TÜRKİYE PETROLLERİ ANONİM ORTAKLIĞI

OTC OFFSHORE TECHNOLOGY CENTER

SAKARYA GAS FIELD DEVELOPMENT PROJECT - ESIA

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ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA)

Chapter 6.3 Offshore Physical and Biological Baseline

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00	Initial draft	N/A
01	Additional sediment samples were reflected to the chapter.	Entire chapter
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Information Classification

Code	Description of Information Classification
PUBLIC	Information and data that may be shared without restrictions because it is unlikely to result in any harm if disclosed to outside parties. Permission to actually release information to the public must be obtained separately through External Affairs
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6.0 ENVIRONMENTAL AND SOCIAL BASELINE

6.3 Offshore Physical and Biological Baseline

6.3.1 Physical

This section describes the offshore physical environment, including the components not considered to be affected by the project as evaluated in Chapter 5.2. Such components are the following:

- Seafloor morphology;
- Sediments (grain size and chemical characterization);
- Seawater (chemical and physical);
- Physical oceanography (currents and waves); and
- Underwater noise.

6.3.1.1 Seafloor morphology

Definition	Seafloor morphology refers to the shape of the land when it interacts with the seawater. These interactions create vary geological structures that occur both near the coast and at greater depths. Seabed habitats covary with topography and organisms benefit from a varied seafloor morphology. Spatial heterogeneity is crucial to the diversity of the benthic infaunal communities and functions as a shelter for juvenile fishes (Kaiser *et al.*, 2002).
Study areas	**RSA:** The Black Sea with focus on the Turkish continental shelf, slope and abyssal plain. **Rationale:** The Turkish continental shelf of the Back Sea shows several prominent structures such as slumping, pockmarks, mud volcanoes, sliding and faults (ÇİFÇİ *et al.*, 2002).
	AoI: The project footprint plus a buffer of 500 m per side. **Rationale:** Seafloor morphology is a seascape component (thus still). Impacts (if any) may only occur in the very vicinity of the project footprint because of the limited influence due to the hydrodynamism. A buffer of 500 m is considered as highly precautional for the pipeline laying and even for the activities of dredging and deposition of the sediments at the temporary storage area.
Data sources	**Primary sources**: Geophysical data gathered through Side Scan Sonar (SSS), Sub Bottom Profiler (SBP) and Multibeam Echosounder (MBES) and reported in the report “Hydrographical and Oceanographic Survey Report” by DenAr Deniz Araştırmaları A.Ş.
	Secondary sources: Secondary data from scientific papers, grey literature, and databases.

Methodological approach

Data to describe the regional context (i.e., RSA) were collected through literature review (references reported in 13.0), whereas the local context (i.e., AoI) was assessed by both literature review and the gathering of field data.

In particular, primary data were gathered in the area (which includes the AoI) by DenAr (2021) through Side Scan Sonar (SSS), Sub Bottom Profiler (SBP) and Multibeam Echosounder (MBES). Details on the methodology, techniques and instruments used are reported in DenAr (2021). Maps were created based on the geophysical data gathered.

Regional context (RSA)

The Black Sea basin is subdivided into Eastern and Western basins by the system of low topographic highs, called Hills and Ridge. Compared to the Eastern basin seafloor, the Western one is complicated by the huge Danube fan and other sedimentary or tectonic features, but a flat abyssal plain also occurs around its depocenter. The abyssal plain is approximately constrained by the contour of the 2,000 m isobath (Esin *et al.*, 2018).

Generalized bathymetric profiles of the Black Sea demonstrate a gradual transition from the abyssal plain to the continental slope without any continental rise indicating restricted sediment accumulation by turbidity currents at the slope base aside of canyon fans. Many submarine canyons incise the Black Sea continental slope, and they are grouped into four main areas: a northwestern area (including the Danube and Dnieper canyons), a western area (Istanbul), a southern area (Samsun) and an eastern area (Batumi-Sochi). Those categories were made by considering only large canyons, the ones that span a bathymetry interval of at least 1,000 m, with a channel depth reaching at least 100 m (Jipa & Panin, 2020).

The Black Sea is characterized by slope failures and sediment instability related to high amounts of gas and gas hydrate that may pose a threat to offshore installations. The formations of submarine mud diapirs, mud volcanoes and gas leaks are linked to the upward migration of free gas in the sediments on the continental edges (Wan *et al.*, 2021).

Specifically, the Turkish seafloor (including the western area – Istanbul and the southern area - Samsun) shows several prominent structures such as slumping, pockmarks, mud volcanoes, sliding and faults (ÇİFÇİ *et al.*, 2002). Based on the “Hydrographical and Oceanographic Survey Report” by DenAr Deniz Araştırmaları A.Ş., Turkey’s continental margin has a narrow shelf (up to 10 km width) located at a water depth of 100 m, a steep continental slope (inclination up to 25 degrees) scoured by the canyon systems, a continental elevation with mild and soft incline, and a smooth abyssal plane with maximum water depth of 2,200 m.

Local context (AoI)

The nearshore part of the Project is located upon the continental shelf, close to the Filyos river mouth and is deeply eroded by an active canyon system. Such system is considered active[1] by the presence of sedimentary waves in the area, especially in the continental slope. Steep slanted areas are confined along the continental slope, while continental elevation has a relatively soft slope extending towards the deep abyssal plain. The abyssal plains represent the deep ocean floor area, which is relatively intact (DenAr, 2021).

A map of the seafloor morphology (made through MBES) around the pipeline corridor is shown in Figure 6-1.

[1] I.e., located on a geological active margin, where two or more lithospheric plates collide. Canyons are steeper, shorter, more dendritic, and more closely spaced on active than on passive continental margins (Shanmugam, 2021)

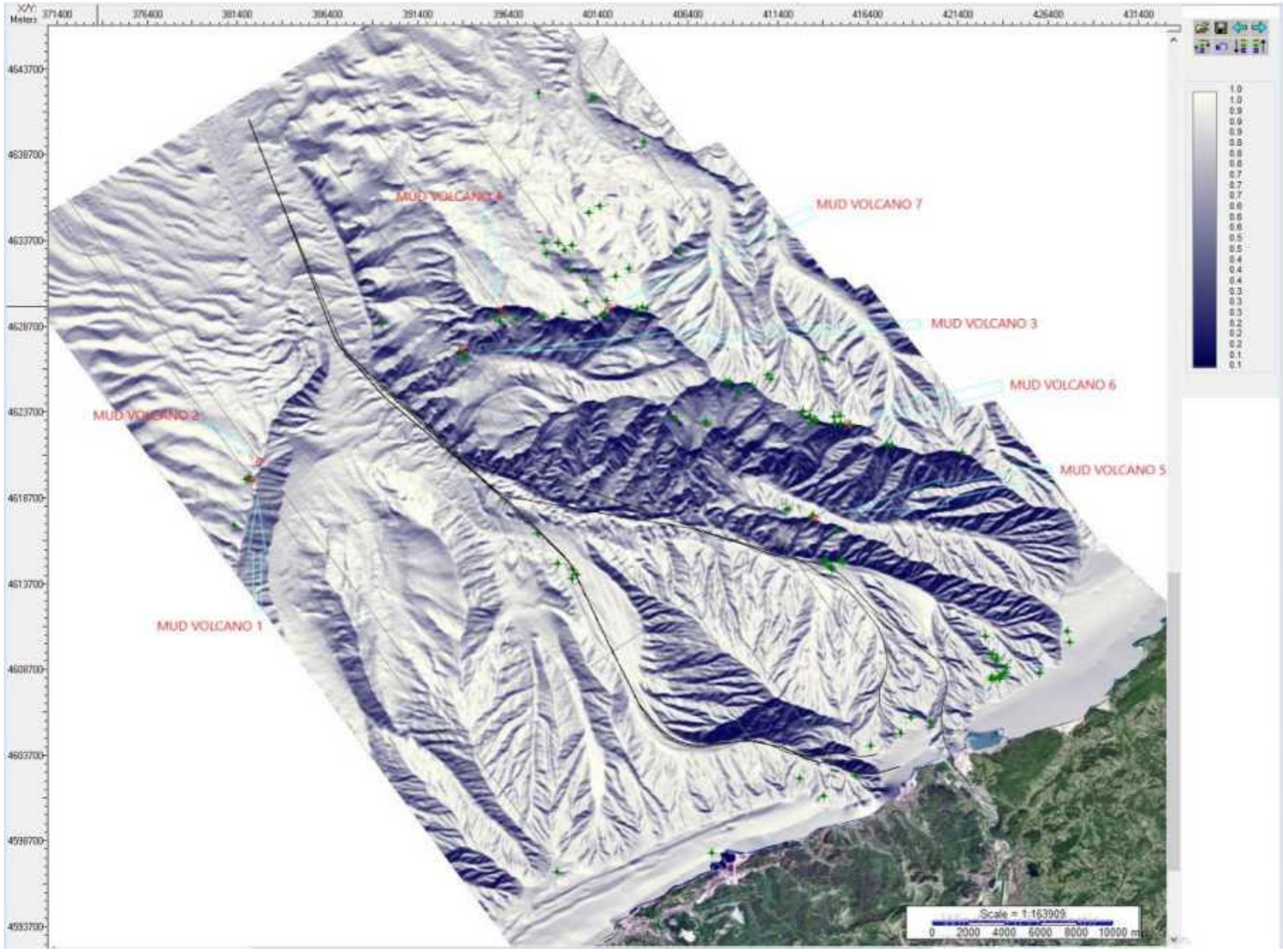

Figure 6-1: Geomorphological map of the offshore area, including the AoI, showing the pipeline route and the location of the closest mud volcanoes.

Based on the results of the geophysical surveys conducted, the seafloor of the AoI is totally characterized by soft bottoms showing a gently sloping bathymetry upon the continental slope, where the -5 m isobath contours are distanced 250 to 500 m each other.

The **temporary storage area** is a homogenous sandy seafloor between about 6 and 12 m of depth, sloping very gently. The only factor of heterogeneity and tridimensionality in such a seascape are continuous and consolidated clay bank outcrops with porous or alveolar appearance located along the -5 m isobath and becoming patchier at the northern border of this area (see Figure 6-29 in 6.3.2.5).

As far as what concerns the **pipeline corridor**, the seafloor morphology of the AoI section lying upon the continental shelf is shown in Figure 6-30 and Figure 6-31, both in 6.3.2.5.

The first 500 m nearshore, being located east of the Filyos river mouth and characterized by shallow waters, show coastal bedforms with alternation of sandwaves (i.e., ripple marks) and channels induced by both the waves and the estuarine processes of the area. Being uniform in the first 5 m of depth, such formations occur only as patches of a homogeneous seafloor between about 7 and 15 m of depth. The head of a canyon touches the north of the AoI at about 1 km offshore, between the isobaths of -15 and -20 m, where the AoI itself shows generally consolidated clay bank outcrops with porous or alveolar appearance. Beyond 20 m of depth, the seafloor appears again uniform and very homogeneous, gently sloping for several km, until the isobath of - 40 m, where the slope of the continental shelf start increasing slightly and the head of a canyon with very steep walls intersects the AoI northwards at about 60 m of depth. The continental slope starts at about 90 m of depth, heading into a canyon where the seafloor gets abruptly steep until 1,200 m (about 10 km offshore) and sloping again until 2,000 m of (about 50 km offshore), where a series of sedimentary waves are present created by turbidity currents that are present in the area (see 0) due to the canyon system and the sediments discharge of the Filyos River (Paull et al., 2018). The rest of the AoI is represented by an abyssal plain at about 2,100-2,200 m of depth.

The bathymetric profile of the whole AoI is shown in the picture below (Figure 6-2), whereas bathymetric lines of the AoI section lying upon the continental shelf is shown in Figure 6-30 e Figure 6-31, both in 6.3.2.5.

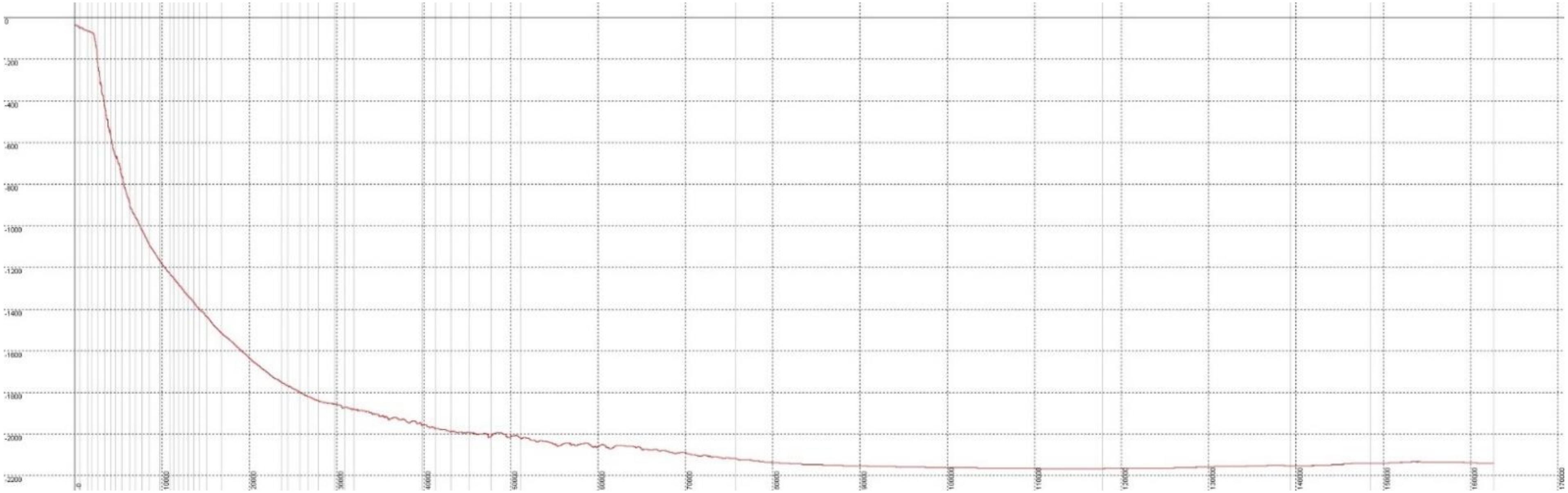

Figure 6-2: Bathymetric profile of the AoI.

It should be stated, in addition, that no geomorphic structures having the potential to pose a threat to the Project are located within the AoI. However, some of such structures are found around the AoI, such as follows.

Mud volcanoes

Mud volcanoes erupt with very dense or expulsive gas emissions from the seabed with average time interval of 20 years up to 60 years, resulting in violent outbursts. Sediments mixed with water rich in gases and minerals is pushed out during those eruptions (Dimitrov, 2002).

Using primary data gathered by DenAr (2021) in the Continental Ascension region at the top of the sedimentary ridges along the canyon edges, seven mud volcanoes in the form of cones were determined and they are all located on shallow mud diapirs (Figure 6-3). The closest one is the one named "Mud volcano 3" and is located at about 6 km northeastwards. Such volcano is not expected to pose a threat to the project being a cone-type mud volcano (a mean surface slope of >10º) with episodic massive mud eruptions that are several orders of magnitude smaller than the ones of the pie-type mud volcanoes (Kioka & Ashi, 2015).

Mud volcanoes may be considered as the main responsible for seismicity in the AoI. Details are available in 6.2.1.4.

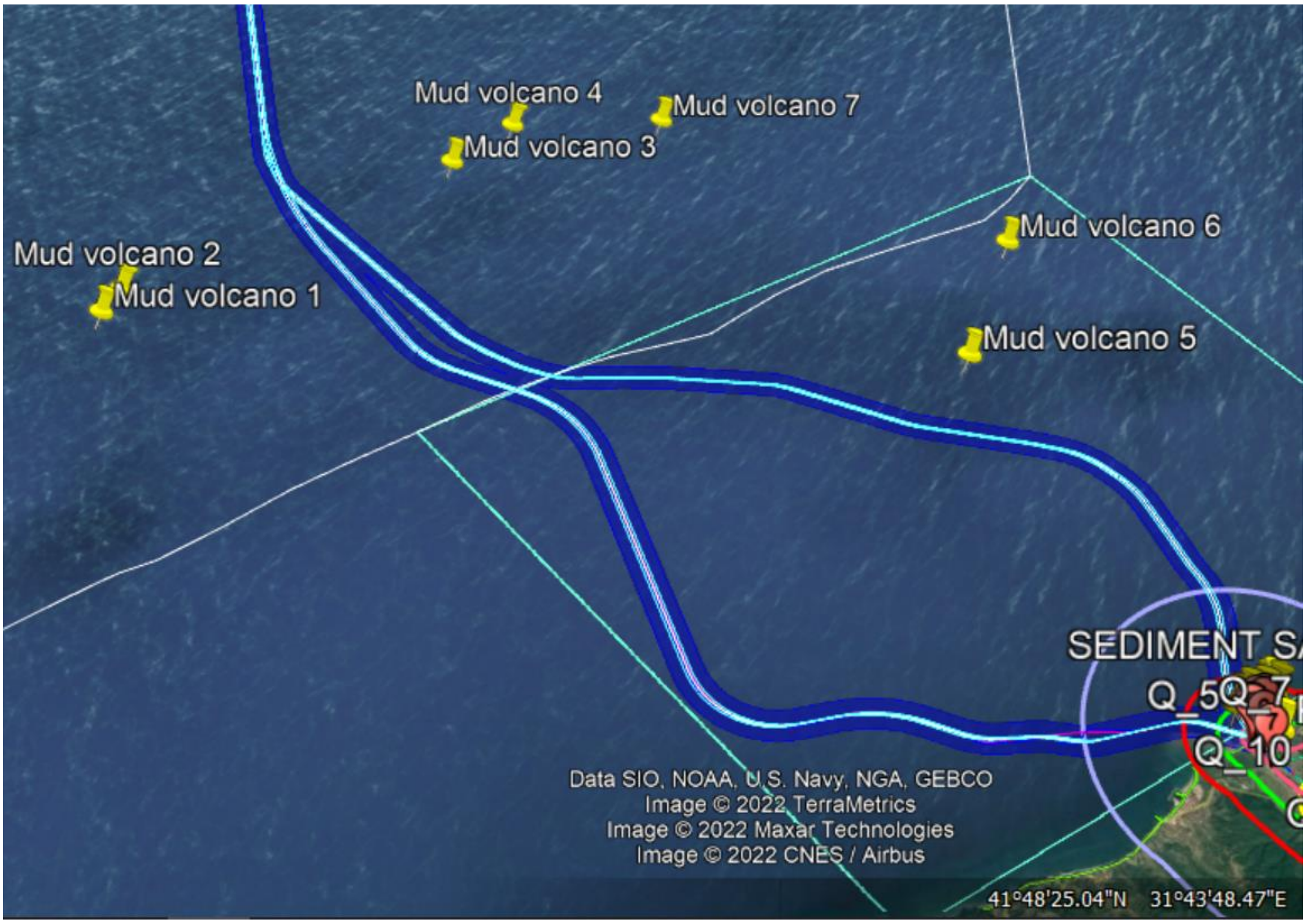

Figure 6-3: Mud volcanoes locations with reference to the AoI.

Mud diapirs

A mud diapir is an intrusive geomorphic structure characterized by a slowly upward migrating mass of clay-rich sediment and fluid discharge (Kopf, 2002). A mud volcano usually occurs above the diapir, because of fluid migration directly along the body of the mud diapir or through faults (fractures) connected to the mud diapirs. Mud volcanoes represent the last manifestation of diapirism (Chen et al., 2014).

Gas outlets

Acoustic transparency in the sediments caused by upwardly moving gases, leaking slowly, that blur the sedimentary stratification. Gas leaks usually occur near submarine mud volcanoes and mud hills. Water column acoustic anomalies are located close to these structures, which indicates that these structures are active gas discharge areas.

Several gas leaks in the area along the top of the sedimentary ridges near possible mud volcanoes, mud piles, and pockmarks[2] are reported by DenAr (2021).

Sensitivity Assessment

Sensitivity features	Supported by	Sensitivity value
Absence of rocky outcrops and gently sloping bathymetry upon the continental slope Presence sedimentary waves in the canyon area Medium Seismicity	Primary data (DenAr, 2021) and secondary data	**Medium-high**

6.3.1.2 Sediments (grain size and chemical characterization)

Definition	Sediment is a stratifying solid material, composed of both geological detritus (i.e., minerals) and biological detritus (i.e., organic matter), that may be moved and deposited in a new location by hydrodynamism (i.e., currents and waves) or mass movement. Thus, both natural and human-made perturbations, have the capability to alter the habitats that sediments provide (Boggs Jr. & Boggs, 2009). In addition, sediment is a conservative matrix, where contaminants (if present) accumulate (Lijklema *et al.*, 1993) and composition can also be used as an indicator of the ecosystem health (Handley *et al.*, 2014).
Study areas	**RSA:** Western Black Sea basin. **Rationale:** The Andrusov Ridge and Archangelsky Ridge extending south from the Crimean Peninsula divide the Black Sea into two depositional basins: the Western Black Sea and the Eastern Black Sea (Shillington *et al.*, 2008).

[2] Craters that commonly occur world-wide on muddy seabeds. They are formed by fluid flow and are indicators of past and present hydraulic seabed activity (Hovland & Judd, 1988).

	AoI: The project footprint plus a buffer of 500 m per side. **Rationale:** The activity of pipeline laying onto the seafloor may resuspend a limited amount of sediments with scarce possibility to be transported through long distances. A buffer of 500 m is considered as highly precautional even for the activities of dredging and deposition of the sediments at the temporary storage area.
Data sources	**Primary sources**: Sediment samples at different depths were taken and analyzed. Data was also collected from the study titled "Hydrographical and Oceanographic Survey Report" by DenAr Deniz Araştırmaları A.Ş. carried out within the Project.
	Secondary sources: Secondary data from scientific papers, grey literature, and databases.

Methodological approach

Data to describe the regional context (i.e., RSA) were collected through literature review (references reported in 14.0), whereas the local context (i.e., AoI) was assessed by both literature review and the gathering of field data.

In particular, primary data were gathered in the area (which includes the AoI) by DenAr (2021) through sediment sampling in 132 stations in the AoI and its vicinity, at depths ranging 2 m to 1,900 m. A Van Veen grab was used in the shallower stations, whereas the deeper were sampled using a OSIL Mega Box Corer. Samples were subsequently analyzed in laboratory to assess the granulometry and the contaminant concentration. Details are reported in DenAr (2021).

Sediment samples gathered for the benthic community and habitat identification, whose methodology is reported in 6.3.2.2, were also used to qualitatively characterize the sediments of the AoI.

Additional four samples were gathered at the temporary storage area in February 2022 using an 8-L grab. Samples were analyzed by the NEN *Mühendislik ve Laboratuvar Hizmetleri Ltd*. for both granulometry and contaminants determination and quantification in accordance with the "Regulation on the Environmental Management of the Dredged Material" that came into effect through publication on the Official Gazette No. 31008 dated 14/01/2020.

Regional context (RSA)

The Western Black Sea basin is characterized by Danube deep-sea fan that extends for about 150 km downslope the edge of the continental shelf, and the distal end of the fan reaches the abyssal plain at 2,200 m water depth. Such system is responsible for the higher supply of terrigenous sediments to the basin. Beyond the Danube, this abyssal fan is also fed by important rivers, such as the Dnepr, the Dnestr and the Southern Bug (also known as Boh River) (Popescu *et al.*, 2001).

With a multiannual mean flow of 6,510 m^3/sec and a multiannual average suspended sediment discharge of 1,619 kg/sec at the delta, the Danube contributes large amounts of sediments to the Western Black Sea basin (Bondar, 2008). The main components of those Black Sea sediments are organic carbon and calcite. Organic carbon shows a high degree of preservation due to anoxia in the waters below 100 - 150 m of depth, making 90% of its water mass as anoxic. This is translated as the world largest anoxic water mass (Sorokin, 1983).

