the EastMed Pipeline route, including the impact, inducing mechanism and potential receptors/resources.

[39] It is noted that additional impacts such as depleting/reduction of quarry resources, quarries restrictions to serve other projects, the affecting area by the deposition of discarded material as well as the case of filling up an existing dumpsite are beyond ESIA purposed due to lack of current design data and these will be part of another study.

Table 9-95 Impacts on quarries and aggregates – Impact mechanism – Potential receptors / resources during the Cosntruction Phase

Impact	Impact mechanisms	Potential receptors / resources
• Potential need of large amount of aggregates, suitable for backfilling works. • Potential discard of excavation materials, unsuitable for backfilling works.	• Backfilling works of the pipeline trench • Earthmoving works along the working zone.	The quarries along the pipeline route

Prepared by ASPROFOS, 2022

Affected Recipient Resources

The affected recipients from potential need and/or discard of aggregates are the quarries along the route.

The *Likelihood* of the occurrence of large number of quarries and large amount of aggregates is <u>*certain*</u>, The *Extent* of impact will present <u>*peripheral*</u> (greater distance from 3000 m from Project or resource footprint). The *Intensity* of the impact on sensitive recipients is expected to be <u>*medium*</u>. The *Duration* of the impact is expected throughout the construction period of the Project, that is about 1- 3 years, so according to the proposed methodology it is characterized <u>*mid-term*</u>. The possibility of dealing with the impact (*Reversibility* of the impact) is considered possible and <u>*minimized.*</u> The *Cumulative Action* of the impact is <u>*probable*</u> as a number of parameters acts to the quantity of aggregates . The *Transboundary Character* is <u>*impossible.*</u>

9.2.9.3.2 Deforestation of forest areas

While designing the pipeline, it was ensured that the shortest possible routing through forest areas was selected in order to minimize the impact on forest ecosystems.

During the construction phase, the work zone is going to be completely cleared of vegetation, that will be more pronounced in those Regional Units where the total forest and semi-forest areas make up a large percentage of the study area, more than 50%, i.e. RU Lasithi (67.34% / 7.39 km^2), RU Messinia (95.87% / 0.45 km^2), RU Arkadia (58.60% / 67.92 km^2), RU Thesprotia (52.75% / 30.44 km^2), as analyzed in Section 8.9.2.2

The mechanisms and impacting parameters and the Affected Receptors are analyzed in sections 9.2.4 and 9.3.4.

9.2.9.3.3 Water Resources

During the construction phase and before operation, rivers will be impacted by means of two impact mechanisms:

- The pipeline passing through crossings with rivers and watercourses; and
- Water intake / discharge for hydraulic testing.

These impacts will be temporary and are not expected to affect the characteristics and productivity of these resources.

9.2.9.3.3.1 Passage through Crossings with Rivers

As regards the pipeline passing through crossings, the magnitude of these impacts will depend on the way of passage. Where tunneling methods are followed, impacts are minimized because the passage is underground and the river flow and existing bed are not affected, not even to a minimum.

The crossings with each river and the passage method are shown in the related tables in section 6. The nuisance caused to each river at the crossing depends on the passage method.

Trenchless passage methods include horizontal directional drilling (HDD), direct pipe and boring without casing. HDD is generally applied in case of large rivers with uninterrupted supply throughout the year. Geotechnical surveys need to be carried out during the study to confirm that the ground is suitable for drilling.

Normally, HDD is a stable and maintenance-free method for a pipeline-water body crossing with minimal or no nuisance at all to the stream bed or river bed. However, if drilling fluids are to be used for HDD, there is a risk of leakage and consequent impacts to the surface and groundwater.

On the other hand, if open cut is to be used, the river needs to be diverted temporarily causing temporary nuisance to the local ecosystem during construction.

The mechanisms and impacting parameters when passing through the water courses are analyzed in section 9.2.13.

However, the passage of the pipeline through rivers will not cause any long-term alteration of their characteristics, therefore these impacts are considered to insignificant for these natural resources.

9.2.9.3.3.2 Water intake / discharge for hydraulic testing

As part of hydraulic test, a quantity of water from nearby water bodies is used in various parts of the pipeline to check the pipeline under pressure and to purge it from foreign bodies (material residue, parts, etc.). To use of water, it is necessary to obtain a permit by the competent authority. Table 6-57 shows the water requirements for hydrotest sections including the quantities of water expected to be required.

Since the quantities of water required are rather large, it is expected that nuisance will be caused to the river ecosystem, which will be of limited duration for as long as the testing takes place. In any cases appropriate measures will be taken to reduce the impact.

The mechanisms and impacting parameters during hydraulic testing are analyzed in Sections 9.2.13 & 9.2.5.

9.2.9.3.4 Agricultural Crops

Using the CORINE Land Cover program, only RU Arta has emerged where more than 70% of the study area is occupied by agricultural land, as analyzed in Section 8.9.2.4.

As discussed in Section 6.3.2.3 and presented in Table 6.11, the width of the working strip for construction of pipelines with ND 48’’ and 46’’ can be reduced to 28 m in areas with permanent plantations (with topsoil stripping), whilst for pipelines with ND 16’’ the regular working strip (in open country and agricultural areas planted with annual crops) is 20 m.

In addition, the construction of the pipeline may affect temporary the productivity of the land. This can be caused by soil cutting after the pipeline has been laid. For this reason, when it comes to agricultural land, the topsoil is placed separately from the excavation and then laid back on the surface when backfilling the trench/tunnel (see also figures 6.11 and 6.12).

The mechanisms and impacting parameters and the Affected Receptors are analyzed in sections 9.2.7 and 9.3.7.

9.2.9.4 Summary

Although, the construction and commissioning of the pipeline causes temporary nuisance to local environmental resources, it is estimated that it will not lead to resource depletion or an increase in man-made pressures in the wider project area. Thus, based on the above and on the criteria presented in the Section 9.1, for correlation to man-made pressures on the environments during the construction of the project is considered as **Moderate**.

Table 9-96 Summary of impacts to man-made pressures during Construction Phase.

S/N SEI			SEI for	Man-made Pressures							
Project stage	Operation										
Impact	Mechanism	Locations	Criteria/ Impact Properties							SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Quarries of aggregates											
Potential need and/or discard of aggregates	Earthmoving works along the working zone. (e.g. backfilling)	Quarries along the pipeline route	1.00	1.00	0.50	0.50	0.75	0.75	0.00	6.43 (Moderate)	

9.2.10 Air Quality

9.2.10.1 Methodology Overview

This section assesses and evaluates the possible effects on air quality resulting from the Project's activities for the construction of the pipeline and associated facilities.

The following table outlines the main sources of impact, potential impacted resources and recipients as well as the factors influencing the current situation and those related to the Project.

Table 9-97 Key Issues for assessment – Air Quality

Sources of Impact/ Risk	Use of IC engines (internal combustion engines) for earthmoving activities, excavation works, vehicle and ship traffic causes a temporary increase in dust and air pollutant emissions (NOx, PM_{10}, SO_2, VOCs, CO, HAPS). Equipment used for pre-commissioning activities
Potentially Impacted Resources and Receptors	• Local communities along the route and along transport routes. More specifically there are 8 settlements at a distance to 50 m on either side of the pipeline axis (4 settlements at Section CCS1 and 4 settlements at Section CCS2). • Local communities near CSs, MS4/PRS - Heating Station and O&M • Natural Environment • LF2 and LF5 where pre-commissioning activities will take place.
Special Baseline Conditions that Potentially Influence Impacts/Risks	The PPC plant in Atherinolakkos is close to the CS2/MS2-CS2/MS2N facilities.
Project Factors that Potentially Influence Impacts/Risks	Project Compressor Stations (CS2/MS2-CS2/MS2N, CS3) for onshore section, and vessels used for inspecting for offshore pipeline
References	• Chapter 6 analyses the amount of CO2 emissions. • Chapter 8.10 present the Air Quality baseline. • In Section 9.2.1 Associated climatic and bioclimatic impacts are analysed where CO2 emissions of the Project are described. • Annex 9F1 “Air dispersion model from pre-commissioning activities at location LF2” and • Annex 9F2 “Air dispersion model from pre-commissioning activities at location LF5”

Prepared by: ASPROFOS, 2022

In the following paragraphs, potential impacts from the construction of the Project are described and assessed.

9.2.10.2 Dust Emissions

During Construction, temporary dust emissions to the atmosphere are created.

Dust emissions are generated by the following activities:

- From the earthmoving activities at the work zone along the route of the pipeline and the access routes;
- From the excavation works along the pipeline route. The effects on air quality along the pipeline route will only last for few days in an area, and will depend on the pipeline's construction progress;
- Powdering and grinding of surfaces caused by trucks carrying soil and materials;
- From transport, dispersion of dust particles from uncoated surfaces due to wind;
- Involuntary sludge transport by the truck wheels that produces dust when dry; and
- Dust emissions by vessel machines.

Important dust-generating activities are the building the Stations, the Operation and Maintenance Base, the MS4/PRS4 - Heating station and the pipeline installation at landfalls. Dust emissions during the dry months in the summer are expected to be higher than the rest of the year.

Table 9-98 shows the potential impact, the causing mechanisms and potentially affected receptors.

Table 9-98 Temporary increase in dust emissions - Impact mechanisms, potentially affected receptors during construction phase

Possible Impact	Impacts Generating Mechanisms	Potentially affected resources / recipients
Temporary increase of dust emissions	• Earthmoving activities; • Excavation works; and • Vehicle and ship traffic.	• Local communities along the pipeline route. More specifically there are 8 settlements at a distance to 50m on either side of the pipeline axis. (4 settlements at Section CCS1 and 4 settlements at Section CCS2); • Local communities near CSs, MS4/PRS, Heating Station and O&M; and • Natural Environment.

Prepared by: ASPROFOS, 2022

9.2.10.3 Exhaust emissions

During construction activities the air quality may be affected by the release of exhaust emissions from internal combustion engines along the pipeline route, both in onshore and offshore locations. It must be noted, however, that the vehicles' emissions, ships' emissions, the main compressors, and other facilities items will not take place at a single location but they will be spread and as a result they will be locally limited and temporary. The exhaust emissions originating from the use of vehicles, equipments of ships and vessels and related to the construction may be considered similar to those of high traffic or municipal roads. Exhaust emissions NOx CO and PM10 also originating, from the equipment used for pre-commissioning activities. Specifically in Landfall 2(LF2) a pre-commissioning test will be performed for the OSS2, OSS2N, OSS3 and OSS3N pipelines. The tests will be performed serially for the 4 pipelines and the emission data are the same for the 4 pipelines. The difference is found in the duration of the tests where for OSS2 and OSS2N pipelines it takes 15 days each, while for OSSS3 and OSS3N pipelines it takes 8 days each. in Landfall 5(LF5) a pre-commissioning test will be performed for the OSS4 pipeline. The duration of the pre-commissioning test estimated at 15 days. For emissions from pre-commissioning activities air dispersion models are prepared. From the air dispersion models derives that, no exceedances of the NOx CO and PM10 respective air quality limits occur over the populated areas within an approximate distance of 20 km from LF2 and LF5 respectively. In fact, the maximum concentrations and hourly NOx, maximum 8-h mean CO and Maximum daily (mean) PM10 concentrations are found to be very low compared to the legislative limits (2008/50/EC). More details are presented at Annex 9F1 and Annex 9F2.

The following Table 9-99 shows the potential impact, the causing mechanisms and potentially affected receptors.

Table 9-99 Temporary increase in exhaust gas (NOx, PM10,SO_2,VOCs,CO,CO_2, HAPS) - Impact mechanisms, potentially affected receptors during construction phase

Possible Impact	Impacts Generating Mechanisms	Potentially affected resources / recipients
Temporary exhaust emissions to the atmosphere (NOx, PM2.5, SO_2,VOCs,CO, HAPS)	Use of excavators, dozers, trucks, cars, vessels and ships	• Local communities along the pipeline route and transport routes. More specifically there are 8 settlements at a distance to 50m on either side of the pipeline axis. (4 settlements at Section CCS1 and 4 settlements at Section CCS2); • Local communities near CS/MSs, MS4/PRS, Heating Station and O&M; and • Natural Environment.
Temporary exhaust emissions to the atmosphere (NOx, PM10, CO)	Precommissioning activities	• Local communities near LF2, LF5

Prepared by: ASPROFOS, 2022

9.2.10.4 Calculation of SEI

- *Local* communities *along the pipeline route and transport routes*

It should be noted that vehicle and ship emissions are distributed along the overall route/footprint of the Project and will be locally limited and temporary. Exhaust emissions from the use of vehicles and ships associated with construction are considered to resemble those of normal vehicle traffic on municipal roads and ship traffic. During the construction phase of offshore pipelines, 1,294 tn NO_2 will be produced (SAIPEM,2021) (NO_2 annual emissions for Greece for the year 2020 according to the National Air Pollution Control Program are 203,000 tn NO_2).

Emissions from construction works will be temporary, continuously moving along the working zone and the road network, at least during pipeline construction. The number of machines will be lower for the construction of permanent stations. In any case, all equipment used shall be certified according to European standards.

Regarding emissions of vehicles in urban areas (e.g. Patras) generated by the transport of pipes and other equipment, the effects are very limited and temporary. In this case the emissions are also diffuse, local and temporary.

For the purpose of this study, it is considered that the residents and settlements within the Study Area (that includes the 1 km buffer zone around the pipeline route, as defined in Section 8.1) will endure a temporary disturbance during the construction phase due to exhaust emissions and dust particles.

Table 9-100 Communities within the Study Area (1 km on Each Side of the Pipeline Route)

Region	Regional Unit	Municipality	Settlement
Crete	Lasithi	Sitia	Goudouras, Asprolithos, Agia Triada
Peloponnese	Laconia	Monemvasia	Agios Fokas, Kastela, Agios Stefanos, Xifias, Argiteika-Foutia-Agia Sofia, Elliniko, Lira, Teria, Agios Nikolaos, Velies, Kryovrysi, Sykea, Metamorfosi, Molaoi
		Evrotas	Apidea, Gouves, Geraki
		Sparti	Agioi Anargyroi, Gkoritsa, Kokkinorrachi, Kladas, Karavas Soustianon, Karavas Loggastras, Pardali, Pellana, Agios Konstantinos, Fountaiika, Longanikos, Kyparissi

Region	Regional Unit	Municipality	Settlement
	Arcadia	Megalopoli	Petrina, Soulari, Potamia, Kalyvia, Leontari, Gavria, Kotsiridi, Veligosti, Voutsaras, Routsi, Kamaritsa, Tripotamos, Neochori, Chrousa, Petrovouni, Kato Karyes, Isoma Karyon, Gefyra, Vrysoules, Perivolia, Kato Makrysi, Megalopoli, Kyparissia, Mavria, Karitaina, Stroggylo
		Gortynia	Chania, Tripotamia
Western Greece	Ilia	Andritsaina - Krestena	Rovia, Thisoa, Karmio, Andritsaina, Miloi, Sikies, Helidoni, Alifeira, Peuki, Agios Ilias
		Archaia Olympia	Aspra Spitia, Vasilaki, Xirokampos, Ampari, Kampos Nemoutas, Nemouta, Tsapareika, Achladini, Koutsouroumpas, Nea Persaina
		Pyrgos	Pefki, Ag. Anna, Goumero, Varbarina, Mouzaki
		Ilida	Akropotamia, Laganas, Kalo Paidi, Simopoulo, Mazaraki, Valmi, Agrapidohori
		Andravida - Kyllini	Kalyvakia, Xenies
	Achaia	Dytiki Achaia	Kato Velitses, Ano Velitses, Psefteika, Kandalos, Michoiko, Lakkopetra G', Ioniki Akti, Portes, Pournari, Myrtos, Karamesineika, Kareika, Gomoston, Kalamaki, Limnochori, Kalamaki Beach, Petrochori, Lampraiika, Veskoukaiika, Nikiforeika
	Aetoloakarnania	Nafpaktia	Kryoneri, Galatas, Paliostani, Perithori
		Iera Poli Mesologgiou	Mpampakoulia, Evinochori, Kokori, Koutsocheri
		Agrinio	Gavalou, Grammatikou, Agia Marina, Mataraga, Papadates, Kato Kerasovo, Kato Zevgaraki, Mpouzio, Lefka, Platanos, Kalivia, Ochthia, Stratos, Kypseli, Lepenou
		Amfilochia	Kanalos, Varetada, Megas Kampos, Ampelaki, Xirolivado, Tsoukka, Psila Alonia, Triantafylloula, Agia Trias, Elatochori, Lagkada, Kastriotissa, Marlesio, Sykoula
Epirus	Arta	Nikolaos Skoufas	Sykies, Peranthi, Neochori, Pachykalamos, Akropotamia, Kalomodia
		Arta	Psathotopi, Gavria, Aneza, Kalogeriko, Polydroso, Rachi, Strongyli, Vathipedo

Region	Regional Unit	Municipality	Settlement
	Preveza	Ziros	Petra
		Preveza	Stefani, Louros, Neos Oropos, Kamarina, Megadendro, Myrsini, Kato Myrsini, Cheimadio
		Parga	Koukkouli, Chochla, Tsouknida, Mesopotamos, Kastri, Stavrochori, Themelo, Koroni, Tzara
	Thesprotia	Igoumenitsa	Eleftheri (Vryses), Spatharaioi, Morfi, Kalodiki, Pyrgi, Margariti, Katavothra, Milokokkia, Palaiokastro, Mesovouni, Mazarakia, Karteri

Prepared by: ASPROFOS, 2022.

- Local communities near CS/MSs, MS4/PRS - Heating Station and O&M

The local communities near CS2/MS2-CS2/MS2N, CS3, MS4/PRS Heating Station and O&M installations are the following:

Table 9-101 Local Communities Near CS2/MS2-CS2/MS2N , CS3, , MS4/PRS Heating Station and O&M

S/N	Communities Near CS2/MS2-CS2/MS2N (distance)	Communities Near CS3	Communities Near , MS4/PRS Heating Station	Communities Near O&M
1	Goudouras (2.6 km)	Portes (3.1 km)	Leontari (1.8 km)	Kalamaki (0.7 km)
2	PPC (0.4 km)	Kato Velitses (3.0 km)	Soulari (0.5 km)	Limnochori (0.6 km)
3	Agia Triada (3.8)	Valmi (0.6 km)	Voutsara (2.0 km)	
4		Kalivakia (2.0 km)		

Prepared by: ASPROFOS, 2022)

It is noted that CS2/MS2-CS2/MS2N is in close proximity (about 400 m) to the power station of the Public Power Corporation (PPC) in Atherinolakkos, therefore dust and exhaust emissions are expected to have a cumulative effect in the area during construction.

Regarding affected recipients “Local communities near CSs, Heating Station and O&M“apply as mentioned in the section “Local communities across the pipeline route”.

- Natural Environment

More data are included in section 9.2.5.

- Local communities near LF2,LF5

From the air dispersion models executed for pre-commissioning phase at LF2 and LF5 locations, derives that , no exceedances of the NOx CO and PM10 respective air quality limits occur over the populated areas within an approximate distance of 20 km from LF2 and LF5 respectively. In fact, the maximum concentrations and hourly NOx, maximum 8-h mean CO and Maximum daily (mean) PM10 concentrationsare found to be very low compared to the legislative limits (2008/50/EC).. More details are presented at Annexes 9F1 and Annex 9F2

- Duration of Impact

The following table shows the duration of construction per Project component. This is the maximum time the nearby settlements will experience disturbance due to dust and exhaust emissions.

Table 9-102 Indicative Duration of Project Construction per Component

Project Component	Duration of Construction
Approx. 838 km offshore pipeline	Approx. 30 months including pipe procurement, pre-lay activities and post-lay activities.
Approx. 5 km nearshore pipeline	Approx. 24 months including construction of landfall sites, pipe yards establishment, preparatory works (preparation of working strip, trenching, etc.), testing, LVS, etc.
Approx. 548 km onshore underground pipeline	Approx. 36 months including construction site and pipe yard establishment, preparatory works (preparation of working strip, trenching, etc.), testing, BVS, etc.
Southern Line Facilities	36 months
Northern Line Facilities	36 months
Pre-Construction Activities	6 months
Construction sites	4 months
Marshalling yards	24 months overlapped with pipeline installation activities
Pre-commissioning	3 months
* For both Southern and Northern Lines: Construction of the two Lines will not be performed simultaneously, except for the shore crossings at LF2 and LF3.	

Source: IGI, 2021

9.2.10.5 Impact Assessment

Based on the above, present the following assessment for both the impacts of dust and exhaust emissions:

The *Likelihood* of the impacts is *certain*. The *Extent* of the impacts is *medium*. The *Intensity* of the impacts on the sensitive receptors of the local communities where the pipeline and its installations passes through and to the natural environment is _low_ if take into account the working time and the quantity emitted. The *Duration* is characterised as _mid-term_ as the construction phase will last approximately three years. *Reversibility* is _reversible_, since the machines will have all the international certificates for their operation. The *Cumulative Action* of the impact is considered _certain_ for LF2 and CS2(the PPC plant in Crete is at a distance of approximately 740 m).

For both the impacts of "Temporary exhaust emissions to the atmosphere (NOx, PM2.5, SO_2, VOCs, CO, HAPS)" and "Temporary increase of dust emissions", the *Transboundary Character* is _rare_ due to the proximity of passing ships in the border sea area of the Project

Based on the above and based on the criteria presented in the section 9.1. For air quality during construction of the Project, the Severity of Impact on the Environment (SEI) is considered to be **Minor.**

For the impact " exhaust emissions derived from pre-commissioning activities", present the following assessment:

The *Likelihood* of the impacts is _certain_. The *Extent* of the impacts is _medium_. The *Intensity* of the impacts on the receptors of the local communities near of LF2 and LF5 is _Low_ if take into account , that the air dispersion model present concentrations very low compared to the legislative limits. The *Duration* is characterised as _short -term_ as the precommissionng phase lasts a total of 3 months. *Reversibility* is _minimisable_, since the machines will have all the international certificates for their operation. The *Cumulative Action* of the impact is considered _certain_ for LF2 and CS2 (the PPC plant in Crete is at a distance of approximately 740 m).

The Transboundary Character for both the impacts is impossible due to the great distance of the LF2 and LF5 from the project sea limit.

Based on the above and based on the criteria presented in the section 9.1. For air quality during construction of the Project, the Severity of Impact on the Environment **(SEI) is considered to be Minor.**

9.2.10.6 Summary

The summary of the impacts on air quality during the construction phase is presented in the following table.

Table 9-103 Summary of Impacts for Air Quality during the Construction Phase

S/N SEI			SEI for	Air Quality							
Project Phase	Construction										
Impact	Mechanism	Locations	Criteria/ Impact Properties							SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Temporary increase of dust emissions	• Use of IC engines (internal combustion engines) • Earthworks • Excavation works • Vehicle and ship traffic	• Local communities across the pipeline route. There are 8 settlements at a distance up to 50 m on either side of the pipeline axis. (4 settlements at Section CCS1 and 4 settlements at Section CCS2) • Local communities near CSs and Heating Station • Natural Environment	1.00	0.25	0.25	0.50	0.50	1.00	0.25	5.00 (Minor)	

S/N SEI			SEI for	Air Quality						
Project Phase	Construction									
Impact	Mechanism	Locations	Criteria/ Impact Properties						SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Temporary exhaust emissions to the atmosphere (NOx, PM2.5, SO2,VOCs,CO, HAPS)	Use of excavators, dozers, trucks, cars, vessels and ships	• Local communities across the pipeline route. There are 8 settlements at a distance up to 50 m on either side of the pipeline axis. (4 settlements at Section CCS1 and 4 settlements at Section CCS2) • Local communities near CSs and Heating Station • Natural Environment	1.00	0.25	0.25	0.50	0.50	1.00	0.25	5.00 (Minor)	

S/N SEI			SEI for	Air Quality						
Project Phase	Construction									
Impact	Mechanism	Locations	Criteria/ Impact Properties						SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Temporary exhaust emissions to the atmosphere (NOx, PM10, CO)	Pre-commissioning activities	Local communities near LF2and LF5	1.00	0.25	0.25	0.25	0.75	1.00	0.00	5.00 (Minor)	

Prepared by: ASPROFOS, 2022.

9.2.11 Acoustic Environment

9.2.11.1 Overview

This section assesses the potential noise impacts at nearby receptors in the onshore study area that may arise from the construction phase of the EastMed Pipeline Project.

Noise impacts on marine and terrestrial fauna species both at construction and pre-commissioning phase are included in Section 9.5 – Natural Environment and the relevant Appropriate Assessments (Annex 9E).

The following Table 9-104 presents the key sources of impact, potentially impacted resources and receptors, baseline and Project influencing factors associated with the Project on the ambient acoustic environment.

Table 9-104 Key Considerations for Assessment –Acoustic Environment (onshore).

Sources of Impact/ Risk	• Construction noise and vibration from equipment and machinery, • Pre-commissioning activities
Potentially Impacted Resources and Receptors	• Nearby settlements and households • Nearby industrial receptors
Special Baseline Conditions that are Potentially Influencing Impacts/Risks	The ambient noise baseline monitoring did not highlight specific criticalities in the study area because the pipeline route crosses mostly agricultural and undeveloped areas.
Project Factors that are Potentially Influencing Impacts/Risks	• Amount and type of machinery in use during the construction phase, • Specific techniques used for pre-commissioning activities • Construction times
References	• Baseline is found in Section 8.11. • Annex 9G: Noise propagation model during pre-commissioning phase ➢ Annex 9G.1: Noise propagation model during pre-commissioning phase for LF2 ➢ Annex 9G.2: Noise propagation model during pre-commissioning phase for LF5

Prepared by ASPROFOS, 2022.

9.2.11.2 Methodology

9.2.11.2.1 Allowed noise limits

In order to assess potential project impacts, both at construction and pre-commissioning phase, an attempt was made to determine the allowed noise limits within the study area of the Project in accordance with National legislation and International Directives.

The Presidential Decree P.D. 1180 defines the allowed noise limits that are emitted to the environment during the operation of the facilities, measured over the border of the estate in which the facility operates.

Regarding legislated industry areas, the maximum noise limit is up to 70 dB(A). In areas where a number of industries are located, the maximum noise level is up to 65 dB(A). In areas where industries and residencies are equally shared, maximum noise level is up to 55 dB(A). In areas where residencies prevail, maximum noise level is up to 50 dB(A). In the area of the project the limit is 65 dB(A).

According to IFC (International Finance Corporation) General EHS Guidelines regarding Noise Management (§ 1.7), noise impacts from the installation should not exceed 55 dB(A) for Daytime (07:00 - 22:00), 45 dB(A) for Nighttime (22:00 - 07:00) or result in a maximum increase in background levels of 3 dB at the nearest receptor location off-site.

Moreover, according to the World Health Organization (WHO, 1999), a noise level of 55 dB (A) during the day is assessed as annoyance.

9.2.11.2.2 Sources of noise

- Noise emissions during construction phase

Noise emissions comes mainly from the operation of site machinery, blasting activities using explosives and the movement of vehicles and machinery to and from the construction site. Analytically, the noise sources as presented in Chapter 6 are as follows:

- Excavation works (preparation of working zone, removal of topsoil layer, trench excavation, use of explosives)
- Preparation of pipeline (bending, sand blasting, welding, lining)
- Pipeline installation
- Pumping Water (Hydrotesting)
- Planting and reinstatement of plant land
- Horizontal drilling headed for perforation
- Preparation of construction sites

- Works foundation / pilings of stations
- General construction works

At this stage, the precise equipments (type, number, size, power, capacity etc.) to be used at each phase of the project is not fully detailed. Figure 9-50 shows the construction steps and estimated noise emissions in LAeq (10m) by the different types of equipment / work per stage according to BS 5228 (Code of practice for noise and vibration control on construction and open sites), based on earlier similar projects.

BS 5228-1:2009+A1:2014

Table F.4 **Example of prediction of noise from stationary plant**

Plant type	$L_{Aeq,T}$ at 10 m	Distance	Adjustments			Resultant $L_{Aeq,T}$	Duration of activity	Duration of activity as percentage of 10 h	Correction to $L_{Aeq(10h)}$	Activity $L_{Aeq(10h)}$
			Distance	Screening	Reflection					
	dB	m	dB	dB	dB	dB	h	%	dB	dB
Step 1	**Step 2**	**Step 3**	**Step 4**	**Step 5**	**Step 6**	**Step 7**	**Step 8**	**Step 8**	**Step 10**	**Step 11**
Excavator	71	25	−8	−5	+3	61	8	80	−1	60
Compressor	65	35	−11	0	+3	57	3	30	−5	52
Breaker	83	35	−11	0	+3	75	3	30	−5	70
Breaker	83	35	−11	0	+3	75	3	30	−5	70

Table F.5 **Example of prediction of noise from mobile plant**

Plant type	Average L_{WA}	Distance	Adjustments			Resultant L_{pA}	Distance ratio	Equivalent on-time	Duration of activity	Correct percentage on-time	Correction to $L_{Aeq(10h)}$	Activity $L_{Aeq(10h)}$
			Distance	Screening	Reflection							
	dB	m	dB	dB	dB	dB			h	%	dB	dB
Step 1	**Step 2**	**Step 3**	**Step 4**	**Step 5**	**Step 6**	**Step 7**	**Step 8**	**Step 9**	**Step 10**	**Step 11**	**Step 12**	**Step 13**
Loader	99	20	−34	0	+3	68	30/20 =1.5	0.5	4	20	−7	61

Preapred by: Asprofos,2022. Data from: British Standard BS 5228 -2009.

Figure 9-50 Phase of construction and noise emissions in LAeq (10m) of various equipment / works according to BS 5228.

- Noise emissions during pre-commissioning phase

Noise emissions comes mainly from the operation of the compressors, pumps and power generator. Table 9-105 and Table 9-106 show the construction steps and estimated noise emissions by the different types of equipment/Methods that are selected to be applied for the pre-commissioning of the EastMed Pipeline Project within the Greek jurisdiction (Chapter 6, Table 6.57)

Table 9-105 SPT Replacement[40] (LF2).

Machinery	Quantity	Noise Level @1m [dB(A)]	Noise Level @7m [dB(A)]	Sound Power Lw [dB(A)]
Primary compressors	27	99.0	92.0	106.9
Boosters	17	103.0	96.0	110.9
MEG Pumps	2	98.0	91.0	105.9
Power Generator	2	101.0	93.0	108.9
Total				125.6

Prepared by: Asprofos, 2022.

Table 9-106 Machinery used in Conventional SPT with the use of water (LF5).

Machinery	Quantity	Noise Level @1m [dB(A)]	Noise Level @7m [dB(A)]	Sound Power Lw [dB(A)]
Primary compressors	11	99.0	92.0	106.9
Lifting pumps	3	98.0	90.0	105.9
Filling pumps	3	98.0	90.0	105.9
High pressure pumps	3	95.0	78.0	102.9
Power Generator	1	101.0	93.0	108.9
Total				116.7

Prepared by: Asprofos, 2022.

9.2.11.2.3 Sensitive recipients identification

- During construction phase

Noise levels are reduced by increasing the distance from the source. In general, doubling the distance from the source will reduce the levels by 6 dB (A). Therefore, supposing that noise measurements are taken at a distance of one meter from the emission source, the noise emitted at 100 dB (A) can be estimated to be perceived as about 53.5 dB (A) in a distance of (200) meters.

Based on the above, it was attempted to identify residential recipients at a distance of 200 meters across the working zone. The selection of sensitive recipients was based on the impact on anthropogenic environment[41].

[40] Replacement of SPT for offshore section, whereby cleaning and gauging will be performed using MEG as medium

[41] Noise impacts on marine and terrestrial fauna species both at construction and pre-commissioning phase are included in section 9.5 – Natural Environment and the relevant Appropriate Assessments (Annex 9E)

Table 9-107 presents the categories of the sensitive receptors concerning the acoustic environment.

Table 9-107 Identified Receptors.

Identified Receptors of Anthropogenic Environment
Nearby settlements and households from working sites
Nearby industrial receptors

Prepared by: Asprofos, 2022.

Due to the nature of the project and its extent, the boundaries of twenty-three (23) settlements (Table 9-108) are located less than two hundred (200) meters from the work zone and may be suffer annoyance.

Table 9-108 Settlements (administrative border) located less than 200 m from working strip.

Settlement	EastMed Pipeline Section	Regional Unit	Distance (m)	Population (2011)
Karmio	CCS1-Peloponnese	ILIA	154.2	21
Xirokampos	CCS1-Peloponnese	ILIA	145.4	200
Ampari	CCS1-Peloponnese	ILIA	118,3	63
Fountaiika	CCS1-Peloponnese	LAKONIA	61.4	19
Lira	CCS1-Peloponnese	LAKONIA	168.8	104
Petrovouni	CCS1-Peloponnese	ARKADIA	70.0	10
Petrina	CCS1-Peloponnese	ARKADIA	80.0	44
Akropotamia	CCS1-Peloponnese	ILIA	0.0	75
Peuki	CCS1-Peloponnese	ILIA	0.0	14
Simopoulo	CCS1-Peloponnese	ILIA	0.0	369
Sikies	CCS1-Peloponnese	ILIA	0.0	14
Kalo Paidi	CCS1-Peloponnese	ILIA	130.0	66
Mazaraki	CCS1-Peloponnese	ILIA	41.0	188
Pachykalamos	CCS2-West Greece	ARTA	113.8	332
Akropotamia	CCS2-West Greece	ARTA	138.2	385
Karteri	CCS2-West Greece	THESPROTIA	73.4	248
Spatharaioi	CCS2-West Greece	THESPROTIA	50.4	91
Kato Myrsini	CCS2-West Greece	PREVEZA	36.1	109
Petra	CCS2-West Greece	PREVEZA	27.9	392
Tzara	CCS2-West Greece	PREVEZA	128.6	48

Settlement	EastMed Pipeline Section	Regional Unit	Distance (m)	Population (2011)
Lagkada	CCS2-West Greece	AITOLOKARNANIA	0.00	59
Megas Kampos	CCS2-West Greece	AITOLOKARNANIA	0.00	62
Triantafylloula	CCS2-West Greece	AITOLOKARNANIA	0.00	45

Prepared by: ASPROFOS 2022. Data from (Noise propagation model during pre-commissioning phase, 2022).

- During pre-commissioning phase

Noise levels are expected to be higher and of longer duration during pre-commissioning phase. Therefore, all the settlements and the PPC Power Plant nearby the main locations of the pre-commissioning activities (LF2 and LF5) have been identified as sensitive receptors (Table 9-109).

Table 9-109 Sensitive receivers near the primary compressors during the pre-commissioning phase.

Position	Pre-commissioning Method	Receptor	Type	Distance (km)
LF2	SPT Replacement	Goudouras	Settlement	1.5
LF2	SPT Replacement	Ag. Triada	Settlement	3.5
LF2	SPT Replacement	Public Power Company	Power Plant	0.07
LF5	Conventional SPT with the use of water	Galatas	Settlement	3.2
LF5	Conventional SPT with the use of water	Kryoneri	Settlement	3.7
LF5	Conventional SPT with the use of water	Evinohori	Settlement	4.5
Note: Distance from settlements has been calculated based on the official administrative border.				

Prepared by: ASPROFOS 2022. Data from (Noise propagation model during pre-commissioning phase, 2022).

9.2.11.3 Impacts on Acoustic Environment during Construction – onshore

Taking into account the considerations previously discussed and following evaluation criteria presented in Section 9.1:

According to the hypotheses obtained in section 9.2.11.2.3 the expected noise level is about 53 dB (A) at a distance of two hundred (200) meters from the working zone. Hence, the *likelihood* of causing the impact during the construction phase is considered *certain* for all the above identified recipients (Table 9-108).

However, the *Extent* of direct impact is estimated to be *medium* (< 500 m) since after this distance (200 m) the noise generated by the construction work is reduced to less than 45 dB. According to the World Health Organization (WHO), a noise level of 45 dB is estimated to be a sleep disorder at night and for the study needs it is estimated that beyond these values, no further assessment of the effects on the acoustic environment is required.

For the evaluation of the intensity of the effect, a conservative approach is followed and it is taken *Very high* for all the sensitive recipients. In areas where there are no identified receptors in the vicinity of the work zone, the intensity is estimated to be zero.

The *duration* of the impact is considered *short-term* related to the construction interval. In particular, the construction work will be carried out per section. Each construction section will range from forty (40) to fifty (50) kilometres and the completion time of the works is not expected to exceed one (1) year.

Reversibility is estimated to be *minimized* by applying appropriate equipment noise abatement measures within the work zone boundaries. Additional measures will be taken in the parts of the project where the work zone is in proximity (<200m) to the sensitive receptors.

As regards *cumulative action* is considered *rare* as the construction activities take place at specific (point) locations, which are at great distance from urban fabric and other noise emitting development. Finally, the *Transboundary Character* is *impossible* considering the limited extent of the potential impact.

Based on the above and based on the criteria presented in Section 9.1 the **SEI is considered as Minor** where sensitive receivers are found in proximity (<200m) to the work zone.

9.2.11.4 Impacts on Acoustic Environment during Pre-Commissioning – onshore

For the impact assessment of noise during the pre-commissioning phase, a specific noise diffusion model has been prepared by Acoustic Consultancy Company (Annex 9G), which assesses the pressures that will be exercised at the nearby settlements (Table 9-109) by the equipment used during the activities. The resulting noise levels are summarized in the table below (Table 9-110).

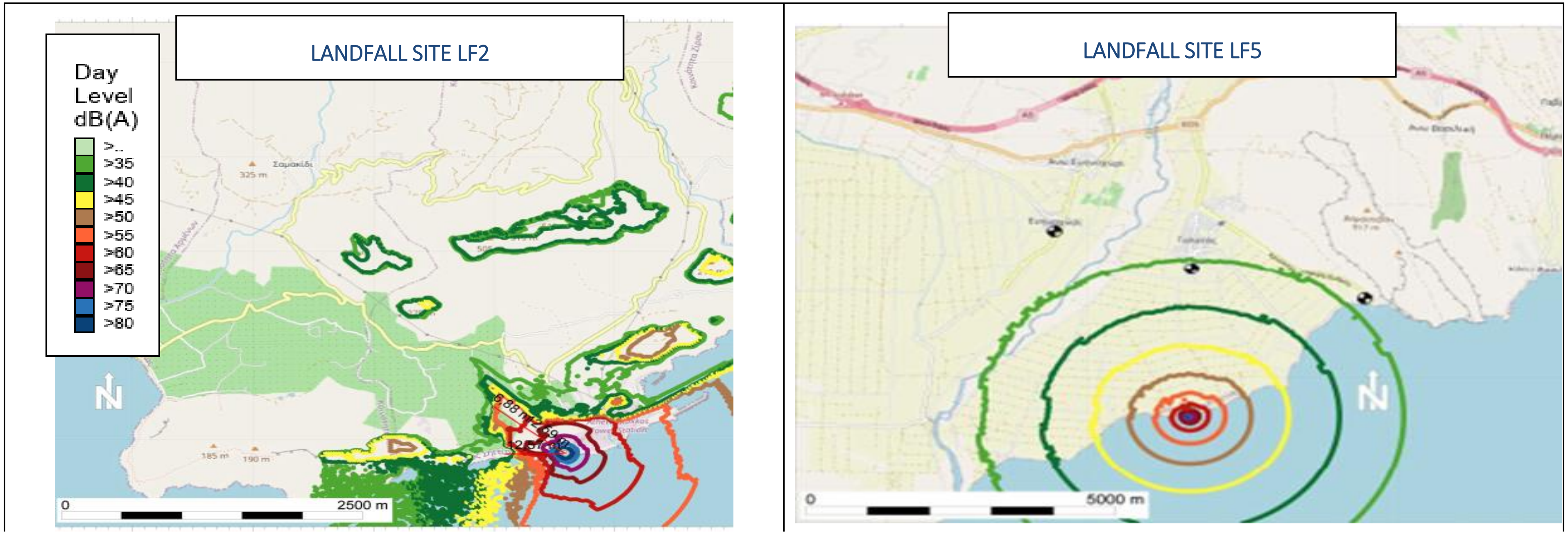
Table 9-110 Summary results from 3D noise emission model

Position	Receptor	Prediction during Hydraulic tests	Baseline measurements (see page 14 and APPENDIX B - DETAILED MEASUREMENT RESULTS)			Cumulative model (prediction + baseline)		
		L_{eq}	L_{night}	L_{eq}	L_{95}	L_{night}	L_{eq}	L_{95}
LF2	Goudouras	15.1	52.3	55.8	33.0	52.3	55.8	33.0
LF2	Ag. Triada	11.9	48.2	54.7	31.2	54.7	54.7	31.2
LF2	PPC Power Plant	110.0	49.0	54.3	43.8	65.4	65.4	65.0
LF5	Kryoneri	30.3	48.0	51.2	33.4	48.1	51.2	35.1
LF5	Galatas	35.8	48.0	51.2	33.4	48.3	51.3	37.8
LF5	Evinohori	33.7	48.0	51.2	33.4	48.2	51.3	36.6

Prepared by: ASPROFOS 2022. Data from (Noise propagation model during pre-commissioning phase, 2022)

Concerning the impact assessment criteria presented in paragraph 9.1 and the above:

The *likelihood* of causing the impact during the construction phase is considered *certain*. The *Extent* of the impact is estimated to be *medium* (< 1,000 m) since according to sound dissipation calculations that were performed the noise generated by the pre-commission activities is reduced to less than 45 dB at a distance of approximately 750 m (Figure 9-51).



Prepared by: ASPROFOS 2022. Data from (Noise propagation model during pre-commissioning phase, 2022).

Figure 9-51 Noise map showing noise emission during hydraulic tests to nearby sensitive receivers.

The *Intensity* of the effect is *low* given that it is evident that due to distance and terrain attenuation, the noise level is lower than IFC limits (55 dB(A) Daytime, 45 dB(A) Night-time) and also lower than the values that were measured during the measurement survey in April 2021 (Annex 9G) (Table 9-110).

The *Duration* of the impact is considered *short-term* given that the maximum duration of the pre-commissioning phase per segment will not exceed 100 days (it is expected to require a total of 57 to 84 days) for the offshore project components (Section 6.4.7.3).

With regard to *Reversibility,* the impact is considered *avoidable* with the application of proper mitigation measures (see Section 10.2.10). As regards *Cumulative action* due to the nature of the effect and taking into account the results of the computational model (Table 9-110), it is estimated to be *rare*. The *Transboundary Character* is *impossible* considering the limited extent of the potential impact.

Based on the above and based on the criteria presented in Section 9.1 the **SEI is considered as Minor** at the sensitive receivers near the primary compressors during the pre-commissioning phase (Table 9-109).

9.2.11.5 Summary of noise impact

Table 9-111 summarizes the impact pressure during the construction phase generated by noise sources as assessed in paragraph 9.2.11.3 and 9.2.11.4.

Table 9-111 Summary of noise impact during construction phase.

S/N SEI			SEI for	Noise						
Project phase	Construction									
Impact	Mechanism	Locations	Criteria/ Impact Properties						SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Impact on Acoustic Environment during Construction–Onshore	• excavation works • preparation and installation of pipeline • Planting and reinstatement of land • horizontal drilling • preparation of construction sites • miscellaneous works	(Table 9-108)	1.00	0.25	1.00	0.25	0.75	0.25	0.00	5.00 (Minor)	
Impacts on Acoustic Environment during Pre-commissioning – Onshore	Pre-commissioning activities	(Table 9-109)	1.00	0.25	0.25	0.25	0.25	0.25	0.00	3.21 (Minor)	

Prepared by: ASPROFOS, 2022.

9.2.12 Electromagnetic Fields

9.2.12.1 Methodology Overview

This section examines a potential increase in existing electromagnetic background values during construction and operation phases for the Project. Table 9-112 summarizes main impact sources, potentially affected resources and receptors, as well as influencing factors on the baseline conditions and those related to the Project.

In general, the impact assessment methodology described in Section 9.1.

Table 9-112 Basic Topics for Assessment - Electromagnetic Fields

Impact/Risk Sources	• Radars and antennas from ships during construction phase
Potentially Impacted Resources and Receptors	• No affected resources or receptors were identified
Particular Baseline Conditions that are Potentially Influencing Impacts/Risks	• Two (2) Antennas and a PPC substation present at Atherinolakkos site (within the Study Area of CS2 / MS2-CS2 / MS2N Compression and Metering stations)
Project Factors that are Potentially Influencing Impacts/Risks	• Compression and Metering Stations (CS2 / MS2-CS2 / MS2N) at Atherinolakkos site
References	• Section 8.12 baseline conditions. • Annex 8.K - Additional information and data for electromagnetic fields

Prepared by: ASPROFOS, 2022

9.2.12.1.1 Source of Electromagnetic Field

During the construction phase for the Project, no activity which would affect or generate electromagnetic fields in the broader project Study Area is foreseen. Construction of pipeline and related works (earthworks, excavation works, vehicle and ship traffic) do not affect existing infrastructure conditions, in terms of the existing electromagnetic background, as they do not refer to electromagnetic radiation sources (e.g. antenna parks). In addition, mechanical equipment that will be used creates no electromagnetic field in the project study area.

It is noted that Vessels involved in pipeline construction have antennas and radar. These ships are in constant motion; their number is limited and therefore emitted radiation is not calculable, but they are expected to be very limited and not different from emissions from other vessels in the Aegean and Cretan sea, like the ferry vessels.

Therefore, no impact is present during construction phase.

9.2.12.2 Summary

According to above Section 9.2.12.1.1, no impact on electromagnetic fields was identified during construction phase for the Project. Therefore, no further evaluation for this parameter is performed.

9.2.13 Water Resources

9.2.13.1 Methodology Overview

When designing the project, crossings with receiving waters were deliberately avoided. However, the nature and extent of the project make it impossible that the project footprint does not cross with some watercourses and rivers. Where this has not been possible, efforts are being made to minimize and reduce the impact on water resources. This section assesses the impacts on the water resources of the study area that may arise from the constructionphase.

It is noted that areas of special ecological interest (Natura 2000 sites) are of high sensitivity and the impacts on their riparian habitats and species cannot be quantified, evaluated, with a general methodological approach. For this purpose, the detailed Appropriate Assessments on these areas is presented in standalone documents (Annex 9E).

In order to assess possible project impacts, both at construction and operation phase, the expected changes in the hydrological and hydrogeological characteristics of surface and groundwater resources are estimated in this chapter. More specifically, in accordance with Ministerial Decision οικ. 170225/2014, the following impacts are assessed:

- Impacts on the hydrographic network resulting from direct interventions (arrangements – bridging – water abstractions, etc.) and indirect changes (clearing vegetation from riparian zones or from significant water catchment areas, etc.);
- Impacts on the availability of water potential and its possible seasonal variations to feed current uses after project implementation;
- Changes in the qualitative and quantitative characteristics of impacted permanent and periodic watercourses; and
- The project's effect on the future evolution of surface water quality and quantity trends.

Moreover, the following table presents the key sources of impact, potentially impacted resources and receptors, baseline and Project influencing factors associated with the Project on the water resources.

Table 9-113 Considerations for Assessment –Water Resources

Sources of Impact/ Risk	• Watercourse crossings; • Shore crossings; • Upgrading existing access roads for moving vehicles, equipment and staff; • Preparation, construction and operation of temporary facilities • Work zone preparation, drainage, erosion control, trench cut, hosting and laying the pipeline; • Hydraulic Testing; • Construction of Compressor Stations and Metering Stations;

	• Accidental leakages of toxic waste into the soil;
Potentially Impacted Resources and Receptors	• Surface water resources • Groundwater resources
Particular Baseline Conditions that are Potentially Influencing Impacts/Risks	• Protection Status • Ecological status • Chemical Status • Availability Status • Natural Flow of Water System • Riparian Woodland and forest land
Project Factors that are Potentially Influencing Impacts/Risks	• Type of machinery in use • Proximity of camp sites with the water resources • Crossing techniques • Water management plan • Workers' sites management • Waste management plan • Construction time • Period in which construction work is performed
References	Baseline is found in Section 8.13. Appropriate Assessments is found in Annex 9E

Prepared by: ASPROFOS, 2022.

9.2.13.1.1 Impacts Generating Mechanisms as deriving from the project description

The mechanisms that could influence the hydrological and hydrogeological characteristics of water resources within the study area are described below:

- Watercourse crossings;

The proposed pipeline routing passes through 31 rivers and streams (listed in section 8.13). Two main methods are going to be used for crossings:

- ➢ The open cut method and
- ➢ The trenchless crossing method.

Although the method will depend on the particular characteristics of each water system in order to minimize impacts, the open cut method is the preferred method (especially for small streams, creeks and canals). Crossing methods without cutting a trench will only be used when allowed by the geology and geomorphology of the site and in case of sensitive receptors downstream the water systems.

In general, the open cut method when combined with appropriate work planning (during the periods of low flow volume) and diverting the water flow in the course of works (upstream and downstream dams and over-abstraction of water or laying ducts if the channels are sufficiently narrow), may minimize the environmental impacts associated with the turbidity and chemical characteristics of water or changes in the river bed morphology. Applying this method to rivers, streams or irrigation canals of low to medium ecological value will typically lead to minor impacts.

Steady stream water resources designated as of high ecological value will be crossed using the drilling method without trenching. Typically, the trenchless crossing methods (e.g. HDD) are alternative technologies used to introduce pipelines underneath sensitive areas and/or infrastructures without impacting directly the river bed and are practically maintenance-free. As a result, the extent of the impacts is considered to be negligible and therefore no significant impact on the quality of surface or groundwater is expected.

Nonetheless, it should be noted that it is necessary to take additional measures in order to properly manage and dispose of any used fluids and cuts. A detailed description of the crossing methods with water bodies is included in Section 6.4.3.

- Shore crossings (Landfall sites);

The shore crossing is the intersection area between the offshore and onshore part of a pipeline, where special construction techniques are required. Although the method for the shore crossing will depend on the particular characteristics of each landfall site in order to minimize impacts, the open cut method is the proposed construction methodology for shore crossings at EastMed landfall locations (section 6.4.3.2).

The open cut construction methodology is a common technique where, generally, the nearshore section is trenched by a combination of dredging equipment (e.g. deeper sections by cutter suction dredger or trailing suction hopper dredger and shallower sections by pontoon-based backhoe) and the onshore section by common excavators to enable the pipeline to be pulled ashore at a required depth of burial. To enable the use of heavy equipment, the landfall requires a sufficiently sized beach (preferably minimum 50 metres from dune to shoreline and minimum 100 metres wide) and good access. To minimise dredging volumes and to protect the trench from natural backfilling during the period between trench excavation and pipeline installation, a cofferdam is often used. If the subsoil is not suitable for sheet piles, a causeway can be created by using rock boulders or gravel of sufficient size to secure a stable dam during the installation process.

In general, the open cut method when combined with appropriate work planning may minimize the environmental impacts associated with the turbidity and chemical characteristics of water or changes in the seabed morphology.

A detailed description of the shore crossing methods is included in Section 6.4.3.

- Upgrading existing access roads for moving vehicles, equipment and staff;

Impacts on water are caused by earthworks to upgrade existing road networks. The wastes that could affect water are dusts and solid particles from excavations, as well as additional backfilling materials, if required (gravel or 3A). These particles, after being transferred to the nearby water resources by free surface runoff, they move as suspended particulate matter (SS) in the water volume of the main surface water bodies.

- Preparation, construction and operation of temporary facilities;

Construction sites and temporary installations are areas where materials and machinery are being stored during construction. It is expected that employees at these facilities will produce solid and liquid household waste and certain hazardous waste, such as engine oils and fuel residues from the repair and maintenance of machinery. The incorrect management of such waste streams may be associated with major impacts if they end up in nearby surface and/or groundwater.

- Work zone preparation, drainage, erosion control, trench cut, hosting and laying the pipeline;

Possible impacts on waters may occur during trenching operations for the following reasons:

- Surface soil and other soil materials will be removed from the work area and kept alongside the trench. Heavy rainfall may carry away such materials and increase the turbidity of the nearby Surface Water Systems, and possibly of significant Surface Water Systems along the pipeline routing. Failure to implement good practice measures against heavy rainfall could impact the water quality of final receptors.
- In some areas with a high aquifer, it will be necessary to drain water during trenching operations. In these cases, drainage is necessary because it allows the trench to be safely built, preventing it from collapsing and allowing the bottom to be inspected prior to excavation. In addition, fine layers of sediment are swept away, which may otherwise modify the future permeability and natural drainage properties of the soil. Water drainage will degrade the aquifer. Water drainage continues until completion of construction works and the final backfilling of the trench. The groundwater removed will then be disposed of in nearby surface water systems, which flow away from the drainage area. In some cases, disposal may take place on pre-agreed land subject to authorisation by the relevant Authority.
- The assessment of the project's routing areas where groundwater drainage may be required was based on data for High Flood Risk Areas (see section 8.13.2). In particular, High Flood Risk Areas experience frequent floods and a high groundwater aquifer. Therefore, it is estimated that they are also the possible areas requiring groundwater drainage when

cutting the trench. Table 8-225 shows the kilometric positions of potential drainage areas based on the data of Flood Risk Management Plans.

- Hydraulic Testing;

After installation of the pipeline, hydrostatic pressure tests will be conducted. The procedure involves filling the pipeline with water, checking the pipeline pressure to ensure water tightness and then disposing of the water. To conduct the hydraulic testing, water from surface water systems will be abstracted. No water reservoirs are to be used for water abstraction and/or disposal. Table 6.58 shows some of the areas for water abstraction to cover the needs of hydraulic testing and the quantities required for the hydraulic testing of each major section. The timetable for the hydraulic testing will take into account the seasonal changes in river flow and reduced flows during the summer months.

Concerning the offshore pipeline segments, for OSS4 section hydrostatic pressure test is applied with the use of sea water and for OSS2, OSS2N, OSS3 and OSS3N project components, it is beneficial not to pressure test the system applying the conventional hydrotesting SPT because of the risk associated with lateral buckling. To conduct the pressure test, the replace Static Pressure Test (SPT) use dry air (section 6.4.7.2), as a result, the extent of the impacts in water resources is considered to be negligible and therefore no impacts on the quality of coastal water is expected.

Testing water will be collected and reused in subsequent sections of the pipeline. After final use, the same water bodies will be taken into consideration for dischargeto avoid the possible transfer of foreign species / invading species of fauna/flora from different water systems. In order to avoid an impact on the physical characteristics of waters into which the discharges are made, the runoff will follow the same rules as for take-up. In addition, the catchment rate of receiving water will be adapted to the size and type of the water resource in order to avoid artificial flooding and changes in the receiving water's morphology. The approach to hydraulic testing described focuses on the reuse of fresh water.

In general, hydraulic testing water will be free of chemicals or oxidants. Before the water is discharged to the receptor, it will pass through a sedimentation pond for any solids to be separated. Concerning the offshore pipeline segment OSS4 for which no SPT replacement will take place, chemical compounds may be used to protect the pipeline from chemical and microbiological damage. However, hydrotest water should be free of biocides and oxygen prior to discharge. If any additives have to be used, they will be included in the PLONOR list[42].

[42] PLONOR is a list of substances used and discharged offshore which are considered to 'Pose Little or No Risk to the Environment' which was issued by OSPAR.

Both water abstraction and discharge can result in changes, e.g. depletion of water resources, water pollution, soil erosion, etc. if not carried out in an environmentally responsible manner. Prior to the implementation of counter-measures, these impacts are expected to be of medium importance to the connected watercourses, given the possible changes to the morphology of the channels after discharge and the *likelihood* of chemical pollution.

- Construction and operation of Compressor Stations and Measuring Station;

The impact on water resources during the construction and operation of the Compression and Metering Stations focuses on the management of man-made urban wastewater produced by the construction site staff at construction phase and by the operating staff at operation phase. The quantity of man-made wastewater at construction phase is expected to be negligible since chemical toilets will be used. At operation phase, infrastructures will either connect to the existing network or septic tanks will be built.

- Accidental leakages of toxic waste;

Impacts on water quality may also originate from possible accidents caused by construction and transport machinery. Similar impacts can also be caused by poor machine management, e.g. uncontrolled oil change in trucks and earthmoving machines and disposal directly on the ground. Oils, if disposed of onto the ground, could be transferred by surface runoff to nearby water resources or end up in the local groundwater aquifer. In both cases, chemical pollution could be caused, which is difficult to counter especially in the case of groundwater resources. Furthermore, urban wastewater from workers could pollute groundwater, albeit on a limited scale due to their small volume.

9.2.13.1.2 Sensitive Receptors identification

To support the study, an attempt was made to categorize the surface and groundwater systems which the project is going to cross. The categorization provides a standardized way of classifying water resources and, by extension, assessing the possible impacts from the implementation of the project. Table 9-114 outlines the criteria used in assessing sensitive receiving surface waters.

Table 9-114 Assessment Criteria of Sensitive Receptors - Surface Water Resource

A/A	Criteria - Protection Status[43]	score
0	None	Zero

[43] Protection status in accordance with Directive 2000/60/EC
i. Areas designated for the protection of economically significant aquatic species

A/A	Criteria - Protection Status43	score
1a	Water Bodies designated as Recreational waters including areas designated as Bathing Waters	Low
1b	Urban Waste Water Treatment Directive Sensitive Areas and Nitrates Directive Nitrate Vulnerable Zones (NVZ)	
2a	Water bodies designated for Drinking Water Abstraction	Medium
2b	Areas designated for the protection of economically significant aquatic species	
3	Areas designated for Birds and Habitats protection including the Natura 2000 protected sites	High
4	Water systems Includes 3 and >1 of the above type of Protected areas	Very High

Prepared by ASPROFOS, 2022.

Table 9-115 shows the sensitivity of the crossed surface water resources

Table 9-115 Sensitivity of crossed Surface Water Resources

WB Name	WB Code	Protection Status	Sensitivity
MARIOREMA STREAM_4	EL0331R000700004N	0	Zero
Small Stream_01 not included in RBD Management plan	---	0	Zero
INOUS RIVER_1	EL0333R000210030N	0	Zero
EVROTAS RIVER_11	EL0333R000211040N	0	Zero
KARDARI STREAM	EL0333R000212042N	2_b	Medium
EVROTAS RIVER_15	EL0333R000217049N	0	Zero
KOUDIFARINA RIVER	EL0129R000220055N	0	Zero
ALFEIOS RIVER_12	EL0129R000221056N	0	Zero
KSERILAS RIVER	EL0129R000218052N	0	Zero
Small Stream_02 not included in RBD Management plan	---	0	Zero
DIPOTAMO RIVER	EL0129R000212039N	0	Zero
ROGOZITIKO STREAM	EL0129R000210037N	0	Zero
ALFEIOS RIVER_4	EL0129R000207020N	0	Zero

ii. Water bodies designated for Drinking Water Abstraction
iii. Water Bodies designated as Recreational waters including areas designated as Bathing Waters
iv. Areas designated for the protection of economically significant aquatic species
v. Urban Waste Water Treatment Directive Sensitive Areas and Nitrates Directive Nitrate Vulnerable Zones (NVZ)
Areas designated for Birds and Habitats protection including the Natura 2000 protected sites

WB Name	WB Code	Protection Status	Sensitivity
ERYMANTOS RIVER_1	EL0129R000206011N	2_a	Medium
LADON PINEIOS_2	EL0228R000204007N	0	Zero
PINEIOS RIVER_4	EL0228R000203009N	0	Zero
EVINOS RIVER_2	EL0420R000200070N	4 (1_a, 2_a & 3)	Very High
PLATANIAS RIVER	EL0415R000000008N	0	Zero
ENOTIKI TAFROS	EL0415R000202007H	3	High
ERMITSAS RIVER	EL0415R000202106N	3	High
Small Stream_03 not included in RBD Management plan	---	0	Zero
ACHELOOS RIVER_5	EL0415R000200011H	4 (1_b & 3)	Very High
Small Stream_05 not included in RBD Management plan	---	0	Zero
AMPHILOXIAS STREAM	EL0415R001301068N	3	High
MANTANI STREAM	EL0514R000102049N	3	High
DIPOTAMO RIVER	EL0514R000100048N	3	High
ARAXTHOS RIVER_1	EL0514R000201050N	3	High
LOUROS RIVER_1	EL0546R000201077N	3	High
ARETHOUA STREAM	EL0513R000101042N	3	High
AXERON RIVER (MAYROPOTAMOS)_2	EL0513R000200045N	4 (1_a & 3)	Very High
AXERON RIVER (MAYROPOTAMOS) PARAPOTAMOS KOKTOS (VOUVOS)	EL0513R000202044N	0	Zero
COASTES OF SOUTHERN CRETAN SEA - LASITHI	EL1341C0016N	1_a & 2_b	Medium
EAST COASTS OF PELOPONNESE	EL0331C0005N	4 (1_a & 3)	Very High
PATRAIKOS GULF	EL0228C0003N	1_a	Low
MESOLONGI SEA	EL0415C0002N	1_a	Low

Prepared by ASPROFOS, 2022.

Table 9-116 outlines the criteria used in assessing receiving groundwater.

Table 9-116 Assessment Criteria of Sensitive Receptors - Ground Water Resource.

Score	Criteria	
	Protection Status	Availability Status
Zero	None	—

Score	Criteria	
	Protection Status	Availability Status
Low	—	BAD
Medium	Urban Waste Water Treatment Directive Sensitive Areas and Nitrates Directive Nitrate Vulnerable Zones (NVZ)	MODERATE
High	Water bodies designated for Drinking Water Abstraction	LOWER THAN GOOD
Very High	Both of the above	GOOD

Prepared by ASPROFOS, 2022.

Table 9-117 Shows the sensitivity of the crossed ground water resources.

Table 9-117 Sensitivity of crossed Ground Water Resources.

WB Name	WB Code	Sensitivity		
		Protection Status	Availability Status	Total
PORODES OF SITIA-PAPAGIANNADON-AGIA TRIADA	EL1300141	None	GOOD	Medium
LAKONIA SOUTHEAST SYSTEM	EL0300120	None	GOOD	Medium
ASOPOS - GLYKOVRYSI SYSTEM	EL0300150	None	BAD	Low
ZARAKA - MONEMVASIA SYSTEM	EL0300110	None	GOOD	Medium
GERAKIOU - GKORITSAS SYSTEM	EL0300160	None	GOOD	Medium
AG. PETROU - VOUTANION SYSTEM	EL0300240	None	GOOD	Medium
EVROTAS SYSTEM	EL0300230	None	GOOD	Medium
PELLANIS – SKORTSINOU SYSTEM	EL0300260	None	GOOD	Medium
AG. FLOROU - PIDIMATOS SYSTEM	EL0100080	Water bodies designated for Drinking Water Abstraction	GOOD	Very High
MEGALOPOLIS SYSTEM	EL0100070	None	GOOD	Medium
DIAVOLITSI - NEA PHIGALIA SYSTEM	EL0100210	None	GOOD	Medium

WB Name	WB Code	Sensitivity		
		Protection Status	Availability Status	Total
LOUSIOS - PALOUMPIAS SYSTEM	EL0100230	None	GOOD	Medium
ALFEIOS SYSTEM	EL0100010	None	GOOD	Medium
PINEIOS SYSTEM	EL0200060	Urban Waste Water Treatment Directive Sensitive Areas and Nitrates Directive Nitrate Vulnerable Zones (NVZ)	GOOD	High
MOVRIS SYSTEM	EL0200100	Urban Waste Water Treatment Directive Sensitive Areas and Nitrates Directive Nitrate Vulnerable Zones (NVZ)	GOOD	High
LARISSOS R. SYSTEM	EL0200092 EL0200091 EL0200094	Urban Waste Water Treatment Directive Sensitive Areas and Nitrates Directive Nitrate Vulnerable Zones (NVZ)	BAD	Medium
MESSOLONGHI - EYINOS SYSTEM	EL0400090	None	GOOD	Medium
SYSTEM OF YDROFORION KATO ROU OF EVINOU BASIN	EL0400240	None	GOOD	Medium
SYSTEM OF YDROFORION KATO ROU OF ACHELOOS	EL0400250	None	GOOD	Medium
AGRINIO SYSTEM	EL0400060	None	GOOD	Medium
AMFILOCHIAS SYSTEM	EL0400140	None	GOOD	Medium
SYSTEM OF YDROFORION OF ACHELOOS BASIN	EL0400190	None	GOOD	Medium
SYSTEM OF YDROFORION OF ARACTHOS R.	EL0500240	None	GOOD	Medium
LOUROS SYSTEM	EL0500152 EL0500153	Urban Waste Water Treatment Directive Sensitive Areas and Nitrates Directive	GOOD	Very High

WB Name	WB Code	Sensitivity		
		Protection Status	Availability Status	Total
		Nitrate Vulnerable Zones (NVZ) Water bodies designated for Drinking Water Abstraction		
ARTAS SYSTEM	EL0500160	None	GOOD	Medium
PREVEZA PENINSULA SYSTEM	EL0500140	Urban Waste Water Treatment Directive Sensitive Areas and Nitrates Directive Nitrate Vulnerable Zones (NVZ)	LOWER THAN GOOD	Medium
ZALOGGOY SYSTEM	EL0500250	Urban Waste Water Treatment Directive Sensitive Areas and Nitrates Directive Nitrate Vulnerable Zones (NVZ)	GOOD	High
SOULIOU - PARAMITHIAS SYSTEM	EL0500090	Urban Waste Water Treatment Directive Sensitive Areas and Nitrates Directive Nitrate Vulnerable Zones (NVZ)	GOOD	High
ACHERONTA - R. KOKYTOU ESTUARIES SYSTEM	EL0500270	Urban Waste Water Treatment Directive Sensitive Areas and Nitrates Directive Nitrate Vulnerable Zones (NVZ)	GOOD	High
KORONIS SYSTEM	EL0500130	None	GOOD	Medium
PARGAS SYSTEM	EL0500170	None	GOOD	Medium

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9.2.13.1.3 Impacts Overview Table per phase and mechanism

Table 9-118 sums up the possible impact per phase and causing mechanism.

Table 9-118 Main Potential Impacts - Water resources.

Mechanism	Potential Impact	Construction phase	Operation phase
Watercourse crossings	Modification of watercourses morphology	×	

Mechanism	Potential Impact	Construction phase	Operation phase
	Modification of Shore morphology		
	Impacts on the quality of water resources	×	
	Impacts on the quality of coastal waters		
	Impacts on the availability of water resources		
	Accidental pollution	×	
Shore crossings (Landfall sites)	Modification of watercourses morphology		
	Modification of Shore morphology	×	
	Impacts on the quality of water resources	×	
	Impacts on the quality of coastal waters		
	Impacts on the availability of water resources		
	Accidental pollution		
Upgrading existing access roads for moving vehicles, equipment and staff	Modification of watercourses morphology		
	Modification of Shore morphology		
	Impacts on the quality of water resources	×	
	Impacts on the quality of coastal waters		
	Impacts on the availability of water resources		
	Accidental pollution		
Preparation, construction and operation of temporary facilities	Modification of watercourses morphology		
	Modification of Shore morphology		
	Impacts on the quality of water resources	×	
	Impacts on the quality of coastal waters		
	Impacts on the availability of water resources		
	Accidental pollution	×	
Work zone preparation, drainage, erosion control, trench cut, hosting and laying the pipeline.	Modification of watercourses morphology		
	Modification of Shore morphology		
	Impacts on the quality of water resources	×	
	Impacts on the quality of coastal waters		
	Impacts on the availability of water resources	×	
	Accidental pollution	×	
Hydraulic Testing	Modification of watercourses morphology		
	Modification of Shore morphology		
	Impacts on the quality of coastal waters	×	

Mechanism	Potential Impact	Construction phase	Operation phase
	Impacts on the quality of water resources	×	
	Impacts on the availability of water resources	×	
	Accidental pollution	×	
Construction and operation of Compressor Stations, Meter Station and O&M.	Modification of watercourses morphology		
	Modification of Shore morphology		
	Impacts on the quality of water resources	×	×
	Impacts on the quality of coastal waters		
	Impacts on the availability of water resources		
	Accidental pollution	×	×
Accidental leakages of toxic waste into the soil	Modification of watercourses morphology		
	Modification of Shore morphology		
	Impacts on the quality of water resources	×	
	Impacts on the quality of coastal waters	×	
	Impacts on the availability of water resources		
	Accidental pollution	×	

Prepared by ASPROFOS, 2022.

9.2.13.1.4 Modifications to the standard IA methodology

The standard IA methodology is followed as shown in section 9.1. However it is noted that, given the spatial context of the engaged water bodies, transboundary character is considered to be negligible for water resources.

9.2.13.2 Surface Water Systems

9.2.13.2.1 Introduction

The ecological value of surface water resources, the crossing method and the natural flow of the water system have been taken into account when assessing possible impacts during the construction phase.

Depending on the Project activities that influence the hydrological and hydrogeological characteristics of water resources described in section 9.2.13.1.1, the potential impacts considered construction phase are as follows:

- Modification of watercourses morphology
- Modification of shore morphology
- Impacts on the quality of surface water systems
- Impacts on the quality of coastal water sustems
- Impacts on the availability of surface water systems
- Accidental pollution

Having regard to the aforementioned and based on the criteria provided for under Section 9.1 the impacts assessment are analyzed below.

9.2.13.2.2 Modification of inland Surface Water Systems morphology

Changes in the morphology of Surface Water Systems (SWS) may be caused at the crossings with the project. In particular, activities such as removing the vegetation and topsoil, placing temporary dams upstream of the water system etc. may alter their morphology, thus causing floods and nuisance to drainage networks.

Regarding the impacts assessment criteria presented under paragraph 9.1.

The *possibility* of causing this impact at construction phase depends on the ecological value of the Surface Water System and the crossing method to be used. In specific:

- The impact is considered to be *certain* for Surface Water Systems crossed with the project using the open cut method. It will be necessary to carry out works on the bed of Surface Water Systems, thus altering the morphology of the water resource, especially riparian vegetation.
- The impact is considered to be *impossible* for Surface Water Systems crossed with the project using the trenchless method. When using this method, the project footprint does not affect the morphology of the water system, because the crossing works are carried out at a safe distance from the sensitive water resource. Therefore no further evaluation is made on

The area of direct impact (i.e. *extent*) is considered to be:

- Small for Surface Water Systems, in which case the trenchless crossing method will be used;
- Small for Surface Water Systems of seasonal flow and length of crossed riparian Woodland and forest land less than 0.5 km; and
- Medium for Surface Water Systems of continuous flow and/or length of crossed riparian Woodland and forest greater than 0.5 km as may suffer increased flooding and/or nuisance of drainage networks at a limited distance around the project.

The *Intensity* of impact on water resources is linked to the sensitivity of crossed surface water resources (Table 9-115). As such water resources of high sensitivity characterized by *high* intensity and so forth.

The *Duration* of the impact is associated with the period required for the restoration of prior morphology and, in particular, of the riparian vegetation and topsoil. Taking a conservative approach, the impact will be *short-term* for water systems characterised by sparse riparian vegetation, considering that after restoration, any changes in morphology are expected to be quickly restored. In the case of Surface Water Systems of extensive riparian vegetation crossed with the project using the open cut method, the change in morphology will be *long-term*. It will not be possible to plant any deep-rooted plants around a 4-meter zone on either side of the pipeline throughout the project lifetime. For Surface Water Systems where the trenchless method is to be used, the *Duration* of impact is expected to be *instantaneous*, because the crossing works are carried out at a safe distance from the sensitive water resource.

Relating to *Reversibility*, it is estimated that the mitigation of impact depends on both the crossing method to be used and the surface flow of the crossed water resource. For Surface Water Systems where the trenchless crossing method is to be used, the impact is considered as *prevented*, since any disruption of the Water System's bed is considered to be negligible with construction works taking place at a distance from the water resource's bed. For steady stream Surface Water Systems where the open cut crossing method is to be used it will be necessary to carry out interruption or diversion of the river bed during construction works. However, with appropriate work planning (during the periods of low flow), it is estimated that the impact-causing mechanisms may be *minimized*, resulting in the water resource returning to its former state at no time. As regards Surface Water Systems of seasonal flow outside protected areas, impact-causing mechanisms may be totally *avoided* with appropriate work planning (no flow period).

Finally, a conservative approach is taken as regards *cumulative action* which is considered as *likely* for all water bodies.