Local context (AoI)

The AoI is located in close proximity to the Filyos river mouth, whose waters influence the sediment supply and, as a consequence, characterization of it. The Filyos River has an annual sediment transport of approximately 233 $m^3/(year*km^2)$, which about 90% of it is suspended load and consists mainly of sand and silt (Donders, 2010). As reported in 6.2.1.6, the sediment of the river is also composed by gravel, peat, and clay, which can be found the AoI.

Sediment grain-size

Based on the results reported by DenAr (2021), the sediments of the AoI (**pipeline corridor**) are averagely composed as follows:

- Gravel (6.27%);
- Sand (47.83%);
- Silt (28.03%); and
- Clay (40.52%).

The sand-sized material is the dominant one and is found (even if in minimum parts) in all the stations throughout the AoI, from 0 m to 2,000 m. The Filyos River discharge and the morphological characteristics of the region that fuel turbidity currents explain this mixed distribution of grain size (Donker & de Swart, 2013). The sediment granulometry changes in proportion to the water depth, with intrusions of different grain sizes in various patches of the shelf.

More in detail sands are dominant in the AoI (including both temporary storage area and the pipeline corridor), from the shoreline to about 25 m depth, and become gradually dominated by muds from about 25 m to about 50 - 60 m depth. Dead shells are abundant in this bathymetric range. Clay becomes dominant about around 65 m depth and onward. Enclaves of clay interrupt the sand-dominated seabed between the coastline and the first 25 m of depth. A relevant amount of clay, forming tridimensional structures, is present in the pipeline corridor between 15 m and 20 m depth and on the bathymetry of 10 m in the temporary storage area.

According to the bathymetry the sediments of the AoI may be described as distributed as follows.

- Till 5 m depth, the pipeline corridor is characterized by coastal bedforms, specifically a mixture of channels and sandwaves created by the interaction of sea and estuarine processes. The sea and river currents might expose underlying clay layers. The density of the coastal bedforms decreases as you go down in depth with a complete halt of their presence at circa 15 m depth.
- The next section, from the 15 m depth to the 20 m depth, has consolidated clay banks outcrops with an alveolar appearance.
- Around 25 m depth, there are no more coastal bedforms and only a muddy seafloor is present.
- The muddy seafloor that starts at 25 m depth continues till the depth of about 65 m with a gradually increase in anoxic conditions.
- From the 65 m depth to the 85 m depth, clay-dominated seabed is found and the colour of the sediments start to turn to black, indicating partial anoxic conditions.
- From 85 m onwards we have a clay seabed with prevalent anoxic conditions.

A qualitative characterization of the sediments upon the continental shelf of the AoI, made in the scope of the benthic community and habitat identification (see 6.3.2.2 and 6.3.2.5), is reported in Figure 6-30 and Figure 6-31.

As per what concerns the **temporary storage** area, the grain-size of the sediment samples collected are shown in Table 6-1.

Table 6-1: Grain-size composition of the sediments in the temporary storage area (analyses performed by NEN Mühendislik ve Laboratuvar Hizmetleri Ltd.).

Site	Sand %	Clay + Silt %	Clay %	Silt %
SEDIMENT SAMPLE-1	87.3	12.7	3.2	9.5
SEDIMENT SAMPLE-2	22.4	77.7	32.9	44.7
SEDIMENT SAMPLE-3	92.6	7.4	2.9	4.5
SEDIMENT SAMPLE-4	92.3	7.7	3.0	4.7

Based on the analyses, the temporary storage area appears as mainly composed by sand as well, but the grain-size at SEDIMENT SAMPLE-2 shows and confirm the presence of intrusion of patches of silt clay, whose origin is suspected to be anthropogenic (e.g. possibly from the port construction).

Chemical characterization

No information about the contamination level of the sediments in the AoI (**pipeline corridor**) is reported in DenAr (2021). For such reason, within the study conducted in the scope of the National EIA, two sediment samples were collected (see Figure 6-4): one in close proximity to the AoI and the other one in close proximity to the pipeline corridor of Phase 2, which is out of the scope of this ESIA and may act as a control.

The chemical characterization of the sediment of the two stations is reported in Table 6-2, together with these of the four stations at the temporary storage area.

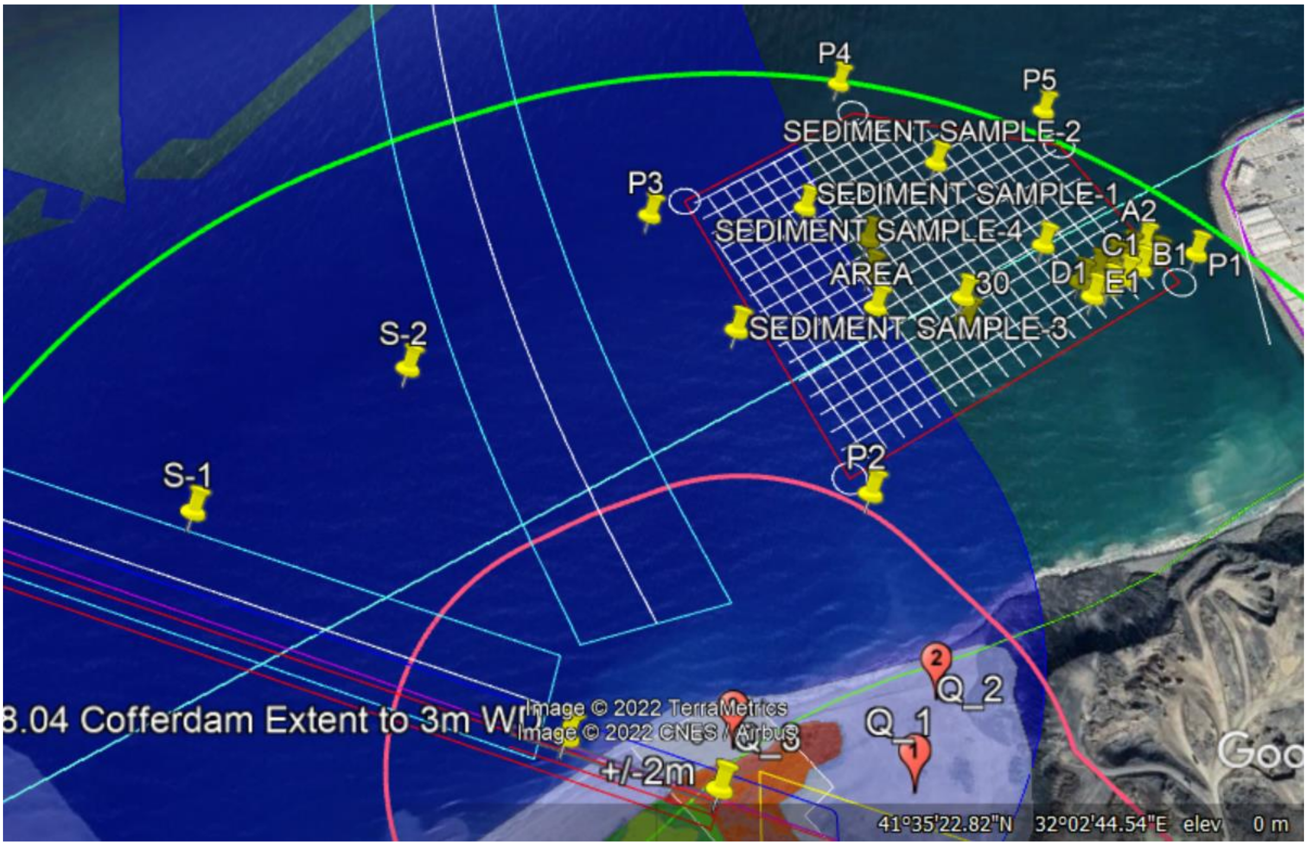

Figure 6-4: Localization of the sediment sampling stations.

Table 6-2: Contaminant quantification in the sediments of the AoI (+ control point).

Elements	Alka Çevre Laboratuvarları		NEN Mühendislik ve Laboratuvar Hizmetleri Ltd.				Turkish Regulation		NOAA Standards	
	S-1	S-2	SEDIMENT SAMPLE-1	SEDIMENT SAMPLE-2	SEDIMENT SAMPLE-3	SEDIMENT SAMPLE-4	TLV[1]	ULV[2]	TELs[3]	PELs[4]
Arsenic (mg/kg)	<0.5	<0.5	<0.3	<0.3	<0.3	<0.3	50	100	7.24	41.6
Cadmium (mg/kg)	<0.15	<0.15	<0.2	<0.2	<0.2	<0.2	3.5	5	0.68	4.21
Chromium (mg/kg)	<0.5	<0.5	48.9	53.6	44.2	56.5	350	700	52.3	160
Copper (mg/kg)	<0.15	<0.15	4.9	6	6	5	300	800	18.7	108
Lead (mg/kg)	<0.5	<0.5	4	6.60	4.91	4.26	150	250	30.24	112
Mercury (mg/kg)	<0.05	<0.05	<2	<2	<2	<2	0.7	3	0.13	0.7
Nickel (mg/kg)	<0.5	4.15	27	41	32	28	100	200	15.9	42.8
Zinc (mg/kg)	<0.5	2.35	44	58	40	48.3	500	1000	124	271
Total PCBs (Polychlorinated Biphenyls)	<0.625 (mg/kg)	<0.625 (mg/kg)	<0.5 (µg/kg)	<0.5 (µg/kg)	<0.5 (µg/kg)	<0.5 (µg/kg)	23 (µg/kg)	65 (µg/kg)	21.6 (µg/kg)	189 (µg/kg)

[1] Threshold Limit Value; [2] Upper Limit Value; [3] Threshold Effect Levels; [4] Probable Effect Levels

The chemical analyses show that none of the elements exceed the Probable Effect Levels of the National Oceanic and Atmospheric Administration (NOAA), where the concentration levels of the contaminant frequently pose adverse effects (Port of London Authority, 2022). Furthermore, all elements in all the samples are below the Threshold Limit Value of the Turkish regulation.

Nevertheless, it must be stated that Nickel values are between the TELs and PELs levels of the NOAA in the temporary storage area. However, it should be underlined that this metal shows no indication of biomagnification in higher levels of the food chain having no dietary toxicity to consumer organisms (Cardwell *et al.*, 2013). In addition, two sampling stations (SEDIMENT SAMPLE-2 and SEDIMENT SAMPLE-4) showed Chromium values slightly exceeding the TELs levels of the NOAA. It must be noted that Chromium shows no sign of biomagnification in aquatic food chains as well (Kimbrough *et al.*, 1999).

The origin of such levels of presence of Ni and Cr should be furtherly assessed but, considering the fact that such levels were identified only in the temporary storage area, this may have anthropogenic origins due to the port construction.

Sensitivity Assessment

Sensitivity features	Supported by	Sensitivity value
Limited presence of fine sediment the excavation area (trench). Absence of significant contamination	Primary data	**Medium-Low**

6.3.1.3 Seawater (chemical and physical)

Definition	Seawater is water from the sea or the ocean, having an average salinity in the world's oceans of about 35⁰/₀₀. Seawater varies from 0 to 30 degree Celsius depending on its geographical location (Loáiciga, 2006), showing different physico-chemical features depending also to the temperature. Seawater has an extremely high dilution power against pollutants, providing itself a so-called "auto-depuration". It is estimated that ~2.2 million of species live in the seawater and that 91% of earth species in the ocean still await a description (Mora *et al.*, 2011).
Study areas	**RSA:** The Black Sea **Rationale:** All the basin is characterized by a permanent halocline and anoxic zone with a limited input of saltwater from the Mediterranean Sea at about 100-150 m of depth (Tuğrul *et al.*, 2014).
	AoI: The project footprint plus a buffer of 500 m per side. **Rationale:** Water has a great diluting effect, depending on the flow rate and the dimensions of the basin (Farhadian *et al.*, 2015). A buffer of 500 m is considered as

	highly precautional for the pipeline laying and even for the activities of dredging and deposition of the sediments at the temporary storage area.
Data sources	**Primary sources**: Data collected from the study titled "Hydrographical and Oceanographic Survey Report" by DenAr Deniz Araştırmaları A.Ş. carried out within the Project.
	Secondary sources: Secondary data from scientific papers, grey literature, and databases.

Methodological approach

Data to describe the regional context (i.e., RSA) were collected through literature review (references reported in 14.0), whereas the local context (i.e., AoI) was assessed by both literature review and the gathering of field data.

In particular, primary data were gathered in the area (which includes the AoI) by DenAr (2021) through multiparametric probe to get the CTD (Conductivity, Temperature and Depth) profile of the water column in 48 stations including the AoI and nearby areas (Figure 6-5). Electrical conductivity measurements to estimate the ionic content of seawater also led to the assessment of the practical salinity scale. Details are reported in DenAr (2021).

Sea water samples were collected off the Filyos port and analyzed in the scope of the national EIA (Armada, 2021) in 25 stations (Figure 6-6) to be compliant to the Water Pollution Control Regulations (Official Gazette, dated 31 December 2014 No. 25687). Samples were collected using a SBE32 Carousel Sampler (or "Rosette") and analyzed by "Febas Çevre Analiz Laboratory" accredited by Ministry of Environment and Urbanization and Turkish Accreditation Agency. Details are reported in Armada (2021).

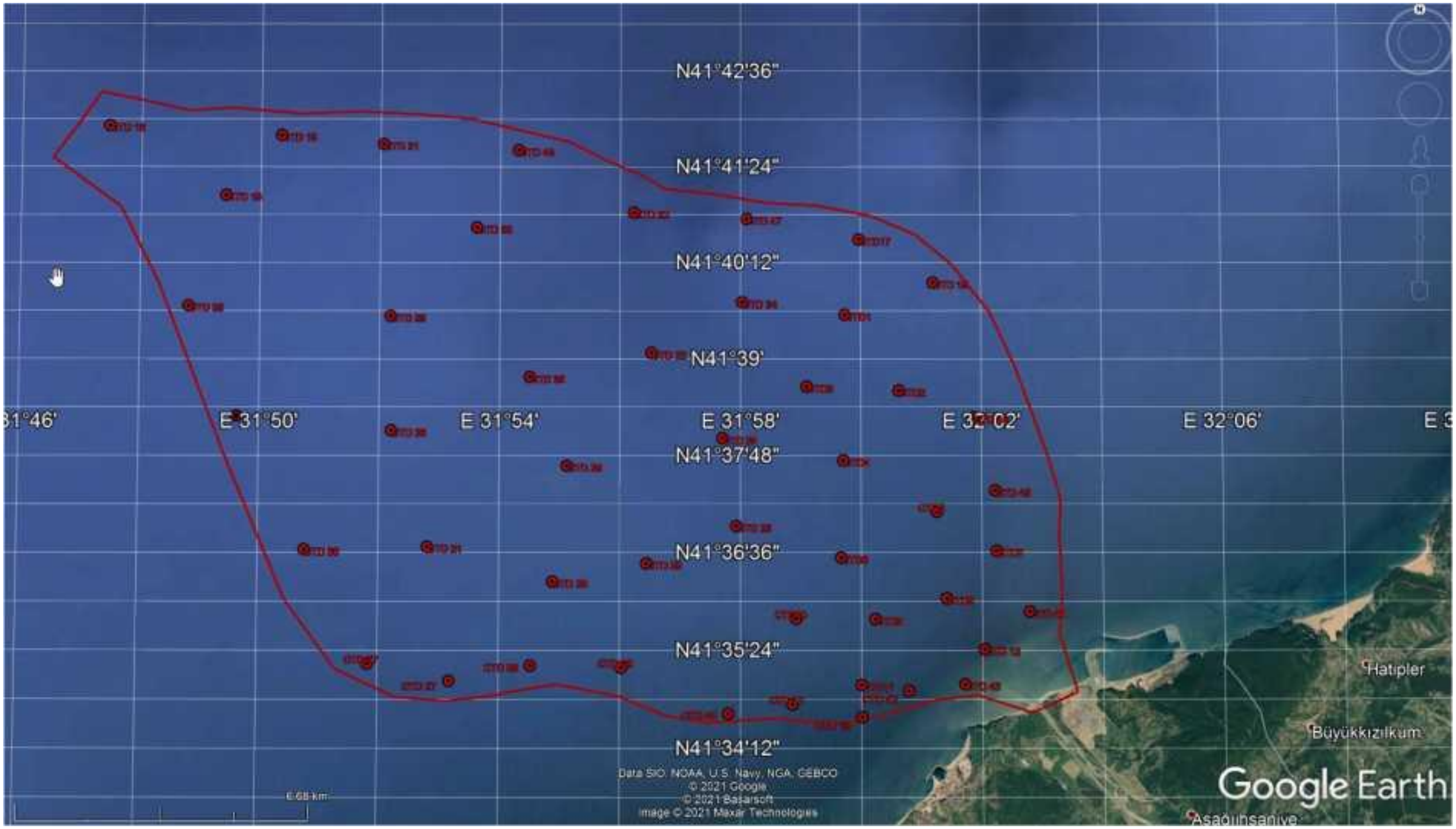

Figure 6-5: Localization of the CTD measurements of the water (source: DenAr, 2021).

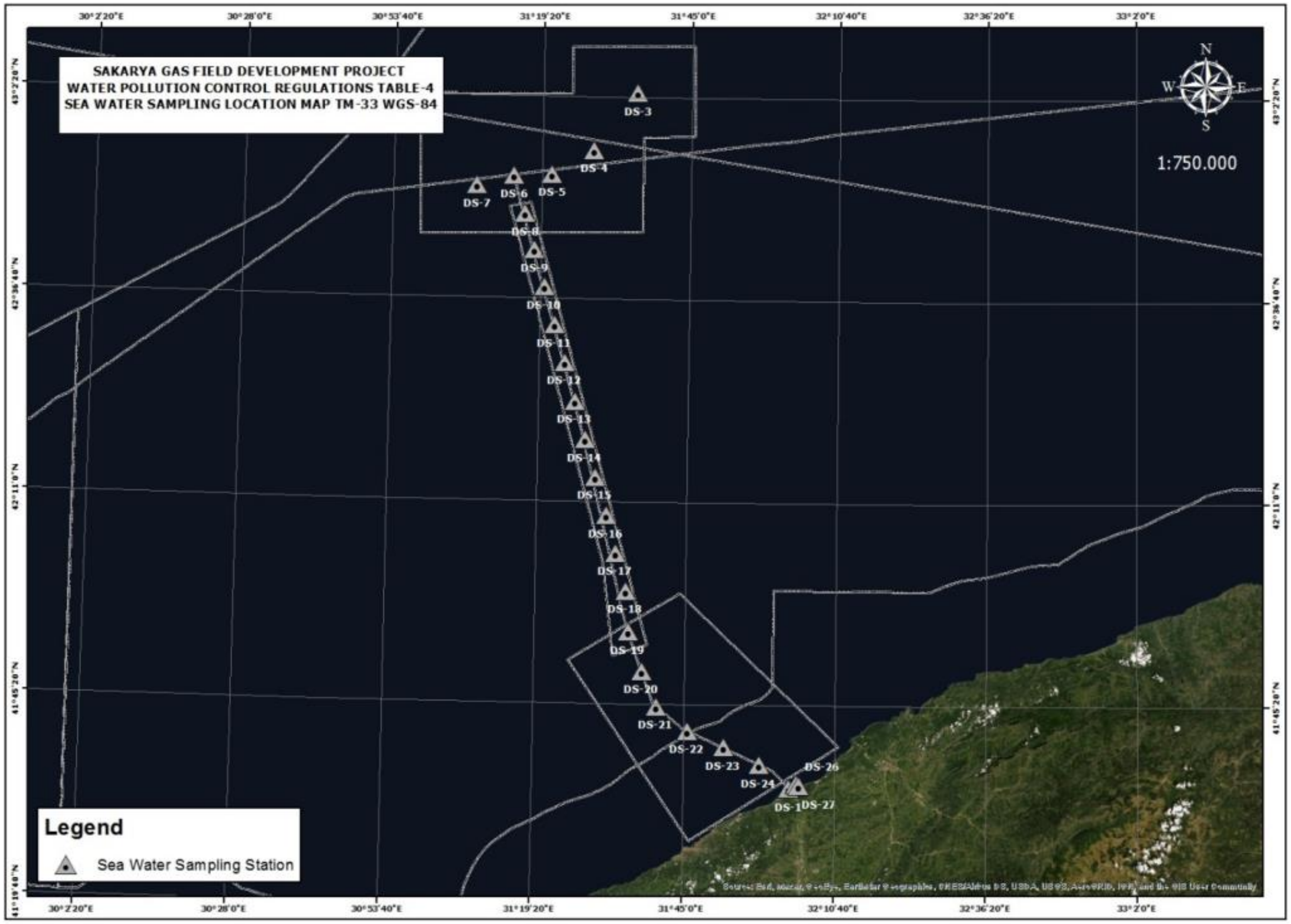

Figure 6-6: Localization of the water samplings (source: Armada, 2021).

Regional context (RSA)

Climate change and anthropogenic actions have modified, in the last decades, the chemical structure of the Black Sea: sulfide and nutrients in the anoxic zone have had an increase in their concentration, whereas the concentration of oxygen in the upper layer (i.e., the oxygenated layer) has decreased. These changes suggest that an increase of the flux of sinking Particulate Organic Matter (POM) has perturbated the biogeochemistry of the Black Sea. The balance in the distribution of the nutrients that was present before the early 1970s have been modified due to intensive eutrophication (Konovalov & Murray, 2001).

The only intake of seawater in the Black Sea is from the Mediterranean Sea, through the Bosphorus Strait via the Sea of Marmara, therefore the Black Sea is strongly stratified with a surface layer of low salinity (S~17 - 18). This situation is emphasized but the large riverine input of fresh water, especially in the Western basin of the sea (Sorokin, 2002), resulting in a strong salinity-driven gradient and a permanent halocline which limits vertical supply from the deeper layers. However, limited exchanges of dissolved oxygen (O_2) and nutrients are reported to occur in winter between the surface layer and the upper depths of the permanent halocline. Permanent anoxia in sub-halocline waters, below 125 - 200 m depth, is a consequence of the permanent halocline and the limited exchanges of dissolved oxygen (Oguz, 2008).

The absence of upwelling makes the primary production in the Black Sea dominated by nutrients inputs from precipitation during the spring-autumn period and from major rivers especially present in the Western Basin (Medinets & Medinets, 2012). Chlorophyll-a concentration may be used as an indirect measure of the nutrient concentration present in the sweater being the main measure of phytoplankton biomass, it's spatial distribution and, seasonal and inter-annual variability (Huot *et al.*, 2007). The natural pattern of the Chlorophyll-a annual cycle in the middle latitudes of the Black Sea shows two peaks in spring and autumn (February/March, with a maximum value of 2.25 mg m^{-3}, and October, with a maximum value of over 1.0 mg m^{-3}) and a minimum in summer (Chu et al., 2005).

Local context (AoI)

Based on the CTD measurements taken by DenAr (2021), the seawater of the AoI appeared totally in line with the characteristics of the region (see regional context) in the same period of the year (i.e., April), such as follows.

- The **halocline** and **pycnocline** were always identified around the depth of 100 m.
- No **thermocline** was identified, but a constant temperature was measured beyond about 20 m of depth.

As per what concerns the chemical analyses carried out in the scope of the national EIA (Armada, 2021), water samples always showed a chlorophyll-a below the limit of detectability of 1 µg/L. Levels of chlorophyll-a under 0.95 µg/L usually indicate an oligotrophic environment low on biomass (Carlson, 2007).

Such oligotrophic environment is also indicated by the average oxygenation among the samples (91.3% of saturation in average) with nine stations having an oxygenation under 90%, out of which 5 of those were near the coast (i.e., far from the anoxic area of the deeper zones).

Ammonium is present at an average of 0.12 mg/L, exceeding the limit value of the Turkish regulation at 0.02 mg/L. This might also explain the low value of chlorophyll-a present in the area, which is expected to show its peak in that period, given that ammonium inhibits growth and carbon gain (Guo et al., 2007).

With the exception of copper (Cu), whose value exceeded the Turkish regulation threshold in 7 stations[3], all the heavy metal quantified were below the limits.

Phenols were also over the limits in 7 stations by a little margin but studies show that both aerobic and anaerobic environments have a satisfactory biodegradation of phenols in both water and soil (Annachhatre & Gheewala, 1996).

In conclusion, based on abovementioned chemical analyses it can be stated that the AoI, including the water column till about 2,000 m depth and far offshore, presents oligotrophic characteristics. However the coastal area, including the Filyos river mouth, is likely to have eutrophic features such as indicated by the results of the survey conducted in February 2022 for the habitat mapping and benthic communities characterization.

Sensitivity Assessment

Sensitivity features	Supported by	Sensitivity value
CTD measurements in line with the regional context AoI located mainly in open sea area with good water circulation	Primary data (DenAr, 2021; Armada, 2021)	**Medium**

6.3.1.4 Physical oceanography (currents and waves)

Definition	Physical oceanography is the dynamics of seawater masses at both surface and deeper layers that influence the productivity and diversity of marine ecosystems at different scales (Lévy, Franks, & Smith, 2018). Such movements are the main responsible for particle transport and pollutant dilution and dispersion throughout the oceans. Currents are underwater streams made of vertical and horizontal movements in the circulation system of the ocean waters produced by gravity, wind and water density variations (Gordon & Cenedese, 2021). Water waves are a swell or ridge in the surface of a body of water normally having an oscillatory motion and a distinct forward motion of the particles that consecutively compose it. Gravity and surface tension are the two physical mechanisms that control and maintain wave motion (Cenedese & Tricker, 2018).
Study areas	**RSA:** The Black Sea **Rationale:** A basin-wide gyre called Rim Current is present in the Black Sea and numerous eddies are present along the coastline. Eddies and the Rim Current keep interacting by merging and detaching creating a big current system in the Black Sea (Oguz *et al.*, 1993).
	AoI: The project footprint plus a buffer of 500 m per side.

[3] Cu does not show biomagnification in the marine food chain, potentially posing no threat (Cardwell et al., 2013) at those concentrations.

	Rationale: Water has a great diluting effect, depending on the flow rate and the dimensions of the basin (Farhadian *et al.*, 2015). A buffer of 500 m is considered as highly precautional for the pipeline laying and even for the activities of dredging and deposition of the sediments at the temporary storage area.
Data sources	**Primary sources**: Data collected from the study titled "Hydrographical and Oceanographic Survey Report" by DenAr Deniz Araştırmaları A.Ş. carried out within the Project.
	Secondary sources: Secondary data from scientific papers, grey literature, and databases.

Methodological approach

Data to describe the regional context (i.e., RSA) were collected through literature review (references reported in 14.0), whereas the local context (i.e., AoI) was assessed by both literature review and the gathering of field data.

In particular, primary data were gathered in the area (which includes the AoI) by DenAr (2021) through Acoustic Doppler Current Profiler (ADCP) to measure the sea current and its velocity in two stations (at 20 and 40 m depth, both located in the AoI, as shown in Figure 6-7), and wave sensor equipped with Acoustic Current Meter option to record wave data (height and length, wave direction, surface runoff, and water temperature) in one station in the vicinity of the AoI (Figure 6-8). Further details are reported in DenAr (2021).

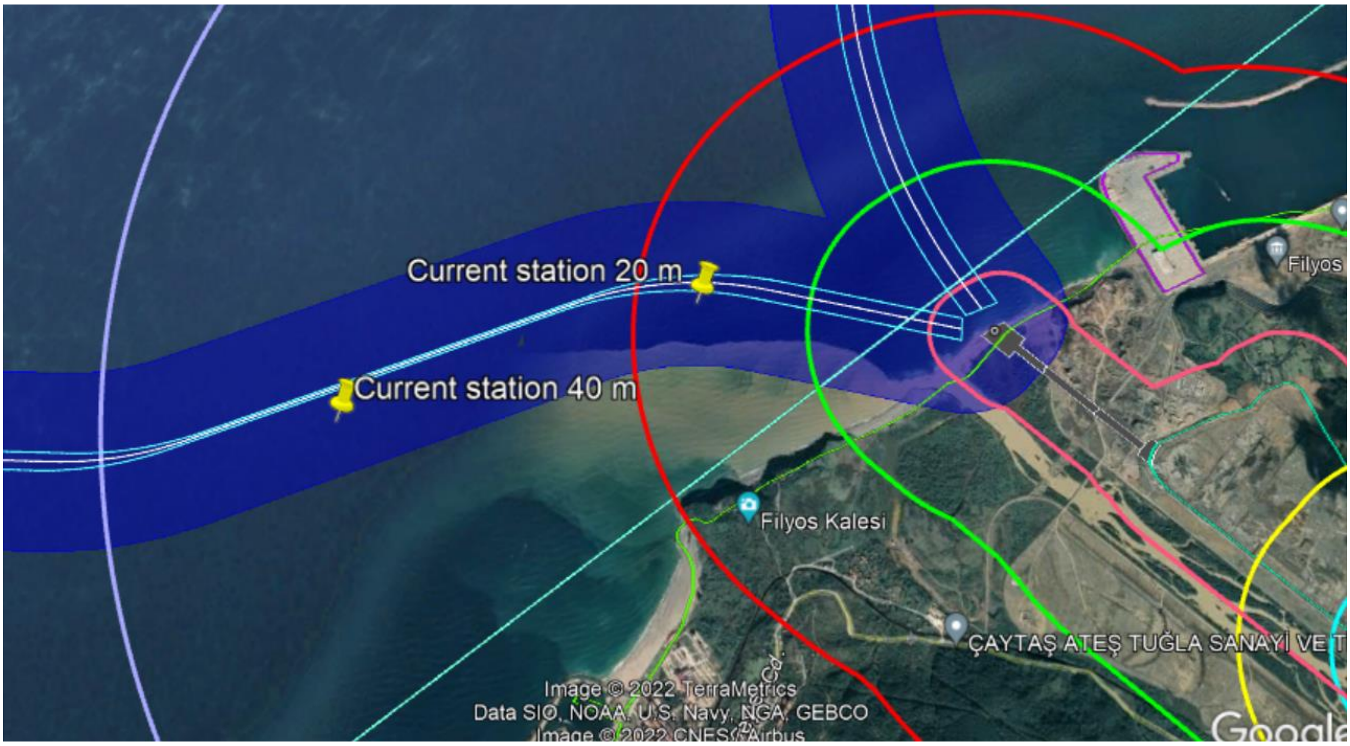

Figure 6-7: Localization of the stations to record the currents in the AoI.

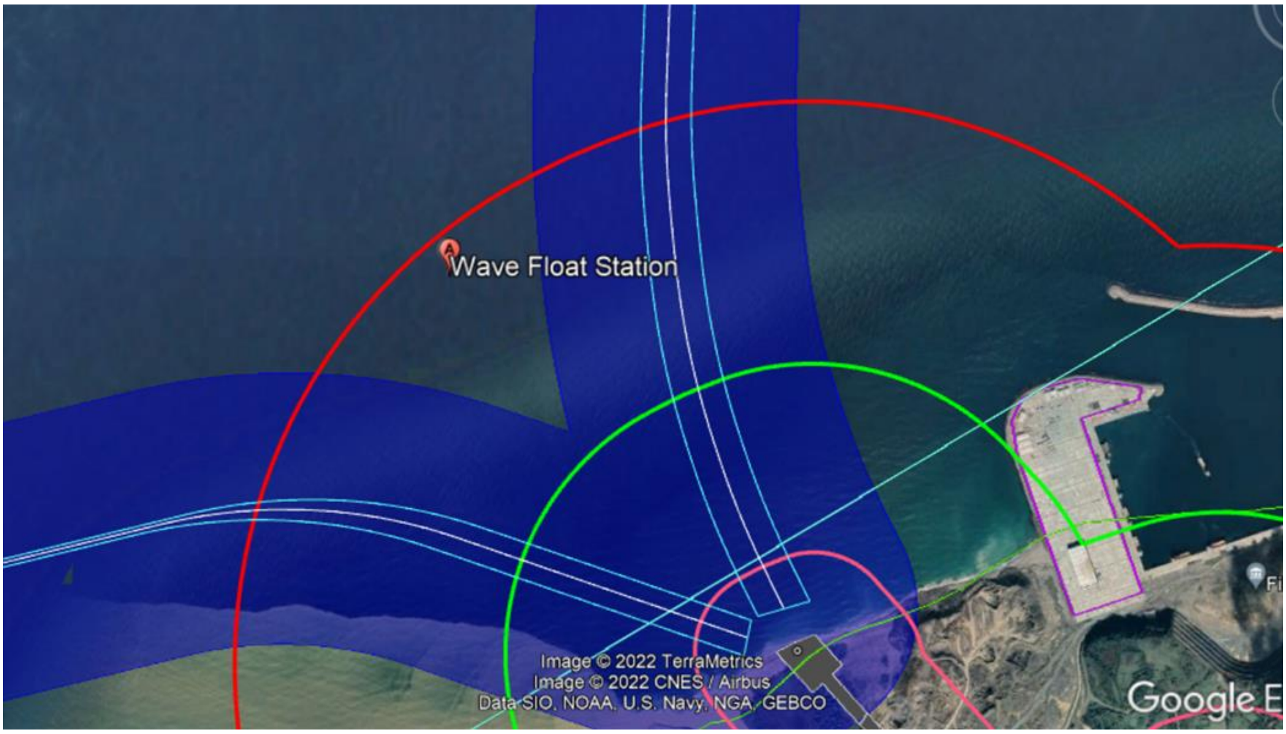

Figure 6-8: Localization of the stations to record the waves in the AoI.

Regional context (RSA)

It is reported that three main characteristics define the **currents** in the Black Sea (Oguz *et al.*, 1993):

1) A basin-wide gyre, moving waters around the perimeter of the Black Sea, known as the Rim Current;

2) An interior cell within the Rim Current and composed by two or more cyclonic gyres; and

3) A series of stable/recurrent anticyclonic eddies present on the coastal side of the Rim Current.

These three main characteristics are shown in Figure 6-9.

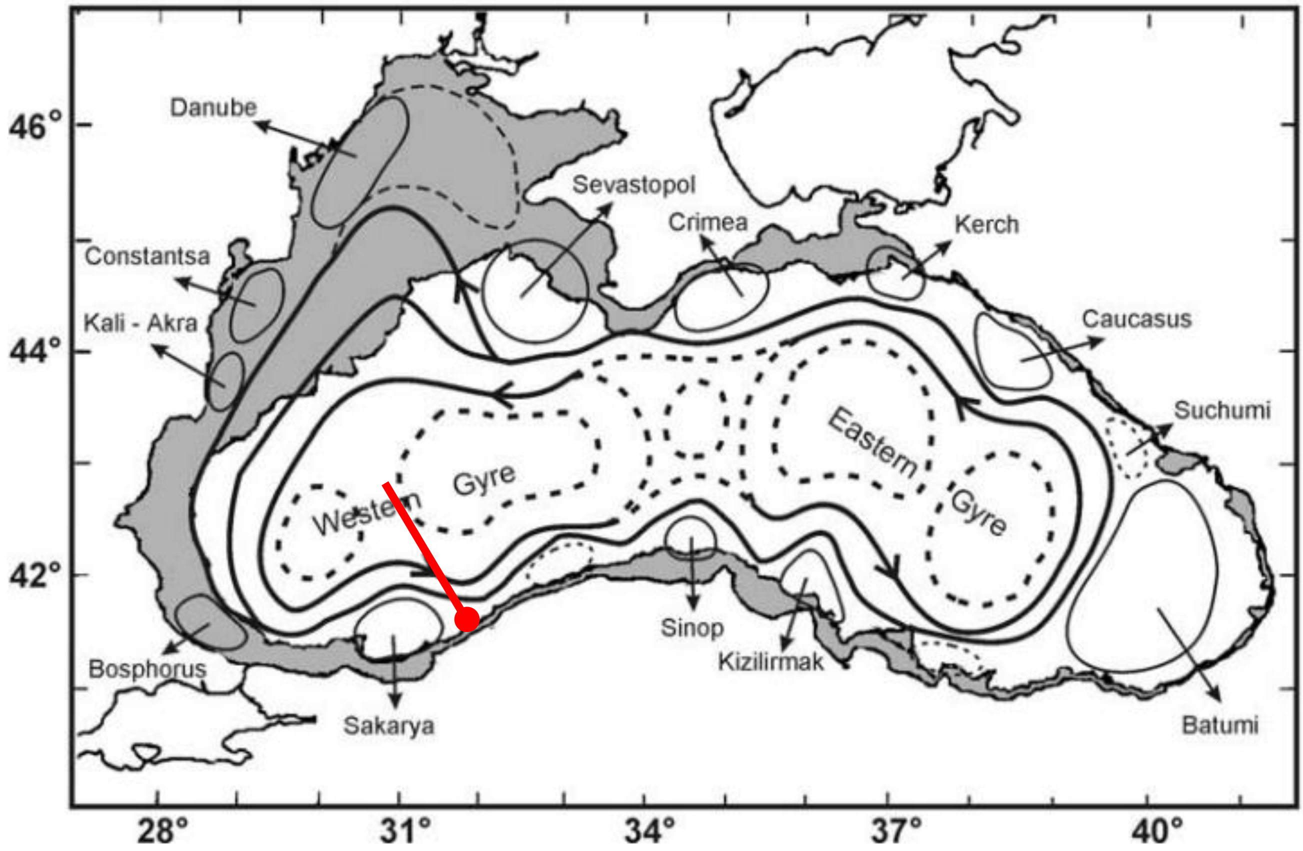

Figure 6-9: The Black Sea circulation (source: Korotaev et al., 2003). The red dot and line indicate the Project location.

As Figure 6-9 shows, the energy of the mesoscale phenomena is confined along the Rim Current jet with a typical timescale of its meanders to be between 50 and 150 days. Permanent or quasi-permanent eddies are drawn as solid lines, whereas recurrent are drawn as dashed lines. For instance, the Bosphorus eddy is observed on the average for 260 days per year, whereas the chain of eddies present along the Anatolian coast have more an on-and-off character and slowly travel to the east along the coast. The Sakarya, Sinop and Kizilirmak eddies tend to exhibit more quasi-permanent character due to controls exerted by regional topographies (see 6.2.1.4 and 6.3.1.1) (Korotaev *et al.*, 2003).

A more in-depth map (Figure 6-10) of the Black Sea circulation that includes the eddies and Rim Current directions was drawn by Staneva et al. (2001) using the DieCAST Ocean Circulation Model (Sheng et al., 1998). Such model allows for identifying zones of sea level variations, highlighting potential zones of upwelling (warm colors in the map) and downwelling (cool colors in the map).

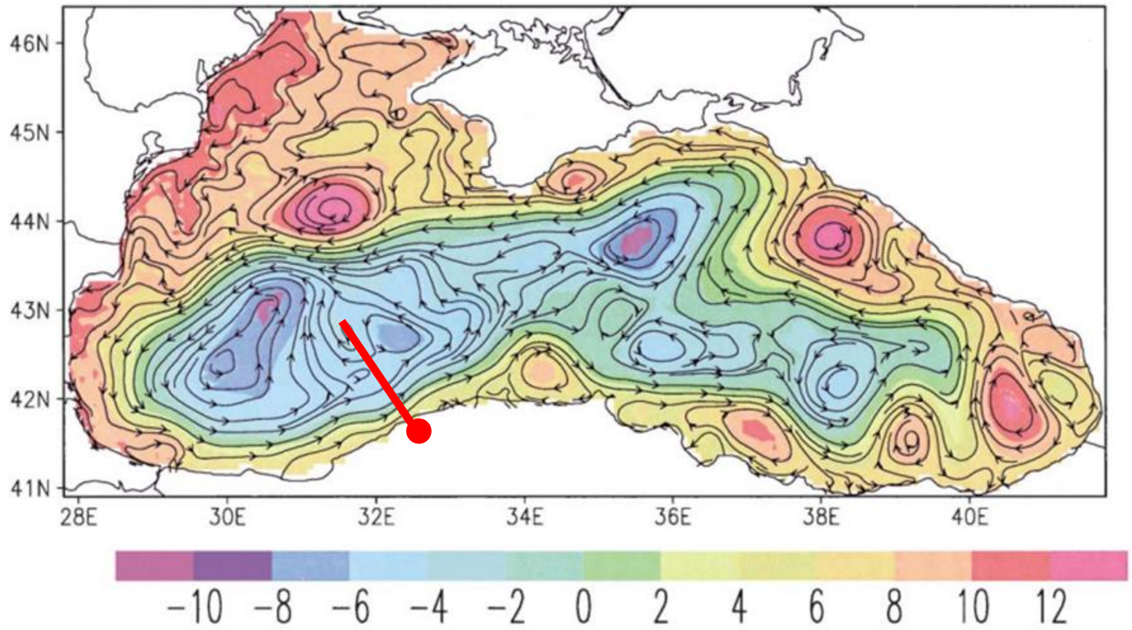

Figure 6-10: DieCAST Ocean Circulation Model of the Black Sea circulation (source: Staneva et al., 2001). The colored scale indicates the sea level variations in cm, whereas the red dot indicates the Project location.

Beside the sea currents, wave dynamics in the Black Sea are generally determined by two processes:

- The propagation of Atlantic cyclones over the Black Sea that result in strong waves in the northeastern part of the sea; and
- The propagation of anticyclones with their center in Eastern Europe that cause waves in the south-western regions of the sea, which encompasses the project location.

Two types of ocean waves can be identified at the ocean surface: wind sea and swell. During the generation and growing processes, they are identified as wind sea. They are instead called swell when the waves propagate away from their area of generation or when their phase speed overcomes the overlaying wind speed. The wind seas are generated locally and are strongly coupled to local winds. Unlike the wind seas swell, waves are generated remotely and are not directly coupled to the local wind field as they travel long distances across the globe (Semedo *et al.*, 2011).

Spatial distribution of the maximum waves in the Black Sea indicates that favorable conditions for developing extreme wave heights of about 12 m may occur. According to models developed by Divinsky et al. (2020) probable real maximum waves could be as high as 19 m. Those extreme conditions follow different seasonal patterns in three distinct regions inside the Black Sea (Divinsky et al., 2020).

1) In the southwestern part of the sea, where the project is located, the extreme events occur usually in December and January.

2) In the southern coast of the Crimea Peninsula, extreme events are most likely to occur in February.

3) In the northeastern part of the sea, extreme events could occur in November.

The southeastern and far eastern parts of the sea are mostly subjected to strong swell, while July and August are calmest months in the entire Black Sea (Divinsky et al., 2020).

Local context (AoI)

Based on the measurements performed by DenAr (2021), the AoI is subjected to two prevailing **current** directions, equally distributed in terms of frequency. While the currents recorded at the shallower station (20 m depth) are mostly directed offshore, the ones recorded at the deeper station (40 m depth) appear rather split into two main components oppositely directed.

Results of the measurements are reported in Figure 6-11 and Figure 6-12.

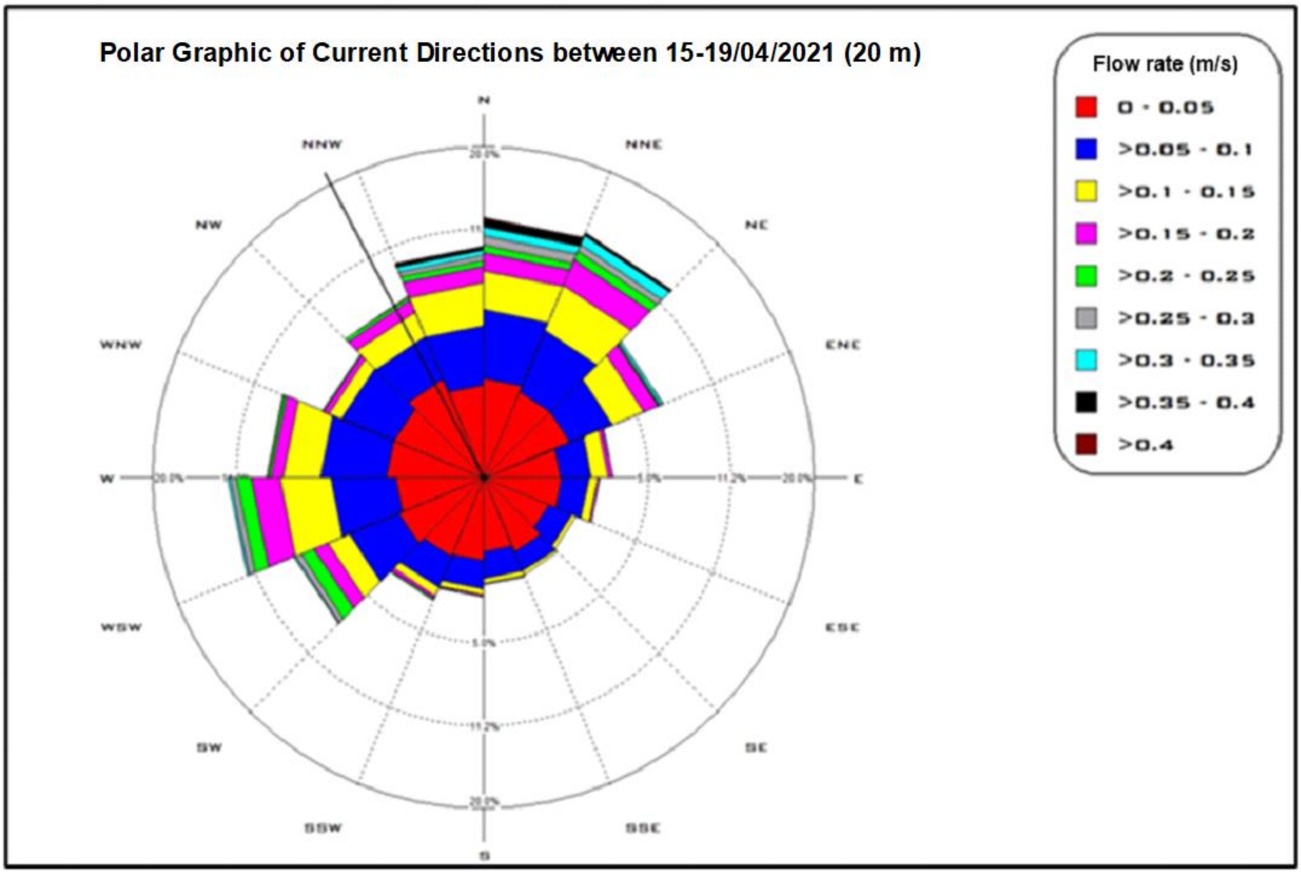

Figure 6-11: Currents recorded at the shallower zone (20 m depth).