Having regard to the aforementioned and based on the criteria presented in Section Section 9.1.2

- For crossed seasonal flow Surface Water Systems of zero sensitivity using the open cut method;

The *Likelihood* of their topography alteration during construction activities is considered *certain*. The *Extent* concerns a limited area around the project footprint and is therefore considered to be *small*. The *Intensity* based on the receptor's sensitivity is *zero*. The *Duration* is *short-term* since the crossed water systems characterised by sparse riparian vegetation. Impact *Reversibility*, taking a conservative approach, is *avoidable*. Finally impact *Cumulative Action* is considered to be *likely*. Consequently, **SEI is considered as Minor**.

- For crossed seasonal flow Surface Water Systems of medium sensitivity using the open cut method;

The *Likelihood* of their topography alteration during construction activities is considered *certain*. The *extent* concerns a limited area around the project footprint and is therefore considered to be *small*. The *Intensity* based on the receptor's sensitivity is *medium*. The *Duration* is *short-term* since the crossed water systems characterised by sparse riparian vegetation. Impact *Reversibility*, taking a conservative approach, is *avoidable*. Finally impact *cumulative action* is considered to be *likely*. Consequently, **SEI is considered as Minor**.

- For crossed seasonal flow Surface Water Systems of high sensitivity, that characterised by sparse riparian vegetation using the open cut method;

The *Likelihood* of their topography alteration during construction activities is considered *certain*. The *extent* concerns a limited area around the project footprint and is therefore considered to be *small*. The *Intensity* based on the receptor's sensitivity is *high*. The *Duration* is *short-term* since the crossed water systems characterised by sparse riparian vegetation. Impact *Reversibility*, taking a conservative approach, is *avoidable*. Finally impact *Cumulative Action* is considered to be *likely*. Consequently, **SEI is considered as Minor**.

- For crossed seasonal flow Surface Water Systems of high sensitivity, that characterised by extend riparian vegetation (crossed riparian Woodland and forest > 0.5 km) using the open cut method;

The *Likelihood* of their topography alteration during construction activities is considered *certain*. The *extent* concerns a limited area around the project footprint and is therefore considered to be *small*. The *Intensity* based on the receptor's sensitivity is *high*. The *Duration* is *long-term* since will not be possible to plant any deep-rooted plants around a 4-meter zone on either side of the pipeline throughout the project lifetime. Impact *Reversibility*, taking a conservative approach, is *minimizable*. Finally impact *cumulative action* is considered to be *likely*. Consequently, **SEI is considered as Moderate**.

- For crossed constant flow Surface Water Systems of zero sensitivity, that characterised by sparse riparian vegetation, using the open cut method;

The *Likelihood* of their topography alteration during construction activities is considered *certain*. The *extent* concerns a limited area around the project footprint and is therefore considered to be *medium*, as may suffer increased flooding and/or nuisance of drainage networks at a limited distance around the project. The *Intensity* based on the receptor's sensitivity is *zero*. The *Duration* is *short-term* since the crossed water systems characterised by sparse riparian vegetation. Impact *Reversibility*, taking a conservative approach, is *minimizable*. Finally impact *Cumulative Action* is considered to be *likely*. Consequently, **SEI is considered as Minor**.

- For crossed constant flow Surface Water Systems of medium sensitivity, that characterised by sparse riparian vegetation, using the open cut method;

The *Likelihood* of their topography alteration during construction activities is considered *certain*. The *extent* concerns a limited area around the project footprint and is therefore considered to be *medium*, as may suffer increased flooding and/or nuisance of drainage networks at a limited distance around the project. The *Intensity* based on the receptor's sensitivity is *medium*. The *Duration* is *short-term* since the crossed water systems characterised by sparse riparian vegetation. Impact *Reversibility*, taking a conservative approach, is *minimizable*. Finally impact *Cumulative Action* is considered to be *likely*. Consequently, **SEI is considered as Moderate**.

- For crossed constant flow Surface Water Systems of high sensitivity, that characterised by sparse riparian vegetation, using the open cut method;

The *Likelihood* of their topography alteration during construction activities is considered *certain*. The *extent* concerns a limited area around the project footprint and is therefore considered to be *medium*, as may suffer increased flooding and/or nuisance of drainage networks at a limited distance around the project. The *Intensity* based on the receptor's sensitivity is *high*. The *Duration* is *short-term* since the crossed water systems characterised by sparse riparian vegetation. Impact *Reversibility*, taking a conservative approach, is *minimizable*. Finally impact *Cumulative Action* is considered to be *likely*. Consequently, **SEI is considered as Moderate**.

- For crossed constant flow Surface Water Systems of very high sensitivity, that characterised by extend riparian vegetation (crossed riparian Woodland and forest > 0.5 km), using the open cut method;

The *Likelihood* of their topography alteration during construction activities is considered *certain*. The *extent* concerns a limited area around the project footprint and is therefore considered to be *medium*, as may suffer increased flooding and/or nuisance of drainage networks at a limited distance around the project. The *Intensity* based on the receptor's sensitivity is *very high*. The *Duration* is *long-term* since the crossed water systems characterised by extend riparian vegetation and since will not be possible to plant any deep-rooted plants around a 4-meter zone on either side of the pipeline throughout the project lifetime. Impact *Reversibility*, taking a conservative approach, is *minimizable*. Finally impact *Cumulative Action* is considered to be *likely*. Consequently, **SEI is considered as Moderate**.

9.2.13.2.3 Modification of Shore morphology

Changes in the morphology of shores relate to significant construction works that will be performed for the shore crossing of the project. In particular, the beach is trenched by common excavators to enable the pipeline to be pulled ashore at a required depth of burial. To enable the use of heavy equipment, the landfall requires a sufficiently sized beach (preferably minimum 50 meters from dune to shoreline and minimum 100 meters wide) and good access.

Regarding the impacts assessment criteria presented under paragraph 9.1.

The *possibility* of causing this impact at construction phase is considered to be *certain* given that the main steps of open cut (the proposed construction methodology for shore crossings at EastMed landfall locations) requires a sufficiently sized beach and good access to enable the use of heavy equipment.

The area of direct impact (i.e. *extent*) is considered to be *medium.* The size of this intersection area depends on local circumstances such as bathymetry, topography, metocean conditions, seabed characteristics (e.g. seabed material, morphology) and environmental conditions. Preferably, the landfall requires minimum 50 meters from dune to shoreline and minimum 100 meters wide. Note that in general the same methodology applies for all landfalls.

The *Intensity* of impact on water resources is linked to the sensitivity of crossed costal water resources (Table 9-114). As such water resources of medium sensitivity characterized by *medium* intensity and so forth.

The *Duration* of the impact is associated with the construction works performed for the shore crossing of the investigated project. Occupation will be temporary, and morphology of the area can be completely reinstated upon completion of the projects. Taking a conservative approach (see section 6.4), the impact will be *short-term*.

Relating to *Reversibility*, it is estimated that the mitigation of impact depends on soil conditions (hard soil and/or rocky soil). For shore approach on LF2, LF4 and LF5 is considered to be *reversible* given that the shore area is characterized by coarse materials. As regards shore at LF3 the *Reversibility* is considered to be *minimizable*.

Finally, a conservative approach is taken as regards *cumulative action* which is considered as *likely* for all areas.

Having regard to the aforementioned and based on the criteria presented in Section Section 9.1.

- For shore crossings of low sensitivity;

The *Likelihood* of their morphology alteration during construction activities is considered *certain*. The *extent* is considered to be *medium*, since the works are going to be carried out at a significant distance from the crossing site and the morphology of the shore is not going to be affected. The *Intensity* based on the receptor's sensitivity is *low*. The *Duration* is considered to be *short-term*, since morphology of the area can be completely reinstated upon completion of the projects. As regards the *Reversibility* is considered to be *reversible*. Finally impact *Cumulative Action* is considered to be *likely*. Consequently, **SEI is considered as Minor**.

- For shore crossings of medium sensitivity;

The *Likelihood* of their morphology alteration during construction activities is considered *certain*. The *extent* is considered to be *medium*, since the works are going to be carried out at a significant distance from the crossing site and the morphology of the shore is not going to be affected. The *Intensity* based on the receptor's sensitivity is *medium*. The *Duration* is considered to be *short-term*, since morphology of the area can be completely reinstated upon completion of the projects. As regards the *Reversibility* is considered to be *reversible*. Finally impact *Cumulative Action* is considered to be *likely*. Consequently, **SEI is considered as Minor**.

- For shore crossings of Very high sensitivity;

The *Likelihood* of their morphology alteration during construction activities is considered *certain*. The *extent* is considered to be *medium*, since the works are going to be carried out at a significant distance from the crossing site and the morphology of the shore is not going to be affected. The *Intensity* based on the receptor's sensitivity is *Very high*. The *Duration* is considered to be *short-term*, since morphology of the area can be completely reinstated upon completion of the projects. As regards the *Reversibility* is considered to be *reversible*. Finally impact *Cumulative Action* is considered to be *likely*. Consequently, **SEI is considered as Moderate**.

9.2.13.2.4 Impacts on the quality of SWS

Impacts on the quality of Surface Water Systems could arise from the projects activities shown in Table 9-118 The main cause is re-suspension and dispersion of sediment during the crossing works (Chapter 6, Section 6.4.7.5.2).

The SWS crossing with the project, due to their proximity to the construction works, are the areas expected to show changes in their quality, mainly as a result of sediment dispersion. Water resources that have been selected for the abstraction and discharge of hydraulic testing water (Table 6-58) will be put under further pressure that is presented in a following paragraph (9.2.13.2.6).

Regarding the impacts assessment criteria presented under section 9.1

The *Likelihood* of this impact being caused during construction works is considered to be *certain* for all steady stream Surface Water Systems approached and crossed by the project using the open cut method. For Surface Water Systems whose crossing with the project will be carried out using the trenchless method, the *Likelihood* of the impact is *rare* since no direct works will take place inside and/or adjacent to the SWS and the impact is related to the risks inherent in every construction operation, especially the accidental release of drilling fluid. Lastly, for seasonal flow water resources, the *Likelihood* of the impact will be *likely* due to possible rainfall during the work period.

The exact *Extent* depends on the speed of water flow, the sedimentary characteristics of the bed and the concentration of suspended materials in the water. For the purposes of this study, a conservative approach is taken and the following are considered as an area of direct impact (i.e. *extent*):

- The area at a large distance around the steady stream SWS (*large*) which are going to be crossed using the open cut method. During the crossing works using the open cut method, works are carried out within the bed of the Surface Water System causing sediment re-suspension and transfer, resulting in a drop in dissolved oxygen (DO), which could adversely affect certain river species;
- The immediate area of project footprint (*small*) for water systems of seasonal flow. In the case of streams of seasonal flow change in water quality is not expected when no water is flowing in the receiving body;
- The immediate area of the project footprint (*small*), for those Surface Water Systems that are going to be crossed using a trenchless method. Unlike the open cut method, no direct works are carried out within the Surface Water Systems and sediment re-suspension is prevented;

The *Intensity* of impact on water resources is linked to the sensitivity of crossed surface water resources (Table 9-115). As such water resources of medium sensitivity characterized by *medium* intensity and so forth.

The *Duration* of the impact is determined by its characteristics. In specific, where the impact is caused by the change in turbidity from sediment dispersion, the *Duration* is determined by excavation works. As detailed in Chapter 6, Section 6.4.3.3 open cut crossing techniques require as little time as possible (few days), while the time needed to prepare, perform, and complete the river crossing with a trenchless method require up to three months. Therefore, irrespective of the crossing construction takes the impact's characteristics and the working method, the *Duration* of the impact is estimated to be *short-term*;

As regards *Reversibility*, it is estimated that impact mitigation depends on the sensitivity value of the water resources, the crossing method to be used, the flow of the crossed SWS and the implementation of measures to counter the discharge of hydraulic testing water. In specific:

- For those SWS of steady stream to be crossed using the open cut method, the impact *Reversibility* will be achieved with appropriate planning (works to be carried out during periods of low flow volume, low rainfall, bypass etc.);
- For SWS characterised by seasonal water flow, appropriate planning (work during periods of no flow) can prevent the impact;

- For SWS whose crossing with the project will be done using the trenchless method, the impact is prevented since no work takes place within the water resources;

Finally, a conservative approach is taken as regards *cumulative action* which is considered as _likely_ for all areas.

Having regard to the aforementioned and based on the criteria provided for under Section 9.1.2.

- For crossed constant flow SWS of zero sensitivity using the open cut method.

The *Likelihood* of a change in the quality of surface water resources during construction is considered to be _certain_. The *extent* of the impact is estimated to be _large_. The *Intensity* based on the receptor's sensitivity is _zero_. The *Duration* is considered to be _short-term_. The impact *Reversibility* is _reversed_. Finally impact *cumulative action* is considered to be _likely_ and the transboundary effect, given the spatial context of the engaged water bodies, is considered to be _impossible_. Consequently, **SEI is considered as Minor**.

- For crossed constant flow SWS of medium sensitivity using the open cut method.

The *Likelihood* of a change in the quality of surface water resources during construction is considered to be _certain_. The *extent* of the impact is estimated to be _large_. The *Intensity* based on the receptor's sensitivity is _medium_. The *Duration* is considered to be _short-term_. The impact *Reversibility* is _reversed_. Finally, impact *Cumulative Action* is considered to be _likely_ and the *Transboundary effect*, given the spatial context of the engaged water bodies, is considered to be _impossible_. Consequently, **SEI is considered as Minor**.

- For crossed constant flow SWS of high sensitivity using the open cut method.

The *Likelihood* of a change in the quality of surface water resources during construction is considered to be _certain_. The *extent* of the impact is estimated to be _large_. The *Intensity* based on the receptor's sensitivity is _high_. The *Duration* is considered to be _short-term_. The impact *Reversibility* is _reversed_. Finally impact *cumulative action* is considered to be _likely_ and the transboundary effect, given the spatial context of the engaged water bodies, is considered to be _impossible_. Consequently, **SEI is considered as Minor**.

- For crossed constant flow SWS of very high sensitivity using the open cut method.

The *Likelihood* of a change in the quality of surface water resources during construction is considered to be _certain_. The *extent* of the impact is estimated to be _large_. The *Intensity* based on the receptor's sensitivity is _very high_. The *Duration* is considered to be _short-term_. The impact *Reversibility* is _reversed_. Finally, impact *Cumulative action* is considered to be _likely_ and the *Transboundary effect*, given the spatial context of the engaged water bodies, is considered to be _impossible_. Consequently, **SEI is considered as Moderate**.

- For crossed seasonal flow SWS of zero sensitivity using the open cut method.

The *Likelihood* of a change in the quality of seasonal flow surface water resources is estimated to be *likely*. The *Extent* is considered to be *small* and the *Intensity* based on the receptor's sensitivity is *zero*. The *Duration* is considered to be *short-term* and impact *Reversibility* with appropriate planning is estimated to be *preventable*. Finally impact *Cumulative action* is considered to be *likely* and the *Transboundary effect*, given the spatial context of the engaged water bodies, is considered to be *impossible*. Consequently, **SEI is considered as Negligible**.

- For crossed seasonal flow SWS of high sensitivity using the open cut method.

The *Likelihood* of a change in the quality of seasonal flow surface water resources is estimated to be *likely*. The *Extent* is considered to be *small* and the *Intensity* based on the receptor's sensitivity is *high*. The *Duration* is considered to be *short-term* and impact *Reversibility* with appropriate planning is estimated to be *preventable*. Finally impact *Cumulative action* is considered to be *likely* and the *Transboundary effect*, given the spatial context of the engaged water bodies, is considered to be *impossible*. Consequently, **SEI is considered as Minor**.

- For crossed SWS of zero sensitivity using the trenchless method.

The *Likelihood* of a change in the quality of surface water resources during construction is considered to be *rare*. The *Extent* is estimated to be *small*. The *Intensity* based on receptor sensitivity is considered to be *zero*, while the *Duration* is considered to be *short-term* and regarding impact *Reversibility*, the choice of crossing method partially *prevents* the main mechanism of the impact. Finally impact *Cumulative action* is considered to be *likely* and the *Transboundary effect*, given the spatial context of the engaged water bodies, is considered to be *impossible*. Consequently, **SEI is considered as Negligible**.

- For crossed SWS of high sensitivity using the trenchless method.

The *Likelihood* of a change in the quality of surface water resources during construction is considered to be *rare*. The *Extent* is estimated to be *small*. The *Intensity* based on receptor sensitivity is considered to be *high*, while the *Duration* is considered to be *short-term* and regarding impact *Reversibility*, the choice of crossing method partially *prevents* the main mechanism of the impact. Finally impact *Cumulative action* is considered to be *likely* and the *Transboundary effect*, given the spatial context of the engaged water bodies, is considered to be *impossible*. Consequently, **SEI is considered as Negligible**.

- For crossed SWS of very high sensitivity using the trenchless method.

The *Likelihood* of a change in the quality of surface water resources during construction is considered to be *rare*. The *Extent* is estimated to be *small*. The *Intensity* based on receptor sensitivity is considered to be *very high*, while the *Duration* is considered to be *short-term* and regarding impact *Reversibility*, the choice of crossing method partially *prevents* the main mechanism of the impact. Finally impact *Cumulative action* is considered to be *likely* and the *Transboundary effect*, given the spatial context of the engaged water bodies, is considered to be *impossible*. Consequently, **SEI is considered as Minor**.

9.2.13.2.5 Impacts on the quality of Coastal Water Systems

Impacts on the quality of coastal waters could arise from the mechanisms shown in Table 9-113. The main cause is the re-suspension and dispersion of sediment during the construction works that will be performed for the shore crossing of the investigated project. In particular, activities such as the trench dredging, construction of a cofferdam and the use of excavation equipment suitable for hard soil and/or rocky soil conditions (e.g. backhoe equipped with hydraulic hammer / chisel, cutter suction dredger) will move sediments into the water column.

As a result, water quality will be affected by increased contaminant levels in areas with suspended sediment, if these are currently embedded in the sediments in the nearshore areas. In this regard the surface sediments in all LF sites were sampled during a survey campaign in period june – july 2021 along the pipeline route from the shore to the first -40 m WD. Based on the chemical analysis the concentrations of heavy metals were found to be proportional to those of the Earth's average crust (Annex 8.P). Regarding Cd and Hg they appear increased concentration in relation to the Earth's average crust (Annex 8.P). However, according to the Wisconsin Department of Natural Resource, the mean concentrations (in all FL sites) are lower than the Threshold Effect Concentration (TEC) below which no biological effects on sediment organisms are expected (MacDonald, Ingersoll, & Berger, 2000). Furthermore, according to WHO concentrations of mercury in waters do not usually create risks for human health (World Health Organization (WHO), 2016). In any case, appropriate mitigation measures (e.g. the use of silt curtains) result to prevent the transport of sediment out of the work site and into the surrounding environment.

Other Project activities that could lead to changes in water quality would include the presence of the construction and support vessels which involve use of anchorages (mobilisation of sediments from the seabed) and the operation of vessels (i.e. management of typical vessel effluents that will be in line with MARPOL).

Regarding the impacts assessment criteria presented under paragraph 9.1.

The *Likelihood* of this impact being caused during construction works is considered to be *certain* for all Landfall sites.

The area of direct impact (i.e. *extent*) has been determined by applying a sediment diffusion model (Annex 9D). The following table summarizes the values of the suspended sediment concentrations in the water column at various distances from the discharge location (x=0).

Table 9-119 Suspended Sediment Concentrations (mg/L) in the water column.

Site	LF2		LF3		LF4		LF5	
X (m)	Max	Min	Max	Min	Max	Min	Max	Min
10	6.8	21.6	14.6	115.1	38.8	147.0	35.0	153.1
20	4.7	2.5	6.2	13.2	27.7	23.3	23.7	36.7
30	3.1	0.0	3.4	0.0	23.1	8.2	18.2	7.4
40	1.9		1.7		19.9	7.9	15.0	6.7
50	1.2		0.8		18.2	7.6	13.1	5.4
75	0.3		0.1		16.2	6.9	11.1	4.4
100	0.1		0.0		15.2	5.4	10.4	3.9
150	0.0				13.9	4.4	9.6	3.1
200					12.7	2.3	8.9	2.7
300					10.7	2.0	7.8	2.3

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From Table 9-119 it is conclusive that the *Extent* is considered small for the potential spread of dredged material. In particular, at distances shorter than 20 m from the discharge location, the suspended sediment concentrations for the maximum current velocity are lower than the threshold value of 35 mg/L for all sites. For the minimum current velocity, the corresponding concentrations are lower than the threshold value of 35 mg/L[44] with the exception of the site LF5 at which the suspended sediment concentration is slightly higher than the threshold value (36.7 mg/L).

The *Intensity* of impact is linked to the sensitivity of crossed costal water resources (Table 9-115). As such water resources of medium sensitivity characterized by *medium* intensity and so forth.

The *Duration* of the impact is associated with the construction works performed for the shore crossing of the investigated project. Occupation will be temporary, and it is estimated that the re-sedimentation will occur over a short time period upon completion of the projects. Taking a conservative approach (see section 6.4), we believe the impact will be *short-term*.

[44] The guidance value for total suspended solids provided by the MARPOL Resolution MEPC.159(55) (IMO, 2006) is 35 mg/L for its maritime effluent discharge standard, as well as the World Bank / International Finance Corporation (IFC) for marine effluent discharges (World Bank Group, 2015)."

Relating to *Reversibility*, with the use of the appropriate mitigation measures, is considered to be *minimizable*. As regards *Cumulative action,* a conservative approach is taken and is considered as *likely* for all LF sites. Finally, the *Transboundary effect*, given the spatial context of the engaged water bodies, is considered to be *impossible*.

Having regard to the aforementioned and based on the criteria provided for under Section 9.1.2.

The *Likelihood* of a change in the quality of coastal water resources during construction is considered to be *certain*. The *Extent* of the impact is estimated to be less than 20 m (*small)*. The *Intensity* based on the receptor's sensitivity is *medium* on LF2, *very high* on LF3 and *low* on LF4 and LF5. The *Duration* is considered to be *short-term*. The impact *Reversibility* is *reversed*. Finally impact *Cumulative action* is considered to be *likely* and the *Transboundary effect*, given the spatial context of the engaged water bodies, is considered to be *impossible*. Consequently, **SEI is considered as Minor for all LF sites**.

9.2.13.2.6 Impacts on the availability of SWS

Impacts on the availability of surface waters may arise from water abstraction and discharge for hydrostatic testing activities. These could reduce the volume and flow of water and subsequently the water in the habitat. In principle, inland water sources with larger amounts of water flow have been considered for water abstraction and discharge. Eleven (Table 6-57) SWS are the potential water sources for hydraulic testing, thus increasing the pressure caused by the impact.

Regarding the impacts assessment criteria presented under section 9.1

Taking a conservative approach, the *Likelihood* of the impact being caused during construction works is considered to be *certain* for the SWS that are the potential water sources. The *Likelihood* for the other SWS is *impossible* as no significant drainage of water is expected to be required and depends on weather conditions. Therefore no further evaluation is made on.

The area of direct impacts (i.e. *Extent*), regarding the potential water sources, is considered to be *medium* as the volume of water to be used for the hydraulic test is a very small percentage of the flowing water. Moreover, the discharge rates will be under 10% of the receiving river flow. For the other SWS, the extent of the impact is not expected to exceed the project footprint (*small*), since no significant drainage of water is expected to be required.

The *Intensity* of impact on water resources is linked to the sensitivity of crossed surface water resources (Table 9-115). As such water resources of medium sensitivity characterized by *medium* intensity and so forth.

The *Duration* of the impact is expected to be *short-term*, since it depends on how long it takes to complete the hydrostatic testing activities. For the other SWS the impact is expected to be *instant*, since the groundwater drainage mechanism is expected to have little to no effect.

As regards *Reversibility*, it is estimated by planning properly the hydraulic test method (the same water bodies will be taken into consideration for abstraction and discharge, the discharge rates are under 10% of the receiving river flow etc) the impact on SWS can be *avoided*. Regarding SWS that will not be sources of water abstraction the impact is *prevented*, irrespective of the physical characteristics of the recipient water (permanent or seasonal flow).

Finally, concerning *Cumulative action,* a conservative approach is taken and is considered as *likely* for all SWS and the *Transboundary effect*, given the spatial context of the engaged water bodies, is considered to be *impossible*.

Having regard to the aforementioned and based on the criteria provided for under Section 9.1.2.

- For SWS that are potential water sources for hydraulic testing and of zero sensitivity.

The *Likelihood* of a change in the quantity of surface water resources during construction is considered to be *certain*. The *Extent* of the impact is considered to be *medium* and the *Intensity* based on the receptor's sensitivity is considered to be *zero*. The *Duration* is considered to be *short-term* and regarding impact *Reversibility*, it is *avoidable* with the appropriate planning of works and discharge mechanisms. Finally impact *Cumulative action* is considered to be *likely* and the *Transboundary effect*, given the spatial context of the engaged water bodies, is considered to be *impossible*. Consequently, **SEI is considered as Minor**.

- For SWS that are potential water sources for hydraulic testing and of high sensitivity.

The *Likelihood* of a change in the quantity of surface water resources during construction is considered to be *certain*. The *Extent* of the impact is considered to be *medium* and the *Intensity* based on the receptor's sensitivity is considered to be *high*. The *Duration* is considered to be *short-term* and regarding impact *Reversibility*, it is *avoidable* with the appropriate planning of works and discharge mechanisms. Finally impact *Cumulative action* is considered to be *likely* and the *Transboundary effect*, given the spatial context of the engaged water bodies, is considered to be *impossible*. Consequently, **SEI is considered as Minor**.

- For SWS that are potential water sources for hydraulic testing and of very high sensitivity.

The *Likelihood* of a change in the quantity of surface water resources during construction is considered to be *certain*. The *Extent* of the impact is considered to be *medium* and the *Intensity* based on the receptor's sensitivity is considered to be *very high*. The *Duration* is considered to be *short-term* and regarding impact *Reversibility*, it is *avoidable* with the appropriate planning of works and discharge mechanisms. Finally impact *Ψumulative action* is considered to be <u>*likely*</u> and the *Transboundary effect*, given the spatial context of the engaged water bodies, is considered to be <u>*impossible*</u>. Consequently, **SEI is considered as Minor**.

9.2.13.2.7 Accidental pollution

Accidental pollution of water resources from solid and/or liquid waste could be caused from the production and disposal of solid and liquid waste, as well as the storage and management of fuels and chemicals to be used for construction equipment. However, these events are extremely rare due to the use of proper good practice measures.

In particular, sources of accidental pollution are the following:

- Household waste produced from the operation of construction sites includes liquid waste, mainly from the use of sanitary facilities, and solid waste produced by site workers.
- Liquid waste from fuel leakages, disposal of waste oils, as well as rinsings when piled materials at the worksite become wet.
- Accidental release of hydraulic fluid, such as wet concrete bentonite, in the course of trenchless crossing works.
- Accidental leakages from vehicles, storage tanks and chemical stocks, metallurgical activities and welding operations.

Regarding the impacts assessment criteria presented under paragraph 9.1

Taking a conservative approach, the *Likelihood* of the impact being caused in the course of construction works is considered to be <u>*rare*</u> for all Surface Water Systems approached and crossed by the project footprint, since all necessary response measures are going to be taken and implemented, as detailed in section 10.

The area of direct impact (i.e. *Extent*), for seasonal flow SWS, is estimated to be limited to resource footprint (<u>*small*</u>) given the low volume of accidental waste but also the small dispersion, due to minimal or no flow. For steady stream SWS, this area is estimated to be at local level (<u>*medium*</u>) given the small volume of accidental waste and the high rate of flowing surface water renewal.

The *Intensity* of impact on water resources is linked to the sensitivity of crossed surface water resources (Table 9-115). As such water resources of medium sensitivity characterized by <u>*medium*</u> intensity and so forth.

The *Duration* of the impact is expected to be <u>*short-term*</u> for all SWS, since it depends on how long it takes to complete the works. The *Duration* of works is not expected to exceed 2 months per working section whichever method is used to cross the Surface Water System.

As regards impact *Reversibility*, it is estimated that with appropriate planning and prevention measures, as described in Section 10, it is possible to *prevent* impact-causing mechanisms. Finally, concerning *cumulative action,* a conservative approach is taken and is considered as *likely* for all SWS and the *transboundary effect*, given the spatial context of the engaged water bodies, is considered to be *impossible*.

Having regard to the aforementioned and based on the criteria provided for under Section 9.1.2.

- For crossed seasonal flow SWS of zero sensitivity;

The *Likelihood* of accidental pollution caused by solid and liquid waste is considered to be *rare*. The *Extent* of the impact is considered to be *small* and the *Intensity* based on the receptor's sensitivity is considered to be *zero*. The *Duration* is considered to be *short-term* and impact *Reversibility* may be *prevented* with planning and implementing appropriate measures. Finally impact *Cumulative action* is considered to be *likely* and the *Transboundary effect*, given the spatial context of the engaged water bodies, is considered to be *impossible*. Consequently, SEI considered **Negligible**.

- For crossed seasonal flow SWS of high sensitivity;

The *Likelihood* of accidental pollution caused by solid and liquid waste is considered to be *rare*. The *Extent* of the impact is considered to be *small* and the *Intensity* based on the receptor's sensitivity is considered to be *high*. The *Duration* is considered to be *short-term* and impact *Reversibility* may be *prevented* with planning and implementing appropriate measures. Finally impact *Cumulative action* is considered to be *likely* and the *Transboundary effect*, given the spatial context of the engaged water bodies, is considered to be *impossible*. Consequently, SEI considered **Negligible**.

- For steady stream SWS of zero sensitivity;

The *Likelihood* of accidental pollution caused by solid and liquid waste is considered to be *rare*. The *Extent* of the impact is considered to be *medium* and the *Intensity* based on the receptor's sensitivity is considered to be *zero*. The *Duration* is considered to be *short-term* and impact *Reversibility* may be *prevented* with planning and implementing appropriate measures. Finally impact *Cumulative action* is considered to be *likely* and the *Transboundary effect*, given the spatial context of the engaged water bodies, is considered to be *impossible*. Consequently, SEI considered **Negligible**.

- For steady stream SWS of medium sensitivity;

The *Likelihood* of accidental pollution caused by solid and liquid waste is considered to be *rare*. The *Extent* of the impact is considered to be *medium* and the *Intensity* based on the receptor's sensitivity is considered to be *medium*. The *Duration* is considered to be *short-term* and impact *Reversibility* may be *prevented* with planning and implementing appropriate measures. Finally impact *Cumulative* *action* is considered to be *likely* and the *Transboundary effect*, given the spatial context of the engaged water bodies, is considered to be *impossible*. Consequently, SEI considered **Negligible**.

- For steady stream SWS of high sensitivity;

The *Likelihood* of accidental pollution caused by solid and liquid waste is considered to be *rare*. The *Extent* of the impact is considered to be *medium* and the *Intensity* based on the receptor's sensitivity is considered to be *high*. The *Duration* is considered to be *short-term* and impact *Reversibility* may be *prevented* with planning and implementing appropriate measures. Finally impact *Cumulative action* is considered to be *likely* and the *Transboundary effect*, given the spatial context of the engaged water bodies, is considered to be *impossible*. Consequently, SEI considered **Minor**.

- For steady stream SWS of very high sensitivity;

The *Likelihood* of accidental pollution caused by solid and liquid waste is considered to be *rare*. The *Extent* of the impact is considered to be *medium* and the *Intensity* based on the receptor's sensitivity is considered to be *very high*. The *Duration* is considered to be *short-term* and impact *Reversibility* may be *prevented* with planning and implementing appropriate measures. Finally impact *Cumulative action* is considered to be *likely* and the *Transboundary effect*, given the spatial context of the engaged water bodies, is considered to be *impossible*. Consequently, SEI considered **Minor**.

9.2.13.3 Groundwater Systems

9.2.13.3.1 Introduction

The quantitative and qualitative state of Groundwater Systems was taken into account in assessing the possible impacts at construction phase.

Depending on the mechanisms described in paragraph 9.2.13.1.1 the likely impacts that could be caused at construction phase are as follows:

- Impacts on the quality of groundwaters
- Impacts on the quantity of groundwaters

9.2.13.3.2 Impact on the quality of Groundwater Systems

The most significant environmental impacts associated with the quality of Groundwater Systems that may occur during Project construction are mainly limited in case of pollutants being released, such as gasoline or engine oils. These wastes could infiltrate the subsoil and contaminate the underground aquifers in the worksite.

Regarding the impacts assessment criteria presented under paragraph 9.1.

The *Likelihood* of impact is _Rare_ due to the high standards of equipment and vehicles that will comply with EU standards.small quantities that may be released are not considered to be capable of deteriorating the receptor's quality status

Area of direct impacts (i.e. *Extent*) is considered to be the project footprint (_small_), since any potential leakage of pollutants concerns small quantities from machinery moving along the project axis or machinery within the worksite.

The *Intensity* of impact on Groundwater Systems is linked to the sensitivity of crossed ground water resources (Table 9-117). As such water resources of high sensitivity characterized by _high_ intensity and so forth.

The *Duration* of impact is estimated to be _short-term_, since quantities are extremely small and hydrocarbons are organic pollutants; as they move into the subsoil, they undergo slow or rapid degradation and consequently pollution is weakened.

It is estimated that impact *Reversibility* can be _prevented_ by appropriate planning and implementing operational rules for machinery and construction sites as mentioned in the relevant paragraphs in Chapters 6 and 10.

Finally, a conservative approach is taken as regards *Cumulative action* which is considered as _rare_ for all water bodies, given the small quantities that may be released that are not considered to be capable of deteriorating the receptor's quality status.

Having regard to the aforementioned and based on the criteria provided for under Section 9.1.2.

- For all the GWB

The *Likelihood* of a change in the quality of Groundwater Systems during construction is considered to be _rare_. The *Extent* of the impact is estimated to be _small_. The *Intensity* based on the receptor's sensitivity (Table 9-117). The *Duration* is considered to be _short-term_ and impact *Reversibility* can be _prevented_ with appropriate planning and implementation of appropriate operational rules. Finally impact *Cumulative action* is considered to be _rare_ and the *Transboundary effect*, given the spatial context of the engaged water bodies, is considered to be _impossible_. Consequently, **SEI is considered as Negligible**. Extra attention should be given to the GWBs of good chemical and availability status where **SEI is considered as Minor**.

9.2.13.3.3 Impacts on the availability of Groundwater Systems

No significant pressures on the availability state of Groundwater Systems are expected at construction phase. Water drainage during the construction of the trench is the some pressure-causing mechanism which results in a small drop in the level of the underlying Groundwater Systems. However, given that project works are carried out at a shallow depth (≤2.5m), the drainage mechanism is not capable of causing any pressure on the availability state. In addition, reduction will be temporary and the aquifer will rise again to its former state in a short time.

In any case, trenching works are planned for the periods of low rainfall. Appropriate planning will minimise the pressure caused by the impact, particularly in areas with a high aquifer. From the above, it is estimated that no impact on availability of Groundwater Systems is expected.

9.2.13.3.4 Accidental pollution

Accidental pollution of Groundwater Systems from liquid waste could be caused from the generation and disposal of liquid waste, as well as the storage and management of fuels and chemicals to be used for construction equipment. In particular, sources of accidental pollution are the following:

- Liquid urban waste from the operation of construction sites, mainly produced when using the sanitary facilities.
- Liquid waste from fuel leakages, disposal of waste oils from machinery.
- Accidental leaks from storage tanks and chemical stocks.

Regarding the impacts assessment criteria presented under paragraph 9.1.

The *Likelihood* of the impact being caused in the course of construction works is considered to be *rare* for all Groundwater Systems approached and crossed by the project footprint, since all necessary response measures are going to be taken and implemented, as detailed in Section 10.

The area of direct impact (i.e. *Extent*), for all Groundwater Systems, is estimated to be the project footprint (*small*). In particular, in case of a possible but unlikely release of pollutants, their small volume and short *Duration* of exposure of the water resources (related to construction works) do not allow for the concentration of pollutants in the water to increase to such an extent so as to alter the ecological state of the water resource.

The *Intensity* of impact on Groundwater Systems is linked to the sensitivity of crossed ground water resources (Table 9-117), since any change may result in loss of irrigable and/or drinking water. As such water resources of high sensitivity characterized by *high* intensity and so forth.

The *Duration* of the impact is expected to be *short-term* for all Groundwater Systems. In particular, the potential exposure of the water resource to pollutants will be of short *Duration*, since it depends on how long it takes to complete the works, which is not expected to exceed 2 months per working section.

As regards *Reversibility*, it is estimated that appropriate planning and operational rules could *prevent* the impact-causing mechanisms. Finally, a conservative approach is taken as regards *Cumulative action* which is considered as *likely* for all water bodies.

Having regard to the aforementioned and based on the criteria presented in Section Section 9.1.

- For all the GWB

The *Likelihood* of a change in the quality of Groundwater Systems during construction is considered to be *rare*. The *Extent* of the impact is estimated to be *small*. The *Intensity* is based on the receptor's sensitivity (Table 9-117). The *Duration* is considered to be *short-term* and impact *Reversibility* can be *prevented* with appropriate planning and implementation of appropriate operational rules. Finally impact *Cumulative action* is considered to be *rare* and the *Transboundary effect*, given the spatial context of the engaged water bodies, is considered to be *impossible*. Consequently, **SEI is considered as Negligible**.

9.2.13.4 Summary

Table 9-120 Summary of Impacts for water resources during the Construction Phase.

S/N SEI / Project phase / Impact	Constructions: Mechanism	Constructions: Locations (crossing locations with refernced WB)	SEI for Water resources – Criteria/ Impact Properties (L)	(Ex)	(I)	(D)	(R)	(C)	(T)	SEI (Sum criteria X 10/7)	Comments
Surface Water Systems (SWS)											
Changes in the morphology of SWS (rivers)	Watercourse crossings	EL0129R000221056N EL0415R000202007H, EL0514R000201050N, EL0546R000201077N EL0420R000200070N, EL0513R000200045N	The impact is considered to be impossible, therefore no further evaluation is made on								Trenchless method
Changes in the morphology of SWS (rivers)	Watercourse crossings	EL0331R000700004N, Small Stream_01, EL0129R000220055N, EL0129R000218052N, Small Stream_02, EL0129R000210037N, Small Stream_03, Small Stream_05	1.00	0.00	0.00	0.25	0.25	0.50	0.00	2.86 (Minor)	Open cut method Zero sensitivity Seasonal water flow Sparse riparian vegetation

S/N SEI / Project phase	Constructions		SEI for Water resources							SEI (Sum criteria X 10/7)	Comments
Impact	Mechanism	Locations (crossing locations with refernced WB)	Criteria/ Impact Properties								
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Changes in the morphology of Surface Water Systems (rivers)	Watercourse crossings	EL0129R000212039N	1.00	0.00	0.50	0.25	0.25	0.50	0.00	3.57 (Minor)	Open cut method Medium sensitivity Seasonal water flow Sparse riparian vegetation
Changes in the morphology of Surface Water Systems (rivers)	Watercourse crossings	EL0514R000102049N, EL0513R000101042N	1.00	0.00	0.75	0.25	0.25	0.50	0.00	3.93 (Minor)	Open cut method High sensitivity Seasonal water flow Sparse riparian vegetation
Changes in the morphology of Surface Water Systems (rivers)	Watercourse crossings	EL0415R001301068N	1.00	0.00	0.75	0.75	0.75	0.50	0.00	5.36 (Moderate)	Open cut method High sensitivity Seasonal water flow Extend riparian vegetation
Changes in the morphology of Surface Water Systems (rivers)	Watercourse crossings	EL0333R000211040N, EL0333R000217049N, EL0129R000207020N, EL0228R000204007N,	1.00	0.25	0.00	0.25	0.75	0.50	0.00	3.93 (Minor)	Open cut method Zero sensitivity Constant flow Surface Water

S/N SEI / Project phase / Impact	Constructions / Mechanism	Locations (crossing locations with refernced WB)	SEI for Water resources / Criteria/ Impact Properties (L)	(Ex)	(I)	(D)	(R)	(C)	(T)	SEI (Sum criteria X 10/7)	Comments
		EL0228R000203009N, EL0415R000000008N, EL0513R000202044N									Sparse riparian vegetation
Changes in the morphology of Surface Water Systems (rivers)	Watercourse crossings	EL0333R000212042N, EL0129R000206011N	1.00	0.25	0.50	0.25	0.75	0.50	0.00	4.64 (Minor)	Open cut method High sensitivity Constant flow Surface Water Extend riparian vegetation
Changes in the morphology of Surface Water Systems (rivers)	Watercourse crossings	EL0415R000200011H	1.00	0.25	1.00	0.75	0.75	0.50	0.00	6.07 (Moderate)	Open cut method Very high sensitivity Constant flow Surface Water Extend riparian vegetation
Changes in the morphology of shore	Shore crossing	EL0228C0003N, EL0415C0002N	1.00	0.25	0.25	0.25	0.50	0.50	0.00	3.93 (Minor)	Landfall sites LF4 and LF5
Changes in the morphology of shore	Shore crossing	EL1341C0016N	1.00	0.25	0.50	0.25	0.50	0.50	0.00	4.29 (Minor)	Landfall site LF2

S/N SEI Project phase	Constructions		SEI for Water resources							SEI (Sum criteria X 10/7)	Comments
Impact	Mechanism	Locations (crossing locations with refernced WB)	Criteria/ Impact Properties								
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Changes in the morphology of shore	Shore crossing	EL0331C0005N	1.00	0.25	1.00	0.25	0.75	0.50	0.00	5.36 (Moderate)	Landfall site LF3
Impacts on the quality of water resources	Re-suspension and dispersion of sediment Discharge of the hydraulic testing water	EL0333R000211040N, EL0333R000217049N, EL0129R000207020N, EL0228R000204007N, EL0228R000203009N	1.00	0.50	0.00	0.25	0.50	0.50	0.00	3.93 (Minor)	Open cut method Zero sensitivity Constant flow Surface Water
Impacts on the quality of water resources	Re-suspension and dispersion of sediment Discharge of the hydraulic testing water	EL0333R000212042N, EL0129R000206011N	1.00	0.50	0.50	0.25	0.50	0.50	0.00	4.64 (Minor)	Open cut method Medium sensitivity Constant flow Surface Water
Impacts on the quality of water resources	Re-suspension and dispersion of sediment Discharge of	EL0415R000202106N, EL0129R000212039N	1.00	0.50	0.75	0.25	0.50	0.50	0.00	5.00 (Minor)	Open cut method High sensitivity Constant flow Surface Water

S/N SEI / Project phase / Impact	Constructions / Mechanism	Locations (crossing locations with refernced WB)	SEI for Water resources – Criteria/ Impact Properties (L)	(Ex)	(I)	(D)	(R)	(C)	(T)	SEI (Sum criteria X 10/7)	Comments
	the hydraulic testing water										
Impacts on the quality of water resources	Re-suspension and dispersion of sediment	EL0415R000200011H	1.00	0.50	1.00	0.25	0.50	0.50	0.00	5.36 (Moderate)	Open cut method Very high sensitivity Constant flow Surface Water
Impacts on the quality of water resources	Re-suspension and dispersion of sediment	Small Stream_01, Small Stream_02, Small Stream_03, Small Stream_05, EL0129R000220055N, EL0129R000218052N, EL0129R000210037N, EL0129R000212039N	0.50	0.25	0.00	0.25	0.00	0.50	0.00	2.14 (Negligible)	Open cut method Zero sensitivity Seasonal flow Surface Water
Impacts on the quality of water resources	Re-suspension and dispersion of sediment	EL0513R000101042N, EL0415R001301068N, EL0514R000102049N	0.50	0.25	0.75	0.25	0.00	0.50	0.00	3.21 (Minor)	Open cut method High sensitivity Seasonal flow Surface Water

S/N SEI / Project phase / Impact	Constructions: Mechanism	Locations (crossing locations with refernced WB)	SEI for Water resources – Criteria/ Impact Properties: (L)	(Ex)	(I)	(D)	(R)	(C)	(T)	SEI (Sum criteria X 10/7)	Comments
Impacts on the quality of water resources	Re-suspension and dispersion of sediment	EL0129R000221056N	0.25	0.00	0.00	0.25	0.00	0.50	0.00	1.43 (Negligible)	Zero sensitivity Trenchless method
Impacts on the quality of water resources	Re-suspension and dispersion of sediment	EL0415R000202007H, EL0514R000201050N, EL0546R000201077N	0.25	0.00	0.75	0.25	0.00	0.50	0.00	2.50 (Negligible)	High sensitivity Trenchless method
Impacts on the quality of water resources	Re-suspension and dispersion of sediment	EL0513R000200045N, EL0420R000200070N	0.25	0.00	1.00	0.25	0.00	0.50	0.00	2.86 (Minor)	Very high sensitivity Trenchless method
Impacts on the quality of Coastal Water Systems	Shore crossings	EL0228C0003N (LF4) EL0415C0002N (LF5) EL0331C0005N (LF3) EL1341C0016N (LF2)	1.00	0.00	0.25 0.25 1.00 0.50	0.25	0.00	0.50	0.00	3.57 3.57 4.64 3.93 (Minor)	
Impacts on the availabilityof surface waters	Draining water when excavating the trench Discharge of	EL0333R000211040N, EL0333R000217049N, EL0129R000207020N, EL0228R000204007N,	1.00	0.50	0.00	0.25	0.25	0.50	0.00	3.57 (Minor)	Potential water sources Zero sensitivity

S/N SEI / Project phase / Impact	Constructions: Mechanism	Locations (crossing locations with refernced WB)	SEI for Water resources – Criteria/ Impact Properties (L)	(Ex)	(I)	(D)	(R)	(C)	(T)	SEI (Sum criteria X 10/7)	Comments
	the hydraulic testing water	EL0228R000203009N, EL0129R000221056N									
Impacts on the availabilityof surface waters	Draining water when excavating the trench Discharge of the hydraulic testing water	EL0514R000201050N, EL0546R000201077N, EL0415R000202007H	1.00	0.50	0.75	0.25	0.25	0.50	0.00	4.64 (Minor)	Potential water sources High sensitivity
Impacts on the availabilityof surface waters	Draining water when excavating the trench Discharge of the hydraulic testing water	EL0415R000200011H, EL0420R000200070N	1.00	0.50	1.00	0.25	0.25	0.50	0.00	5.00 (Minor)	Potential water sources Very high insitivity
Impacts on the availabilityof surface waters	Draining water when excavating the	EL0513R000200045N EL0514R000102049N, EL0513R000101042N,	The *Likelihood* for the SWS that are not a water source for hydraulic testing is *impossible* as no significant drainage of water is expected to be required. Therefore no further evaluation is made on								Not a water source for hydraulic testing Zero insitivity

S/N SEI / Project phase	Constructions		SEI for Water resources							SEI (Sum criteria X 10/7)	Comments
			Criteria/ Impact Properties								
Impact	Mechanism	Locations (crossing locations with refernced WB)	(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
	trench Discharge of the hydraulic testing water	EL0415R000202106N, EL0514R000100048N, EL0415R001301068N EL0129R000206011N, EL0333R000212042N EL0513R000202044N, EL0129R000220055N, EL0129R000218052N, EL0129R000212039N, EL0415R000000008N, EL0331R000700004N, EL0129R000210037N, Small Stream_01, Small Stream_02, Small Stream_03, Small Stream_05									
Accidental pollution	Preparation, construction and operation of temporary	EL0129R000220055N, EL0129R000218052N, EL0129R000212039N, EL0331R000700004N,	0.25	0.00	0.00	0.25	0.00	0.50	0.00	1.43 (Negligible)	Seasonal flow Zero sensitivity

S/N SEI / Project phase / Impact	Constructions: Mechanism	Locations (crossing locations with refernced WB)	SEI for Water resources – Criteria/ Impact Properties (L)	(Ex)	(I)	(D)	(R)	(C)	(T)	SEI (Sum criteria X 10/7)	Comments
	facilities Work zone preparation, drainage, erosion control, trench cut, hosting and laying the pipeline. Hydraulic Testing Construction and operation of Compressor Stations, Meter Station and O&M.	EL0129R000210037N, Small Stream_01, Small Stream_02, Small Stream_03, Small Stream_05									
		EL0514R000102049N, EL0513R000101042N, EL0415R001301068N	0.25	0.00	0.75	0.25	0.00	0.50	0.00	2.50 (Negligible)	Seasonal flow High sensitivity
		EL0513R000202044N, EL0415R000000008N, EL0333R000211040N, EL0333R000217049N, EL0129R000207020N, EL0228R000204007N, EL0228R000203009N, EL0129R000221056N	0.25	0.25	0.00	0.25	0.00	0.50	0.00	1.79 (Negligible)	Steady stream Zero sensitivity
		EL0129R000206011N, EL0333R000212042N	0.25	0.25	0.50	0.25	0.00	0.50	0.00	2.50 (Negligible)	Steady stream Medium sensitivity

S/N SEI / Project phase / Impact	Constructions / Mechanism	Locations (crossing locations with refernced WB)	(L)	(Ex)	(I)	(D)	(R)	(C)	(T)	SEI (Sum criteria X 10/7)	Comments
			SEI for Water resources – Criteria/ Impact Properties								
		EL0415R000202106N, EL0514R000100048N, EL0514R000201050N, EL0546R000201077N, EL0415R000202007H	0.25	0.25	0.75	0.25	0.00	0.50	0.00	2.86 (Minor)	Steady stream High sensitivity
		EL0513R000200045N, EL0415R000200011H, EL0420R000200070N	0.25	0.25	1.00	0.25	0.00	0.50	0.00	3.21 (Minor)	Steady stream Very high sensitivity
GroundWater Systems (GWS)											
Impact on the quality of Groundwater Systems	Upgrading existing access roads for moving vehicles, equipment and staff Preparation, construction and operation	EL1300141, EL0300120, EL0300110, EL0300160, EL0300240, EL0300230, EL0300260, EL0100070, EL0100210, EL0100230,	0.50	0.25	0.50	0.25	0.00	0.50	0.00	2.86 (Minor)	Good chemical and availability status Medium sensitivity

S/N SEI / Project phase / Impact	Constructions: Mechanism	Locations (crossing locations with refernced WB)	SEI for Water resources: Criteria/ Impact Properties (L)	(Ex)	(I)	(D)	(R)	(C)	(T)	SEI (Sum criteria X 10/7)	Comments
	of temporary facilities Construction of Compressor Stations, Meter Station and O&M.	EL0100010, EL0400090, EL0400240, EL0400250, EL0400060, EL0400140, EL0400190, EL0500240, EL0500160, EL0500130, EL0500170									
		EL0200060, EL0200100, EL0500250, EL0500090, EL0500270	0.50	0.25	0.75	0.25	0.00	0.50	0.00	3.21 (Minor)	Good chemical and availability status High sensitivity
		EL0100080, EL0500152, EL0500153	0.50	0.25	1.00	0.25	0.00	0.50	0.00	3.57 (Minor)	Good chemical and availability status Very high sensitivity

S/N SEI / Project phase	Constructions		SEI for Water resources							SEI (Sum criteria X 10/7)	Comments
Impact	Mechanism	Locations (crossing locations with refernced WB)	Criteria/ Impact Properties								
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
		EL0300150	0.25	0.25	0.25	0.25	0.00	0.50	0.00	2.14 (Negligible)	Bad chemical and availability status low sensitivity
		EL0200092, EL0200091, EL0200094, EL0500140	0.25	0.25	0.50	0.25	0.00	0.50	0.00	2.50 (Negligible)	Bad chemical state and bad/good availability Medium sensitivity
Impact on the availability of Groundwater Systems	Work zone preparation, drainage, erosion control, trench cut, hosting and laying the pipeline.	All	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 (No impact)	
Accidental pollution	Work zone preparation, drainage, erosion	EL0300150	0.25	0.00	0.25	0.25	0.00	0.50	0.00	1.79 (Negligible)	Low sensitivity
		EL1300141, EL0300120,	0.25	0.00	0.50	0.25	0.00	0.50	0.00	2.14 (Negligible)	Medium sensitivity

S/N SEI	Constructions		SEI for Water resources							SEI (Sum criteria X 10/7)	Comments
Project phase											
Impact	Mechanism	Locations (crossing locations with refernced WB)	Criteria/ Impact Properties								
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
	control, trench cut, hosting and laying the pipeline.	EL0300110, EL0300160, EL0300240, EL0300230, EL0300260, EL0100070, EL0100210, EL0100230, EL0100010, EL0400090, EL0400240, EL0400250, EL0400060, EL0400140, EL0400190, EL0500240, EL0500160, EL0500130, EL0500170,									

S/N SEI / Project phase	Constructions		SEI for Water resources							SEI (Sum criteria X 10/7)	Comments
Impact	Mechanism	Locations (crossing locations with refernced WB)	Criteria/ Impact Properties								
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
		EL0200060, EL0200100									
		EL0500090, EL0500270, EL0200092, EL0200091, EL0200094, EL0500140, EL0300150	0.25	0.00	0.75	0.25	0.00	0.50	0.00	2.50 (Negligible)	High sensitivity
		EL0100080, EL0500152, EL0500153	0.25	0.00	1.00	0.25	0.00	0.50	0.00	2.86 (Minor)	Very high sensitivity

9.2.14 Wave Conditions Oceanographic Characteristics – Coastal Mechanics

This section, in accordance with Ministerial Decision 170225/2014, examines potential project impacts during construction phase, on coastal dynamic balance for beaches located in the wider area of landfall sites.

9.2.14.1 Methodology Overview

Table 9-121 summarizes the main impact sources, potentially affected resources and receptors as well as influencing factors for baseline conditions and those related to the Project.

Table 9-121 Key Issues for assessment – Wave Conditions-Oceanographic characteristics-Coastal Mechanics

Impact/Risk Sources	Construction activities during shore crossing.
Potentially Impacted Resources and Receptors	Beaches on the wider area in Landfall locations.
Special Baseline Conditions that are Potentially Influencing Impacts/Risks	• Beach and Seabed characteristics • Waves • Tides & Currents
Project Factors that are Potentially Influencing Impacts/Risks	• Construction method • Period in which construction work is performed • Construction time
References	• Chapter 6 • Chapter 8 • Chapter 10

Prepared by: ASPROFOS, 2022

9.2.14.2 Impact-Generating Mechanisms

For shore crossing construction at EastMed landfall locations, open-cut is the proposed method.

Open cut construction method is a common technique where, generally, a nearshore section is trenched by a combination of dredging equipment and common excavators working at the onshore section, all intended to enable the pipeline to be pulled ashore at a required depth for burial. To enable the use of heavy equipment, the landfall site requires a sufficiently sized beach, preferably minimum 50 m from the back of the beach to shoreline and minimum 100 m wide. In case the onshore construction area is not adequate, different pulling methods may be used (see section 6.4.2.2). To minimise dredging volumes and to protect the trench from natural backfilling during the period between trench excavation and pipeline installation, a cofferdam in the marine section is often used. In those cases, where the subsoil is not suitable for sheet piles required for the cofferdam, a causeway can be created by using rock boulders or gravel of sufficient size to secure a stable dam during the installation process. The following table presents a summary of the trench dimensions at the landfalls.

Table 9-122 Summary of Cofferdam/Trench Dimensions

Landfall	Cofferdam Size		Nearshore Trenching	
	Length (m)	Width (m)	Length of Trench (m)	Width (m)
LF2	n.a.		300	50
LF3	n.a.		600	30
LF4	200	21	1000	15
LF5	200	21	1000	15

Source: IGI Poseidon, 2021

As a result of this process, existing coastal mechanics patterns and conditions may be affected by the changes in natural beach profile (onshore and offshore). These changes may alter the direction and/or magnitude of waves and consequently the coastal dynamic leading to erosion.

The following paragraphs present project specificities along the four landfalls planned.

9.2.14.2.1 Project specificities at LF2

At LF2 a causeway would be constructed on each side of the trench. The preliminary length of the causeway is assessed at 50 m with further trenching of 250 m. The working time in LF2 is presented in the Table 9-123 below and varies between 5 to 9 months.

Table 9-123 Indicative Construction Time of LF2.

Site	LF2 Construction	
Offshore	Pre-lay dredging	5-7 weeks
	Post-lay backfilling	2-4 weeks
Onshore	Site preparation & bund construction	8-16 weeks
	Pull in operation	1week
	Site reinstatement	4-8 weeks

Prepared by: ASPROFOS, 2022, Source: Allseas, 2021

9.2.14.2.2 Project specificities at LF3

At LF3 where rocky terrain is expected, the proposed construction method is the traditional open cut method with causeways. A length of 200 m is proposed for the causeways followed by a 400 m trench. The working time in LF3 is presented in the table below and varies between 6 to 11 months.

Table 9-124 Indicative Construction Time of LF3.

Site	LF3 Construction	
Offshore	Pre-lay dredging	4-6 weeks
	Post-lay backfilling	2-4 weeks
Onshore	Site preparation & bund construction	10-24 weeks
	Pull in operation	1 week
	Site reinstatement	6-10 weeks

Prepared by: ASPROFOS, 2022, Source: Allseas, 2021

9.2.14.2.3 Project specificities at LF4

The proposed shore crossing construction method for LF4 is the traditional open cut method with sheet piled cofferdams. The pipeline is installed in a pre-dredged trench, typically to a 25 m water depth. The current assessment shows the sheet piled cofferdam for LF4 is at least 200 m, followed by a 1,000 m trench. The working time in LF4 is presented in the table below and varies between 6 to 11 months.

Table 9-125 Indicative Construction Time of LF4

Site	LF4 Construction	
Offshore	Pre-lay dredging	3-5 weeks
	Post-lay backfilling	2-3 weeks
Onshore	Site preparation, cofferdam installation	12-20 weeks
	Pull in operation	1 week
	Cofferdam removal and reinstatement	7-14 weeks

Prepared by: ASPROFOS, 2022. Source: Allseas, 2021

9.2.14.2.4 Project specificities at LF5

The proposed shore crossing construction method for LF5 is the traditional open cut method with sheet piled cofferdams. The pipeline is installed in a pre-dredged trench in deeper waters, typically to a 25 m water depth. The current assessment shows the sheet piled cofferdam for LF5 is at least 200 m, followed by a 1000 m trench The working time in LF5 is presented in the table below and varies between 6 to 11 months.

Table 9-126 Indicative Construction Time of LF5

Site	LF5 Construction	
Offshore	Pre-lay dredging	3-5 weeks
	Post-lay backfilling	2-3 weeks
Onshore	Site preparation, cofferdam installation	12-20 weeks
	Pull in operation	1 week
	Cofferdam removal and reinstatement	7-14 weeks

Prepared by: ASPROFOS, 2022. Source: Allseas, 2021

At figures 6-31 to figure 6-34 of chapter 6 of present study, an overview of LF2, LF3, LF4 and LF5 design respectively is presented.

9.2.14.3 Sensitive Receptors Identification

To support the study, the coastal erosion hazard degree (sensitivity) on the wider area of each Landfall site was assessed. Erosion rates vary depending on a variety of factors including:

- **Existing erosion rate**. In case a beach shows increased erosion rate even small changes in local coastal dynamic may accelerate the erosion rate. The following table presents the coastal evolutionary trend on the LF sites (for more details see section 8.14.3).

Table 9-127 Erosion rate score per LF

Landfall	Coastal Evolutionary Trend	Erosion rate score
LF2	low level of erosion	Low
LF3	Stable: evolution almost imperceptible	Low
LF4	Stable: evolution almost imperceptible	Low
LF5	Aggradation probable, but not documented	Zero

Prepared by: Asprofos, 2022. Data source: (EUROSION project The Coastal Erosion Layer WP 2.6, 2004)

- **Wave conditions**. Winds create waves that crash into the shore. Even the slightest angle between the land and the waves will create currents that transport sediment along the shore. The higher the wave energy the stronger the currents and the sediment transport. The following table presents the wave conditions on the LF sites (for more details see section 8.14.2).

Table 9-128 Wave conditions score per LF

Landfall	Significant wave height(Hs [m])	Wave conditions score
LF2 (S2_21)	6.59	Moderate
LF3 (S3_45)	4.64	Low
LF4 (S4_02)	2.65	Low
LF5 (S4_13)	2.34	Low

Prepared by: ASPROFOS, 2022. Data from : (Metocean Design Parameters Report – FEED, 2020) Document No 00225-Cv10A-TDR-00224-04.

- **Beach profile**. The shape of the beach profile determines the vulnerability of the coast to erosion. A beach with a steep slope has a narrower surf zone, so the wave energy is more concentrated than on a beach with a gentle slope, which is characterized by a wide surf zone where wave energy is spread out. As general principle, initial wave breaking occurs when the wave is in a water depth that is 1.3 times the wave height (Hughes, 2016). Table 9-129 presents the beach profile score for each LF site based on the above and the seabed profile data at the LF sites that are presented in section 8.3.1.

Table 9-129 Seabed profile at the LF sites

Landfall	Seabed profile	Beach profile score
LF2	Steep to Very steep slope up to -10 m WD and narrow (250 m) very gentle slope from -10 m WD to 0 WD.	Moderate
LF3	Moderate to steep slope up to -20 m WD and wide (600 m) gentle slope from -20 m WD to 0 WD (presence of rocky outcrops and Posidonia oceanica areas)	Low
LF4	Extensive (1 km) gentle slope (*Posidonia oceanica* on matte characterizes the seabed, followed by a section with sand and a prairie of *Cymodocea nodosa*, there are three breakwaters)	Low
LF5	Extensive (1 km) very gentle slope up to – 10 m WD. This area is featured by the presence of *Posidonia oceanica.*	Low

Prepared by: ASPROFOS, 2022. Data sources: E780_IGI002-WE4a2-PRC-RNHG_LF2_B1_Nearshore Hydrographic Geophysical and ROV Report LF2 (WE 4a-2), E780_IGI002-WE4a3-PRC-RNHG_LF3_B1_Nearshore Hydrographic Geophysical and ROV Report F3 (WE 4a-3), E780_IGI002-WE4a4-PRC-RNHG_LF4_B1 Nearshore Hydrographic Geophysical an ROV Report LF4 (WE 4a-4), E780_IGI002-WE4a5-PRC-RNHG-LF5_C2_Nearshore Hydrographic Geophysical an ROV Report LF5 (WE 4a-5).

- **Grain size**. Although the magnitude of wave energy is a determining factor in the volume of sediment that is moved across a beach, the grain size of the beach material is also important. In general, coarser-grained beaches tend to be more protected as more wave energy is needed to move the material. Table 9-130 presents the grain size on each LF site (for more details see section 8.14.4).

Table 9-130 Grain size at the LF sites

Landfall	Grain size	Grain size score
LF2	Rocky shore with pocket beaches of coarse sediment (pebbles)	Low
LF3	Rock waste and sediments (sand or pebbles)	Low
LF4	Presence of loose rock waste and sediments (sand or pebbles) on the strand	Low
LF5	Strands of fine to coarse sand	Moderate

Prepared by: ASPROFOS, 2022.

It is noted that tidal currents are not taken into account, since on the basis of the results of the tidal model the tidal currents along the route are limited (see Section 8.14).

Table 9-131 shows the sensitivity (coastal erosion hazard degree) of the shoreline on the landfall sites.

Table 9-131 Coastal erosion hazard degree of Landfall sites

Location	Erosion rate score	Wave conditions	Beach profile (angle of the coastal slope)	Grain size	Coastal erosion hazard degree (sensitivity)
LF2	Low	Moderate	Moderate	Low	Medium
LF3	Low	Low	Low	Low	Low
LF4	Low	Low	Low	Low	Low
LF5	Zero	Low	Low	Moderate	Low

9.2.14.4 Impacts Overview

Based on the above, the following paragraph examines the identified impacts during the construction phase, on the beaches in the wider area of each landfall site.

9.2.14.4.1 Modification of Coastal Dynamic Balance

As presented above, changes in natural beach profile may alter the direction and/or magnitude of waves and consequently the coastal dynamic balance leading to erosion.

Regarding the impacts assessment criteria presented under paragraph 9.1 the *Likelihood* of causing this impact is *Certain* as the activities of crossing operations and mainly the trenching, will cause changes in the sediment circulation and beach profile (backshore and foreshore).

The *Extent* of the impact is *Small* in LF2 and LF3 where the shoreline is characterised by small beaches interrupted by rocky cliffs, something also supported by the type of sediments in the area, which are mainly coarse and are more difficult to transport. In contrast, the extent of the impact is estimated to be *Perimetric* in LF4 and LF5 where the shoreline is characterized by long straight sandy beaches, more likely to be affected in case of changes of sediment patterns.

The I*ntensity* of the impact is related to the sensitivity of the LF beaches to the factors that leads to erosion (Table 9-131). As such beaches of high sensitivity are characterized by *High* intensity and so forth.

The *Duration* of the impact is associated with the period required for the restoration of prior morphology and in particular of the beach profile (mainly the profile of the foreshore beach). Taking a conservative approach, we believe the impact will be *short-term* considering that the working area will be totally restored and the pipeline will be buried in the seabed for the part near the coast down to approximately 25 m.

Relating to *Reversibility*, it is estimated that the mitigation of impact depends on both the weather conditions during construction and the *Duration* of the construction works. It is estimated that the impact-causing mechanisms may be *minimized* by selecting the appropriate start-up period and completing them in a short period (<6 months).

As regards to *Cumulative* action, it is related to the extent of the impact. As such, it is considered as *Rare* for LF2 and LF3 and conservatively is considered *Likely* in LF4 and LF5. Finally given the spatial context of the engaged shore section, *Transboundary effects* are not expected (*Impossible*).

Taking into account all the aforementioned and following the criteria detailed in section 9.1.2, the *Likelihood* of the impacts is *Certain*. The *Extent* of the impacts is *Medium* in LF2 and LF3 and *Perimetric* in LF4 and LF5. The *Intensity* of the impacts is *Low* on LF3, LF4 and LF5 and *Medium* on LF2. The *Duration* is characterized as *Short-term* as the construction phase will last up to 11 months. *Reversibility* is *Minimizable*. The *Cumulative Action* of the impact is considered *Rare* in LF2 and LF3 and *Likely* in LF4 and LF5. The *Transboundary Character is Impossible.* Consequently, SEI is **Minor for all LF sites.**

9.2.14.5 Summary

The following table presents an impact summary for Wave Conditions-Oceanographic Characteristics-Coastal Mechanics during construction phase.

Table 9-132 Impact Summary for Wave Conditions-Oceanographic characteristics-Coastal Mechanics during Construction Phase

S/N SEI	Construction		SEI for		Wave Conditions-Oceanographic characteristics-Coastal Mechanics					
Project phase										
Impact	Mechanism	Locations	Criteria/ Impact Properties						SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Modification for Coastal Dynamic Balance	Construction activities during shore crossing	LF2	1.00	0.25	0.50	0.25	0.75	0.25	0.00	4.29	Medium Coastal Erosion Hazard Degree Rocky sea cliffs, characterized by discontinuous and intermittent occurrence of pocket beaches.
		LF3	1.00	0.25	0.25	0.25	0.75	0.25	0.00	3.93	Low Coastal Erosion Hazard Degree Rocky sea cliffs, characterized by discontinuous and intermittent occurrence of pocket beaches.
		LF4 LF5	1.00	0.75	0.25	0.25	0.75	0.50	0.00	5.00	Low Coastal Erosion Hazard Degree Long straight sandy beaches

Prepared by: (ASPROFOS, 2021),

9.2.15 Impacts Assessment from Project's Vulnerability to Risks of Serious Accidents

The potential impacts due to the construction of the project are presented in the related sections of this chapter, whilst as presented in in Section 8.15 no major accidents due to the project are expected during the construction phase that may have significant environmental impacts.

9.3 Operation Phase

9.3.1 Introduction

The present section provides the impact assessment and evaluation for impacts (negative or positive ones) that could be induced by the project **operation phase**. Mitigation measures are presented in the corresponding sections of Chapter 10.

9.3.2 Climatic and Bioclimatic Characteristics

9.3.2.1 Methodology Overview

This section assesses and evaluates the possible effects on the microclimate and bioclimatic characteristics of the Study Area, the possible increase of hot and gaseous mass emissions with changes in thermal capacity, as well as the climatic effects of the greenhouse gas emissions of the Project. Table 9-133 outlines the main sources of impact, potential impacted resources and receptors as well as the factors influencing the baseline condition and those related to the Project.

The impact assessment methodology described in section 9.1 is followed.

Table 9-133 Key Issues for Assessment - Climate and Bioclimatic Characteristics (Operation Phase)

Sources of Impact/ Risk	• Change in greenhouse gas emissions (CO_2) - Replacement of polluting conventional fossil fuels with natural gas.
Potentially Impacted Resources and Receptors	• Atmospheric environment (increase in global warming potential)
Special Baseline Conditions that Potential Influence Impacts/Risks	• The PPC plant in Atherinolakkos which is close to the CS2/MS2-CS2/MS2N Compressor and Metering Stations.
Project Factors that Potentially Influence Impacts/Risks	• Project Compressor and Metering Stations (CS2/MS2-CS2/MS2N, CS3)
References	• Baseline is provided in Section 8.2 • Impact Assessment in Section 9.3.10 on air quality is analysed, as it describes the air pollution of the Project. • Mitigation Measures are provided in Section 10.3.2

Prepared by: ASPROFOS, 2022

In the following paragraphs, potential impacts from the operation of the Project are described and assessed.

9.3.2.2 Change in Microclimate and bioclimatic characteristics

For the evaluation of microclimate and bioclimate, changes in parameters concerning[45] temperature, rainfall, humidity, wind and the deforestation of forest areas are examined. During operation phase the compressor stations are not expected to affect the bioclimatic characteristics in the Study Area as a whole, nor locally. All the equipment, as mentioned earlier in the construction phase analysis, must have all international certificates and operate under European regulations. Therefore, no impact on bioclimatic characteristics is expected by the operation of the project.

9.3.2.3 Cold or Hot Gas Emissions

Due to the nature of the project (construction and operation of a natural gas pipeline and accompanying installations), not cold gas emissions are expected during the operation phase. Hot emissions by gas turbines will be diffused into the atmosphere and will not cause any impact on local and regional climate.

9.3.2.4 Change in Greenhouse Gas Emissions

This section assesses and evaluates the potential greenhouse gas emissions during project operation phase. Table 9-134 shows the potential impact, the causal mechanisms and potentially affected recipients.

Table 9-134 Change in greenhouse gas emissions –Causal mechanisms, potentially affected receptors during operation phase

Possible Impact	Impacts Generating Mechanisms	Potentially affected resources/receptors
Change in Greenhouse Gas Emissions	Replacement of polluting conventional fossil fuels with natural gas.	Atmospheric environment

Prepared by: ASPROFOS, 2022

[45]https://www.metlink.org/fieldwork-resource/microclimates/#microclim

9.3.2.4.1 Impacts Generating Mechanisms (Replacement of polluting conventional fossil fuels with natural gas)

For the replacement of polluting conventional fuels with natural gas the following table showing the pollutants emitted in relation to other fuels during combustion in a steam generating unit in mg / MJ of imported fuel heat is followed.

Table 9-135 Pollutants emitted in relation to other fuels during combustion in a steam generating unit in mg/MJ of imported fuel heat

Fuel type	Particles	Nitrogen oxides	Sulphur dioxide	Carbon monoxide	Hydrocarbons
Coal	1,092	387	2,450	13	2
Fuel oil	96	170	1,400	14	3
Diesel	6	100	220	16	3
NG	4	100	0.3	17	1
* Natural gas releases 25-30% less CO_2 than oil and 40-50% less than carbon per unit of energy produced ** By replacing a coal-fired combined cycle power plant (CCGT), CO_2 emissions are reduced by up to 70%					

Prepared by: ASPROFOS, 2022. Data from:: https://www.depa.gr/fysiko-aerio/

9.3.2.4.2 Affected resources/receptors (Atmospheric environment)

- Change in Greenhouse Gas Emissions

The compressor stations will be fuelled natural gas. Given that they will operate all year round, with only a small ventilation interruption (175 hours), the total annual operating time is calculated, and translates into a production of 45 tons of CO_2/hour for CS2/MS2, 45 tons of CO_2/hour for CS2/MS2N and 31 tons CO_2/hour for CS3 in accordance with Chapter 6.