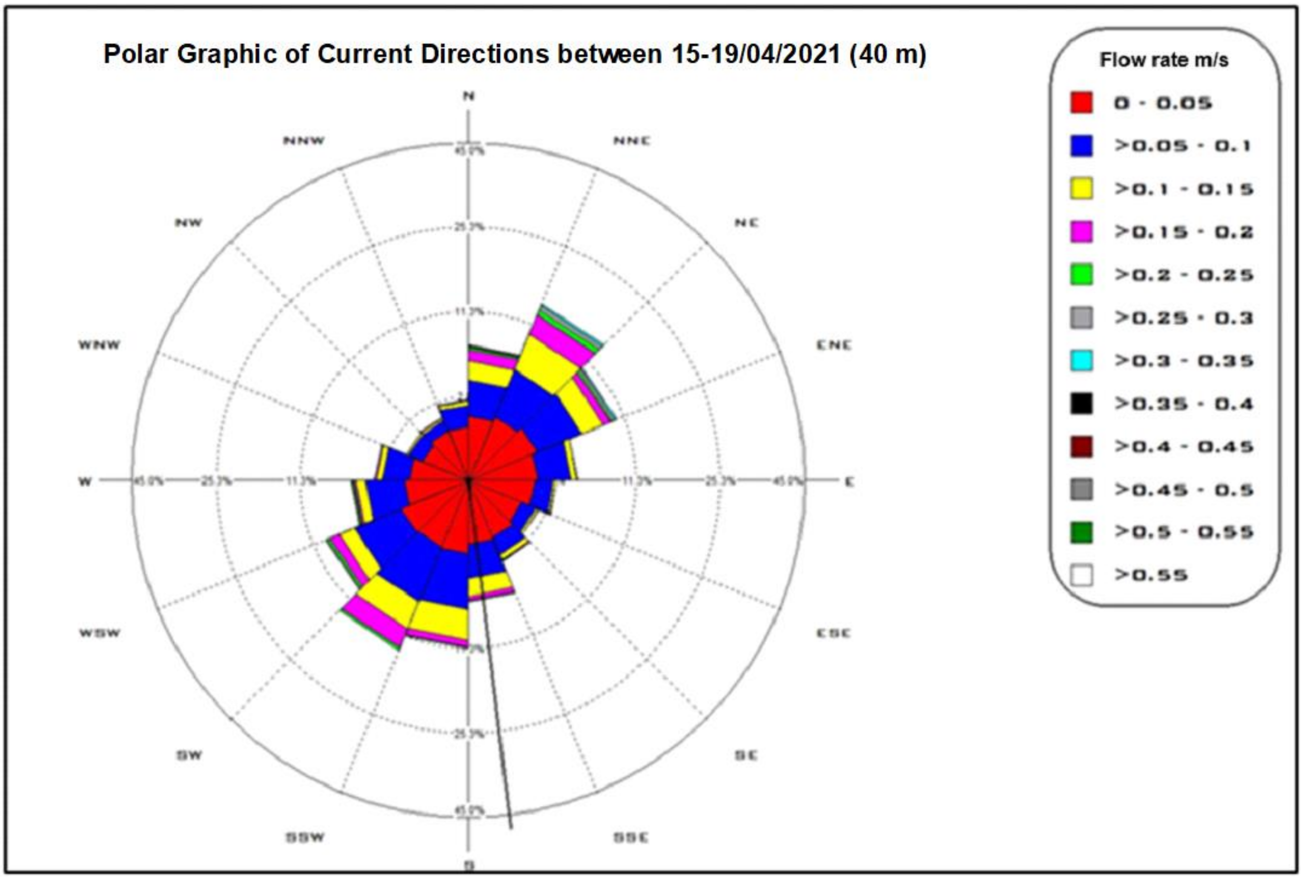

Figure 6-12: Currents recorded at the deeper zone (40 m depth).

As shown in both figures, the prevailing current in terms of speed (i.e., flow rate) is the one directed north-northeastwards in both stations. However, while the second main current component in the shallower station is directed southwest-westwards, the one in the deeper station in directed south-southwestwards. Both reflect the shoreline direction in correspondence to relative the station and indicate that currents of the AoI are mainly directed offshore and parallel to the coast. Such situation is also empirically highlighted by the plume of the sediment intake of the Filyos river, as shown in Figure 6-13.

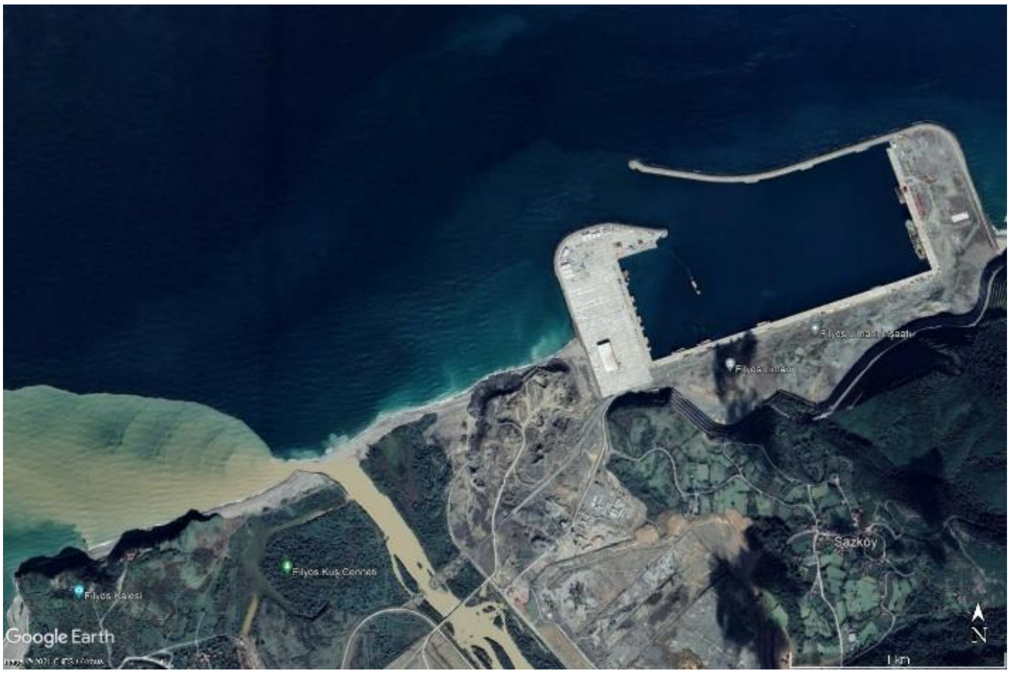

Figure 6-13: Plume of sediment from the satellite (source: Google Earth©).

As per what concerns the **waves** of the area, two datasets are available: one recorded prior the construction of the port, and reported by Bilyay et al. (2011), and the other recorded by DenAr (2021) in the scope of this project.

The recordings carried out by Bilyay et al. (2011) were taken continuously for two years, between 1994 and 1996, at 12.5 m depth in front of the port (Figure 6-14a). The prevailing direction was north-northwest (Figure 6-14b) and extreme waves were recorded with a probability of 0.00018 (i.e., around once every 5,000 waves). Extreme waves are formed when the wind waves or swells are propagating against current (Kharif et al., 2008) but also when currents and wave propagation are nearly aligned (Gemmrich, 2010).

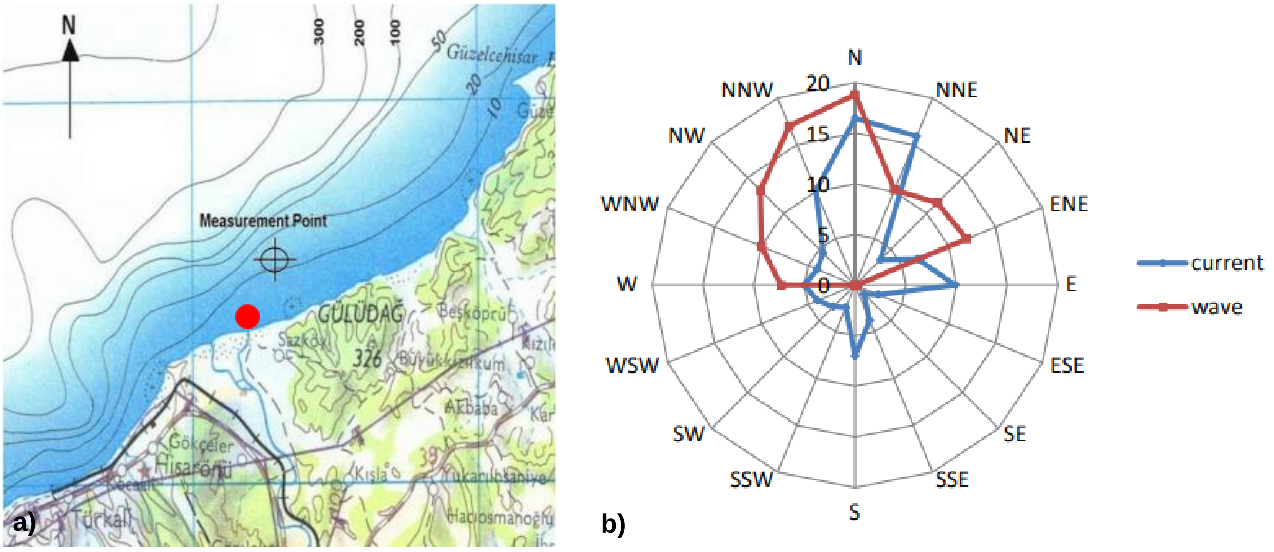

Figure 6-14: Localization of the station to measure waves (a) and wave direction recorded (b) (source: Bilyay et al., 2011). The red dot shows the Project location.

The results of the recordings made by DenAr (2021) were consistent with those of Bilyay et al. (2011), with prevailing direction from the northern sectors (Figure 6-14b), indicating that the construction of the port may not have altered the wave regime. However, it must be noted that the measurement was conducted in the nearby (i.e., proximity of the AoI) rather than in the same location of Bilyay et al. (2011). No extreme waves were recorded during the measurements (Table 6-3).

More details about wave height, wave period and current speed recorded are reported in Table 6-3, whereas the direction is shown in Figure 6-15.

Table 6-3: Wave measurements in the vicinity of the AoI.

Parameter	14/04/21 - 30/04/2021			01/05/21 – 18/05/2021		
	Minimum	Maximum	Mean	Minimum	Maximum	Mean
Current speed (m/s)	0.003	0.609	0.15	0.004	0.44	0.19
Significant wave height (m)	0.05	1.79	0.55	0.08	1.79	0.48
Wave period (s)	1.43	4.97	3.47	1.46	5.59	3.15

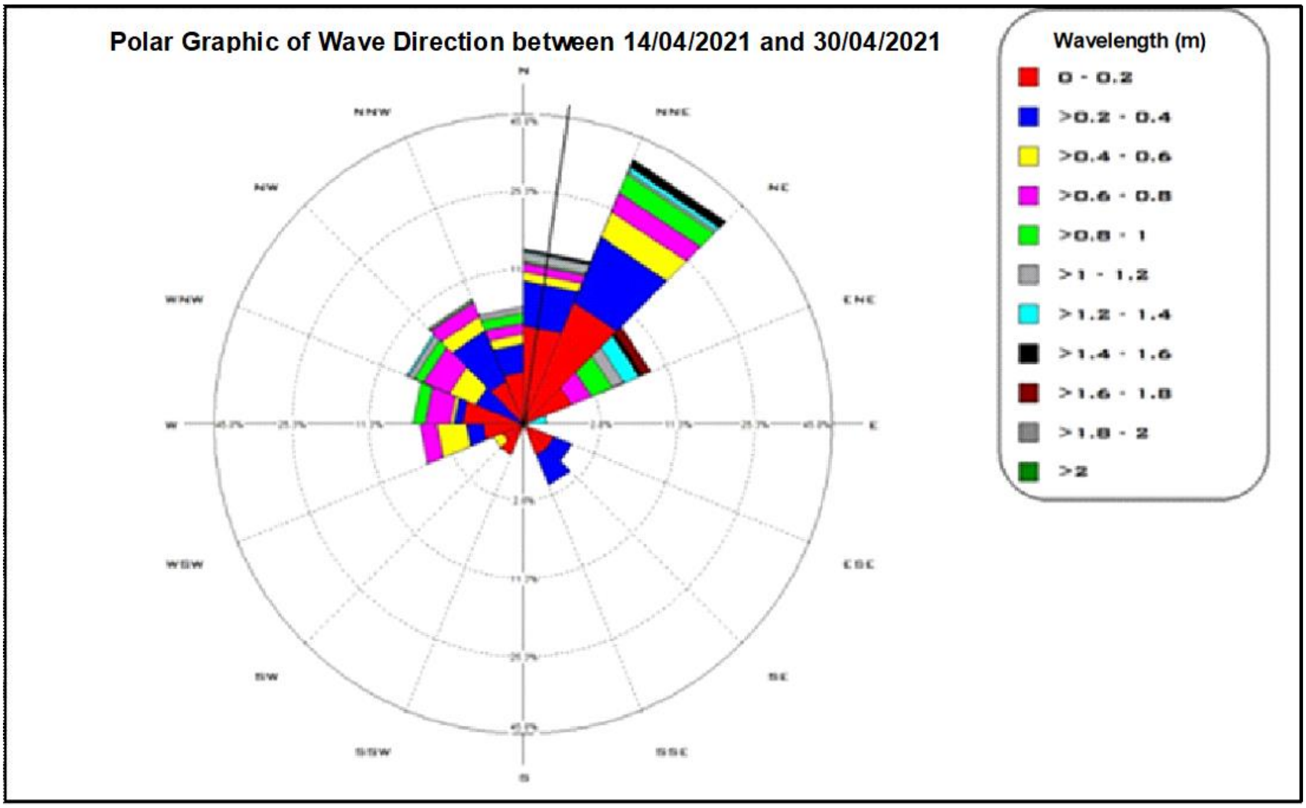

Figure 6-15: Waves recorded in proximity of the AoI.

Sensitivity Assessment

Sensitivity features	Supported by	Sensitivity value
Absence of local upwelling phenomena Low probability of extreme wave events	Primary data (DenAr, 2021) and secondary data (Bilyay et al., 2011)	**Medium-low**

6.3.1.5 Underwater noise

Definition	In acoustics, the term “sound” is usually referred to as the acoustic energy radiated from a vibrating object, with no particular reference for its function or potential effect, whereas “noise” is usually referred to as the acoustic emission causing specifically described adverse effects (Southall et al., 2009) or technical distinctions (i.e., ambient noise). Sounds are omnipresent in the underwater environment and can be produced by both natural and anthropogenic sources (OSPAR, 2015).
Study areas	**RSA:** Turkish EEZ of the Black Sea.

	Rationale: The biggest majority of maritime routes overlap with the Turkish EEZ, and in particular the Turkish territorial waters, since the Bosphorus strait is the only way back and forth the Mediterranean Sea.
	AoI: The project footprint with a buffer of 10 km on both sides. **Rationale:** Sound speed in the seawater is approximately 1,500 m/s (Pierce, 1989), proportionally increasing with pressure, temperature and salinity and density (Mackenzie, 1981). Any alteration of the ambient acoustics can be detected up to several km far, depending on the sound level emitted by the source (Urick, 1979). A buffer of 10 km is considered as highly precautional for any kind of manmade underwater sound emission.
Data sources	**Primary sources**: Primary data about the presence of marine mammals in the area.
	Secondary sources: Secondary data from scientific papers, grey literature, and databases.

Methodological approach

Data to describe both the regional context (i.e., RSA) and the local context (i.e., AoI) were collected through literature review (references reported in 14.0). During the field survey carried out within this study, the presence of marine mammals in the AoI was documented and confirmed.

Regional context (RSA)

Many are the offshore natural physical and biological factors determining a sound source. The main physical natural factors contributing to the underwater ambient noise include wind, breaking waves, splashes from raindrops and lightning, as well as the sound produced by marine fauna and wave interactions (TNO, 2009). Main biological sources are mostly related to the underwater communication of the marine fauna or the echolocation of cetaceans (Southall & Nowacek, 2009).

Anthropogenic activities such as shipping, military activities, construction work and oil and gas exploitation lead to an increase of underwater sound sources in areas where natural sound sources would typically be the only sources available. There is an increasing concern about the possibility of negative effects of anthropogenic underwater noise on the life of marine fauna. Behaviour such as foraging, migration and reproduction could be disrupted (Southall *et al.*, 2009).

The typical sound levels of ocean background acoustics at different frequencies as measured by Wenz (1962) are shown in the graph below, also referred to as the Wenz curves (Figure 6-16).

Generally, the wave noise generated by the wind is prevailing in offshore environments. In absence of anthropogenic noise sources, the wind-generated environmental noise can be recorded at a frequency interval ranging from 1Hz to 100 kHz. The sound levels may vary in relation to the sources (e.g., rain may increase the environmental noise up to 35 dB in a frequency range between 100 Hz and 20 kHz) (Wenz, 1962).

The RSA is crossed by the biggest majority of maritime routes, navigating back and forth the Mediterranean Sea, highly contributing to the underwater ambient noise of the area.

In addition, it should be noted that the United Nations Convention on the Law of the Sea (UNCLOS) includes the introduction of energy (including sound) into the marine environment under the definition of pollution in Article 1 (4). The whole Black Sea and consequently the AoI is under the ACCOBAMS (Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and contiguous Atlantic Area) that is a regional international treaty that binds its States Parties on the conservation of Cetacea in their territories. The agreement has been ratified by Tukey that has been party of the agreement since 2018.

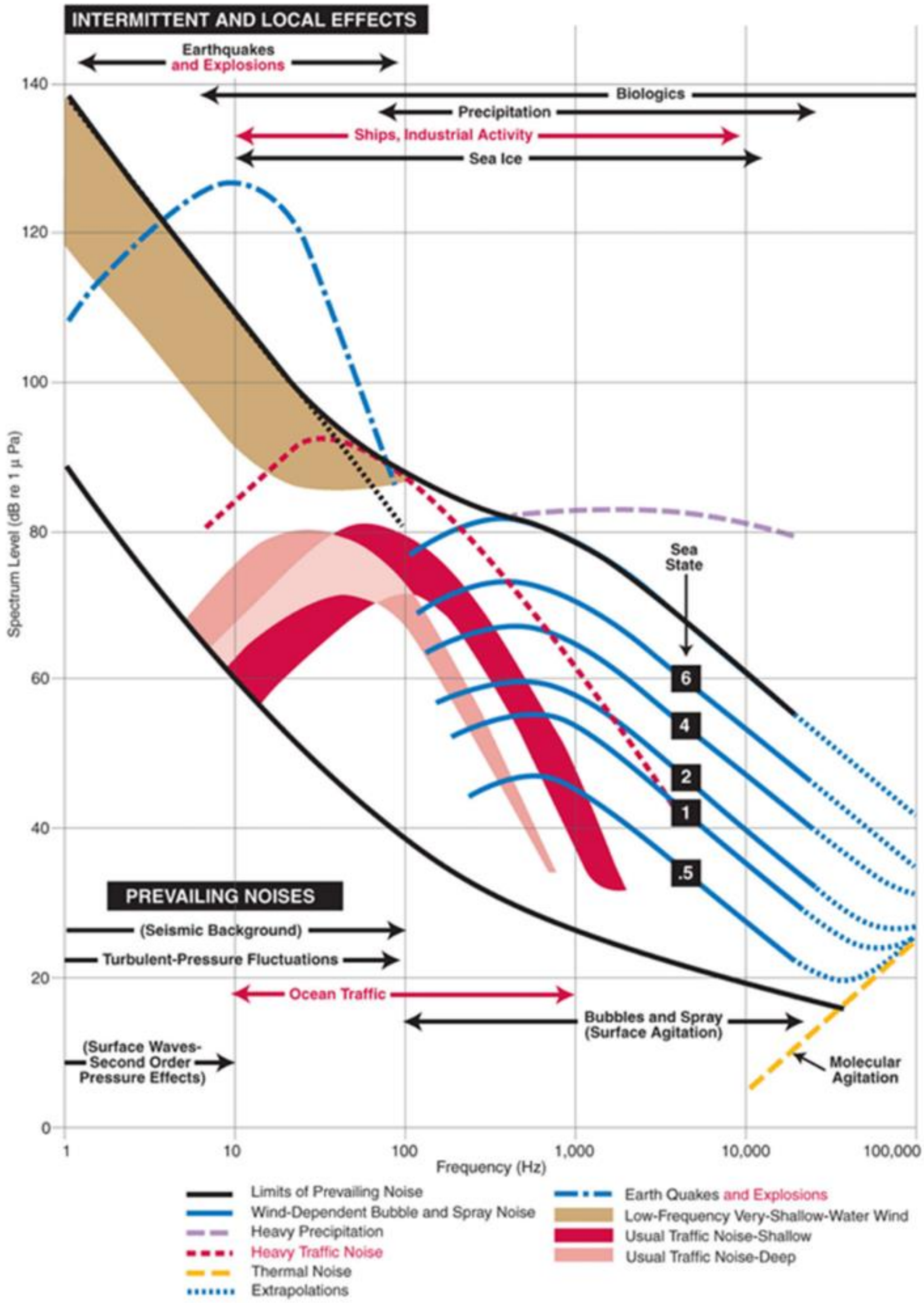

Figure 6-16: Wenz curves, showing prevailing ocean noises and sounds (source: dosits.org).

Local context (AoI)

No specific information on underwater acoustics is available for the AoI. Geophysical surveys, including geo-acoustics (i.e., SSS, MBES, SBP, see 6.3.1.1), were carried out providing with results such as photomosaics, DTMs, acoustic maskings and acoustic columns. All those, however, are acoustic responses that generate images, so they could not provide information about the under acoustic environment of the area.

However, based on known baseline conditions previously mentioned, some considerations can be made. Apart from natural physical sources due to weather and oceanography, the underwater acoustics of the AoI may be primarily influenced by anthropogenic (i.e., marine traffic) and natural biological sources (i.e., marine fauna).

The AoI is crossed by various maritime routes and some of them follow the AoI for its whole length (Figure 6-17), being probably the working vessels of the Sakarya Gas Field.

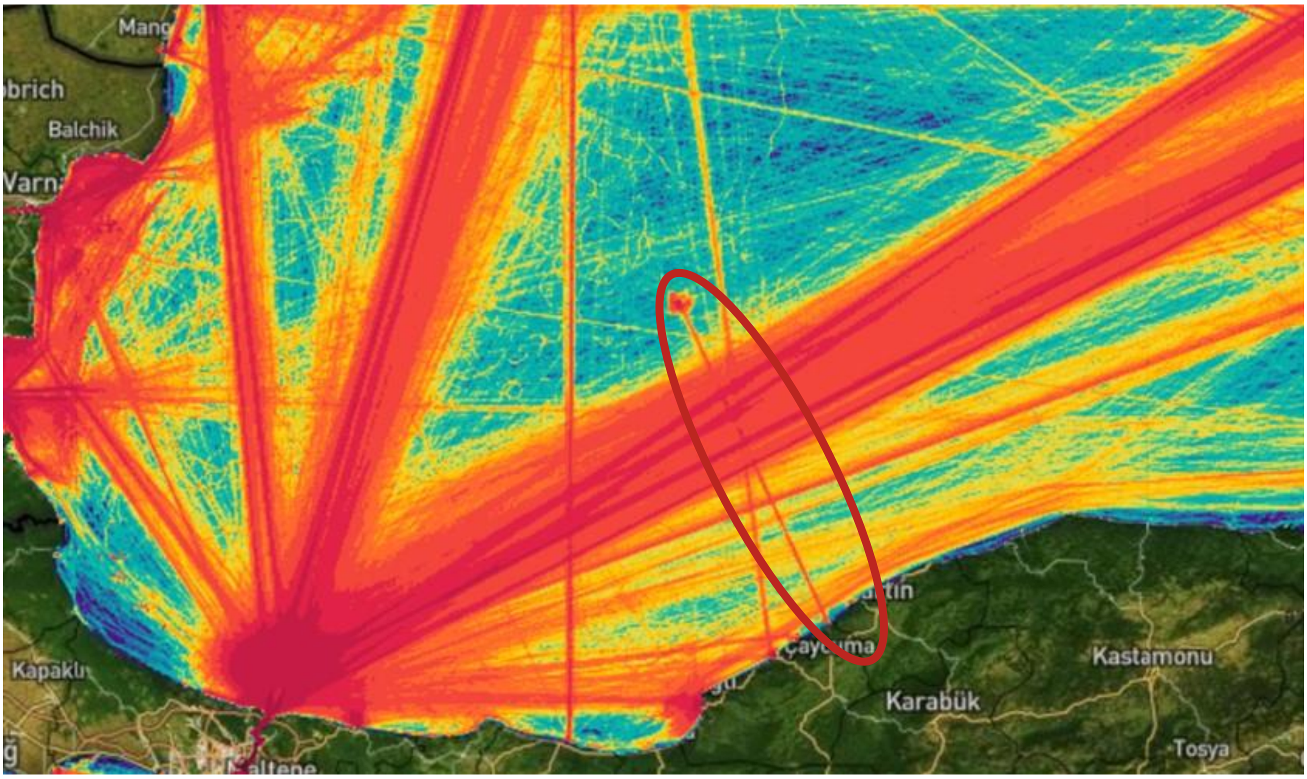

Figure 6-17: Maritime routes in the southwestern basin of the Black Sea (source: marinetraffic.com). The blue shape indicates the routes most likely to be linked to the development of the Sakarya Gas Field.