The operation of CS2/MS2 and CS2/MS2N Stations in Crete will lead to 384,522 and 384,522 tons of CO_2 respectively per year. In Achaia the operation of CS3 Station will lead to 267,079 tons of CO_2 per year.

In addition to these combustion emissions, as part of the annual decompression of the stations (straordinary maintenance) there will be a single, direct release of CH_4 into the atmosphere through ventilation (not combustion). This will amount to 82 tons of CH_4 per year for CS2/MS2, 82 tons of CH_4 per year for CS2/MS2N and 63 tons of CH_4 per year for CS3. The quantities of CH_4 that will be ventilated from the annual decompression of the Compressor Stations are estimated based on previous experience of similar projects. The global warming potential of CH_4 is 21 times greater than CO_2, so a single scheduled decompression will result in a corresponding emission of 1,722 tons of CO_2

equivalent per year for CS2/MS2, 1,722 tons of CO_2 equivalent per year for CS2/MS2N and 1,323 tons CO_2 equivalent per year for CS3. Escaping or fugitive emission is considered to be of limited quantity and therefore that escaped gas has no impact. Thus, in total, the Compressor Stations of Crete and Achaia will emit approximately, cumulatively, 1,040,891 millions tons of CO_2 equivalent per year[46].

According to the European Environment Agency[47] the Greek greenhouse gas emissions of the greenhouse effect in 2019 were 85.6 million tons of CO_2 equivalent. The projected greenhouse gas emissions from the stations will represent approximately 1.22% of the total annual national emissions. It is noted that the greenhouse gas emissions from combustion of fossil fuels by the thermal units of PPC and by individuals for electricity and heat production in 2018 were 33.28 million tons of carbon dioxide equivalent (CO_2) and accounted for about 36.1% of the total national emissions, which was 92.2 million tons of CO_2.[48] Therefore, initially the impact could be considered as moderate and negative.

It is worth noting that positive environmental impacts are caused by the replacement of other fossil fuels by natural gas, a target served by the project under consideration in conjunction with the withdrawal of lignite power plants by 2028. In particular, natural gas is expected to be the intermediate fuel for the transition to a low-emission model of greenhouse gases in all final consumption sectors, while at the same time it may lead to both an improvement in energy efficiency and a lower energy cost compared to other conventional technologies (National Plan for Energy and Climate (NPEC), 2019). According to the current project's design, it is foreseen to connect with the National Greed of DESFA and to supply 1 BSCM/yr to the Greek market, via Megalopoli's Branch. It is worth noting that, given the proximity of the project sites in Crete and the PPC power plant, the replacement of the fossil fuel currently used by this unit (fuel oil) with natural gas is feasible and will have a direct positive impact on the area given the environmental advantages of natural gas in relation to fuel oil (see Table 9-135).

Additionally pipeline transfer is the most efficient than import of LNG from far sources. Some of the advantages are:

- Safe and reliable, no pollution, low cost;
- The energy consumption is small, which is the lowest among various modes of transportation;

---

[46] Calculation: The total hourly production rate of CO_2 for CS2/MS2 is 14.93 tn/h (for each turbine) or 384,522 tons CO_2 per year (for 3 turbines), for CS2/MS2N is 14.93 tn/h (for each turbine) or 384,522 tons of CO_2 per year (for 3 turbines), for CS3 it is 10.37 tn/hour (for each turbine) or 267,079 tons of CO_2 per year (for 3 turbines).
The equivalent emission of CO_2 from CH_4 is 4,767 tons/year. Taking into account the oxidation and conversion factor for CH_4 is 0.995 (as shown by the emission factors: 2007/589/EE).

[47] https://www.eea.europa.eu/data-and-maps/data/data-viewers/greenhouse-gases-viewer(Accessed on 30/11/2021)

[48] https://www.dei.gr/Documents2/%CE%95%CE%9A%CE%95/Apologismos%20EKE_BiosimiAnaptyxi%2027x22cm-new_GR.pdf

- High environmental benefits and no harmful substances

Taking into account the above mentioned, the ultimately estimated impact (Change in Greenhouse Gas Emissions) will be moderate and positive in greenhouse gas balance in Greece. Similarly, we can expect emission reductions in other European markets to be supplied by the project under study.

9.3.2.4.3 Impact Assessment

In line with the above-mentioned, the *Likelihood* of the impact is *certain*; as it is expected to affect the overall greenhouse gas emissions. The *Extent* of the impact will be *peripheral* (>3000 m from Project). As regards to the *Intensity* of the effect, it is considered *moderate* and Positive as reported in section 9.3.2.4.2 above. The *Duration* of the impact will be *long-term* (throughout the *Duration* of operation). *Reversibility* of the impact is considered *irreversible* as in any case a reduction will occur in the total emissions to the atmosphere. However, it is noted that using appropriate measures (see Section 10.3.2) the positive effects are expected to increase due to the emissions reduction by the project (CS2/MS2-CS2/MS2N, CS3). The *Cumulative Action* in emissions (reduction) is considered to be *certain* due to the replacement of existing conventional polluting fuels with the transferred gas. The *Transboundary Character* of the impact is *certain* as the reduction in CO_2 emissions will positively impact global warming potential.

Based on the above and based on the criteria presented in the Section 9.1, for the change of greenhouse gas emissions during the operation of the project, the **SEI is considered as Possitive and Major**. section 10.3.2 presents the proposed measures applicable to the impact in order to improve the positive results

9.3.2.5 Summary

The summary of the impacts on the climatic and bioclimatic characteristics during the operation phase is shown in the following table.

Table 9-136 Summary of Impacts for Climatic and Bioclimatic Characteristics during the Operation Phase

S/N SEI			SEI for	Climatic and Bioclimatic Characteristics						
Project phase	Operation									
Impact	Mechanism	Locations	Criteria/ Impact Properties						SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Change in Greenhouse Gas Emissions	• Replacement of polluting conventional fossil fuels with natural gas	Regionals and users	1.00	1.00	0.50	0.75	1.00	1.00	1.00	8.93 (Positive and Major)	«-»

Prepared by: ASPROFOS, 2022.

9.3.3 Landscape and Morphological Characteristics

9.3.3.1 Landscape Characteristics

9.3.3.1.1 Methodology Overview

Based on Chapter 6 (Section 6.4.2), Project-related works that may cause significant impacts to landscape features include:

- The Pipeline Protection Strip (PPS) of 8 m width (4 m on each side of the pipeline axis); and
- Presence of permanent Project features, mainly Facilities at Crete, Megalopoli and Achaia.

Table 9-137 Key Considerations for Assessment - Landscape Characteristics (Operation Phase)

Impact/Risk Sources	• Permanent pipeline protection strip or PPS (8m wide) cleared from woody vegetation; Permanent, above ground, project structures, such as Line Valve Stations and Main Stations.
Potentially Impacted Resources and Receptors	• Landscape and visual receptors (local inhabitants, commuters, passers-by, tourists, etc.) • Any nearby settlements and households.
Particular Baseline Conditions that are Potentially Influencing Impacts/Risks	• Areas including Forests or other woody vegetation • River Crossings • Quality (Sensitivity) of compromised landscapes • Characteristics of sensitive receptors (quality of landscape, viewers, etc.) • Statutory protection for affected and or nearby landscapes
Project Factors that are Potentially Influencing Impacts/Risks	• Architectural characteristics of permanent project facilities • Width of Pipeline Protection Strip • Location of permanent facilities for project construction (Main Stations, i.e. Facilities at Crete, Megalopoli and Achaia) • Capacity to reinstate temporary cleared areas
References	• Baseline is provided in Section 8.3 • Annex 9C - Baseline and impact assessment for landscape (incl. zone of visual impact from permanent stations and their photosimulations) • Mitigation Measures are provided in Section 10.3 • Photographic documentation is provided in Chapter 14 • Landscape Map is provided in Section 15.1.8

Prepared by: ASPROFOS, 2022.

As described in Section 9.2.3, during project operation, the Pipeline Protection Strip (PPS) of 8 m width shall be kept clear of deep rooted species. Apart from this, the rest of the working strip will be reinstated to its former condition, as much as possible.

Permanent facilities that might interfere with Landscape characteristics include 20 small Line Valve Stations (i.e. BVS, SS, LS)[49], 3 major facilities, i.e. Crete Facilities (CS2/MS2-CS2/MS2N), Compressor Station at Achaia (CS3) and the Metering & Regulation and Heating Station at Megalopoli (MS4/PRS4 & Heating Station), and the Operation and Maintenance Center.

Impact on landscape conditions during operation phase varies according to restoration level and a landscape type can attain depending on PPS requirements. The following paragraphs describe how this affects different landscape types identified along the pipeline route.

Similarly, disturbance to viewers (sensitive receptors) depends on restoration quality in temporary facilities and Main Stations (both identified in Section 9.2.3). Especially regarding permanent project facilities, according to MD 170225/2014, in this section impacts on the landscape during the operational phase are supported through photosimulations modelling.

Taking into consideration landscape features, as detailed in the corresponding baseline section (8.3) and supported material (e.g. Annex J.3; see Table 9-9 for detailed references list), the following impacts are described:

- Landscape Modification from Pipeline Protection Strip (incl. Restored Temporary Facilities)
- Disturbance to Viewers from Permanent Facilities

Methodology is described in Section 9.2.3. Building on Table 9-14, Table 9-138 summarizes the area that shall be occupied by PPS shall occupy and each characteristic landscape type.

Table 9-138 Estimation of PPS Area per Landscape Type

Landscape Types (number of sections crossed)	Total PPS area (in 1000 m²)
Agricultural Landscape (47)	800.93
Agricultural Plain Landscape (25)	1068.68
Built Landscape (2)	0.47
Coastal Agricultural Landscape(1)	2.29
Coastal Mosaic of Agricultural and Natural Landscape (1)	17.16
Coastal Rural Landscape (1)	0.14
Hilly Natural (Forest) Landscape (33)	235.35
Hilly Natural (Shrublands) Landscape (38)	1137.38

[49] It is noted that the type of the Line Valve Station makes no difference for impact assessment. That is because, regardless specific operational services, every Line Valve Station has minimum (if any) interaction with environmental and social parameters. Additionally, many such stations are located within the same plot and/or within the same plot as a Main Station.

Landscape Types (number of sections crossed)	Total PPS area (in 1000 m²)
Karteri Marshland(1)	15.34
Mosaic of Agricultural and Natural (Shrublands) Landscape (46)	650.77
Mountainous Natural (Forest) Landscape (10)	248.59
Mountainous Natural (Shrublands) Landscape (7)	176.11
Nearshore Seascape (6)	80.78
Phryganic Landscape (2)	4.20
Riparian Agricultural Landscape (5)	13.79
Riparian Natural Landscape (3)	3.10
Rural Landscape (7)	48.13
Rodia Lagoon Wetland (1)	3.54

Prepared by: ASPROFOS, 2022.

9.3.3.1.2 Landscape Modification from Pipeline Protection Strip (incl. Restored Temporary Facilities)

After installing a pipeline below ground, agricultural, built and coastal areas (including seascape), landscape types are fully restored to their previous conditions, and regular practice (except for tree crops) is maintained, resulting in no changes to landscape[50]. The working strip may be planted with annual species, agricultural activities may continue and the entire working area is not perceived. The same applies for the coastal area and landfall sites. As an example of landscape restoration, the following photographs for existing DESFA pipeline in areas similar to those in which the project under consideration will be installed.

[50] Building restrictions are also imposed but no continuous urban fabric is related to the project, thus no landscape modification is assessed.

Source: Google Earth Street View. Θέση lat 41.065315°, lon 24.843268°. The orange line depicts existing DESFA pipeline – constructed in 2000.

Source: C&M, 2018. Θέση lat: 41.047017° lon: 25.571411°. Marker post of DESFA pipeline is evident - constructed in 2010.

Figure 9-52 Natural Gas Pipeline in Agricultural Landscape.

In areas where tree vegetation is present, landscape cannot be fully restored. In particular, 8-m wide PPS (4 m on each side of the pipeline) should be free of deep-rooted species. Therefore, this zone will be visible. In dense forests, the protection zone will cause a landscape disruption, disturbing its unity. However, 8 m width is much smaller than the working area, the rest of which will be restored with local species, based on a study approved by the competent authorities. Depending on the type of existing vegetation, plant species and local climatic conditions, a revegetation of the area may be completed in 3 – 5 years time, after construction. The clear-cut protected area will resemble a forest road or a path (depending on viewing distance) or a fire protection zone. However, whether the PPS shall be implemented as a fire protection zone or not, is up to the competent authorities (in such case, it is possible that enlargement/ special design of the PPS shall be required). Indicatively, for coniferous forests in <70% slopes, minimum width is 45 m[51], whilst other management tools, e.g. fuelbreaks[52] might be also applicable). This is supported by the following photographs of an existing DESFA pipeline, in areas similar to those in which the project under consideration will be installed.

[51] According to the "TECHNICAL SPECIFICATIONS FOR THE PREPARATION OF FIRE PROTECTION PLANS FOR FORESTS AND FOREST ECOSYSTEMS" of Special Secretariat for Forests, Ministry of Environment, Energy and Climate Change, 2011. Retrieved on 03.02.2022 from http://www.pkd.gr.

[52] https://ir.library.oregonstate.edu/downloads/q237hs27w

Source: Google Earth Street View. Θέση lat 40.934187°, lon 25.792205°. The orange line depicts existing DESFA pipeline – constructed in 2010.

Source: Google Earth Street View. Θέση lat 39.977634°, lon 22.615337°. PPS is widened in order to be used as fire protection zone – constructed in 1995.

Source: Google Earth Street View. Θέση lat 38.268503o, lon 23.862391o. PPS is widened in order to be used as fire protection zone – constructed in 2012.

Source: Google Earth Street View. Θέση lat 39.016174o, lon 22.376508o. PPS is widened in order to be used as fire protection zone – constructed in 1995

Prepared by: ASPROFOS, 2022.

Figure 9-53 Natural Gas Pipeline in Forested Landscape.

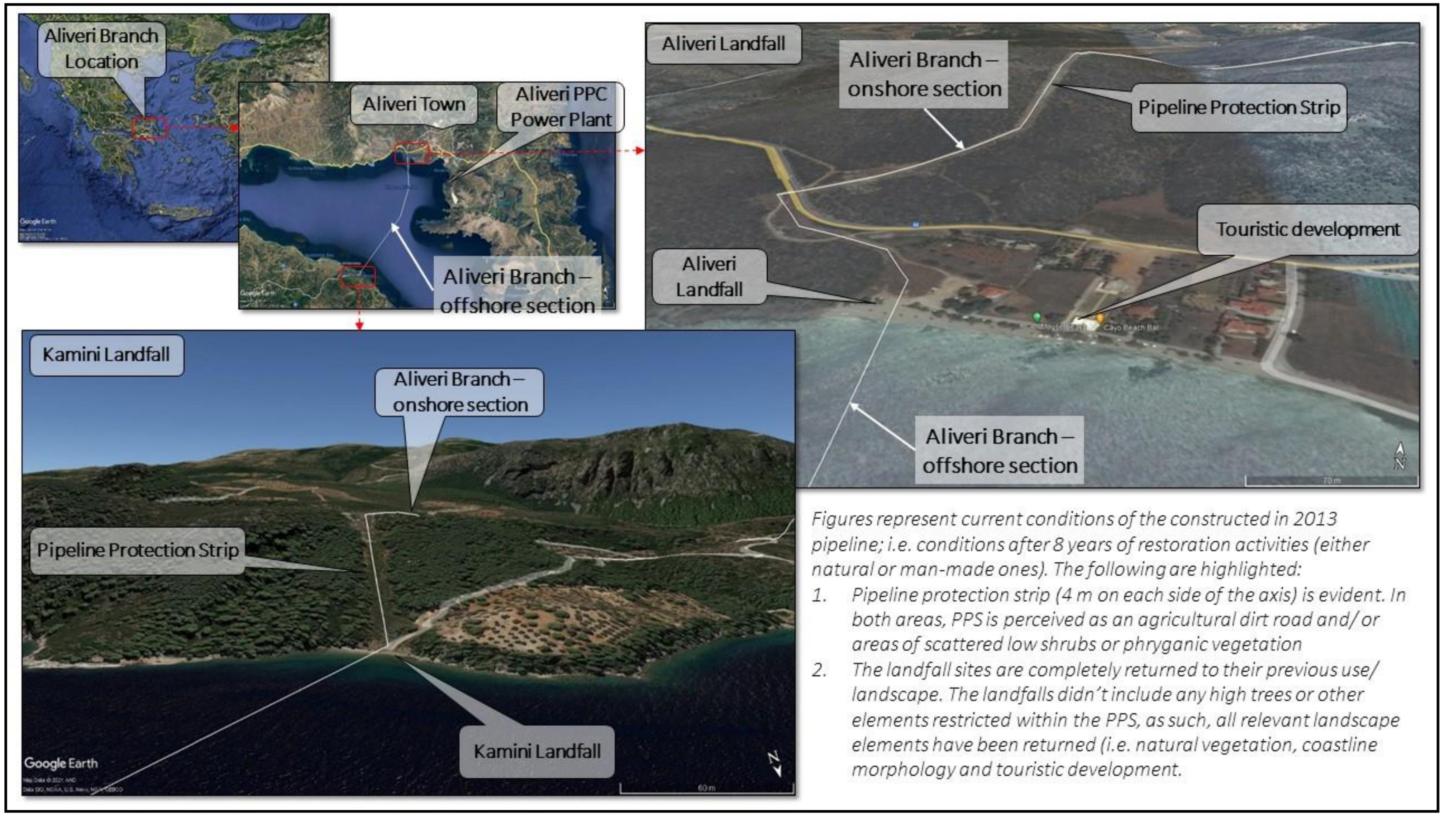
It is noted that other sensitive landscapes, i.e. Nearshore Seascape, Marshland of Karteri, Wetland of Rodia's Lagoon, TIFK "Parapotami Alfeiou" (Alfios' Tributaries) (AT1011011), TIFK "Ekvoli Acheronta and Nekromanteio" (R. Acheronta Estuary and Necromancer) (AT3010051) will not experience any significant visible impact during operation phase. This is due to the combination of landscape sensitivity and minimum visual intrusion by the project during operation activities.

Especially for nearshore seascape (and coastal areas), an example of DESFA's Aliveri Branch pipeline is illustrative (see Section 9.2.3.1.3). DESFA's Aliveri Branch includes an onshore section through very sensitive areas north of Athens Urban Fabric (through suburban forested areas hosting a large number of Athenians summer houses, highly sensitive in terms of aesthetics and value - highly priced land) and an offshore section, in quite treacherous waters (S. Evoikos Gulf).

Figure 9-54 and Figure 9-55 represent current conditions for DESFA pipeline constructed in 2012; i.e. conditions 9 years after completing restoration activities (either natural or man-made). Although, the two projects are different in size, their permranent impact to landscape is similar. The following conclusions can be highlighted:

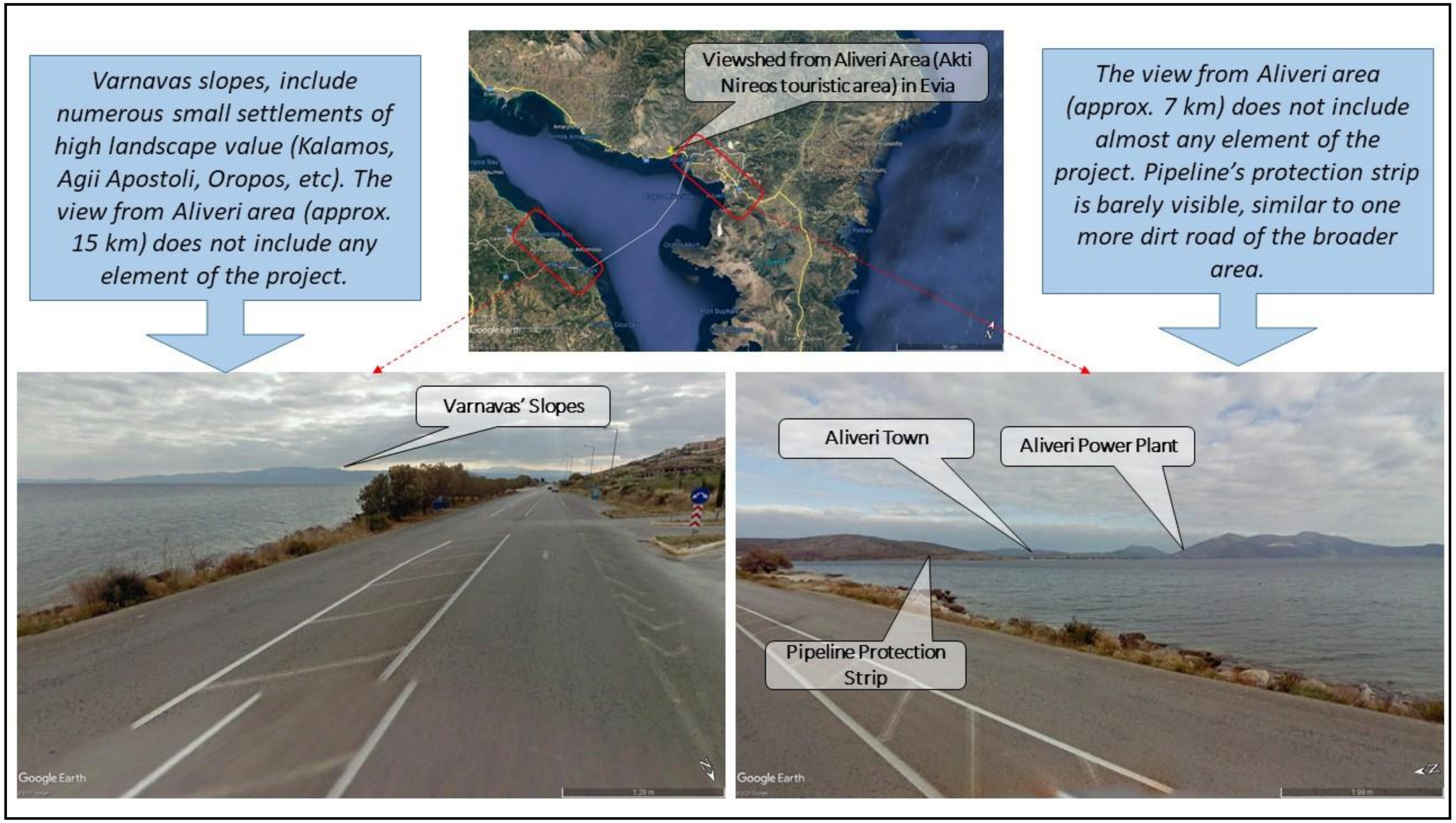
- Pipeline protection strip (4 m on each side of the axis) is evident. In both areas (Figure 9-54 and Figure 9-55), PPS is perceived as an agricultural dirt road and/or areas of scattered low shrubs or phryganic vegetation
- Landfall sites are completely returned to their previous use/landscape. Landfalls didn't include any high trees or other elements restricted within the PPS and, as such, every relevant landscape element has been restored (i.e. natural vegetation, coastline morphology and touristic development). Conditions are similar for landfall sites for the investigated project, i.e. LF2, LF3, LF4 and LF5.
- Especially in Aliveri coast, a touristic development, at less than 100 m, is active and running without any problem.
- The viewshed from an indicative vantage point (a touristic venue close to Aliveri Town) illustrates that at a 7 km distance (and in an unobstructed seascape/ coastal view), landscape perception is not modified from the original; pipeline working strip presence is similar to the one in existing dirt roads (Figure 9-55).

As such, during operation, no disturbance to viewers assessed in Section 9.2.3.1.3 is expected.



Prepared by: ASPROFOS, 2022. Base cmap from Google Earth Pro. Construction of Aliveri branch was completed in 2012.

Figure 9-54 DESFA Aliveri Branch (lack of) Landscape Modification during Operation (1).



Prepared by: ASPROFOS, 2022. Base camp from Google Earth Pro. Construction of Aliveri's branch was completed in 2012.

Figure 9-55 DESFA Aliveri Branch (lack of) Landscape Modification during Operation (2).

Sensitivity and value analysis for typical landscape types is not modified to the one presented for construction phase (see Section 9.2.3.1). It is clarified that Table 9-14 presents the landscape types crossed by the pipeline itself whilst Table 9-138 presents PPS area within each landscape type.

Taking into account all considerations discussed, and following the assessment criteria presented in Section 9.1, impact assessment for operation activities in different landscape types identified can be assessed as follows. It is clarified that what was presented in Section 9.2.3.1, regarding impacts on landscape during construction phase, is valid and not repeated.

Impact *Likelihood* during operation is *Certain*.

As impact *extent*, an exact project footprint could be considered. PPS will be typically 8 m wide. In forested areas, the PPS can be increased in order to act as a fire protection zone. Competent authorities shall specify exact width. Taking into consideration landscape characteristics (texture, colour, etc), changes caused by the project footprint will be visible from a greater distance; thus, the extent was considered *Perimetric* for Mountainous and Hilly Forested (Forests or Shrublands) Landscape. In the other natural typical landscape types (e.g. Mosaic of hilly natural and agricultural landscape), a main characteristic is constant alteration of vegetation cover. In such surroundings, the PPS can be absorbed by vegetation changes, except if the PPS is formed to be a fire protection zone.

Impact *Intensity* is related, as previously described and presented in Table 9-14 and Annex J.3, with landscape sensitivity.

With regard to impact *Duration*, this is considered as equal to the entire life of the project, hence as *Long-term*.

Regarding *Reversibility*, PPS cannot be planted with deep rooted species; however, along its perimeter, trees can be planted whilst shallow rooted species (grasslands) can be *minimized* fragmentation in the landscape. It is repeated that the working strip and consequently PPS, in collaboration with compromised stakeholders before and after construction phase, could be configured/designed so as to serve management purposes for stakeholders (e.g. fire protection zone).

Regarding *Cumulative* action, in densely vegetated forest areas, i.e. in the Mountain and Hilly Forested (Forests or Shrublands) Landscape, it could be considered that cumulative fragmentation action for landscape will be present in areas including an existing road network. In the present study, identifying areas with dense or non-forest road network was not feasible. Therefore, adopting a conservative approach, *Likely* cumulative action is considered. Respectively for the other "natural" landscapes, less probable cumulative action was considered.

Transboundary character is deemed *Impossible*, given lack of transboundary areas with possible landscape modification.

Based on the above and criteria presented in Section 9.1, landscape modification during Project operation:

- For landscape types: Hilly Natural (Forest or Shrubland), Mountainous Natural (Forest or Shrubland) the **SEI is considered as Moderate;**
- For compromised TIFKs and sensitive viewers the **SEI is considered as Negligible**; and
- For other landscape types (i.e. Agricultural, Agricultural Plain, Built, Coastal Agricultural, Phryganic Landscape, Rural, Coastal Rural, Coastal Mosaic of Agricultural and Natural, Karteri Marshland , Agricultural and Natural Mosaic (Shrublands), Riparian Agricultural and Rodia Lagoon Wetland) **No impacts are assessed (the SEI is considered as Zero).**

Section 10.3.2 presents the proposed mitigation and management measures applicable to the impact.

9.3.3.1.3 Disturbance to Viewers from Permanent Facilities

Besides PPS previously described, the project will result in impacts to landscape related to permanent buildings present and specifically:

- Compression, Metering, Pressure Regulating and Heating Stations (Major Facilities)
- Line Valve Stations (i.e. Blockvalves, Beach Blockvalves, and Scraper Stations).

Line Valve Stations are small facilities, with limited visible (above ground) elements. Effectively, they are of such a small scale that are unable to modify the landscape. They are mostly installed in agricultural areas of low to medium sensitivity and high absorption capacity. Consequently, no impacts from these facilities are expected, and only impacts resulting from the main facilities are considered. Fencing or limiting artificial elements do not pose any real visual intrusion, as illustrated in Figure 9-56.

Source: Google Earth Street View. Θέση 37°23'33.09"N, 22° 9'29.73"E. Existing DESFA BVS. Constructed in 2018.

Figure 9-56 Existing DESFA BVS in Megalopoli Area.

Although Main Facilities are also located in low sensitivity and high absorption landscapes (agricultural landscapes), they may affect landscape due to their size.

Each Main Station will be an installation covering a significant area. Table 9-139 is indicative.

Table 9-139 Land Take from Main Facilities.

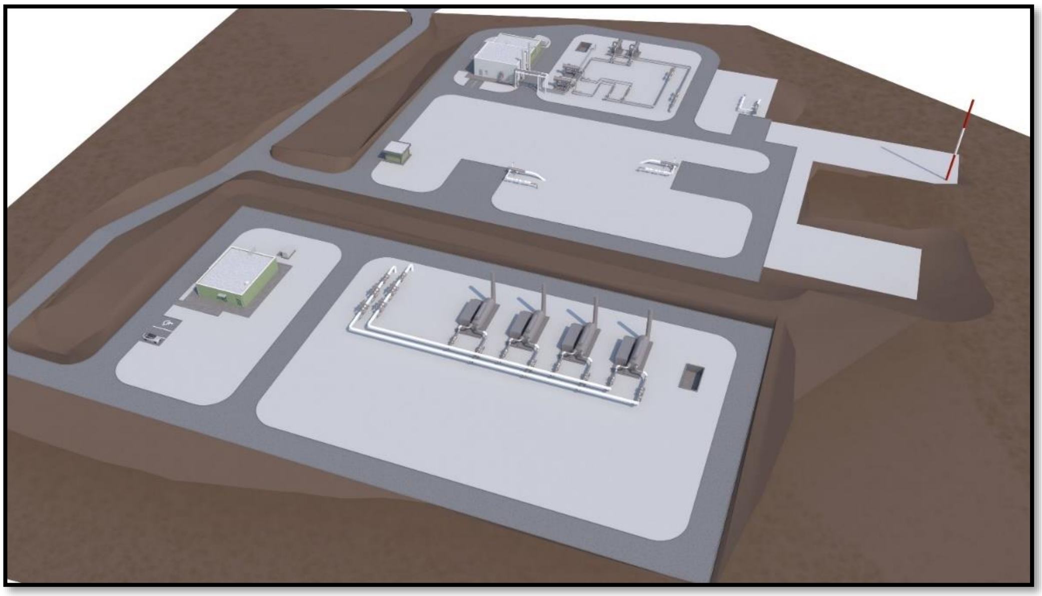
Project component	Indicative fenced area (m^2)	Indicative built area (m^2)	coverage of fenced area (%)	Typical landscape type
Crete Facilities	178288	103608	58%	Agricultural (dominant type)
Megalopoli Facilities	65370	30004	46%	Mosaic of Agricultural (dominant in the specific site) and Natural (Shrublands) Landscape
Achaia Facilities	110365	51963	47%	Agricultural

Prepared by: ASPROFOS, 2022. Source: plot plans of facilities presented in Annex 6E.

As a result of the analysis presented by Table 9-139, Crete, Megalopoli and Achaia Facilities will cover almost 60%, 45% and 45% of the total fenced area. This means that actual built area will cover a significantly smaller area than the available one. Based on Chapter 6, the artificial area will include buildings such as administration building, gateway, buildings in compressor units, compressor units and open spaces for gas pipelines. The following figures show a typical display for stations in Crete, Megalopoli and Achaia areas, respectively.

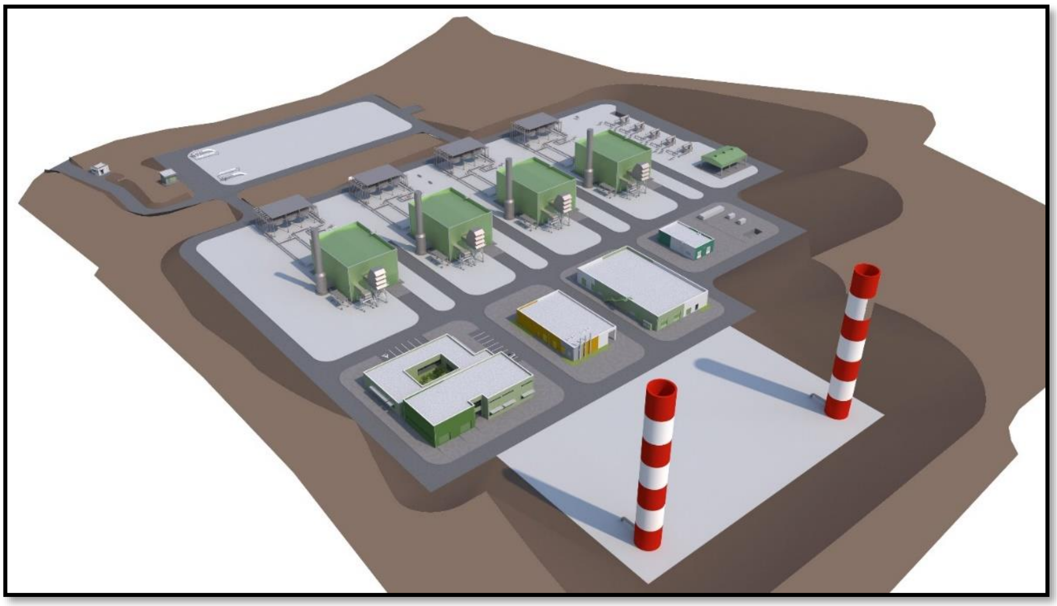
Source: FEED, 2022.

Figure 9-57 Typical Display for Compressor and Metering Stations in Crete (CS2/MS2-CS2/MS2N).



Source: FEED, 2022.

Figure 9-58 Typical Display for Metering, Pressure Regulating and Heating Station in Megalopoli (MS4/PRS4 & Heating Station).



Source: FEED, 2022.

Figure 9-59 Typical Display for Compression Station in Achaia (CS3).

The most prominent feature in permanent installations, which are expected to be visible from a larger distance, is a vent stack, located at the edge of each site, at a safety distance from the rest of the buildings, and expected to be 40 m high (with a conical shape of approx. 7 m on the base and 1.5 m to the top, more details on typical layout for the stations are presented in Chapter 6 and corresponding annexes, illustrating architectural characteristics of the stations).

A view of the project (through its representative element) by sensitive receptors in the area was assessed by calculating a Zone of Visual Impact (ZVI) for each facility.

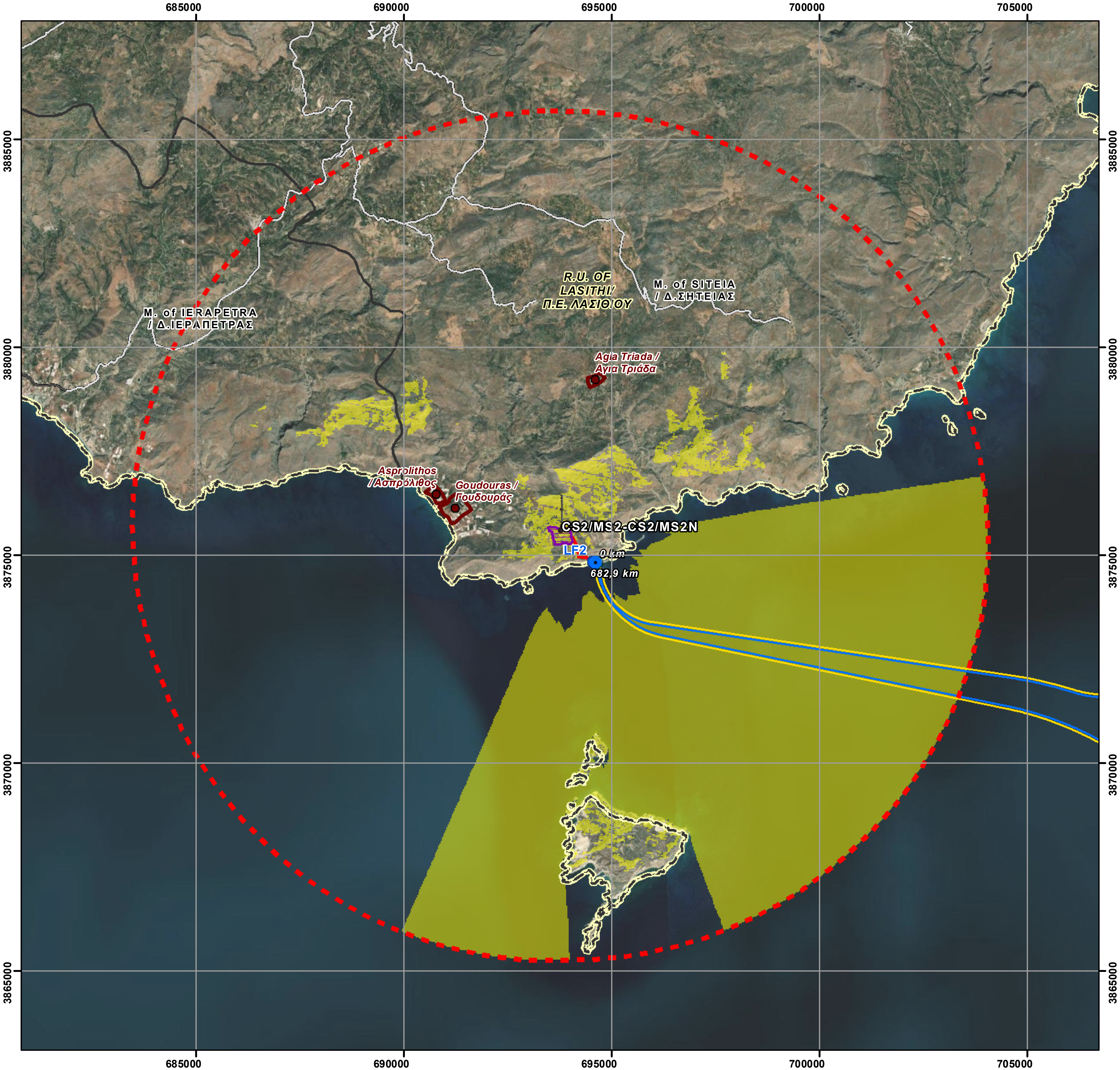
Planned stations, CS2/MS2-CS2/MS2N at Atherinolakkos of Crete, MS/PRS4 & Heating Station near Soulari of Megalopoli, and CS3 near Kato Velitses of Achaia, are the largest facilities included in the Project. For this reason, the extent to which these facilities would be theoretically visible was assessed. Using a GIS application, the Zone of Visual Impact (ZVI) was identified and the theoretical area from which the installations will be visible was mapped.

ZVI is considered theoretical as the area is digitally computed and based on local topography without taking into account any obstacle from standing objects (e.g. vegetation, buildings, etc.). ZVI is depicted in a map format by covering a radius of 10 km from the center of proposed compression stations.

Location and height for the highest point in the facility were used as input data. Specifically, in order to be more specific on location, a central point where each facility would be constructed was chosen. A 40-m vent stack chimney as the highest point was chosen for the Compressor Stations (i.e. CS2, CS2N, CS3) and a 10-m high radiocommunication antenna for the facilities at Megalopoli (MS4/PRS4 and Heationg Station), being the highest visible elements.

Below, Zone of Visual Impact maps for each installation as well as the photosimulations images are presented. Photosimulations are a three-dimensional representation of installations in real space that simulate new landscape conditions that will be created to install the project in a particular area. Position for each photograph was registered with GPS accuracy as well as viewing angle. Due to software constraints, sometimes the viewing angle was approximated when processing these photographs (although this brought about no substantial variations to impact assessment results).

Details are presented in Annex J3.



LEGEND/ ΥΠΟΜΝΗΜΑ

Project's Elements/ Στοιχεία του Έργου

- Indicative Stack Location (20m height)/ Ενδεικτική Θέση Καμινάδας (ύψους 20 μ)
- Proposed Location of Compressor Station CS2/MS2-CS2/MS2N / Προτεινόμενη Θέση Σταθμού Συμπίεσης CS2/MS2-CS2/MS2N
- Onshore Routing of N.G. Pipeline/ Χερσαία Όδευση Αγωγού Φ.Α.
- Offshore Routing of N.G. Pipeline (Southern&Northern Line)/ Υποθαλάσσια Όδευση Αγωγού Φ.Α.(Νότια&Βόρεια Γραμμή)

Study Area / Περιοχή Μελέτης

- Radius 10000 m / Ακτίνα 10000 μ

Potentially Sensitive Reseptors /Πιθανοί Ευαίσθητοι Αποδέκτες

- Motorway User/ Χρήστης Αυτοκινητόδρομου (Εθνική Οδός)
- Primary Road User/ Χρήστης Πρωτεύοντος Οδικού Δικτύου
- Secondary Road User/ Χρήστης Δευτερεύοντος Οδικού Δικτύου
- Settlement Limit / Όρια Οικισμού

Zone of Visual Impact/ Ζώνη Οπτικής Επιρροής

- Visibility of the stack/ Θέαση από την καμινάδα

Administrative Boundaries/ Διοικητικά Όρια

- Municipality Border / Όριο Δήμου
- Regional Unit Border / Όριο Περιφερειακής Ενότητας

KEY PLAN/ ΚΛΕΙΔΑ

SCALE/ ΚΛΙΜΑΚΑ

N

0 2 4 km

Rev. Αναθ.	Date Ημερομ.	Description Περιγραφή	Drawn Σχεδίαση	Checked Έλεγχος	Approved Έγκριση
0	14/12/2021	ISSUED FOR REVIEW	GIE	HOD	SPP

Contract No: Αρ. Συμβολαίου: AF117275

Coordinate System: Greek Grid
Projection: Transverse Mercator
Datum: GGRS 1987
WKID: 3857 Authority: EPSG

COMPANY / ΕΤΑΙΡΕΙΑ: IGI Poseidon

ENGINEER/CONSULTANT: Asprofos engineering

PROJECT TITLE - ΤΙΤΛΟΣ ΕΡΓΟΥ

EASTMED PIPELINE PROJECT
ΕΡΓΟ ΑΓΩΓΟΥ ΦΥΣΙΚΟΥ ΑΕΡΙΟΥ EASTMED

DOCUMENT TITLE - ΤΙΤΛΟΣ ΕΓΓΡΑΦΟΥ

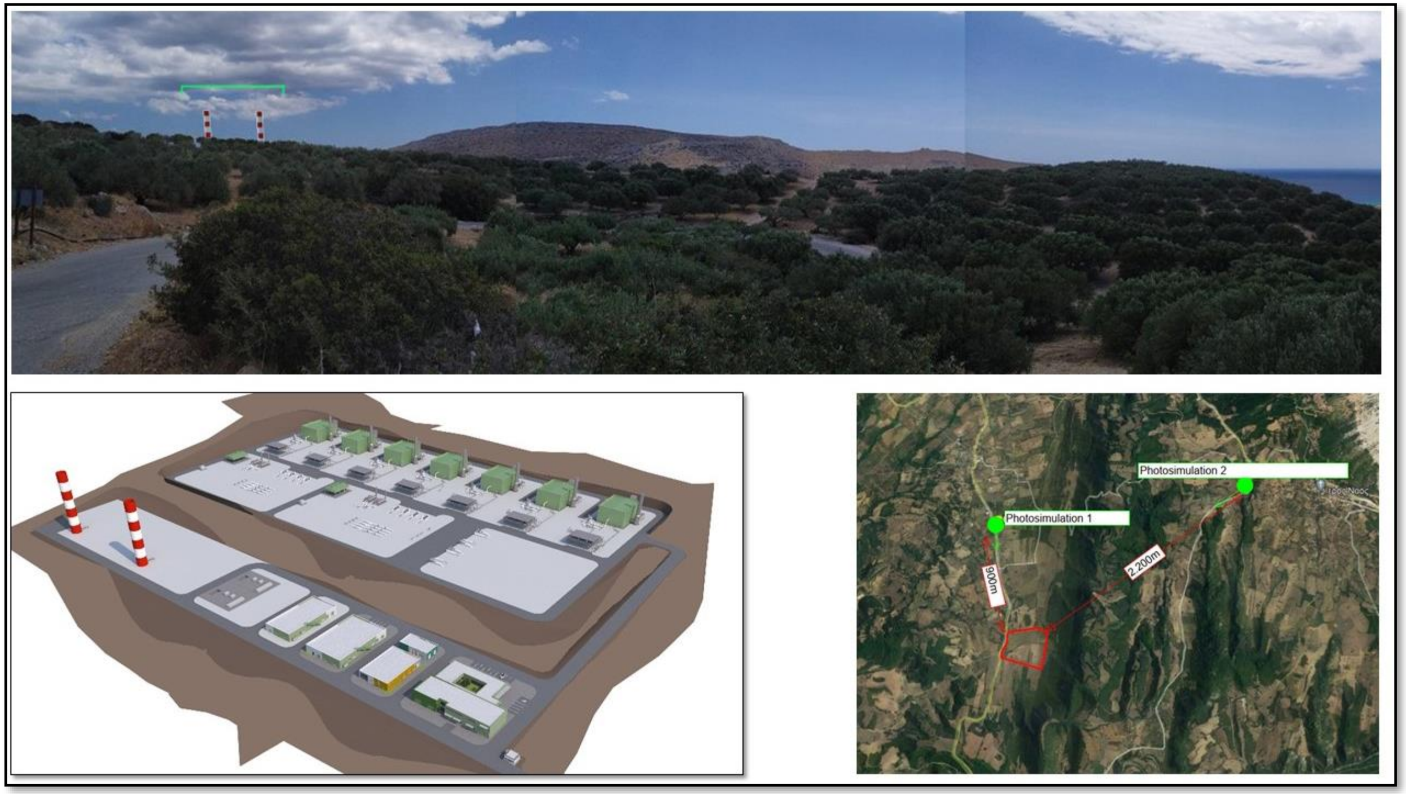
EASTMED GREEK SECTION - ENVIRONMENTAL & SOCIAL IMPACT ASSESMENT
ΕASTMED ΕΛΛΗΝΙΚΟ ΤΜΗΜΑ - ΜΕΛΕΤΗ ΠΕΡΙΒΑΛΛΟΝΤΙΚΩΝ & ΚΟΙΝΩΝΙΚΩΝ ΕΠΙΠΤΩΣΕΩΝ

Map n°: ANNEX

ZONE OF VISUAL IMPACT FOR CS2/MS2-CS2/MS2N STATION/ ΖΩΝΗ ΟΠΤΙΚΗΣ ΕΠΙΡΡΟΗΣ ΑΠΟ ΤΟΝ ΣΤΑΘΜΟ CS2/MS2-CS2/MS2N

Scale/ Κλίμακα	Project DWG No./ Αρ. Σχ. Έργου:		Rev/ Αναθ
1:90.000	Figure 6-60 ZVI - Crete Facilities		0
Size/ Μέγεθος	Company's DWG No/Αρ. Σχ. Εταιρείας:	Engineer's DWG No/Αρ. Σχ. Μελετητή:	Sheet/ Φύλλο
A3	-	XXX-XXX-XXX/ANNEX	

Document Name: Zone of Visual Impact Map_CS2MS2

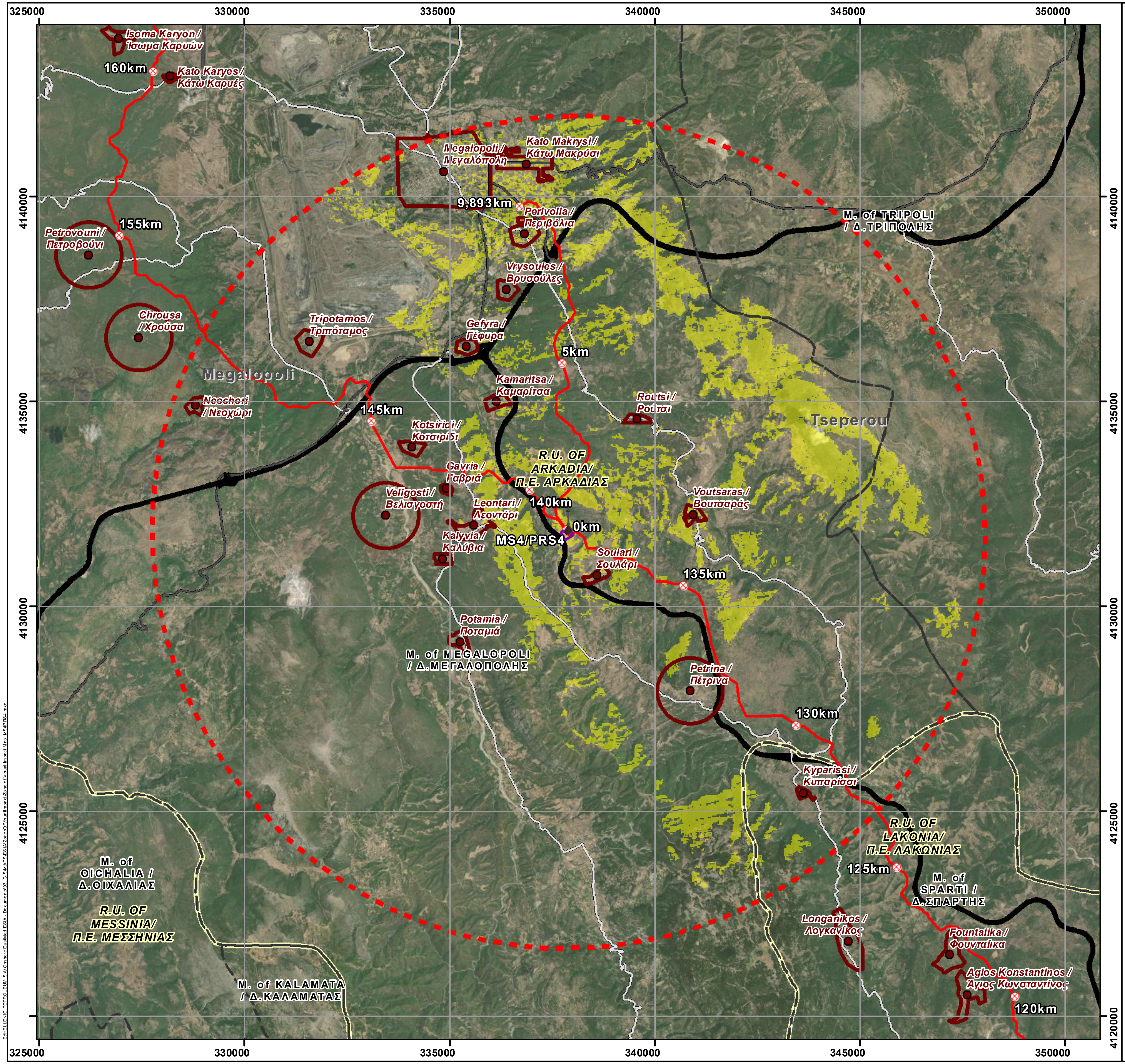


Prepared by: FEED, 2022.

Figure 9-61 Photorealistic for Crete Facilities – View from Road Users to the South-West of the Facility (SE view of sensitive receptors).

Prepared by: FEED, 2022.

Figure 9-62 Photorealistic for Crete Facilities – View from Road Users to the South-east of the Facility (SW view of sensitive receptors).



LEGEND/ ΥΠΟΜΝΗΜΑ

Project's Elements/ Στοιχεία του Έργου

- Highest Element - Indicative Location (10m height)/ Ενδεικτική Θέση Ψηλότερου Σημείου (ύψους 10 μ)
- Proposed Location of Heating & Metering/Regulating Station MS4/PRS4/ Προτεινόμενη Θέση Σταθμού Θέρμανσης & Μέτρησης/Ρύθμισης MS4/PRS4
- Proposed Onshore Routing/ Προτεινόμενη Χερσαία Όδευση
- Proposed Offshore Routing (Southern&Northern Line)/ Προτεινόμενη Υποθαλάσσια Όδευση (Νότια&Βόρεια Γραμμή)

Study Area / Περιοχή Μελέτης

- Radius 10000 m / Ακτίνα 10000 μ

Potentially Sensitive Reseptors /Πιθανοί Ευαίσθητοι Αποδέκτες

- Motorway User/ Χρήστης Αυτοκινητόδρομου (Εθνική Οδός)
- Primary Road User/ Χρήστης Πρωτεύοντος Οδικού Δικτύου
- Secondary Road User/ Χρήστης Δευτερεύοντος Οδικού Δικτύου
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Zone of Visual Impact/ Ζώνη Οπτικής Επιρροής

- Visibility of the stack/ Θέαση από την καμινάδα

Administrative Boundaries/ Διοικητικά Όρια

- Municipality Border / Όριο Δήμου
- Regional Unit Border / Όριο Περιφερειακής Ενότητας

KEY PLAN/ ΚΛΕΙΔΑ

SCALE/ ΚΛΙΜΑΚΑ

N

0 2 4 km

Rev. Αναθ.	Date Ημερομ.	Description Περιγραφή	Drawn Σχεδίαση	Checked Έλεγχος	Approved Έγκριση
0	8/4/2022	ISSUED FOR REVIEW	GIE	HOD	SPP

Contract No: Αρ. Συμβολαίου: AF117275

Coordinate System: Greek Grid
Projection: Transverse Mercator
Datum: GGRS 1987
WKID: 3857 Authority: EPSG

COMPANY / ΕΤΑΙΡΕΙΑ: IGI Poseidon

CONSULTANT / ΜΕΛΕΤΗΤΗΣ: Asprofos engineering

PROJECT TITLE - ΤΙΤΛΟΣ ΕΡΓΟΥ

EASTMED PIPELINE PROJECT
ΕΡΓΟ ΑΓΩΓΟΥ EASTMED

DOCUMENT TITLE - ΤΙΤΛΟΣ ΕΓΓΡΑΦΟΥ

EASTMED GREEK SECTION - ENVIRONMENTAL & SOCIAL IMPACT ASSESMENT
EASTMED ΕΛΛΗΝΙΚΟ ΤΜΗΜΑ - ΜΕΛΕΤΗ ΠΕΡΙΒΑΛΛΟΝΤΙΚΩΝ & ΚΟΙΝΩΝΙΚΩΝ ΕΠΙΠΤΩΣΕΩΝ

Map n°: *ZONE OF VISUAL IMPACT FOR MS4/PRS4 STATION/ ΖΩΝΗ ΟΠΤΙΚΗΣ ΕΠΙΡΡΟΗΣ ΑΠΟ ΤΟΝ ΣΤΑΘΜΟ MS4/PRS4*

Scale/ Κλίμακα	Project DWG No./ Αρ. Σχ. Έργου:		Rev/ Αναθ
1:90.000	Figure 9-63 ZVI - Megalopoli Facilities		0
Size/ Μέγεθος	Company's DWG No/Αρ.Σχ. Εταιρείας:	Engineer's DWG No/Αρ. Σχ. Μελετητή:	Sheet/ Φύλλο
A3	-		

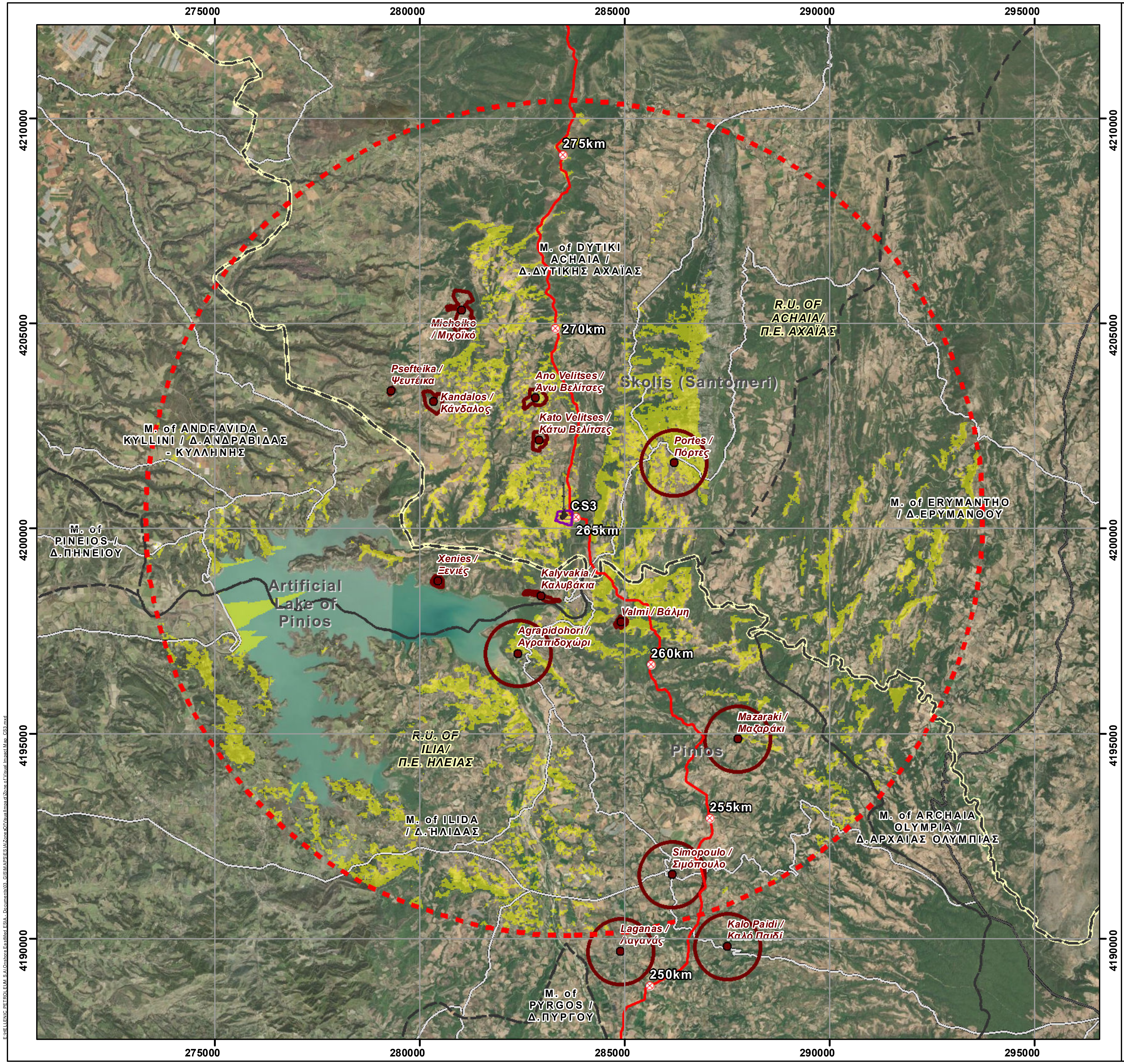
Document Name: Zone of Visual Impact Map_MS4PRS4

Prepared by: FEED, 2022.

Figure 9-64 Photorealistic for Megalopoli Facilities – View from Soulari Settlement to the South-east of the Facility (NW view).

Prepared by: FEED, 2022.

Figure 9-65 Photorealistic for Megalopoli Facilities – View from Church to the West of the Facility (E view).



LEGEND/ ΥΠΟΜΝΗΜΑ

Project's Elements/ Στοιχεία του Έργου

- Indicative Stack Location (20m height)/ Ενδεικτική Θέση Καμινάδας (ύψους 20 μ)
- Proposed Location of Compressor Station CS3 / Προτεινόμενη Θέση Σταθμού Συμπίεσης CS3
- Onshore Routing of N.G. Pipeline/ Χερσαία Όδευση Αγωγού Φ.Α.
- Offshore Routing of N.G. Pipeline (Southern&Northern Line)/ Υποθαλάσσια Όδευση Αγωγού Φ.Α.(Νότια&Βόρεια Γραμμή)

Study Area / Περιοχή Μελέτης

- Radius 10000 m / Ακτίνα 10000 μ

Potentially Sensitive Reseptors /Πιθανοί Ευαίσθητοι Αποδέκτες

- Motorway User/ Χρήστης Αυτοκινητόδρομου (Εθνική Οδός)
- Primary Road User/ Χρήστης Πρωτεύοντος Οδικού Δικτύου
- Secondary Road User/ Χρήστης Δευτερεύοντος Οδικού Δικτύου
- Settlement Limit / Όρια Οικισμού

Zone of Visual Impact/ Ζώνη Οπτικής Επιρροής

- Visibility of the stack/ Θέαση από την καμινάδα

Administrative Boundaries/ Διοικητικά Όρια

- Municipality Border / Όριο Δήμου
- Regional Unit Border / Όριο Περιφερειακής Ενότητας

KEY PLAN/ ΚΛΕΙΔΑ

SCALE/ ΚΛΙΜΑΚΑ

N

0 2 4 km

Rev. Αναθ.	Date Ημερομ.	Description Περιγραφή	Drawn Σχεδίαση	Checked Έλεγχος	Approved Έγκριση
0	14/12/2021	ISSUED FOR REVIEW	GIE	HOD	SPP

Contract No: Αρ. Συμβολαίου: AF117275

Coordinate System: Greek Grid
Projection: Transverse Mercator
Datum: GGRS 1987
WKID: 3857 Authority: EPSG

COMPANY / ΕΤΑΙΡΕΙΑ: IGI Poseidon

ENGINEER/CONSULTANT: Asprofos engineering

PROJECT TITLE - ΤΙΤΛΟΣ ΕΡΓΟΥ

EASTMED PIPELINE PROJECT
ΕΡΓΟ ΑΓΩΓΟΥ ΦΥΣΙΚΟΥ ΑΕΡΙΟΥ EASTMED

DOCUMENT TITLE - ΤΙΤΛΟΣ ΕΓΓΡΑΦΟΥ

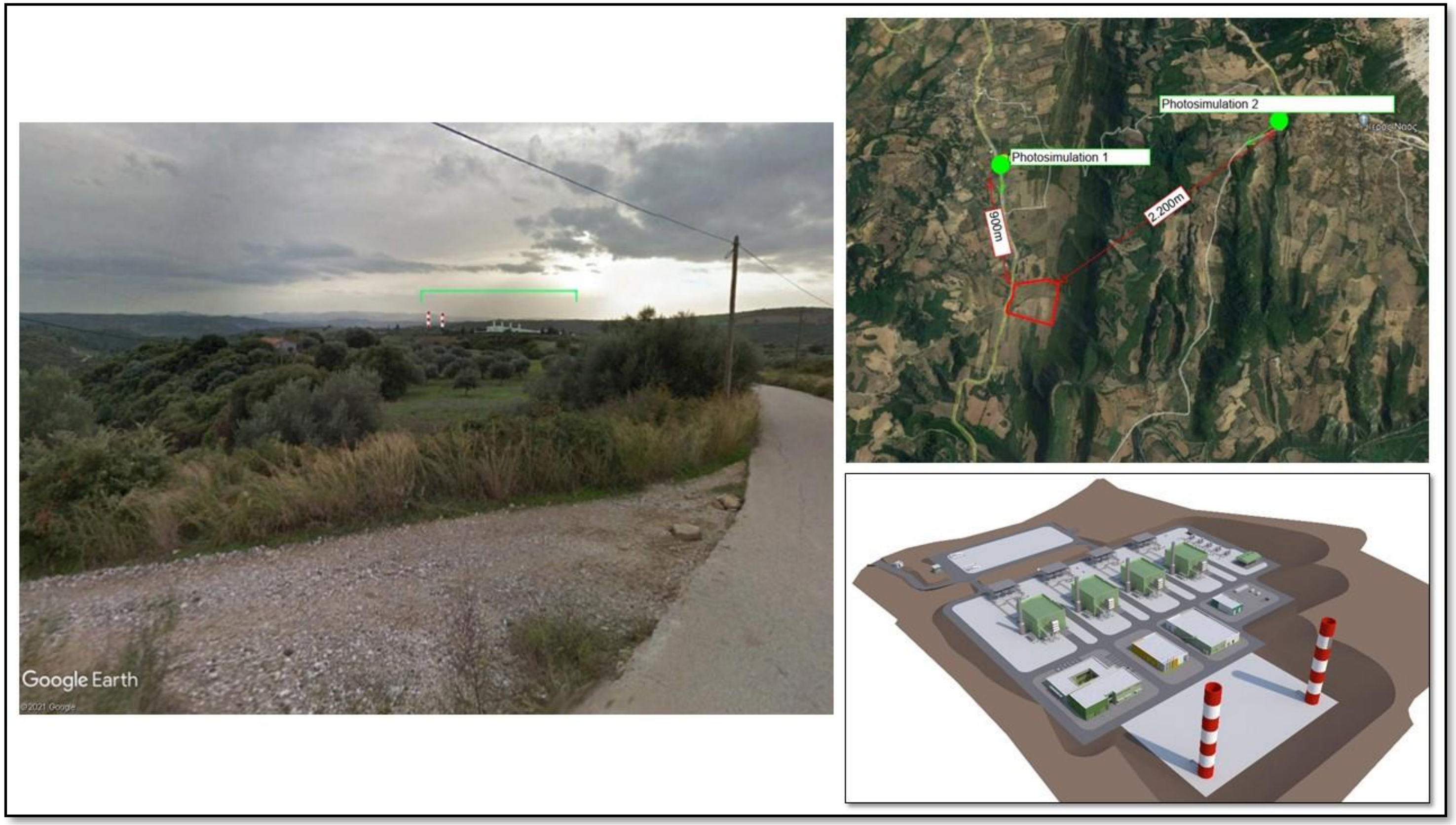
EASTMED GREEK SECTION - ENVIRONMENTAL & SOCIAL IMPACT ASSESMENT
EASTMED ΕΛΛΗΝΙΚΟ ΤΜΗΜΑ - ΜΕΛΕΤΗ ΠΕΡΙΒΑΛΛΟΝΤΙΚΩΝ & ΚΟΙΝΩΝΙΚΩΝ ΕΠΙΠΤΩΣΕΩΝ

Map n°: ANNEX

ZONE OF VISUAL IMPACT FOR CS3 STATION/ ΖΩΝΗ ΟΠΤΙΚΗΣ ΕΠΙΡΡΟΗΣ ΑΠΟ ΤΟΝ ΣΤΑΘΜΟ CS3

Scale/ Κλίμακα	Project DWG No./ Αρ. Σχ. Έργου:		Rev/ Αναθ
1:90.000	Figure 9-66 ZVI - Achaia Facilities		0
Size/ Μέγεθος	Company's DWG No/Αρ. Σχ. Εταιρείας:	Engineer's DWG No/Αρ. Σχ. Μελετητή:	Sheet/ Φύλλο
A3	-	XXX-XXX-XXX/ANNEX	

Document Name: Zone of Visual Impact Map_CS3



Prepared by: FEED, 2022.

Figure 9-67 Photorealistic for Achaia Facilities – View from Kato Velitses Settlement to the North-west of the Facility (SE view).

Prepared by: FEED, 2022.

Figure 9-68 Photorealistic for Achaia Facilities – View from Portes Settlement to the East of the Facility (SW view).

Table 9-140 Zone of Visual Impact for Main Stations

	Crete Facilities		Megalopoli Facilities		Achaia Facilities	
	1000 m²	%	1000 m²	%	1000 m²	%
Visible	101207	30.5	36220	11.2	35814	10.9
Onshore	6396	6.3	36220	11.2	35814	10.9
Offshore	94811	93.7	0	0	0	0
Not Visible	230320	69.5	286858	88.8	291578	89.1
Total Area	331528	100.0	323078	100.0	327392	100.0

Prepared by: ASPROFOS, 2022.

As summarized in Table 9-140, Crete facilities are not visible from any location within 70% of the total area modelled (i.e. of the 10 km radius from the center of the specific facility plot). The corresponding percentage for facilities at Megalopoli and Achaia is even higher, i.e. 89%. It should be considered that almost 94% of the zone including visibility to Crete Facilities is located offshore, where sensitive receptors (e.g. day cruising tourists) are even more rare (see Figure 9-60 and Figure 9-70). Megalopoli Facilities are not expected to be visible from almost 90% of the entire study area (10 km radius around the facilities' plot center) whilst the rest of the area (~10% of the ZVI from where the facilities might be visible) are located on the eastern-most area of the ZVI, mostly on mountainous areas, and along A71 highway (Lefktro – Sparti) close to the facilities. Megalopoli's Power Plant and Lignite Mine are the dominant landscape features, much more prominent than the modification proposed (Figure 9-62 and Figure 9-71). As such, viewers for Megalopoli facilities are mostly highway (and other roads) users. As far as Achaia Facilities refers to (see Figure 9-66 and Figure 9-72), the analysis is similar to that presented for Megalopoli Facilities. It is noted that Monastery of Agios Nikolaos, at the northern-most limits of the ZVI, has no view over Achaia Facilities due to morphology and vegetation present in the area. In summary, no sensitive receptors (as defined in Section 9.2.3) are expected to be present in the area.

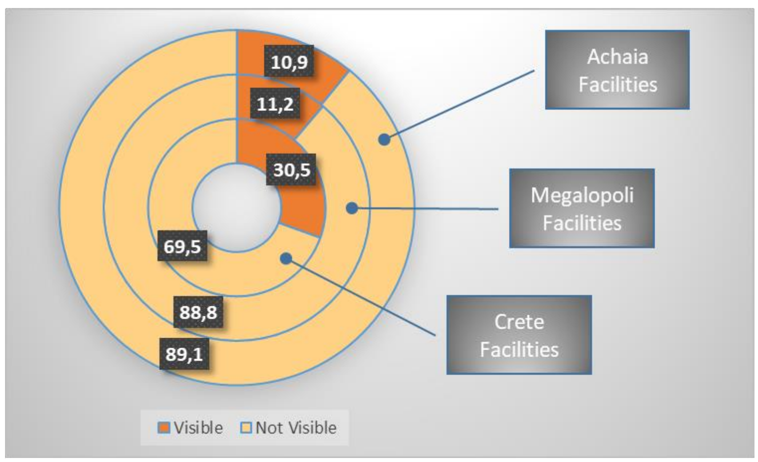
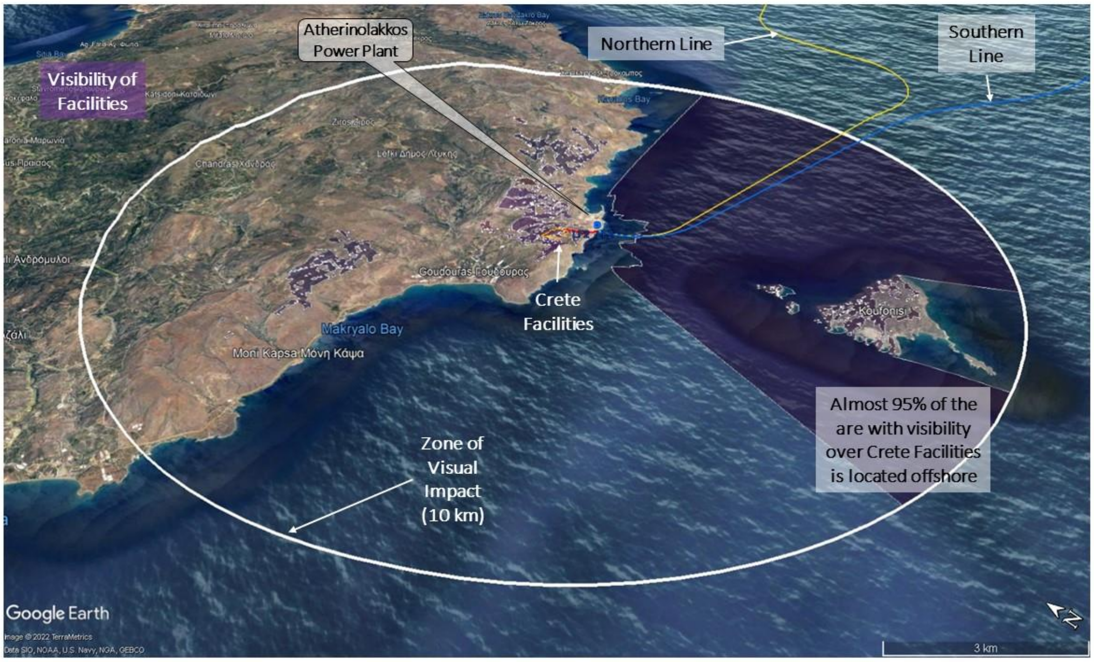
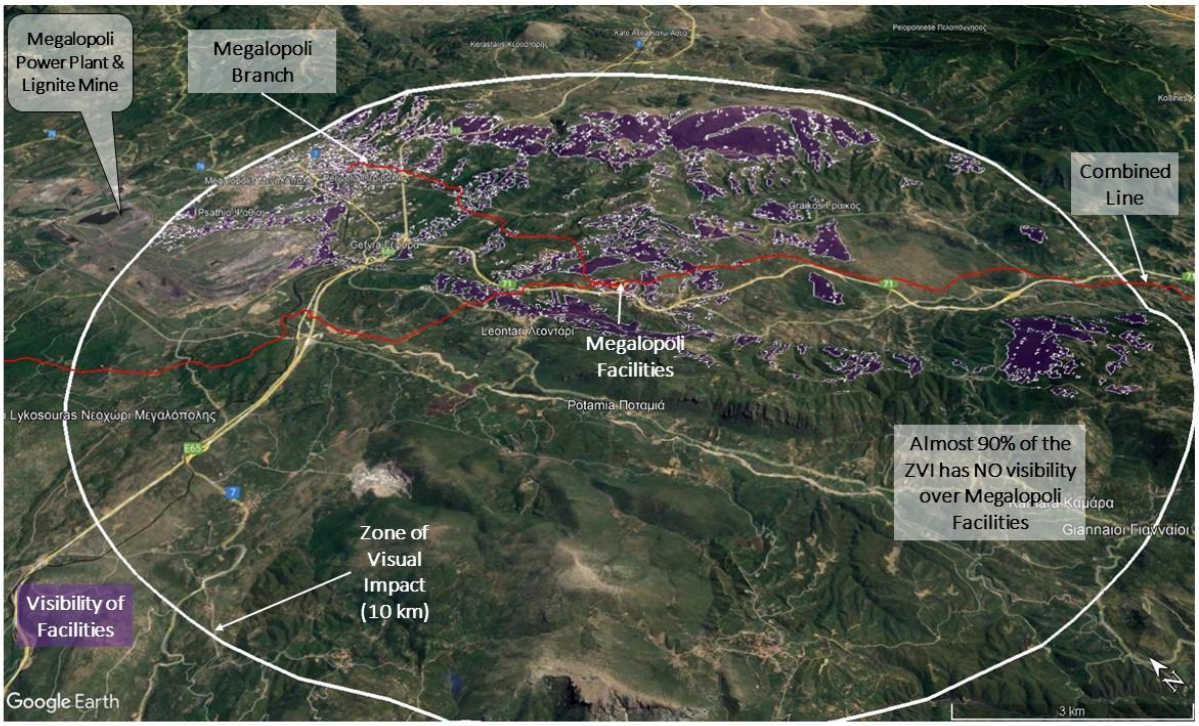


Figure 9-69 Visibility Percentages for Main Stations.