Maritime traffic is a low-frequency source of sound (< 300 Hz). Large commercial vessels generally produce relatively loud, low frequency sounds. The main noise sources include propellers cavitation, vibration of engines and related facilities and water displacement caused by the moving hull. The source noise levels may range 180 dB to 195 dB re 1 μPa at 1 m with peak levels in the 10 Hz - 50 Hz frequency band. At frequencies lower than 200 Hz, the propeller systems mostly contribute to the underwater noise. Large cargo vessels may emit high frequency sounds with sound levels over 150 dB re 1 μPa at 1 m around 30 Hz. Moreover, additional noise sources may be the on-board equipment (e.g., equipment in the machine room or auxiliary systems) and the hydrodynamic flow around the vessel hull. Noise also increases with an increase in the vessel speed and the sound pressure levels depend on the vessel propeller system (McKenna et al., 2013).

Cetaceans produce sounds for communication, orientation, and navigation purposes. These sounds may range from a low frequency value of about 10 kHz of some whales, absent in the Black Sea, to a high frequency value of 200 kHz for some dolphins. Source levels for communication sounds are around 170 dB to 180 dB re 1 μPa at 1 m, while echolocation clicks range from a source level of 175 dB re 1 μPa at 1 m in the frequency range of 125 to 200 kHz for the Black Sea harbour porpoise (*Phocoena phocoena relicta*), up to 226 dB re 1 μPa at 1 m in the frequency range of 23 kHz to 102 kHz for the bottlenose dolphin (*Tursiops truncatus*), as well as for its Black Sea subspecies (*T. truncatus ponticus*) (Southall *et al.*, 2009).

Both subspecies are present in the AoI.

For such reason, the underwater ambient noise of the AoI may be assumed as currently dominated by low frequency anthropogenic noises generated by vessels and high to very high frequency biological vocalizations.

Sensitivity Assessment

Sensitivity features	Supported by	Sensitivity value
Presence of cetaceans Moderate number of maritime routes	Primary and secondary data	**Medium-high**

6.3.2 Biological

This section describes the offshore biological environment, including the components not considered to be affected by the project as evaluated in 5.2. Such components are the following:

- Plankton;
- Benthic communities (phyto- and zoobenthos);
- Fishes;
- Marine mammals;
- Marine habitats;
- Legally Protected Areas and Internationally Recognized Areas; and
- Critical Habitats.

However, it is to note that, according to literature review, there are no sea turtles inhabiting the Black Sea (when spotted, they are only considered as occasional visitors) (IUCN, 2012; Zinenko et al., 2021). According to Zinenko et al. (2021), from 1922 to 2021 only 11 specimens of *Caretta caretta* have been sighted in the Black Sea. Regarding Green Turtles (*Chelonia mydas*), while nesting sites can be found in the Mediterranean side of Turkey (in addition to Syria and Cyprus), the species has only once been found in the Black Sea: Nanakinov (1998) found only one Green Turtle record from Bulgaria, no records are available from Romania (Nanakinov 1998), and according to Valkanov et al. (1978) there are no reports of sea turtles from the former Soviet coasts (Öztürk et al., 2013). For such reason, sea turtles are not described in this baseline.

Also, considering their ecological habits, linked both to the terrestrial and marine environments, seabirds are described in the onshore biological baseline only (see 6.2.2.6).

6.3.2.1 Plankton

Definition	Plankton are all those organisms that cannot contrast water circulation and are horizontally moved by currents. The group is usually divided into: (i) phytoplankton, which groups the autotrophic cells, (ii) zooplankton, which groups the heterotrophic cells and organisms, and (iii) ichthyoplankton, which is a particular subgroup of the zooplankton, composed by only fish eggs and larvae. Although these organisms are subjected to even hourly vertical migrations in the water column, plankton is considered an important indicator of the water quality being the base of the marine food chain.
Study areas	**RSA:** The Black Sea **Rationale:** A basin-wide gyre called Rim Current cover all the Black Sea, which is also characterized by a strong freshwater input, causing also a permanent halocline and anoxic zone and limited input of saltwater from the Mediterranean Sea at about 100-150 m of depth (Tuğrul *et al.*, 2014).
	AoI: The project footprint plus a buffer of 500 m per side **Rationale:** Plankton is rather affected by natural environmental factors (i.e., rain) and, considering the dilution power of water, it is unlikely that limited pressures introduced may alter the plankton communities and mid and long distance. A buffer of 500 m is considered as highly precautional for the pipeline laying and even for the activities of dredging and deposition of the sediments at the temporary storage area.
Data sources	**Primary sources**: Primary data from field work conducted in the scope of the national EIA. Also, opportunistic visual observations of macrozooplankton (i.e., ctenophores) and megaplankton (i.e., jellyfishes) occurred during the sediment samplings and ROV survey for characterizing the benthic communities and habitats.
	Secondary sources: Secondary data from scientific papers, grey literature and databases.

Methodological approach

Data to describe the regional context (i.e., RSA) were collected through literature review (references reported in 14.0), whereas the local context (i.e., AoI) was assessed by both literature review and the gathering of field data.

In particular, primary data were collected in three sampling stations along the pipeline route, one at 7 km from the shore, one at 4 km from the shore and one point nearshore (Figure 6-18) in the scope of the national EIA (Armada, 2021). Details about the sampling techniques and taxon identification are reported in Armada (2021).

Additional occasional visual observations occurred in February 2022 (i.e., only for macrozooplankton and megaplankton), during the sediment samplings and ROV survey for characterizing the benthic communities and habitats.

Figure 6-18: Sampling points from the field work conducted in April and May 2021.

Regional context (RSA)

The distribution of phytoplankton and zooplankton (including ichthyoplankton) is interlinked with the presence of sunlight, oxygen, and nutrients in the water. Phytoplankton only occurs in the photic zone as they need sunlight for photosynthesis. The photic zone of the Black Sea is from 0 to 100 m but most of the phytoplankton is located between 0 and 60 m. Zooplankton organisms don't depend on sunlight to survive, however, they feed mostly on phytoplankton. Therefore, the zooplankton distribution in the water column is usually similar to the one of phytoplankton.

Because of their dependence to environmental light, sea surface temperature and trophic conditions of the sea water (e.g., eutrophication), it is not rare plankton to show blooms in particular locations throughout the year. Plankton blooms, in fact, are huge phenomena happening around the world which occur when all the ideal living parameters of plankton align. In the Black Sea, they are known to occur mainly during mid-spring and limitedly in autumn. Figure 6-19 shows a bloom of coccolithophores (i.e., phytoplankton) occurred in the RSA in May 2016 (lighter colours).

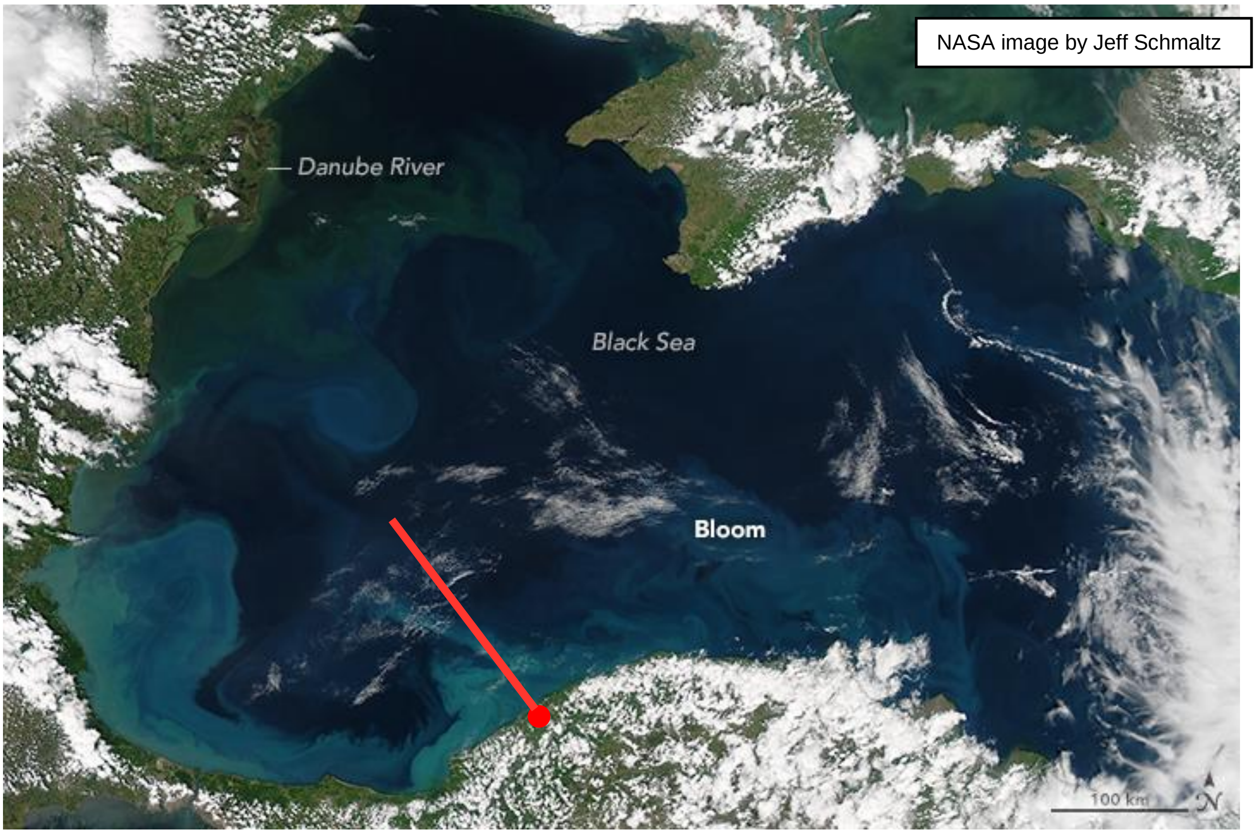

Figure 6-19: Coccolithophore bloom in the Black Sea (May 2016) (source: NASA 2016). The red circle and line indicate the project location.

The portion of gelatinous plankton is unusually high in the Black Sea, mainly because of overfishing (but also the introduction of the invasive ctenophore *Mnemiopsis leidyi* largely contributed). In fact, the biomass of scyphozoans (i.e., true jellyfishes) and ctenophores account for more than 90% of total zooplankton biomass in coastal Black Sea waters during the warm period of year (Living Black Sea, 2016).

The most common phytoplankton *taxa* in the Black Sea are:

- Dinoflagellates (*Ceratium furca*, *Prorocentrum micans*, and *Gonyaulax spinifera*);
- Diatoms (*Chaetoceros compressus*, *Achnantes brevipes*, *Licmophora gracilis* and *Pleurosigma elongatum*);
- Coccolithophores (*Syracosphaera* spp. and *Emiliana huxleyi*).

The most common zooplankton *taxa* in the Black Sea are:

- Jellyfishes (*Aurelia aurita* and *Rhizostoma pulmo*);
- Ctenophores (*Pleurobrachia rhodopis*, *Mnemiopsis leidyi*, and *Beroe ovata*);
- Copepods (*Oithona* spp., *Calanus* spp. and *Acartia* spp.);
- Ciliates;
- Rotifers.

In addition, there are multiple coastal upwelling zones[4] reported in the Black Sea. These are the Russian coast of Gelendzhik (Silvestrova, Zatsepin, & Myslenkov , 2017), the South Crimea, the Bulgarian and Romanian coasts, and the Western part of the Turkish coast (Stanichnaya, Davidov, Stanichny, & Soloviev, 2004), where the project is located.

Local context (AoI)

Based on the plankton samplings carried out in the scope of the national EIA (Armada, 2021), 108 phytoplankton species and 70 zooplankton species were identified.

Phytoplankton:

- Dinoflagellates (52 species);
- Diatoms (32 species);
- Cyanobacteria (23 species);
- Coccolithophores (1 species).

Zooplankton:

- Copepods (52 species);
- Cladocera (6 species);
- Ctenophores (4 species);
- Scyphozoans (3 species);
- Chaetognaths (3 species);
- Larvaceans (1 species);
- Siphonophores (1 species).

Such diversity highlights the productivity of the area already mentioned in 6.3.1.3.

In addition, the opportunistic observations carried out in February 2022 highlighted a very high density of gelatinous plankton, often index of overfishing, in particular the scyphozoan jellyfish *Aurelia aurita* (density estimated around 10 individuals per m^3) (Figure 6-20). Individuals of *Rhizostoma pulmo* and the ctenophores *Beroe* spp., even if in very limited numbers, were also observed. Such condition is in line with the regional context, despite the high productivity of the AoI, also in terms of other biological resources (see 6.3.2.3 and 6.3.2.4). No specimens of *Mnemiopsis leidyi* were observed, but the species is normally not observed in the winter period.

[4] Because of the almost only horizontal water circulation, no permanent upwelling areas are reported for the Black Sea. Upwelling areas are not permanent and rather coastal.

Figure 6-20: *Aurelia aurita* specimens (on the left side) and their density in water (tyre size on the right: about 60 cm).

Sensitivity Assessment

Sensitivity features	Supported by	Sensitivity value
Presence of highly productive waters High density of gelatinous plankton	Primary data and secondary data	**High**

6.3.2.2 Benthic communities (phyto- and zoobenthos)

Definition	Benthos is a category that encompasses different taxonomical groups, vegetal or animal, both sessile and motile. All the species belonging to this category are characterized by living in close contact with the substrate or settled down on it, either soft or hard (Wetzel, 2001). The animal organisms belonging to this group show all the existing feeding habits, including filter feeders, detritus feeders, grazers, scavengers, and carnivores (Versar, 2006).
Study area	**RSA:** Western Black Sea basin with focus on the Turkish continental shelf, slope and abyssal plain. **Rationale:** The Andrusov Ridge and Archangelsky Ridge extending south from the Crimean Peninsula divide the Black Sea into two depositional basins: the Western Black Sea and the Eastern Black Sea (Shillington *et al.*, 2008).
	AoI: The project footprint plus a buffer of 500 m per side. **Rationale:** The activity of pipeline laying onto the seafloor may resuspend a limited amount of sediments with scarce possibility to be transported through long distances. A buffer of 500 m is considered as highly precautional even for the activities of dredging and deposition of the sediments at the temporary storage area.

Data sources	**Primary sources**: Sediment samples at different depths were taken and analyzed within the preparation of the present ESIA. Data were also collected from the national EIA (Armada, 2021).
	Secondary sources: Secondary data from scientific papers, grey literature, and databases.

Methodological approach

Data to describe the regional context (i.e., RSA) were collected through literature review (references reported in 14.0), whereas the local context (i.e., AoI) was assessed by both literature review and the gathering of field data.

In particular, primary data were gathered in April and May 2021 in three sampling stations (i.e., nearshore, 3 km offshore and 7 km offshore along the pipeline corridor) in the scope of the national EIA. Details on the sampling techniques and species identification are reported in Armada (2021).

Furthermore, additional data were gathered in February 2022 in the scope of this ESIA. Ten sampling stations were selected: 9 along the pipeline corridor and 1 at the temporary storage area (see Figure 6-29 in 6.3.2.5). Sediments were collected using an 8-L sampling grab (Figure 6-21) or, alternatively, a 60 x 60 cm box corer (Figure 6-22). The box corer was used mainly at higher depths because of its weight, allowing for a more efficient sinking, and because of the more clayish nature of the sediments (see 6.3.1.2 and 6.3.2.5). When using the box corer, a subsample was taken (about 30 x 30 x 20 cm) for the subsequent analyses, whereas composite samples (made by two to three grabs, depending on the quantity of sediment sampled, to reach the standard volume of about 17 L) were created from the grab samples.

Samples collected were rinsed and sieved aboard using a 1 mm meshed sieve. Living organisms were pre-sorted and fixed in 90% alcohol, subsequently diluted to 70%.

The identification was made to the lowest taxonomic level as possible by Pelagosphera, a research unit of the Laboratory of Zoology and Marine Biology of the University of Turin, Italy, using stereomicroscopes and appropriate taxonomic guides. Individuals were counted to assess the specific abundances.

In addition, 2 transects and 2 observation points were investigated by ROV. Details are available in marine habitats (see 0). These visual inspections added information also to the presence of benthic assemblages.

Figure 6-21: Sampling grab

Figure 6-22: Box corer

Regional context (RSA)

As previously stated in the offshore physical baseline (see 6.3.1), the Black Sea shows anoxic conditions below 100-150 m depth. Benthic communities are, for such reason, strictly divided into:

- Communities living in the oxygenated layer above 100-150 m depth;
- Communities tolerating anoxic levels;
- Communities of the anoxic layers.

As per what concerns the oxygenated layer, based on the regional context highlighted in 6.3.1.1, the RSA is mostly composed by soft bottoms; hence, hard bottom communities could be safely excluded. However, biogenic substrates created by *Ficopomatus* reefs can be found, being the species euryhaline, often living in estuaries (Micu & Micu, 2004).

Most important vegetal species and habitat-forming species for the RSA are the seagrass *Zostera marina* and *Z. noltii*. *Cymodocea nodosa* and *Ruppia maritima* are also reported as present, as well as the brackish water vascular plants *Stuckenia pectinata*, *Zannichellia palustris*, *Potamogeton gramineus* (Karacuha and Okudan, 2017). *Cystoseira crinita* and *C. barbata* are reported as the ecologically most important algal species for the RSA.

Such as most of the oxygenated soft bottoms, sediments of the RSA may be considered as mainly colonized by infaunal organisms, such as bivalves, polychaetes and nematodes, and epifaunal organisms, such as echinoderms, crustaceans and errant and sessile polychaetes.

Communities at the oxic/anoxic interface are reported as dominated, when the sediment typology allows for it (i.e., limited amount of clay) by nematodes and oligochaetes, sometimes also with polychaetes and harpacticoids present. From the upper anoxic zone around 200 m only few nematodes can be found (Luth, 2004).

Only anaerobic microbial assemblages can be found below 200 m depth.

Local context (AoI)

From the national EIA conducted by Armada (2021), 164 benthic species were listed (no phytobenthos reported), grouped as follows:

- Sponges (1 species);
- Cnidarians (2 species);
- Ribbon worms (2 species);
- Annelids (49 species);
- Horseshoe worms (2 species);
- Molluscs (55 species);
- Crustaceans (45 species);
- Echinoderms (5 species);
- Fishes (3 species).

The total list of species included in the national EIA by Armada. Most of them have, however, a very wide range and could actually be used as general information to integrate the regional context.

The field work conducted in February 2022 in the specific scope of this ESIA was focused on the pipeline corridor and highlighted a paucity of species (Table 6-4). This low species richness was however compensated by the high specific densities of individuals, in particular in the shallower waters. In total, 20 species were identified, grouped as follows:

- Anthozoans (1 species);
- Polychaetes (4 species);
- Gastropods (2 species);
- Bivalves (9 species);
- Crustaceans (4 species).

Table 6-4: Benthic species found in the AoI and their relative abundances (i.e., density in number of individuals per m²).

		Sampling sites										
Group	**Species**	**G1 [n./m²]**	**G2 [n./m²]**	**G3 [n./m²]**	**G4 [n./m²]**	**G5 [n./m²]**	**G6 [n./m²]**	**R6 [n./m²]**	**G10 [n./m²]**	**G12 [n./m²]**	**G13 [n./m²]**	**Notes**
Anthozoas	Actiniaria	-	-	-	50	-	40	-	-	-	-	-
Polychaetes	*Eunereis longissima*	-	-	-	-	-	-	-	10	-	-	Non-native species
	Nephtys hombergii	-	-	-	-	-	10	-	-	-	-	-
	Serpulidae	-	-	-	-	Empty tubes	-	Empty tubes	-	-	-	-
	Spio filicornis	10	-	-	-	-	-	-	-	-	-	-
Gastropods	*Calyptraea chinensis*	-	-	-	-	10	-	70	-	-	-	Non-native species
	Tritia neritea	-	20	-	-	-	50	-	-	-	-	Non-native species

Bivalves	*Anadara kagoshimensis*	-	-	-	10	10	80	10	-	-	-	Non-native species
	Chamelea gallina	50	1490	520	1450	1180	240	80	70	-	40	Non-native species
	Donax trunculus	-	20	-	20	-	-	-	-	-	10	Non-native species
	Lentidium mediterraneum	2470	10	3060	-	-	-	-	-	-	10	Non-native species
	Macomangulus tenuis	10	-	-	10	-	-	-	-	-	-	Non-native species
	Modiolus adriaticus	-	-	-	-	-	-	-	10	-	-	-
	Papillicardium papillosum	-	-	-	-	-	-	10	350	10	-	Non-native species
	Pitar rudis	-	-	-	-	10	20	50	170	-	-	Non-native species

	Spisula subtruncata	-	-	-	-	-	-	-	390	-	-	-
Crustaceans	*Ampelisca spinipes*	-	-	-	-	-	-	-	-	10	-	Non-native species
	Amphibalanus improvisus	10	110	160	70	60	160	130	-	-	-	-
	Diogenes pugilator	-	-	-	20	10	90	-	-	-	-	-
	Liocarcinus navigator	-	-	-	-	-	-	-	10	-	-	-

None of these species are evaluated either by the Turkish Red List or the IUCN Red List, at both regional and global level.

As shown in Table 6-4, no seagrass or seaweed species was found. Such absence was also confirmed by the ROV surveys carried out in the AoI. However, it must be stated that much ligneous debris (i.e., most likely from seagrass roots and/or rhizomes) was retrieved in G4, highlighting the likelihood of the presence of seagrass meadows in the vicinity (i.e., G4 may be an accumulation site of the dead parts of the plants).

As per what concerns the zoobenthos, the visual inspections through ROV highlighted a very limited presence of bioturbations and the total absence of both sessile (either erect or not) and vagile epibenthic macro-organisms (Figure 6-23). Based on the sediment samplings, the most abundant species found in the AoI are the bivalves *Chamelea gallina* and *Lentidium mediterraneum*, and the cirriped *Amphibalanus improvisus*, mostly colonizing the valves of the mentioned molluscs or pebbles and debris. While *C. gallina* and *A. improvisus* were widely distributed and found from 0 to 35 m depth, *L. mediterraneum* was only found between 0 to 10 m depth.

Figure 6-23: Seabed showing no epibenthic organisms and limited bioturbations at R2 (about 20 m deep).

In general, it must be stated that both the species richness and the specific abundance decreased with the depth.

In addition, all the species that were sampled in more than one station showed a decrease in size directly proportional with the depth. This may suggest a sort of vicariance between the juveniles and the adults of the same species, where the juveniles appeared as occupying the shallowest areas, moving deeper as they grow old. Such behaviour is also consistent with what is mostly observed for the species. Further information can be found in Chapter 6.3.2.5.

Figure 6-24: Barnacles and empty Serpulid tubes upon a mussel valve at 35 m depth (Station G6).

Figure 6-25: *Chamelea gallina*, the most abundant organism found in the AoI.

Sensitivity Assessment

Sensitivity features	Supported by	Sensitivity value
Absence of protected, endemic or threatened species Presence species of economical importance	Primary data	**Medium-high**

6.3.2.3 Fishes

Description	Fish are gill-bearing aquatic animals that can be found in almost all aquatic environments and have a great diversity. It's an informal group, universally recognized by some common features, resulted from convergent evolutionary processes (such as scales, fins, gills and shape) lampreys, hagfish, bony fish, and cartilaginous fish (Castro & Hubert, 2012).
Study Area	**RSA:** The Black Sea **Rationale:** Fish are highly motile organisms, able to cover long distances and some species are migrant, but the Black represents a closed basin with similar characteristics.
	AoI: The project footprint with a buffer of 5 km per side **Rationale:** This component includes both highly vagile species, able to move for long distances in a day, and demersal species, more linked to the sea bottom. A 5-km buffer is considered appropriate and highly precautional also considering that demersal species become inexistent beyond the continental shelf (because of anoxic conditions).
Data sources	**Primary sources**: Interviews to local fishermen in the scope of the National EIA (Armada, 2021). Additional interviews conducted in the scope of the fishery baseline

	of this ESIA. Opportunistic visual observations occurred during the ROV survey carried out within the elaboration of the present ESIA.
	Secondary sources: Secondary data from scientific papers, grey literature, and databases

Methodological approach

Data to describe the regional context (i.e., RSA) were collected through literature review (references reported in 14.0), whereas the local context (i.e., AoI) was assessed by both literature review and the gathering of primary data.

In particular, interviews were conducted with local fishermen in the scope of the national EIA. Details are reported in Armada (2021). Additional interviews were conducted in February 2022 to describe the fishery baseline in the scope of this ESIA and provided also information about the species caught in the area. Also, the ROV survey for characterizing the benthic communities and habitats had the goal of detecting benthic fish species through opportunistic observations.

Regional context (RSA)

In the Black Sea, the fish population is distributed according to the water depth. In fact, as already described in 6.3.1.3, the oxygen dissolved in water decrease with the depth, becoming depleted at around 100-150 m depth. The water column is therefore completely inhabitable for fish after that depth (Living Black Sea, 2016).

Based on the available checklists, there are 165 species and subspecies living in the Black Sea, composed as follows:

- Marine species (119);
- Anadromous[5] and semi-anadromous species (24); and
- Freshwater species[6] (22).

The information on their distribution, especially in the waters of the central Black Sea, is limited. However, considering the lack of fishing areas and the low level of plankton productivity in such area (i.e., the central Black Sea), it can be stated that the fish species in the central Black Sea is limited to the pelagic species which use the area to travel, such as the Black Sea sprat (*Clupeonella cultriventris*), the European anchovy (*Engraulis encrasicolus*), and Black Sea horse mackerel (*Trachurus mediterraneus*). Most fish species distribution in the Black Sea are located close to the shoreline (Yankova, et al., 2014), where most of the fisheries are also found (see 6.1.8.1).

A recent study carried out in the Turkish waters of the Black Sea has shown that about 2% of the fish species are non-native, such as, for instance, the red mullet (*Mullus barbatus*), the obtuse barracuda (*Sphyraena obtusata*) and the Atlantic salmon (*Salmo salar*).

[5] Born in freshwater, living in saltwater and spawning in freshwater.

[6] Living at the large river mouths of the basin.

Local context (AoI)

Based on the information provided by the fishermen interviews (Armada, 2021). Due to the lack of oxygen below 100-150 m depth, there is no fishing activity below that depth and fisheries are restricted to coastal areas, even in the AoI. However, as already stated, the AoI is reported by fishermen a rich in pelagic and benthic fish biodiversity due to nutrient rich waters coming from the Filyos and Bartin rivers (see 6.2.1.6 and 6.3.2.1).

Fishes reported to be mostly caught by fishermen interviewed in 2021 are reported in Table 6-5 in comparison with those reported in the interviews carried out in 2022.

Table 6-5: Fish species reported by fishermen as mostly caught in 2021 (Armada) fished by local fishermen in the study area (Armada, 2021).

Species	Common name	Reported in 2021 (Armada, 2021)	Reported in 2022	IUCN Global Red List Status	UNEP Black Sea Protocol
Arnoglossus kessleri	Scaldback Sole	X	-	DD	-
Alosa fallax	Twaite Shad	-	X	LC	-
Belone belone	Garfish/Garpike	-	X	LC	**
Dicentrarchus labrax	European sea bass	-	X	LC	**
Engraulis encrasicolus	European anchovy	-	X	LC	-
Merlangius merlangus euxinus	Whiting	X	X	LC	-
Mugil spp.	Gray mullet	X	X	LC	-
Mullus barbatus	Red mullet	X		LC	-
Pomatomus saltatrix	Bluefish	X	X	LC	-
Sarda sarda	Atlantic Bonito	X	X	LC	-
Scophthalmus maximus	Turbot	X	X	NT	-
Scorpaena porcus	Black scorpionfish	X	-	LC	-
Solea nasuta	Blackhand sole	X	-	DD	-
Trachurus mediterraneus	Mediterranean horse mackerel	X	X	LC	-
Liparidae	Snailfish	-	X	-	-
Sparidae	Seabream	-	X	-	-

As it can be noted, species caught in the two years are not always the same. This can be explained by the diversity of fishermen interviewed (i.e., the same person may not have the availability or will of being interviewed in both years). Hence, the species targeted could not be the same. This is also supported by the fact that no benthic species (*A. kessleri*, *S. nasuta* and *M. barbatus*) is reported in the interviews of 2022. In addition, it should be noted that fish communities are highly seasonal; interviews in 2021 were conducted in April-May, while those in 2022 were conducted in February. This may provide a wide and complete spectrum of the fish species present in the AoI.

Only one fish species (a benthic fish) was observed during the ROV inspections. It is a non-identified Gobiidae, a cryptic species circled in red in Figure 6-26 to be easily detected.

Figure 6-26: Non-identified Gobiidae (circled in red) opportunistically observed during the ROV inspections (R6 - 35 m depth).

However, based on the fishermen activities and target species (see also 6.1.8.1), it can be stated that the AoI is rich in pelagic fish species, which appeared very abundant in the area also by the constant presence of cetaceans (see 6.3.2.4) observed in feeding activities.

Sensitivity Assessment

Sensitivity features	Supported by	Sensitivity value
Abundance of pelagic fish targeted by fisheries	Primary data	**High**

Sensitivity features	Supported by	Sensitivity value
Presence of species of economic interest		

6.3.2.4 Marine mammals

Description	Marine mammals are aquatic mammals that rely on the ocean and other marine ecosystems for their existence (Castro & Hubert, 2012). They include cetaceans, pinnipeds, sirenians and marine fissipeds (i.e., polar bears and sea otters), even if only the first two can be found in the Black Sea. Marine mammals are however an informal group, unified only by their reliance on marine environments for feeding (Jefferson et al., 1993). All cetaceans are protected in the Black Sea by the international Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and contiguous Atlantic Area (ACCOBAMS).
Study Area	**RSA:** The Black Sea **Rationale:** Marine mammals are swimmers which can cover long distances. Moreover, the Black Sea is home to endemic subspecies of cetaceans which migrate throughout the basin.
	AoI: The project footprint with a buffer of 10 km per side **Rationale:** Marine mammals are very skilled swimmers, able to cover long distances in few time (Berta et al., 2015) that highly rely on underwater acoustics. Considering any alteration of the underwater ambient acoustics can be detected up to several km far (Urick, 1979), a buffer of 10 km is considered as appropriate in a highly precautional approach.
Data sources	**Primary sources**: Opportunistic visual observations occurred during the sediment samplings and ROV survey for characterizing the benthic communities and habitats. Data were also collected in the scope of the National EIA (Armada, 2021).
	Secondary sources: Secondary data from scientific papers, grey literature, and databases.

Methodological approach

Data to describe the regional context (i.e., RSA) were collected through literature review (references reported in 14.0), whereas the local context (i.e., AoI) was assessed by both literature review and the gathering of field data.

In particular, interviews were conducted with local fishermen in the scope of the national EIA. Details are reported in Armada (2021). Additional occasional visual observations occurred in February 2022, during the sediment samplings and ROV survey for characterizing the benthic communities and habitats. A drone was also used to identify species when the animals were too far from the vessel for visual identification.

Regional Context (RSA)

Three marine mammal species are resident in the Black Sea are cetaceans:

- The Black Sea Harbour Porpoise (*Phocoena phocoena relicta*);
- The Black Sea Bottlenose Dolphin (*Tursiops truncatus ponticus*); and
- The Black Sea Common Dolphin (*Delphinus delphis ponticus*).

Other species may occasionally occur in the basin, but are not considered as resident (BlackSeaWatch).

All the three species mentioned are actually scientifically considered as subspecies endemic to the Black Sea (IUCN, 2012; Akkaya Bas et al., 2017). Their ecology, IUCN Red List Status and Status for the UNEP Black Sea Protocol is reported in Table 6-6.

Table 6-6: List of Marine Mammal species of the Black Sea

Species	Common Name	Global IUCN Red List Status	UNEP Black Sea Protocol
Phocoena phocoena relicta	**Black Sea harbour porpoise**	**EN**	**
The Black Sea harbour porpoise inhabits mainly shallow waters (0 to 200 m deep) on the continental shelf surrounding the Black Sea coast but can also be seen in deep waters well away from the coast. It usually aggregates in large groups, that occasionally may be encountered 200 km offshore, waters of over 2,000 m deep. Some individuals migrate southwards from the Azov Sea and north-western Black Sea before winter and return in spring. The primary wintering areas are in the southeaster part of the Black Sea. This subspecies suffered from unregulated hunting until 1983 and the decline of this species continues caused by entanglements and bycatch leaving only several thousands of individuals left (IUCN, 2012).			
Delphinus delphis ponticus	**Black Sea common dolphin**	**VU**	**
The Black Sea common dolphin is primarily found in the open sea, where it migrates from for seasonal feeding or to pursue preys to shallow coastal waters. The annual winter aggregations of anchovies (the dolphin's main prey) in the southeastern Black Sea and in the south of the Crimean Peninsula create the ideal conditions for the winter aggregations of dolphins. Summer foraging is rather made of sprat in the northwest, northeast and central Black Sea. The Black Sea common dolphin used to be target of deliberate catches in such large numbers that they came close to extinction. Nowadays, the population went back up to tens of thousands of individuals (IUCN, 2012).			
Tursiops truncatus ponticus	**Black Sea bottlenose dolphin**	**EN**	**
The Black Sea Bottlehead Dolphin is mostly found on the continental shelf but can also be found far from the coast, especially upon the continental slope, where it is used to feed. The animal is usually found in scattered groups of about 10 to 150 animals at different points around the Crimean Peninsula and in the northern Black Sea. It is also known that there are resident groups in areas close to the Turkish coasts. The subspecies suffered from active catches that drove its population to be less than a thousand (IUCN, 2012).			

VU: Vulnerable; EN: Endangered; **: Endangered.

Local Context (AoI)

Primary data gathered, including the opportunistic visual observations, confirmed the presence in the AoI of two of the three Black Sea cetacean subspecies:

- The Black Sea harbour porpoise (*P. phocoena relicta*); and
- The Black Sea bottlenose dolphin (*T. truncatus ponticus*).

The **harbour porpoise** was observed during all the sampling days (Figure 6-27), particularly at dusk and dawn, which is in line with the time when dolphins are more active for feeding. Three groups of 2 to 4 individuals were seen travelling in the AoI, while a group of more than 20 individuals was seen feeding at dusk in the surface water corresponding to the heads of the canyon touching the AoI. The drone also allowed for the identification of the presence of calves (Figure 6-28), suggesting that the area may be a calving site for the species.

In addition, it must be stated that the harbour porpoise, while making seasonal migrations within the Black Sea, is a relatively sedentary species (Bjorge & Tolley, 2018); its presence in such numbers, showing feeding activities, can be an indicator of resident populations and that the AoI and its vicinity may play the role of feeding ground.

Figure 6-27: Black Sea Harbour Porpoise seen in the study area.

Figure 6-28: Black Sea Harbour Porpoise with its calf seen in the study area.

The Black Sea **bottlenose dolphin** was also observed during the sediment sampling for benthos. However, the observation occurred only once. A group of 4 individuals was observed travelling in the AoI in the morning. Being the cruising behaviour the only one observed for this subspecies, there are no elements enough to judge the area as important for such animal. However, considering that the diet of this subspecies partially overlaps with the porpoise's one, using a precautionary approach, the AoI may be considered as a feeding ground to the bottlenose dolphin as well.

Eventually, no **common dolphin** was observed in the AoI. This can be explained by the fact that the sediment samplings for the benthic community and habitat identification were carried out in neritic waters (i.e., upon the continental shelf), while the subspecies has rather oceanic habits (i.e., beyond the continental shelf). However, considering also the fact that blue fishes (i.e., the dolphin's main prey) are caught in the AoI and its vicinity (see 6.1.8.1 and 6.3.2.3), the subspecies may be considered as potentially present and occasionally visiting the AoI, in particular in the sections corresponding to the deeper zones.

Sensitivity Assessment

Sensitivity features	Supported by	Sensitivity value
Presence of protected and/or threatened species. Presence of feeding grounds.	Primary data	**High**

6.3.2.5 Marine habitats

Definition	Marine habitats are saltwater habitats which sustain marine life (Abercrombie, Hickman, & Johnson, 1966). Because of the tridimensionality of the marine environment, marine habitats are divided into benthic habitats, standing on the substrate, and pelagic habitat, relying on the water column. Both the habitat typologies are highly influenced by the light availability, which is the main limiting factor.
Study area	**RSA:** Western Black Sea basin with focus on the Turkish continental shelf, slope and abyssal plain. **Rationale:** The Andrusov Ridge and Archangelsky Ridge extending south from the Crimean Peninsula divide the Black Sea into two depositional basins: the Western Black Sea and the Eastern Black Sea (Shillington *et al.*, 2008).
	AoI: The project footprint plus a buffer of 500 m per side. **Rationale:** The activity of pipeline laying onto the seafloor may resuspend a limited amount of sediments with scarce possibility to be transported through long distances. A buffer of 500 m is considered as highly precautional even for the activities of dredging and deposition of the sediments at the temporary storage area.
Data sources	**Primary sources**: Geophysical data gathered through Side Scan Sonar (SSS) and Multibeam Echosounder (MBES) carried out by DenAr (2021). Ground-truth by sediment samplings, benthic species identification and ROV inspections carried out in February 2022.
	Secondary sources: Secondary data from scientific papers, grey literature and databases.

Methodological approach

Data to describe the regional context (i.e., RSA) were collected through literature review (references reported in 14.0), whereas the local context (i.e., AoI) was assessed by both literature review and the gathering of field data.

In particular, benthic habitats were described using the primary data collected in the scope of the description of the seafloor morphology (see methodology presented in 6.3.1.1), where ground-truth in selected targeted areas was conducted through sediment sampling for benthic organisms classification (see methodology reported in

6.3.2.2) and ROV (Remotely Operating Vehicle) inspections along transects and observation points (see Figure 6-29). A GoPro was attached to the ROV to provide HD images to the conduct the visual observations on. Three observation points and one transect were carried out along the pipeline corridor and one observation point and one transect at the temporary storage area.

Pelagic habitats were described through inferences derived from the data collected to describe all the offshore physical and biological baseline.

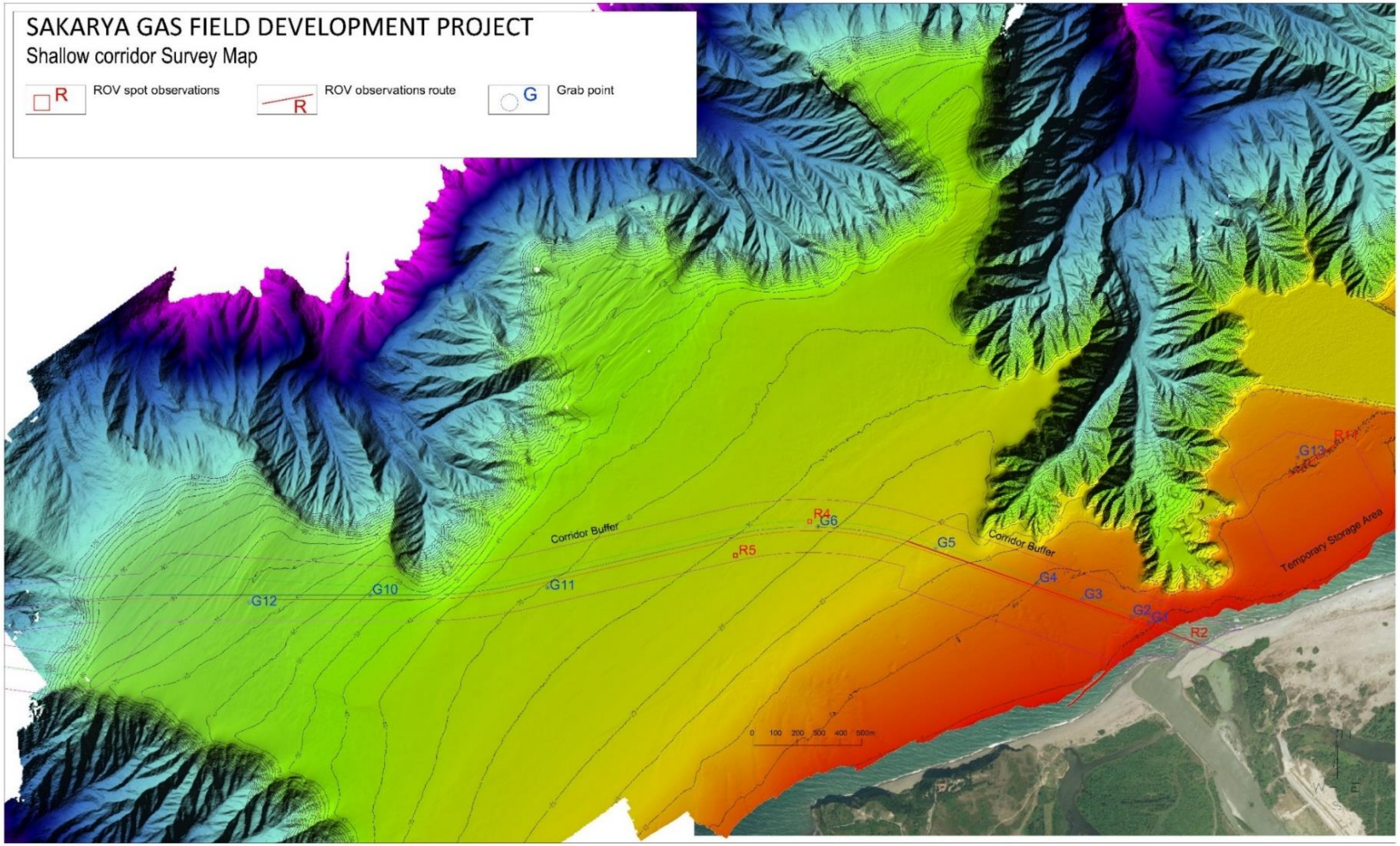

Figure 6-29: Sediment sampling stations (Gx) and ROV transects and observation points (Rx).

Regional context (RSA)

According to the EUNIS database, there are 72 types of **benthic habitats** in the Black Sea (EUNIS, 2016). Within these habitats, 6 are considered endangered (EN) and 3 are considered critically endangered (CR). However, the distribution of benthic habitats in the Black Sea is strongly correlated with the amount of oxygen in the water. Indeed, as the depth increases, the oxygen concentration decreases until reaching anoxic conditions at around 100-150 m depth (see 6.3.1.3). The general zonation in the Back Sea is the following (EUNIS, 2016).

- 0 to 20 m depth: Bed rock and coarse sediments dominated by algal communities.
- 10 to 25 m: Fine to medium sandy bottom sediments dominated by polychaetes such as *Melinna palmata* and molluscs (e.g., *Chamelea gallina, Lentidium mediterraneum* and *Gelidiophycus divaricatus*).
- 25 to 50 m: Substrate becoming a mixture between sand and mud and showing a decrease in the species richness.
- 50 to 80 m: Substrate composed of a mixture of mud, clay and dead seashells, where species diversity is the lowest and mainly dominated by polychaetes and echinoderms.
- Beyond 80 m: The species richness declines until the oxygen is completely depleted.

On the opposite, no information is available for the **pelagic habitats** of the Black Sea. However, based on what is reported in the previous baseline sections, only the epipelagic zone is actually inhabited by living organisms and may act as pelagic habitat.

Local context (AoI)

Based on the results that allowed for the characterization of the seafloor (see 6.3.1.1), sediments (see 6.3.1.2) and benthic communities (see 6.3.2.2) the benthic habitats of the AoI may be described as shown in Figure 6-30 and Figure 6-31.

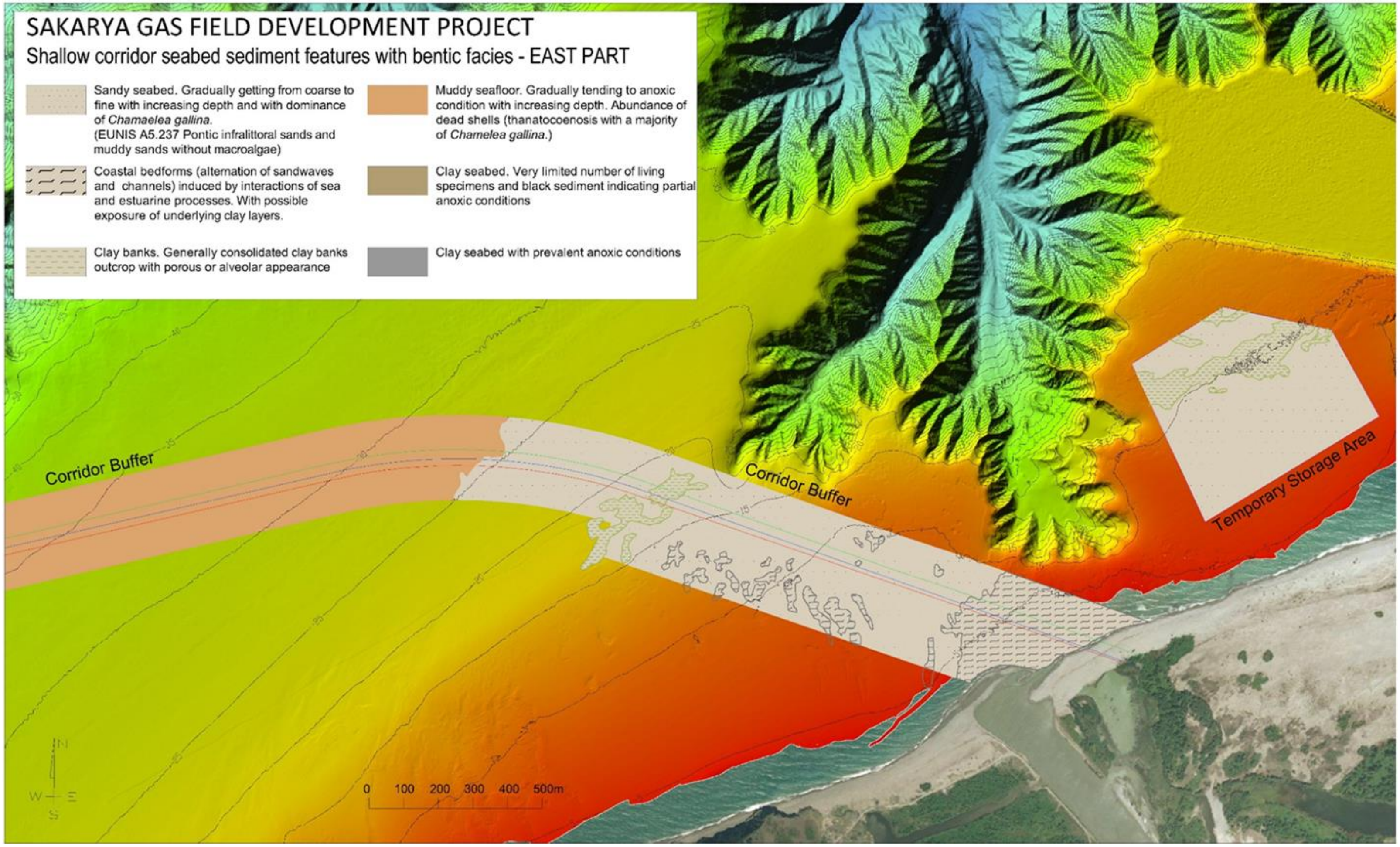

Figure 6-30: Seabed sediment features of the AoI (part 1 of 2).