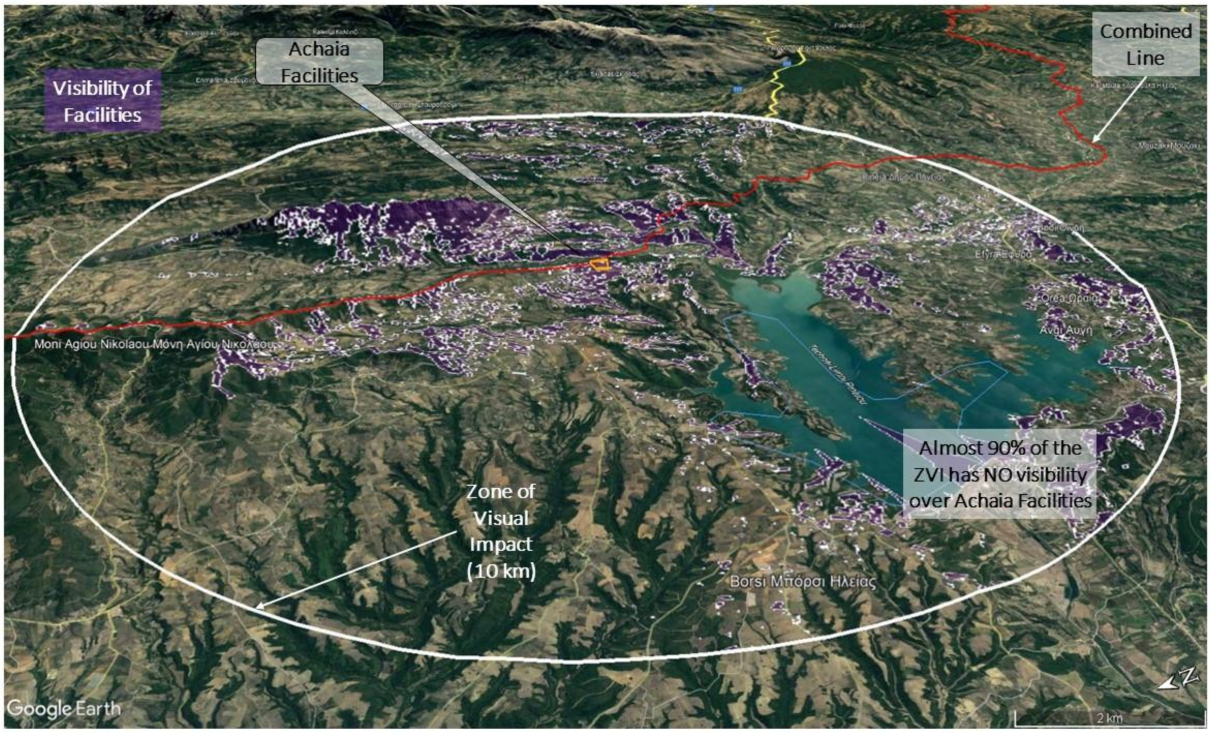
Prepared by: ASPROFOS, 2022.

Figure 9-70 Viewshed Analysis on Google Earth Basemap for Crete Facilities.



Prepared by: ASPROFOS, 2022.

Figure 9-71 Viewshed Analysis on Google Earth Basemap for Megalopoli Facilities.



Prepared by: ASPROFOS, 2022.

Figure 9-72 Viewshed Analysis on Google Earth Base map for Achaia Facilities

Based on the above and the analysis previously described, the following can be concluded:

Impact *Likelihood* during construction works is *certain*. Impact *extent* could be considered the distance according to which the ZVI shall be visible from each station. Assessing the fact that the ZVI is theoretical and it does not consider existing obstacles or a viewing angle of the facilities (from some sensitive receptor), it is deemed realistic to assess that the extent from which each station will be visible shall be *perimetric*. Impact *intensity* is related, as previously described and presented in Table 9-14 and Annex 9C, with landscape sensitivity. Every station shall be located in agricultural landscapes as a dominant landscape type with *low* or no sensitivity and high absorption capacity.

Regarding impact *Duration*, viewing facilities shall be, theoretically, possible throughout project lifetime (*long-term*).

Regarding *Reversibility*, viewing facilities can be *minimized* by planting trees and taking other measures.

Regarding *cumulative* action, given the character of landscapes where stations shall be located, no such action is assessed (*impossible*).

Transboundary character is deemed *impossible*, given location of sensitive receptors.

Based on the above and based on criteria presented in Section 9.1 for disturbance to viewers from permanent facilities, the **SEI is considered as Minor**. Section 10.3.2 presents a proposed mitigation and management measures applicable to this impact.

9.3.3.1.4 Summary

The following table summarizes impacts to landscape characteristics during operation phase.

Table 9-141 Summary of Impacts to Landscape Characteristics during Operation Phase.

S/N SEI			SEI for	Landscape Characteristics							
Project phase	Operation										
Impact	Mechanism	Locations	Criteria/Impact Properties							SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Landscape Modification from PPS (incl. restored temporary facilities)	PPS establishment	• Hilly Natural (Forest) Landscape • Mountainous Natural (Forest) Landscape • Hilly Natural (Shrublands) Landscape • Mountainous Natural (Shrublands) Landscape	1.00	0.75	0.75	0.75	0.75	0.50	0.00	6.43 (Moderate)	In agricultural landscapes, PPS won't be visible. In natural landscapes, PPS will be typically appreciated as a forest road or local vegetation clearing. Where PPS is configured as a fire protection measure, it might be more visible.
Disturbance to Viewers from Permanent Facilities	Permanent Facilities presence	Station sites	1.00	0.75	0.25	0.75	0.75	0.00	0.00	5.00 (Minor)	Facilities are located in landscapes including increased absorption capacity; no sensitive receptors are identified in the Zone of Visual Impact.

Prepared by: ASPROFOS, 2022.

9.3.3.2 Morphological Characteristics

9.3.3.2.1 Methodology Overview

Terrestrial morphology, in terms of altitude and formations, as the ones identified in Section 8.3, is not going to be impacted. This is because no construction is performed in high elevation and steep slopes areas, or in elevated embankments. In such areas, significant changes to the morphology may be necessary resulting to ridge modification (in simple words, *cut off entire mountain picks*). However, as clearly described in Landscape Characteristics (see Sections 9.2.3 and 9.3.3.1), any modification shall be temporary and baseline contours shall be reinstated, as can be experienced from existing DESFA pipelines constructed in Greece.

Similarly, nearshore seabed and coastal morphology is not going to be impacted given restoration of bathymetry and contours in nearshore and coastal areas (see Sections 9.2.14 & 9.3.14)

In principle, the pipeline is simply placed on the bottom of the sea in deep water marine sections; however, according to current design development, few areas along the pipeline may require pre-lay or post-lay intervention to overcome irregularities met on the seafloor surface (e.g. free span, bumps, etc.), so as to ensure safe pipe installation and operation (e.g. ensure pipeline stability and safety against sea hydrodynamics, free spans, trawl gear interference).

Seabed intervention strategy, in general, is based on a combination of peak shaving (e.g. mass flow excavation techniques), and installing supports (e.g. rock dump, mattresses or grout bags) along the pipeline route. The choice of method for individual spans depends on the characteristics required to construct over each span. As such, the type of work and methodology to be used are identified on a case-by-case basis in a more advanced phase of the Project. These intervention methods may be carried out by a common installation support vessel provided with adequate lifting / handling capabilities such as a crane or A-frame and a sufficient free deck area to accommodate required equipment.

In order to identify exact locations where seabed intervention works shall be required, Detailed Marine Survey (DMS) data will be used. Before Project construction, these seabed intervention areas shall be mapped and a construction method for each one shall be decided and issued, as part of the detailed design by EPC contractor[53]. In order to prepare the seabed for pipe-laying, an entire route is surveyed beforehand. Gravel berms will then be strategically placed to support the pipeline in areas of high seabed relief, in order to serve as basement structures at pipeline crossing areas and stabilize the pipelines, where required. Rock placement is the most common practice to prepare infrastructure crossings, also where necessary, as pre-lay and post-lay intervention works to reduce anticipated free spans, and as a pipeline stability measure.

Indicative broader areas are provided in Section 8.3, however, exact locations are yet to be identified. Especially regarding free spans mitigation, key areas identified so far are:

- Fault area – SE Crete (OSS2, OSS3);
- Crete continental margin (OSS3);
- Peloponnese continental slope (OSS3);
- Patraikos Gulf (OSS4) to a lesser extent, but a combination of significant seabed features including shipping and fishing activity in shallow water will require protection of free spans.

Although an exact location for seabed intervention works is not available yet, their impact on seabed morphology (bathymetry) can be tentatively assessed.

Table 9-142 presents key impact sources (or mechanisms), potentially impacted resources and (sensitive) receptors, baseline and Project influencing factors associated with the Project on seabed morphology characteristics.

Table 9-142 Key Considerations for Assessment - Morphological Characteristics

Impact/Risk Sources	• Permanent modification of seabed morphology (bathymetry) in deep waters
Potentially Impacted Resources and Receptors	• Deepwater Seabed morphology (bathymetry) • Creation of hard substrate for benthic communities (Positively impacted)
Particular Baseline Conditions that are	• Seabed morphology • Potential presence of: (i) Steps, (ii) Scarps and (iii) Faults

53 Available DMS data have been used for the design of the project. Specifically for OSS4, according to Route Field Report – OSS4 (Doc Number 00225-Ev41A-TDR-00080-4, 27-07-2021), the following bathymetric steps/ scarps have been identified (i) at KP4, approx. 14m high, with gradient 22° (the highest seabed gradient found along OSS4), (ii) at KP4.59, approx. 3m high, with gradients 4° to 10°, (iii) at KP4.9, approx. 5m high, with gradients 4° to 10°, (iv) at KP5.3, approx. 5m high, with gradients 4° to 10°; (v) at KP7.2, approx. 19 m high, with 7° gradient, (vi) at KP11.3, approx. 10 m high, with 7.5° gradient; (vii) at KP14, approx. 7 m high, with 13° gradient.

Potentially Influencing Impacts/Risks	
Project Factors that are Potentially Influencing Impacts/Risks	• Free span length is partly driven by residual lay tension • Free spans tolerance is related to pipeline tension capacity • Seabed intervention method
References	• Section 6.4.2.1 • Mitigation Measures are provided in Section 10.3

Prepared by: ASPROFOS, 2022.

It is noted that a change is induced during construction phase and it is permanent during the entire operation lifetime of the project (or even greater, depending on decommissioning phase), essentially with no modification to mechanisms or results of their action to seabed morphology. As such, it is considered that deep-water seabed morphology (bathymetry) modification is permanent and impact is the same (continuous) for every project phase (construction, operation, decommissioning). Consequently, no distinction between construction and operation (or decommissioning) phases is necessary.

Table 9-143 Potential Impacts to Morphology

Potential Impact	Construction/Operation
Modifications (Changes) to deep-water seabed morphology (bathymetry)	X

Prepared by: ASPROFOS, 2022.

9.3.3.2.2 Modification of Seabed Morphology

As described in Chapter 6 and Section 9.2.3, the construction technique to be used in the nearshore section includes a trench excavation and seabed reinstatement into the same morphology (bathymetry) as before project implementation, with the same material. As such, no impacts on the nearshore morphology are assessed.[54] Based on various studies[55], submarine pipelines in deep-water are mostly laid directly on the seabed. Secure placement of a pipeline on the seabed would ideally require a seabed to be as flat and regular as possible. However, this is not the case sometimes, due to various geophysical and morphological features present on the seabed. If such geophysical features make the seabed irregular or undulating, then the pipeline could face the risk of spanning and overstressing beyond mechanical tolerances. In such cases, seabed morphology needs to be modified and therefore seabed interventions are performed.

Following an overview provided in Chapter 6 (section 6.4.2.1), an offshore pipeline installation potentially requires additional stabilization and/or protection against hydrodynamic loading in some areas, which can be achieved either by pre-laying or post-laying methods (e.g. trenching the pipeline into the seabed or placing rocks in areas where no natural support will be provided). Such intervention works (i.e. the mechanisms for the impact) include[56]:

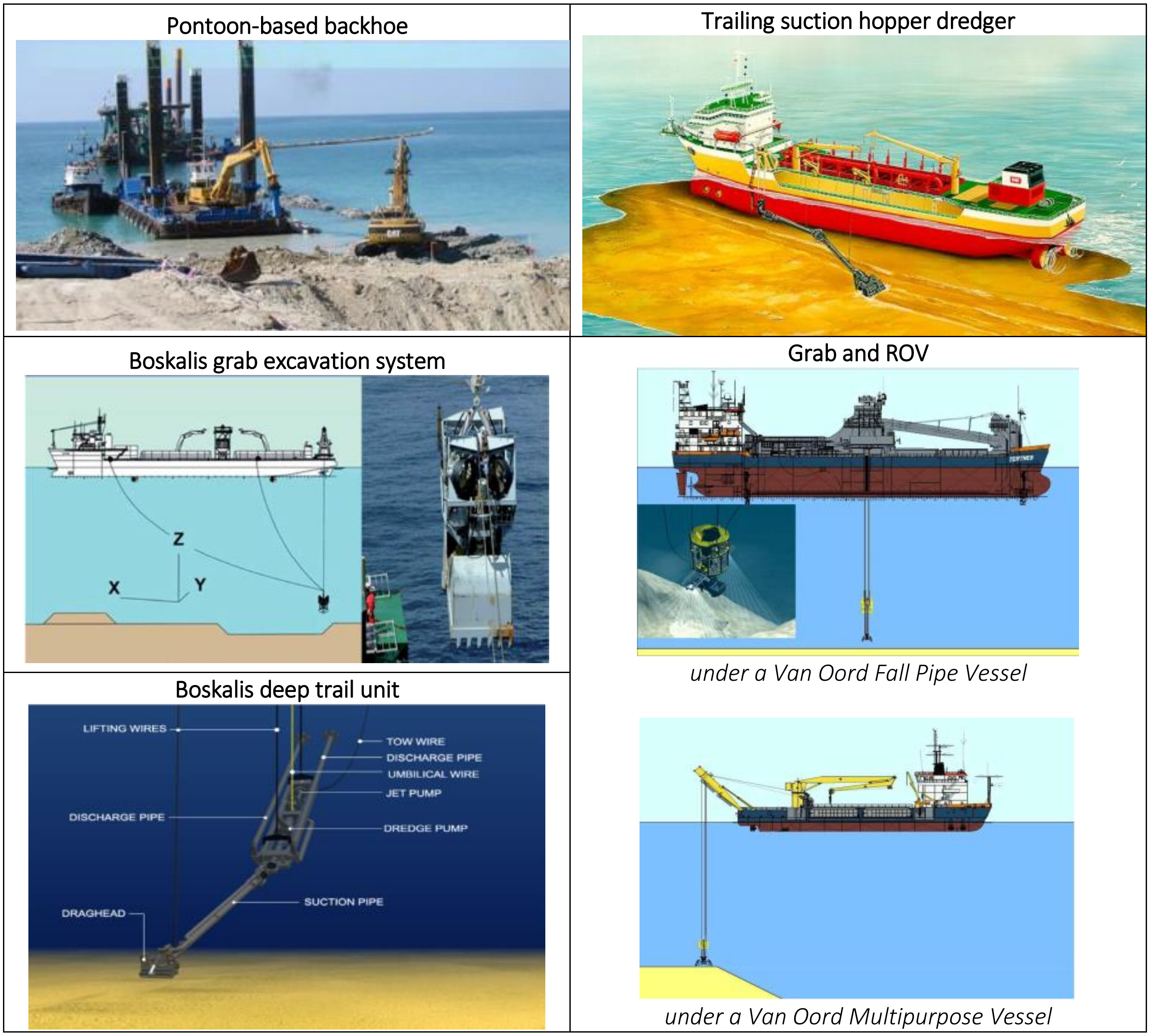
- Pre-installation methods:
  - Dredging (pre-installation). Dredging can be used to modify the seabed over a large area and large lengths prior to pipeline installation. Most often, as in the investigated project, dredging is used at a landfall area (details on shore crossing are provided in Section 6.4.3.2). This method is also used for pre-sweeping large bed-forms such as ridges prior to pipe installation, intended to potential pipe laying under excessive straining conditions. Offshore dredging has been performed for many projects in order to create a smoother sea bottom for a pipeline, and thereby reduce span height and length. Another reason to opt for dredging is route rectification work in the areas where soil conditions do not allow post-lay trenching, such as boulder fields or base rock. Figure 9-73 is relevant. There are two main groups of deep water subsea intervention equipment (essentially for dredging):
    - *Subsea excavators* used to perform subsea precision dredging or excavation work, mainly seabed levelling, pipeline de-burial, boulder / rock relocation.

[54] Impacts from the construction activities on the sediments, shore morphology and oceanographic characteristics are presented in the corresponding sections, i.e. Sections 9.2.3, 9.2.15 & 9.3.15.
[55] (i) Offshore Pipelines: Design, Installation and Maintenance by Boyun Guo, Shanhong Song (PhD), Ali Ghalambor (PhD), Tian Ran Lin (PhD) and (ii) Subsea Pipeline Design, Analysis and Installation, by Qiang Bai and Yong Bai, as cited in "Seabed Intervention Techniques", All About Pipelines. Retrieved by https://allaboutpipelines.com
[56] IntecSea, 2018. Poseidon Pipeline Project - Offshore Section Update. Seabed Intervention Summary Design Report. IGI POSEIDON.

- *Mass flow excavation* tools rely on subsea jetting equipment which collects seawater redirecting it with high velocities to the seabed. This type of equipment allows for localized pre- and post-installation span correction in very deep waters in most soils without risk of damage to the pipeline.

- Rock dump is used to cover or support the pipeline, to protect it against a wide range of external loads, to control pipe buckling or to correct pipeline free spans. In shallow water, the rock can be dumped over the side, from a vessel. Fall pipe vessels are used to place rock dump accurately in shallow and deep water. For rock dumping operations in deep water, the bottom end of fall pipe will be positioned by an ROV equipped with a positioning system. Rock dump could be used for the following applications:

  - To create overtrawlable free spans in fishing areas (including crossing locations)
  - To create pipe supports to reduce maximum free span lengths
  - To create intermittent berms (spot rock dumping) to locally restrain the pipe preventing lateral buckles from forming; this is relevant for the hot end of the pipeline where buckling could be triggered by trawl gear interaction.

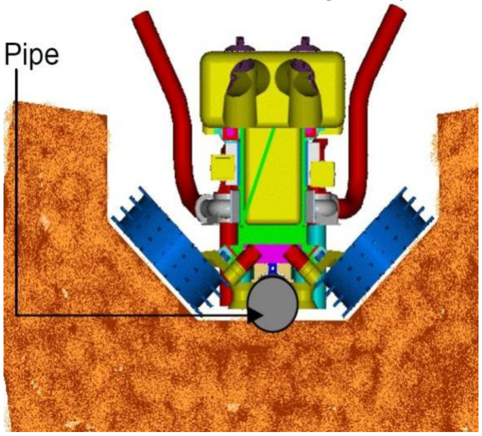
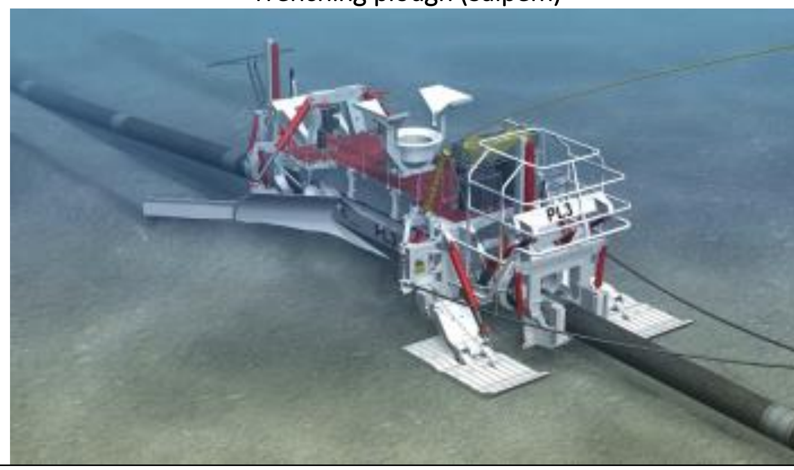


Source: IntecSea, 2018. Poseidon Pipeline Project - Offshore Section Update. Seabed Intervention Summary Design Report. IGI POSEIDON.

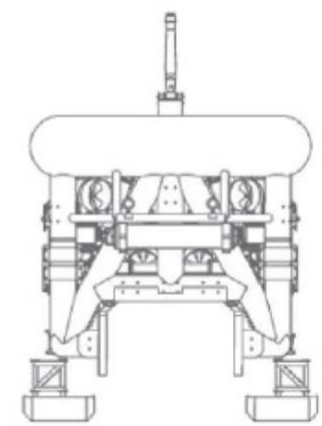
Figure 9-73 Seabed Dredging Indicative Pictures and Figures

- Post-installation intervention can be used for protection, stabilisation or free span correction.

- Trenching or lowering of the pipe can be performed by various means; some equipment is self-propelled, pulled by a surface vessel, including or excluding contact with the pipeline. The method to be applied depends on water depth, soil conditions and burial depth to be achieved. The systems can be grouped in three categories as follows (Figure 9-74):
  - Jetters. The soil is penetrated by arms, and water under high pressure is forced into the soil. Jetting systems are generally free floating or light weight and exert no significant loads on the pipe.
  - Mechanical Cutters. These can cut both soft and hard soils from under the pipe and gradually lower the pipe. This is usually heavy equipment on crawlers that makes direct contact with the pipe. A mechanical cutter requires a matching support vessel to handle and lower it in deeper water and position it accurately over the pipe.
  - Ploughs. A plough is a relatively large tool that is pulled over the seabed, lifts the pipe, cuts the soil and deposits it at the side of the trench and finally lowers the pipe in the created channel. The trench can be left to backfill naturally, or the deposited soil can be replaced on top of the pipe in a successive operation by a backfill plough. A plough requires a good matching support vessel.
- Pipeline supports (Figure 9-75). Besides above described solutions, free-spans are also addressed through artificial supports. These include:
  - *Mattresses*, which can be used both to support and cover the pipeline to provide stability and protection. Mattresses are normally installed from a vessel with crane and ROV support.
  - Smaller sand or *grout bags* can be used, especially in shallow water.
  - Rigid Supports. Use of flexible concrete mattresses for crossing support might be not feasible. In such cases, rigid supports, e.g. steel structure on a base plate (mudmat) can be considered.
  - Mechanical supports are primarily intended to reduce span lengths and come in many different forms and shapes. They are designed for specific task and conditions. This method is suitable for spans with a gap between pipe and seabed of several meters; i.e. where use of rock dump is not efficient. Foundation methods for subsea structures are generally piling, suction anchors or gravity based. The final shape of the fixture may vary with changing soil and span height.
- Piling or Anchoring can be used for stabilisation of the pipeline against lateral external loads or to maintain a specific curvature on a sloping seabed. Anchoring can be achieved by driven or suction piles or a large weight placed on the seabed; a gravity anchor.

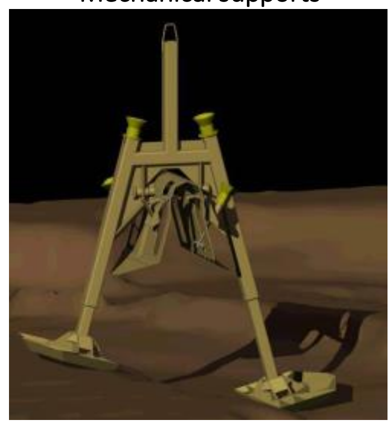
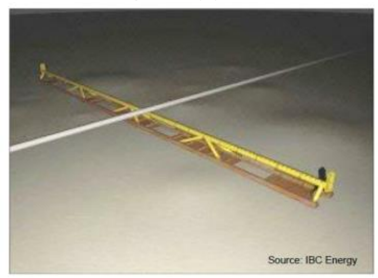
Mechanical trencher Beluga (Saipem)	Trenching plough (Saipem)
	

Jet trencher (DeepOcean)



Source: IntecSea, 2018. Poseidon Pipeline Project - Offshore Section Update. Seabed Intervention Summary Design Report. IGI POSEIDON.

Figure 9-74 Trenching Equipment

Mattresses	Mechanical supports
	
Grout bags	**Rigid supports**
	

Source: IntecSea, 2018. Poseidon Pipeline Project - Offshore Section Update. Seabed Intervention Summary Design Report. IGI POSEIDON.

Figure 9-75 Pipeline Supports

Alternative Solutions to seabed intervention include:

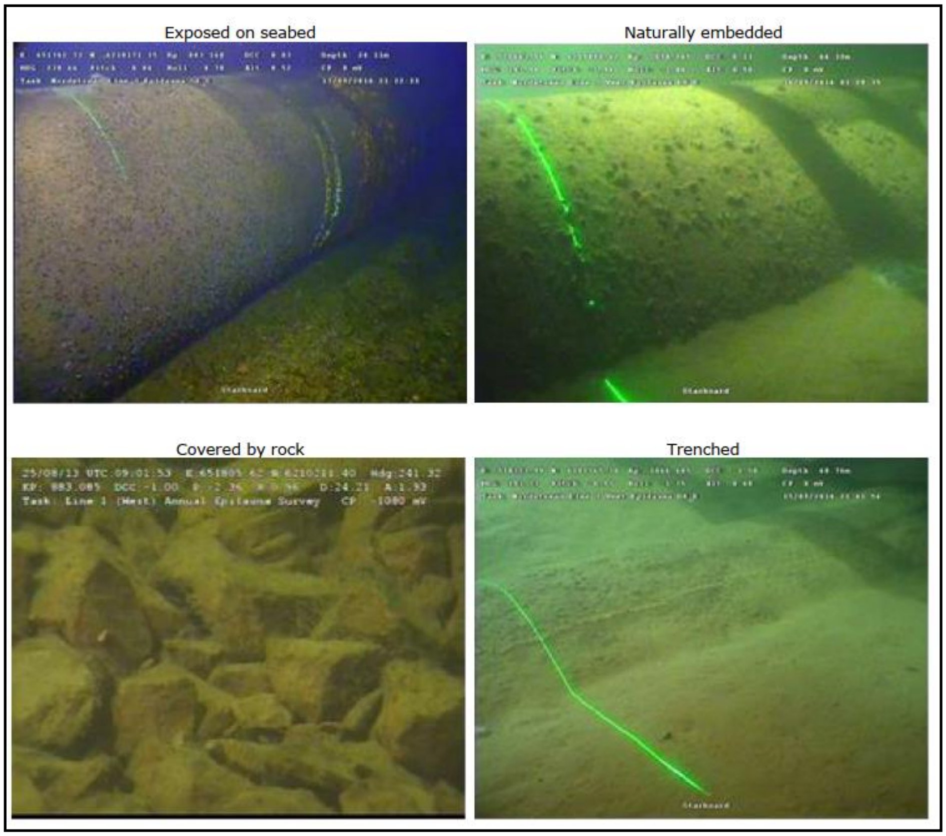
- VIV Suppression Strakes which are used to reduce loads and allow for larger free spans. Two types of strakes are considered: collapsible and non-collapsible (solid) strakes. The collapsible strakes can be installed prior to pipe lay and collapse as they pass through barge and stinger rollers. Once over the rollers the strakes resume their shape. The non-collapsible / solid strakes are installed after pipe lay and may be fitted using divers or ROV support, depending upon the water depth.
- Re-routing. During DMSs and after assessment of their results, extensive route optimization work is performed. Further micro-route optimizations can be performed by EPCI contractor in order to avoid local undulations such as individual pockmarks.
- Increase in structural strength and weight of the pipeline by increasing wall thickness or applying weight coating.

It is noted that actual free spans that occur after pipelaying may differ from the results in initial reports, due to lay tolerances, pipe behavior (e.g. bottom tension) and pipe-soil interactions (e.g. settlement). Final on-bottom stress analysis will be performed by the EPC contractor after installation using the as-laid survey data.

Regardless of the seabed intervention strategy, the height of the modification to the bathymetry is not expected to cause any change to seabed currents. Seabed currents are influenced by water salinity and temperature, not affected by any of the previously discussed intervention works. According to available data, as-lay pipeline height will be few meters different from baseline conditions, which is considered negligible comparing significant water depths encountered in the Greek seas. Pipelines and support structures (rock placement, mattresses) present will result in a localized reduction of water depth. However, given that pipeline diameter will be 46'' (maximum offshore diameter)[57] , overall reduction in water depth should not exceed a few meters (it will be slightly greater in rock placement areas).

As supported by Nord Stream existing pipeline and Nord Steam 2 Environmental Impact Assessment[58], once pipelines are on the seabed, depending on seabed conditions, the pipeline may become naturally embedded. Examples of how existing Nord Stream pipeline appears on the seabed are shown in Figure 9-76.

[57] Offshore diameter for OSS2/OSS2 N diameter is 26'', for OSS3/OSS3 N 28'' and for OSS4 46''.
[58] RAMBOLL S.A.., 2018. NORD STREAM 2 ENVIRONMENTAL IMPACT ASSESSMENT, DENMARK NORTH-WESTERN ROUTE. Document No.: W-PE-EIA-PDK-REP-805-RN0100EN-07.



Source: RAMBOLL S.A.., 2018. NORD STREAM 2 ENVIRONMENTAL IMPACT ASSESSMENT, DENMARK NORTH-WESTERN ROUTE. Document No.: W-PE-EIA-PDK-REP-805-RN0100EN-07.

Figure 9-76 Example of how an existing offshore pipeline (Nord Stream) is incorporated to seabed morphology.

In any case, as soon as the exact locations and methods of seabed intervention are identified, Ar. 7 of L. 4014/2011 shall be followed. Specifically, the article provides for the submission of a Technical Environmental Report (TEPEM) for facilities or works (e.g. construction sites, depositing sites, etc) that are defined by a project's technical design at a stage following the issuance of Environmental Terms Approval.

Regarding assessment criteria presented in Section 9.1, based on the above:

Impact *likelihood* during construction works is *certain*. Impact *extent* is expected to be very limited and localized. Specific locations shall be determined upon DMS completion and prior to construction phase[59]. As such, impact extent is considered *small*. Regarding impact *intensity*, construction activities, mainly post-lay trenching and rock placement, will result in modification of seabed bathymetry, which can be considered a receptor that is not resilient to changes and as such, involves high intensity. Nevertheless, changes in bathymetry will not cause any significant depth-related changes in the seabed morphology[60]. Furthermore, the area to be affected by the project is very small compared to surrounding region, which is characterized by similar environment. In case that an anchored pipe-lay vessel is employed, anchors and their chains will disturb sediment on a local basis; however very little impact on bathymetry will be present. As such, impact intensity is considered *low*. With regard to impact *Duration*, as explained in Section 9.3.3.2.1, it is considered *permanent*. With regard to *reversibility*, impacts are completely *minimizable,* including implementation of proper measures (see Chapter 10). Regarding *cumulative* action, it is considered *impossible*. *Transboundary character* depends on the exact location of each intervention work, which is currently unknown. Adopting a conservative approach, it is deemed as *likely*.

Based on the above and based on criteria presented in Section 9.1, for seabed morphology modification, during construction and operation of the project, the **SEI is considered as Minor**. Sections 10.2.2 and 10.3.2 present proposed mitigation and management measures applicable to the impact.

9.3.3.2.3 Summary

The following table summarizes impacts to morphology characteristics during operation phase.

[59] The TEPEM procedure, as defined in L. 4014/2011, shall be followed.
[60] Potential impacts from sediments dispersion due to dredging and other activities are described in Section 9.2.4. Potential impacts on benthic communities in Section 9.2.5.

Table 9-144 Summary of Impacts to Morphological Characteristics

S/N SEI			SEI for	Morphological Characteristics							
Project phase	Construction & Operation										
Impact	Mechanism	Locations	Criteria/ Impact Properties							SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Seabed morphology (Bathymetry) modification	Seabed intervention works (trenching, rock dumping, anchoring, supports)	Expected to be very limited and localized. Specific locations to be determined upon DMS completion and prior to construction phase	1.00	0.00	0.25	1.00	0.75	0.00	0.50	5.00 (Minor)	

Prepared by: ASPROFOS, 2022.

9.3.4 Geological, Tectonic and Soil/Sediments characteristics

9.3.4.1 Onshore Section

9.3.4.1.1 Overview

This section evaluates the potential impact on:

Potential Activation of Geohazards

The effect of the permanent loading on the geological formations from the installation of the pipeline and its Stations and the simultaneous action of the increased load of geological formations and many parameters that accelerate landslides such as heavy rainfall, seismic activity, contribute to the acceleration of geohazard events (Strong ground motions, Mass Gravity Flow, Rock Fall, Landslides, Liquefaction) during the operation phase.

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Table 9-145 outlines the main sources of impact, the potentially affected resources and recipients as well as the influencing factors of the current situation and those related to the Project.

Table 9-145 Basic Issues for assessment – Geological, Tectonic and soils

Sources of Impact/ Risk	Potential Activation of Geohazards due to the following: • Effect of the permanent loading of the geological formations from the installation of the pipeline and its Stations and the simultaneous action of the increased load of geological formations and many parameters that accelerate landslides such as heavy rainfall, seismic activity, contribute to the acceleration of landslides and similar geohazards events during the operation phase • Restoration of any soil cover to its original state along the modified sections in elevated areas.
Potentially Impacted Resources and Receptors	For Geohazard the recipients are referred to Annex 8M • Table M-9 for landslides along CCS1 Section • Table M-10 for landslides along CCS2 Section • Table M-11 for liquefaction along CCS1 Section • Table M-12 for liquefaction along Megalopolis branch • Table M-13 for liquefaction along CCS2 Section The steep slopes on modified sections of mountains and elevated areas
Special Baseline Conditions that are Potentially Influencing Impacts/Risks	-

Project Factors that are Potentially Influencing Impacts/Risks	The following factors of the project enhance the occurrence of geo-hazards earthworks to reveal the pipeline for maintenance repair
References	In chapter 8.4.4, soils of the project are analyzed. In the chapter 8.4.6 and in theAnnex 8M,geohazards are analyzed.

Prepared by: ASPROFOS, 2022.

9.3.4.1.2 Potential Activation of Geohazards

The effect of the permanent loading on the geological formations from the installation of the pipeline and its Stations, contribute to the acceleration of geohazard events ,) during the operation phase.

Additionally, earthworks to reveal the pipeline for maintenance repair accelerates the creation of unstable slopes.

Based on chapter 8.4.6, the geohazards identified along onshore sections of the EastMed Pipeline Project, including the impact inducing mechanism and potential recipients/resources.

Table 9-146 Potential Activation of Geohazards- Impact mechanism-Potential recipients/resources during the Operation Phase

Impact	Impact mechanisms	Potential recipients / resources
Potential Activation of Geohazards	• Permanent loading of geological formations due to pipeline installation and its Stations	• Annex 8M • Table M-9 for landslides along CCS1 Section • Table M-10 for landslides along CCS2 Section • Table M-11 for liquefaction along CCS1 Section • Table M-12 for liquefaction along Megalopolis branch • Table M-13 for liquefaction along CCS2 Section

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Calculation of SEI

The affected resources from geohazard activation are the following:

- 26 locations concerning landslides susceptibility phenomena along the onshore section of pipeline (Annex 8M, table M-9, table M-10)
- 10 locations concerning liquefaction susceptibility along the onshore section of pipeline (Annex 8M, table M-11, table M-12, table M-13).

The *Likelihood* of the occurrence of geohazard activation is *Rare*, due to minimal locations will be needed Earthworks to reveal the pipeline for maintenance repair. The *Extent* of impact is considered

<u>*Medium*</u> (500 m from Project or resource footprint). The *intensity* of the impact on sensitive recipients is expected to be <u>*Medium*</u>. The *Duration* of the impact is expected throughout the entire e project life, so according to the proposed methodology it is characterised <u>*Long term*</u>. The possibility of dealing with the impact (*Reversibility* of the impact) is considered <u>*Avoidable,*</u> due to the proper design and construction management The *Cumulative Action* of the impact is <u>*Rare*</u> as a number of parameters accelerate the creation of unstable slopes, such as high aquifer, seismic action, soil erosion etc. The *Transboundary Character* is <u>*Impossible*</u>.

Based on the above and based on the criteria presented in the Section 1.1, for activation of geohazards during the operation of the project, the **SEI is considered as Minor**, according to Table 9-147

9.3.4.1.3 Summary

The summary of the effects on Geological, Tectonic and Soil during the operation phase is presented in the table below.

Table 9-147 Summary of Impacts for Geological, Tectonic and Soil during the Operation Phase

S/N SEI			SEI for	Geological, Tectonic and Soil							
Project Phase	Operation										
Impact	Mechanism	Locations	Criteria/ Impact Properties							SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Potential Activation of Geohazards	• Permanent loading of geological formations due to pipeline installation and its Stations	Presented at Annex 8M • Table M-9 for landslides along CCS1 Section • Table M-10 for landslides along CCS2 Section • Table M-11 for liquefaction along CCS1 Section • Table M-12 for liquefaction along Megalopolis branch • Table M-13 for liquefaction along CCS2 Section	0.25	0.25	0.50	0.75	0.25	0.25	0.0	3.21 Minor	

Prepared by (ASPROFOS, 2022).

9.3.4.2 Offshore Section

9.3.4.2.1 Overview

This section evaluates the potential impact on:

Potential Activation of Geohazards.

The effect of the permanent loading on the submarine geological formations from the installation of the pipeline and many parameters that accelerate landslides such as seismic activity, contribute to the acceleration of geohazard events during the operation phase.

Table 9-148 outlines the main sources of impact, the potentially affected resources and recipients as well as the influencing factors of the current situation and those related to the Project.

Table 9-148 Basic Issues for assessment – Geological, Tectonic and sediments

Sources of Impact/ Risk	Potential Activation of Geohazards • Effect of the permanent loading of the geological formations from the installation of the pipeline and the simultaneous action of many parameters that accelerate landslides such as seismic activity, contribute to the acceleration of landslides and similar geohazards events during the operation phase
Potentially Impacted Resources and Receptors	For Geohazard the receptors are referred to Annex 8M: • Table M-14 for Main Geohazards along the route OSS2/OSS2N • Table M-16 for Main Geohazards along the route OSS3/OSS3N • Table M- 18 for Main Geohazards along the route OSS4 • All sediments along the offshore pipelines
Special Baseline Conditions that are Potentially Influencing Impacts/Risks	• Seabed morphology which can lead to free span creation • Intersection of the pipeline with hydrates, pock marks
Project Factors that are Potentially Influencing Impacts/Risks	Activation of Geohazards • The permanent loading of the geological formation from the installation of the pipeline and the simultaneous action of many natural events such as seismic activity accelerate landslides and similar geohazards events during the operation phase • Maintenance works for offshore sections
References	In chapter 8.4.5, sediments of the Project are analysed. In section 8.4.5 and inAnnex 8M, geohazards are analysed too.

Prepared by: ASPROFOS, 2022.

9.3.4.2.2 Activation of Geohazards

The effect of the permanent loading on the submarine geological formations from the installation of the pipeline, contribute to the acceleration of geohazard events during the operation phase.

Based on section 8.4.6, the geohazards identified along offshore Project sections, including the impact inducing mechanism and potential receptors/resources.

Table 9-149 Activation of Geohazards - Impact Mechanism - Potential Receptors/Resources during Operation Phase

Impact	Impact mechanisms	Potential recipients / resources
Activation of Geohazards	• Permanent loading of geological formations due to pipeline installation	Annex 8.M: • Table M-14 for Main Geohazards along the route OSS2/OSS2N • Table M16 for Main Geohazards along the route OSS3/OSS3N • Table M- 18 for Main Geohazards along the route OSS4

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<u>Affected Resources</u>

The affected resources from geohazard activation are as follows:

- 5 locations along OSS2/OSS2N route, where they present mass transport deposits and 4 locations along the OSS2/OSS2N route, where they present possibility of slope instability (Annex 8M, table M-14);
- 254 locations along OSS3/OSS3N route, where they pass throw steep slopes, low stability slopes, seabed channels, rocky outcrops where they present possibility of slope instability (Annex 8M, Table M-16); and
- 2 locations concerning areas with slope stability susceptibility along OSS4 route (Annex 8 M , Table M-18).

The *Likelihood* of the occurrence of geohazard activation is <u>*Rare*</u> due to the many intersections with existing geohazards. The *Extent* of impact is considered <u>*Medium*</u> (500 m from Project or resource footprint). The *Intensity* of the impact on sensitive recipients is expected to be <u>*Low*</u>. The *Duration* of the impact is expected to be the entire project life, so according to the proposed methodology it is characterised <u>*Long-term*</u>. The possibility of dealing with the impact (*Reversibility* of the impact) is considered <u>*Avoidable*</u> due to the proper design The *Cumulative Action* of the impact is <u>*Rare*</u> as a number of parameters accelerate the creation of unstable slopes, such as, seismic action, etc. The *Transboundary Character* is Impossible.

Based on the above and based on the criteria presented in Section 9.1 for activation of geohazards during the operation of the Project, the **SEI is considered as Minor** (See Table 9-150).

9.3.4.2.3 Summary

The summary of the effects on Geological, Tectonic and Soil during the operation phase is presented in the table below.

Table 9-150 Summary of Impacts for Geological, Tectonic and Sediments during Operation Phase

S/N SEI			SEI for	Geological, Tectonic and Sediments							
Project Phase	Operation										
Impact	Mechanism	Locations	Criteria/ Impact Properties							SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Potential Activation of Geohazards	• Permanent loading of geological formations due to pipeline installation	Presented at Annex 8M: • Table M-14 for Main Geohazards along the route OSS2/OSS2N • Table M-16 for Main Geohazards along the route OSS3/OSS3N • Table M- 18 for Main Geohazards along the route OSS4	0.25	0.25	0.25	0.75	0.25	02.5	0.00	2.86 Minor	

Prepared by ASPROFOS, 2022.

9.3.5 Natural Environment

9.3.5.1 Methodology Overview

The key considerations for the assessment of impacts on biodiversity, during operation, are summarised in the table below. It is clarified that the working strip shall be reinstated to its former conditions; specifically for forests and forested areas, upon consultation with the competent authorities, the working strip may be reinstated in such a way as to serve for various managerial purposes (e.g. Fire belt).

Table 9-151 Key Considerations for Assessment –Natural Environment (operation phase).

Sources of Impact/ Risk	• Onshore: ➢ Restriction of deep rooted species within the Pipeline Protection Strip; ➢ Noise generation (disturbance of species and habitat degradation); and • Offshore: ➢ Offshore maintenance works ➢ Noise and vibration from pipeline operation ➢ Release of ions ➢ Marine traffic
Potentially Impacted Resources and Receptors	• Onshore Habitats: Forests or Forested Areas (Bushlands, shrublands, macquis). • Terrestrial fauna species: Species protected under national law, international conventions and globally or nationally threatened (CR/EN/VU) or restricted range, congregatory and migratory; • Offshore habitats: *Posidonia oceanica* meadows, benthic communities • Marine Species: Marine mammals and sea turtles, fish species and benthic species
Particular Baseline Conditions that Potentially Influence Impacts/Risks	• Onshore: Unfragmented/ remote areas with limited or no current access • Offshore: Seabed morphology varying along the route. Nearshore section with *Posidonia oceanica* meadow on sand with presumably a weathered rock basement below some metres. From -40 m to – 2600 m there are various benthic communities and communities of muddy detritic bottoms, sandy muds, bathyal muds. Deeper than – 2600 m there are bathyal seabeds with bathypelagic ocean waters. The offshore routing takes into account and avoids all major geomorphologically complex areas likely sustaining high biodiversity along the corridors.
Project Factors that Potentially Influence Impacts/Risks	• Onshore: deeprotted species clearance within the PPS. Location of permanent facilities • Offshore: Specific techniques used for periodically inspection, monitoring and maintaining to ensure adequate and normal operation of the pipeline.

References	• Corresponding baseline on natural environment is provided in Section 8.5 supported by numerous Annexes (e.g. Annex 8D – Ecological status of main inland water bodies, incl. abiotic and biotic characteristics, Annex 8F – Basline study on Flora, Annex 8G – Baseline Study on Fauna, Annex 8H – Baseline study on Avifauna) • Appopriate Assessments are presented in Annex 9E • Mitigation Measures are provided in Chapter 10.3.5 • Protected Areas and ecological sensitivities Map is provided in Section 15.1.9

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9.3.5.2 Onshore biodiversity

9.3.5.2.1 Vegetation / flora loss

According to Chapter 6, an 8 m wide strip (4 m on each side of the pipeline axis) needs to be maintained free of deep rooted species, i.e. Trees and bushes. Table 9-152 summarizes the land take per ecosystemt type.

Table 9-152 Permanent land take of Pipeline Protection Strip per ecosystem type.

Ecosystem Types	Area (m^2)	%
Floodplain forests (Riparian forest/Fluvial forest)*	5801,34	0,13
Sparsely vegetated areas	6184,78	0,14
Phrygana vegetation	8428,89	0,19
Inland and coastal saline marshes	11815,37	0,26
Low density built-up areas / Settlements	19617,72	0,44
Mediterranean coniferous forests	25651,97	0,57
Fruit trees and berry plantations	42490,88	0,94
Sea and ocean	138415,55	3,07
Mixed Forest	176356,82	3,92
Mediterranean deciduous forests	183460,25	4,07
Grasslands	185615,33	4,12
Transitional woodland-shrub	237252,20	5,27
Arable land	297042,72	6,59
Complex cultivation patterns	436218,44	9,68
Agricultural areas with a significant cover of natural vegetation (Agroforestry areas)	607296,28	13,48

Ecosystem Types	Area (m²)	%
Olive groves	635667,60	14,11
Permanent crops	648025,28	14,39
Sclerophyllous vegetation	829305,64	18,41
Total	**4504117,74**	**100,00**
*The area of affected floodplain forests (riparian forest/fluvial forest) will be in fact less, due to the application of trenchless techniques in water bodies. The exact area of the affected floodplain forests (riparian forest/fluvial forest) will be estimated, when the detail design of trenchless techniques will be finalized. As a result, the total area of ecosystem types affected will be less.		

Prepared by: ASPROFOS, 2022.

Construction and operation of the Main Stations shall impact on a total of approx. 0,32 km² of land. Table 9-153 summarizes the ecosystem types that are going to be occupied for construction, initially, and then operation, permanently. It is reminded that the construction sites (temporary facilities) for the erection of the Main Stations shall be the same plot as the one to be used for the operation phase (no additional land is going to be affected).

Table 9-153 Ecosystem types occupation for Main Stations.

Station Name (Code)	Ecosystem Type	Station area (km²)	%
Crete Facilities (CS2/MS2-CS2/MS2N)	Sclerophyllous vegetation	0,01	5%
	Olive groves	0,16	95%
Achaia Facilities (CS3)	Complex cultivation patterns (incl. vinyards)	0,11	100%
Megalopoli Facilities (MS4/PRS4 & Heating Station)	Low density built-up areas / Settlements	0,00	0%
	Agroforestry areas	0,05	100%

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As discussed during construction phase (Section 9.2.5.1) in other sections (e.g. Sections on Landscape and Anthropogenic Environment – Uses of Land) only within the PPS is some habitat/ vegetation loss going to take place and specifically only in areas of deep-rooted species, i.e. forests and forested areas. Based on the ecosystem types presented in Table 9-152 (for pipeline) and Table 9-153 (for the Main Stations), the following can be highlighted:

- Deep rooted (natural) flora species cover in total approx. 31.5%. More specifically, forests cover approx. 8.5% of the total land occupied by the project footprint. In these areas, limited fragmentation could be assessed. However, the 8 m wide vegetation clearance cannot be considered significant enough to modify the overall continuity of a forest ecosystem. The PPS is encompassed in the forest ecosystem similar to a forest dirt road and no break of the ecological services of the forest is anticipated. In any case, these are permanently lost in terms of forest vegetation. Forested areas (bushlands) cover approx. 23% of the total land occupied by the project footprint. What was previously discussed is still applicable. Nevertheless, it must be taken into consideration that the overall plan coverage of forested areas (bushlands) are usually smaller than that of a forest ecosystem (forest), and some clearances are typical. As such, restriction of revegetation within the PPS could lead to even less vegetation loss than the already limited one in Forests. It must be emphasized that, an offset of the forest vegetation clearance will take place by reforestation – with native forest species - in other areas, as per the forest legislation requirements. Only the 8m width safety zone will be kept clear from deep rooted species (max. 100 cm route system).

- Deep rooted (Crops) flora species cover approx. 18%. As detailed in Section 9.3.7, planting schemes are usually wide enough and only one planting row is lost. This is not significant enough as to modify the habitat.
- Areas with shallow rooted flora species cover approx. 51% of the total land occupied by the project footprint. In these areas, no restriction is imposed by the PPS and no habitat/ vegetation loss is expected.

Table 9-154 Summary of ecosystem types occupied during operation phase (Pipeline and Main Stations) and correspondance to naturalness.

Vegetation Type	Ecosystem Types	Area (m^2)	%
Deep rooted (Natural)	Floodplain forests (Riparian forest/Fluvial forest)*	5801,34	0,12
Shallow rooted	Sparsely vegetated areas	6184,78	0,13
Shallow rooted	Phrygana vegetation	8428,89	0,18
Shallow rooted	Inland and coastal saline marshes	11815,37	0,25
Shallow rooted	Low density built-up areas / Settlements	19617,72	0,42
Deep rooted (Natural)	Mediterranean coniferous forests	25651,97	0,55
Deep rooted (Crops)	Fruit trees and berry plantations	42490,88	0,91
Deep rooted (Natural)	Mixed Forest	176356,82	3,76
Deep rooted (Natural)	Mediterranean deciduous forests	183460,25	3,91
Shallow rooted	Grasslands	185615,33	3,96
Deep rooted (Natural)	Transitional woodland-shrub	237252,2	5,06
Shallow rooted	Arable land	297042,72	6,34
Shallow rooted	Complex cultivation patterns	546218,44	11,66

Vegetation Type	Ecosystem Types	Area (m^2)	%
Shallow rooted	Agricultural areas with a significant cover of natural vegetation (Agroforestry areas)	657296,28	14,03
Deep rooted (Crops)	Olive groves	795667,6	16,98
Shallow rooted	Permanent crops	648025,28	13,83
Deep rooted (Natural)	Sclerophyllous vegetation	839305,64	17,91
	Total	4686231,51	100,00

Prepared by: ASPROFOS, 2022.

In other words, no impacts are assessed for shallow rooted flora species and their corresponding habitats/ vegetation types, nor for deep rooted cultivations. For the deep rooted natural flora species the discussion held for the construction phase (see Section 9.2.5.2.1) is applicable and not repeated.

Taking into account the considerations previously discussed and following evaluation criteria presented in Section 9.1, impact assessment for operation activities on habitats/ vegetation type of deep-rooted flora species loss may be performed as follows:

Likelihood of the impact during construction works is *certain*. Due to the mechanisms inducing impact (vegetation clearance within the PPS), impact cannot be avoided.

Extent of the impact is directly related to the precise project footprint and the corresponding PPS. Vegetation clearance is going to be limited within the PPS and as such, it is assessed as *small.*

Intensity of the impact is linked to the ecosystem type's sensitivity, as discussed in Table 9-32. Floodplain forests (Riparian forest/Fluvial forest) and Mediterranean deciduous forests are assessed by *very high* intensity; Mediterranean coniferous forests, Mixed forests, Sclerophyllous vegetation and Transitional woodland-shrub are assessed by *high* intensity.

The *Duration* of the impact is associated with the period required for the restoration of vegetation prior to construction and, in particular, of the work zone's vegetation. Given that in the PPS no deep rooted species will be allowed for the project's lifetime, the duration of the impact is assessed as *long-term*.

With regard to *reversibility*, it is assessed that by applying the appropriate mitigation measures per category of semi-natural and natural ecosystem types the impact footprint is *minimized.* Again, it is noted that the PPS (or the initial working strip) may be formulated in such a way as to serve management objectives of the competent forest authorities. In case competent authorities deem it purposeful the PPS can be increased to act as a fire belt. Other objectives can be also suppored (e.g. collection of forest products) (see Chapter 10).

Regarding *cumulative* action, no other projects or conditions were identified that could potentially interact with the Project and the loss of vegetation or habitats. However, for densly vegetated areas, i.e. forests and schlerophyllous vegetation, potential cumulative effect cannot be completely discarded; hence, cumulative action is assessed as *rare* for these types.

The *Transboundary Character* is *impossible* considering the nature of the potential impact.

Based on the above and the criteria presented in Section 9.1, habitats/ vegetation loss for areas classified as:

- Mediterranean deciduous forests, Floodplain forests (Riparian forest/Fluvial forest), **SEI is considered as Moderate**.
- Mediterranean coniferous forests, Mixed Forest, Transitional woodland-shrub, Sclerophyllous vegetation, **SEI is considered as Minor**.
- For all other ecosystem types, no impacts are assessed

9.3.5.2.2 Habitat fragmentation

Similar to what was discussed during construction phase (see Section 9.2.5.2.2), the following are noted for operation phase.

9.3.5.2.2.1 Terrestrial Mammal species

As discussed in the construction phase (see Section 9.2.5.2.2), the nature and effects of this fragmentation will vary depending on the type of vegetation cleared, as well as on the fauna potentially affected.

As discussed previously, habitat/ vegetation loss is considered minor or even not applicable for most ecosystem types, expect for forest areas. Fauna habitat fragmentation may be induced along the PPS at sensitive areas (not along the entire) for the biodiversity and in areas where the breach of isolation and the subsequent edge effects are most likely to affect fauna species.

Similar to Section 9.2.5.2.2, the following are discussed:

- Golden jackal (*Canis aureus*)

The jackal is known to be adaptable species, whenever the disturbance is temporary and short term and it does not change habitat quality and food availability. The clearance of the PPS will have no negative impact, if not positive, on the habitat quality of the jackal. Jackals would be somewhat benefited from the creation of small openings along thick scrubs, based on the ecological needs of the species.

Consequently, **no negative impacts** are assessed due to habitat fragmentation to the jackal, during operation

- Wolf (*Canis lupus*)

Along forested areas and specifically the Mt. Arakynthos (see Table 9-34) where wolves have been recorded, the pipeline working strip, even in its reduced width, could create some minor edge effects and reduce habitat suitability. Specifically, it could increase forest fragmentation thus reduce habitat suitability of the area in the long term, during operation phase. However, the Pipeline Protection Strip (PPS) (8 m), which will be kept clear from deep rooted species is not much wider than a typical greek forest road (6 m wide), and thus are considered to be really limited.

The impacts of fragmentation in the areas of high suitability for wolves are considered of small intensity and extent. Although wolves may abandon their habitat altogether due to disturbance and avoid re-colonization if fragmentation levels reduce habitat suitability, the fragmentation potentially generated is considered as small as the PPS is not much different than a forest road whilst is smaller than a fire belt.

Taking into account the considerations previously discussed and following evaluation criteria presented in Section 9.1, impact assessment for operation on *Canis lupus* habitat loss may be assessed as follows: The *Likelihood* of the impact is considered <u>likely</u>. The *Extent* of the impact will be localised at the Project footprint thus is considered <u>small;</u> additionally, the pipeline length through areas where wolf's habitat may be present (and consequently affected) is quite limited (approx. 5.5 km, in total). The *Intensity* of the impact is considered <u>very high</u>. If the Project has an impact on the habitat during the operation phase, this would be <u>long-term</u> (see Section 9.2.5.2.1). Regarding *Reversibility*, impacts are mostly reversible, but adopting a conservative approach, are assessed as <u>minimizable</u> (see Chapter 10). The *Cumulative Action* of the impact is considered <u>rare</u> assuming unlikely the possibility that impacts from the EastMed Pipeline Project and from other projects or activities in the area can have a cumulative effect. The *Transboundary Character* is <u>impossible</u> considering the nature of the potential impact. Based on the considerations above, the impacts are **Minor.**

9.3.5.2.2.2 Freshwater species

As discussed in the construction phase (see Section 9.2.5.2.2), habitat fragmentation for freshwater species could (potentially) be imposed as result of the vegetation clearance in the riverbanks, potential modification of river bed itself and modification of the water flow regime.

During operation, freshwater species habitat impacts may be induced only at the rivers crossed with open cut (details on Section 9.2.5.2.2). Nevertheless, the following are noted:

- Vegetation clearance will be limited only within the PPS and only where Riparian forests (galleys) exist. This fact limits the potentially affected riparian habitats
- Hydrological conditions of the water body are fully reinstated. This is because, the reinstatement of the rivers bed and banks crossed with open cut are reinstated to the initial topography immediately after construction (see Chapter 6). In turn, this allows the Surface Water bodies' water flow and water characteristics to completely return to their initial conditions (see also Section 9.3.13).

Details are provided in Chapter 6 and Section 9.3.13.

Similar to Section 9.2.5.2.2, the following are discussed:

- Otter (*Lutra lutra*)

Taking into account the considerations previously discussed, the correspondingdiscussion during construction phase, and following evaluation criteria presented in Section 9.1, impact assessment for operation on *Lutra lutra* habitat loss may be assessed as follows: The *Likelihood* of the impact is considered *likely*; however, this is conservative, given that presence of otter is not verified in the specific water bodies crossing points. The *Extent* of the impact will be localised at the Project footprint thus is considered *small*. The *Intensity* of the impact is considered *high*. The Project will have an impact on the habitat during the construction phase, therefore, the *Duration* is *medium-term*. Regarding *Reversibility*, impacts are in part *reversible* after the implementation of mitigation measures. The *Cumulative Action* of the impact is considered *rare* assuming unlikely the possibility that impacts from the EastMed Pipeline Project and from other projects or activities in the area can have a cumulative effect. The *Transboundary Character* is *impossible* considering the nature of the potential impact. Based on the considerations above, the impacts are **Minor.**

- Fish fauna

Fish fauna is not affected by the operation of the project, since no interaction between the project and any water body takes place during operation phase.

Consequently, **no impacts** are assessed due to habitat fragmentation to fishfauna, during operation.

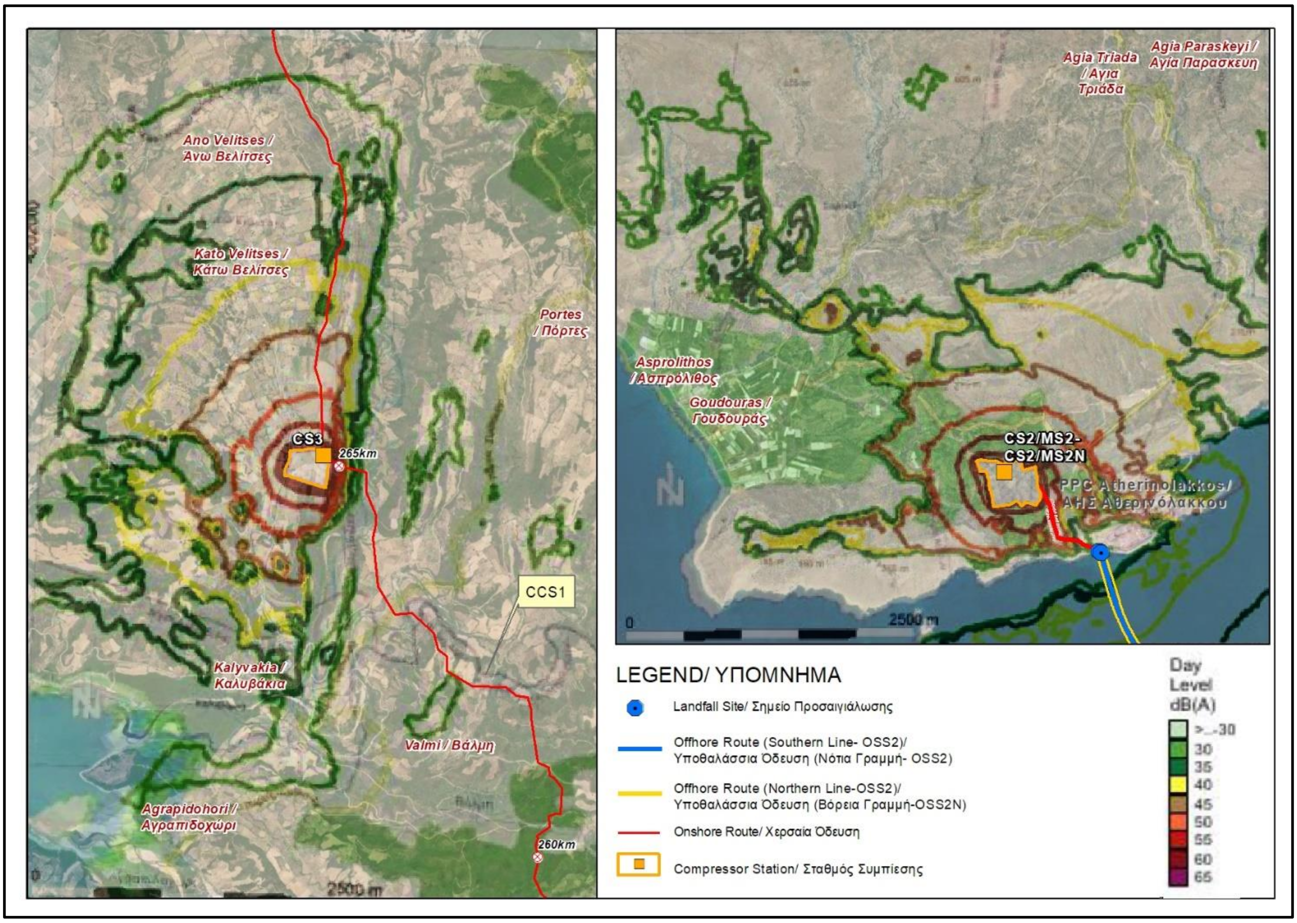
9.3.5.2.3 Disturbance of Fauna (terrestrial, freshwater and avifauna)

Fauna species loss is not relevant during operation phase. No mechanisms that could potential induce injuries or mortality to fauna species take place during operation of the project. However, operation of the Main Stations may disturbe species (mostly through noise and light generation).

This section should be read in conjunction to Sections 9.2.5.2.3 and 9.2.5.2.4 of the construction phase.

During the operation of the investigated project, noise emission from Main Stations, together with light emissions during nighttime, will be sources of disturbance to terrestrial mammals in this area, of which rodents and bat are the most representative species. After restoration of the working strip and temporary facilities, the species living in the site will possibly return to their original habitats and repopulate the zones in the vicinity of the construction sites abandoned during the works.

The Noise propagation models for the Main Stations (see Annex 8C) predicted low values of noise emission during day and night time. As detailed in Section 9.3.11 (Noise), noise contours are illustrated in the following figure (Figure 9-77). Noise level of 45 dB(A) is reached at average 1.5 km from the border of CS3 and at average 1 km from the border of CS2/MS2-CS2/MS2N (Figure 9-77 and Section 9.3.11).



Prepared by: ASPROFOS, 2022. Noise propagation model as per Annex 8C. Satelite imagery: ESRI.

Figure 9-77 Noise propagation model results correlation to existing habitats (based on satelite imagery).

It is anticipated that noise emissions from the compressor stations might disturb mamals, like the jackal, though the species is considered adaptable to small scale or recurrent disturbances. It is estimated that the 45 dB(A) noise contour is an acceptable noise pressure for the jackal. For these reasons the impact to jackal could be considered as minor at the area next of the compressors. As summarized in Table 9-33, although not definite, the area might support jackal populations, in the transitional woodland-shrub areas from KP 250- KP 280. Jackal is not identified close to Crete Facilities.

Illumination of all above ground installatins (CSs, BVSs) will be kept to the minimum necessary during nighttime to ensure the safety of workers and operations. Considering the onshore facilities plant lighting during nighttime, the natural behaviour of the species populating the area, their adaptation capacity, and the mitigation measures in place, the impacts on mammals during the operation phase are evaluated as **Not Relevant.**

The wolf populations are very far from the Main Stations, thus **no impacts are anticipated**.

No impacts on small mammals, including otter, rodents or bats, are assessed.

Taking into account the considerations previously discussed and following evaluation criteria presented in Section 9.1, impact assessment for operation on *Canis aureus* disturbance may be assessed as follows: The *Likelihood* of the impact is considered *probable*; it seems that the distribution of jackal in Peloponnese includes the area of CS3 (most likely connecting the mountains of North Achaia to the Artificial Lake of Pinios). The *Extent* of the impact will be localised at the Project footprint thus is considered *medium*. The *Intensity* of the impact is considered *high*. Noise from the Compressor Stations at Crete and Achaia will be generated throughout Project's life-time, therefore, the *duration* is *long-term*. Regarding *Reversibility*, impacts are mostly *minimizable* after the implementation of the mitigation measures. The *Cumulative Action* of the impact is considered *rare* assuming unlikely the possibility that impacts from the EastMed Pipeline Project and from other projects or activities in the area can have a cumulative effect. The *Transboundary Character* is *impossible* considering the nature of the potential impact. Based on the considerations above, the impacts are **Minor.**

- Avifauna:

As discussed above and detailed in Section 9.3.11, noise emitted by the project will be disseminated within 1 – 1.5 km from the compressor stations. As such, emission impacts are **Not Relevant**. Illumination of all above ground installatins (CSs, BVSs) will be kept to the minimum necessary during nighttime to ensure the safety of workers and operations. Considering the onshore facilities plant lighting during nighttime, the natural behaviour of the species populating the area, their adaptation capacity, and the mitigation measures in place, the impacts on avifauna during the operation phase are evaluated as **Not Relevant.**

- Reptiles:

The openings that will be created during construction phases are expected to increase landscape diversity with a finegrained mosaic structure. This will result in increasing available habitats for reptiles and will offer more thermoregulatory points, provided that the area will be left to be subsequently covered with natural vegetation of indigenous and local species. As discussed in Section 9.2.5.2.3, most suitable habitats include a wide range of ecosystem types: rocky areas with crevice-rich surfaces, riparian habitats, heathlands, maquis, open forests, pasture lands and agricultural areas. As such, many suitable habitats for the species groups are available. Furthermore, the width of the PPS will not be large enough to increase predation risk. Cumulative impacts are anticipated from the motorways. As a result, the impacts on reptiles during the operation phase are evaluated as **Not Relevant.**

- Amphibians:

Amphibians are expected in marshlands and wetlands and in general in areas where water plays a significant role in the ecosystem. Given that the the closest riparian area is the Artificial Lake of Pinios more than 2.5 km SW of CS3 and that by that distance, noise is less than 30 dB(A) (see Figure 9-77), the impacts on amphibians during the operation phase are evaluated as **Not Relevant.**

9.3.5.3 Offshore biodiversity

9.3.5.3.1 Impacts on Marine Habitats – Nearshore /Deep water sections

During the operation phase, the offshore pipelines will be periodically inspected, monitored and maintained to ensure adequate and normal operation. Inspection and monitoring operations may require the use of vessels with consequent underwater noise generation (i.e. equivalent to typical vessel usage). In addition, gas flow can generate noise and vibrations and also a slight temperature increase in the immediate vicinity of the pipeline, though probably at levels not capable of leading to impacts, consequently they are considered negligible.

A second factor of disturbance is cathodic protection (CP) of the pipelines, used to control metal corrosion. Sacrificial anodes (positioned along the offshore pipelines at regular intervals) will release small concentrations of metal ions in the seawater/marine sediments to safeguard against the risk of pipeline corrosion. However, the quantities will be negligible, so that any impact consequent is considered negligible.

The physical presence of the pipeline on the seabed will likely positively modify the composition and increase the abundance of the benthic habitat. That is, the pipeline will constitute a solid substrate ("artificial reef") which will be colonised by marine organisms, triggering the formation of new habitat also used by demersal and pelagic species. An overall increase in localised biodiversity and abundance may result as observed, for example, in France along the Gardanne pipeline (Bonhomme et al., 2014[61]) where ROV surveys revealed that the "artificial reef effect" provided by the pipeline structure

[61] https://www.researchgate.net/publication/271270154_Unexpected_artificial-reef-like_effect_due_to_a_Mediterranean_pipeline_and_the_conservation_of_two_circalittoral_emblematic_species_Centrostephanus_longispinus_and_Cystoseira_zosteroides

itself increased the abundance of two protected species: the urchin *Centrostephanus longispinus* and brown algae *Cystoseira zosteroides.*

After trenching, backfilling and conclusion of construction works for the shore crossing, the impacts envisaged on the offshore section will be similar in extent to those in the nearshore area. However, the effect of *P. oceanica* clearing caused by trenching during construction may be followed by changes on the local movement of sediment along the cleared areas, modifying the capability of the seagrass meadow to trap and stabilise sediment. Movement of sediment along the cleared areas affect mainly the soft bottom of Landfall sites at LF4 and LF5, however piles of coarse material could be laid on the seabed in patches and in specific locations. This measure aims to minimise sediment dispersion, stabilise the seabed and reduce impacts on marine habitats.

The *Likelihood* of events of disturbance during operation of the pipelines is *likely*. The *Extent* will be limited to the Project footprint; i.e. *small.* The *Intensity* of the impacts is considered *low*. The *Duration* is considered *mid-term* as the effect will be highly localised (around the pipeline) and will decrease over time as the seabed reaches its new equilibrium. Regarding *Reversibility*, physical presence of the pipelines on the seabed will possibly have a *positive impact* on offshore benthic communities, resulting in spotted increase in species abundance. To mitigate the effects on coastal dynamics, a series of procedures and measures would be implemented, with the most relevant being the localised positioning of coarse material that heaps to enhance sediment trapping and *Posidonia oceanica* recovery. The impacts are considered *minimisable*. The C*umulative Action* is considered *impossible* due to the local character of the impact and the T*ransboundary Character* *impossible*.

Based on the above, impacts from the Project on seabed habitats during operation are considered **Negligible**.

9.3.5.3.2 Impacts on Marine Invertebrates – Nearshore /Deep water sections

Impacts on marine invertebrates during operation will be connected to the physical presence of the pipelines on the seabed will possibly result in a positive overall impact on the benthic community, in both nearshore and deep soft bottom environments (‘artificial reef effect’). The pipelines are likely to favour the colonisation of coralline algae typical of the Mediterranean environment and other benthic species having planktonic larvae in their life cycle, capable of settling and colonising hard substrates. These processes will possibly lead to a development of coralligenous habitat growing over the pipeline surface, hosting a populated and biodiverse environment. Similarly, in the abyssal plain where the habitat is very poorly populated, the hard substrate of the laid pipes will possibly favour the colonisation of various sessile species such as soft corals, cold water corals, other cnidarians and sponges. Consequently, **no impacts are assessed**.

Considering the above, impacts on marine invertebrates generated during operation of the Project are considered **Negligible**.

9.3.5.3.3 Impacts on Marine Fish – Nearshore/Deep water sections

Noise emissions and vibrations from operating pipelines, maintenance works and surveys that will be carried out over the Project's life and the release of ions in the water due to oxidation of the pipeline's coating are considered impacts not affecting or negligibly affecting the fish population within the Study Area of the Project. Therefore, the impacts on fish during operation are considered **Negligible**.

9.3.5.3.4 Impacts on Marine Reptiles – Nearshore/Deep water sections

As described above, during the operation of the Project the impacts connected with noise disturbance and seabed disturbance would be very limited in intensity and extent, so not expected to lead to any behavioural disturbance to the sea turtle populations.

Another impact could be linked to possible collisions with moving or manoeuvring vessels operating during periodic inspections. However as discrebed above this impact is extremely rare. In any case, the presence of MMO on vessels during routine and non-routine maintenance works and monitoring surveys will abate such impacts.

For the above reasons the impacts on marine reptiles during operation are considered **Negligible.**

9.3.5.3.5 Impacts on Marine Mammals by the operation of the offshore pipeline

The sources of disturbance in the marine environment for marine mammals during pipeline operation are due to the noise generated from the normal pipeline operation, additional noise from pigging operations and vessel movement for occasional intervention during the Project life. An increase in turbidity is expected to coincide with external inspections and routine maintenance works should they interact with the seabed. However, the intensity of impacts generated from such mechanisms is very low and does not influence the behaviour nor cause damage to the hearing apparatus of cetaceans.

Other possible disturbances are caused by accidental collisions with maintenance operating vessels, however this impact is extremely rare due to the frequency of the maintenance activities. Seabed intervention works, routine and non-routine maintenance works and monitoring surveys will be carried out with a MMO on board following the same mitigation measure described for the construction phase.

Considering the above, impacts on marine mammals are considered **Negligible** during the operation phase of the Project.

9.3.5.4 Impacts on Protected Areas – Onshore/ Offshore

As discussed in the corresponding section during construction phase (9.2.5.6),Table 9-155 summarizes the engagement of the protected areas included in the national system with the investigated project (Table 9-47 provides the codes for the protected areas).

As discussed during construction, for the Natura2000 sites, Appropriate Assessments have been prepared, including performance of seasonal fielworks. For the purposes of this chapter, a summary of impacts to Natura Areas, as analysed at the annexed Appropriate Assessments, is presented in Table 9-156. More details are presented in the relevant annexes (see Annex 9E).

Out of the 14 Natura2000 sites for which Appropriate Assessment was performed, the most important interaction is identified in the following sites:

- SAC GR2310010. Impact for Wolf's habitat loss is assessed as **Moderate;** impacts for Wolf's disturbance is assessed as **Minor.** Details are provided in Annex 9E.7
- SAC/SPA GR2330002. Impacts on habitat/ vegetation loss and fauna habitat deterioration/ fragmentation are assessed as **Minor.** Details are provided in Annex 9E.9

For the other types of protected areas engaged with the project, i.e. Wildlife Refuges and National Parks, discussion held in previous sections are applicable. The same approach as the one presented during construction phase is applied (see Section 9.2.5.6). In short, impacts on the integrity of the protected area is assessed in relation to the availability of any given ecosystem type affected (habita fragmentation/ vegetation loss) by the project footprint within the protected area.

Regarding Wildlife Refuges, as illustrated in Table 9-157, almost all of the affected ecocystem types are engaged in a percentage < 0.5 % of the total available specific ecosystem type within the protected area. This means that the availability of a specific ecosystem type within the Wildlife Refuge is not severely impacted by the operation of the project. This is because, impacts are assessed only in terms of habitats/ vegetation loss, as previously mentioned. Even in the 3 records that the affected ecocystem types are engaged in a percentage higher than 0.5 %, the percentage is, still, very small (<1 %). More specifically:

- In K361 (Mt. Arakynthos area), affected Mixed forests represent 0.57% of the total available ecosystem type within the Wildlife Refuge, whilst Transitional woodland- shrub represent 0.89%.
- In K838 (Lekatsa area of M. of Zalogos), affected Agroforestry areas represent the 0.95% of the total available ecosystem type within the Wildlife Refuge.

It is noted that most of the ecosystem types will be fully reinstated. Those that are not fully reinstated are forests and forested areas (bushlands) where deep-rooted species are dominant but they cannot be allowed to grow within the PPS.

Given the limited area affected, overall availability of the specific ecosystem types within the Wildlife Refuges and their characteristics (as discussed in Seciton 9.3.5.2.1), **no impacts on the integrity of the Wildlife Refuge areas are assessed.**

Regarding National Parks, Table 9-158 is informative. Adopting the same approach as described for Wildlife Refuges, no ecosystem type is impacted at a percentage higher than 0.1% but for the Permanent crops of ΕΠ10 (Amvrakikos Gulf). More specifically:

- In ΕΠ5 (Lagoons of Messolonghi-Aetoliko), almost the entire PPS (94%) passes through annual crops (Permanent crops - 91%, complex cultivations patterns - 2%, and arable land – 1%). The rest of the PPS crosses Sparsely vegetated areas (6%). All these ecosystem types will be fully reinstated.
- In ΕΠ10 (Amvrakikos Gulf), most of the PPS (66%) crosses through annual cultivations which will be fully reinstated (Permanent crops – 35%, complex cultivation patterns – 17% and arable land – 5%) whilst 19% through tree crops (Fruit trees and berry plantations – 9% - and Olive grooves – 10%). The rest of the PPS within ΕΠ10, is mainly characterized by typical Greek Mediterranean ecosystems, e.g. Agroforestry areas (6%) or Macquis (Sclerophyllous) vegetation (9%). Mixed forests are engaged for approx. 7% of the total pipeline protection strip within the specific National Park; however, this corresponds to 0.06% of the total area of the specific ecosystem.

Given the limited area affected, overall availability of the specific ecosystem types within the National Parks and their characteristics (as discussed in Section 9.3.5.2.1), **no impacts on the integrity of the National Park areas are assessed.**

Table 9-155 Engagement of protected areas with the investigated project during operation phase.

Site Code	Zone	Approximate KP (From KP-To KP)	Total Route length Intersected (km)	Total Area of Pipeline Protection Strip within protected area (km^2)	Total Area of Protected Site (km^2)	% of Protected site's area within the Pipeline Protection strip	Overlapping (partial or complete)	Approximate Distance to Project Footprint (m)
ΕΠ5	Peripheral Zone (ΠΠ1)	8.570-9.186, 39.331 - 56.647	1,639	0,013	37,116	0,03	GR2310009 & GR2310013	0
	Peripheral Zone (ΠΠ2)	39.331-56.647	17,316	0,138	190,515	0,07	GR2310009 & GR2310013	0
ΕΠ10	Zone C: Zone of Environmental Control	104.101-113.558, 114.198-134.853, 134.970-158.661, 160.419-161.623 165.153-166.792. 168.009-176.425	65,063	0,519	1522,696	0,03	-	0
	Zone B: Special Regulations Area	134.853-134.970, 158.661-159.602, 159.602-160.034, 160.034-160.419, 161.623-165.153, 166.792-168.009	6,622	0,053	287,633	0,02	**GR2110001 & GR2110004**	0
GR2310009	n/a	37.010-38.242	1,232	0,009	143,495	0,006	ΕΠ5	0
GR2110001	n/a	134.838-135.022, 159.632-160.024	0,575	0,001	601,556	0,000	ΕΠ10 & GR2110004	0

Site Code	Zone	Approximate KP (From KP-To KP)	Total Route length Intersected (km)	Total Area of Pipeline Protection Strip within protected area (km^2)	Total Area of Protected Site (km^2)	% of Protected site's area within the Pipeline Protection strip	Overlapping (partial or complete)	Approximate Distance to Project Footprint (m)
GR2120002	n/a	212.435-212.574	0,139	0,001	8,236	0,012	-	0
GR2330002	n/a	227.13-237.38	10,252	0,082	97,486	0,084	-	0
GR2540007	n/a	20.46-22.41	1,954	0,015	377,883	0,003	-	0
GR2120006	n/a	212.435-212.574	0,139	0,001	17,983	0,005	K599	0
K524	n/a	17.706-18.731	1,024	0,008	31,356	0,026	-	0
K361	n/a	20.269-25.891	5,622	0,045	15,722	0,137	-	0
K316	n/a	60.721-73.164	12,442	0,099	147,238	0,067	-	0
K728	n/a	113.363-116.867, 117.411-117.523, 118.084-118.734, 119.380-119.721	3,270	0,026	32,704	0,08	ΕΠ10	0
K838	n/a	181.734-182.891, 183.588-183.851	1,419	0,011	7,937	0,143	-	0

Note: Features not intersected by the Pipeline Protection Strip are not included in this table.

Prepared by: ASPROFOS, 2022.

Table 9-156 Impacts on Natura 2000 sites during operation phase.

Natura2000 site type & code	Relevant ESIA Annex	Threat	Receptor	Nature	Extent	Duration	Intensity	Value of the receptor	Frequency	Overall importance	Reversibility	Residual impact
SAC GR2310010	Annex9E.7	Habitat loss	Fauna	Negative	Local	Short term	Medium	High	High	High	Medium	Medium
		Disturbance	Fauna	Negative	Local	Short term	Medium	High	Low	Medium	Medium	Low
SPA/SAC GR2330002	Annex9E.9	Habitat type loss, deterioration, fragmentation	Habitat	Negative	Local	Long term	Negligible	High	Medium	Low	-	Low
			Fauna	Negative	Local	Long term	Negligible	High	Medium	Low	-	Low
SAC GR2120002	Annex9E.13	Habitat type coverage loss, deterioration, fragmentation	Habitat 5420	Negative	Local	Long term	Negligible	High	Medium	Low	Medium	Negligible

Prepared by: ASPROFOS, 2022.

Table 9-157 Impacts on Wildlife Refuges during operation phase.

Wildlife Refuge Code	Coverage	Low Density built up areas/ Settlements	Permanent crops	Complex cultivation patterns	Agroforestry areas	Mediterranean coniferous forests	Mixed forest	Grasslands	Sclerophyllous vegetation	Transitional woodland-shrub
K316	1	378,10	19517,42	15592,37	2077,31	n/a	n/a	25089,39	36865,96	n/a
	2	1692343,82	9776815,98	14994165,20	2485823,52	n/a	14910337,55	39097790,74	50883053,04	n/a
	%	0,02	0,20	0,10	0,08	n/a	n/a	0,06	0,07	n/a
K361	1	n/a	n/a	n/a	2908,17	23266,30	15165,21	n/a	n/a	3634,12
	2	n/a	n/a	n/a	853199,15	11131761,49	2677476,31	n/a	529266,52	410439,59
	%	n/a	n/a	n/a	0,34	0,21	0,57	n/a	n/a	0,89
K524	1	n/a	n/a	n/a	n/a	n/a	n/a	n/a	8197,99	n/a
	2	100715,07	n/a	396724,63	4770403,24	n/a	n/a	n/a	19227927,56	n/a
	%	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0,04	n/a
K728	1	n/a	n/a	n/a	2991,66	7171,03	9176,70	n/a	6914,55	n/a
	2	n/a	n/a	n/a	2177031,66	13860680,80	4973085,31	n/a	11598511,59	n/a
	%	n/a	n/a	n/a	0,14	0,05	0,18	n/a	0,06	n/a
K838	1	n/a	n/a	n/a	3149,32	n/a	n/a	n/a	8201,15	n/a
	2			43069,36	333254,93	94759,25	2833192,69		4099614,54	7290,27
	%	n/a	n/a	n/a	0,95	n/a	n/a	n/a	0,20	n/a

Notes:
1: Pipeline Protection Strip area within specific ecosystem type (m²) | 2: Total ecosystem type within the Wildlife Refuge (m²).

Prepared by: ASPROFOS, 2022.

Table 9-158 Impacts on National Parks during operation phase.

	ΕΠ5 Messolonghi-Aetoliko Lagoon National Park, downstream and estuaries of Acheloos and Evinos rivers and Echinades islands			ΕΠ10 Amvrakikos Wetlands National Park		
Ecosystem Type	Pipeline Protection Strip within specific ecosystem type (m^2)	Total area of ecosystem type within the National Park (m^2)	%	Working Strip within specific ecosystem type (m^2)	Total area of ecosystem type within the National Park (m^2)	%
Low Density built up areas/ Settlements	699,14	4442927,66	0,02	2030,04	42983682,41	0,01
Arable land	931,34	11696817,99	0,01	31205,63	115232187,04	0,03
Permanent crops	137634,98	148183867,91	0,09	200720,20	121939729,92	0,16
Fruit trees and berry plantations	n/a	2209889,91	n/a	50041,86	75986066,48	0,07
Olive gro crops	n/a	3003517,58	n/a	56389,74	74993123,95	0,08
Complex cultivation patterns	2765,59	33840887,35	0,01	94976,95	176646802,25	0,05
Agroforestry areas	n/a	838782,78	n/a	33957,32	94797509,89	0,04
Mediterranean deciduous forests	n/a	2135600,71	n/a	7863,87	61073976,63	0,01
Mixed forests	n/a	1399611,85	n/a	41611,07	67957283,40	0,06
Grasslands	n/a	11881819,58	n/a	1881,62	72269371,78	0,00
Sclerophyllous vegetation	n/a	44137838,50	n/a	48476,12	239855218,19	0,02
Sparsely vegetated areas	9597,70	25785478,04	0,04	n/a	3524102,62	n/a
Inland and coastal saline marshes	n/a	10205838,67	n/a	n/a	146241000,73	n/a
Riparian areas	n/a	9957881,64	n/a	n/a	4415640,93	n/a

Prepared by: ASPROFOS, 2022.

9.3.5.5 Summary of impacts during operation phase

The following table summarizes the impacts during the operation phase. The mitigation measures are analyzed in chapter 10 of this ESIA.

Table 9-159 Summary of impacts during operation phase (Onshore / Offshore biodiversity)

S/N SEI			SEI for		Uses of the Land					
Project phase	Construction									
Impact	Mechanism	Locations	Criteria/ Impact Properties						SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Habitats/ Vegetation loss	Restriction of deep rooted species within the Pipeline Protection Strip	Mediterranean deciduous forests, Floodplain forests (Riparian forest/Fluvial forest)	1.00	0.00	1.00	0.75	0.75	0.25	0.00	5.36 (Moderate)	See Section 9.3.5.2.1
		Mediterranean coniferous forests, Mixed Forest, Transitional woodland-shrub, Sclerophyllous vegetation	1.00	0.00	0.75	0.75	0.75	0.25	0.00	5.00 (Minor)	See Section 9.3.5.2.1
		Sparsely vegetated areas, Phrygana vegetation, Inland and coastal saline marshes, Low density built-up areas / Settlements, Fruit trees and berry plantations, Sea and ocean, Grasslands, Arable land, Complex cultivation patterns, Agroforestry areas,Olive groves, Permanent crops	No impacts assessed.								
Fauna Habitats loss for Golden	Restriction of deep rooted species within the	See Table 9-33 "Sensitive areas for the golden jackal"	No impacts assessed.								

S/N SEI			SEI for	Uses of the Land					
Project phase	Construction								
Impact	Mechanism	Locations	Criteria/ Impact Properties							SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
jackal (*Canis aureus*)	Pipeline Protection Strip										
Fauna Habitats loss for Wolf (*Canis lupus*)	• Restriction of deep rooted species within the Pipeline Protection Strip	See Table 9-34. Sensitive areas for the wolf (CCS2: KP 17.5 – KP 19 | KP 21 – KP 25 | KP 22 – KP 24)	0.50	0.00	1.00	0.75	0.75	0.25	0.00	4.65 (Minor)	See Section 9.3.5.2.2.1
Fauna Habitats loss for Otter (*Lutra lutra*)	• Restriction of deep rooted species within the Pipeline Protection Strip	See Table 9-35. Sensitive areas for the otter	0.50	0.00	0.75	0.75	0.75	0.25	0.00	4.29 (Minor)	See Section 9.3.5.2.2.2
Fauna Habitats loss for Fishfauna	• Restriction of deep rooted species within the Pipeline Protection Strip	See Table 9-36 Threatened fishfauna species potential presence	No impacts assessed								
Disturbance of Fauna - Golden jackal (*Canis aureus*)	Noise from Main Stations operation.	KP 250 - KP 280	0.75	0.25	0.75	0.75	0.75	0.25	0.00	5.00 (Minor)	See Section 9.3.5.2.3

S/N SEI			SEI for	Uses of the Land						
Project phase	Construction									
Impact	Mechanism	Locations	Criteria/ Impact Properties						SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)	
Disturbance of Fauna - Wolf (*Canis lupus*)	Noise from Main Stations operation.	-	No impacts assessed.							
Disturbance of Fauna - Small Mammals	Noise from Main Stations operation.	-	No impacts assessed.							
Disturbance of Fauna - Fishfauna	Noise from Main Stations operation.	-	No impacts assessed.							
Disturbance of Fauna - Avifauna	Noise from Main Stations operation.	-	No impacts assessed.							
Disturbance of Fauna - Reptiles	Noise from Main Stations operation.	-	No impacts assessed.							
Disturbance of Fauna - Amphibians	Noise from Main Stations operation.	-	No impacts assessed.							
Impacts on Protected Areas	Main impacts are habitat and	Within the Protected Areas	As per analyses at the Appropriate Assessments (see relevant Annexes).							

S/N SEI			SEI for	Uses of the Land						
Project phase	Construction									
Impact	Mechanism	Locations	Criteria/ Impact Properties						SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
- Natura2000 Sites	species loss, disturbance									
Impacts on Protected Areas - Wildlife Refuges	Main impacts are habitat and species loss, disturbance	Within the Protected Areas	No impacts on the integrity of the protected areas given the limited area affected, overall availability of the specific ecosystem types within the Protected Areas and their characteristics.							
Impacts on Protected Areas - National Parks	Main impacts are habitat and species loss, disturbance	Within the Protected Areas	No impacts on the integrity of the protected areas given the limited area affected, overall availability of the specific ecosystem types within the Protected Areas and their characteristics.							
Impacts on Marine Habitats by the operation of the offshore pipeline	• Offshore maintenance works • Noise and vibration from pipeline operation • Release of ions • Marine traffic	• Deep water section • Nearshore section	0.25	0.00	0.25	0.50	0.75	0.00	0.00	2.50 (Negligible)	See Section 9.3.5.3.1

S/N SEI			SEI for	Uses of the Land						
Project phase	Construction									
Impact	Mechanism	Locations	Criteria/ Impact Properties						SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Impacts on Marine Invertebrates – Nearshore /Deep water sections	physical presence of the pipelines	• Deep water section • Nearshore section	-	-	-	-	-	-	-	0.00 (Negligible)	See Section 9.3.5.3.2
Impacts on Marine Fish – Nearshore/Deep water sections	• Noise and vibration from pipeline operation • Release of ions • Marine traffic	• Deep water section • Nearshore section	-	-	-	-	-	-	-	0.00 (Negligible)	See Section 9.3.5.3.3
Impacts on Marine Reptiles – Nearshore/Deep water sections	• Noise and vibration from pipeline operation • Marine traffic	• Deep water section • Nearshore section	-	-	-	-	-	-	-	0.00 (Negligible)	See Section 9.3.5.3.4

S/N SEI			SEI for	Uses of the Land							
Project phase	Construction										
Impact	Mechanism	Locations	Criteria/ Impact Properties							SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Impacts on Marine Mammals by the operation of the offshore pipeline	• Noise and vibration from pipeline operation • Marine traffic	• Deep water section • Nearshore section	-	-	-	-	-	-	-	0.00 (Negligible)	See Section 9.3.5.3.5

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9.3.6 Anthropogenic Environment

Following potential impacts on the anthropogenic environment during construction phase, here below, the corresponding impacts during operation phase are presented.

9.3.6.1 Regional planning - uses of land & sea

The outline of the existing uses of land the project crosses, given also the lack of adequate statutory spatial data for the entire project footprint, was carried out in accordance with CORINE database (see Section 8.6).

Similarly, uses of sea are not determined yet, for Greece. However, aquaculture areas and fishing areas are assessed (see Section 8.7.2.6).

During the operation phase, the existing (and future) uses of land will be influenced by the creation of three control/ protection zones, in accordance with national legislation two distinct zones of eight (8) meters and forty (40) meters with specific constraints and another one, of four hundred (400) meters wide (preventive under certain conditions), equally distributed on each side of the pipeline's axis - details in the paragraphs below). It is noted that most of the Regional Plans make reference to natural gas transportation projects (if not explicitly to EastMed), as documented in Chapter 5. As such, implementation of the investigated project does not impact on statutory designation of uses of land.

Regarding uses of sea, after pipeline's installation on the seabed, some restrictions may be applied for anchoring and trawling along the offshore (deep-water) footprint of the project. In the nearshore section (where the pipeline will be buried) no restrictions are foreseen.

9.3.6.1.1 Uses of Land

Impacts to uses of land are expected as a result of the restrictions imposed by the presence of the pipeline and Main Stations and the surrounding land uses.

Table 9-160 shows the key sources of impact, potentially impacted resources and receptors, baseline and project influencing factors associated to the impacts of the investigated project on uses of land.

Table 9-160 Key Considerations for Assessment – Uses of the Land (Operation Phase).

Sources of Impact/ Risk	• Permanent Right of Way for the route • Presence of Main Stations and Pipeline Route
Potentially Impacted Resources and Receptors	• Owners and users of land affected by permanent land take or land use restrictions. • Local communities • Local authorities (regional and municipal/communal).
Particular Baseline Conditions that are Potentially Influencing Impacts/Risks	• Existing morphology • Existing land uses within project footprint (incl. permanent facilities); • Pipeline crosses 6 local spatial plans (SXOOAP of Lefki, Crete; SCOOAP of Monemvasia, Peloponnese, GUB of Agrinio, Aetoloakarnania, GUB of Louros, Preveza, SXOOAP of Zalongos, Preveza and GUB of Fanari, Preveza).
Project Factors that are Potentially Influencing Impacts/Risks	• Project's footprint • Pipeline Protection Strip (8 m corridor – 4 m on each side of the pipeline axis) • Building Control Strip (40 m corridor – 20 m on each side of the pipeline axis) • Spatial Development Control Strip (400 m corridor – 200 m on each side of the pipeline axis) • Project of National Importance
References	• Baseline is provided in Section 5, 8.6 and 8.7. Information on technical infrastructure in 8.8 • Annex 9B • Mitigation Measures are provided in Section 10.2.6 • Land uses and Socioeconomic Map is provided in Section 15.1.6 • Information on technical infrastructure (incl. traffic) is provided in Sections 8.8 (Baseline), 9.2.8 (Impacts assessment - construction) and 10.2.8 (Impacts assessment – operation).

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Table 9-68 summarizes the potential key impacts on uses of Land, due to the operation of the investigated project.

Table 9-161 Key Potential Impacts – Uses of Land.

Potential Impact	Operation Phase
Direct/ Indirect Changes in Land Uses	X
Impact on Land Value	See Section 9.3.7

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It is clarified, that according to MD 170225/2014, assessment of the changes in Land Uses as a result of the construction and operation of the project is performed. This assessment includes direct, primary, changes expected as a result of the project and also indirect or secondary, likely to be induced as a result of the primary changes.

It is deemed that Regional planning won't be affected by the Project. **In fact, as documented in Chapter 5, the project is in full compliance to existing regional and spatial planning. On top of that, the project is classified as of national importance. This means that its objectives support significant national goals. Such goals are incorporated in the Regional planning or they are even over and above any local planning. As such, no impacts are assessed in Regional Planning during operation phase, as a result of the project.**

9.3.6.1.1.1 Methodology overview during the operation phase

During the operation phase, the existing uses of land will be influenced by the creation of a safety/ control zone along the pipeline. More specifically, in accordance with Ministerial Decision Δ3/Α/οικ. 4303 ΠΕ 26510/2012 - Technical Regulation on "Natural gas pipelines with maximum pressure operation above 16 bar", the following safety/ control zones will be created:

- 8 m Pipeline Protection Strip (PPS). The 1st zone consists of an eight (8) meters wide corridor, four (4) meters on each side of the pipeline axis, within which no deep-rooted species or foundations that could potentially jeopardize pipeline's integrity are allowed.
- 40 m Building Control Strip (BCS). The 2nd zone consists of a forty (40) meters wide corridor, twenty (20) meters on each side of the pipeline axis, within which no building is allowed to be constructed.
- 400 m Spatial Development Control Strip (SDC). The 3rd zone consists of a four hundred (400) meters wide corridor, two hundred (200) meters on each side of the pipeline axis (approximately), within which consultation with the Natural Gas Infrastructure Owner is necessary for any adjustment to the local spatial plan (e.g. through the potential extension of villages building areas close to the pipeline) or similar activities (building complexes /high population density facilities) in the said area.

In the first category, i.e. the PPS, impacts are considered direct. It is the strictest safety/ control zone, restricting plantation of deep-rooted species and any foundation. However, all other activities, e.g. traffic, irrigation, etc., will be allowed as previous.

In the second category, i.e. the BCS, indirect impacts may be induced by the restriction of buildings construction.

In the third category, i.e. the SDC, the only restriction imposed is a requirement for consultation with the Project Owner prior to any significant spatial developments.

The above-mentioned restrictions are not imposed on existing land uses. Specifically,

- Direct impacts from the restrictions of PPS, where no deep-rooted species shall be allowed, are mainly imposed and are more significant on ***tree crops or forested areas***. For other agricultural areas, the potential switch of cultivation from annual crops to tree crops is impacted, but to a limited extent; annual crops cultivations and the rest of the agricultural related activities and any other activity are allowed as before the construction of the project. Given the design of the project, as described in Chapter 6, footprint has mostly avoided artificial surfaces (Continuous or Discontinuous urban fabric or Industrial/ commercial zones) with the exception of transportation facilities and limited extraction sites. As such, no direct impacts are expected to these high value land uses.
- Indirect impacts from the restrictions of BCS, where specific restrictions may impact the potential or a land use or the value, are mainly imposed and are more significant on areas of **Discontinuous urban fabric or Industrial/ commercial development**. As previously mentioned, engagement with these categories has been avoided for the direct impacts, due to the careful design of the project footprint. Selection design made effort to avoid indirect impacts, by keeping distances of > 200 m from existing artificial areas and or avoid known spatial development plans. During the operation phase, within two hundred (200) meters on each side of the pipeline axis, future spatial developments might be feasible in agreement with the Project Owner. Other artificial land uses, i.e. transportation related (e.g. roads) are largely left unaffected given that all existing practices and activities can be carried out across the width of every protection zone of the pipeline[62]. Similarly, agricultural and/ or natural areas are not affected by indirect impacts, because their characteristics (e.g. identified development trends or town planning regulations) do not include buildings within the specific land use types (especially for forests and forested areas, land use is not allowed to be modified, based on current legislation).

The project's operational footprint interacts with 24 different categories of existing uses of land. These categories were grouped as per their sensitivity, in order to create a standardized land use classification (Table 9-55). Sensitivity of the land uses group has been assessed based on the following characteristics of the land uses:

[62] Nevertheless, adopting a conservative approach, their contribution to the overall coverage has been considered. This is a conservative approach, because the total affected area is increased.

- Capacity to absorb potential modification (change) of existing land uses,
- Commercial value of the specific land use

Sensitivity classification is carried out based on the ability of each land use type to return to its initial conditions upon completion of the project and on the commercial value of the specific land use; in lack of relevant data, experts judgement and any statutory framework for the protection and planning of the corresponding area have been used to assess commercial value.

Table 9-162 Categories of existing uses of land within the project's impact zone and assessment of sensitivity of land use change during the operation phase.

CORINE Classification	Classification according to ESIA Team	Sensitivity	Justification
• Airports (CLC: 124) • Discontinuous urban fabric (CLC: 112) • Industrial or commercial units (CLC: 121) • Mineral extraction sites (CLC: 131) • Road and rail networks and associated land (CLC: 122)	Industrial - commercial zones	Very high	The areas located within the industrial, commercial and urban zone may be impacted by the indirect secondary pressures within a distance of 20 meters from the Project's axis. The land value is considered high (at least higher than the other land cover types).
• Natural grasslands (CLC: 321) • Non-irrigated arable land (CLC: 211) • Pastures (CLC: 231) • Permanently irrigated land (CLC: 212) • Rice fields (CLC: 213)	Open spaces of productive land with little or no vegetation	Medium	These are primarily areas of annual cultivations and grazing activities. The existing practices and activities can be carried out across the width of every land use type. However, agricultural lands, that could support (apart from annual cultivations) perennial or tree crops, they will be experiencing specific restrictions of deep-rooted species within the PPS.
• Beaches, dunes, sands (CLC: 331) • Inland marshes (CLC: 411) • Salt marshes (CLC: 421) • Sea and ocean (CLC: 523) • Sparsely vegetated areas (CLC: 333) • Water bodies (CLC: 512)	Open spaces of unproductive land with little or no vegetation	Zero	These are areas where no change to the existing land use occurs; the existing practices and activities can be carried out across the width of every protection zone of the pipeline.

CORINE Classification	Classification according to ESIA Team	Sensitivity	Justification
• Complex cultivation patterns (CLC: 242) • Fruit trees and berry plantations (CLC: 222) • Land principally occupied by agriculture, with significant areas of natural vegetation (CLC: 243) • Olive groves (CLC: 223) • Vineyards (CLC: 221)	Areas of systematic arboriculture	High	These are areas of arboriculture (tree crops) directly impacted by the presence of the PPS. Furthermore, there is a likelihood for them to be impacted within a distance of up to 20 meters from the Project's axis by indirect secondary pressures.
• Broad-leaved forest (CLC: 311) • Coniferous forest (CLC: 312) • Mixed forest (CLC: 313) • Sclerophyllous vegetation (CLC: 323) • Transitional woodland-shrub (CLC: 324) • Water courses (CLC: 511)	Forested Areas (within or not Protected Areas)	Low	These areas include forests and/ or forested areas (bushlands) impacted by the presence of the PPS, whereas they do not show changes caused by secondary pressures.

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Finally, the assessment criterion of the extent of the impact was adjusted to the technical description data and to the statutory protection measures, as presented above. Table 9-163 shows the assessment criterion of the extent of the impact on the land use change during the operation phase.

Table 9-163 Adjustment of the assessment criterion of the extent of the impact on the existing land use change during the project's operation phase.

	Rating				
	0 (low rating)	0.25	0.5	0.75	1 (high rating)
Extent of Impact (E)	Pointwise (Project or resource footprint)	Local (≤4 m from the Project or resource footprint)	Supra local (≤20 m from the Project or resource footprint)	Perimetric (≤200 m from the Project or resource footprint, approximately)	Peripheral (>200 m from the Project or resource footprint, approximately)

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Construction and operation of the Main Stations shall impact on a total of approx. 0,32 km² of land. Table 9-164 summarizes the land uses that are going to be occupied for construction, initially, and then operation, permanently.

Table 9-164 Land uses occupation for Main Stations.

Station Name (Code)	Regional Unit (Municipality)	Land use (CLC Code)	Station area (km²)	Total available area in the R.U. for the specific land use (km²)	% [(1)x100/(2)]	Total available area in the Municipality for the specific land use (km²)	% [(1)x100/(4)]
			(1)	(2)	(3)	(4)	(5)
Crete Facilities (CS2/MS2-CS2/MS2N)	Lasithi (Sitia)	Sclerophyllous vegetation (CLC: 323)	0,01	574,41	0,00	164,790	0,01
		Olive groves (CLC: 223)	0,16	387,17	0,04	134,174	0,12
Achaia Facilities (CS3)	Achaia (Western Achaia)	Vineyards (CLC: 221)	0,10	76,663	0,13	11,753	0,85
		Complex cultivation patterns (CLC: 242)	0,01	281,664	0,00	123,806	0,01
Megalopoli Facilities (MS4/PRS4 & Heating Station)	Arcadia (Megalopoli)	Road and rail networks and associated land (CLC: 122)	0,00	12,830	0,00	6,347	0,00
		Land principally occupied by agriculture, with significant areas of natural vegetation (CLC: 243)	0,05	553,000	0,01	152,990	0,03

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9.3.6.1.1.2 Assessment of changes in land use during the operation phase

During operation phase, the land use of the areas where Main Stations shall be installed shall be modified. Based on Table 9-164, only an insignificant percentage of the overall available area per each specific land use within the entire Regional Unit (<0.5%) and even Municipality (<1%) is related with a change of land use. As such, no impacts are assessed.

During the operation phase, the existing uses of land will be influenced by the creation of a safety/ control zone on each side of the project's axis. More specifically, in accordance with Ministerial Decision Δ3/Α/οικ. 4303 ΠΕ 26510/2012 - Technical regulation on "Natural gas pipelines with maximum pressure operation above 16 bar", the following safety/ control zones are created (details are provided in Section 9.3.6.1.1.1)

- 8 m Pipeline Protection Strip (PPS).
- 40 m Building Control Strip (BCS).
- 400 m Spatial Development Control Strip (SDC).

As mentioned, the project's construction footprint intersects 24 different categories of existing uses of land, out of the total 27 included in the entire study area (Rice fields (CLC: 231) and Water Bodies (CLC: 512) are not included within any of the three safety/ control ones; Sea and ocean (CLC: 523) are by definition excluded by the assessment of land uses.

In total, during the operation phase, it is assessed that the project will have direct primary pressures on about 3.162 km² of land. Indirect, secondary, pressures may be induced in on about 14.415 km² of land. For the rest of the area, no impacts are assessed; for approx. 1.732 km² the only requirement is prior of significant spatial development, the interested parties to consult with the Project Owner. Table 9-165 illustrates the above mentioned areas for each category of land use. Figure 9-78 illustrates the distribution of the safety/control zones per Regional Units (data per Municipalities is available at Annex 9B)

Table 9-165 Total extent of the safety/ control zone that are induced per land use.

CORINE Classification	Classification according to ESIA Team (Operation)	Total safety/ control zone within each Land Use Type (km²)		
		8 m (PPS)	40 m (BCS)	400 m (SDC)
Olive groves (CLC: 223)	Areas of systematic arboriculture	0.633	3.150	30.085
Land principally occupied by agriculture, with significant areas of natural vegetation (CLC: 243)		0.609	3.039	29.105
Complex cultivation patterns (CLC: 242)		0.432	2.159	21.167
Fruit trees and berry plantations (CLC: 222)		0.050	0.251	2.598
Vineyards (CLC: 221)		0.000	0.000	0.042
Sclerophyllous vegetation (CLC: 323)	Forested Areas (within or not Protected Areas)	0.829	4.138	40.340
Broad-leaved forest (CLC: 311)		0.184	0.919	10.974
Mixed forest (CLC: 313)		0.176	0.893	10.199
Coniferous forest (CLC: 312)		0.026	0.129	1.364
Water courses (CLC: 511)		0.002	0.009	0.092
Transitional woodland-shrub (CLC: 324)		0.220	1.103	12.351
Road and rail networks and associated land (CLC: 122)	Industrial - commercial zones	0.016	0.085	1.365
Discontinuous urban fabric (CLC: 112)		0.002	0.008	0.162
Industrial or commercial units (CLC: 121)		0.001	0.004	0.116
Mineral extraction sites (CLC: 131)		0.000	0.000	0.055
Airports (CLC: 124)		0.000	0.000	0.035
Permanently irrigated land (CLC: 212)	Open of spaces of productive land with little or no vegetation	0.655	3.268	31.473
Non-irrigated arable land (CLC: 211)		0.289	1.445	12.675
Natural grasslands (CLC: 321)		0.165	0.819	7.908
Pastures (CLC: 231)		0.038	0.187	1.715
Rice fields (CLC: 213)		0.000	0.000	0.000
Beaches, dunes, sands (CLC: 331)	Open spaces of non-productive land with little or no vegetation	0.012	0.058	0.825
Inland marshes (CLC: 411)		0.008	0.041	0.509
Salt marshes (CLC: 421)		0.004	0.018	0.275
Sparsely vegetated areas (CLC: 333)		0.008	0.032	0.196

CORINE Classification	Classification according to ESIA Team (Operation)	Total safety/ control zone within each Land Use Type (km²)		
		8 m (PPS)	40 m (BCS)	400 m (SDC)
Sea and ocean (CLC: 523)		0.000	0.001	0.020
Water bodies (CLC: 512)		0.000	0.000	0.000

Legend

	Potentially direct changes per protection zone.
	Potentially indirect changes per protection zone.
	No changes imposed, simply requirement for consultation prior to any significant spatial developments
	No changes are assessed

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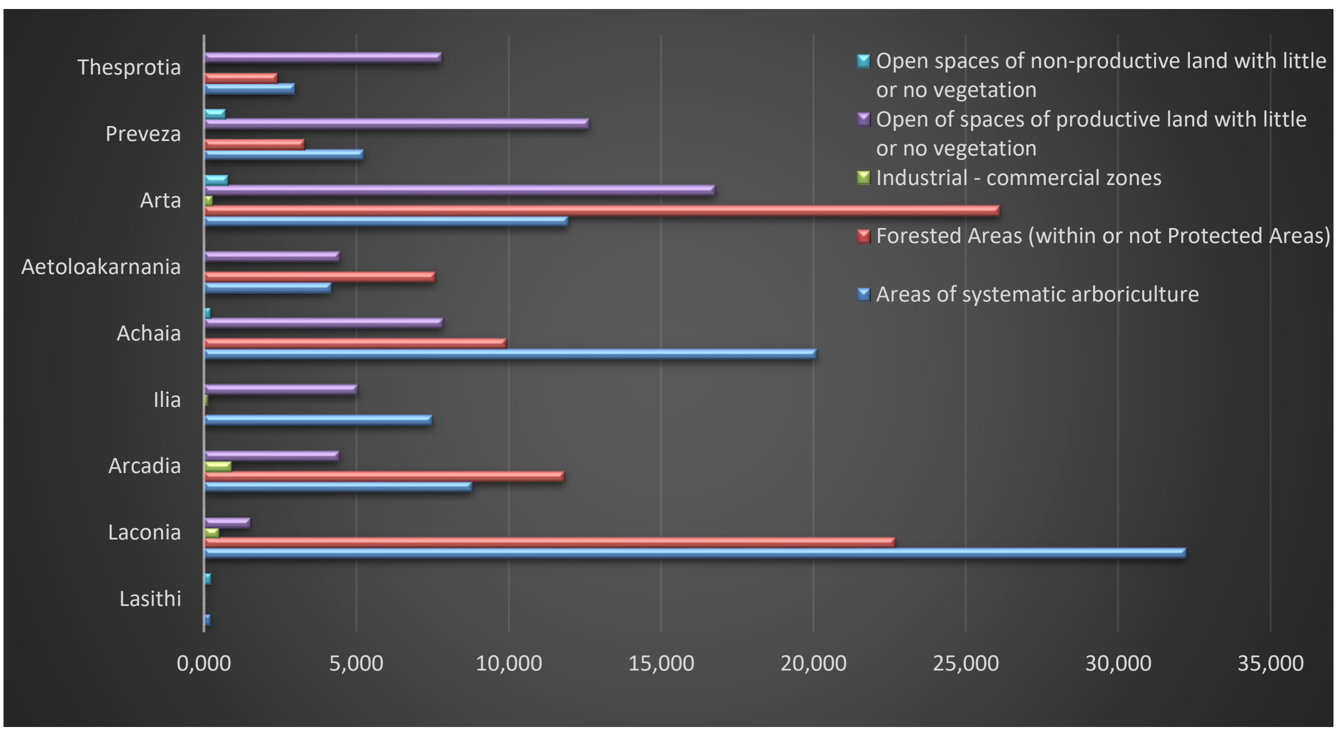

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Figure 9-78 Distribution of Land Uses (ESIA Classification) and Safety/ Control Zones per Regional Unit.

Importance of changes to land uses is assessed as being proportional to the ratio of each land cover type within the study area in comparison to the total coverage of the specific land cover type in the entire Regional Unit. Relevant is Table 9-166.

Table 9-166 Comparison of land uses with the highest ratio of engagement within the study area and per safety/ control zone per Regional Unit.

	Regional Unit								
	Lasithi	Laconia	Arcadia	Ilia	Achaia	Aetoloakarnania	Arta	Preveza	Thesprotia
Corine Land Cover type with the highest ratio of coverage within the entire study area compared to the corresponding land use coverage within the entire Regional Unit	121	122	122	242	212	124	222	411	411
Corresponding Classification as per the ESIA	1	1	1	3	2.1	1	3	2.2	2.2
8 m width safety/ control zone (PPS)									
Corine Land Cover type with the highest participation within the specific safety/ control zone	333	223	243	243	323	212	212	212	211
Corresponding Classification as per the ESIA	2.2	3	3	3	4	2.1	2.1	2.1	2.1
40 m width safety/ control zone (BCS)									
Corine Land Cover type with the highest participation within the specific safety/ control zone	333	223	243	243	323	212	212	212	211
Corresponding Classification as per the ESIA	2.2	3	3	3	4	2.1	2.1	2.1	2.1

Notes:
Corine Land Cover types definition is provided in Table 9-57
1: Industrial - commercial zones
2.1: Open of spaces of productive land with little or no vegetation
2.2: Open spaces of non-productive land with little or no vegetation
3: Areas of systematic arboriculture
4: Forested Areas (within or not Protected Areas)

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Corine Land Cover type with the highest ratio of coverage within the entire study area compared to the corresponding land use coverage within the entire Regional Unit corresponds to the importance of each land use type for the specific Regional Unit. If the ratio is high, the total availability of the specific land use type in the entire Regional Unit may be impacted by its coverage within the safety/ control zones. As such, if the land use with the highest ratio is the same with the land use with the highest participation in the various safety/ control zones, then the land use availability to the local community will be jeopardized.

Based on Table 9-166, it is evident that no land use, which total coverage within the specific Regional Unit, is of highest ratio, is also engaged with the highest participation within the typical working strips.

The change in land use by category of evaluation is presented below (details are provided in Table 9-165 and Annex 9B):

- **Industrial – commercial zones:**

Regarding direct impacts, it is calculated that approx. 0.019 km² of land characterized as industrial, commercial and/or urban zone is located within the PPS. This is consisted mostly by roads and associated land.

Regarding indirect impacts, BCS occupies 0.097 km².

SDC occupies 1.732 km².

It is noted that BCS and SDC strips are consisted mainly by roads and associated land.

As described in Section 9.3.6.1.1.1, **direct impacts are not assessed for industrial/ commercial zones**. Indirect impacts are not imposed on existing land uses; these restrictions are mainly imposed and are more significant on areas of urban fabric and industrial/ commercial development. As such, other land uses, i.e. transportation related (e.g. airports, roads) or extraction sites are largely left unaffected given that all existing practices and activities can be carried out across the width of every protection zone of the pipeline[63].

- **Open spaces of productive land with little or no vegetation:**

[63] Nevertheless, adopting a conservative approach, their contribution to the overall coverage has been considered. This is a conservative approach, because the total affected area is increased.

Regarding direct impacts, it is calculated that approx. 1.147 km² of land characterized as "Open spaces of productive land with little or no vegetation" is located within the PPS. This is consisted mainly by Permanently irrigated land or Non-irrigated arable land and to a lesser extent by grasslands.

Regarding indirect impacts, BCS occupies 5.719 km²

SDC occupies 53.771 km²

It is noted that BCS and SCD are consisted mainly by Permanently irrigated land or Non-irrigated arable.

As described in Section 9.3.6.1.1.1, **direct impacts are not imposed to open spaces of productive land**. Agricultural practices of annual crops cultivations are not obstructed in any way. Annual crops can be planted, Small (light) agricultural structures (e.g. Greenhouses) or even other type of small-scale structures (e.g. Solar Panels) can be constructed. **Indirect impacts are not imposed**, also, since no building have been identified so far or are reasonably assessed to take place in the near future.

- **Open spaces of non-productive land with little or no vegetation:**

Regarding direct impacts, it is calculated that approx. 0.032 km² of land characterized as "Open spaces of non-productive land with little or no vegetation" is located within the PPS. This is consisted mainly by Beaches, dunes, sands, Inland marshes or Sparsely vegetated areas.

Regarding indirect impacts, BCS occupies 0.150 km².

SDC occupies 1.825 km²

It is noted that BCS and SDC are consisted mainly by Beaches, dunes, sands or Inland marshes.

As described in Section 9.3.6.1.1.1, it is considered that **no change occurs** to the land use, given the existing regulatory (urban planning, regional planning, forestry, etc.) provisions and the fact that all existing practices and activities can be carried out in the whole width of the pipeline's each protection zone. It is very important to notice that in Beach, dunes, sand (and the entire coastal and nearshore section) the pipeline will be buried and the pipeline shall not be visible whilst development plans can still be implemented conditionally that consultation with the project owner is performed in order to agree on a commonly accepted design.

- **Areas of systematic arboriculture:**

Regarding direct impacts, it is calculated that approx. 1.724 km² of land characterized as "Areas of systematic arboriculture" is located within the PPS. This is consisted mainly by Olive groves or Land principally occupied by agriculture, with significant areas of natural vegetation and to a lesser extent Complex cultivation patterns (and very few areas with Fruit trees and berry plantations).

Regarding indirect impacts, BCS occupies 8.599 km².

SDC occupies 82.997 km²

It is noted that BCS and SDC are consisted mainly by Olive groves or Land principally occupied by agriculture, with significant areas of natural vegetation.

As described in Section 9.3.6.1.1.1, direct impacts on tree crops are imposed due to the deep-rotted species restriction within the PPS. The actual size of the impact depends on the planting scheme of the tree crops (indicatively 4x6 for kiwi[64] or 7x7 for olives[65]); assuming a general planting scheme of 5x5 only one planting row is lost. In fact, conditionally that distance of planting rows is greater than 4 m, only one planting row is lost. **Indirect impacts are not assessed**, given the existing regulatory (urban planning, regional planning, forestry, etc.) provisions and the fact that all existing practices and activities can be carried out in the whole width each of the pipeline's protection zone.[66] As such, no change occurs to the specific land use class but (limited) restrictions are imposed.

- Forested Areas:

Regarding direct impacts, it is calculated that approx. 1.438 km² of land characterized as "Forested Areas" (within or not Protected Areas) is located within the PPS. This is consisted mainly by Sclerophyllous vegetation and to a much lesser extent Transitional woodland-shrub, Broad-leaved forests and Mixed forests (and very few areas of Coniferous forests).

Regarding indirect impacts, BCS occupies 7.192 km².

SDC occupies 75.321 km².

It is noted that BCS and SDC are consisted mainly by Sclerophyllous vegetation or Transitional woodland-shrub.

As described in Section 9.3.6.1.1.1, direct impacts on Forested Areas are imposed due to the deep-rooted species restriction within the PPS. Indirect impacts are not assessed, given the existing regulatory (urban

[64] https://www.mistikakipou.gr/aktinidio-kalliergeia/
[65] https://www.mistikakipou.gr/fitefsi-elias/
[66] Nevertheless, adopting a conservative approach, their contribution to the overall coverage has been considered. This is a conservative approach, because the total affected area is increased.

planning, regional planning, forestry, etc.) provisions and the fact that all existing practices and activities can be carried out in the whole width each of the pipeline's protection zone.

Taking into account the considerations discussed, and following the assessment criteria presented in Section 9.1 and the methodology specified in Section 9.3.6.1.1.1, the changes in land uses can be assessed as follows:

The *Likelihood* for an impact to occur during operation phase is _certain_ for existing uses of land which will be impacted by direct primary pressures, i.e. *Areas of systematic arboriculture* and *Forested Areas* (within or outside Protected Areas); other land uses classes shall not suffer any impact given the footprint selection process of the project or the fact that annual species (cultivations and natural) as well as all of the agricultural related activities and any other activity are allowed as before the construction of the project on top of the PPS (hence likelihood is assessed as *_impossible_*). Exception is the *Open spaces of productive land with little or no vegetation* where one might consider the possibility for change a cultivation from annual crops to tree crops; in this case, likelihood is assessed as _rare_. On the other hand, the likelihood for indirect changes to land uses is limited in the Industrial – commercial zone and the development trends of the broader area of the project footprint. Given the fact that the footprint of the Project is avoiding and is in great distance to most anthropogenic developments, the likelihood of indirect impacts to the specific land use class is assessed as _certain_ for the BCS.

Extent, the assessment criterion of the extent of the impact was adjusted to the technical description data and to the statutory protection measures, as presented above. Table 9-163 shows the assessment criterion of the extent of the impact on the land use change during the operation phase. *Extent* is determined according to Table 9-163 by the actual width of applicable restriction, e.g. 8 m wide (4 m on each side of the pipeline axis) for the PPS and the type of impact (direct or indirect). As such, extent is assessed as:

- _Local_ in areas characterized as *Open spaces of productive land with little or no vegetation*, *Areas of systematic arboriculture* or *Forested Areas* (within or outside Protected Areas)
- _Supra local_ in areas characterized as *Industrial – commercial zone*, for the possible changes induced by the BCS, i.e. the 40 m wide corridor (20 m on each side of the pipeline axis)
- _Pointwise_ for all other cases, i.e. direct impacts to *Industrial - commercial zones* or *Open spaces of unproductive land with little or no vegetation*; indirect impacts to *Open spaces of productive*

land with little or no vegetation, *Open spaces of unproductive land with little or no vegetation*, *Areas of systematic arboriculture* or *Forested Areas* (within or without Protected Areas).

Intensity of the impact is linked to the area's sensitivity to the changes occurring, as detailed in Section 9.3.6.1.1.1. Industrial - Commercial zones are assessed of *Very high* intensity; Open spaces of productive land with little or no vegetation of *Medium*; Open spaces of unproductive land with little or no vegetation of *Zero*; Areas of systematic arboriculture of *High*; Forested Areas (within or not Protected Areas) of *Low* (see Table 9-162).

The *Duration* of the impact is linked to the period the restrictions and requirements of the safety/ control zones will be applied for. More particularly, for all existing uses of land the restrictions in force in accordance with the Ministerial Decision Δ3/Α/οικ. 4303 ΠΕ 26510/2012 will be applicable for the entire project operation phase.

With regard to *reversibility*, the most important mitigation measure is the one already incorporated in the design of the project, i.e. appropriate footprint selection to avoid as much as possible potential interactions with high sensitivity land uses. Apart from this, mitigation measures do exist to *minimize* direct impacts on *Open spaces of productive land with little or no vegetation*, *Areas of systematic arboriculture* or *Forested Areas* (within or without Protected Areas) or *prevent* indirect impacts on *Industrial - commercial zones* (see Chapter 10).

It is noted that by definition of the assessed impact (changes in land use by the investigated project) *Cumulative action* is considered *impossible*.

Transboundary character is deemed *impossible*, given the fact that land use is, per definition, of strictly national interest.

Based on the above and the criteria presented in Section 1.1, as specified in Section 9.3.6.1.1.1,

- Direct changes, as induced by the Pipeline Protection Strip (i.e. the 8 m wide corridor), for areas classified as:
  - "Areas of systematic arboriculture" or "Forested Areas (within or not protected areas)", **SEI is considered as Minor**
  - "Open spaces of productive land with little or no vegetation", **SEI is considered as Negligible**
  - "Industrial - commercial zones" or "Open spaces of unproductive land with little or no vegetation", **no impacts are assessed**

- Indirect changes in land uses, as induced by the Building Control Strip (i.e. the 40 m wide corridor) for areas classified as:
  - “Industrial - commercial zones”, SEI is considered as Minor
  - Open spaces of productive land with little or no vegetation”, “Open spaces of unproductive land with little or no vegetation”, “Areas of systematic arboriculture” or “Forested Areas (within or not protected areas)”, no impacts are assessed
- No impacts are induced in the Spatial Development Control Strip (i.e. the 400 m wide corridor), but only a requirement for consultation prior to any significant spatial development .

9.3.6.1.1.3 Summary of impacts during operation on the Regional planning - Uses of Land

The following table summarizes the impacts during the operation phase to Uses of Land.

Table 9-167 Overview of the impacts on Uses of Land during operation phase.

S/N SEI			SEI for	Uses of the Land							
Project phase	Operation										
Impact	Mechanism	Locations	Criteria/ Impact Properties							SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Direct Changes in Land Use	Establishment of the Pipeline Protection Strip (8 m wide corridor, 4 m on each side of the pipeline axis)	Industrial - commercial zones	0,00	0,25	1,00	0,75	0,00	0,00	0,00	n/a	Given the design of the project, footprint has mostly avoided artificial surfaces (Continuous or Discontinuous urban fabric or Industrial/ commercial zones).
		Open spaces of productive land with little or no vegetation	0,25	0,25	0,50	0,75	0,00	0,00	0,00	2,50 (Negligible)	Annual crops cultivations and the rest of the agricultural related activities and any other activity are allowed as before the construction of the project.
		Open spaces of unproductive land with little or no vegetation	0,00	0,25	0,00	0,75	0,00	0,00	0,00	n/a	
		Areas of systematic arboriculture	1,00	0,25	0,75	0,75	0,75	0,00	0,00	5,00 (Minor)	No deep-rooted species are allowed within the PPS. Conditionally that distance of planting rows is greater than 4 m, only one planting row is lost. For olive groves, a typical

S/N SEI			SEI for	Uses of the Land							
Project phase	Operation										
Impact	Mechanism	Locations	Criteria/ Impact Properties							SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
											plantation scheme is 7x7 (for kiwi 4x6).
		Forested Areas (within or not Protected Areas)	1,00	0,25	0,25	0,75	0,75	0,00	0,00	4,29 (Minor)	No deep-rooted species are allowed within the PPS. However, the character of the land use is not modified. PPS can be configured as a fire protection strip.
Indirect Changes in Land Uses	Establishment of the Building Control Strip (40 m wide corridor, 20 m on each side of the pipeline axis)	Industrial - commercial zones	1,00	0,50	1,00	0,75	0,00	0,00	0,00	4,64 (Minor)	Footprint has mostly avoided artificial surfaces. Engaged areas could potentially host standalone buildings (scattered houses or shops). Establishment of the BCS decrease this capacity.
		Open spaces of productive land with little or no vegetation	0,00	0,00	0,50	0,75	0,75	0,00	0,00	n/a	Agricultural and/ or natural areas of low vegetation are not affected by indirect

S/N SEI			SEI for	Uses of the Land						
Project phase	Operation									
Impact	Mechanism	Locations	Criteria/ Impact Properties						SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
		Open spaces of unproductive land with little or no vegetation	0,00	0,00	0,00	0,75	0,00	0,00	0,00	n/a	impacts, because their characteristics (e.g. identified development trends or town planning regulations) do not include buildings or high population density plans development within the specific land use types.
		Areas of systematic arboriculture	0,00	0,00	0,75	0,75	0,00	0,00	0,00	n/a	
		Forested Areas (within or not Protected Areas)	0,00	0,00	0,25	0,75	0,00	0,00	0,00	n/a	

Prepared by: ASPROFOS, 2022.

9.3.6.1.2 Uses of Sea

Impacts to uses of the sea, are expected as a result of the restrictions imposed by the presence of the pipeline on the sea bottom, in deep waters. Nearshore, the pipeline will be buried and no interaction takes place with the marine environment.

As clarified in the Chapter 5 and 8, currently no spatial plan has been issued for the marine space. Only the Special Framework for Spatial Planning and Sustainable Development for Aquaculture (see Section 5.2.1.3.6) is in force whilst the corresponding SFSPSD for Marine Windfarms is under development (see Section 5).

Table 9-168 shows the key sources of impact, potentially impacted resources and receptors, baseline and project influencing factors associated to the impacts of the investigated project on uses of the sea.

Table 9-168 Key Considerations for Assessment – Uses of the Sea (Operation Phase).

Sources of Impact/ Risk	• Presence of pipeline in deep waters • Restrictions for deep-water pipeline safety
Potentially Impacted Resources and Receptors	• Fishermen in the study area • Marine traffic • Port facilities
Particular Baseline Conditions that are Potentially Influencing Impacts/ Risks	• Fishing activity in the area • Aquaculture development in the area • Marine Traffic/ Routes
Project Factors that are Potentially Influencing Impacts/Risks	• Project's footprint • Restrictions for deep-water pipeline safety • Number of marine vessels and routes during operation • Monitoring procedures
References	• Baseline is provided in Section 5, 8.6 and 8.7. Information on technical infrastructure in 8.8 • Mitigation Measures are provided in Section 10.3.6 • Land uses and Socioeconomic Map is provided in Section 15.1.6 • Information on technical infrastructure (incl. marine traffic, ports) is provided in Sections 8.8 (Baseline), 9.3.8 (Impacts assessment - operation) and 10.3.8 (Impacts assessment – operation).

Prepared by: ASPROFOS, 2022.

Table 9-68 summarizes the potential key impacts on community health and safety, due to the operation of the investigated project.

Table 9-169 Key Potential Impacts – Uses of Sea.

Potential Impact	Operation Phase
Fishing activities restrictions	n/a
Marine traffic (berthing) restrictions	X

Prepared by: ASPROFOS, 2022.

9.3.6.1.2.1 Fishing activities restrictions during operation phase

During operation, the physical presence of pipelines and structures on the seabed has the potential to impact fishing activities either through the imposition of protection zones (loss of opportunity) or through obstruction (potential damage or loss of gear). Obstruction-related impacts will essentially be limited to bottom trawling activities, as the use of gear such as gill nets, pound nets, seine nets and longlines will allow for fishery in the area without the risk of incidence or obstruction. Furthermore, pelagic trawlers will be able to avoid the pipelines by allowing a sufficient depth between the pipelines and the towed net.

The placed on the sea bottom pipeline will be visible and will be included in the nautical charts. As such, all vessels shall be informed accordingly about the pipeline's presence.

Fishing activities restrictions depends on the national regulations and the restrictions imposed by the competent port authorities. For example,

TAP. The Trans Adriatic Pipeline crosses Adriatic Sea from Albania before reaching Italy. For this section, no restrictions on the operation of fishing equipment, including demersal trawling, are applied.

NordStream (I & II). The Nord Stream Pipelines cross the Baltic Sea. Offshore pipelines in Danish waters automatically receive a 200 m protection zone along each side of the pipeline in which certain activities, e.g. bottom trawling, are not allowed. For NordStream I, this restriction is imposed. However, NordStream II is designed to be resistant to impacts from any interaction with fishing gear and other larger objects.

No restrictions on the operation of fishing equipment, including demersal trawling, will apply. Even if the pipeline is dimensioned to withstand impacts from demersal trawls, some fishermen may perceive the presence of the pipeline on the seabed as an obstruction to the operation of such equipment. However, over-trawling tests conducted in the North Sea show that the trawl equipment crosses this type of pipeline without any significant problems. In conclusion, subsea pipelines during operation are unlikely to impede or obstruct fishing activities or cause damage to fishing equipment[67].

The risk for trawl gear to get stuck with the pipeline increases if the approach angle to the pipelines is small (less than 15 degrees). In areas where the pipelines do not become naturally embedded in the seabed, fishermen will need to cross the pipelines at as steep an angle as possible – preferably 90 degrees – to reduce the risk of the trawl boards becoming stuck. Therefore, fishermen will be required to adapt their trawling patterns in the immediate vicinity of the pipelines. Experience from the Nord Stream I pipelines has shown that fishermen can coexist with the pipeline system and so far no gear has been reported lost or damaged.[68]

Once the pipeline is installed, there will be no restrictions on marine vessel movements in the area. In other pipeline projects in Greece, of smaller scale and characteristics (e.g. Gastrade FRSU Alexandroupoli), a fishing safety zone was necessary. In this zone, use of bottom trawling fishing equipment that may intersect with the submarine pipeline was be prohibited. Such fishing safety zones are determined by the local port authorities and is usually 200 m wide (100 m on each side of the pipeline axis).

As documented in Chapter 6, the EastMed pipelines will in principle be designed to withstand the fishing gear loads as such **no fishing restriction zone is necessary for the investigated project**. However, given the rough seabed conditions encountered along few segments of the EastMed pipelines, high loads due to fishing gear may be experienced in case of large free spans in water depths within reach of bottom trawl gear. If these loads appear to be too high to design for, a bottom trawling safety zone may be required. This will likely be in deeper waters where the trawl gear frequency is low.

9.3.6.1.2.2 Marine Traffic (Berthing) Restrictions

Project vessel movements during operation will be limited to the patrolling/ monitoring and possible maintenance of the deep-water pipeline (the nearshore shall be buried). Although exact data are not

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[67] TAP A.G., 2013 TAP ESIA Italy, IAL00-ERM-643-Y-TAE-1008. Acquired from https://www.tap-ag.com/sustainability/esia-documents . Retrieved on 2/3/2022.

[68] Nord Stream A.G., 2018. Nord Stream 2 ESIA Denmark, W-PE-EIA-PDK-REP-805-RN0100EN-07. Acquired from http://am.lrv.lt. Retrieved on 07/09/2019.

currently available (number of vessels, inspection means, etc.) it is only reasonable to expect that this would involve a very limited number of vessels and itineraries.

Based on other projects, external surveys of the deep-water pipeline sections by project-related inspection vessels are expected to be carried out in one- or two-year intervals at the beginning of the operational phase. Later in the operational phase, there may be longer intervals between these surveys, depending on the initial survey results. The inspection vessels will be relatively small and travel along the proposed route at a speed of around two to four knots.

A **berthing safety zone** shall be imposed. In this zone, the mooring of any vessel (not related to the project) will be prohibited so that there is no risk of anchors moving along the sea bottom. This berthing safety zone will be determined by the local port authority but is expected to be approx. 500 m width (250 m on each side of the pipeline axis).

However, all other marine traffic activities, not interacting with the bottom, are allowed as previously.

The pipeline is not located close to any significant port. As such, it cannot be expected that berthing restrictions shall increase pressure on ports (or smaller facilities) or generate specific restrictions.

Following discussion in the corresponding section of construction phase (Section 9.2.6.1.2), pressures on marine traffic shall be very limited.

Taking into account the considerations discussed, and following the assessment criteria presented in Section 9.1, the assessment of the marine traffic restrictions can be assessed as follows:

The *Likelihood* of impact during operation works is *certain*. Regardless of any other criteria, it is certain that some (limited) restrictions shall be applied within a small percentage of the overall specific marine traffic areas.

The *extent* of the impact is considered as *small* given the fact that the restrictions are expected to be imposed only in the berthing safety zone around the deep-water pipeline.

The *Intensity* of the impact has been related to the number of vessels navigating for the needs of project's operation and the existing ships density. As discussed in Section 9.2.6.1.2, vessels traffic is very low for most of the engaged marine space; exception is the Patraikos Gulf where the density is higher due to the limited marine area and the increased marine traffic of Port of Patra. Nevertheless, taking into consideration the very limited number of vessels necessary to operate during operation phase, intensity is assessed as *low*.

With regard to the *duration* of the impact, whatever restrictions are imposed, they will be applicable for the entire project lifetime. As such, the duration is considered as *long-term*.

With regard to *reversibility*, the restrictions will be fully *preventable*, once documented on the nautical charts. All applicable mitigation measures are described in the corresponding section of Chapter 10.

Regarding *cumulative* action, no offshore projects have been identified that could potentially be imposing simultaneously berthing restrictions of their own. Given that the possibility cannot be completely omitted, the cumulative character of this impact is considered as *rare*.

Transboundary character is deemed *rare.* It cannot be completely excluded that some ships/ vessels of international flags might interact with the offshore project footprint and/ or very limited offshore operational activities, during the lifecycle of the project.

Based on the above and the criteria presented in Section 9.1, marine traffic restrictions during the operation of the project **SEI is considered as Minor.**

Section 10 presents the proposed mitigation and management measures applicable to the impact.

9.3.6.1.2.3 Summary of impacts on Regional Planning – Uses of Sea

The following table summarizes the impacts during the operation phase to Uses of Sea.

Table 9-170 Overview of the impacts on the Uses of Sea during operation phase.

S/N SEI			SEI for	Uses of the Sea							
Project phase	Operation										
Impact	Mechanism	Locations	Criteria/ Impact Properties							SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Marine traffic (berthing) restrictions	• Presence of pipeline in deep waters • Restrictions for deep-water pipeline safety	• Berthing safety zone	1,00	0,25	0,25	0,75	0,00	0,25	0,25	3,93 (Minor)	Berthing restrictions are limited compared to available berthing area. Project is not located close to any significant port facility.

Prepared by: ASPROFOS, 2022.

9.3.6.2 Structure and operation of anthropogenic environment

9.3.6.2.1 Community Health & Safety

The presence of the Project could raise safety concerns from a potential accident or concerns regarding secondary impacts on community health through decrease in air quality and increase of noise.

Table 9-9 shows the key sources of impact, potentially impacted resources and receptors, baseline and project influencing factors associated to the impacts of the investigated project on community health and safety.

Table 9-171 Key Considerations for Assessment – Community Health & Safety (Operation Phase).

Sources of Impact/ Risk	• Presence of the pipeline and Main Stations. • Changes to the environment due to increased noise, decreased air quality, waste and changes to the visual environment as a result of the Project.
Potentially Impacted Resources and Receptors	• Communities along the pipeline route. • Settlements close to compressor stations.
Particular Baseline Conditions that are Potentially Influencing Impacts/Risks	• Distance of residential areas to permanent facilities • Concerns regarding safety issues recorded during ESIA consultation
Project Factors that are Potentially Influencing Impacts/Risks	• Location of project's permanent locations and route
References	• Baseline is provided in Section 5, 8.6 and 8.7 • Mitigation Measures are provided in Section 10.3.6 • Land uses and Socioeconomic Map is provided in Section 15.1.6 • Impacts assessment on air quality is provided in Section 9.3.10 and Mitigation Measures in Section 10.3.10. • Impacts assessment on acoustic environment is provided in Section 9.3.11 and Mitigation Measures in Section 10.3.11.

Prepared by: ASPROFOS, 2022.

Table 9-68 summarizes the potential key impacts on community health and safety, due to the operation of the investigated project.

Table 9-172 Key Potential Impacts – Community Health and Safety.

Potential Impact	Operation Phase
Environmental health (air quality and acoustic environment)	X (See Air Quality & Acoustic Environment)

Prepared by: ASPROFOS, 2022.

9.3.6.2.1.1 Environmental health (air quality and acoustic environment)

The operation of the pipeline and BVSs will not generate any significant air or noise emissions nor waste effluents that could influence environmental health. Long-term changes to the landscape and visual amenity along the pipeline route will be limited to the presence of the aboveground, permanent structures (i.e. BVSs). However, it is not expected that these will have any impact on the wellbeing of residents of nearby communities.

During the operational phase of the Project the compressor stations will increase noise levels and affect the local air quality (increased emissions of NOx) within their vicinity as well as pose landscape visual elements and generate waste. However given that:

- Emissions levels are way within statutory limits and thus no impacts are expected in community health and safety (see Section 9.3.10),
- Noise levels are also within statutory limits and the resulted difference in background noise levels at the nearest sensitive receptor lays within the IFC limit of 3 dB maximum increase[69] (see Section 9.3.11).
- Landscape intrusion is also negligible (see Section 9.3.3) from all three Main Stations.
- Waste generation shall be managed according to national provisions, effortlessly (see Sections 9.3.4, 9.3.8 and 9.3.13).

9.3.6.2.2 Community Cohesion

Following discussion in Section 9.2.6.2.2, the following are noted specifically for operation phase.

[69] it is noted that inside the Power Plant of Atherinolakkos, the model calculated increase of background noise level greater than 3 dB, i.e. ~ 10 dB Leq. However, the specific receptor is an heavy industrial unit (mazout operating) and is not considered a sensitive receptor.

The size of the workforce is approximately 25 persons per Main Station.

9.3.6.2.2.1 Break of urban fabric continuity

As summarized in Table 9-74, no Main Station is located within urban fabric. Hence, no break of urban fabric continuity is expected.

9.3.6.2.2.2 Summary of impacts on Community Cohesion

The following table summarizes the impacts during the operation phase to Community Cohesion.

Table 9-173 Summary of Impacts to Community Cohesion during Operation Phase.

S/N SEI			SEI for	Community Cohesion								
Project phase	Operation											
Impact	Mechanism	Locations	Criteria/ Impact Properties							SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Break of urban fabric continuity	• Land occupation by project related facilities.	• Communities close to Main Stations	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	No Main Station is located within urban fabric.

Prepared by: ASPROFOS, 2022.

9.3.6.3 Cultural Heritage

Project activities during the operation phase include maintenance of the pipeline and associated facilities, operation of machinery and equipment (namely in the Main Stations), and traffic of equipment and vehicles. Table 9-76 outlines the key sources of impact, the potentially impacted resources and receptors, including baseline and Project influencing factors associated with impacts of the Project on cultural heritage sites. Due to the nature of activities at operation phase, the cultural heritage sites likely to be affected are those receiving visitors or users.

In addition, it needs to be reminded that the Project has sought to avoid, as much as possible, interaction with cultural heritage resources, i.e. distancing, as much as possible, from identified (declared or not) resources. Maintenance procedures and plan are not currently available, but based on past projects, they do not include activities that involve excavations and/ or in general activities that could bring to surface unidentified cultural heritage resources or interact with them.

Mechanisms and their potential impacts on cultural heritage resources, during construction phase, are presented and analyzed in Table 9-77.

Table 9-174 Key Considerations for Assessment – Cultural Heritage (Operation Phase).

Sources of Impact/ Risk	• Traffic of vehicles, equipment and personnel to and from Main Stations • Traffic of vehicles for monitoring/ patrolling of onshore project footprint • Navigation of vessels for monitoring/ patrolling of offshore project footprint
Potentially Impacted Resources and Receptors	• Cultural heritage resources located close to the project receiving visitors or users
Particular Baseline Conditions that are Potentially Influencing Impacts/Risks	• Presence of declared cultural heritage sites • Presence of identified cultural heritage sites
Project Factors that are Potentially Influencing Impacts/Risks	• Project's footprint • Maintenance and monitoring plan
References	• Baseline is provided in Section 5, 8.6.3 • Mitigation Measures are provided in Section 10.3.6 • Cultural Heritage Map is provided in Section 15.1.7 • Impacts on landscape are discussed in Section 9.3.3

Prepared by: ASPROFOS, 2022.

Table 9-175 Mechanisms Potential Impacts - Cultural Heritage.

Potential Impact	Traffic of vehicles, equipment and personnel, Vessels navigation	Machine and Equipment Operation
Direct physical damage to resource		
Secondary degradation or damage to the resource due to pollution or vibrations	X	
Nuisance to resource visitors	X	X

Prepared by: ASPROFOS, 2022.

In detail, there are no anticipated impacts during the operation and maintenance phase of the Project. The only activity that could induce impacts (source of impact/ mechanism) is the traffic of vehicles, equipment and personnel that shall circulate for the maintenance and patrolling of the PPS and personnel transportation to Main Stations. It is noted that all vehicles circulating in Greece are obliged to comply with national and European standards, in terms of emissions generation. In any case, the number of vehicles will be very limited.

Direct physical disturbance or damage is no longer a potential impact during the operations phase, since routine maintenance and patrolling is not expected to require ground-disturbing activities in previously undisturbed areas.

Monitoring of aboveground cultural heritage resources will continue during operation, however, to ensure the preservation of risky areas sites within the Right of Way (PPS). This activity shall not generate significant pollutants emissions; all vehicles to be used shall comply with applicable legislation.