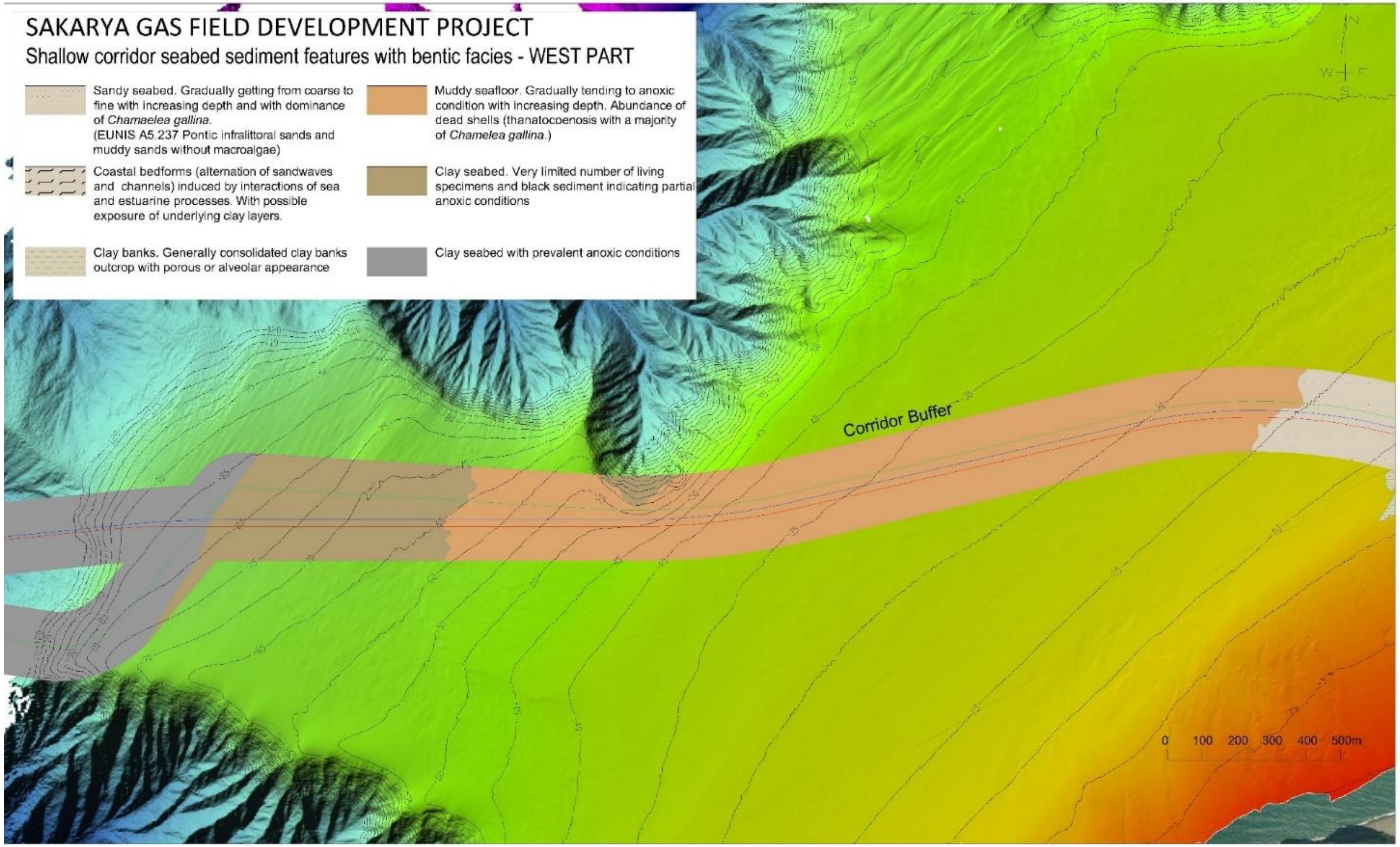

Figure 6-31: Seabed sediment features of the AoI (part 2 of 2).

As per what concerns the pipeline corridor, from the shoreline up to about 20-25 m of depth the seafloor is sandy, gradually getting from coarse to fine as the depth increases with a majority of *Chamelea gallina* (Figure 6-32 and Figure 6-36). An enclave of clay emerging from the seafloor, comparable to a step, can be seen between the depths of 16 and 17 m (Figure 6-38), whereas several small enclaves of clay covered by sand and muds are distributed along the corridor, in particular in the shallow water section. Due to the presence of four characteristic species (*Donax trunculus, Chamelea gallina, Lentidium mediterraneum,* and *Modiolus adriaticus*; see 6.3.2.2), the habitat may be attributable to the EUNIS A5.237 Pontic infralittoral sands and muddy sands without macroalgae. However, it should be noted that, like all the soft bottom benthic habitats, this one is also characterized by low species richness and high biomass (expressed, in this case, by the density of individuals). This is particularly reflected in the benthic communities sampled (see 6.3.2.2), where a strong dominance of two species (*D. trunculus* and *Chamelea gallina*) is observed. Such simple communities (i.e., characterized by a low species richness and high dominance) are known to be highly resilient to disturbance.

Also, because of the observe vicariance among juveniles and adults, it can be stated that the shallower sections of such habitat may act as a sort of nursery to the bivalve species[7].

From 25 m up to about 60 m of depth the seafloor muddier, gradually going toward anoxic conditions. In the shallower sections (i.e., 25 to 35 m depth), this area appears rather as thanatocoenosis with a majority of *Chamelea gallina* dead shells (Figure 6-33, Figure 6-34 and Figure 6-37), whereas, due the presence of one characteristic species (*Papillicardium papillosum*), the deeper section of this area may be attributable to the EUNIS habitat A5.xZ Pontic circalittoral terrigenous muds.

From 60 m up to about 80 m of depth the sediment is mainly composed by clay with very limited number of living specimens. Also, its colour appears as black, indicating partial anoxic conditions (Figure 6-35). Beyond that depth, no living organism is found, and total anoxic conditions (at least within the sediments) are assumed. For those reason, considering that the continental slope is encountered at about 80 m of depth (see 6.3.1.1), it can be safely stated that benthic habitats in the AoI (intended *sensu stricto* as habitats to eukaryotic aerobic organisms) are only present upon the continental shelf.

Moreover, based on the descriptions made above, all the benthic habitats along the pipeline corridor may be considered as Natural Habitats according to the definitions by IFC PS6.

[7] The term nursery is not used here in its most common meaning, intended as a shelter to mostly halieutic species, such as, for instance, submerged meadows or reefs are. The term is rather intended here to describe the vicariance between juvenile and adults.

Figure 6-32: Sediment sampled at 8 m depth (Station G3).

Figure 6-33: Sediment sampled at 26 m depth (Station G6).

Figure 6-34: Sediment sampled at 55 m depth (Station G10).

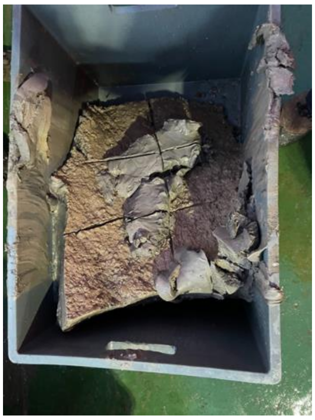

Figure 6-35: Sediment Sampled at 68 m depth (Station 12).

Figure 6-36: Seafloor at 8 m depth (Transect R2).

Figure 6-37: Seafloor at 35 m depth (Transect R6).

Figure 6-38: Clay "step" at 16-17 m depth (Transect R2).

Figure 6-39: Seafloor at 10 m depth in the dumping area (Transect R11).

Very limited presence of living organisms was found in the central portion the temporary storage area, which showed sand rich in mud and abnormal accumulations of clay at around 10 m. Because of their three-dimensional structure (Figure 6-39), it is not clear if such accumulations are the result of natural processes (e.g., freshwater sources) or consequence of impacts by previous activities (e.g., the construction of the port). For such reason, instead of considering the area as a Modified Habitat according to the definition by IFC PS6, the area is considered as a disturbed Natural Habitat, using a precautionary approach. The remnant portion of the temporary storage area is interested by the habitat EUNIS A5.237 Pontic infralittoral sands and muddy sands without macroalgae.

As far as what concerns the **pelagic habitats** of the AoI, no information is available and, for such reason, assumptions are made in order to identify them.

Based on the data reported in the previous baseline sections, the AoI may be characterized by the pelagic habitats described here below.

- Estuarine-influenced neritic waters facing the Filyos river mouth

The always illuminated water layer upon the continental shelf, characterized by high primary production, as indicated by the greenish water (see Figure 6-36 and Figure 6-38). Because of the water circulation of the area (see 6.3.1.4), this may not be considered as a true estuarine area characterized by brackish water, but only influenced but the river mouth. Because of these features, such habitat may be potentially frequented by all the biological components considered in this baseline (except for benthos), as indicated by the presence of cruising Black Sea harbour porpoises (see 6.3.2.4).

- Sakarya epipelagic zone
  The illuminated water layer at the surface of the sea where enough light is available for photosynthesis (Talley et al., 2012), located beyond the continental shelf and characterized by high primary production, in particular during the months of February and March (see 6.3.1.3 and 6.3.2.1). It is the most biodiverse pelagic habitat of the AoI, inhabited by all the biological components considered in this baseline (except for benthos) (Miller, 2004). As indicted by the constant presence of cetaceans (see 6.3.2.4) and birds (see 6.2.2.6), such habitat is rich in halieutic resources. In fact, because of its features and the organisms inhabiting it (see 6.3.2.3), this habitat takes on great importance to humans (see 6.1.8.2). The zone extends from the sea surface to the depth where 1% of the sunlight is found (i.e., generally identified as 100 m in the Black Sea).

Nevertheless, even if the AoI reaches the depth of 2,200 m, because of the total anoxic conditions of the Black Sea below 100-150 m of depth, including the AoI (see 6.3.1.3), no living organism could be found beyond that depth. For those reason, it can be safely stated that no other pelagic habitat may be found within the AoI.

Sensitivity Assessment

Because of their diversity and ecosystem functioning the benthic habitats and pelagic habitats are here assessed separately.

Sensitivity features	Supported by	Sensitivity value
Benthic habitats		
Presence of nursery areas (*sensu lato*) Simple communities dominated by few species Absence of bioconstructions and seagrasses	Primary data	**Medium-low**
Pelagic habitats		
Productive pelagic habitats highly rich in species Probable feeding area Presence of protected species		**High**

6.3.2.6 Legally Protected Areas and Internationally Recognized Areas

Definition	Legally protected areas are clearly defined geographical spaces, nationally or internationally recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values (IUCN, 2008). Internationally recognised areas are important areas for biodiversity identified and designated because their particular features have the potential to support global biodiversity. Officially, they are non-legally protected areas and are usually defined by networks of internationally recognized environmental NGOs and Institutions (e.g., IUCN; Conservation International; Birdlife International, etc.) based on solid standardized scientific criteria. Some of the important areas for biodiversity may also overlap with legally protected areas, while others remain with no legal protection for a period of time until they are eventually recognized as such by the local authorities.
Study area	**RSA:** Turkish EEZ of the Black Sea **Rationale:** Turkey is the nation the Project belong to and, for this reason, the Black Sea waters under its jurisdiction are taken as reference.
	AoI: The project footprint with a buffer of 10 km per side. **Rationale:** Turkey does not have regulations on distances from the boundaries of a protected area where a project can be implemented. Therefore, using a precautionary approach, a 10-km buffer is considered as appropriate.
Data sources	**Secondary sources:** Secondary data from scientific papers, grey literature and databases.

Methodological approach

Data to describe the regional context (i.e., RSA) and the local context (i.e., AoI) were collected through literature review (see 14.0).

Due to the typology of this project (see 3.0), having both an offshore and an onshore part, this offshore baseline includes only the legally protected areas and internationally recognized areas that are totally or partially marine (i.e., coastal areas embedding also offshore within their boundaries). All the other areas that are considered totally terrestrial (i.e., even coastal, but not having a marine part inside their boundaries), as well as the onshore description of the mixed areas (terrestrial and marine) are listed and described in the onshore baseline (see 6.2.2.9).

The typologies of **legally protected areas** here considered are the same already presented in the onshore baseline (see 6.2.2.9), being either marine or terrestrial, whereas, besides the internationally recognized areas already presented in in that section, the ones listed below are exclusively marine.

- **Ecologically or Biologically Significant Marine Areas (EBSAs)**
  EBSAs are areas of the ocean carrying special importance in terms of ecological and biological characteristics: for example, by providing essential habitats, food sources or breeding grounds for particular species. They are designated under the CBD, but their designation does not bring any

management measures or restriction of activities. However, it can be of support for the identification of new areas to be legally protected.

- **Important Marine Mammal Areas (IMMAs)**
  Areas defined as discrete portions of habitat, important to marine mammal species, that have the potential to be delineated and managed for conservation. IMMAs consist of areas that may merit place-based protection and/or monitoring. They are not legally protected or managed and have usually the aim of supporting existing EBSA and KBA designations as a basis for promoting environmental protection and developing management plans for specific areas in the world's oceans.
- **Cetacean Critical Habitats (CCHs)**
  These are parts of a cetacean range within the ACCOBAMS area (i.e. Mediterranean and Black Seas, and the Atlantic area contiguous to the Gibraltar Strait), either a whole species or a particular population of that species, that are essential for day-to-day survival, as well as for maintaining a healthy population growth rate. CCHs can include both areas that are regularly used for feeding, breeding and raising calves, as well as, sometimes, migrating, and areas where cetaceans are known to under direct threats (ship strike, by-catch, impulsive noise, harassment from whale-watching or pleasure boating, ...).

Regional Context (RSA)

According to the available data, there are no exclusively offshore **legally protected areas** in the RSA, which, however, partially overlaps with 19 legally protected coastal areas (see Table 6-7), and, based on the available georeferenced data, none is located within or in proximity of the AoI.

Table 6-7: Legally protected areas located within RSA borders.

Name	Typology	Distance from the AoI
Kızılırmak Delta	Ramsar site, Wetland of International Importance (1998)	> 100 km
İğneada Longoz	National Park	> 100 km
Çamgölü	Natural Park	> 100 km
Çamlikoy	Natural Park	> 100 km
Çilingoz	Natural Park	> 100 km
Elmas Burnu	Natural Park	> 100 km
Hamsilos	Natural Park	> 100 km
Marmaracik Koyu	Natural Park	> 100 km
Yeşilyuva	Natural Park	> 100 km
Çamburnu	Natural Protection Area	> 100 km
Demirciönü	Natural Protection Area	70 km

Name	Typology	Distance from the AoI
Kasatura Körfezi	Natural Protection Area	> 100 km
Sarikum	Natural Protection Area	> 100 km
Bozburun Yaban	Wildlife Protection Area	> 100 km
Çilingoz Yaban	Wildlife Protection Area	> 100 km
Feneryolu Yaban	Wildlife Protection Area	> 100 km
Gölardi Simenlik	Wildlife Protection Area	> 100 km
Kizilirmak Deltasi	Wildlife Protection Area	> 100 km
Seyrek Yaban	Wildlife Protection Area	> 100 km

As far as what concerns the exclusively offshore **internationally recognized areas**, 3 IMMAs, 1 cIMMA and 1 AOI (Area Of Interest[8]) partially overlap with the RSA. They are however located farther than 70 km from the project location (Table 6-8). All these areas have been designated because hosting the three threatened and endemic marine mammal subspecies (*Delphinus delphis ponticus, Phocoena phocoena relicta, Tursiops truncatus ponticus*).

Table 6-8: Legally protected areas located within RSA borders

Name	Typology	Rationale for designation	Distance from the AoI
Western Black Sea	IMMA	Criteria A, B, C for *Phocoena phocoena relicta*	> 200 km
Turkish Straits System and Prebosphoric	IMMA	Criteria A, B, C for *Delphinus delphis ponticus, Phocoena phocoena relicta, Tursiops truncatus ponticus*	> 200 km
Sinop	IMMA	Criteria A, B, C for *Delphinus delphis ponticus, Phocoena phocoena relicta, Tursiops truncatus ponticus*	> 200 km

[8] The starting point (stage 1) in the IMMA identification process is the nomination of Areas Of Interest (AOIs) by experts at regional workshops. The AOIs, if given further monitoring and survey effort, could be reassessed as candidate IMMAs (cIMMAs) (stage 2) in a future IMMA workshop. Finally (stage 3, 4 ,5), the Task Force, in consultation with the IUCN (e.g. through the Chairs of the relevant specialist groups), nominates an independent Review Panel, charged with assessing the scientific robustness of the proposals and satisfaction of the criteria, confirming or not the definitive identification of the IMMA. Areas that are not accepted as full IMMAs by the Task Force because they do not present convincing evidence that they satisfy the criteria remain as either cIMMAs or AOIs.

Name	Typology	Rationale for designation	Distance from the AoI
Black Sea Estern Anatilian Coast	cIMMA	Unconfirmed – pending further assessment (for *Delphinus delphis ponticus, Phocoena phocoena relicta)*	> 200 km
Sakarya Canyon	AOI*	-	> 70 km

* The AOI may be reassessed by experts at regional workshops and determined as future candidate IMMA.

IMMA criteria

A: Species or population vulnerability

B: Distribution and abundance

C: Key life cycle activities

In addition, the RSA includes 13 coastal internationally recognized areas (see Table 6-9), and, based on the available georeferenced data, one partially overlaps with the AoI.

Table 6-9: Internationally recognized areas located within RSA borders

Name	Typology	System	Rationale for designation	Distance from the AoI
Terkos Basin (MAR 015)	KBA, IBA, IPA	Terrestrial, Marine	KBA criterion: A1d (2004) IBA criterion: A1, B2 (2004)	> 100 km
Bosphorus (MAR 023)	KBA, IBA, IPA	Terrestrial, Marine	KBA criterion: A1b, A1d, B1, D1a (2017) IBA criterion: A1, A4i, A4ii, A4iii, A4iv, B1i, B1ii, B1iv (2016)	> 100 km
Şile Coast (MAR 030)	KBA, IBA, IPA	Terrestrial, Marine	IBA criterion: B1i, B3 (2004) KBA criterion: -* (2004)	> 100 km
Sakarya Delta (MAR 032)	KBA, IBA	Terrestrial, Marine	IBA criterion: B1i (2004) KBA criterion: -* (2004)	> 100 km
Kozlu coast (OBK 007)	KBA, IBA	Terrestrial, Marine	IBA criterion: B3 (2004) KBA criterion: -* (2004)	15 km
Amasra Coast (OBK 009)	KBA, IBA	Terrestrial, Marine	IBA criterion: B3 (2004) KBA criterion: -* (2004)	Overlapping
Küre Mountains (OBK 013)	KBA, IBA	Terrestrial, Marine	IBA criterion: B3 (2004) KBA criterion: -* (2004)	15 km

Name	Typology	System	Rationale for designation	Distance from the AoI
Sinop Peninsula (OBK 015)	KBA, IBA, IPA	Terrestrial, Marine	IBA criterion: A1, A4iii (2004) KBA criterion: -* (2004)	> 100 km
Kızılırmak Delta (OBK 019)	KBA, IBA, IPA	Terrestrial, Marine	KBA criterion: A1a, A1b, A1c, A1d, B1, D1a (2004) IBA criterion: A1, A4i, A4ii, A4iii, B1i, B1ii, B2, B3 (2004)	> 100 km
Yeşilırmak Delta (OBK 020)	KBA, IBA, IPA	Terrestrial, Marine	IBA criterion: B1i, B2 (2004) KBA criterion: -* (2004)	> 100 km
Akkuş Island (DKD001 - Giresun and Ordu Coasts)	KBA, IBA	Terrestrial, Marine	IBA criterion: B3 (2004) KBA criterion: -* (2004)	> 100 km
Giresun Island (DKD001 - Giresun and Ordu Coasts)	KBA, IBA	Terrestrial, Marine	IBA criterion: B1i (2004) KBA criterion: -* (2004)	> 100 km
Eastern Black Sea Mountains (DKD 005)	KBA, IBA, IPA	Terrestrial, Freshwater, Marine	KBA criterion: A1c (2004) IBA criterion: A1, A2, A3, B1i, B1iii, B1iv, B2 (2004)	> 100 km

* Key Biodiversity Area of international significance was identified using previously established criteria and thresholds and for which available data indicate that it does not meet the new global KBA criteria and thresholds set out in the Global Standard.

KBA criteria

A1: Threatened species

- A1a: >0.5% of global population size and 25 reproductive units (RU) of a CR/EN species
- A1b: ≥1% of global population size and ≥10 RU of a VU species
- A1c: ≥0.1% of global population size and ≥5 RU of species listed as CR/EN due only to past/current decline
- A1d: ≥0.2% of global population size and ≥10 RU of a species listed as VU due only to past/current decline

B1: Geographically restricted biodiversity

D1: Biological processes

- D1a: ≥1% of global population size of a species, over a season, and during ≥1 key stage in life cycle

Global IBA criteria

A1. Globally threatened bird species

A2. Restricted-range bird species

A3. Biome-restricted bird species

A4. Congregations of bird species/individuals

Regional IBA criteria

B1: Bird species of conservation concern

B2: Bird species with most of their range restricted to a region.

- B2a: Bird species with a favourable conservation status but concentrated in the region.

B3: Regionally important congregations of bird species/individuals

- B3a: Regionally important bird congregations – biogeographical populations; this criterion is a unification of former criteria A4i, B1i, B1ii & B1iii (Europe), B1i & B1ii (Middle East).

- B3b: Regionally important bird congregations – multi-species aggregations; formerly part of criterion A4 (A4iii).
- B3c: Regionally important bird congregations – bottleneck sites; this criterion is a unification of former criteria A4iv & B1iv (Europe) and B1iv (Middle East).

Local Context (AoI)

According to the georeferenced available data, the AoI is not located within or in the vicinity of any **legally protected area**; however, it partially overlaps with the **internationally recognized area** "Amasra Coasts" KBA and IBA partially overlaps with it (22% of the total KBA/IBA area) (Figure 6-40).

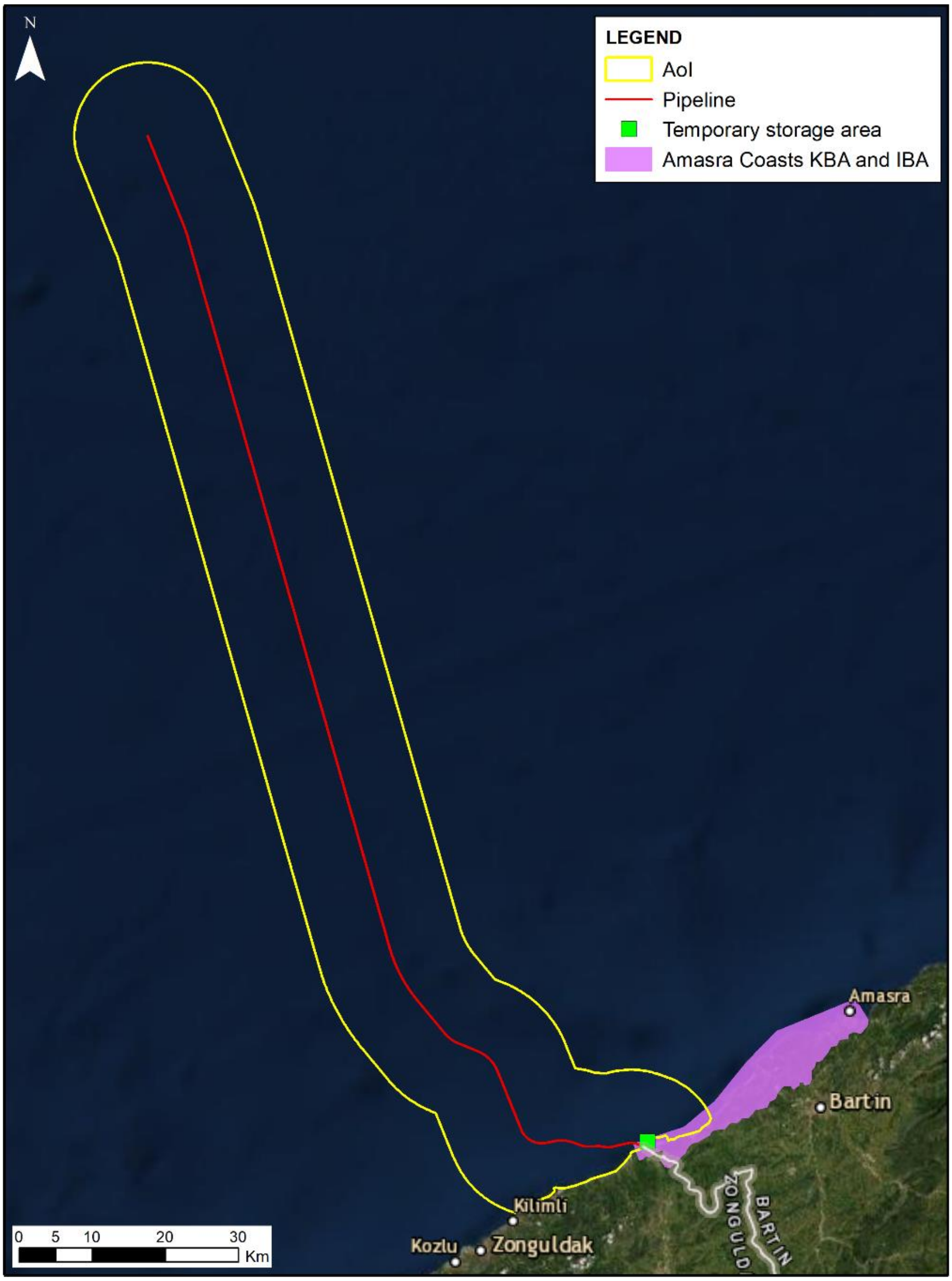

Figure 6-40: View of the AoI partially overlapping the Amasra Coasts KBA and IBA.