Siting of all permanent facilities (i.e. line valve stations and Main Stations) have been selected so as to keep significant distance from known cultural heritage resources (including religious sites such as churches or cemeteries). No cultural heritage sites that receive visitors have been identified along the permanent facilities nor the Pipeline Protection Strip. Similar for any potential negative effect on the landscape and surroundings of the identified cultural heritage resources. Impacts on landscape in the areas of Main Stations are discussed in Section 9.3.3.

It is clarified that the above discussion is applicable for both onshore and offshore sections. In fact, in the offshore section, no interaction between the project operational activities (e.g. monitoring) and any marine cultural heritage resources is expected.

9.3.6.3.1 Summary of impacts during operation on Cultural Heritage

Although no impacts are assessed to cultural heritage resources during operation, it was decided for completeness purposes to include the following table summarizing the issues discussed in this section, regarding potential impacts during the operation phase to Cultural Heritage Resources.

Table 9-176 Summary of Impacts to Cultural Heritage during Operation Phase.

S/N SEI			SEI for	Cultural Heritage							
Project phase	Operation										
Impact	Mechanism	Locations	Criteria/ Impact Properties							SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Direct physical damage	n/a	n/a	0,00	0,00	0,00	0,00	0,00	0,00	0,00	n/a	No ground disturbing mechanisms that could induce direct physical damage exists during operation phase; hence, no impacts are assessed.
Secondary Degradation or Damage	n/a	n/a	0,00	0,00	0,00	0,00	0,00	0,00	0,00	n/a	No sources of major vibration or pollution. All vehicles/ vessels used EU certification is mandatory by law.
Nuisance to visitors access	Traffic of vehicles, equipment and personnel	Permanent facilities	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	All permanent facilities (i.e. line valve stations and Main Stations) have been selected so as to keep significant distance from known cultural heritage resources (incl. religious sites). No cultural heritage sites that receive visitors have been identified along the permanent facilities nor the Pipeline Protection Strip. Similar for negative effect on the landscape and surroundings of the identified cultural heritage resources

Prepared by: ASPROFOS, 2022.

9.3.7 Socio-economic Impacts

9.3.7.1 Economy – Employment

This section evaluates potential impacts on economy and employment, which are directly or indirectly linked to the Project.

The mechanisms likely to impact the local or regional (even national) economies of vulnerable receptors could be directly linked to the Project, but also indirectly. Table 9-81 shows the main impact sources on economy/ employment and the potential sensitive receptors related to the investigated Project.

Table 9-177 Key Issues for assessment – Economy/ Employment

Sources of Impact/ Risk	• Economic impact on taxes, fees and local transactions (positives) (main economic impact at operation phase will be taxes to the Greek government.). • Economic impact on agricultural sector (income) (Pipeline Protection Strip on agricultural land) • Economic impact on tourism (any noise generating and/ or landscape disturbing activity)
Potentially Impacted Resources and Receptors	• Local and Regional economy • Greek State • Farmers • Fishermen • Tourist infrastructure professionals mainly at areas near LFs
Special Baseline Conditions that are Potentially Influencing Impacts/Risks	• Availability of goods and services: • Structure of local/ regional economy. The services industry is a major employer at a regional level. In addition, several cities within a short distance to the pipeline corridor offer a full range of services. • The Tourism infrastructures (hotels, restaurants) near LF4 • Education and skill levels providing capacity for local workforce to be engaged in the project construction/ operation. • Unemployment levels. This is of importance to local stakeholders since unemployment is significant for engaged regions (11.3% ÷ 21.6%)
Project Factors that are Potentially Influencing Impacts/Risks	• Operational workforce (approx. 100 direct new jobs) • Procurement of goods and services strategy • Project footprint • Restriction zones
References	• Project's Compliance with Statutory Provisions (Chapter 5) • Technical description of the project (Chapter 6) • Baseline is provided in Section 8.7

	• Baseline Information, Technical Infrastructures (Section 8.8) • Impact Assessment on Anthropogenic Environment (9.3.6) and Landscape (9.3.3) • Mitigation Measures are provided in Chapter 10

Prepared by: ASPROFOS, 2022

In the following paragraphs, a description and assessment of potential impacts from the operation of the project is made. Specifically, the following impacts are assessed:

- Employment opportunities (Direct and/ or Indirect)
- Economic impact of taxes, fees and local transactions
- Economic impact on agricultural sector (income)
- Economic impact on fishing sector (income)
- Economic impact on tourism sector (income)

9.3.7.1.1 Methodology Overview

Most of the information and data presented in section 9.2.7.2 are still applicable. The following are applicable specifically for operation phase.

The most important factor/ mechanism for impacts on local or regional (or even National) economy is the engagement of local/ regional players in operational activities (procurement of goods or services) and the potential supply of natural gas by the project to the local community. Additionally, employment opportunities shall arise (direct, especially for unskilled personnel; indirect for providers of services to the project, e.g. safety). In addition, taxes, fees and other local transactions payable by the project directly (taxes) or indirectly (consumption of workforce) shall have a positive impact on economy.

During operations, the Project in Greece will employ approx. 100 permanent employees (direct employment opportunities). Permanent employees will be needed for operation and maintenance of the pipeline system, for monitoring and security, etc. However, the operation of the project is closely related to a number of indirect employment opportunities for procurement of goods and mostly services.

It needs to be clarified that direct and indirect employment opportunities creation (e.g. personnel hiring and procurement of goods/ services) will meet EBRD standards, EU requirements and IGI POSEIDON policies (e.g. on CSR).

As discussed in Section 9.3.6, during the operation phase, the existing uses of land will be influenced by the creation of a safety/ control zone on each side of the project's axis, both onshore and offshore. These are summarized in Table 9-178.

Table 9-178 Safety/ control zones, onshore and offshore, imposed by the Project during operation phase.

Restriction Zone	Width (on each side of the pipeline axis) (m)	Description of restrictions	Reference
Pipeline Protection Strip (PPS)	8 (4+4)	No deep-rooted species or foundations that could potentially jeopardize pipeline's integrity are allowed	Ministerial Decision Δ3/A/οικ. 4303 ΠΕ 26510/2012 - Technical regulation on "Natural gas pipelines with maximum pressure operation above 16 bar"
Building Control Strip (BCS)	40 (20+20)	No building is allowed to be constructed	
Spatial Development Control Strip (SDC)	400 (200+200)	Consultation with the Natural Gas Infrastructure Owner is necessary for the development of significant spatial plans and or high population density facilities (e.g. hospitals).	
Berthing Safety Zone (BSZ)	500 (250+250)	Mooring of any vessel (not related to the project) will be prohibited so that there is no risk of anchors moving along the sea bottom.	

Prepared by: ASPROFOS, 2022.

It is clarified that due to the stage of Project development, there are a number of aspects of the Project yet to be defined that influence potential impacts on economy and employment. These include:

- the size and characteristics of required workforce (onshore and offshore);
- Project's supply and procurement plan/ policies, CSR

9.3.7.1.2 Employment opportunities (Direct and/ or Indirect)

As discussed, impacts on employment will be mostly available during construction phase. Regarding the pipeline, a number of permanent employees for inspection, maintenance and other work will be required, up to about 20 persons. These employees will be based in the O&M bases.

Regarding stations, the workforce during operation is estimated at approximately 25 persons per compressor station.

The total number of permanent (direct) jobs created by the Project will be relatively small. The majority of these will be skilled positions and will be based around the Major Stations.

Apart from the direct employment opportunities, the operation of the project is closely related to a number of indirect employment opportunities. For example, permanent facilities shall require safety, cleaning and in general facilities management, even though limited in numbers. Such services are most probable to be procured by local market. Additionally, apart from specialized maintenance/ repair works which will require special equipment/ materials, many other operational requirements (e.g. consumables, stationary, lubricants, technicians, etc.) would include procurement of goods and/ or services from the local market. These refer to long-term permanent employment opportunities not directly by the Project but by other, third party, companies that will be contracted to support project's operation (along with any other client they manage to attract).

It needs to be clarified that employees might not be from the local workforce, but they will most probably be Greek nationals. This depends mostly on the expertise and the exact job description in combination to the capacity of local workforce. The same applies for indirect employment opportunities; nevertheless, there is much greater flexibility in awarding supporting services to local enterprises than hiring (and properly training) a local expert on project needs. In any case, direct and indirect employment (e.g. personnel hiring and procurement of goods/ services) will meet EBRD standards, EU requirements and IGI POSEIDON policies (e.g. on CSR).

Direct employment is related to the duration of the project's operation (50 years). However, indirect employment and mainly professional capacity building may outlast the operation of the project.

Regarding importance of employment, what was discussed in Section 9.2.7.2 is still valid. What needs to be highlighted is that for in three of the four engaged Regions, the "Wholesale and retail trade, repair of motor vehicles and motorcycles, transport and storage, accommodation and catering services" sector holds the first place to the regional economy contribution; only in R. of Peloponnese is the specific sector not first, but second. As a result, people and businesses in the study area are likely to have relevant experience for support and service-related opportunities. As discussed during construction phase, the purchase of goods and services is expected to generate employment opportunities, mainly in nearby cities and in settlements close to the Main Stations.

It is not known what percentage of food or supplies for the Project will be procured from Greek companies, but it can be expected that any associated job creation will mostly occur in cities or large villages. The total amount of job creation associated with procurement is expected to be small.

Regarding vulnerable groups in the employment context, most (if not all) of them are employed in the "Agriculture, Forestry and Fishing" sector. Impacts on these activities are negligible (almost non-existing) and as such, no loss of income shall take place because of project's operation to the economy of vulnerable people. Nevertheless, a communication line during operation of the project shall be there for everyone to express their concerns and issues, and possible claims for income loss or degradation, which was not timely identified by the Project or filled by the local stakeholders (groups or individuals).

In summary, employment benefits will be limited and relatively small number of positions open to unskilled workers. Workers with experience in construction, land clearing and the services industry are present in the study area and could benefit from some of the skilled and semi-skilled opportunities associated with the Project. Depending on recruitment and procurement strategy/ policy, direct employment opportunities for local communities may be most significant near permanent facilities; indirect employment opportunities are expected to be created mostly in large, regional, population centers (main cities or large villages).

Taking into account the considerations discussed and following the assessment criteria presented in Section 9.1, the assessment of impacts on employment opportunities (direct and/ or indirect) during operation phase is very similar to the one for construction phase (Section 9.2.7.2.2).

Likelihood for the impact is considered *certain*, since many employment opportunities shall be created, for some of which local workforce/ businesses will be selected.

Extent as discussed above and during construction phase, it is considered *Peripheral*.

Intensity as discussed above and during construction phase, it is considered *medium*.

The *duration* of the impact is associated with need of direct employment for operation of the project, which is obviously the same with the lifecycle of the project (i.e. 50 years, *long-term*). Indirect employment is somewhat similar. However, capacity building is a permanent skill (impact) induced by the project to the local workforce/ business (i.e. *permanent*). As such, adopting a conservative approach, duration of the impact is considered *long-term*.

With regard to *reversibility*, as discussed above and during construction phase, it is considered *maximizable*[70] (see Chapter 10).

Regarding *cumulative* action, as discussed above and during construction phase, it is considered *likely*.

Transboundary character is deemed *impossible*, by definition of economy (local/ regional and how this is interconnected to other regional areas and national jurisdiction).

Based on the above and the criteria presented in Section 9.1, impacts from employment opportunities (direct and/ or indirect) during the operation of the project **SEI is considered as Moderate (in a positive manner).**

Section 10.2.7 presents the proposed mitigation and management measures applicable to the impact.

9.3.7.1.3 *Economic impact of taxes, fees and local transactions*

This section assesses and evaluates the potential Economic impact of taxes, fees and local transactions during the operation phase of the project. The following Table 9-179 shows the potential impact, the Impacts Generating Mechanisms and potentially affected receptors.

Table 9-179 Economic impact of taxes, fees and local transactions– Impacts Generating Mechanisms, potentially affected receptors during operation phase

Possible Impact	Impacts Generating Mechanisms	Potentially affected resources / receptors
Economic impact of taxes, fees and local transactions	Payment of taxes	• Local/ Regional economy • National economy • European economy

Prepared by: ASPROFOS, 2022

The main economic impact at operation phase will be taxes to the Greek government. The details of paying taxes including the amount payable by the project provider is expected to be determined based on a special taxation agreement.

[70] Given that the impact is a positive one, this classification is used instead of *minimizable.*

The implementation of the project will pave the way for more large-scale investments in the country, whilst implementation of such large projects strengthens the confidence of investors in the prospects of Greece, as "Brand name". The role of Greece in the wider Balkan region, as well as Europe, is expected to be upgraded. Local communities will gain visibility because of the pipeline. Details on project's significance for Greece are provided in Section 9.3.7.3.

As documented in Chapter 4 (and highlighted in Section 9.3.7.3), the project is of outmost importance for European Union, as a whole. Validating this, the EastMed Pipeline Project has been included in NECP projects list. For its contribution to the European Union' s energy targets, the EastMed Pipeline Project has been included in the list of Projects of Common Interest (PCI), benefiting from the fast-track procedures provided by EU Regulation 347/2013, and its development activities are supported by the European Commission with the EU Connecting Europe Facility (CEF) grants. The EastMed Pipeline Project is included in the "Infrastructure projects of national and international interest" of the Road Map of the Natural Gas Market 2017-2022 (GG 59/B/2018) contributing to strengthening energy security by diversifying sources and routes of the NG supply for the EU (eastern Mediterranean and Middle East).

Taking into account the considerations discussed, and following the assessment criteria presented in Section 9.1, the assessment of impacts on economy from taxes, fees and local transactions during operation phase is very similar to the one for construction phase (Section 9.2.7.2.3) and to the analysis presented in Section 9.3.7.3.

Likelihood for the impact is considered *certain*, since at least some transactions shall take place.

Extent as discussed above and during construction phase, it is considered *Peripheral*.

Intensity as discussed above and during construction phase, it is considered *low*.

The *duration* of the impact is associated with the objectives fulfilled by the project and these are met as long as the project is operational, i.e. *long-term.*

With regard to *reversibility*, as discussed above and during construction phase, it is considered *maximizable*[71] (see Chapter 10).

Regarding *cumulative* action, as discussed above and during construction phase, it is considered *probable*.

[71] Given that the impact is a positive one, this classification is used instead of *minimizable.*

Transboundary character is deemed *certain*, given the importance of the investigated project to European Union.

Based on the above and the criteria presented in Section 9.1, impacts from increase in taxes, fees and local transactions during the operation of the project **SEI is considered as Major (in a positive manner).**

Section 10.3.7 presents the proposed mitigation and management measures applicable to the impact.

9.3.7.1.4 Economic impact on agricultural sector (income)

This section assesses and evaluates the potential Economic impact on agricultural sector (i.e. income from farming and live stocking) during the operation phase of the project. The following Table 9-180 shows the potential impact, the Impacts Generating Mechanisms and potentially affected receptors.

Table 9-180 Economic impact on rural income – Impacts Generating Mechanisms, potentially affected receptors during operation phase

Possible Impact	Impacts Generating Mechanisms	Potentially affected resources / receptors
Economic impact on rural income	Pipeline passing through agricultural and arable land	• Professional farmers

Prepared by: ASPROFOS, 2022

It should be noted that the impact is not different whether the cultivated land is owned by the farmer or rented.

The economic impact on rural income during the operation phase is negligible. The Pipeline passing through agricultural and arable land during the operation phase is expected not to affect the income of farmers. All agricultural activities such as cultivating soil, planting, raising, and harvesting crops, rearing, feeding, and managing animals will be allowed once the working strip is reinstated. Farmers will be able to farm the land even within the safety zone (8 meters from the pipeline axis), cross the safety zone with their trucks and vehicles, irrigate, etc.

As discussed in Section 9.3.6.1.1, in accordance with Ministerial Decision Δ3/Α/οικ. 4303 ΠΕ 26510/2012 - Technical regulation on “Natural gas pipelines with maximum pressure operation above 16 bar", the following safety/ control zones are created which might have impact on agricultural activities[72]:

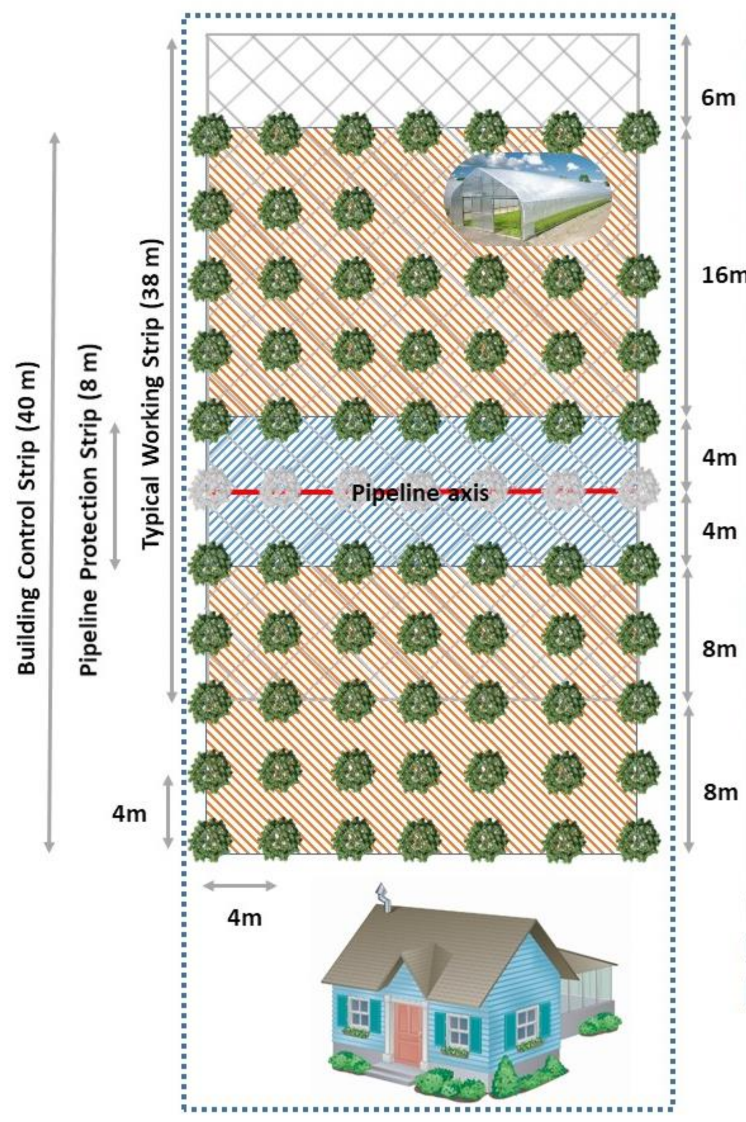
- 8 m Pipeline Protection Strip (PPS), four (4) meters on each side of the pipeline axis, within which no deep-rooted species or foundations that could potentially jeopardize pipeline's integrity are allowed.
- 40 m Building Control Strip (BCS), twenty (20) meters on each side of the pipeline axis, within which no building is allowed to be constructed.

The only limitation applicable includes the restrictions of PPS, where no deep-rooted species shall be allowed, and refer mainly on ***tree crops***. Additionally, the potential switch of cultivation from annual crops to tree crops is impacted, which might be of future interest for the agricultural sector. From what already discussed in section 9.3.6.1.1, the actual size of the impact depends on the planting scheme of the tree crops (indicatively 4x6 for kiwi[73] or 7x7 for olives[74]); assuming a general planting scheme of 5x5 only one planting row is lost. In fact, conditionally that distance of planting rows is greater than 4 m, only one planting row is lost.

This is visualized in Figure 9-79. The typical working strip of 38 m width is illustrated (with a typical unequal distribution on each side of the pipeline axis), along with the Pipeline Protection Strip (PPS, 8 m wide) and the Building Control Zone (40 m wide), within a tree crop of 4x4 plantation scheme. This infographic includes a deliberate inconsistency between the foreseen in the design of the project typical working strip in tree crops and the one presented. In tree crops, the typical working strip will be 28 m (in order to decrease impacts on tree crops). Nevertheless, even when adopting a conservation approach (i.e. a wider working strip than the one to be actually implemented), it is evident that the impacts on tree crops is very limited.

It is repeated that **no impacts are expected in annual crops (or pastures).** All activities, including greenhouses construction are allowed.

[72] The third safety/ control zone of 400 m (200 m on each side of the pipeline axis) is not considered likely to impact the agricultural sector.
[73] https://www.mistikakipou.gr/aktinidio-kalliergeia/
[74] https://www.mistikakipou.gr/fitefsi-elias/



Area	Nature of Restriction
Pipeline Protection Strip (PPS). an 8 m strip with the pipeline at its centre (4 m on each side of the pipeline axis). This Pipeline Protection Strip is part of the Working Strip.	No buildings of whatever nature, no deep ploughing, no deep-rooted species. All agricultural activities are allowed, except for activities evolving any action in soil depths greater than 0,60 m
Building Control Strip (BCS) A 40 m strip with the pipeline at its centre (20 m on each side of the pipeline axis). This zone includes the working strip.	No residential buildings. All agricultural activities (incl. warehouses and greenhouses) are allowed. Restrictions within PPS are still valid.
Spatial Development Control Strip (SDC) A 400 m strip with the pipeline at its centre (200 m on each side of the pipeline axis)	Development of urban plans (new or amendment, eg clusters of houses, or new industrial and town developments) need to take into account pipeline's safety considerations. For this consultation with Project Owner is held. Restrictions within the PPS and BCS are valid.

Typical Working Strip (38 m)
Building Control Strip (20 m on each side of the axis)
Pipeline Protection Strip (4 m on each side of the axis)
Indicative Tree Crop of Plantation Scheme 4 m x 4 m
Permanently Lost Planting Row

Prepared by: ASPROFOS, 2022.

Figure 9-79 Safety/ control zones and agricultural sector.

It is noted that a Land Easement and Acquisition Strategy (LEAS) and Land Access Plan (LAP) shall be prepared. This would describe in detail the management of temporary and permanent acquisition of easement rights for the pipeline and land for above ground installations and road access, for the onshore section, and sea bottom for the offshore section (in conjunction with the Livelihoods Restoration Framework).

Taking into account the considerations discussed and following the assessment criteria presented in Section 9.1, the impact on economy of the agricultural sector during operation phase is very similar to the one for construction phase (Section 9.2.7.2.4).

Likelihood for the impact is considered *certain*, since at least some restrictions shall take place, given the fact that olive groves are very extensive within the study area (especially in R. of Peloponnese and R. of Western Greece).

Extent is determined by the width of the safety/ control zones. Especially for the agricultural areas, the PPS is considered as the only applicable safety/ control zone. Consequently, the *extent* of the impact is considered *Small*.

Intensity as discussed above and during construction phase, it is considered *medium*.

The *duration* of the impact is associated with the time the safety/ control zones are applicable, i.e. for the entire lifetime of the project. For the crops to mature enough as to yield the same amount of crops as before construction. As such, duration of the impact is considered *long-term*.

With regard to *reversibility*, a number of pipeline in Greece (and all over the world) have been constructed in agricultural lands applying for specific monetary measures (i.e. compensation for loss of present and future crops) preventing the impact itself. For these reasons, impact on agricultural sector is considered to be *preventable* (see Chapter 10).

Regarding *cumulative* action, no projects have been identified that could potentially restrict on their own tree crops in the same area as the investigated project. As such, it can be assessed as *impossible*.

Transboundary character is deemed *impossible*, by definition of economy (local/ regional and how this is interconnected to other regional areas and national jurisdiction).

Based on the above and the criteria presented in Section 9.1, impacts on agricultural sector (farming and livestock) during the operation of the project **SEI is considered as Minor.**

Section 10.3.7 presents the proposed mitigation and management measures applicable to the impact.

9.3.7.1.5 Economic impact on fishing sector (income)

This section assesses and evaluates the potential Economic impact on fisheries during the Operation phase of the project. The following Table 9-181 shows the potential impact, the Impacts Generating Mechanisms and potentially affected receptors.

Table 9-181 Economic impact on fisheries – Impacts Generating Mechanisms, potentially affected receptors during operation phase

Possible Impact	Impacts Generating Mechanisms	Potentially affected resources / receptors
Economic impact on fisheries	Permanent Safety Zone:	• Professional fishermen

Prepared by: ASPROFOS, 2022

The economic impact on fishing sector (income) during the operation phase is negligible. As detailed in Section 9.3.6.1.2, **no fishing safety zone** is currently foreseen to be imposed along the offshore pipeline route during the operation phase.

All fishing activities are allowed as previously.

It is noted that a potential restriction of bottom trawling in the area, if requested by the competent authorities, of the pipeline could act protectively of the fish populations in the area. The offshore pipeline and a bottom trawling fishing control zone can act as a nursery ground for fishes, which in turn enriches biodiversity population and overall dynamics. Following any increase of fish population, an increase of fish catches is reasonable to be expected. In fact, many would argue that this is much more influential in terms of fish availability, and consequently of fishing income, than the potential restriction of fishing grounds availability to the fishing sector. Fishing activity, especially bottom trawling fishing equipment, puts pressure on fish population; sustainable fishing is very difficult to be achieved and regulated. The presence of the offshore pipeline, its inclusion along with its related safety zone in the nautical maps, and in general the refuge the pipeline will serve as for benthic biodiversity, at first, and secondarily to overall fish population and marine biodiversity pyramid, would positively impact the fishing sector in the long term.

9.3.7.1.6 Economic impact on tourism sector (income)

This section assesses and evaluates the potential Economic impact on tourism during the Operation phase of the project. The following Table 9-182 shows the potential impact, the Impacts Generating Mechanisms and potentially affected receptors.

Table 9-182 Economic impact on tourism - Impacts Generating Mechanisms, potentially affected receptors during operation phase

Possible Impact	Impacts Generating Mechanisms	Potentially affected resources / receptors
Economic impact on tourism sector	-	Tourist infrastructures (hotels, restaurants)

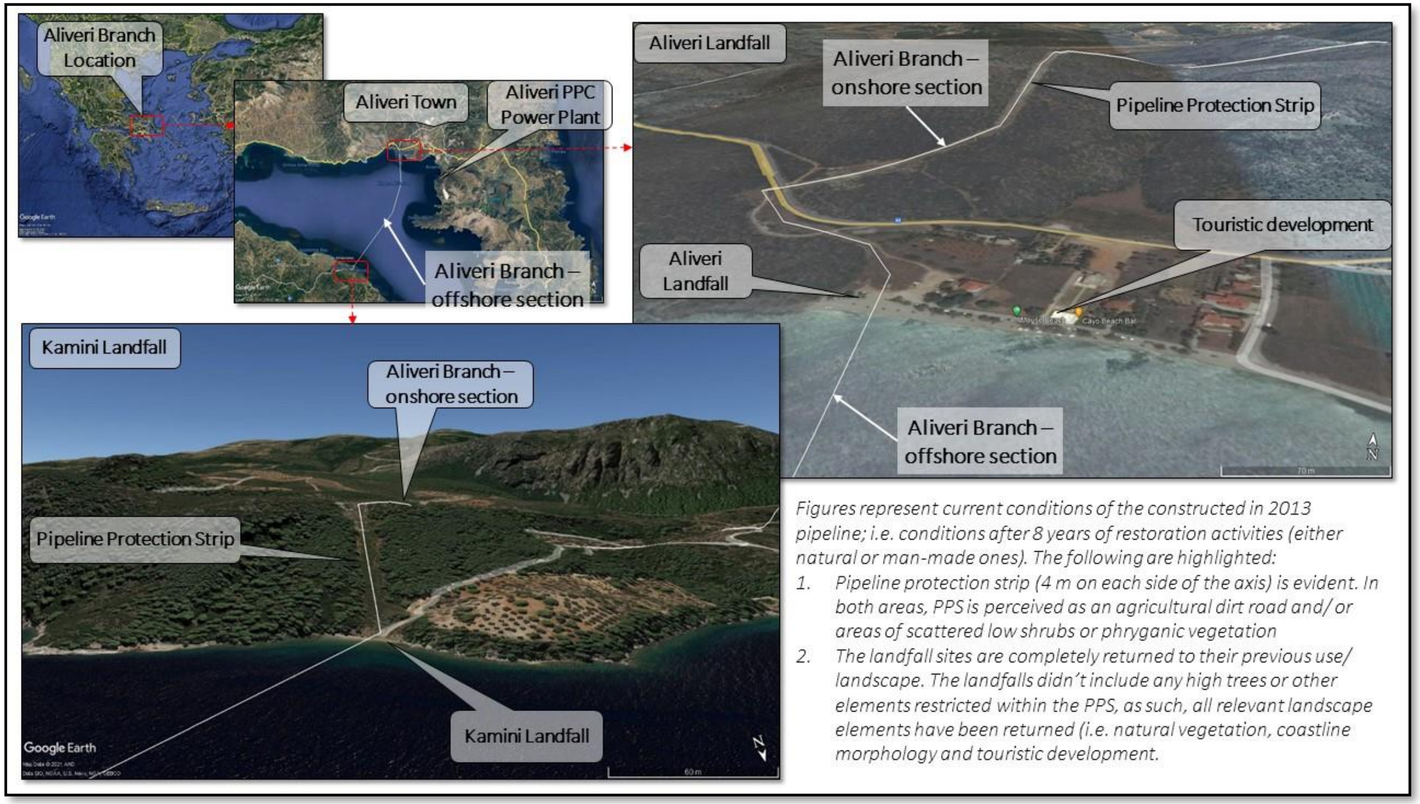
Prepared by: ASPROFOS, 2022

This section is strongly related to the assessment of landscape modification (see Section 9.3.3.1).

Economic impacts on tourism could be induced by any activity that would generate noise or cause landscape modification. Nevertheless, no such activities are expected to take place (at least not during normal operation conditions). Permanent facilities are not located close to identified tourism businesses. As discussed in Section 9.3.3.1, landscape modification close to tourism sensitive receptors (i.e. the landfalls) is completely and fully reinstated in coastal areas. To this end, it is deemed useful to repeat the following documentation supporting no impacts from landscape disturbance to sensitive receptors for tourism.

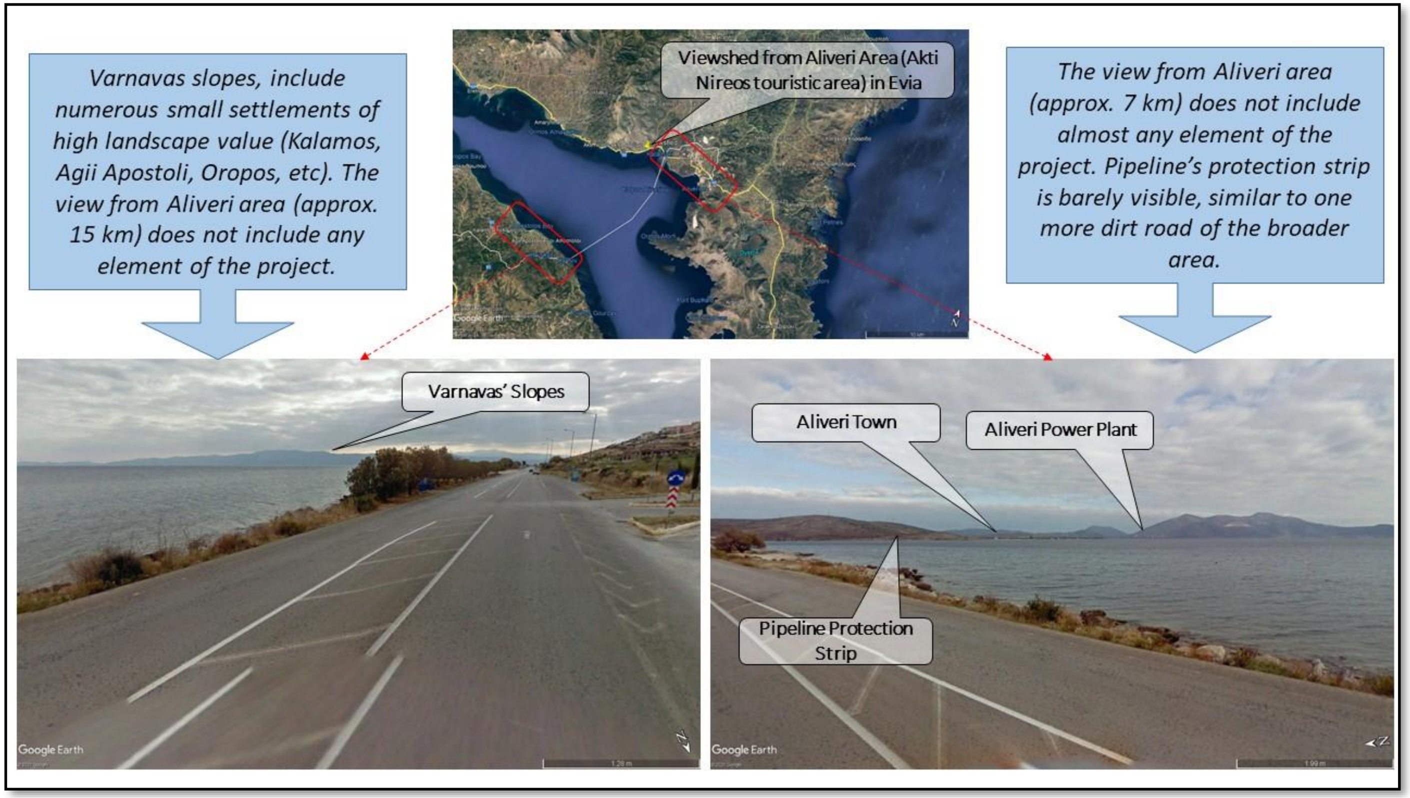
Quoted from Section 9.3.3.1, especially for the nearshore seascape (and coastal areas), the example of DESFA's Aliveri Branch pipeline is illustrative. Figure 9-54 and Figure 9-55 represent current conditions of the DESFA pipeline constructed in 2012; i.e. conditions 8 years after completion of restoration activities (either natural or man-made ones). The following conclusions can be highlighted:

- Pipeline protection strip (4 m on each side of the axis) is evident. In both areas (Figure 9-80 and Figure 9-81), PPS is perceived as an agricultural dirt road and/ or areas of scattered low shrubs or phryganic vegetation
- The landfall sites are completely returned to their previous use/ landscape. The landfalls did not include any high trees or other elements restricted within the PPS and, as such, all relevant landscape elements have been returned (i.e. natural vegetation, coastline morphology and touristic development). The conditions are similar for the landfall sites of the investigated project, i.e. LF2, LF3, LF4 and LF5.
- Especially in Aliveri coast, a touristic development, at less than 100 m is up and running without any problem.
- The viewshed from an indicative vantage point (a touristic venue close to Aliveri Town) illustrates that at a 7 km distance (and in an unobstructed seascape/ coastal view) landscape perception is not modified from the original; pipeline working strip presence is similar to that of one of the existing dirt roads (Figure 9-81).



Prepared by: ASPROFOS, 2021. Basecamap from Google Earth Pro. Construction of Aliveri's branch was completed in 2012.

Figure 9-80 DESFA's Aliveri Branch (lack of) landscape modification during operation (1).



Prepared by: ASPROFOS, 2021. Basecamap from Google Earth Pro. Construction of Aliveri's branch was completed in 2012.

Figure 9-81 DESFA's Aliveri Branch (lack of) landscape modification during operation (2).

The exact maintenance procedure and program is not currently available, it will be developed during commissioning phase. However, based on previous projects and experience, this does not include noise generating or landscape disturbing activities (e.g. excavation works, hydrotesting, construction activities, etc.).

No project-related vessels will be permanently present along the proposed offshore routes during normal operation of the pipeline. However, it may be necessary to impose temporary safety zones around survey vessels used during periodic inspections of the pipeline system. Inspections are expected to be carried out every one to two years during the first years of operation, with potential subsequent adjustments to the inspection frequency based on experience and requirements.

This temporary safety zone is not expected to interact with tourism activities, since it will be located in the deep waters, away from any sensitive receptor. In any case, proper scheduling of such activities can completely prevent possible nuisance (if any).

On the other hand, the presence of the offshore pipeline itself could attract diving tourists.

Based on the **above no impacts on tourism sector** are assessed during operation phase.

9.3.7.1.7 Summary

The summary of the impacts on the Local Economy during the operation phase is presented in the following table

Table 9-183 Summary of Impacts on Local/ Regional Economy during the Operation Phase

S/N SEI			SEI for	Local Economy							
Project phase	Operation										
Impact	Mechanism	Locations	Criteria/ Impact Properties							SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Employment opportunities (direct and indirect)	Workforce (direct employment)	• Population centres (cities or villages) close to temporary and permanent facilities • along the Pipeline Protection Strip	1.00	1.00	0.50	1.00	1.00	0.50	0.00	7.14 (Positive and Moderate)	Unemployment level is significant. Vulnerable groups are not affected. Direct employment will be limited. Indirect employment and capacity building will be much greater and more significant.
Economic impact of taxes, fees and local transactions	• Payment of taxes • Energy security	Greece, Europe	1.00	1.00	0.25	0.75	1.00	0.75	1.00	8,21 (Positive and Major)	A PCI project promoting energy security to Europe. In full alignment with national strategy and policies.

S/N SEI			SEI for	Local Economy							
Project phase	Operation										
Impact	Mechanism	Locations	Criteria/ Impact Properties							SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
	• Improve of country's brand name										
Economic impact on agricultural sector/ income	Establishment of safety/ control zones	Tree crops along the pipeline route	1.00	0.00	0.050	0.75	0.00	0.00	0.00	3.21 (Minor)	Annual crops and pastures suffer no impact whatsoever, as former activities are fully allowed. Tree crops are suffering only a small negative impact, from the restriction of one single planting row (conditionally that planting rows distance is greater than 4 m).
Economic impact on tourism sector/ income	-	• LF3, • LF4, • LF5	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00 (None)	No noise generating or landscape disturbing activities are foreseen during operation of the project. Nuisance from vessels for maintenance purposes offshore, will be

S/N SEI			SEI for	Local Economy							
Project phase	Operation										
Impact	Mechanism	Locations	Criteria/ Impact Properties							SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
											located away from sensitive receptors and can be scheduled so as to prevent any impacts. Permanent facilities are not located close to identified tourism businesses. As discussed in Section 9.3.2.1, landscape modification close to tourism sensitive receptors (i.e. the landfalls) is completely and fully reinstated in coastal areas; as documented by already constructed pipeline in Greece.

Prepared by: ASPROFOS, 2022.

9.3.7.2 Socio-economic Impact on Quality of Life/ Land Value

9.3.7.2.1 Overview – Quality of Life

Following what has already been discussed for economy and employment (Section 9.2.7.2 and 9.3.7.1), during construction and operation of the project there will be positive impacts on the quality of life of residents in the areas through which the pipeline is going to pass. This is because, on the one hand, there will be an increase in employment and on the other hand, because the project will boost and bring about other infrastructure projects, will enhance workforce capacity, and improve country's (and regions') investing *brand name*.

Key considerations are almost identical to the discussion held for Uses of Land (see Section 9.3.6.1.1, Table 1-40)

The main axes of the impact caused by the project or activities on the quality of life in terms of services are the following:

- Supporting the improvement of quality of life, through increase of local/ regional economy.
- Improving skills and competences by supporting education and training of local workforce (gained during construction phase).
- Improving environmental conditions, through potential use of natural gas as a fuel.

The positive impact on quality of life in terms of services provided is difficult to quantify. Consequently, the impacts are considered positive both during construction and operation phase.

As already mentioned, the construction of the Project will contribute millions of euros to the state through the payment of taxes throughout its operation and paves the way for more large-scale investments in the country. The implementation of such large and complex projects like the one at hand strengthens the confidence of investors in the prospects of Greece and helps to acquire know-how from cooperating Greek companies in various fields (construction, raw materials and services, transport, etc.).

In addition, the project is important for all four regions, as their role is upgraded in the energy map of South East Europe.

Finally, people in the wider area of the project will also benefit at a personal level since the pipeline will transfer natural gas - one of the cheapest, cleanest and more environmentally friendly energy sources - by developing the necessary infrastructure for local gas distribution networks to connect in the future, conditionally that proper network infrastructure shall be developed and naturally, adequate demand is evident.

The project under study is not expected to affect the unity of the urban fabric, since its basic infrastructure lies beneath ground's surface. Any pressures applied focus on the changes made in the residential areas' structure in direct vicinity with the project.

During operation phase, the structure and operation of the anthropogenic environment will be affected by restrictive conditions in terms of the minimum distance required for the construction of new residences and/or for determining the expansion limits of the residential areas.

9.3.7.2.2 Value of Land

During operation phase, the value of land will be affected by restrictions imposed as regards the minimum distance for the development of economic activities through the exploitation of farmland. In particular, the value of land is expected to be affected in areas of systematic arboriculture, since replanting of deep-rooted species is not allowed within a four (4)-meter protection zone on either side of the pipeline. Conversely, no changes in land value are expected in low vegetation areas, since all existing activities will continue throughout the area. In the case of woodland, shrubland and heathland, no change in land value is expected, mainly because they are state-owned and secondly because the economic output of activities in these areas (grazing, exploitation of forest products, etc.) is quite low per square kilometer.

The project can also have a positive impact on areas where commercial and industrial activities are being developed, increasing the land value in these areas. The presence of the pipeline gives the opportunity, where there is a strong commercial interest, for further development of the gas network. Nevertheless, this would be subject of other companies, not of IGI POSEIDON. Linking commercial and industrial facilities to the gas network will lead to a reduction of energy costs, environmental load and gas emissions, a relief of possible carbon dioxide costs, and improved product competitiveness.

This section is closely related to Section 9.2.6.1.1 – Uses of Land; analysis presented there, is not repeated. Indirect impacts on land uses are reflected to impacts on land value, as discussed in the corresponding section.

As mentioned in Section 9.3.6.1.1 – Uses of Land at operation phase three protection and safety zones are to be created around the project axis. As shown in Table 1-42, the three protection and safety zones do not include any areas classified as residential, therefore the areas expected to be affected by the operation of the project are areas used for agriculture and, in particular, areas of systematic arboriculture, since a part of land measuring four (4) meters around the pipeline cannot be used for these traditional economic activities. As for the other land uses within the project's impact area, no changes in land value are expected either because the project does not interrupt economic activities (areas of low or no vegetation) or because the existing land use is of no commercial value (forest areas, shrubs and heathlands). Exceptions are certain areas within the industrial and/or commercial zone; these areas may be positively or negatively affected depending on various factors.

Potential connection to the benefits of the project (alternative energy source, cost reduction, etc.) would have a positive impact on the land value. On the other hand, building restrictions may have a negative impact. Nevertheless, project footprint does not engage with areas identified of great development patterns.

In order to assess impact sensitivity, the categorization of land uses shown in Table 9-184 has been adopted. The calibration was based on the land value determined by the existing use. In particular, industrial, commercial and urban zones are specialized and organized business receptors with a host of accompanying infrastructures, which highly increases the value of land within these areas. The value of agricultural land was estimated taking into account the type of cultivation, with agricultures considered to be of greater value compared to seasonal crops and taking into account the value of mature trees. Non-farmland was considered to have a low sensitivity mainly due to its use for grazing and finally woodland was considered to be of zero sensitivity, as it does not have any direct economic activity.

Table 9-184 Assessment of the sensitivity of acquisition value by land use category during the operational phase.

Criteria	Description/Justification
Land value	• Industrial, commercial, urban zones: (**very high sensitivity**). • Areas of systematic arboriculture: (**high sensitivity**). • Open spaces of productive land with little or no vegetation: (**medium sensitivity**). • Open spaces of unproductive land with little or no vegetation: (**low sensitivity**). • Forests: (**zero sensitivity**).

Prepared by: ASPROFOS, 2022.

Based on the above and the criteria presented in Section 9.1, as specified in Section 9.2.6.1.1.1,

- Potential impact on land value for land uses, as induced by the Building Control Strip (i.e. the 40 m wide corridor which extends 20 m on each side of the pipeline axis where no buildings shall be allowed) for areas classified as:
  - “Industrial - commercial zones”, **SEI is considered as Minor**

- Open spaces of productive land with little or no vegetation", "Open spaces of unproductive land with little or no vegetation", "Areas of systematic arboriculture" or "Forested Areas (within or not protected areas)", **no impacts are assessed.**

9.3.7.3 Deriving Development Trends from the Project

This section is aimed to evaluate the impact on the wider planning of each region in relation to the project, i.e. if the project affects planning at socio-economic level.

The overall project of EastMed is included in the "Infrastructure projects of national and international interest" of the Road Map of the Natural Gas Market 2017-2022 (GG 59/B/2018) contributing to strengthening energy security by diversifying sources and routes of NG supply for the EU (East. Mediterranean and Middle East). Therefore, it was deemed appropriate in this chapter to evaluate the impact at National level as well.

In the following sections, an impact assessment is made whether the investigated project induces impacts (positive or negative) based on each region's planning, as well as at National level during the **construction** and **operation** phase.

In general, the impact assessment methodology described in Section 9.1 is followed.

Table 9-185 Key Issues for assessment - Deriving Development Trends from the Project

Sources of Impact/ Risk	• Operation of the project • Further capacity building of workforce and companies • Engagement of many economy sectors (infrastructures, construction, services) • Improvement of market "Brand Name"
Potentially Impacted Resources and Receptors	• Regions • Greece • Europe
Special Baseline Conditions that are Potentially Influencing Impacts/Risks	• Geographical location (Regions, Country) • Productive sectors of economy
Project Factors that are Potentially Influencing Impacts/Risks	• Natural Gas transportation (It is worth noting that positive environmental impacts are caused by the replacement of other fossil fuels by natural gas). • The transboundary character of the project at operation phase is very important; the role of Greece in the wider Balkan region, as well as Europe, is expected to be upgraded.
References	• Baseline Information,

	➢ Regional planning is discussed in Sections 5.2 and 8.6. ➢ Trends in environmental developments (without the project - Section 8.16) • Goals and Objectives of EastMed Project are discussed in Chapter 4 • Compatibility of the Project with Institutionalised Spatial or Urban Commitments is discussed in Chapter 5.

Prepared by: ASPROFOS, 2022

9.3.7.3.1 Methodology Overview

Any Project impacts will be positive, since Greece is going to be upgraded in all Strategic Sectors targeted. A qualitative assessment is provided based on the available Regional Framework for Spatial Planning and Sustainable Development of the engaged Regions (i.e. Crete, Peloponnese, Western Greece and Epirus) (see Section 5.2).

Given that, most of the assessment criteria are identical for all investigated spatial units; these are presented in the summary section (9.3.7.3.7), once.

9.3.7.3.2 National Level

According to paragraph 8.16.1, the National Energy and Climate Plan (NPEC) is a Strategic Plan for the Greek Government, for the achievement of specific Energy and Climate Objectives by the year 2030. The strategic aim is that the energy and climate targets set by the NPEC by 2030 should contribute decisively to the necessary energy transition in the most economically competitive way for the national economy, achieve a drastic reduction of greenhouse gas emissions and ultimately make Greece one of the Member States that will have adopted ambitious climate and energy objectives, through a comprehensive and coherent program of measures and policies.

Positive environmental impacts are induced by the replacement of other fossil fuels by natural gas. A target served by the project under consideration in conjunction with the withdrawal of lignite power plants by 2028. In particular, natural gas is expected to be the intermediate fuel for the transition to a low-emission model of greenhouse gases in all final consumption sectors, while at the same time it may lead to both an improvement in energy efficiency and a lower energy cost compared to other conventional technologies (Government Gazette B΄4893, 2019).

As presented in Chapter 4, the Project meets a number of developmental, environmental and social criteria that support its implementation. The most important ones are listed below:

- Enhance competition in the energy market by providing access to additional new sources;

- Enhance EU security of supply;
- Support the transitory phase, from coal (or oil) to renewable sources using sources, as natural gas, that are less polluting but still capable of guaranteeing the power supply demand covering energy production peaks;
- Provide a new energy corridor to sustain and encourage the South-East Europe and east Mediterranean region's transition towards a sustainable and efficient energy transmission network, supporting the development of hydrogen production plants as well.

The benefits on Local, Regional and National level, resulting from implementing the Project at national and regional levels, as presented in Chapter 4, are listed below:

- Contributes to the emergence of Greece as a key player in European energy market;
- Provides a competitive gas supply source for EU markets, including Greek one, that allows reduction of energy costs;
- Facilitates economic growth as well as increasing competition in the gas market;
- Enhances security of supply at the European regional levels;
- Create direct, indirect and induced economic effects during its development, construction and operation phases;
- Opens a new energy corridor for Greece that can cover future and additional sources as well as future accommodation of increased quantities of hydrogen;
- Facilitates the reduction of greenhouse gas emissions; and
- Contributes to development of natural gas resources within the EU or in neighbouring countries (Israel), thus reducing Europe's dependence on third countries.

9.3.7.3.3 Region of Crete

According to Section 8.16.1, Crete is the largest island in Greece and the second largest in the Eastern Mediterranean after Cyprus, and over time has been a gateway for the country and the European Union to the Eastern Mediterranean. The geographical location of the island, as well as the recent announcement of "plots" for exploration of hydrocarbons by the Hellenic Hydrocarbon Resources Management SA. (HHRM SA) in the wider region southwest and west of Crete confirms and reinforces this timeless conclusion.

This project will boost other infrastructure projects and highlight the role Crete can play as an energy hub in Greece. It is worth noting that, given the proximity of the project sites in Crete and the PPC power plant, the replacement of the fossil fuel currently used by this unit (fuel oil) with natural gas is feasible and will have a direct positive impact on the area given the environmental advantages of natural gas in relation to fuel oil.

It is clarified that the presence of the Crete facilities (CS2/MS2-CS2/MS2 N) allows for supply of natural gas to the local market, conditionally that adequate demand is raised.

9.3.7.3.4 Region of Peloponnese

According to Section 8.16.1, significant energy projects have been or are currently in progress at either design or construction level. The transfer of natural gas to the center of the Peloponnese and the operation of the 5th Natural Gas Unit of Megalopolis with the simultaneous prospect of transferring the natural gas network to urban and rural areas for domestic and industrial use give new opportunities for sustainable development and the creation of new jobs.

As described in Chapter 5 (Section 5.2.3.4), in harmonization with the forecasts of the National Plan for Energy and Climate (ESEK) (Government Gazette B '4893 /31.12.2019) the preparation of a Fair Development Transition Plan (SDAM) is already in progress, provisioning (among many others) the development/enhancement of local district heating infrastructure and the target of zero lignite share in electricity generation by 2028.

Based on the Updated Master Plan of Fair Development Transition of Lignite Areas[75], along with private sector investment, proposals and plans are being drawn up for the implementation of an extensive public works program, with projects including, inter alia, the introduction of natural gas and the development of networks, the strengthening of district heating infrastructure, etc.

It is clarified, that the presence of the Megalopoli facilities (MS4/PRS4 & Heating Station) allows for supply of natural gas to the local market conditionally that adequate demand is raised.

Based on the above, not only is the investigated project compatible with Megalopoli's SDAM, it is an additional big investment that along with other projects in the area may built on each other development activity, in transitioning Megalopoli's economy (and the broader area of the R. of Peloponnese) to the objectives of regional planning.

As a result, the region's plans are not impacted by the Project. Any impacts can be considered as being positive for Peloponnese further plans.

[75] https://sdam.gr

9.3.7.3.5 Region of Western Greece

According to Section 8.16.1, the Region of Western Greece is the gateway of Greece to Western Europe and holds an important geostrategic position. It is connected to major urban centers such as Athens and Ioannina through the new Olympia and Ionia motorways. Any impacts that may arise will only be positive considering that the pipeline is an energy project that could activate and boost the entire Region of Western Greece.

It is clarified that the presence of the Achaia facilities (CS3) allows for supply of natural gas to the local market, conditionally that adequate demand is raised.

9.3.7.3.6 Region of Epirus

According to Section 8.16.1, despite the peculiarities of the region and the lack of high-level infrastructure, tourism is considered an important source of wealth for Epirus. The tourism industry is constantly growing, which is a great advantage for the development of the tertiary sector. The existence of hospitals and university institutions creates an adequate environment for providing a high level of services, in order to make the region a model center for health, education and research with a supranational scope. At the same time, through the creation of the road corridors (Egnatia Odos, Ionia Odos) of the international ports (Igoumenitsa, Preveza) and the airports (Ioannina, Aktio) it is possible to strengthen trade since Epirus is a gateway to Greece Western Europe due to its geographical location.

Any impacts will be positive, since Epirus is going to be upgraded in all Strategic Sectors targeted. Tourism will not be affected since the project does not pass through Epirus tourist and cultural resorts.

It is clarified that EastMed Pipeline Project is connected with the Poseidon Pipeline Project, at PPP's Florovouni Facilities[76], before they both combine and allow transportation of their product to Italy and the rest of Europe. As such, R. of Epirus might be supplied with natural gas conditionally that adequate demand is raised.

[76] Offshore and Onshore Poseidon Pipeline Projects (PPP) have been acquired Environmental Terms Approval in 2015 and 2018, respectively. For more information please visit www.igi-poseidon.com

9.3.7.3.7 Summary

Taking into account the considerations discussed, and following the assessment criteria presented in Section 9.1, the deriving development trends from the implementation of the project can be assessed as follows:

The *Likelihood* for the impact is considered *certain*, for the National level and for the Region of Peloponnese. Specifically for the Regions of Crete, W. Greece and Epirus, although it is almost certain that the project will have a positive impact on the development trends, adopting a conservative approach, likelihood is considered *likely*.

The *Extent* is deemed as *Peripheral*, by definition of the impact (regional development trends).

The *Intensity* of the impact is linked to the contribution of the investigated project to the identified development trends and also capacity building (either in terms of education/ skills building or improvement of the “brand name” of a specific region of country. For National level, and for the R. of Peloponnese, the identified development goals are in full alignment with the investigated project; as such, for these, intensity is considered *very high.* For the rest of the engaged Regions, adopting a conservative approach, intensity is considered *medium,* given the lack of a directly related trend identified.

With regard to the *duration* of the development trends once set, are difficult to be modified (at least not because of the presence and routine operation of the project); on the contrary, they are expected to be positively affected for ever, at least for some time after the decommission of the project. Therefore, the duration of the impact is *permanent*.

With regard to *reversibility*, as with duration, the positive impact on the development trends of a region (or country) as induced by the implementation of a project is not reasonable to be reversed. As such, impact on development trends is considered to be *irreversible* (positively) (see Chapter 10).

Regarding *cumulative* action, taking into consideration the data presented before, it is the same as likelihood (for the National level and R. of Peloponnese, *certain*; for R. of Crete, W. Greece and Epirus, *likely*)

Transboundary character is deemed *certain*, for National level. For Regional level, the transboundary character is assessed as *impossible* (although this is a very conservative approach because, development of a Region, usually is interconnected/ interacting with other parts of the country and/ or other countries; but this lays way outside the scope of an ESIA.

Based on the above and the criteria presented in Section 9.1, impacts during the construction and operation of the project on development trends of:

- National level**, SEI is considered as Extreme (positive)**.
- Region of Peloponnese level**, SEI is considered as Major (positive)**.
- Region of Crete, Western Greece and Epirus level**, SEI is considered as Moderate (positive)**.

Section 10.3.7 presents the proposed mitigation and management measures applicable to the impact.

The summary of the impacts on the Development Trends induced by the project is presented in the following table.

Table 9-186 Summary of Impacts on the Development Trends.

S/N SEI			SEI for	Development Trends								
Project phase	Operation											
Impact	Mechanism	Locations	Criteria/ Impact Properties								SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)			
Development Trends at National Level	• Construction and operation of the project • Capacity building of workforce and companies • Engagement of various economy sectors • Improvement of country's "Brand Name" • Alignment with national goals	• Greece • Europe	1.00	1.00	1.00	1.00	1.00	1.00	1.00		10 (Possitive/ Extreme)	• Enhance EU security of supply and Support Green Deal; • Contributes to the emergence of Greece as a key player in European energy market; • Supports national goals for reduction of greenhouse gas emissions (ESEK) • Facilitates economic growth • Create direct, indirect and induced economic effects;
Development Trends at Regional Level	• Construction and operation of the project • Capacity building of workforce and companies	Peloponnese	1.00	1.00	1.00	1.00	1.00	1.00	0.00		8.57 (Possitive/ Major)	In full alignement with regional planning and the SDAM.

S/N SEI			SEI for	Development Trends							
Project phase	Operation										
Impact	Mechanism	Locations	Criteria/ Impact Properties							SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
	• Engagement of many economy sectors (infrastructures, construction, services) • Improvement of region's "Brand Name" • Alignment with national goals	• Crete • W. Greece • Epirus	0.5	1.00	0.50	1.00	1.00	0.50	0.00	6.43 (Possitive/ Moderate)	In alignement with regional planning.

Prepared by: ASPROFOS, 2022.

9.3.8 Technical Infrastructure

9.3.8.1 Land, Sea and Air Transportation

The following paragraphs analyze impact in land, sea, and air transport infrastructure during operation. Key issues are outlined in the table below.

Table 9-187 Key Issues for Assessment – Land, Sea and Air Transportation

Impact/Risk Sources	• Road movement of personnel vehicles for pipeline operation and maintenance • Marine conditions at cable crossings
Potentially Impacted Resources and Receptors	• Road infrastructure • Submarine cables
Special Baseline Conditions that are Potentially Influencing Impacts/Risks	-
Project Factors that are Potentially Influencing Impacts/Risks	-
References	Section 8.8.1.1.1 refers to road network in project area.

Prepared by ASPROFOS, 2022

9.3.8.1.1 Road Network

During project operation, personnel cars and vehicles used for pipeline operation and maintenance will also be on the road network. This traffic will be limited and it will not include any heavy-duty vehicles; it is, therefore, not expected to cause any significant impact.

For employees to access facilities sites, motorways and the primary road network will be used. Line valve stations are not manned and therefore will not affect local traffic except in maintenance or emergency situations.

Impact on road network is _Rare_ to occur and its *Extent* is expected to be _Small_. Impact *Intensity* is characterized as _Zero_. *Duration* is characterized as _Long-term_. In terms of *Reversibility*, the impact is _Avoidable_. Impact *Cumulative Action* is _Rare_. *Transboundary Character* is not taken into account. The SEI is negligible.

9.3.8.1.2 Railroad Network

Regular pipeline operation will have no impact on railway infrastructure operation.

9.3.8.1.3 Airport Facilities

Pipeline operation will have no impact on local airport facilities.

9.3.8.1.4 Port Facilities, Marine Traffic and Submarine Cables

- Cables:

During operation, the pipeline will be a passive element located on the seabed. As long as technical solutions for the crossings are well established and implemented during construction, no impacts are expected. However, a crossing present in the area has potential to hinder possible repairs of existing cables at that specific crossing point, but this would still be a very rare situation.

Impact on port facilities, marine traffic and submarine cables is ***Rare*** to occur and its *Extent* is expected to be ***Small***. Impact *Intensity* is characterized as ***Zero***. *Duration* is characterized as ***Long-term***. In terms of *Reversibility*, the impact is ***Avoidable***. impact *Cumulative Action* is ***Rare***. *Transboundary Character* is not taken into account. The SEI is negligible.

9.3.8.2 Environmental Infrastructure Systems

Very low impact on environmental infrastructure systems is expected during regular operation.

Table 9-188 Key Issues for Assessment – Environmental Infrastructure Systems

Impact/Risk Sources	• Wastewater generation by machinery washing and equipment maintenance. Oily wastewater produced by compressor station operations. Sanitary wastewater generated by station personnel. • Solid waste generation by works and workers along the route
Potentially Impacted Resources and Receptors	• Local wastewater treatment plants and landfills
Special Baseline Conditions that are Potentially Influencing Impacts/Risks	-
Project Factors that are Potentially Influencing Impacts/Risks	-
References	Section 8.8.2 states wastewater treatment plants and solid waste management facilities within the project area.

Prepared by (ASPROFOS, 2021)

9.3.8.2.1 Wastewater Treatment

9.3.8.2.1.1 Onshore

Typical pipeline operation does not produce any wastewater. Limited amount of wastewater could be produced by machinery washing and equipment maintenance. Sanitary waste, oily water, detergents and lubricants for disposal result from regular operation in compressor stations. These are locally limited to compressor station sites.

Impact on wastewater treatment facilities is *Rare* to occur and its *Extent* is expected to be *Small*. Impact *intensity* characterized as *Zero*. *Duration* is characterized as *Long-term*. In terms of *Reversibility*, the impact is *Avoidable*. Impact *Cumulative Action* is *Rare*. *Transboundary Character* is not taken into account. The SEI is negligible.

9.3.8.2.2 Sanitary Landfill Sites

9.3.8.2.2.1 Onshore

Limited solid waste will be produced by regular pipeline operation, maintenance works and employees along the route.

Therefore, the impact on sanitary landfill sites is *Rare* to occur and its *Extent* is expected to be *Small*. Impact *Intensity* is characterized as *Zero*. *Duration* is characterized as *Long-term*. In terms of *Reversibility*, the impact is *Avoidable*. Impact *Cumulative Action* is *Rare*. *Transboundary Character* is not taken into account. The SEI is negligible.

9.3.8.2.2.2 Offshore

Project operation is expected to produce minimum solid waste; therefore, impact is considered to be zero.

9.3.8.3 Water, Electricity and Telecommunication Networks

Almost no impact on water, electricity and telecommunications networks is expected during regular operation.

Table 9-189 Key Issues for Assessment – Water, Electricity and Telecommunications Networks

Impact/Risk Sources	EastMed Pipeline operation contributes to the construction of an energy network at the eastern Mediterranean region.
Potentially Impacted Resources and Receptors	Consumers in Greece, Balkans and Europe
Special Baseline Conditions that are Potentially Influencing Impacts/Risks	EastMed pipeline operation is closely related to Poseidon Pipeline operation, as the route ends in Florovouni Compressor Station.
Project Factors that are Potentially Influencing Impacts/Risks	-
References	Section 8.8.1.1.5 outlines projects involving high-pressure natural gas pipelines near the project area.

Prepared by ASPROFOS, 2022

9.3.8.3.1 Watering and Irrigation Network

No interruptions of regular operation of utility networks is expected; therefore, impact is considered as zero.

9.3.8.3.2 Electricity Transmission System

No impact from pipeline operation is expected.

9.3.8.3.3 Telephone Networks

No impact from pipeline operation is expected.

9.3.8.3.4 Renewable Energy Sources

No impact from pipeline operation is expected.

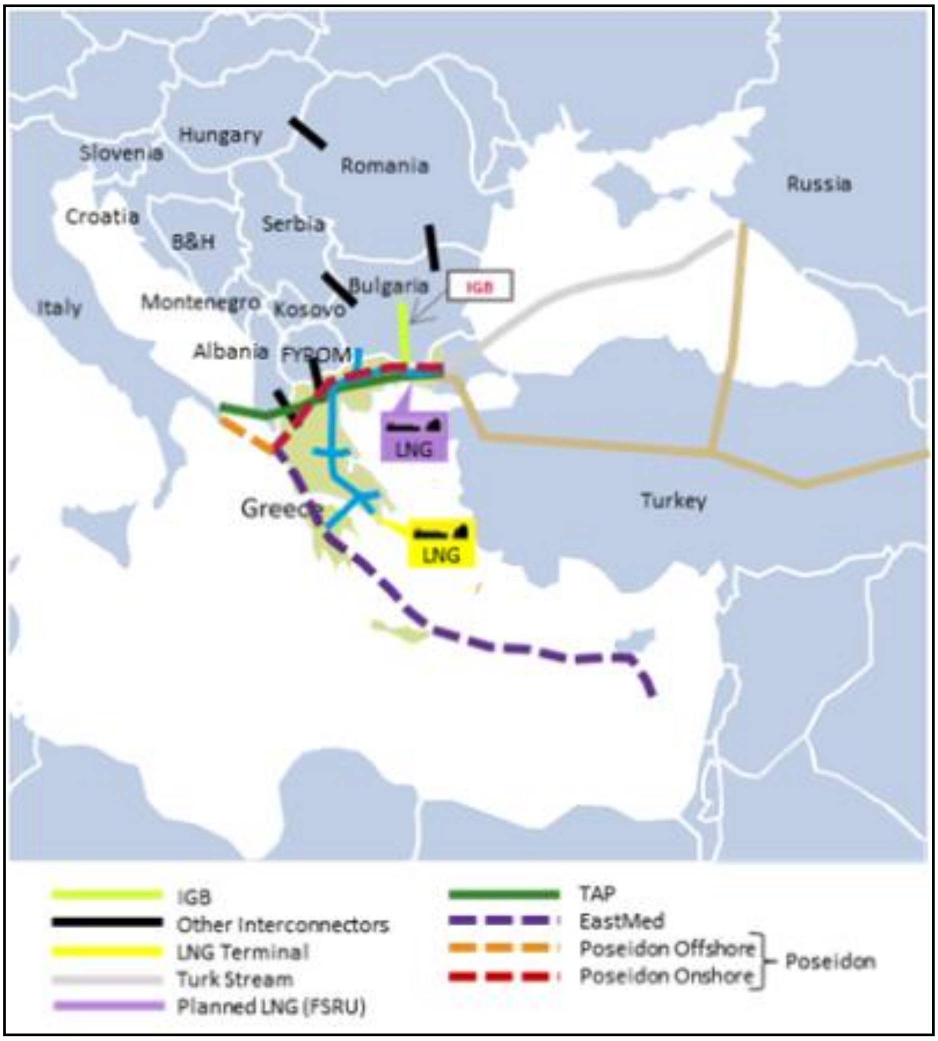
9.3.8.3.5 High Pressure Natural Gas Pipelines

The EastMed pipeline route will end at the IGI Poseidon compressor station in Florovouni, Thesprotia; therefore, operation of both pipelines is closely related.

EastMed Megalopoli branch will provide Megalopoli Power Generation Unit with high pressure natural gas.

This whole high-pressure pipeline network consisting of EastMed pipeline, Poseidon pipeline and DESFA pipeline, creates an extended gas transmission network for connection and transmission to Balkans and Europe.

Impact on high pressure natural gas pipeline projects is _Certain_ to occur and its *Extent* is expected to be _Peripheral_. Impact *Intensity* is characterized as _High_. *Duration* is characterized as _Long-term_. In terms of *Reversibility*, impact is *Irreversible*. Impact *Cumulative Action* is _Probable_. *Transboundary Character* is _Certain_. However, it is emphasized that this is a _positive impact_. The SEI is major.



Source: www.depa.gr, accessed on 9/12/2021.

Figure 9-82 Energy Projects in Greece.

9.3.8.4 Impact Summary on Technical Infrastructures

Table 9-190 Summary of Impacts for Technical Infrastructure during Operation Phase

S/N SEI			SEI for	Technical Infrastructure						
Project phase	Operation									
Impact	Mechanism	Locations	Criteria/ Impact Properties						SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Road Network											
Limited Increasing traffic	Regular and maintenance works	Existing road network	0.25	0.00	0.00	0.75	0.25	0.25	0.00	2.14 (Negligible)	
Port Facilities, Marine Traffic and Submarine Cables											

S/N SEI			SEI for	Technical Infrastructure						
Project phase	Operation									
Impact	Mechanism	Locations	Criteria/ Impact Properties						SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Potential Damage of existing cables	Crossing including cables	Offshore route	0.25	0.00	0.00	0.75	0.25	0.25	0.00	2.14 (Negligible)	
Wastewater Treatment											
Wastewater generation	• Machinery washing • Equipment maintenance • Sanitary facilities • Local treatment facilities	Project stations	0.25	0.00	0.00	0.75	0.25	0.25	0.00	2.14 (Negligible)	
Sanitary Landfill Sites											
Solid waste generation	• Regular operation	Onshore route & stations	0.25	0.00	0.00	0.75	0.25	0.25	0.00	2.14 (Negligible)	

S/N SEI			SEI for	Technical Infrastructure							
Project phase	Operation										
Impact	Mechanism	Locations	Criteria/ Impact Properties							SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
	• Maintenance works • Solid waste by employees										
High Pressure Natural Gas Pipelines											
Positive impact in national energy infrastructure such as Poseidon Pipeline and PPC Powerplant in Megalopoli	• Connection with Poseidon Pipeline • Connection with PPC Powerplant	• Florovouni, RU of Thesprotia • Megalopoli	1.00	1.00	0.75	0.75	1.00	0.75	1.00	8.93 (Major)	

Prepared by ASPROFOS, 2022.

9.3.9 Correlation to man-made pressures on the environment

9.3.9.1 Methodology Overview

Man-made pressures on the environment in the wider Project area have been recorded in Section 8.9 and can be categorized in the following sub-categories:

- Sources of Pollution or other Pressures on the Environment; and
- Exploitation of Natural Resources.

In short, the main source of impacts from the Project, is the clearance of vegetation of the pipeline protection zone and the permanent facilities during operation phase.

During operation of the Project, a Pipeline Protection Strip (PPS) of 8 m width shall be preserved (see Section 6.5.4.1 for more details), in which deep ploughing and planting deep-rooted trees will be forbidden. Additionally, at the locations of main stations and line valve stations the acquisition and change of land use will be permanent through the purchase of the respective plots of land. Apart from these, the rest of the project footprint will be reinstated to its former condition, as much as possible and the areas of the temporary facilities will be reinstated completely upon agreement with the landowners.

Table 9-191 presents the key sources (or mechanisms) of impact, the potentially impacted resources and (sensitive) receptors, the baseline and Project influencing factors associated with the Project on the characteristics of the man made pressures.

Table 9-191 Key Considerations for Assessment – Man made pressure Characteristics.

Sources of Impact/ Risk	• Permanent pipeline protection strip or PPS (8 m wide) cleared: ➢ Permanent land take • Permanent, above ground, project structures: ➢ Permanent land take
Potentially Impacted Resources and Receptors	• For the permanent pipeline protection strip or PPS (8 m wide) cleared: • Land owners • For the permanent, above ground, project structures: • Land owners
Particular Baseline Conditions that are Potentially Influencing Impacts/Risks	• Characteristics of sensitive receptors (olive trees, vineyards etc.) • Statutory protection of affected areas (eg Natura sites)

Project Factors that are Potentially Influencing Impacts/Risks	• The following factors of the project correlate with the deforestation of forest areas: ➢ Vegetation clearance and formation of working zone ▪ Erection of temporary or permanent facilities; ▪ Reinstatement activities of trench, working strip and temporary facilities plots. ➢ Location of project's construction supporting temporary facilities (pipeyards, construction sites) ➢ Construction schedule (duration and season/ timing) ➢ Width of Pipeline Protection Strip
References	• Baseline is provided in Section 8.9 • Mitigation Measures are provided in Section 10.9

Prepared by: ASPROFOS, 2022.

9.3.9.2 Sources of Pollution or other Pressures on the Environment

9.3.9.2.1 Industrial Areas

Promoting the use of natural gas in the industry has a positive impact on the environment compared to the use of lignite or other fossil fuels. According to the current design, the possibility of supplying gas to industrial areas through the EastMed pipeline via the Megalopolis's Branch line and the National Grid of DESFA has a direct and positive impact, with long-term perspective. The mechanisms and impacting parameters are analyzed in Section 9.2.8.

9.3.9.2.2 Fishing Activities

During regular operation of the Project no correlation is expected.

9.3.9.3 Exploitation of Natural Resources

9.3.9.3.1 Quarries of Aggregates

During regular operation of the Project no correlation is expected.

9.3.9.3.2 Forest Areas

After installing the pipeline, part of the work area is restored, while the right of way it will remain empty and used as fire protection zone. This results in the permanent loss of vegetation within this zone.

The mechanisms and impacting parameters and the Affected Receptors are analyzed in sections 9.2.4 and 9.3.4.

9.3.9.3.3 Water Resources

The regular operation of the project is not expected to impact water resources, because the waste water produced by operation and maintenance processes will be disposed of after treatment in accordance with applicable legislation. A further impact analysis on surface waters is given in Sections 9.3.13 & 9.3.15.

9.3.9.3.4 Agricultural Crops

As already mentioned, only RU Arta has emerged where more than 70% of the study area is occupied by agricultural land, as analyzed in Section 8.9.2.4.

Once the pipeline has been installed, a permanent 8m-wide pipeline protection zone is to be preserved (see Section 6.5.4.1 for more details), in which deep ploughing and planting deep-rooted trees will be forbidden. Clearing the work zone at construction phase will cause a temporary loss of agricultural production and a need for restoration.

The compulsory cultivation of seasonal crops over the protection zone may, in some cases, cause permanent loss of deep-rooted crops. However, given their limited extent along the pipeline and the payment of compensation, the impact is judged to be small.

At the locations of compressor stations, metering stations and line valve stations, which are mostly found on farmland, the acquisition and change of land use will be permanent through the purchase of the respective plots of land. The impact on agricultural production in these locations will be permanent, however they are considered to be small due to their limited extent.

The mechanisms and impacting parameters and the Affected Receptors are analyzed in sections 9.2.7 and 9.3.7.

9.3.10 Air Quality

9.3.10.1 Methodology Overview

This section assesses and evaluates the possible effects on air quality as a result of the Project's activities, consisting of the operation of the natural gas pipeline and associated facilities (Compressor).

Table 9-192 outlines the main sources of impact, potential impacted resources and receptors as well as the factors influencing the current situation and those related to the Project.

Table 9-192 Key Issues for assessment – Air Quality

Sources of Impact/ Risk	• Emissions from Compressor Stations. During operation, the compressor station facilities emit air pollutants as a result of the combustion of natural gas that drives the compressor units. The emissions mainly consist of nitrogen dioxide (NO_2), carbon monoxide (CO), volatile organic compounds (VOC), particulate matter less than 10 micrometers in diameter (PM_{10}), sulphur dioxide (SO_2), and hazardous air pollutants (HAPs). Mainly increase in NOx and CO emissions is presented from the use of IC engines (Compressor Stations CS2/MS2-CS2/MS2N, CS3). The effect of increasing CO_2 emissions is reported in subsection 2.3.1 of this study.
Potentially Impacted Resources and Receptors	• Nearby settlements from Compressor Stations CS2/MS2-CS2/MS2N, CS3 • Natural Environment • Alongside the pipeline during inspection and maintenance works
Special Baseline Conditions that are Potentially Influencing Impacts/Risks	The PPC plant in Atherinolakkos is close to the CS2/MS2-CS2/MS2N Compressor Stations.
Project Factors that are Potentially Influencing Impacts/Risks	• Project Compressor Stations (CS2/MS2-CS2/MS2N, CS3) • Inspecting the offshore pipeline using vessels
References	Chapter 6 analyzes the amount of CO_2 emissions. Associated climatic and bioclimatic impacts are analyzed in section 9.2.2 where the CO_2 emissions of the Project are described., Annex 9.A.1 and Annex 9.A.2 where air dispersion models for Atherinolakkos and Achaia areas are presented.

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In the following paragraphs, a description and assessment of potential impacts from operation of the project is made.

9.3.10.2 Emissions from Compressor Stations

The key air emissions during operations will be produced from Compressor Stations CS2/MS2-CS2/MS2N, at Atherinolakkos area and CS3 at Achaia area.

For this reason air dispersion models was executed, for Atherinolakkos and Achaia areas. The scope of the models is to investigate the impact of the dispersion of Nitrogen Oxides (NO_x) and Carbon Monoxide (CO) on the atmospheric quality from the future installation of the gas Compression Stations (CS3), in the area of Achaia and in Atherinilakkos (CS2 and CS2N), aimed at providing additional compression required in the Natural Gas transmission system of the EastMed pipeline. During the operation of the onshore installation of the pipeline, pollutant gases are emitted to the atmosphere as a result of the combustion of natural gas in the Compression Stations through Gas Turbines (GT) according to the standard of the European Association for the Streamlining of Energy Exchange – gas (EASEE-gas). Consequently, emissions of particulate matter (PM) and sulfur dioxide (SO_2) are negligible. According to the European Best available techniques Reference document (BREFs) developed under the IPPC Directive for large combustion installations, CO and NO_x are the only gas pollutants emitted that should be taken into account in air dispersion modelling studies.

For the 10 BSCM/year case the Compressor Station CS2N will be equipped with 3 gas turbines with a total installed power of 75.6 MW (3* 25.2MW)

Simultaneously for 11BSCM/year case, the Compressor Station CS2 installed at the same plot with CS2N will be equipped with 3+1 gas turbines with a total installed power of CS2 100.8 ~ 101MW {(3+1) * 25.2 MW}. The one turbine with installed power 25.2 MW is spare, idle as backup.

For the 20 BSCM/year case the Compressor Station CS3 will be equipped with 3+1 gas turbines with a total installed power of 70MW ((3+1) * 17.5) The one turbine with installed power 17.5 MW is spare, idle as backup.

Air – emission modeling was carried out for the three Compressor Stations, so for the most conservative case of 20 BSCM/year capacity transportation.

<u>Atherinolakkos (CS2/MS2-CS2/MS2N)</u>

At Atherinilakkos area for the CS2 and CS2N a modelling was performing as one Station for their operation phase only.

It was also assumed that CS2 and CS2N would be running at 8,585 hr / yr. The model includes the assessment of the effects of gas emissions on the quality of the atmosphere taking into account the case of emissions of the stations, which will come from a total of six (6) gas turbines.

During the operation phase, each Compressor Station will be the only potentially relevant emission source. The ambient concentrations of NO_x and CO were not considered in the modelling study as the field measurements in the area surrounding the industrial field were found to be significant low and negligible for a meaningful assessment.

The model and additional information on the emission scenario are provided in Annex 9A1.

Achaia (CS3)

At Achaia area for the CS3 an air dispersion modelling was performed for operation phase only.

It was also assumed that CS3 would be running at 8,585 hr / yr. The model includes the assessment of the effects of gas emissions on the quality of the atmosphere taking into account the case of emissions of the station, which will come from a total of three (3) gas turbines.

During the operation phase, each Compressor Station will be the only potentially relevant emission source. Specifically the background concentrations of NO_x and CO were not considered in the modelling study as the field measurements in the Achaia area of the CS3 were found to be negligible for a meaningful assessment.

The model and additional information on the emission scenario are provided in Annex 9A2.

Based in Annexes 9.A1 and 9.A2. Table 9-193 presents the impact from the emissions from Compressor Stations of the EastMed Pipeline Project, including the impact inducing mechanism and potential receptors/resources.

Table 9-193 Impacts from Compressor Stations' Emissions - Impact mechanism-Potential receptors/resources during the Operation Phase

Impact	Impact mechanisms	Potential receptors / resources
Emissions from Compressor Stations	Operation of Compressor Stations	Nearby settlements from Compressor Stations CS2/MS2-CS2/MS2N (distance 0-8 Km) • Ag. Triada (3.77Km) • Goudouras (2.56Km) • Perivolakia (7.57Km) • Ziros (7.83 Km) Nearby settlements from Compressor Station CS3 (distance 0-8Km) • Kalivakia(1.99Km) • Agrapidochori(3.33 Km) • AnoVelitses (3.01 Km) • Kandalos (3.43 Km) • Portes (3.12 Km) • Velanidi (4.97 Km)

Impact	Impact mechanisms	Potential receptors / resources
		• Dafni B (5.60 Km) • Latas (5.47 Km) • Michio (5.69 Km) • Mazaraki (6.82Km) • Kampos (7.10 Km) • Santomeri (7.59 Km) • Charavgi (7.87 Km) Natural Environment

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Affected Receptors Resources

The affected recipient from emissions from Compressor Stations are the following:

At the Atherinolakkos area, 2 settlements are located at a distance of less than 5 km, while 4 settlements are located at a distance of less than 8 km. The Maximum concentrations of NOx and CO are estimated for Goudouras settlement located at a distance 2.56 Km from the Future Compressor Stations CS2 and CS2N. Specifically hourly (mean) NOx concentration, estimated in Goudouras settlement is 8.59 μg/m^3 compared to limit 200 μg/m^3. Similarly the Annual average NOx concentration in Goudouras settlement is 0.21 μg/m^3 compared to 40 μg/m^3 and the maximum 8-h mean CO concentration is 12.99 μg/m^3 compared to limit 10,000 μg/m^3

The distance of 8 km was chosen because at this distance the emission effects of the Compression Stations are negligible.

At Table 9-194 the maximum calculated concentration values of NOx and CO from CS2 and CS2N, over the residential areas in the domain of Lasithi, for all Characteristics Weather Types, are presented.

Table 9-194 Maximum calculated concentration values of NOx and CO from CS2 and CS2N, over the residential areas in the domain of Lasithi, for all Characteristic Weather Types.

CS2 and CS2N					
Nu.	Place of residence	Distance from the centroid (km)	Maximum hourly (mean) NOX concentration (μg/m^3)	Annual average NOx concentration (μg/m^3)	Maximum 8-h mean CO concentration (μg/m^3)
			(limit200 μg/m^3)	(limit 40 μg/m^3)	(limit 10000 μg/m^3)
1	ACHLADI	18.93	0.27	0.01	0.38
2	AGIA FOTIA	20.84	0.00	0.00	0.00
3	AGIA TRIADA	3.77	0.00	0.00	0.00
4	AGIOS GEORGIOS	14.20	0.00	0.00	0.00
5	AGIOS SPIRIDONAS	12.56	0.34	0.00	0.42
6	AGIOS STEFANOS	16.02	0.00	0.00	0.00
7	AGKATHIA	24.59	0.00	0.00	0.00
8	ANALIPSI	13.71	0.00	0.00	0.00
9	ARMENI	8.12	0.00	0.00	0.00
10	AZOKERAMOS	17.62	0.00	0.00	0.07
11	CHAMEZI	21.13	0.29	0.00	0.46
12	CHANDRAS	8.78	0.17	0.00	0.04
13	CHOCHLAKIES	18.97	0.02	0.00	0.02
14	CHRICHOPIGI	19.54	0.00	0.00	0.00
15	EPANO EPISKOPI	15.05	0.00	0.00	0.02
16	EXO MOYLIANA	21.88	0.08	0.00	0.19
17	GOUDOURAS	2.56	8.59	0.21	12.99
18	KARIDI	14.73	0.00	0.00	0.00
19	KATO KRIA	16.13	0.00	0.00	0.00
20	KATO ZAKROS	15.85	0.21	0.00	0.18
21	KATSIDONI	13.60	0.00	0.00	0.00
22	KOUTSOURAS	16.57	0.23	0.00	0.07
23	LANGADA	20.36	0.00	0.00	0.00
24	LITHINES	10.64	0.56	0.00	0.39

CS2 and CS2N					
Nu.	Place of residence	Distance from the centroid (km)	Maximum hourly (mean) NOX concentration (μg/m^3)	Annual average NOx concentration (μg/m^3)	Maximum 8-h mean CO concentration (μg/m^3)
			(limit200 μg/m^3)	(limit 40 μg/m^3)	(limit 10000 μg/m^3)
25	MAKRIS GIALOS	14.59	0.08	0.00	0.07
26	MARONIA	15.66	0.00	0.00	0.00
27	MESA MOYLIANA	22.23	0.05	0.00	0.02
28	MIRSINI	24.11	0.04	0.00	0.05
29	MITATO	17.11	0.00	0.00	0.00
30	ORINO	21.09	0.00	0.00	0.00
31	PALAIKASTRO	23.99	0.00	0.00	0.00
32	PAPAGIANNADES	10.93	0.32	0.00	0.21
33	PERIVOLAKIA	7.57	0.22	0.00	0.17
34	PISOKEFALO	19.36	0.81	0.01	1.65
35	ROUSSA EKKLISIA	19.25	0.00	0.00	0.00
36	SFAKA	24.70	0.05	0.00	0.08
37	SIKIA	13.70	0.00	0.00	0.00
38	SITANOS	12.90	0.00	0.00	0.00
39	SITIA	22.62	0.62	0.01	1.57
40	SKOPI	20.61	0.17	0.00	0.27
41	STAVROCHORI	18.49	0.00	0.00	0.00
42	STAVROMENOS	17.01	0.20	0.00	0.05
43	TOURLOTI	24.21	0.04	0.00	0.06
44	XEROKAMPOS	10.01	0.59	0.02	0.75
45	ZAKROS	14.55	0.00	0.00	0.03
46	ZIROS	7.83	0.11	0.00	0.11

Prepared by the Environmental Research Laboratory (EREL) of the National Centre for Scientific Research “Demokritos” on behalf of ASPROFOS,2022

Regarding the Results of air dispersion model for CS2 and CS2N emissions, it must also be emphasised that no exceedances of the NO_2 and CO respective air quality limits were found over the populated settlements within a distance of approximately 25 km due to the emissions from the gas compressor stations. Conclusively, the modelling study yielded the following results:

- The maximum mean hourly NO_x concentration was found to be equal to ~13% of the air quality limit 200 μg/m^3
- The maximum annual NO_x concentration was found to be equal to 7% of the air quality limit 40 μg/m^3.
- The maximum 8-hour running mean CO concentration was found to be equal to 0.27% of the air quality limit of 10000 μg/m^3 .

Generally it can be concluded that the modelled NOx and CO concentrations from both compression stations (CS2 and CS2N), at the location of Lasithi, emitted from six identical gas turbines are very low and insignificant compared to the air quality limits of the legislation in force.

At the Achaia area, 6 settlements are located at a distance of less than 5 km, while 9 settlements are located at a distance of less than 8 km. The Maximum concentrations of NOx and CO are estimated for Kalivakia Settlement located at a distance 1.99 Km from the Future Compressor Station CS3. Specifically hourly (mean) NOx concentration, estimated in Kalivakia settlement is 1.88μg/m^3 compared to limit 200 μg/m^3. Similarly the Annual average NOx concentration in Kalivakia settlement is 0.13 μg/m^3 compared to limit 40 μg/m^3 and the maximum 8-h mean CO concentration is 1.31μg/m^3 compared to limit 10,000 μg/m^3.

At Table 9-195 the maximum calculated concentration values of NOx and CO from CS3, over the residential areas in the domain of Achaia, for all characteristics weather types, are presented

Table 9-195 Maximum calculated concentration values of NOx and CO from CS3, over the residential areas in the domain of Achaia, for all Characteristic Weather Types.

CS3					
Nu.	Place of residence	Distance from centroid (km)	Maximum hourly (mean) NOX concentration (μg/m3)	Annual average NOx concentration (μg/m^3)	Maximum 8-h mean CO concentration (μg/m3)
			(limit200 μg/m^3)	(limit 40 μg/m^3)	(limit 10000 μg/m^3)
1	ABRAMI	15.63	0.03	0.00	0.03
2	AGIA BARBARA	8.20	0.07	0.00	0.06

CS3					
Nu.	Place of residence	Distance from centroid (km)	Maximum hourly (mean) NOX concentration (μg/m3)	Annual average NOx concentration (μg/m^3)	Maximum 8-h mean CO concentration (μg/m3)
			(limit200 μg/m^3)	(limit 40 μg/m^3)	(limit 10000 μg/m^3)
3	AGIA MARINA	8.49	0.01	0.00	0.29
4	AGIA TRIADA	11.95	0.07	0.00	0.02
5	AGIOS ATHANASIOS	12.37	0.00	0.00	0.07
6	AGIOS CHARALAMBOS	12.34	0.13	0.00	0.33
7	AGIOS DIMITRIOS	11.88	0.10	0.00	0.09
8	AGIOS GEORGIOS	15.58	0.06	0.00	0.00
9	AGIOS ILIAS	8.79	0.05	0.00	0.07
10	AGIOS KONSTANTINOS	11.44	0.05	0.00	0.19
11	AGIOS NIKOLAOS	8.95	0.16	0.00	0.03
12	AGNANTA	13.71	0.07	0.00	0.01
13	AGRAPIDOCHORI	3.33	0.61	0.02	0.36
14	ANO VELITSES	3.01	0.23	0.01	0.17
15	ANTHON	11.72	0.05	0.00	0.02
16	ARLA	15.44	0.05	0.00	0.08
17	AVGI	8.53	0.12	0.00	0.07
18	BORSI	9.04	0.16	0.00	0.25
19	CHARAVGI	7.87	0.10	0.00	0.04
20	CHAVARI	16.27	0.01	0.00	0.03
21	CHIONA	17.04	0.05	0.00	0.03
22	DAFNI_A	12.05	0.01	0.00	0.05
23	DAFNI_B	5.60	0.11	0.00	0.33
24	DAFNIOTISA	11.97	0.04	0.00	0.04
25	EFIRA	8.04	0.23	0.00	0.10

CS3					
Nu.	Place of residence	Distance from centroid (km)	Maximum hourly (mean) NOX concentration (μg/m3)	Annual average NOx concentration (μg/m^3)	Maximum 8-h mean CO concentration (μg/m3)
			(limit200 μg/m^3)	(limit 40 μg/m^3)	(limit 10000 μg/m^3)
26	FLOKAS	14.32	0.13	0.00	0.09
27	GERAKI	19.45	0.02	0.00	0.04
28	ILIDA	14.35	0.03	0.00	0.10
29	INOI	9.84	0.09	0.00	0.03
30	KAGKADI	14.95	0.00	0.00	0.12
31	KAKOTARI	17.21	0.08	0.00	0.01
32	KALFAS	6.49	0.17	0.00	0.06
33	KALIVAKIA	1.99	1.88	0.13	1.31
34	KAMPOS	7.10	0.13	0.00	0.19
35	KANDALOS	3.43	0.58	0.01	0.75
36	KARIA	15.92	0.04	0.00	0.03
37	KARPETA	11.31	0.09	0.00	0.04
38	KEFALAIIKA	12.01	0.06	0.00	0.07
39	KENTRO	8.66	0.20	0.00	0.15
40	KERAMIDIA	10.94	0.05	0.00	0.06
41	KOUTSOCHERA	14.95	0.12	0.00	0.05
42	KRIONERO	13.76	0.06	0.00	0.04
43	LAGANAS	10.64	0.14	0.00	0.06
44	LATAS	5.47	0.28	0.01	0.13
45	LOUKAS	14.90	0.08	0.00	0.03
46	MANESI	13.37	0.14	0.00	0.04
47	MATARAGA	12.13	0.09	0.00	0.05
48	MAZARAKI	6.82	0.21	0.01	0.08
49	MELISSA	14.84	0.00	0.00	0.40
50	MICHIO	5.69	0.19	0.01	0.08
51	MITOPOLI	19.24	0.09	0.00	0.02
52	NEA MANOLADA	19.54	0.01	0.00	0.04

CS3					
Nu.	Place of residence	Distance from centroid (km)	Maximum hourly (mean) NOX concentration (μg/m3)	Annual average NOx concentration (μg/m^3)	Maximum 8-h mean CO concentration (μg/m3)
			(limit200 μg/m^3)	(limit 40 μg/m^3)	(limit 10000 μg/m^3)
53	NEAPOLI	14.73	0.02	0.00	0.46
54	NEOCHORI	11.08	0.01	0.00	0.03
55	NISI	12.30	0.00	0.00	0.23
56	PANOPOULOS	17.91	0.07	0.00	0.03
57	PERISTERI	14.62	0.04	0.00	0.01
58	PETAS	14.17	0.17	0.00	0.09
59	PIGADI	12.77	0.05	0.00	0.20
60	PIGADIA	11.95	0.02	0.00	0.03
61	PORTES	3.12	0.21	0.01	0.10
62	PRODROMOS	9.32	0.17	0.00	0.03
63	PSARI	17.21	0.01	0.00	0.15
64	RIOLOS	15.89	0.05	0.00	0.01
65	RODIA	13.38	0.07	0.00	0.04
66	ROUPAKIA	9.78	0.06	0.00	0.02
67	SANTOMERI	7.59	0.10	0.00	0.03
68	SIMIZA	12.65	0.02	0.00	0.15
69	SIMOPOULO	8.85	0.11	0.00	0.03
70	SKIADA	13.66	0.07	0.00	0.03
71	SKLIVA	10.50	0.09	0.00	0.02
72	SKOURAS	10.58	0.12	0.00	0.05
73	STAVRODROMI	12.39	0.04	0.00	0.03
74	TSAMEIKA	9.05	0.11	0.00	0.14
75	VELANIDI	4.97	0.22	0.01	0.20
76	VOULIAGMENI	11.71	0.10	0.00	0.06

Prepared by the Environmental Research Laboratory (EREL) of the National Centre for Scientific Research “Demokritos” on behalf of ASPROFOS,2022

Regarding the Results of air dispersion model for CS3 emissions, it must be emphasised that no exceedances of the NO_2 and CO respective air quality limits were found over the populated settlements within a distance of approximately 20 km due to the emissions from the CS3.

Conclusively, the modelling study yielded the following results:

- The maximum mean hourly NOx concentration was found to be equal to ~9.7% of the air quality limit of 200 μg/m^3 .
- The maximum annual NOx concentration was found to be equal to 8.3% of the air quality limit of 40 μg/m^3.
- The maximum 8-hour running mean CO concentration was found to be equal to 0.12% of the air quality limit of 10000 μg/m^3 .

Generally it can be deduced that the modelled NOx and CO concentrations from the compression station CS3, in the Achaia region, emitted from three identical gas turbines are very low and insignificant compared to the air quality limits of the legislation in force.

The effect on the natural environment of the emissions from the Compression Stations is insignificant, due to the very low values of NOx and CO concentrations, as well as to the lack of protected areas in the study area of the Compression Stations

The *Likelihood* of the occurrence of emissions from Compressor Stations is *Certain*, the *extent* of impact will present *Peripheral* (greater distance from 3000m from Project or resource footprint). The *intensity* of the impact on sensitive recipients is expected to be *low*. The *duration* of the impact is throughout the entire project's life so according to the proposed methodology it is characterized *Long-term*. The possibility of dealing with the impact (*Reversibility* of the impact) is considered possible and *minimized.* The *Cumulative Action* of the impact is *Certain* as the PPC plant in Atherinolakkos is close to the CS2/MS2-CS2/MS2N Compressor Stations. The *Transboundary Character* is *impossible*.

Based on the above and based on the criteria presented in the section 9.1 for emissions from Compressor Stations during the operation of the Project, the **SEI is considered as Moderate**, according to Table 9-196.

During operation at onshore section maintenance and inspection works is a possibility that they will appear. The effects are proportional to those presented during the construction phase.

9.3.10.3 Summary

The summary of the impacts on the air quality during the operation phase is presented in the following table.

Table 9-196 Summary of Impacts for the Air Quality during the Operation Phase

S/N SEI			SEI for	Air Quality							
Project phase	Operation										
Impact	Mechanism	Locations	Criteria/ Impact Properties							SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Emissions from Compressor Stations	Operation of Compressor Stations	<u>Nearby settlements from Compressor Stations CS2/MS2-CS2/MS2N (distance 0-8 Km)</u> • Ag. Triada (3.77Km) • Goudouras (2.56Km) • Perivolakia (7.57Km) • Ziros (7.83 Km) <u>Nearby settlements from Compressor Station CS3 (distance 0-8Km)</u> • Kalivakia(1.99Km) • Agrapidochori(3.33 Km) • AnoVelitses (3.01 Km) • Kandalos (3.43 Km) • Portes (3.12 Km) • Velanidi (4.97 Km) • Dafni B (5.60 Km) • Latas (5.47 Km) • Michio (5.69 Km)	1.00	10.75	0.25	0.75	0.75	1.00	0.00	6.43 moderate	

S/N SEI			SEI for	Air Quality							
Project phase	Operation										
Impact	Mechanism	Locations	Criteria/ Impact Properties							SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
		• Mazaraki (6.82Km) • Kampos (7.10 Km) • Santomeri (7.59 Km) • Charavgi (7.87 Km) <u>Natural Environment</u>									

Prepared by: (ASPROFOS 2022)

9.3.11 Acoustic Environment

9.3.11.1 Overview

This section assesses the impacts at nearby noise sensitive receptors in the onshore Study Area due to operation of the Compressors CS2 and CS2N in Atherinolakkos and CS3 in Achaia. Impacts on fauna, both terrestrial and marine, from noise emitted by the operation of the project are included in the relevant sections of the Natural Environment (Section 9.3.5).

The following Table 9-197 presents the key sources of impact, potentially impacted resources and receptors, baseline and Project influencing factors associated with the Project on the ambient acoustic environment.

Table 9-197 Key Considerations for Assessment –Acoustic Environment.

Sources of Impact/ Risk	• Operation Phase: noise from Compressor Stations
Potentially Impacted Resources and Receptors	• Nearby settlements and households. • Nearby industrial receptors
Special Baseline Conditions that are Potentially Influencing Impacts/Risks	• The ambient noise baseline monitored did not highlight specific criticalities in the study area because the pipeline route crosses mostly agricultural and undeveloped areas. • The ambient noise in the centers of the settlements near the proposed site for the construction of the 'Atherinolakkos' Compressor Stations is in the L_{DEN} = 55 – 60 dB(A) zone. The main noise source is the traffic noise from vehicles crossing the main road of each settlement. During nighttime the noise levels are in the L_night = 45 – 55 dB(A) zones. • The noise currently at the proposed site location (CS2/CS2N) is in the 55 – 60 dB(A) zone due to the noise from the adjacent factory from Public Power Company (PPC). • The ambient noise in the centers of the settlements near the proposed site for the construction of the 'Achaia' Compressor Station is in the L_{DEN} = 50 – 55 dB(A) zone. The main noise source is the traffic noise from vehicles crossing the main road of each village. During nighttime the noise levels are in the Lnight = 40 – 45 dB(A) zone.
Project Factors that are Potentially Influencing Impacts/Risks	• Compression Stations equipment
References	• Baseline is found in Section 8.11. • Annex 8C Noise baseline and propagation model reports for permanent facilities subject to IED Directive

	• Annex 8C.1 Baseline Noise Study and Propagation Model for Atherinolakkos Compressor Stations • Annex 8C.2 Baseline Noise Study and Propagation Mode for Achaia Compressor Station

Prepared by ASPROFOS, 2022.

- Impacts Generating Mechanisms as deriving from the project description

The operation of the pipeline will not be a significant source of noise itself. The Table 9-197 presents the key sources of impact, potentially impacted resources and receptors, baseline and Project influencing factors associated with the Project on the ambient acoustic environment.

- Sensitive Receptors identification

Following Table 9-198 presents the Sensitive Receptors of the Project concerning the acoustic environment.

Table 9-198 Sensitive Receptors.

Operation Phase
Nearby settlements and households from Compressor Stations
Nearby industrial receptors

Prepared by: ASPROFOS, 2022.

- Impacts Overview Table per mechanism

Following Table 9-199 presents the key potential impacts of the Project on the acoustic environment. Noise impacts on fauna are considered in Section 9.5.

Table 9-199 Key potential impacts of the Project on the acoustic environment

Operations Phase
Disturbance from Compressor Stations Noise Emissions (potential sleep disturbance or stress).

Prepared by: ASPROFOS, 2022.

9.3.11.2 Methodology

For the evaluation of impact intensity, the calibration was done according to the sensitivity of the human ear at different sound intensities. Classification of the intensity was made using the limits set by the World Health Organization (WHO) as a guide, in combination with the allowed noise limits set by the Technical Chamber of Greece (TCG) and the guidelines of the International Finance Corporation (IFC) for the management of environmental noise.

Table 9-200 shows analytically the categorization of intensity in detail for the purposes of this study.

Table 9-200 Evaluation of noise impact intensity during the operational phase

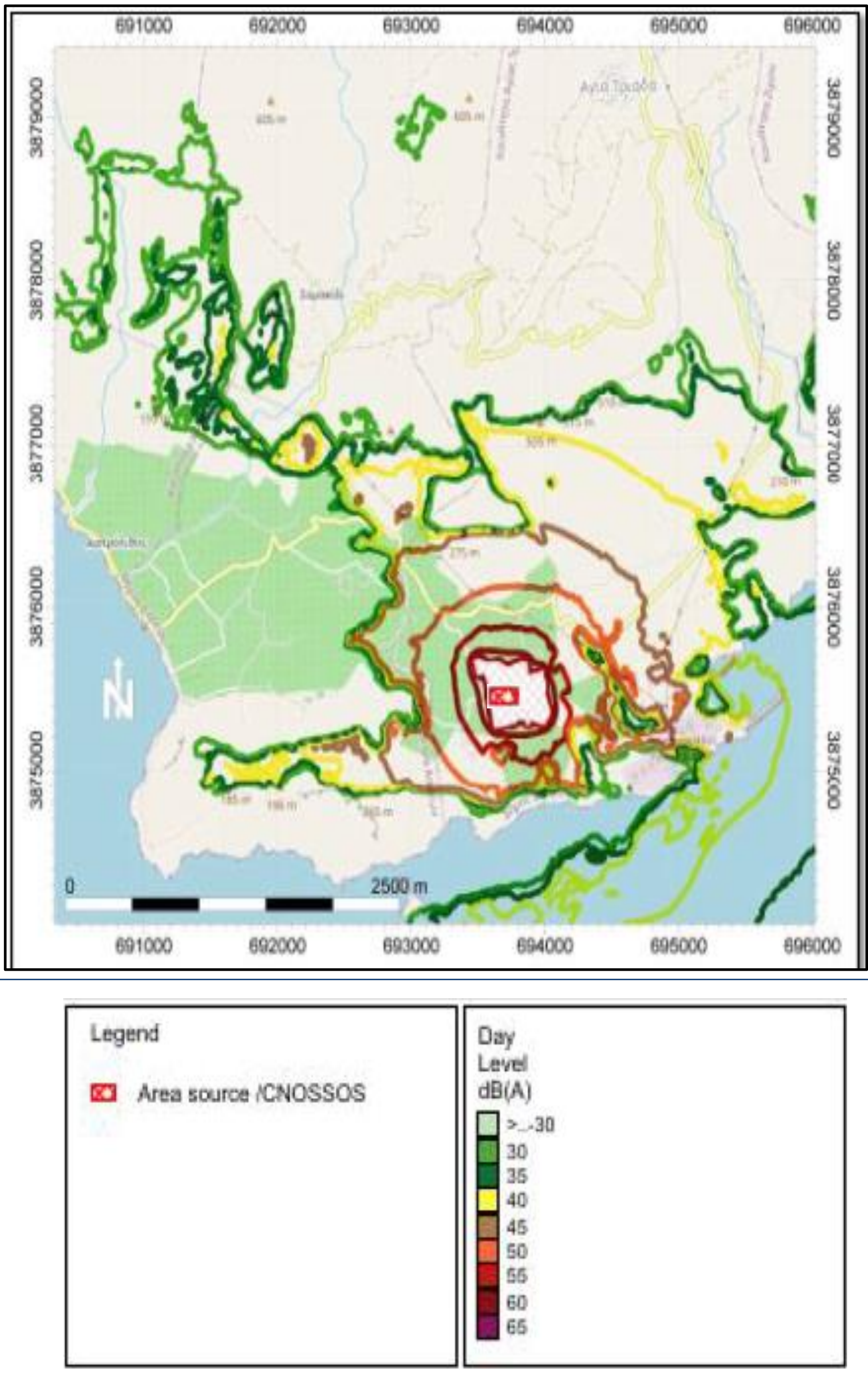
Criteria	Description / **Justification**
Noise intensity **(dB)**	• Very noisy situation: For the sound intensity ≥ 80 dB the effect on human health is considered to be intolerable (very high sensitivity). • Noisy situation: For the sound intensity <80 dB και ≥70 dB the impact on human health is estimated to have an effect on hearing (high sensitivity). • Annoyance: For the sound intensity <70 dB και ≥55 dB the impact on human health is estimated to severe discomfort (medium sensitivity). • Little annoyance: For the sound intensity <55 dB και ≥45 dB the impact on human health is estimated to be a minor disruption both during the day and during the night (low sensitivity). • No annoyance: For the sound intensity <45 dB the impact on human health is estimated at a comfortable situation with possible disturbance only during sleep at night (zero sensitivity).

Prepared by: ASPROFOS, 2022.

During the operation phase of the Project, the only regular noise emissions expected will be the result of the operation of the compressor stations. This section is therefore focused on the assessment of the effects derived of the noise emissions from these facilities.

For the assessment of noise impacts during the operation of Compressors CS2 and CS2N in Atherinolakkos and CS3 in Achaia, two special noise propagation models were prepared by ACC, Acoustics Consultancy Company (see Annex 8C.1 Baseline Noise Study for Atherinolakkos Compressor Stations CS2/CS2N and Annex 8C.2 Baseline Noise Study for Achaia Compressor Station CS3), following the field surveysmeasurement in March 2021. The emission source levels for each Compressor Station are provided in the relevant studies.

The subject of the Acoustic Study concerning proposed CS2/CS2N is to measure the existing ambient noise in settlements around the location of CS2/CS2N and to assess the impact to these settlements from noise emitted from the plant when it will be operating. The assessment was made by simulating the propagation of the sound emitted during the operation to the nearby settlements of Goudouras (1.5 km West) and Agia Triada (3.5 km Northeast) (Figure 9-83).



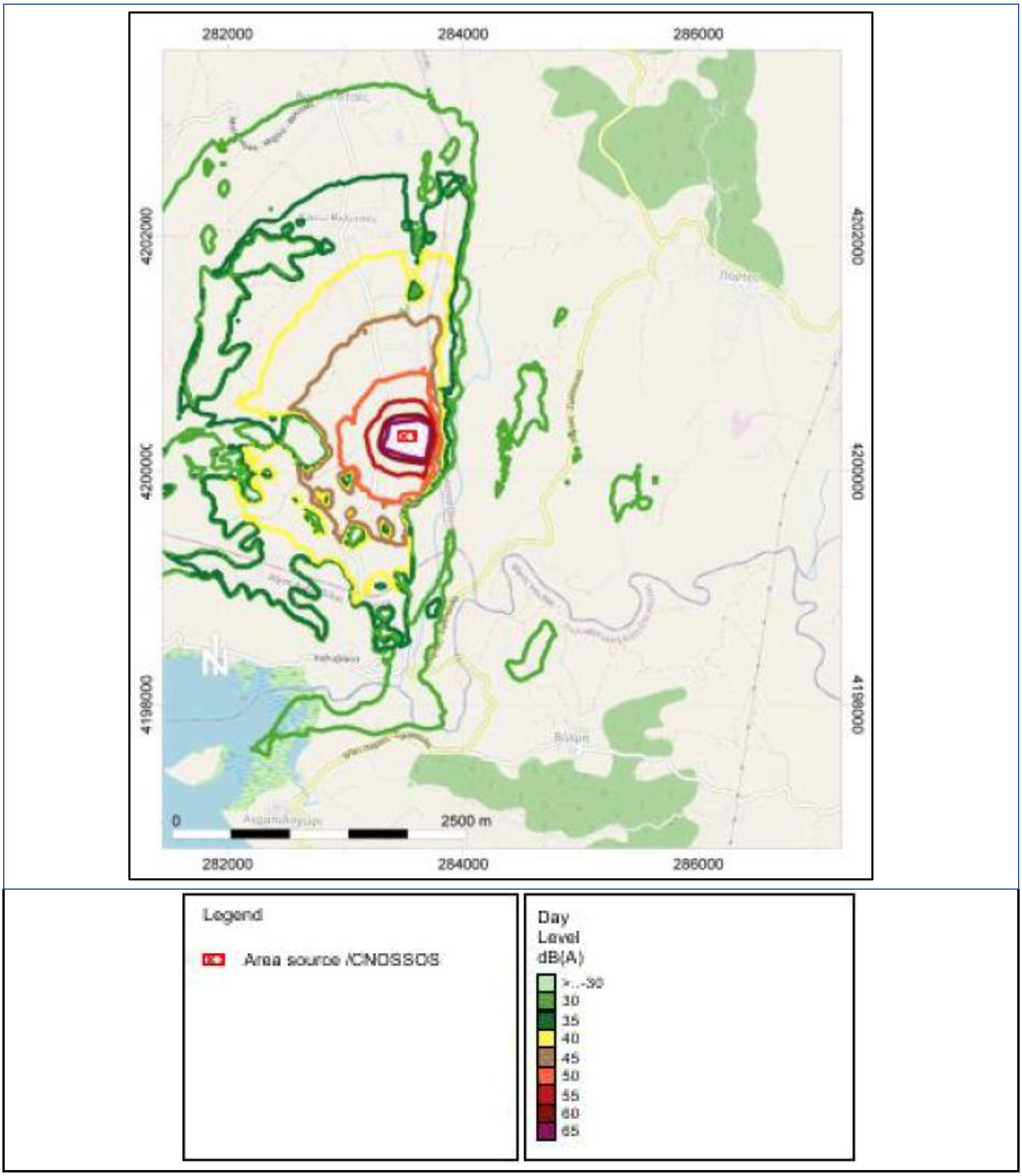
Prepared by: ASPROFOS, 2022. Data from ACC 2021

Figure 9-83 Noise contour map for proposed CS2/CS2N and nearby communities.

Conclusions of the noise propagation model for CS2/CS2N in Atherinolakkos Annex 8C.1 Baseline Noise Study and Propagation Model for Atherinolakkos Compressor Stations:

- From the acoustic measurements made by specialist acoustic consultants, the ambient noise in the centers of the settlements near the proposed site for the construction of the 'Atherinolakkos' Compressor Stations is in the L_{DEN} = 55 – 60 dB(A) zone. The main noise source is the traffic noise from vehicles crossing the main road of each settlement. During nighttime the noise levels are in the L_{night} = 45 – 55 dB(A) zones.
- The noise currently at the proposed site location is in the 55 – 60 dB(A) zone due to the noise from the adjacent factory from Public Power Company (PPC).
- According to sound dissipation calculations that were performed using a computer 3-D model of an area about 3km around the site, the noise impact to the nearby settlements from the operation of 'Atherinolakkos' Compressor Stations will be compliant with the imposed specifications for environmental noise, assuming that all the necessary measures will be taken so that the Compressor Stations will comply with the limit of emitting noise levels no more than 65 dB(A) at the plant's border, which is implied by the Law.

The subject of the Acoustic Study concerning proposed CS3 is to measure the existing ambient noise in settlements around the location of CS3 and to assess the impact to these settlements from noise emitted from the plant when it will be operating. The assessment was made by simulating the propagation of the sound emitted during the operation to the nearby settlements of Kato Velitses (1.7 km Northwest), Kalivakia (1.7 km South), Portes (2.6 km Northeast) and Valmi (2.5 km Southeast) (Figure 9-84).



Prepared by: ASPROFOS, 2022. Data from: ACC 2021.

Figure 9-84 Noise contour map for proposed CS3 and nearby communities.

Conclusions of the noise propagation model for CS3 in Achaia (Annex 8C.2 Baseline Noise Study and Propagation Mode for Achaia Compressor Station):

- From the acoustic measurements made by specialist acoustic consultants, the ambient noise in the centers of the settlements near the proposed site for the construction of the 'Achaia' Compressor Station is in the LDEN = 50 – 55 dB(A) zone. The main noise source is the traffic noise from vehicles crossing the main road of each village. During nighttime the noise levels are in the **Lnight** = 40 – 45 dB(A) zone.
- According to sound dissipation calculations that were performed using a computer 3-D model of an area about 3km around the site, the noise impact to the nearby settlements from the operation of 'Achaia' Compressor Station will be compliant with the imposed specifications for environmental noise, assuming that all the necessary measures will be taken so that the Compressor Station will comply with the limit of emitting noise levels no more than 65 dB(A) at the plant's border, which is implied by the Law.

9.3.11.3 Impacts on Acoustic Environment during Operation – Onshore

Concerning the impact assessment criteria presented in paragraph 9.1:

The *Likelihood* of causing the impact during the operation phase is *certain*. The noise level of about 65 dB (A) at the boundaries of the installation is within the statutory noise level standards determined by Greek legislation (PD 1180/81) of 65 dB(A).

The *Extent* of the incidence is *Large* with the limit of emitting noise levels no more than 45 dB(A) at a distance up to 1,000 m from Project footprint.

The *Intensity* of the impact is *low* according to the sensitivity of the human ear to the sound, as shown in Table 9-200.

The *Duration* of the impact will be *long-term*, throughout the entire project's life.

Reversibility is estimated to be *minimized* by applying appropriate equipment noise mitigation measures to the compressor plant boundaries to meet the requirements of PD1180/81.

The *Cumulative action* although *certain*, causes noise increase by much less than 3dB, meeting the guidelines of the International Finance Corporation (IFC) for the management of environmental noise. The *Transboundary Character* is *impossible* considering the limited extent of the potential impact.

Based on the above assessment criteria, SEI related to dust emissions during operation is evaluated as **Moderate.**

9.3.11.4 Summary of noise impact

Table 9-201 summarizes the impact pressure during the operating phase by noise source as assessed in respective abovementioned studies.

Table 9-201 Impact pressure during the operating phase by noise source as assessed in Noise studies.

S/N SEI			SEI for	Noise						
Project phase	Operation									
Impact	Mechanism	Locations	Criteria/ Impact Properties						SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Impacts on Acoustic Environment during Operation – Onshore	Noise from Compressor Stations	• Nearby settlements and households. • Nearby industrial receptors	1.00	0.50	0.25	0.75	0.75	1.00	0.00	6.07 (Moderate)	

Prepared by: ASPROFOS, 2022

9.3.12 Electromagnetic Fields

9.3.12.1 Methodology Overview

See Section 9.2.12.1

9.3.12.1.1 Source of Electromagnetic Field

The pipeline, and especially its cathodic protection, is not of such a scale to affect or be affected by electromagnetic fields.

Operation of Main Stations (CS2/MS2-CS2/MS2N, CS3, MS4/PRS4 & Heating) are not related to any electromagnetic field generation. Nevertheless, there could be possible interactions with existing sources of electromagnetic radiation (antennas, PPC substation).

As mentioned in Section 8.12.2 at the CS2 / MS2-CS2 / MS2N Compression Stations in Crete and within the study area, the electricity plant in Atherinolakkos is located at a distance of about 740 m (from the plant substation) including two antennas, as shown from data by the Hellenic Atomic Energy Commission (GAEC), at a distance of 1.4 km and 1.5 km respectively. As mentioned in Section 8.12.2 and data by Independent Power Transmission Operator (IPTO)[77], it appears that distances are too long for any interaction.

In addition, and according to data by the Hellenic Atomic Energy Commission (GAEC) at the installation site for Heating Station MS4 / PRS4, no sources of electromagnetic fields were identified. The nearest sources are more than 10 km away including two antennas. Regarding location of CS3 Compression Station, no electromagnetic field sources were identified. According to GAEC, the nearest radiation sources are more than 2.5 km away including three antennas.

Therefore no impact occurs during the operation phase.

[77] In areas other than high voltage substations and Extra high-Voltage Stations (EVS), electric and magnetic fields are created exclusively by the lines connected to them and not by their equipment. In general, depending on the type of line and the intensity of the flowing current, the magnetic fields of the transmission lines at a distance of 20 ~ 70 meters become smaller than those produced in a typical house. More information at: https://www.admie.gr/sites/default/files/users/dssm/tidp/ENTYPO_ADMHE_12_2020_web.pdf

9.3.12.2 Summary

According to the above Section 9.3.12.1.1 no effects on electromagnetic fields were recognized during operation phase for the Project. Therefore, no further evaluation is performed on this parameter.

9.3.13 Water Resources

9.3.13.1 Surface Water Systems

9.3.13.1.1 Introduction

No works or activities during operation can affect water resources. Therefore, impacts on water resources can be considered to be practically **Negligible**. In rare cases, impacts may arise as a result of poor management of the waste generated by the operation of the Stations. This can be addressed with the proper management of liquid and solid waste as explained in the relevant paragraph of Section 6.

9.3.13.1.2 Accidental pollution

No interaction, even accidental, of the pipeline with surface waters is expected at operation phase. The product is gaseous and any accidental leakage will result in being released into the air. Impacts may arise as a result of poor management of the waste generated by the operation of the Project's Stations. Only limited quantities of waste are expected during the operation phase, mainly due to the maintenance activities of the Compressor Station and the line valve stations.

Regarding the impacts assessment criteria presented under Section 9.1

Taking a conservative approach, the *Likelihood* of the impact being caused is considered to be *rare* for all SWS close to the facilities, since all necessary response measures are going to be taken and implemented, as detailed in Section 10.

An area of direct impact (i.e. *Extent*) is estimated to be in a short distance (<500m) from resource footprint (*medium*).

The *Intensity* of impact on water resources is linked to the sensitivity of nearby surface water resources (Table 9-115). As such water resources of medium sensitivity characterized by *medium* intensity and so forth.

The *Duration* of the impact is expected to be *short-term* for all SWS. A possible accident could release quickly degraded organic waste rapidly degrade; the volume in case of an accident is not expected to be significant.

As regards *Reversibility*, it is estimated that appropriate planning and operational rules could *prevent* the impact-causing mechanisms.Finally, a conservative approach is taken as regards *Cumulative action* which is considered as *likely* for all water bodies.

Having regard to the aforementioned and based on the criteria presented in Section Section 9.1

- For SWS at a short distance from CS3 (EL0228R000203009N)

For SWS close to the facilities, the *Likelihood* of accidental pollution is considered to be *rare*. The *Extent* of the impact is estimated to be *medium*. The *Intensity* based on receptor sensitivity is considered to be *zero*, while the *Duration* is considered to be *short-term*. Finally, as regards impact *Reversibility*, it is possible to *prevent* the impact by planning and implementing appropriate measures. Consequently, SEI is **Negligible.**

- For SWS at a short distance from MS4/PRS4 – Heating Station (EL0129R000220055N)

For SWS close to the facilities, the *Likelihood* of accidental pollution is considered to be *rare*. The *Extent* of the impact is estimated to be *medium*. The *Intensity* based on receptor sensitivity is considered to be *zero*, while the d *Duration* is considered to be *short-term*. Finally, as regards impact *Reversibility*, it is possible to *prevent* the impact by planning and implementing appropriate measures. Consequently, SEI is **Negligible.**

9.3.13.2 Ground Water Systems

9.3.13.2.1 Introduction

No works or activities foreseen by the project operation can affect groundwater resources. Therefore, impacts on groundwater resources can be considered to be practically **Negligible**. In rare cases, impacts may arise as a result of poor management of the waste generated by the operation of the stations. This can be addressed with the proper management of liquid and solid waste as explained in the relevant paragraph of Section 6.

9.3.13.2.2 Accidental pollution

Impacts may arise as a result of poor management of the waste generated by the operation of the project.

The *Likelihood* of the impact being caused is considered to be *rare* for all GWS, since all necessary response measures are going to be taken and implemented, as detailed in Section 10.

The area of direct impact (i.e. *Extent* of direct damage) it is estimated to be the project footprint (*small*). In particular, the nature of potential pollutants (rapidly degradable organic waste) and their small volume are covered by the system's carrying capacity; as a result the ecological value of the water resource and that of neighbouring water resources is not altered.

The *Intensity* of impact on Groundwater Systems is linked to the sensitivity of crossed ground water resources (Table 9-117). As such water resources of high sensitivity characterized by *high* intensity and so forth.

The *Duration* of the impact is expected to be *short-term* for all GWS. A possible accident could release quickly degraded organic waste rapidly degrade; the volume in case of an accident is not expected to be significant.

As regards *Reversibility*, it is estimated that appropriate planning and operational rules could *prevent* the impact-causing mechanisms. Finally, a conservative approach is taken as regards *Cumulative action* which is considered as *likely* for all GWS.

Having regard to the aforementioned and based on the criteria presented in Section Section 9.1.

- For GWS EL1300141 crossed by CS2/MS2-CS2/MS2N

For GWS close to the facilities, the *Likelihood* of accidental pollution is considered to be *rare*. The *Extent* of the impact is estimated to be *small*. The *Intensity* based on receptor sensitivity is considered to be *medium*, while the *Duration* is considered to be *short-term*. Finally, as regards impact *Reversibility*, it is possible to *prevent* the impact by planning and implementing appropriate measures. Consequently, SEI is **Negligible.**

- For GWS EL0100070 crossed by MS4/PRS4

For GWS close to the facilities, the *Likelihood* of accidental pollution is considered to be *rare*. The *Extent* of the impact is estimated to be *small*. The *Intensity* based on receptor sensitivity is considered to be *medium*, while the *Duration* is considered to be *short-term*. Finally, as regards impact *Reversibility*, it is possible *to prevent* the impact by planning and implementing appropriate measures. Consequently, SEI is **Negligible.**

- For GWS EL0100080 crossed by MS4/PRS4

For GWS close to the facilities, the *Likelihood* of accidental pollution is considered to be *rare*. The *Extent* of the impact is estimated to be *small*. The *Intensity* based on receptor sensitivity is considered to be *very high*, while the *Duration* is considered to be *short-term*. Finally, as regards impact *Reversibility*, it is possible to *prevent* the impact by planning and implementing appropriate measures. Consequently, SEI is **Minor.**

- For GWS EL0200060 and EL0200100 crossed by CS3

For GWS close to the facilities, the *Likelihood* of accidental pollution is considered to be *rare*. The *Extent* of the impact is estimated to be *small*. The *Intensity* based on receptor sensitivity is considered to be *high*, while the *Duration* is considered to be *short-term*. Finally, as regards impact *Reversibility*, it is possible to ***prevent*** the impact by planning and implementing appropriate measures. Consequently, SEI is **Negligible.**

9.3.13.3 Summary

Table 9-202 Summary of Impacts for water resources during the Operation Phase.

S/N SEI	13.2		SEI for	Water resources							
Project phase	Operation										
Impact	Mechanism	Locations	Criteria/ Impact Properties							SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Accidental pollution	Operation of Compressor/ Metering Stations and O&M.	EL0228R000203009N	0.25	0.25	0.00	0.25	0.00	0.50	0.00	1.79 (Negligible)	At a short distance from CS3
Accidental pollution	Operation of Compressor/ Metering Stations and O&M.	EL0129R000220055N	0.25	0.25	0.00	0.25	0.00	0.50	0.00	1.79 (Negligible)	At a short distance from MS4/PRS4
Accidental pollution	Operation of Compressor/ Metering Stations and O&M.	EL1300141	0.25	0.25	0.00	0.25	0.00	0.50	0.00	1.79 (Negligible)	crossed by CS2/MS2 – CS2/MS2N
Accidental pollution	Operation of Compressor/ Metering Stations and O&M.	EL0100070	0.25	0.25	0.00	0.25	0.00	0.50	0.00	1.79 (Negligible)	crossed by MS4/PRS4
Accidental pollution	Operation of Compressor/ Metering Stations and O&M.	EL0100080	0.25	0.00	1.00	0.25	0.00	0.50	0.00	2.86 (Minor)	crossed by MS4/PRS4
Accidental pollution	Operation of Compressor/ Metering Stations and O&M.	EL0200060, EL0200100	0.25	0.00	0.75	0.25	0.00	0.50	0.00	2.50 (Negligible)	crossed by CS3

9.3.14 Wave Conditions – Oceanographic Characteristics – Coastal Mechanics

This section, in accordance with Ministerial Decision 170225/2014, examines possible project impacts during operation phase on coastal dynamic balance for beaches located in the wider area of landfall sites.

9.3.14.1 Methodology Overview

Table 9-203 summarizes the main impact sources, potentially affected resources and recipients as well as influencing factors for baseline conditions and others related to the Project.

Table 9-203 Key Issues for assessment – Wave Conditions-Oceanographic characteristics-Coastal Mechanics

Impact/Risk Sources	Physical presence of pipelines and structures on the seabed
Potentially Impacted Resources and Receptors	Beaches on the wider area in Landfall locations
Special Baseline Conditions that are Potentially Influencing Impacts/Risks	• Beach and Seabed characteristics • Waves • Tides & Currents
Project Factors that are Potentially Influencing Impacts/Risks	
References	• Chapter 6 • Chapter 8 • Chapter 10

9.3.14.2 Impact-generating Mechanisms

Potential impacts on ocean characteristics are related to the physical presence of a pipeline that may alter local hydrodynamic and sediment transport. Pipeline installation is planned directly on the seabed, except for the part near the coast down to approximately 25 m WD where it will be underground.

9.3.14.3 Identifying Sensitive Receptors

At depths greater than half of the wavelength (d ≤ L⁄2), no interaction is expected between wave conditions; therefore, no effects are expected on wave regime from project installation activities and project operation. Indeed, the pipelines in the sea are a passive element located on the seabed, thus interaction with surrounding environment is just limited to its physical presence (which is irrelevant given pipelines size compared against sea and water column scale). This is also applicable to nearshore and landfall areas due to the fact that pipelines will be buried/protected from waves and will not be able to alter sea conditions or coastal dynamics.

9.3.14.4 Impact Overview

Any potential effect will be highly localised (limited to the vicinity around the pipeline) and will decrease over time as the seabed reaches its new balance.

9.3.14.5 Summary

Based on the above, no effects are expected to Wave Conditions-Oceanographic Characteristics-Coastal Mechanics during operational phase, so no further discussion is required.

9.3.15 Impacts Assessment from Project's Vulnerability to Risks of Serious Accidents

9.3.15.1 Methodology Overview

As presented in section 8.15 no major accidents due to the project are expected during the construction phase that may have significant environmental impacts. For transmission pipelines of natural gas the main major hazard scenario is the loss of containment as result of a leak or rupture, which can only take place during operation phase.

- Leaks in the pipeline resulting in either vertical (unobstructed) releases or horizontal (obstructed) releases; these releases will result in jet fires after immediate ignition or in flash fires after delayed ignition;
- Ruptures of the pipeline resulting in releases from both open ends of the ruptured pipeline. The release from ruptures will results in a jet fire obstructed within the crater after immediate ignition or in a flash fire after delayed ignition

Loss of containment of the high pressure gas containing pipeline have the potential to expose people to harmful effects of the released and dispersed natural gas. Especially the large inventory of natural gas in the pipeline can have a major effect on people and assets when ignited causing a large long-lasting fire.

It is noted that the flammability or explosive limits of natural gas are between 5 and 15% gas / air. If there is a gas content (in relation to air) below 5% it is not enough for there to be combustion while if its content exceeds 15% then it does not exist. To ignite Natural Gas a temperature of 600 ° C (ignition temperature) is required. In addition, natural gas is lighter than air and therefore in case of leakage it does not accumulate, eliminating the risk of explosion. In addition, natural gas is a natural, non-toxic product, lighter than air and, in open spaces such as the areas of the project in question, it is very difficult to inhale.

Furthermore, the Project will be constructed in accordance with applicable European and international regulations to ensure the smooth operation of the system and to minimize the risk of failure. Due to the high level of national, European and international safety standards and modern technology, the transportation of gas today can be considered very safe.

Table 9-204 presents the key sources (or mechanisms) of impact, the potentially impacted resources and (sensitive) receptors, the baseline and Project influencing factors associated with the Project's vulnerability.

Table 9-204 Key Considerations for Assessment – Project's Vulnerability.

Sources of Impact/ Risk	Construction Phase: • No major accidents or disasters are expected. Operation Phase: • The main major hazard scenario is the loss of containment as result of a leak or rupture, the following failure modes can be distinguished • External Interference: - Fishing Interaction (trawling), - Shipping Interaction (ship sinking, ship grounding, anchoring, anchor dragging, dropped objects) - Industrial Accidents - Vandalism, Terrorism and/ or armed conflicts • External and internal corrosion and erosion • Material and construction defects • Geohazards (e.g. earthquakes, landslides following earthquakes, flooding erosion etc)
Potentially Impacted Resources and Receptors	• Human health and life • Infrastructures • Land Use • Economy • Flora • Fauna • Cultural Heritage
Particular Baseline Conditions that are Potentially Influencing Impacts/Risks	• Areas of intense ship traffic along the pipeline route • Water sections where depth is equal to a ship draught (for ship grounding) • Sections in water depths from 30m to 100 m (for anchoring) • Areas of intense fishing activities (trawling) • Industries in the vicinity of the project (PPC at Atherinolakos and DESFA's facilities) • Areas prone to ground movements • Areas of increased flood risk (river crossings and coastal areas) • Backfilling soil properties
Project Factors that are Potentially Influencing Impacts/Risks	• The properties of the fluid in the pipeline • The selected pipeline material • Corrosion protection design (coating, inhibitor injection) • Corrosion control procedures (pigging) • External coating • Cathodic protection system • Project Owner Pipeline Inspection Plan • Project Owner Emergency Management Plan

References	• Baseline is provided in Section 8.15 • Mitigation Measures are provided in Section 10.14

Prepared by: ASPROFOS, 2022.

9.3.15.2 External Interface

9.3.15.2.1 Fishing Interaction

Pipeline sections in the coastal areas are exposed to fishing gear being dragged over the sea bed (bottom trawling) which, when interacting, can cause damage to the pipeline. Mitigating measures consist of designing the pipeline, in accordance with DNVGL-RP-F111, such that it can withstand impact from trawling gear and thereby reducing the risk to an acceptable level. Two risk reducing parameters that reduce the damage due to fishing interaction could be identified:

- Coated pipeline: Concrete weight coating adds to the loading capacity of the pipeline. Based on performed studies, it is concluded that sections of the pipeline will be coated with concrete weight coating to prevent damage to the pipeline / anti-corrosion coating
- The span height of pipeline free spans is sufficiently small: Although the pipeline may also be able to resist trawl gear hooking loads, hooking may also cause a safety risk for the fishermen on board the vessel. Therefore, hooking is typically avoided by ensuring that the span height of pipeline free spans is sufficiently small to avoid that a trawl board can become stuck.

As the current design already includes the aforementioned, no further mitigation measures are required to protect the pipeline from damage due to interaction with trawling gear. Considering the above, the risk level of trawling interaction is negligible.

9.3.15.2.2 Shipping Interaction

Offshore safety risks are characterized by release of gas subsequently causing fatalities.

Subsea release is characterized by a dispersed gas release at the surface, that is caused by the formation of a bubble column (bubble plume) in which the release impulse is absorbed by the seawater column above the pipeline. The size of the gas cloud at the sea surface after a loss of containment is a function of the release rate which is driven by the leak size and pipeline pressure. For the offshore pipeline given the operation pressure, it can be assumed that the diameter of a plume at the sea surface is 20% of the water depth at the release point.

On open sea, it can be assumed that the only possible exposed objects to an accidental gas cloud are vessels in the vicinity of the accidental release. This may be the ship that has caused the release or ships passing after the leak is made. When exposed to the effects of the ignited gas cloud/flash fire, it is likely that more than one person of the crew will be fatally injured. For releases that are not ignited, exposure of the gas cloud to personnel is assumed not to have a lethal effect. When ignited a flash fire of the same size will occur, which will result in 100% fatality for persons within the gas cloud.

The following shipping hazards have been identified to impose a risk to the offshore pipeline:

- Ship sinking
- Ship grounding
- Anchoring
- Anchor dragging
- Dropped objects (: containers)

While sinking of ships or dropping objects from ships can occur along the entire pipeline route, grounding can only occur in water sections where the depth is equal to a ship draught and anchoring can only occur in sections where the depth is equal to a ships anchor chain length. For anchoring it is common to anchor in water depths from 30m - 100m; anchoring becomes effective when the amount of chain paid-out is at least three times the water depth diminishing the vertical pull force on the anchor and allowing the anchor to 'dig in'.

9.3.15.2.2.1 Ship Sinking

A sinking vessel can damage the pipeline such that a leak occurs. In the assessment of the fatality probability, it is assumed that the crew of the sunken vessel is already fatally injured due to drowning or timely evacuated from the ship and at a safe distance from the sinking ship and the possible gas cloud.

This risk can occur over the entire subsea section of the pipeline except for sections where grounding can occur.

Three risk reducing parameters that reduce the damage due to impact form external loads could be identified:

- Buried pipeline: A ship that sinks on a buried section of the pipeline imposes a load on the soil on top of the pipeline which is in turn being transferred and to some extent reduced by distributing through the soil, to the pipeline.
- Coated pipeline: Concrete weight coating adds to the loading capacity of the pipeline.
- Sinking orientation: When a ship sinks, it does not necessarily sink 'in a straight line', but can change orientation relative to the pipeline thereby reducing the 'effective Length of a Vessel' and the frequency of a vessel sinking on the pipeline.

Although the above measures provide some degree of protection to the pipeline, it is assumed that a ship sinking on top of a pipeline, whether buried and/or coated or neither, imposes such a load that the above measures, which are originally introduced to provide hydrodynamic stability, do not prevent damage to the pipeline.

Furthermore, it should be noted that the buried section of the pipeline is relatively short; and the most ships do not navigate so close to shore that they navigate above the buried section of the pipeline.

Table 9-205 presents the impacts from the ship sinking on the EastMed-Poseidon Pipeline Project, including the impact, inducing mechanism and potential receptors/resources.

Table 9-205 Impacts from ship sinking - Impact mechanism - Potential receptors/resources during the Operation Phase

Impact	Impact mechanisms	Potential receptors / resources
Gas cloud at the sea surface after pipeline failure (: leak / rupture).	A sinking vessel can damage the pipeline such that a leak occurs.	The crew of the sunken vessel

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Affected Recipient Resources

As already mentioned, for the offshore pipeline given the operation pressure, it can be assumed that the diameter of a plume at the sea surface is 20% of the water depth at the release point. When ignited a flash fire of the same size will occur, which will result in 100% fatality for persons within the gas cloud. Ship sinking can occur over the entire subsea section of the pipeline except for sections where grounding can occur.

The *likelihood* of a sunken vessel on the pipeline is _Rare_. The *extent* of impact will present _Medium_ (500 m from the project footprint) for the OSS3 and OSS4 whilst for the OSS2 will present _Large_ (1000 m from the project footprint). The *intensity* of the impact on sensitive recipients is expected to be _Very high_. The *duration* of the impact is expected to be about 0- 1 years, so according to the proposed methodology it is characterized _Short-term_. The possibility of dealing with the impact (*Reversibility* of the impact) is considered _Irreversible_. The *Cumulative Action* of the impact is _Rare_ as a number of parameters acts for a ship sinking. The *Transboundary Character* is _Rare._

9.3.15.2.2.2 Ship Grounding

A grounding vessel may damage the pipeline resulting in a release of gas. For grounding, it is assumed that the persons on the grounding ship are still present when the release occurs.

Grounding can be divided in two subcategories: 'powered grounding' and 'drift grounding'. Powered grounding refers to the situation in which a ship has full mechanical functionality (i.e. propulsion and navigation); grounding is caused by a human error concerning navigation/judging. Drift grounding refers to the situation in which a ship is mechanically disabled (e.g. no propulsion and/or navigation) In the latter situation, if the ship still has navigational capabilities, it can try navigate to a safe location for either drifting/anchoring using the ships (decreasing) resulting velocity.

A ship grounding on a buried section of the pipeline imposes a load to the soil on top of the pipeline which is in turn being transferred, and to some extent reduced by distributing through the soil, to the pipeline. A buried pipeline could be damaged if the keel of a grounding ship cuts a furrow deep enough to contact the pipeline. A pipeline may also be at risk as a result of the loading imposed on the seabed by the grounding ship and the resulting stresses in the pipe. The elements that can reduce the damage due to impact form external loads are the burial depth of the pipeline and the concrete weight coating.

The pipeline is buried in a back filled trench with a depth of 2.5m for the transition zone (the transition between the buried section and not buried section), which corresponds to a layer of soil of approximately 1.5m on top of the pipeline. However, it is not unreasonably to assume that the pipeline design and burial mitigates the risk of (small) vessels causing (significant) damage to the pipeline by grounding.

Table 9-206 presents the impacts from the ship grounding on the EastMed-Poseidon Pipeline Project, including the impact, inducing mechanism and potential receptors/resources.

Table 9-206 Impacts from ship grounding - Impact mechanism - Potential receptors/resources during the Operation Phase

Impact	Impact mechanisms	Potential receptors / resources
Gas cloud at the sea surface after pipeline failure (: leak / rupture).	Vessel grounding can damage the pipeline such that a leak occurs.	The crew of the vessel

Prepared by ASPROFOS, 2022

Affected Recipient Resources

As already mentioned, for the offshore pipeline given the operation pressure, it can be assumed that the diameter of a plume at the sea surface is 20% of the water depth at the release point. When ignited a flash fire of the same size will occur, which will result in 100% fatality for persons within the gas cloud. Grounding can only occur in water sections where the depth is equal to ship draught.

The *likelihood* of a Vessel grounding on the pipeline is _rare_. The *extent* of impact will present _medium_ (500 m from the project footprint). The *intensity* of the impact on sensitive recipients is expected to be _very high_. The *duration* of the impact is expected to be about 0- 1 years, so according to the proposed methodology it is characterized s_hort-term_. The possibility of dealing with the impact (*Reversibility* of the impact) is considered _irreversible._ The *Cumulative Action* of the impact is _likely_ as a number of parameters co-acts. The *Transboundary Character* is _impossible._

9.3.15.2.2.3 Anchoring

For anchor dropping scenarios, the ship dropping the anchor may be exposed to the possible gas release caused by the dropped anchor on the pipeline. The crew on the ship is present during the gas release. The hazard of anchoring becomes a risk when an anchor large enough to cause damage to the pipeline is dropped on the pipeline

Anchoring on top of the pipeline can be caused by normal anchoring situations or when an emergency requiring anchoring occurs (so called emergency anchoring). Both scenarios are discussed in the upcoming paragraphs.

Under normal circumstances prior to anchoring, admiralty charts are checked for locations where anchoring is allowed and is appropriate concerning depth, soil type etc. Anchoring procedures includes for reduction of the velocity of the vessel to zero, lower the anchor and back up slowly allowing the anchor to dig in. If the anchor would be dropped while vessel still has forward velocity the possibility of navigating over the anchor chain can arise with the possible consequence that the anchor does not dig in properly or damages the ship's hull below the waterline.

The frequency for normal anchoring in sections with shallow water depth, near shore, is considered quite low based on the following assumptions:

- Passenger vessels are not expected to have to anchor outside ports since it is assumed that they navigate on fixed time schedules and therefore always have a docking place in the destination harbour.
- Smaller (local) vessels are expected to have a fixed dock inside the port (or other local ports) and are there for considered not to anchor outside ports. Additionally, the effect of an anchor drop on the pipeline by small scale vessels does not lead to a significant dent.
- Prior to anchoring, admiralty chart are checked for location appropriate for anchoring. This involves checking soil conditions for effective anchoring holding conditions and appropriate anchoring depths, checking for restricted areas for instance locations of pipelines.
- As a mitigating measure routing of the pipeline is outside anchoring areas.

- Furthermore, the EastMed pipeline will be indicated on the admiralty chart; this chart will include a statement that no anchoring is allowed in the vicinity of the pipeline.

If a vessel navigating in the vicinity of the pipeline needs to perform an emergency anchoring operation, the risk of anchoring on top of the pipeline arises. Two situations can be distinguished; a vessel dropping its anchor directly on the pipeline and a vessel dragging its anchor over the pipeline.

Two risk reducing parameters reducing the damage due to impact form external loads can be introduced: the pipeline is buried and the pipeline is coated with concrete weight coating that adds to the loading capacity of the pipeline. However, the buried section of the pipeline is relatively short; in other words (most) ships do not navigate so close to shore that they anchor above the buried section of the pipeline. Thus, the risk is reduced to the lowest frequency.

Table 9-207 presents the impacts from anchoring on the EastMed-Poseidon Pipeline Project, including the impact, inducing mechanism and potential receptors/resources.

Table 9-207 Impacts from anchoring - Impact mechanism - Potential receptors/resources during the Operation Phase

Impact	Impact mechanisms	Potential receptors / resources
Gas cloud at the sea surface after pipeline failure (: leak / rupture).	Anchoring can damage the pipeline such that a leak occurs.	The crew of the vessel

Prepared by ASPROFOS, 2022

Affected Recipient Resources

As already mentioned, for the offshore pipeline given the operation pressure, it can be assumed that the diameter of a plume at the sea surface is 20% of the water depth at the release point. When ignited a flash fire of the same size will occur, which will result in 100% fatality for persons within the gas cloud. For anchoring it is common to anchor in water depths from 30m - 100m; anchoring becomes effective when the amount of chain paid-out is at least three times the water depth diminishing the vertical pull force on the anchor and allowing the anchor to ‘dig in’.

The *likelihood* of anchoring on the pipeline is *Rrare*. The *extent* of impact will present *medium* (500 m from the project footprint). The *intensity* of the impact on sensitive recipients is expected to be *very high*. The *duration* of the impact is expected to be about 0- 1 years, so according to the proposed methodology it is characterized s*hort-term*. The possibility of dealing with the impact (*Reversibility* of the impact) is considered *irreversible*. The *Cumulative Action* of the impact is *likely* as a number of parameters co-acts. The *Transboundary Character* is *impossible.*

9.3.15.2.2.4 Anchor Dragging

For the anchor dragging scenario it is assumed that the ship dragging the anchor and causing the gas release is at sufficient distance not to be exposed to effect of the gas release and only passing vessels crossing the release area (after the leak has occurred) may be affected by the gas release.

If a ship has anchored in the vicinity of the pipeline due to an emergency, the possibility of emergency anchor dragging can occur. Anchor dragging concerns the situation where the holding power of the anchor is exceeded by forces exerted on the ship due to environmental conditions, as loads due to wind, current and waves, causing the ship to drift by dragging the anchor.

Drifting speeds are assumed to be low based on the assumption that anchors have dug in and do provide holding power although not sufficient; drifting speed is assumed as one knot.

Two risk reducing parameters that reduce the damage due to impact form external loads could be identified:

- Buried pipeline: An anchor dragged over a buried section of the pipeline could 'miss' the pipeline as it is buried, this depends on the depth of burial and the depth with which the anchor 'digs in'. The buried section of the pipeline is relatively short; in other words (most) ships do not navigate so close to shore that they can drag an anchor above the buried section of the pipeline.
- Coated pipeline: Concrete weight coating adds to the loading capacity of the pipeline but the impact energy from dragged anchors is assumed to be high, causing major damage. If an anchor hits the pipeline, but does not hook, the energy is dependent on the energy of the dragged anchor. If the anchor hooks the pipeline, the impact energy is dependent on the ships' energy.

Table 9-208 presents the impacts from anchor dragging on the EastMed-Poseidon Pipeline Project, including the impact, inducing mechanism and potential receptors/resources.

Table 9-208 Impacts from anchoring - Impact mechanism - Potential receptors/resources during the Operation Phase

Impact	Impact mechanisms	Potential receptors / resources
Gas cloud at the sea surface after pipeline failure (: leak / rupture).	Anchor dragging can damage the pipeline such that a leak occurs.	The crew of passing vessels crossing the release area.

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Affected Recipient Resources

As already mentioned, for the offshore pipeline given the operation pressure, it can be assumed that the diameter of a plume at the sea surface is 20% of the water depth at the release point. When ignited a flash fire of the same size will occur, which will result in 100% fatality for persons within the gas cloud. For anchoring it is common to anchor in water depths from 30m - 100m; anchoring becomes effective when the amount of chain paid-out is at least three times the water depth diminishing the vertical pull force on the anchor and allowing the anchor to 'dig in'.

The *likelihood* of anchor dragging on the pipeline is *rare*. The *extent* of impact will present *medium* (500 m from the project footprint). The *intensity* of the impact on sensitive recipients is expected to be *very high*. The *duration* of the impact is expected to be about 0- 1 years, so according to the proposed methodology it is characterized s*hort-term*. The possibility of dealing with the impact (*Reversibility* of the impact) is considered *irreversible*. The *Cumulative Action* of the impact is *likely* as a number of parameters co-acts. The *Transboundary Character* is *impossible.*

9.3.15.2.2.5 Dropped Objects

Objects might be dropped from ships; this paragraph describes the risk caused by dropped containers. Dropping of containers is usually related to excessive ship roll due to heavy weather conditions. The vessel type 'cargo' is not specified in terms of 'container' and other possible types of cargo vessels; for the risk assessment it is therefore assumed that all cargo vessels are in fact container vessels, providing a conservative approach. Other ship types (e.g passenger, tank and other) are assumed to rarely carry heavy deck cargo.

Additionally, the estimated frequency could be reduced assuming a percentage of containers will drift to shore as containers are made 'water-resistant' meaning that containers will float for a while before they will sink.

Table 9-209 presents the impacts from dropped objects on the EastMed-Poseidon Pipeline Project, including the impact, inducing mechanism and potential receptors/resources.

Table 9-209 Impacts from dropped objects - Impact mechanism - Potential receptors/resources during the Operation Phase

Impact	Impact mechanisms	Potential receptors / resources
Gas cloud at the sea surface after pipeline failure (: leak / rupture).	Dropped can damage the pipeline such that a leak occurs.	The crew of passing vessels crossing the release area.