The Amasra Coasts internationally recognized area corresponds to the shores starting from the Amasra district in the western Black Sea region and developing southwestwards till the Filyos river mouth at the western border of the Bartin province. The area also includes the small delta formed by the Bartin Stream and the islets off Amasra and was designated as both KBA and IBA.

While its terrestrial portions are described in 6.2.2.9, based on the available bibliographic data, the shores of Amasra, which has small well-preserved beaches and steep rocky slopes, are an important wintering area for blackwater divers (*Gavia arctica*) in the region. Moreover, it is known that otters (*Lutra lutra*) live in significant numbers in the region and, until the mid-1990s, Mediterranean monk seals (*Monachus monachus*) were also reported to live in the KBA/IBA.

Both the KBA and IBA have been designated by the presence of the European shag (*Gulosus aristotelis*), which is the primary bird species breeding in the area and was also observed in large numbers in the AoI (see 6.2.2.6). However, while the IBA has been designated according to the criterion B3 “Regionally important congregations”, it should be noted that the KBA designation was based on criteria and thresholds previously established and for which available data indicate that it does not meet the new criteria and thresholds set out in the Global Standard anymore.

As previously stated, the AoI overlaps with 22% of the total KBA/IBA, which is all marine, being the AoI designed for the offshore baseline exclusively marine.

In addition, no legal protection tool is reported for this internationally recognized area.

Sensitivity Assessment

Sensitivity features	Supported by	Sensitivity value
Absence of legally protected areas Presence of internationally recognized coastal areas	Secondary data	**Medium-High**

6.3.2.7 Critical Habitats

Based on the information reported in the sections above, three species (and no habitats) are considered eligible to potentially trigger Critical Habitat (CH) according to the definitions, criteria and thresholds provided by IFC Performance Standard 6 (PS6, 2019). Such species are reported in Table 6-10 and, thus Critical Habitat Determination under IFC PS6 was conducted only for those ones.

Table 6-10: Eligible species for the Critical Habitat Determination under IFC PS6.

Species/ subspecies	Common name	Global IUCN Red List Status	Endemic/ Restricted Range [Y/N]	Congregatory/ Migratory [C/M]	IFC PS6 Criteria of eligibility
Phocoena phocoena relicta	Black Sea harbour porpoise	EN	N*	C**	C1a; C3
Tursiops truncatus ponticus	Black Sea bottlenose dolphin	EN	N*	C**	C1a; C3
Delphinus delphis ponticus	Black Sea common dolphin	VU	N*	C**	C1b; C3

* The subspecies is endemic to the Black Sea, but is not considered as locally endemic

** The subspecies make seasonal feeding migrations in the Black Sea not considered to be true migrations *sensu stricto*

Considering the fact that all the three species are marine mammals, the Critical Habitat Determination was conducted within the AoI as defined in 6.3.2.4.

Criterion 1: Habitats of significant importance to Critically Endangered and/or Endangered species

All the three subspecies meet Criterion 1 standards (GN72, IFC GN6 2019):

- *Phocoena phocoena relicta* (Black Sea harbour porpoise) and *Tursiops truncatus ponticus* (Black Sea bottlenose dolphin), evaluated under Criterion 1a "Areas that support globally important concentrations of an IUCN Red-listed EN or CR species (≥ 0.5% of the global population AND ≥ 5 reproductive units GN16 of a CR or EN species)" as Endangered (EN) species; and
- *Delphinus delphis ponticus* (Black Sea common dolphin), assessed with a precautionary approach under Criterion 1b "Areas that support globally important concentrations of an IUCN Red-listed Vulnerable (VU) species, the loss of which would result in the change of the IUCN Red List status to EN or CR and meet the thresholds in GN72(a)" as a VU species having a distribution range limited to the Black Sea, Bosphorus Strait and Marmara Sea (IUCN, 2022).

Among these subspecies, only *Phocoena phocoena relicta* and *Tursiops truncatus ponticus* were observed within the AoI during the survey conducted in February 2022.

In order to apply the Criterion 1a threshold, an Ecologically Appropriate Area of Analysis (EAAA) has been identified for each species and used to determine the presence of CHs, since an exact numerical estimation of the local populations of the abovementioned species does not exist.

The EAAA was then compared with the Extent of Occurrence (EOO) of each species, which represents the global population distribution, in order to identify if that area could potentially meet Criterion 1a threshold: if the EAAA is ≥ 0.5% of the EOO, the area is defined as triggering Critical Habitat (CH). The EAAA identification for each species is reported below:

- For the Black Sea harbour porpoise (*Phocoena phocoena relicta*), being typically a neritic species that inhabits mainly shallow waters (0–200 m deep) over the continental shelf, the EAAA (Figure 6-41) has been identified as <u>the continental shelf present within its EOO</u>, corresponding to the Black and Azov Seas (with the related Kerch Strait), and the Marmara Sea (no confirmed information from the Dardanelles Straits is known) (IUCN, 2022);
- For the Black Sea bottlenose dolphin (*Tursiops truncatus ponticus*), being typically a neritic species that sometimes may occur far offshore on the continental slope, the EAAA (Figure 6-42) has been identified as <u>the continental shelf and the slope present within its EOO</u>, corresponding to the Black Sea, the Kerch Strait along with the adjoining part of the Azov Sea, and the Turkish Straits System (TSS) (IUCN, 2022);
- For the Black Sea common dolphin (*Delphinus delphis ponticus*), having typically more oceanic habits and inhabiting offshore waters over the continental slope and deep-sea depression, the EAAA (Figure 6-43) has been identified as <u>the abyssal plane present within its EOO</u>, corresponding to the Black Sea, the Bosphorus Strait and Marmara Sea (IUCN, 2022).

All the EAAAs identified as mentioned above correspond to >0.5% of the EOO, therefore <u>*Phocoena phocoena relicta* and *Tursiops truncatus ponticus* are determined to trigger Critical Habitat</u> since they were directly observed in the AoI, while <u>*Delphinus delphis ponticus* is determined to trigger Potential Critical Habitat</u> since this species is considered only potentially present within the AoI, based on literature information. The results of the CH Determination are detailed in Table 6-11.

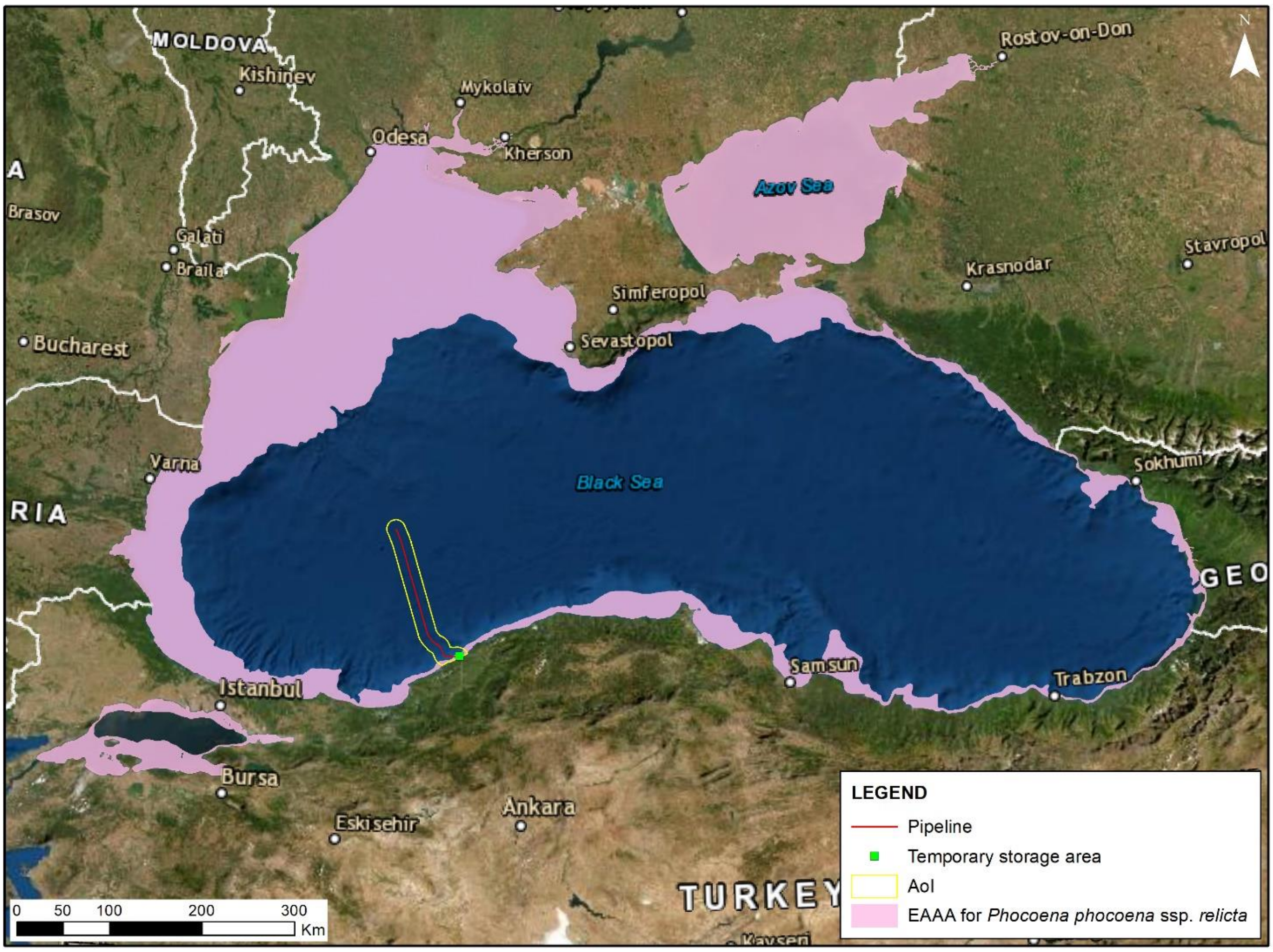

Figure 6-41: Ecologically Appropriate Area of Analysis for the Black Sea harbour porpoise (*Phocoena phocoena relicta*).

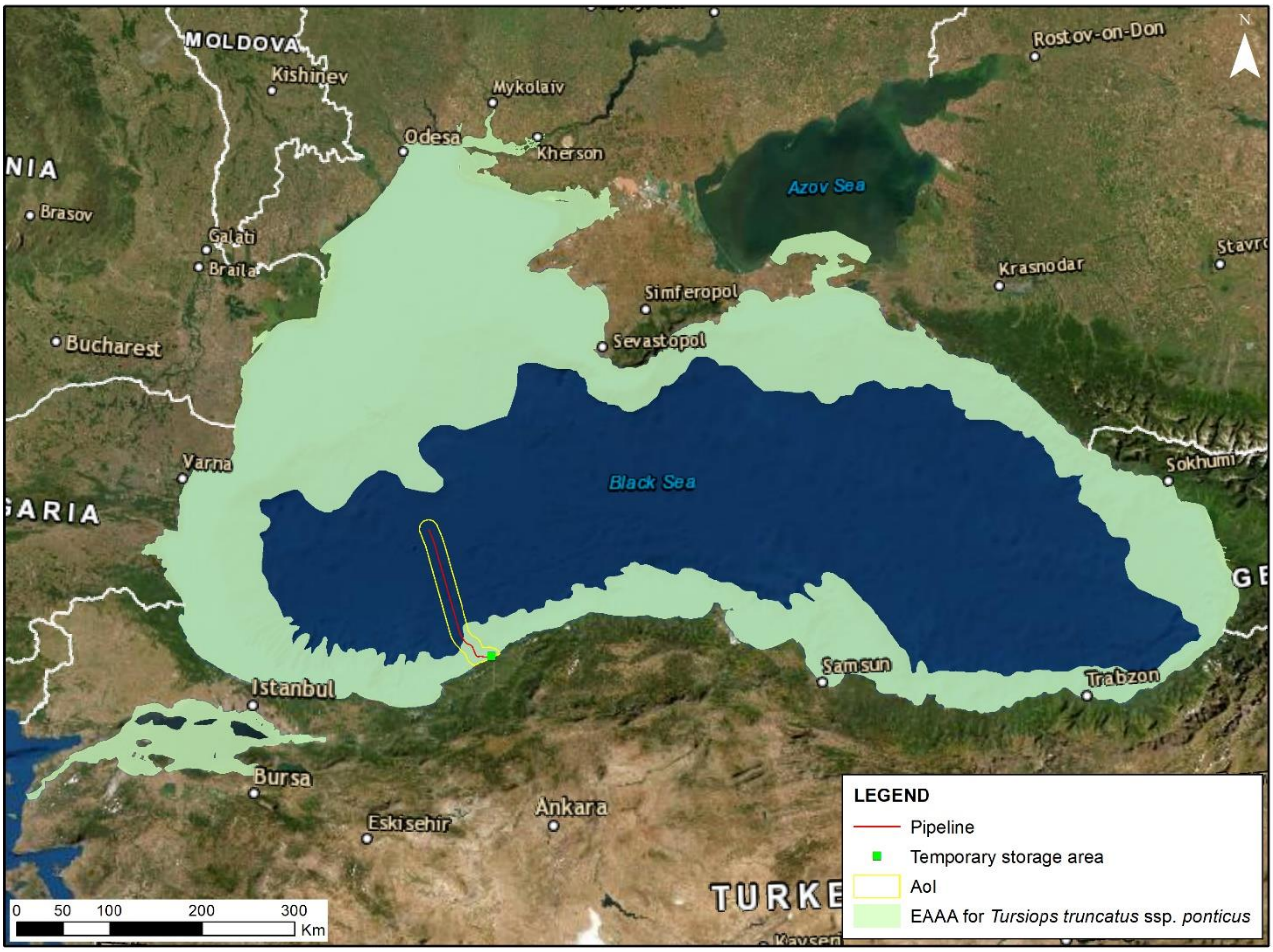

Figure 6-42: Ecologically Appropriate Area of Analysis for the Black Sea bottlenose dolphin (*Tursiops truncatus ponticus*).

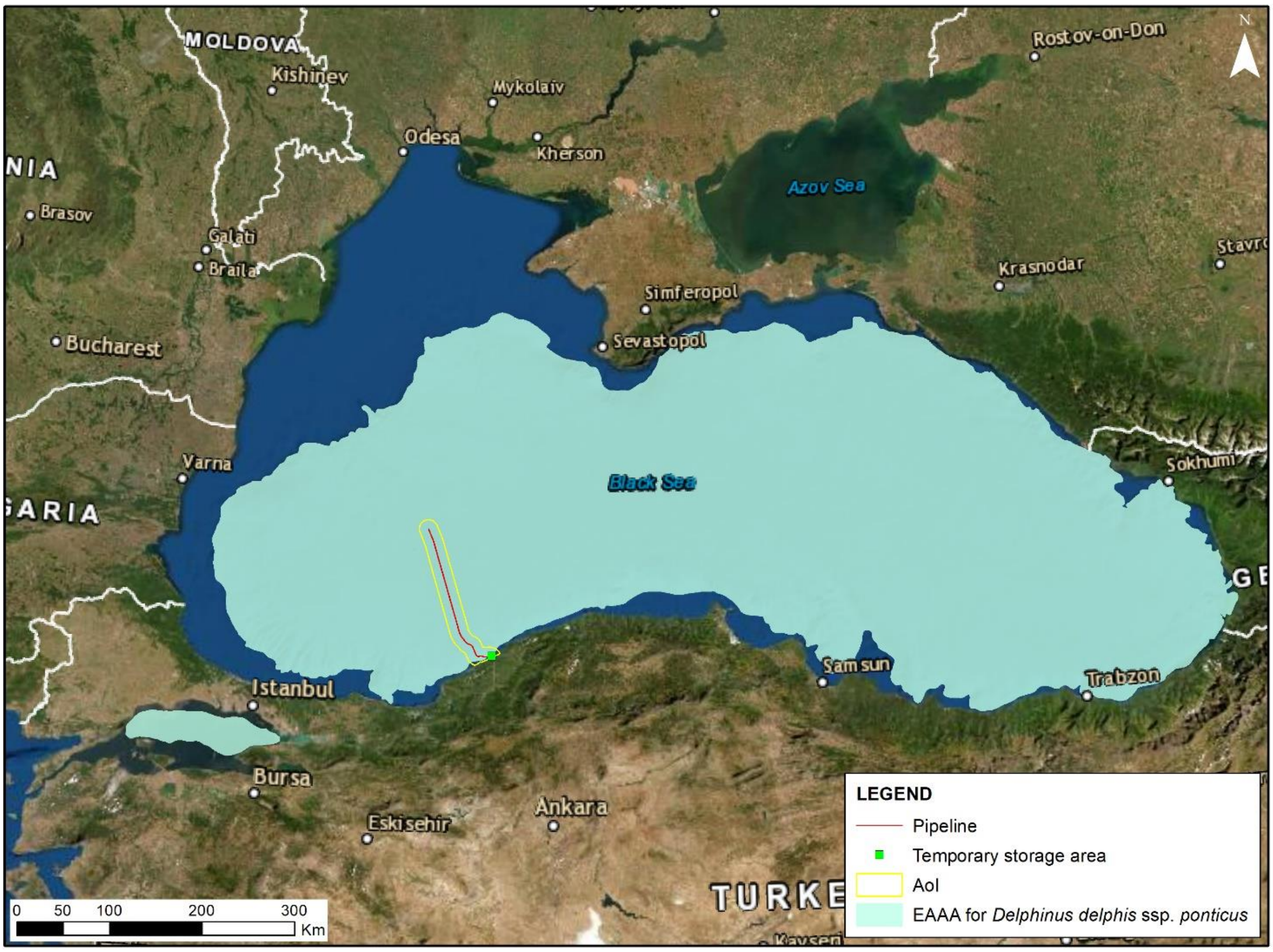

Figure 6-43: Ecologically Appropriate Area of Analysis for the Black Sea common dolphin (*Delphinus delphis ponticus*).

Table 6-11: CH Determination for the species eligible to trigger Critical Habitat according to Criterion 1 (IFC PS6, 2019).

Species/ Subspecies	Common name	IUCN Global Red List Status	Potentially Present/ Observed [P/O]	EOO (km^2)	0.5% of EOO (km^2)	EAAA (km^2)	EAAA is ≥ 0.5% of EOO [Y/N]	Trigger Critical Habitat [Y/N]
Phocoena phocoena relicta	Black Sea Harbour Porpoise	EN	O	496,636	2,483	153,847	Y	Y
Tursiops truncatus ponticus	Black Sea Bottlenose Dolphin	EN	O	437,321	2,187	225,983	Y	Y
Delphinus delphis ponticus	Black Sea Common Dolphin	VU	P	434,194	2,171	316,504	Y	Potentially*

* The subspecies was not directly observed

Criterion 2: Habitats of significant importance to Endemic and/or Restricted-range species

No species meets the endemic and restricted range standards of Criterion 2 (GN74, IFC 2019); therefore no species were identified as Endemic and/or Restricted-range.

As a result, no species are determined as triggering Critical Habitat or potentially CH for Criterion 2 (GN75, IFC 2019).

Criterion 3: Habitats supporting globally significant concentrations of Migratory and/or Congregatory species

All the three subspecies meet Criterion 3 standards (GN76 and GN77, IFC GN6 2019), being identified as congregatory, as follows.

- *Phocoena phocoena relicta* is known to form dense aggregations of some hundreds of individuals during its seasonal migration every year (IUCN, 2022).
- *Tursiops truncatus ponticus* is known to form aggregations close to the Turkish coast (Sergey Krivokhizhin pers. comm., 2005; IUCN, 2022).
- *Delphinus delphis ponticus* is known to be a highly social animal that lives in groups ranging from a few tens to several thousands of individuals (Perrin 2018, Saavedra et al. in press; IUCN, 2022).

Among these species, only *Phocoena phocoena relicta* and *Tursiops truncatus ponticus* were observed within the AoI during the survey conducted in February 2022.

However, using a precautionary approach, all the subspecies have been assessed according to Criterion 3a threshold "areas known to sustain, on a cyclical or otherwise regular basis, ≥ 1 percent of the global population of a migratory or congregatory species at any point of the species' lifecycle". Within this scope, since an exact numerical estimation of the local populations of these species does not exist, the same EAAAs presented in section "Criterion 1: Habitats of significant importance to Critically Endangered and/or Endangered species" have been compared with the EOO of each species, which represents the global population estimate, in order to identify if that area could potentially meet Criterion 3 threshold: if the EAAA is ≥ 1% of the EOO, the area is defined as potentially Critical Habitat.

All the EAAAs identified correspond to >1% of the EOO, therefore *Phocoena phocoena relicta* and *Tursiops truncatus ponticus* are determined to trigger Critical Habitat since they were directly observed in the AoI, while *Delphinus delphis ponticus* is determined to trigger Potential Critical Habitat since this species is considered only potentially present within the AoI based on literature information. The results of the CH Determination are detailed in Table 6-12.

Table 6-12: CH Determination for the species eligible to trigger Critical Habitat according to Criterion 3 (IFC PS6, 2019).

Species/ Subspecies	Common name	IUCN Global Red List Status	Potentially Present/ Observed [P/O]	EOO (km^2)	1% of EOO (km^2)	EAAA (km^2)	EAAA is ≥ 1% of EOO [Y/N]	Trigger Critical Habitat [Y/N]
Phocoena phocoena relicta	Black Sea Harbour Porpoise	EN	O	496,636	4,966	153,847	Y	Y
Tursiops truncatus ponticus	Black Sea Bottlenose Dolphin	EN	O	437,321	4,373	225,983	Y	Y
Delphinus delphis ponticus	Black Sea Common Dolphin	VU	P	434,194	4,342	316,504	Y	Potentially*

* The subspecies was not directly observed

Criterion 4: Highly Threatened and/or Unique Ecosystems

The Criterion 4 application (GN79, IFC 2019) foresees the use of the "Red List of Ecosystems (RLE)" where formal IUCN assessments have been conducted, however no evaluation were performed within the Black Sea area as shown in the IUCN RLE Database[9]. The "European Red List of Habitats – Part 1. Marine habitats" was used instead.

None of the EUNIS habitats identified in 6.3.2.5 is considered as unique ecosystem and/or highly threatened. Therefore, no Critical Habitat is expected to be present in the AoI according to Criterion 4 (GN80, IFC GN6 2019).

Criterion 5: Areas associated with Key Evolutionary Processes

The AoI is not known to contain landscape features that may influence evolutionary processes, as described in 6.3.1.1, giving rise to regional configurations of species and ecological properties. In fact, no species and/or subpopulations of species is characterized by a particular level of isolation[10], spatial heterogeneity, and wealth of environmental gradients or edaphic interfaces. Moreover, the areas are not considered to be of demonstrated importance as to climate change adaptation or as biological corridor. These considerations suggest that the AoI does not support any key evolutionary processes. Thus, no Critical Habitat is triggered under Criterion 5.

[9] http://assessments.iucnrle.org/

[10] The endemism at regional level (whole Black Sea) of the three cetaceans described in 6.3.2.4 cannot be considered as a level of isolation, since it is not at local scale.

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