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Affected Recipient Resources

As already mentioned, for the offshore pipeline given the operation pressure, it can be assumed that the diameter of a plume at the sea surface is 20% of the water depth at the release point. When ignited a flash fire of the same size will occur, which will result in 100% fatality for persons within the gas cloud. Dropping objects from ships can occur along the entire pipeline route.

The *likelihood* of dropping objects on the pipeline is *rare*. The *extent* of impact will present *medium* (500 m from the project footprint). The *intensity* of the impact on sensitive recipients is expected to be *very high*. The *duration* of the impact is expected to be about 0- 1 years, so according to the proposed methodology it is characterized s*hort-term*. The possibility of dealing with the impact (*Reversibility* of the impact) is considered *irreversible*. The *Cumulative Action* of the impact is *rare* as a number of parameters co-acts. The *Transboundary Character* is *impossible.*

9.3.15.2.3 Industrial Accidents

Routing of the pipeline is outside industrial areas, but there is proximity of CS2/MS2 – CS2N/MS2N to the PPC at Atherinolakos, and segments of the routing that EastMed pipeline will run near the route of the planned POSEIDON pipeline (: from 224KP to 225KP that the separation distance between EastMed CCS2 and Poseidon is 30m and from 228KP to 232KP that the separation distance between EastMed CCS2 and Poseidon is 17m) and the existing DESFA pipelines(: from 146KP to 147KP that the min separation distance between EastMed CCS1a and DESFA pipeline to Megalopoli is 30m). The smaller diameter (16”) Megalopolis branch also runs parallel to the DESFA pipeline for about a kilometer at the 9-9.893 KP section near its end. The separation distance is 19m.

In case of a rupture on the EastMed pipeline and specifically in case the released gas ignites causing an explosion, a crater would be formed that would expose the parallel pipeline segment and the subsequent jet fire would cause damage and escalate to the other pipeline as well. If there still would be soil left covering the other pipeline it is assumed that this would provide protection to the subsequent fire and prevent escalation. The minimum distance between parallel routed segments of the East Med pipeline to the POSEIDON pipeline is 17 meters and 30 meters for the DESFA pipelines, and therefore it can be concluded that the risk of escalation between parallel pipeline segments is very low. However, due to the proximity of the EastMed pipeline to the POSEIDON pipeline it is recommended that care should be taken to provide an adequate separation distance during the detailed design of either pipelines.

There are no crossings of the East Med main pipeline with either the POSEIDON or DESFA pipelines. There is only a crossing of the Megalopolis 16” branch with the DESFA pipeline. A rupture in a crossing is expected to escalate to the other pipeline and rupture that as well. From a 3rd party perspective, this event is however not relevant for the East Med pipeline as all crossings are located in desolate areas (class location I) with negligible presence of 3rd parties.

Table 9-210 presents the impacts from industrial accidents on the EastMed-Poseidon Pipeline Project, including the impact, inducing mechanism and potential receptors/resources.

Table 9-210 Impacts from industrial accidents - Impact mechanism - Potential receptors/resources during the Operation Phase

Impact	Impact mechanisms	Potential receptors / resources
Jet fire would cause damage and escalation	A crater formed due to rupture on the EastMed pipeline that would expose the parallel pipeline segment	• Human health and life • Climatic characteristics • Infrastructures • Land Use • Economy • Flora • Fauna • Cultural Heritage. • In the vicinity of the release area.

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Affected Recipient Resources

- EastMed onshore CCS1a KPs 146 – 147, near DESFA pipeline to Megalopolis
- EastMed onshore CCS2 KPs 224-225, near the POSEIDON Pipeline
- EastMed onshore CCS2 KPS 228-232, near the POSEIDON Pipeline

The *likelihood* of industrial accidents is _rare_. The *extent* of impact will present _large_ (1000 m from the project footprint). The *intensity* of the impact on sensitive recipients is expected to be _very high_. The *duration* of the impact is expected to be about 0-1 years, so according to the proposed methodology it is characterized _short-term_. The possibility of dealing with the impact (*Reversibility* of the impact) is considered _reversible._ The *Cumulative Action* of the impact is _likely_ as a number of parameters co-acts. The *Transboundary Character* is _rare._

9.3.15.2.4 Vandalism, Terrorism and/ or Armed conflicts

This scenario is included for completeness purposes. These acts in Greece are very rare and far beyond the scope of an ESIA. In any case, the probability of occurrence of such situations is considered almost negligible.

9.3.15.3 External and Internal Corrosion

Corrosion failures can occur due to internal or external corrosion.

The properties of the fluid in the pipeline as well as the selected pipeline material determine the likelihood and rate of internal corrosion. In addition, different corrosion protection design (coating, inhibitor injection) and corrosion control procedures (pigging) contribute to the internal corrosion.

External corrosion is possible as the pipeline is exposed to the soil properties. External coating protects the pipeline against external corrosion and only degradation or damage to this coating can affect this protection and cause accelerated external corrosion.

For the EastMed project the natural gas properties do not present concerns regarding internal corrosion. Transportation of sweet gas will ensure that the failure frequency as results of internal corrosion is negligible.

The external coating of the EastMed pipeline onshore section is designed such that possibility of external corrosion is minimized. Furthermore, a cathodic protection system will be installed (by means of impressed current). Regular inspection of the pipeline will monitor the condition of the coating during the operational life of the pipeline. Same applies for the offshore section (i.e. high integrity coating system, cathodic protection system in case coating system is damaged, which will be sacrificial bracelet type anodes and periodic visual inspection and check). For pipelines with wall thickness of more than 15 mm the external corrosion frequency can be considered negligible.

9.3.15.4 Material and Construction defects

Material and construction defects are grouped together as “mechanical” failure associated with weaknesses in the steel pipe wall due to manufacturing or welding defects, and dents or other weaknesses dating from the original construction activities. Failure frequency due to material and construction defects is dependent upon the year of construction and hence the age and associated design and construction standards, in particular the material selection controls and welding inspection standards applied. These standards have improved significantly since the early 1970s, hence the risk level due to material and construction defects is negligible.

9.3.15.5 Geohazards

The impacts of geohazards, during construction and during the operation of the project, have been studied and evaluated in paragraph 9.4 and will be studied in more detail during the design safety studies (e.g. QRA) at a later stage. The most severe and unavoidable is the occurrence of ground movement due to seismic activity in the area of the pipeline routes that cannot be excluded, as the occurrence of seismic activity has an increased likelihood.

Considering that no detailed seismic hazard assessment studies have been performed at this stage of the project but only Studies of correlation of active seismic faults with the pipeline route in scales 1:50,000 and 1:5000, the entire length of the Poseidon pipeline was screened for the different aspects of seismic hazard.

For the offshore section, a seismic event could trigger slope instability, which could evolve in a debris flow, which in turn could impose large loads to the pipeline (and subsequent pipeline failure). The assessment of routing in seismic hazard has been already provided in the related sub-section (see 9.3) and will be studied in more detail during the design safety studies (e.g. QRA) at a later stage.

After a screening process, a few sections of the onshore pipeline have been identified as critical and as such will be subject in this paragraph. Based on the current design data, a generic approach is to select the most critical sections for such specific assessment and thereby indirectly confirm that the risk levels for the less critical sections also are acceptable. The critical sections have been selected based on:

- Population
- Routing in seismic hazard zones

The population influences the risk, as more people present and exposed to accidental scenarios from the pipeline will increase the risk ranking. Large parts of Greece are prone to earthquakes and the sub-sequent risk of landslides. Routing through such areas gives an increased contribution to the failure frequency.

Table 9-211 presents the impacts geohazards (seismic activity) on the EastMed-Poseidon Pipeline Project, including the impact, inducing mechanism and potential receptors/resources.

Table 9-211 Impacts from Geohazards (seismic activity) - Impact mechanism - Potential receptors/resources during the Operation Phase

Impact	Impact mechanisms	Potential receptors / resources
Jet fire/ Fireball would cause damage	A rupture on the EastMed pipeline due to seismic loads	• Human health and life • Climatic characteristics • Infrastructures • Land Use • Economy • Flora • Fauna • Cultural Heritage.

Impact	Impact mechanisms	Potential receptors / resources
		• In the vicinity of the release area.

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Affected Recipient Resources

Of the identified critical areas, only 2 sections fall under class location 3 (relatively high population density) and shall be further examined here.

Table 9-212 Critical Areas with Seismic Hazard and high Population Density

Pipeline Section	Segment	Notes
CCS1b	289-299-300	• Near LF4
CCS2	28-29-30	• Between villages Gavalou (population 1018) and Grammatikou (population 802)

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The *Likelihood* is *probable*. The *Extent* of impact will present *large* (1000 m from the project footprint). The *Intensity* of the impact on sensitive recipients is expected to be *very high*. The *Duration* of the impact is expected to be about 0-1 years, so according to the proposed methodology it is characterized *short-term*. The possibility of dealing with the impact (*Reversibility* of the impact) is considered *reversible.* The *Cumulative Action* of the impact is *likely* as a number of parameters co-acts. The *Transboundary Character* is *impossible.*

9.3.15.6 Summary

Based on the above and on the criteria presented in the the Section 9.1, the **SEI is considered as Minor**.

Table 9-213 Summary of impacts from Project's Vulnerability to Risks of Serious Accidents during Operation Phase.

S/N SEI			SEI for	Project's Vulnerability to Risks of Serious Accidents							
Project stage	Operation										
Impact	Mechanism	Locations	Criteria/ Impact Properties							SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Shipping Interraction											
Gas cloud at the sea surface after pipeline failure (:leak / rupture).	Ship sinking	Along OSS3 & OSS4	0.25	0.25	1.00	0.25	1.00	0.25	0.25	4.64 (Minor)	
		Along OSS2	0.25	0.50	1.00	0.25	1.00	0.25	0.25	5.00 (Minor)	
Gas cloud at the sea surface after pipeline failure (:leak / rupture).	Ship grounding	In water sections where the depth is equal to a ship draught.	0.25	0.25	1.00	0.25	1.00	0.50	0.00	4.64 (Minor)	
Gas cloud at the sea surface after pipeline failure (:leak / rupture).	Anchoring	In water depths for 30m to 100m.	0.25	0.25	1.00	0.25	1.00	0.50	0.00	4.64 (Minor)	

S/N SEI			SEI for	Project's Vulnerability to Risks of Serious Accidents							
Project stage	Operation										
Impact	Mechanism	Locations	Criteria/ Impact Properties							SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
Gas cloud at the sea surface after pipeline failure (:leak / rupture).	Anchor Dragging	In water depths for 30m to 100m.	0.25	0.25	1.00	0.25	1.00	0.50	0.00	4.64 (Minor)	
Gas cloud at the sea surface after pipeline failure (:leak / rupture).	Dropped objects.	The crew of passing vessels crossing the release area.	0.25	0.25	1.00	0.25	1.00	0.25	0.00	4.28 (Minor)	
Industrial Accidents											
Jet Fire would cause damage and escalation	A crater formed due to rupture on the EastMed pipeline that would expose the parallel	• EastMed onshore CCS1a KPs 146 – 147, near DESFA pipeline to Megalopolis • EastMed onshore CCS2 KPs 224-225, near the POSEIDON Pipeline	0.25	0.50	1.00	0.25	0.50	0.50	0.25	4.64 (Minor)	

S/N SEI		SEI for	Project's Vulnerability to Risks of Serious Accidents							
Project stage	Operation									
Impact	Mechanism	Locations	Criteria/ Impact Properties						SEI (Sum criteria X 10/7)	Comments
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)		
	pipeline segment	• EastMed onshore CCS2 KPS 228-232, near the POSEIDON Pipeline									
Geohazards											
JetFire / Fireball	A rupture on the EastMed pipeline due to seismic loads.	• EastMed onshore CCS1b KPs 289-299-300, Near LF4 • EastMed onshore CCS2 KPs 28-29-30, Between villages Gavalou (population 1018) and Grammatikou (population 802)	0.75	0.50	1.00	0.25	0.50	0.50	0.00	5.00 (Minor)	

9.4 Decommissioning Phase

Design life for the EastMed Pipeline Project is 50 years and at least 25 years for its facilities. These are common values for onshore/offshore pipelines. The original pipeline design life will be verified by a re-qualification at the end of a 40-year period from initial installation, or sooner. It may well be the case that that life expectancy of the Project is increased as technology further develops during operation for the Project. Indeed, this could be subject to a technical evaluation and the standards applicable at that time.

Independently from decommissioning date, a detailed plan would be developed and submitted to competent authorities for approval in advance with respect to a projected date to end operation activities; the plan will detail every required activity in compliance with relevant legislation, good industrial practice, and dismantling technologies available at the time of plan execution. The plan will also include assessment for environmental, social and cultural heritage impacts related to proposed decommissioning technique and proper mitigation measures.

A decommissioning process for the onshore facilities will involve removing structures and rehabilitating areas, in order to create conditions enabling a return to previous conditions of the area (within a reasonable period of time) or reuse for other land purposes (industrial, residential and/or agricultural). Subsequent phases expected include:

- Stopping every process;
- Removal and safe disposal of every substance (e.g. chemicals, lubricants present in equipment, if any);
- Disassembling facilities and structures;
- Demolishing buildings;
- Removal and safe disposal of all waste resulting from previous actions; and
- Restoring vegetation and geomorphology in the area.

Related actions and therefore their potential effects are expected to be similar to those evaluated for the construction phase (in reverse chronological order).

Decommissioning activities for pipelines will take place through consecutive phases. With regard to onshore pipelines, in agreement with local authorities, the termination process will likely consist of pipeline removal, unless specific segments where removal operations would be technically impossible are present, or it would have a detrimental effect on natural or social environment from underground abandonment. In this case, the section will be disabled by filling the pipe with a suitable concrete mix or bentonite mixture (to prevent the empty pipe from collapsing) after sealing its ends.

Based on current practice, the offshore pipeline would be typically expected to stay in place as the risks and challenges of recovering deep pipelines would produce relevant environmental and social impacts (to some extent similar to those caused by construction). Only those sections located near shores or shallow areas (not in sensitive environmental areas, e.g. recolonised areas) could be considered for recovery should their abandonment increase environmental, social or safety risks.

9.5 Summary of Impacts

9.5.1 Construction Phase

Table 9-214 Summary of Impacts during Construction Phase.

Impact	Mechanisms	Locations	Criteria/ Impact Properties							SEI
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)	
Climatic and Bioclimatic Characteristics										
Temporary increase in greenhouse gas emissions	• Use of IC engines (internal combustion engines) • Earthworks • Excavation works • Vehicle and ship traffic • Hydrotest/Pre-commissioning	• Project Total	Certain	Medium	Low	Mid-term	Minimisable	Rare	Rare	Minor
Landscape Characteristics .										
Landscape Modification from Pipeline Construction	• Preparing pipeline working strip/ cofferdam • Erecting (construction) permanent Project features, such as line valve stations and compressor and metering stations. • Building temporary Project features such as construction sites. • Traffic of project-related vehicles/ vessels;	• Agricultural Landscape • Agricultural Plain Landscape • Built Landscape • Coastal Agricultural Landscape • Phryganic Landscape • Rural Landscape	Certain	Medium	Low	Short-term	Reversible	Rare	Impossible	Minor
		• Coastal Rural Landscape • TIFK “Parapotami Alfeiou” (Alfios' Tributaries) (AT1011011) • TIFK “Ekvoli Acheronta and Nekromanteio” (R. Acheronta Estuary and Necromancer) (AT3010051)	Certain	Medium	Medium	Short-term	Reversible	Rare	Impossible	Minor
		• Coastal Mosaic for Agricultural and Natural Landscape • Karteri Marshland • Mosaic for Agricultural and Natural (Shrublands) Landscape • Riparian Agricultural Landscape • Rodia Lagoon Wetland	Certain	Large	Medium	Short-term	Reversible	Rare	Impossible	Minor
		• Hilly Natural (Shrublands) Landscape	Certain	Large	High	Mid-term	Minimisable	Probable	Impossible	Moderate
		• Nearshore Seascape	Certain	Perimetric	High	Mid-term	Reversible	Probable	Impossible	Moderate
		• Hilly Natural (Forest) Landscape • Mountainous Natural (Forest) Landscape	Certain	Perimetric	High	Mid-term	Minimisable	Probable	Impossible	Moderate

Impact	Mechanisms	Locations	Criteria/ Impact Properties							SEI
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)	
		• Mountainous Natural (Shrublands) Landscape • Nearshore Seascape • Riparian Natural Landscape								
Disturbance to Viewers by Temporary Facilities		• Monemvasia Castle Town UNESCO site (view of LF3) • Lakopetra touristic establishments (view of LF4)	Certain	Perimetric	Very High	Short-term	Reversible	Probable	Impossible	Moderate
Geological, Tectonic and Soil Impacts (onshore section)										
Activation of geohazards	• earthmoving, • excavation, • circulation of vehicles, • accumulate of excavation materials, • accumulation of ground mantle, • creation of landslides, creeps • soil erosion • soil compaction	Presented at Annex 8M • Table M-9 • Table M-10 • Table M-11 • Table M-12 • Table M-13	Impossible	Medium	Medium	Mid-term	Minimisable	Certain	Impossible	Minor
Soil erosion	• earthmoving, • excavation, • circulation of vehicles, • accumulation of excavation materials, • accumulation of ground mantle	• the mountain steep slopes and elevated areas alongside the pipeline	Certain	Small	Medium	Mid-term	Minimisable	Likely	Impossible	Minor
Soil compaction	• circulation of heavy machines • circulation of vehicles	• Clayey and silty materials of the soil, mainly in a wet state with the simultaneous action of large loads • In Construction sites, pipe yards, marshalling yards	Impossible	Small	Medium	Mid-term	Minimisable	Likely	Impossible	Minor
Soil pollution	• The accidental leakage from construction machines for preparation of working strip,trench excavation, pipe-string ,bending,trenching,lower ing /laying, backfilling • Pipeline crossings with probable contaminated areas	• The existing soils alongside the working strip, at temporarily facilities, at crossings, area equal to 17,876,960 m2 where leakage from construction machines is possible	Likely	Medium	Medium	Mid-term	Reversible	Likely	Impossible	Minor

Impact	Mechanisms	Locations	Criteria/ Impact Properties							SEI
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)	
Reduced Soil Productivity	The construction works along the pipeline at areas with exclusively agricultural character	The soils for agricultural areas , and specifically in the construction strip.	Likely	Small	Medium	Mid-term	Reversible	Likely	Impossible	Minor
Geological, Tectonic and Soil Impacts (offshore section)										
Potential Activation of geohazards	• Crossing with unstable submarine slopes • Excavation at landfalls areas • Crossing with liquefied formations • Crossing with high relief bedrock • Crossing with mud-volcanoes • Crossings with salt tectonics • Crossings with gas related hazards (Pockmarks,fluid seepage,Hydrates)	Presente d in Annex 8M • Table M-14 for Main Geohazards areas alongside the route OSS2/OSS2N • Table M-16 for Main Geohazards areas alongside route OSS3/OSS3N • Table M-18 for Main Geohazards areas alongside route OSS4	Likely	Medium	Medium	Mid-term	Avoidable	Rare	Rare	Negligible
Sediments diffusion	• Excavation of trench at landfall locations • Preparation of cofferdams at LF4, LF5 • Preparation at causeways at LF2, LF3 • Anchoring of ships and vessels • Backfilling and reinstatement at landfall locations • Intervention techniques for normalization of free span	• All sediments along the offshore pipelines • The near coast areas at Landfall locations	Certain	Large	Medium	Short-term	Minimisable	Rare	Rare	Minor
Potential activation of sediments pollution	• Accidental leakage of fuel from ships/vessels • Accidental escape of sanitary waste from ships/vessels • Accidental leakage of fuels, lubricants and chemicals at landfall sites	• All sediments along the offshore pipelines • The near coast areas at Landfall locations	Rare	Peripheral	Medium	Short-term	Avoidable	Rare	Rare	Minor
Natural Environment (Onshore / Offshore biodiversity)										
Habitats/ Vegetation loss		• Sparsely vegetated areas	Certain	Small	Low	Mid-term	Reversible	Impossible	Impossible	Minor

Impact	Mechanisms	Locations	Criteria/ Impact Properties							SEI
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)	
	• Earthmoving, excavation and trenching	• Mediterranean deciduous forests, Floodplain forests (Riparian forest/Fluvial forest)	Certain	Small	Very High	Long-term	Minimisable	Rare	Impossible	Moderate
		• Inland and coastal saline marshes, Grasslands	Certain	Small	Low	Instant	Minimisable	Impossible	Impossible	Minor
		• Mediterranean coniferous forests, Mixed Forest	Certain	Small	High	Long-term	Minimisable	Rare	Impossible	Minor
		• Fruit trees and berry plantations, Olive groves, Agroforestry areas	Certain	Small	Medium	Mid-term	Minimisable	Impossible	Impossible	Minor
		• Transitional woodland-shrub	Certain	Small	High	Mid-term	Minimisable	Impossible	Impossible	Minor
		• Annual cultivations (Arable land, Complex cultivation patterns, Permanent crops,	Certain	Small	Low	Instant	Reversible	Impossible	Impossible	Negligible
		• Sclerophyllous vegetation	Certain	Small	High	Mid-term	Minimisable	Rare	Impossible	Minor
Fauna Habitats loss for Golden jackal (*Canis aureus*)	• Earthmoving, excavation and trenching	See Table 9-33."Sensitive areas for the golden jackal" (CCS1: KP 0 – KP 30 | KP 94 – KP 97 | KP 108 – KP 112 | KP 117 - KP 123 | KP 125 – KP 127 | KP 133 – KP 135 |KP 138 – KP 145 | KP 1 – KP 4 (Megalopoli Branch) |KP 162 – 165 | KP 167 – KP 185 | KP 187 – KP 203 | KP 204 – KP 205 | KP 216 – KP 218 | KP 223 – KP 225 | KP 233 – KP 240 | KP 246 | KP 258 – KP 262 | KP 263 – KP 266 | KP 274 – KP 278 | KP 280 – KP 281)	Certain	Small	High	Mid-term	Reversible	Rare	Impossible	Minor
Fauna Habitats loss for Wolf (*Canis lupus*)	• Earthmoving, excavation and trenching	See Table 9-34 Sensitive areas for the wolf (CCS2: KP 17.5 – KP 19 | KP 21 – KP 25 | KP 22 – KP 24)	Certain	Small	Very High	Mid-term	Minimisable	Rare	Impossible	Moderate
Fauna Habitats loss for Otter (*Lutra lutra*)	• Open cut crossing (excavation and trenching) of water bodies	See Table 9-35 Sensitive areas for the otter (CCS1: KP 103 KP 110 / KP 145 / KP 202 / KP 204 / KP 248 / KP 264 / LF5/ CCS2: KP 9 / KP 37 / KP 57 / KP 105 / KP 125 & KP 127 / KP 129 / KP 135 / KP 160 / KP 177 / KP 196 / KP 199)	Certain	Small	High	Mid-term	Reversible	Rare	Impossible	Minor
Fauna Habitats loss for Fishfauna	• Open cut crossing (excavation and trenching) of water bodies	See Table 9-36. Threatened fishfauna species potential presence (CCS1: KP 103 / KP 110 / KP 202 / KP 248 / KP 264 / CCS2: KP 9 / KP 37 / KP 57 / KP 129 / KP 135 / KP 160 / KP 196 / KP 199)	Certain	Small	High	Short-term	Reversible	Rare	Impossible	Minor

Impact	Mechanisms	Locations	Criteria/ Impact Properties							SEI
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)	
Fauna species loss for Small mammals	• Preparation and excavation of the terrain (working strip and facilities) • Heavy vehicle traffic • Air, noise and vibration emissions from the construction front • Light emission from construction areas	To be identified during pre-construction survey	Certain	Small	Medium	Mid-term	Minimisable	Rare	Impossible	Minor
Fauna species loss for Bats	• Preparation and excavation of the terrain (working strip and facilities) • Heavy vehicle traffic • Air, noise and vibration emissions from the construction front • Light emission from construction areas	• Forests and Forested Areas • Agricultural lands	Likely	Small	High	Short-term	Minimisable	Rare	Impossible	Minor
Fauna species loss for Reptiles	• Preparation and excavation of the terrain (working strip and facilities) • Heavy vehicle traffic • Air, noise and vibration emissions from the construction front • Light emission from construction areas	To be identified during pre-construction survey	Certain	Small	High	Short-term	Reversible	Rare	Impossible	Minor
Fauna species loss for Amphibians	• Preparation and excavation of the terrain (working strip and facilities) • Heavy vehicle traffic • Air, noise and vibration emissions from the construction front • Light emission from construction areas	• Floodplain forests (Riparian forest/Fluvial forest) • Inland and coastal saline marshes	Certain	Small	Medium	Short-term	Minimisable	Rare	Impossible	Minor
Fauna species loss for Macro-invertebrates	• Preparation and excavation of the terrain (working strip and facilities)	• Rivers crossed with open cut	Certain	Small	Medium	Short-term	Reversible	Rare	Impossible	Minor

Impact	Mechanisms	Locations	Criteria/ Impact Properties							SEI
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)	
Disturbance of Fauna - Golden jackal (*Canis aureus*)	• Noise from construction activities	See Table 9-33. "Sensitive areas for the golden jackal" (CCS1: KP 0 – KP 30 | KP 94 – KP 97 | KP 108 – KP 112 | KP 117 - KP 123 | KP 125 – KP 127 | KP 133 – KP 135 |KP 138 – KP 145 | KP 1 – KP 4 (Megalopoli Branch) |KP 162 – 165 | KP 167 – KP 185 | KP 187 – KP 203 | KP 204 – KP 205 | KP 216 – KP 218 | KP 223 – KP 225 | KP 233 – KP 240 | KP 246 | KP 258 – KP 262 | KP 263 – KP 266 | KP 274 – KP 278 | KP 280 – KP 281)	Likely	Small	High	Short-term	Reversible	Rare	Impossible	Minor
Disturbance of Fauna - Wolf (*Canis lupus*)	• Noise from construction activities	See Table 9-34. Sensitive areas for the wolf (CCS2: KP 17.5 – KP 19 | KP 21 – KP 25 | KP 22 – KP 24)	Certain	Small	Very High	Short-term	Minimisable	Rare	Impossible	Minor
Disturbance of Fauna - Otter (*Lutra lutra*)	• Noise at any river crossings with presence of otter • Sediments downstream of the crossing point, in case of open cut technique.	See Table 9-35 Sensitive areas for the otter (CCS1: KP 103 KP 110 / KP 145 / KP 202 / KP 204 / KP 248 / KP 264 / LF5/ CCS2: KP 9 / KP 37 / KP 57 / KP 105 / KP 125 & KP 127 / KP 129 / KP 135 / KP 160 / KP 177 / KP 196 / KP 199)	Likely	Small	High	Short-term	Reversible	Rare	Impossible	Minor
Disturbance of Fauna – Fishfauna	• Sediments downstream of the crossing point, in case of open cut technique.	See Table 9-36. Threatened fishfauna species potential presence (CCS1: KP 103 / KP 110 / KP 202 / KP 248 / KP 264 / CCS2: KP 9 / KP 37 / KP 57 / KP 129 / KP 135 / KP 160 / KP 196 / KP 199)	Likely	Small	High	Short-term	Reversible	Rare	Impossible	Minor
Impacts to Biodiversity during SPT	• Water abstraction • Water discharge • Noise from SPT compressors/ pumps	• Water abstraction and discharge locations	Certain	Small	High	Short-term	Minimisable	Rare	Impossible	Minor
Impacts on Avifauna during Construction – Onshore/Offshore	• Preparation and excavation of the terrain before erection of temporary and permanent facilities • Preparation of the working strip excavation of the trench for onshore pipeline installation • Heavy vehicle traffic • Air, noise and vibration emissions from the construction front	see Table 9-46 "Main areas of avifauna special interest along project footprint"	Likely	Medium	Medium	Mid-term	Minimisable	Rare	Impossible	Minor

Impact	Mechanisms	Locations	Criteria/ Impact Properties							SEI
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)	
	• Light emission from construction areas									
Habitat/Flore species loss	• Seabed intervention works • Pipelaying and seabed occupation	• Deep water section	Certain	Small	Low	Short-term	Minimisable	Rare	Impossible	Minor
Habitat/Flore species loss	• Construction of cofferdam and trenching • Anchoring of the pipelay barge • Pipelaying and seabed occupation • Increased re-suspended particles in the water column	• Nearshore section at LF3	Certain	Medium	Very High	Permanent	Minimisable	Impossible	Impossible	Moderate
Habitat/Flore species loss	• Construction of cofferdam and trenching • Anchoring of the pipelay barge • Pipelaying and seabed occupation • Increased re-suspended particles in the water column	• Nearshore section at LF4	Certain	Medium	High	Mid-term	Reversible	Impossible	Impossible	Minor
Habitat/Flore species loss	• Construction of cofferdam and trenching • Anchoring of the pipelay barge • Pipelaying and seabed occupation • Increased re-suspended particles in the water column	• Nearshore section at LF5	Certain	Medium	Low	Mid-term	Reversible	Probable	Impossible	Minor
Impacts on Marine Invertebrates	• Seabed intervention works • Pipelaying and seabed occupation • Construction of cofferdam and trenching (nearshore) • Anchoring of the pipelay barge (nearshore)	• Deep water section • Nearshore section	Certain	Small	Low	Short-term	Reversible	Rare	Impossible	Minor
Impacts on Marine Fish species	• Construction of cofferdam and trenching • Seabed intervention works • Anchoring of the pipelay barge • Temporary passage of different types of vessels	• Deep water section • Nearshore section	Certain	Small	Very High	Short-term	Minimisable	Impossible	Impossible	Minor

Impact	Mechanisms	Locations	Criteria/ Impact Properties							SEI
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)	
Impacts on Marine turtles	• Construction of cofferdam and trenching • Temporary passage of different types of vessels • Artificial lights from the Project activities	• Deep water section • Nearshore section at LF2, LF4 & LF5	Likely	Medium	Very High	Short-term	Avoidable	Likely	Rare	Minor
Impacts on Marine turtles	• Construction of cofferdam and trenching • Temporary passage of different types of vessels • Artificial lights from the Project activities	• Nearshore section at LF3	Certain	Medium	Very High	Short-term	Avoidable	Likely	Rare	Minor
Impacts on Marine mammals	• Construction of cofferdam and trenching • Temporary passage of different types of vessels	• Deep water section • Nearshore section	Rare	Large	Very High	Short-term	Preventable	Likely	Rare	Minor
Impacts on Marine mammals	• Construction of cofferdam and trenching • Temporary passage of different types of vessels	• Hellenic Trench IMMA	Likely	Large	Very High	Short-term	Preventable	Likely	Rare	Minor
Impacts on Protected Areas - Natura2000 Sites	• Main impacts are habitat and species loss, disturbance	• Within the Protected Areas								As per analyses at the Appropriate Assessments (see relevant Annexes)
Impacts on Protected Areas - Wildlife Refuges	• Main impacts are habitat and species loss, disturbance	• Within the Protected Areas								No impacts on the integrity of the protected areas given the limited area affected, overall availability of the specific ecosystem types within the Protected Areas and their characteristics
Impacts on Protected Areas - National Parks	• Main impacts are habitat and species loss, disturbance	• Within the Protected Areas								
Regional Planning – Uses of Land										
Changes in Land Uses	• Temporary land-take along the pipeline working strip;	• Industrial - commercial zones	Certain	Small	Zero	Instant	Avoidable	Impossible	Impossible	Negligible
		• Open spaces with little or no vegetation	Certain	Small	Low	Instant	Reversible	Impossible	Impossible	Negligible

Impact	Mechanisms	Locations	Criteria/ Impact Properties							SEI
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)	
	• Establishment of temporary construction facilities (e.g. construction sites) • Land take for permanent facilities, mainly the Main Stations.	• Sparsely vegetated forest areas and areas of systematic arboriculture	Certain	Small	Medium	Mid-term	Minimisable	Impossible	Impossible	Minor
		• Forested Areas	Certain	Small	High	Long-term	Minimisable	Impossible	Impossible	Minor
		• Forested Areas within protected site	Certain	Small	Very High	Long-term	Minimisable	Impossible	Impossible	Moderate
Regional Planning – Uses of Sea										
Fishing areas restrictions	• Navigation of Project vessels within fishing areas • Marine vessel traffic and use of Port Facilities • Offshore pipeline construction activities • Shore crossing and related construction at landfalls	• Fishing areas mainly of (i) Coasts of Kefalonia, Zakynthos and Gulf of Patra; (ii) Kriti island; and secondary of (iii) Gulf of Laconia, (iv) Gulf of Argolida and Saronikos Gulf, (v) Dodekanissos islands, and (vi) Kyklades islands	Certain	Medium	Medium	Instant	Minimisable	Likely	Rare	Minor
Indirect nuisance of aquaculture development and/ or fishing activity	• Offshore pipeline construction activities • Shore crossing and related construction at landfalls	• Landfall sites and Fishing areas of (i) Coasts of Kefalonia, Zakynthos and Gulf of Patra and (ii) Kriti island.	Likely	Medium	Low	Short-term	Minimisable	Likely	Rare	Minor
Increase in marine traffic	• Navigation of vessels within fishing areas • Marine vessel traffic and use of Port Facilities • Offshore pipeline construction activities	• Ports used for the project	Certain	Peripheral	Low	Short-term	Avoidable	Rare	Likely	Minor
Structure and functions of anthropogenic environment - Community Health & Safety										
Increased pressure on health care	• Presence of the construction workforce and interactions with local community. • The provision of health care for the workforce may lead to competition of local health care facilities. • Involvement of community members in accidents.	• Closest health care facilities (Hospitals).	Rare	Peripheral	Low	Mid-term	Minimisable	Rare	Impossible	Minor

Impact	Mechanisms	Locations	Criteria/ Impact Properties							SEI
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)	
Increased transmission of infectious diseases	• Presence of the construction workforce and interactions with local community.	• Residential areas close to Temporary facilities	Likely	Peripheral	Low	Mid-term	Minimisable	Rare	Rare	Minor
Structure and functions of anthropogenic environment - Community Cohesion										
Break of urban fabric continuity	• Land occupation by project related facilities.	• Temporary construction sites.	Rare	Small	Low	Mid-term	Avoidable	Likely	Impossible	Negligible
Cultural Heritage										
Direct physical damage	Mechanical engagement due to: • Ground/ seabed disturbing activities, including land-clearing and site preparation activities associated with Project facilities, • Excavation of the pipe trench/ cofferdam, • Establishment of working strip and other temporary facilities such as construction sites and pipeyards	• Declared resources at National Level (CH-LAK-009, CH-LAK-033, CH-LAK-087, CH-PRE-006, CH-PRE-011, CH-PRE-012)	Certain	Peripheral	Very High	Permanent	Minimisable	Impossible	Impossible	Moderate
Secondary Degradation or Damage	Dust (and other pollutants) dispersion and/ or Shocks/vibrations due to: • Ground/ seabed disturbing activities, including land-clearing and site preparation activities associated with Project facilities, • Excavation of the pipe trench/ cofferdam • Establishment of working strip and other temporary facilities such as construction sites and pipeyards	• Declared at National Level Resources (incl. Monuments, e.g. Stone arched bridges, Buildings and Caves) (CH-LAK-001, CH-ARK-010, CH-AIT-015) (CH-LAK-024, CH-LAK-028, CH-LAK-067, CH-LAK-073, CH-LAK-079, CH-LAK-086, CH-ARK-001, CH-ARK-002)	Probable	Perimetric	Very High	Permanent	Avoidable	Impossible	Impossible	Moderate
		• Not Declared, at National Level, resources (CH-LAK-062, CH-ILI-002, CH-AIT-005, CH-ARK-003, CH-ARK-005, CH-ARK-008, CH-ART-003, CH-THE-002, T4699, T3003, T3004, T3512, T3485, T4121, T4115)	Probable	Perimetric	Medium	Permanent	Avoidable	Impossible	Impossible	Minor
Nuisance to visitors access	• Establishment of working strip and other temporary facilities such as construction sites and pipeyards	• Declared resources at National Level (Table 9-79 and CH-LAS-003, CH-LAK-002, CH-LAK-066, CH-LAK-068, CH-LAK-004, CH-LAK-077, CH-LAK-081,	Probable	Large	Very High	Short-term	Preventable	Impossible	Impossible	Minor

Impact	Mechanisms	Locations	Criteria/ Impact Properties							SEI
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)	
		CH-LAK-082, CH-LAK-007, CH-LAK-084, CH-LAK-085, CH-LAK-014, CH-LAK-023, CH-LAK-031, CH-LAK-032, CH-LAK-089, CH-LAK-039, CH-LAK-042, CH-LAK-051, CH-LAK-065, CH-LAK-059, CH-ARK-010, CH-ILI-006, CH-ILI-004, CH-ACH-003, CH-ACH-001, CH-AIT-003, CH-AIT-014, CH-AIT-001, CH-AIT-002, CH-ART-002, CH-PRE-009, CH-PRE-003, CH-THE-009, CH-THE-012, CH-THE-022, CH-THE-011)								
		• Not Declared, at National Level, resources (Table 9-79 and CH-LAK-055, CH-LAK-060, CH-ARK-009, CH-ILI-003, CH-ACH-002, CH-AIT-006, CH-PRE-005, CH-PRE-007, CH-PRE-004, CH-THE-008, CH-THE-015, CH-THE-017, CH-THE-025, CH-THE-003, CH-THE-004, CH-THE-006, CH-THE-005)	Likely	Large	Medium	Short-term	Preventable	Impossible	Impossible	Negligible
Socioeconomic Impacts – Economy & Employment										
Employment opportunities (direct and/ or indirect)	• Supply of the necessary goods and services • Local workforce engagement	• Population centres (cities or villages) close to temporary and permanent facilities • along the working strip	Certain	Peripheral	Low	Mid-term	Minimisable	Probable	Impossible	Moderate
Economic impact of taxes, fees and local transactions	• Supply of the necessary goods and services	• In the entire study area	Certain	Peripheral	Low	Mid-term	Minimisable	Probable	Impossible	Moderate
Economic impact on agricultural sector / income	• Pipeline passing through agricultural and arable land	• Along project footprint (onshore section)	Certain	Small	Medium	Mid-term	Preventable	Likely	Impossible	Minor
Economic impact on fishing sector/ income	• Establishment of an offshore safety exclusion zone	• OSS2/OSS2N • OSS3/OSS3N • OSS4 (offshore section)	Certain	Medium	Low	Instant	Preventable	Likely	Impossible	Minor
Economic impact on tourism sector/ income	• Noise and visual disturbance (Construction works)	• LF3 • LF4 • LF5	Certain	Peripheral	Medium	Short-term	Preventable	Likely	Impossible	Minor
Technical Infrastructure – Road Network										
• Increasing traffic	• Use of construction vehicles	• Existing road network	Certain	Medium	Low	Short-term	Minimisable	Rare	Impossible	Minor

Impact	Mechanisms	Locations	Criteria/ Impact Properties							SEI
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)	
• Traffic delays • Traffic regulation • Increase in accident probability • Damage to road infrastructure	• Construction of pipeline crossings including national roads • Entry/exit traffic at construction sites	• Entry/exit traffic at construction sites								
Technical Infrastructure – Railway Network										
• Subsidence • Train service interruption	• Trenchless crossing method • Safety regulations	• Crossing including railway network	Likely	Medium	Low	Short-term	Reversible	Rare	Impossible	Minor
Technical Infrastructure – Airport facilities										
Potential small increase in air transportation	• Use of airport facilities to transport expert personnel	• Local airports	Rare	Large	Zero	Short-term	Reversible	Rare	Impossible	Negligible
Technical Infrastructure - Port Facilities, Marine Traffic and Submarine Cables										
• Potential Damage to existing infrastructure • Disturbance to vessels and fishing shelters	• Increased construction vessel traffic around major ports • Marine Vessel Wakes • Increasing Traffic on Maritime Transit Corridors	• Local ports • Offshore route	Rare	Large	Low	Short-term	Reversible	Rare	Rare	Minor
Technical Infrastructure – Environmental Infrastructure System										
Increasing wastewater for disposal in WWTPs	• Hygiene installations in construction sites • Ballast water	• Construction sites • Construction vessels	Certain	Large	Medium	Short-term	Reversible	Rare	Impossible	Minor
Increased solid waste for disposal in landfills	• Construction activities	• Onshore and offshore section	Certain	Large	Medium	Short-term	Reversible	Rare	Impossible	Minor
Technical Infrastructure – Water, Power and Telecommunication Networks										
Potential damage to the network	• Crossing including watering and irrigation network	• Onshore section	Rare	Medium	Medium	Short-term	Minimisable	Rare	Impossible	Minor

Impact	Mechanisms	Locations	Criteria/ Impact Properties							SEI
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)	
Potential disruption of the network	• Construction works	• Communication lines within working strip	Rare	Medium	Medium	Short-term	Minimisable	Rare	Impossible	Minor
Temporary reduction of energy production in photovoltaics	• Dust emission byconstruction works	• Photovoltaic stations close to working strip	Rare	Medium	Low	Short-term	Reversible	Rare	Impossible	Negligible
Temporary water supply interruption	• Construction works	• Water abstraction points within working strip	Rare	Medium	Medium	Short-term	Minimisable	Rare	Impossible	Minor
Man-made pressures – Quarries of aggregates										
Potential need and/or discard of aggregates	• Earthmoving works along the working zone. (e.g. backfilling)	• Quarries along the pipeline route	Certain	Peripheral	Medium	Mid-term	Minimisable	Probable	Impossible	Moderate
Air Quality										
Temporary increase of dust emissions	• Use of IC engines (internal combustion engines) • Earthworks • Excavation works • Vehicle and ship traffic	• Local communities across the pipeline route. There are 8 settlements at a distance up to 50 m on either side of the pipeline axis. (4 settlements at Section CCS1 and 4 settlements at Section CCS2) • Local communities near CSs and Heating Station • Natural Environment	Certain	Medium	Low	Mid-term	Reversible	Certain	Rare	Minor
Temporary exhaust emissions to the atmosphere (NOx, PM2.5, SO2,VOCs,CO, HAPS)	• Use of excavators, dozers, trucks, cars, vessels and ships	• Local communities across the pipeline route. There are 8 settlements at a distance up to 50 m on either side of the pipeline axis. (4 settlements at Section CCS1 and 4 settlements at Section CCS2) • Local communities near CSs and Heating Station • Natural Environment	Certain	Medium	Low	Mid-term	Reversible	Certain	Rare	Minor
Temporary exhaust emissions to the atmosphere (NOx, PM10, CO)	• Pre-commissioning activities	• Local communities near LF2and LF5	Certain	Medium	Low	Mid-term	Reversible	Certain	Rare	Minor
Noise during construction and pre-commissioning										
Impact on Acoustic Environment during Construction– Onshore	• excavation works • preparation and installation of pipeline	See Table 9-108	Certain	Medium	Very High	Short-term	Minimisable	Rare	Impossible	Minor

Impact	Mechanisms	Locations	Criteria/ Impact Properties							SEI
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)	
	• Planting and reinstatement of land • horizontal drilling • preparation of construction sites • miscellaneous works									
Impacts on Acoustic Environment during Pre-commissioning – Onshore	• Pre-commissioning activities	See Table 9-109	Certain	Medium	Low	Short-term	Avoidable	Rare	Impossible	Minor
Water Resources -Surface Water Systems (SWS)										
Changes in the morphology of SWS (rivers)	Watercourse crossings	EL0129R000221056N EL0415R000202007H, EL0514R000201050N, EL0546R000201077N EL0420R000200070N, EL0513R000200045N								No impact
		EL0331R000700004N, Small Stream_01, EL0129R000220055N, EL0129R000218052N, Small Stream_02, EL0129R000210037N, Small Stream_03, Small Stream_05	Certain	Small	Zero	Short-term	Avoidable	Likely	Impossible	Minor
		EL0129R000212039N	Certain	Small	Medium	Short-term	Avoidable	Likely	Impossible	Minor
		EL0514R000102049N, EL0513R000101042N	Certain	Small	High	Short-term	Avoidable	Likely	Impossible	Minor
		EL0415R001301068N	Certain	Small	High	Long-term	Minimisable	Likely	Impossible	Moderate
		EL0333R000211040N, EL0333R000217049N, EL0129R000207020N, EL0228R000204007N, EL0228R000203009N, EL0415R000000008N, EL0513R000202044N	Certain	Medium	Zero	Short-term	Minimisable	Likely	Impossible	Minor
		EL0333R000212042N, EL0129R000206011N	Certain	Medium	Medium	Short-term	Minimisable	Likely	Impossible	Minor
		EL0415R000200011H	Certain	Medium	Very High	Long-term	Minimisable	Likely	Impossible	Moderate
Changes in the morphology of shore	Shore crossing	EL0228C0003N, EL0415C0002N	Certain	Medium	Low	Short-term	Reversible	Likely	Impossible	Minor
		EL1341C0016N	Certain	Medium	Medium	Short-term	Reversible	Likely	Impossible	Minor

Impact	Mechanisms	Locations	Criteria/ Impact Properties							SEI
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)	
		EL0331C0005N	Certain	Medium	Very High	Short-term	Minimisable	Likely	Impossible	Moderate
Impacts on the quality of water resources	• Re-suspension and dispersion of sediment • Discharge of the hydraulic testing water	EL0333R000211040N, EL0333R000217049N, EL0129R000207020N, EL0228R000204007N, EL0228R000203009N	Certain	Large	Zero	Short-term	Reversible	Likely	Impossible	Minor
		EL0333R000212042N, EL0129R000206011N	Certain	Large	Medium	Short-term	Reversible	Likely	Impossible	Minor
		EL0415R000202106N, EL0129R000212039N	Certain	Large	High	Short-term	Reversible	Likely	Impossible	Minor
		EL0415R000200011H	Certain	Large	Very High	Short-term	Reversible	Likely	Impossible	Moderate
		Small Stream_01, Small Stream_02, Small Stream_03, Small Stream_05, EL0129R000220055N, EL0129R000218052N, EL0129R000210037N, EL0129R000212039N	Likely	Medium	Zero	Short-term	Preventable	Likely	Impossible	Negligible
		EL0513R000101042N, EL0415R001301068N, EL0514R000102049N	Likely	Medium	High	Short-term	Preventable	Likely	Impossible	Minor
		EL0129R000221056N	Rare	Small	Zero	Short-term	Preventable	Likely	Impossible	Negligible
Impacts on the quality of water resources	• Re-suspension and dispersion of sediment	EL0415R000202007H, EL0514R000201050N, EL0546R000201077N	Rare	Small	High	Short-term	Preventable	Likely	Impossible	Negligible
		EL0513R000200045N, EL0420R000200070N	Rare	Small	Very High	Short-term	Preventable	Likely	Impossible	Minor
Impacts on the quality of Coastal Water Systems	• Shore crossings	EL0228C0003N (LF4) EL0415C0002N (LF5) EL0331C0005N (LF3) EL1341C0016N (LF2)	Certain	Small	Low Low Very High Medium	Short-term	Preventable	Likely	Impossible	Minor
Impacts on the availabilityof surface waters	• Draining water when excavating the trench Discharge of the hydraulic testing water	EL0333R000211040N, EL0333R000217049N, EL0129R000207020N, EL0228R000204007N, EL0228R000203009N, EL0129R000221056N	Certain	Large	Zero	Short-term	Avoidable	Likely	Impossible	Minor
		EL0514R000201050N, EL0546R000201077N, EL0415R000202007H	Certain	Large	High	Short-term	Avoidable	Likely	Impossible	Minor

Impact	Mechanisms	Locations	Criteria/ Impact Properties							SEI
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)	
		EL0415R000200011H, EL0420R000200070N	Certain	Large	Very High	Short-term	Avoidable	Likely	Impossible	Minor
Impacts on the availabilityof surface waters	• Draining water when excavating the trench Discharge of the hydraulic testing water	EL0513R000200045N EL0514R000102049N, EL0513R000101042N, EL0415R000202106N, EL0514R000100048N, EL0415R001301068N EL0129R000206011N, EL0333R000212042N, EL0513R000202044N, EL0129R000220055N, EL0129R000218052N, EL0129R000212039N, EL0415R000000008N, EL0331R000700004N, EL0129R000210037N, Small Stream_01, Small Stream_02, Small Stream_03, Small Stream_05								No impact
Accidental pollution	• Preparation, construction and operation of temporary facilities • Work zone preparation, drainage, erosion control, trench cut, hosting and laying the pipeline. • Hydraulic Testing • Construction and operation of Compressor Stations, Meter Station and O&M.	EL0129R000220055N, EL0129R000218052N, EL0129R000212039N, EL0331R000700004N, EL0129R000210037N, Small Stream_01, Small Stream_02, Small Stream_03, Small Stream_05	Rare	Small	Zero	Short-term	Preventable	Likely	Impossible	Negligible
		EL0514R000102049N, EL0513R000101042N, EL0415R001301068N	Rare	Small	High	Short-term	Preventable	Likely	Impossible	Negligible
		EL0513R000202044N, EL0415R000000008N, EL0333R000211040N, EL0333R000217049N, EL0129R000207020N, EL0228R000204007N, EL0228R000203009N, EL0129R000221056N	Rare	Medium	Zero	Short-term	Preventable	Likely	Impossible	Negligible
		EL0129R000206011N, EL0333R000212042N	Rare	Medium	Medium	Short-term	Preventable	Likely	Impossible	Negligible
		EL0415R000202106N, EL0514R000100048N,	Rare	Medium	High	Short-term	Preventable	Likely	Impossible	Minor

Impact	Mechanisms	Locations	Criteria/ Impact Properties							SEI
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)	
		EL0514R000201050N, EL0546R000201077N, EL0415R000202007H								
		EL0513R000200045N, EL0415R000200011H, EL0420R000200070N	Rare	Medium	Very High	Short-term	Preventable	Likely	Impossible	Minor
Water Resources - GroundWater Systems (GWS)										
Impact on the quality of Groundwater Systems	• Upgrading existing access roads for moving vehicles, equipment and staff • Preparation, construction and operation of temporary facilities • Construction of Compressor Stations, Meter Station and O&M.	EL1300141, EL0300120, EL0300110, EL0300160, EL0300240, EL0300230, EL0300260, EL0100070, EL0100210, EL0100230, EL0100010, EL0400090, EL0400240, EL0400250, EL0400060, EL0400140, EL0400190, EL0500240, EL0500160, EL0500130, EL0500170	Likely	Medium	Medium	Short-term	Preventable	Likely	Impossible	Minor
		EL0200060, EL0200100, EL0500250, EL0500090, EL0500270	Likely	Medium	High	Short-term	Preventable	Likely	Impossible	Minor
		EL0100080, EL0500152, EL0500153	Likely	Medium	Very High	Short-term	Preventable	Likely	Impossible	Minor
		EL0300150	Rare	Medium	Low	Short-term	Preventable	Likely	Impossible	Negligible
		EL0200092, EL0200091, EL0200094, EL0500140	Rare	Medium	Medium	Short-term	Preventable	Likely	Impossible	Negligible
Impact on the availability of Groundwater Systems	• Work zone preparation, drainage, erosion control, trench cut, hosting and laying the pipeline.	All	Impossible	Small	Zero	Instant	Preventable	Impossible	Impossible	No impact
Accidental pollution	• Work zone preparation, drainage, erosion control, trench cut, hosting and laying the pipeline.	EL0300150	Rare	Small	Low	Short-term	Preventable	Likely	Impossible	Negligible
		EL1300141, EL0300120, EL0300110, EL0300160, EL0300240, EL0300230, EL0300260, EL0100070, EL0100210, EL0100230, EL0100010, EL0400090, EL0400240, EL0400250, EL0400060, EL0400140, EL0400190, EL0500240, EL0500160, EL0500130, EL0500170, EL0200060, EL0200100	Rare	Small	Medium	Short-term	Preventable	Likely	Impossible	Negligible
		EL0500090, EL0500270, EL0200092, EL0200091, EL0200094, EL0500140, EL0300150	Rare	Small	High	Short-term	Preventable	Likely	Impossible	Negligible
		EL0100080, EL0500152, EL0500153	Rare	Small	Very High	Short-term	Preventable	Likely	Impossible	Minor

Impact	Mechanisms	Locations	Criteria/ Impact Properties							SEI
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)	
Wave Conditions Oceanographic Characteristics – Coastal Mechanics										
Modification for Coastal Dynamic Balance	Construction activities during shore crossing	LF2	Certain	Medium	Medium	Short-term	Minimisable	Rare	Impossible	Minor
		LF3	Certain	Medium	Low	Short-term	Minimisable	Rare	Impossible	Minor
		LF4, LF5	Certain	Perimetric	Low	Short-term	Minimisable	Likely	Impossible	Minor

Prepared by: ASPROFOS, 2022.

9.5.2 Operation Phase

Table 9-215 Summary of Impacts during Operation Phase.

Impact	Mechanisms	Locations	Criteria/ Impact Properties							SEI
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)	
Climatic and Bioclimatic Characteristics										
Change in Greenhouse Gas Emissions	• Replacement of polluting conventional fossil fuels with natural gas	• Regionals and users	Certain	Peripheral	Medium	Long-term	Irreversible	Certain	Certain	Major
Landscape Characteristics										
Landscape Modification from PPS (incl. restored temporary facilities)	• PPS establishment	• Hilly Natural (Forest) Landscape • Mountainous Natural (Forest) Landscape • Hilly Natural (Shrublands) Landscape • Mountainous Natural (Shrublands) Landscape	Certain	Perimetric	High	Long-term	Minimisable	Likely	Impossible	Moderate
Disturbance to Viewers from Permanent Facilities	• Permanent Facilities presence	• Station sites	Certain	Large	Low	Long-term	Minimisable	Impossible	Impossible	Minor
Morphological Characteristics										
Seabed morphology (Bathymetry) modification	• Seabed intervention works (trenching, rock dumping, anchoring, supports)	• Expected to be very limited and localized. Specific locations to be determined upon DMS completion and prior to construction phase	Certain	Small	Low	Permanent	Minimisable	Impossible	Likely	Minor
Geological, Tectonic and Soil Impacts (onshore section)										
Potential Activation of Geohazards	• Permanent loading of geological formations due to pipeline installation and its Stations	Presented at Annex 8M • Table M-9 for landslides along CCS1 Section • Table M-10 for landslides along CCS2 Section • Table M-11 for liquefaction along CCS1 Section • Table M-12 for liquefaction along Megalopolis branch • Table M-13 for liquefaction along CCS2 Section	Rare	Medium	Medium	Long-term	Avoidable	Rare	Impossible	Minor

Impact	Mechanisms	Locations	Criteria/ Impact Properties							SEI
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)	
Geological, Tectonic and Soil Impacts (offshore section)										
Potential Activation of Geohazards	• Permanent loading of geological formations due to pipeline installation	Presented at Annex 8M: • Table M-14 for Main Geohazards along the route OSS2/OSS2N • Table M-16 for Main Geohazards along the route OSS3/OSS3N • Table M- 18 for Main Geohazards along the route OSS4	Rare	Medium	Low	Long-term	Avoidable	Rare	Impossible	Minor
Natural Environment (Onshore / Offshore biodiversity)										
Habitats/ Vegetation loss	• Restriction of deep rooted species within the Pipeline Protection Strip	• Mediterranean deciduous forests, Floodplain forests (Riparian forest/Fluvial forest)	Certain	Small	Very High	Long-term	Minimisable	Rare	Impossible	Moderate
		• Mediterranean coniferous forests, Mixed Forest, Transitional woodland-shrub, Sclerophyllous vegetation	Certain	Small	High	Long-term	Minimisable	Rare	Impossible	Minor
		• Sparsely vegetated areas, Phrygana vegetation, Inland and coastal saline marshes, Low density built-up areas / Settlements, Fruit trees and berry plantations, Sea and ocean, Grasslands, Arable land, Complex cultivation patterns, Agroforestry areas, Olive groves, Permanent crops	-	-	-	-	-	-	-	n/a
Fauna Habitats loss for Golden jackal (*Canis aureus*)	• Restriction of deep rooted species within the Pipeline Protection Strip	See Table 9-33 "Sensitive areas for the golden jackal"	-	-	-	-	-	-	-	n/a
Fauna Habitats loss for Wolf (*Canis lupus*)	• • Restriction of deep rooted species within the Pipeline Protection Strip	See Table 9-34. Sensitive areas for the wolf (CCS2: KP 17.5 – KP 19 | KP 21 – KP 25 | KP 22 – KP 24)	Likely	Small	Very High	Long-term	Minimisable	Rare	Impossible	Minor

Impact	Mechanisms	Locations	Criteria/ Impact Properties							SEI
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)	
Fauna Habitats loss for Otter (*Lutra lutra*)	• • Restriction of deep rooted species within the Pipeline Protection Strip	See Table 9-35. Sensitive areas for the otter	Likely	Small	High	Long-term	Minimisable	Rare	Impossible	Minor
Fauna Habitats loss for Fishfauna	• • Restriction of deep rooted species within the Pipeline Protection Strip	See Table 9-36 Threatened fishfauna species potential presence	-	-	-	-	-	-	-	n/a
Disturbance of Fauna - Golden jackal (*Canis aureus*)	• Noise from Main Stations operation.	• KP 250 - KP 280	Probable	Medium	High	Long-term	Minimisable	Rare	Impossible	Minor
Disturbance of Fauna - Wolf (*Canis lupus*)	• Noise from Main Stations operation.	-	-	-	-	-	-	-	-	n/a
Disturbance of Fauna - Small Mammals	• Noise from Main Stations operation.	-	-	-	-	-	-	-	-	n/a
Disturbance of Fauna - Fishfauna	• Noise from Main Stations operation.	-	-	-	-	-	-	-	-	n/a
Disturbance of Fauna - Avifauna	• Noise from Main Stations operation.	-	-	-	-	-	-	-	-	n/a
Disturbance of Fauna - Reptiles	• Noise from Main Stations operation.	-	-	-	-	-	-	-	-	n/a
Disturbance of Fauna - Amphibians	• Noise from Main Stations operation.	-	-	-	-	-	-	-	-	n/a
Impacts on Marine Habitats by the operation of the offshore pipeline	• Offshore maintenance works • Noise and vibration from pipeline operation • Release of ions • Marine traffic	• Deep water section • Nearshore section	Rare	Small	Low	Mid-term	Minimisable	Impossible	Impossible	Negligible
Impacts on Marine Invertebrates – Nearshore /Deep water sections	• Physical presence of the pipelines	• Deep water section • Nearshore section	-	-	-	-	-	-	-	n/a
Impacts on Marine Fish – Nearshore/Deep water sections	• Noise and vibration from pipeline operation • Release of ions • Marine traffic	• Deep water section • Nearshore section	-	-	-	-	-	-	-	n/a
Impacts on Marine Reptiles – Nearshore/Deep water sections	• Noise and vibration from pipeline operation • Marine traffic	• Deep water section • Nearshore section	-	-	-	-	-	-	-	n/a

Impact	Mechanisms	Locations	Criteria/ Impact Properties							SEI
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)	
Impacts on Marine Mammals by the operation of the offshore pipeline	• Noise and vibration from pipeline operation • Marine traffic	• Deep water section • Nearshore section	-	-	-	-	-	-	-	n/a
Impacts on Protected Areas - Natura2000 Sites	• Main impacts are habitat and species loss, disturbance	• Within the Protected Areas	-	-	-	-	-	-	-	As per analyses at the Appropriate Assessments (see relevant Annexes).
Impacts on Protected Areas - Wildlife Refuges	• Main impacts are habitat and species loss, disturbance	• Within the Protected Areas	-	-	-	-	-	-	-	No impacts on the integrity of the protected areas given the limited area affected, overall availability of the specific ecosystem types within the Protected Areas and their characteristics.
Impacts on Protected Areas - National Parks	• Main impacts are habitat and species loss, disturbance	• Within the Protected Areas	-	-	-	-	-	-	-	
Regional Planning – Uses of Land										
Direct Changes in Land Use	Establishment of the Pipeline Protection Strip (8 m wide corridor, 4 m on each side of the pipeline axis)	• Industrial - commercial zones	Impossible	Medium	Very High	Long-term	Preventable	Impossible	Impossible	n/a
		• Open spaces of productive land with little or no vegetation	Rare	Medium	Medium	Long-term	Preventable	Impossible	Impossible	Negligible
		• Open spaces of unproductive land with little or no vegetation	Impossible	Medium	Zero	Long-term	Preventable	Impossible	Impossible	n/a
		• Areas of systematic arboriculture	Certain	Medium	High	Long-term	Minimisable	Impossible	Impossible	Minor
		• Forested Areas (within or not Protected Areas)	Certain	Medium	Low	Long-term	Minimisable	Impossible	Impossible	Minor
Indirect Changes in Land Uses	Establishment of the Building Control Strip (40 m wide corridor, 20 m on each side of the pipeline axis)	• Industrial - commercial zones	Certain	Large	Very High	Long-term	Preventable	Impossible	Impossible	Minor
		• Open spaces of productive land with little or no vegetation	Impossible	Small	Medium	Long-term	Minimisable	Impossible	Impossible	n/a
		• Open spaces of unproductive land with little or no vegetation	Impossible	Small	Zero	Long-term	Preventable	Impossible	Impossible	n/a
		• Areas of systematic arboriculture	Impossible	Small	High	Long-term	Preventable	Impossible	Impossible	n/a
		• Forested Areas (within or not Protected Areas)	Impossible	Small	Low	Long-term	Preventable	Impossible	Impossible	n/a

Impact	Mechanisms	Locations	Criteria/ Impact Properties							SEI
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)	
Direct Changes in Land Use	• Establishment of the Pipeline Protection Strip (8 m wide corridor, 4 m on each side of the pipeline axis)	• Industrial - commercial zones	Likely	Perimetric	Very High	Long-term	Preventable	Impossible	Impossible	Minor
		• Open spaces of productive land with little or no vegetation	Impossible	Small	Medium	Long-term	Preventable	Impossible	Impossible	n/a
		• Open spaces of unproductive land with little or no vegetation	Impossible	Small	Zero	Long-term	Preventable	Impossible	Impossible	n/a
		• Areas of systematic arboriculture	Impossible	Small	High	Long-term	Preventable	Impossible	Impossible	n/a
		• Forested Areas (within or not Protected Areas)	Impossible	Small	Low	Long-term	Preventable	Impossible	Impossible	n/a
Regional Planning – Uses of Sea										
Marine traffic (berthing) restrictions	• Presence of pipeline in deep waters • Restrictions for deep-water pipeline safety	• Berthing safety zone	Certain	Medium	Low	Long-term	Preventable	Rare	Rare	Minor
Structure and functions of anthropogenic environment										
Break of urban fabric continuity	• Land occupation by project related facilities.	• Communities close to Main Stations	Impossible	Small	Zero	Instant	Preventable	Impossible	Impossible	n/a
Cultural Heritage										
Direct physical damage	• n/a	• n/a	Impossible	Small	Zero	Instant	Preventable	Impossible	Impossible	n/a
Secondary Degradation or Damage	• n/a	• n/a	Impossible	Small	Zero	Instant	Preventable	Impossible	Impossible	n/a
Nuisance to visitors access	• Traffic of vehicles, equipment and personnel	• Permanent facilities	Impossible	Small	Zero	Instant	Preventable	Impossible	Impossible	n/a
Socioeconomic Environment – Economy & Employment										
Employment opportunities (direct and indirect)	Workforce (direct employment)	• Population centres (cities or villages) close to temporary and permanent facilities • along the Pipeline Protection Strip	Certain	Peripheral	Medium	Permanent	Irreversible	Likely	Impossible	Moderate

Impact	Mechanisms	Locations	Criteria/ Impact Properties							SEI
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)	
Economic impact of taxes, fees and local transactions	• Payment of taxes • Energy security • Improve of country's brand name	Greece, Europe	Certain	Peripheral	Low	Long-term	Irreversible	Probable	Certain	Major
Economic impact on agricultural sector/ income	Establishment of safety/ control zones	Tree crops along the pipeline route	Certain	Small	Medium	Long-term	Preventable	Impossible	Impossible	Minor
Economic impact on tourism sector/ income	-	• LF3, • LF4, • LF5	Impossible	Small	Zero	Instant	Preventable	Impossible	Impossible	n/a
Deriving Development Trends from the Project										
Development Trends at National Level	• Construction and operation of the project • Capacity building of workforce and companies • Engagement of various economy sectors • Improvement of country's "Brand Name" • Alignment with national goals	• Greece • Europe	Certain	Peripheral	Very High	Permanent	Irreversible	Certain	Certain	Extreme
Development Trends at Regional Level	• Construction and operation of the project • Capacity building of workforce and companies • Engagement of many economy sectors (infrastructures, construction, services) • Improvement of region's "Brand Name" • Alignment with national goals	• Peloponnese	Certain	Peripheral	Very High	Permanent	Irreversible	Certain	Impossible	Major
		• Crete • W. Greece • Epirus	Likely	Peripheral	Medium	Permanent	Irreversible	Likely	Impossible	Moderate
Technical Infrastructure – Road Network										
Limited Increasing traffic	• Regular and maintenance works	• Existing road network •	Rare	Small	Zero	Long-term	Avoidable	Rare	Impossible	Negligible
Technical Infrastructure – Port Facilities, Marine Traffic and Submarine Cables										

Impact	Mechanisms	Locations	Criteria/ Impact Properties							SEI
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)	
Potential Damage of existing cables	• Crossing including cables	• Offshore route	Rare	Small	Zero	Long-term	Avoidable	Rare	Impossible	Negligible
Technical Infrastructure – Wastewater Treatment										
Wastewater generation	• Machinery washing • Equipment maintenance • Sanitary facilities • Local treatment facilities	• Project stations	Rare	Small	Zero	Long-term	Avoidable	Rare	Impossible	Negligible
Technical Infrastructure – Sanitary Landfill Sites										
Solid waste generation	• Regular operation • Maintenance works • Solid waste by employees	• Onshore route & stations	Rare	Small	Zero	Long-term	Avoidable	Rare	Impossible	Negligible
Technical Infrastructure – High Pressure Natural Gas Pipelines										
Positive impact in national energy infrastructure such as Poseidon Pipeline and PPC Powerplant in Megalopoli	• Connection with Poseidon Pipeline • Connection with PPC Powerplant	• Florovouni, RU of Thesprotia • Megalopoli	Certain	Peripheral	High	Long-term	Irreversible	Probable	Certain	Major
Air Quality										

Impact	Mechanisms	Locations	Criteria/ Impact Properties							SEI
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)	
Emissions from Compressor Stations	Operation of Compressor Stations	<u>Nearby settlements from Compressor Stations CS2/MS2-CS2/MS2N (distance 0-8 Km)</u> • Ag. Triada (3.77Km) • Goudouras (2.56Km) • Perivolakia (7.57Km) • Ziros (7.83 Km) <u>Nearby settlements from Compressor Station CS3 (distance 0-8Km)</u> • Kalivakia(1.99Km) • Agrapidochori(3.33 Km) • AnoVelitses (3.01 Km) • Kandalos (3.43 Km) • Portes (3.12 Km) • Velanidi (4.97 Km) • Dafni B (5.60 Km) • Latas (5.47 Km) • Michio (5.69 Km) • Mazaraki (6.82Km) • Kampos (7.10 Km) • Santomeri (7.59 Km) • Charavgi (7.87 Km)	Certain	Perimetric	Low	Long-term	Minimisable	Certain	Impossible	Moderate
Acoustic Environment										
Impacts on Acoustic Environment during Operation – Onshore	• Noise from Compressor Stations	• Nearby settlements and households. • Nearby industrial receptors	Certain	Large	Low	Long-term	Minimisable	Certain	Impossible	Moderate
Water Resources										
Accidental pollution	Operation of Compressor/ Metering Stations and O&M.	• EL0228R000203009N • EL0129R000220055N • EL1300141 • EL0100070	Rare	Medium	Zero	Short-term	Preventable	Likely	Impossible	Negligible
		• EL0100080	Rare	Small	Very High	Short-term	Preventable	Likely	Impossible	Minor
		• EL0200060, EL0200100	Rare	Small	High	Short-term	Preventable	Likely	Impossible	Negligible
Project's Vulnerability to Risks of Serious Accidents - Shipping interaction										
	• Ship sinking	• Along OSS3 & OSS4	Rare	Medium	Very High	Short-term	Irreversible	Rare	Rare	Minor
		• Along OSS2	Rare	Large	Very High	Short-term	Irreversible	Rare	Rare	Minor

Impact	Mechanisms	Locations	Criteria/ Impact Properties							SEI
			(L)	(Ex)	(I)	(D)	(R)	(C)	(T)	
Gas cloud at the sea surface after pipeline failure (:leak / rupture).	• Ship grounding	• In water sections where the depth is equal to a ship draught.	Rare	Medium	Very High	Short-term	Irreversible	Likely	Impossible	Minor
	• Anchoring	• In water depths for 30m to 100m.	Rare	Medium	Very High	Short-term	Irreversible	Likely	Impossible	Minor
	• Anchor Dragging	• In water depths for 30m to 100m.	Rare	Medium	Very High	Short-term	Irreversible	Likely	Impossible	Minor
	• Dropped objects.	• The crew of passing vessels crossing the release area.	Rare	Medium	Very High	Short-term	Irreversible	Rare	Impossible	Minor
Project's Vulnerability to Risks of Serious Accidents - Industrial Accidents										
Jet Fire would cause damage and escalation	• A crater formed due to rupture on the EastMed pipeline that would expose the parallel pipeline segment	• EastMed onshore CCS1a KPs 146 – 147, near DESFA pipeline to Megalopolis • EastMed onshore CCS2 KPs 224-225, near the POSEIDON Pipeline • EastMed onshore CCS2 KPS 228-232, near the POSEIDON Pipeline	Rare	Large	Very High	Short-term	Reversible	Likely	Rare	Minor
Project's Vulnerability to Risks of Serious Accidents - Geohazards										
JetFire / Fireball	• A rupture on the EastMed pipeline due to seismic loads.	• EastMed onshore CCS1b KPs 289-299-300, Near LF4 • EastMed onshore CCS2 KPs 28-29-30, Between villages Gavalou (population 1018) and Grammatikou (population 802)	Probable	Large	Very High	Short-term	Reversible	Likely	Impossible	Minor

Prepared by: ASPROFOS, 2022.

ANNEX 9 SUPPORTING MATERIALS FOR SECTION 9

ANNEX 9A AIR DISPERSION MODEL FOR PERMANENT FACILITIES SUBJECT TO IED DIRECTIVE

ANNEX 9A.1 AIR DISPERSION MODEL FOR ATHERINOLAKKOS COMPRESSOR STATIONS

ANNEX 9A.2 AIR DISPERSION MODEL FOR ACHAIA COMPRESSOR STATION

ANNEX 9B ADDITIONAL DATA ON LAND USES AND SOCIOECONOMIC ENVIRONMENT FOR IMPACT ASSESSMENT

ANNEX 9C SUPPORTING MATERIAL ON LANDSCAPE BASELINE AND IMPACT ASSESSMENT

ANNEC 9D MARINE SEDIMENT DISPERSION MODEL/ CALCULATIONS

ANNEX 9E APPROPRIATE ASSESSMENTS

ANNEX 9E.1 APPROPRIATE ASSESSMENT SCREENING PROCESS

ANNEX 9F AIR DISPERSSION MODEL FOR PRE-COMMISSIOINING ACTIVITIES

ANNEX 9F.1 AIR DISPERSSION MODEL FOR PRE-COMMISSIOINING ACTIVITIES AT LF2

ANNEX 9F.2 AIR DISPERSSION MODEL FOR PRE-COMMISSIOINING ACTIVITIES AT LF5

ANNEX 9G NOISE PROPAGATION MODEL DURING PRE-COMMISSIONING PHASE

ANNEX 9G.1 NOISE PROPAGATION MODEL DURING PRE-COMMISSIONING PHASE FOR LF2

ANNEX 9G.2 NOISE PROPAGATION MODEL DURING PRE-COMMISSIONING PHASE FOR LF5

ANNEX9H UNDERWATER NOISE PROPAGATION MODEL DURING CONSTRUCTION PHASE