ENVIRONMENTAL SCOPING REPORT

BALTICA 1+ OFFSHORE WIND FARM (LOCATED WITHIN AREA 60.E.3)

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Baltica sp. z o.o.

Environmental Scoping Report, Baltica 1+ Offshore Wind Farm

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Revision log

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PGE Baltica sp. z o.o.

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LIST OF ABBREVIATIONS

APO	Applicant Proposed Option
Area 60.E.3	the area defined in Annex 2 to Act of 17 December 2020 on promoting energy production in offshore wind farms (Journal of Laws of 2023, item 1385)
CLV	cable laying vessel
CTV	crew transfer vessel
EEZ	exclusive economic zone
EHV	extra high voltage
EIA Report	Environmental Impact Assessment Report
HDPE	high-density polyethylene
HLCV	heavy lift crane vessel
HLJV	heavy lift jack-up vessel
HV	high voltage
HVAC	high-voltage alternating current
HVDC	high-voltage direct current
JUV	jack-up installation vessel
MASL	metres above sea level
MBSB	metres below seabed level
MV	medium voltage
OSS	offshore substation(s)
OWF	offshore wind farm
OWT	offshore wind turbine
Project	Baltica 1+ OWF located within the part of Area 60.E.3 taking account of restrictions resulting from the Regulation of the Council of Ministers of 14 April 2021 *on the adoption of the Maritime Spatial Plan for Internal Sea Waters, Territorial Sea and Exclusive Economic Zone* at a scale of 1:200 000 (Journal of Laws of 2021, item 935, as amended), which forbids the construction of artificial islands and structures within the sea basin POM.60.E where the Project is located, and within less than 2 km from the boundary of the Natura 2000 site "*Hoburgs bank och Midsjöbankarna*" (SE0330308). Offshore wind turbines, offshore substations and subsea cable lines will be installed within the Project

area. Within this area also an infrastructural corridor (sub-basin 60.205.I) running through the development area will be located.

PSA Polish sea areas

PSzW permit for the construction and use of artificial islands, structures and devices in Polish sea areas [abbreviation from Polish: *Pozwolenie na wznoszenie i wykorzystywanie Sztucznych Wysp, konstrukcji i urządzeń w polskich obszarach morskich*]

PSzW decision Decision of the Minister of Infrastructure No. MFW/60.E.3 of 8 August 2023, i.e. the permit for the construction and use of artificial islands, structures and devices in Polish sea areas for the project entitled: "Zespół morskich farm wiatrowych Baltica 1+ wraz z infrastrukturą techniczną oraz pomiarowo-badawczą związaną z etapem przygotowania do realizacji, realizacji i eksploatacji" [literally: Baltica 1+ Offshore Wind Farm Complex together with Technical, Research and Measurement Infrastructure Related to the Preparation, Implementation and Operation Stages] (reference number: DGM-3.530.60.2021)

RAO Rational Alternative Option

SOV service operation vessel

1 Project type, characteristics, scale and location

1.1 Project type and location

The proposed project will comprise the construction, operation and decommissioning of the Baltica 1+ Offshore Wind Farm with a maximum total capacity of 1185 MW (hereinafter: Baltica 1+ OWF or the Project).

The area of the Baltica 1+ OWF will be located within the EEZ of the Republic of Poland, on the eastern side of the Middle Bank, in the depth range from approximately 30 m to approximately 55 m, at a distance of approximately 80 km north of the coastline, opposite the Smołdzino commune and the Łeba commune (Pomorskie voivodeship) [Figure 1.1].

The power generated by the Baltica 1+ OWF will be exported onshore via a power connection, which will constitute a separate project and will be subject to a separate procedure for issuing a decision on environmental conditions. The Project Owner – Elektrownie Wiatrowa Baltica - 1 sp. z o.o. – has not yet concluded a grid connection agreement with the Transmission System Operator (TSO), and as a result, the grid connection point of the said offshore wind farm has not yet been determined.

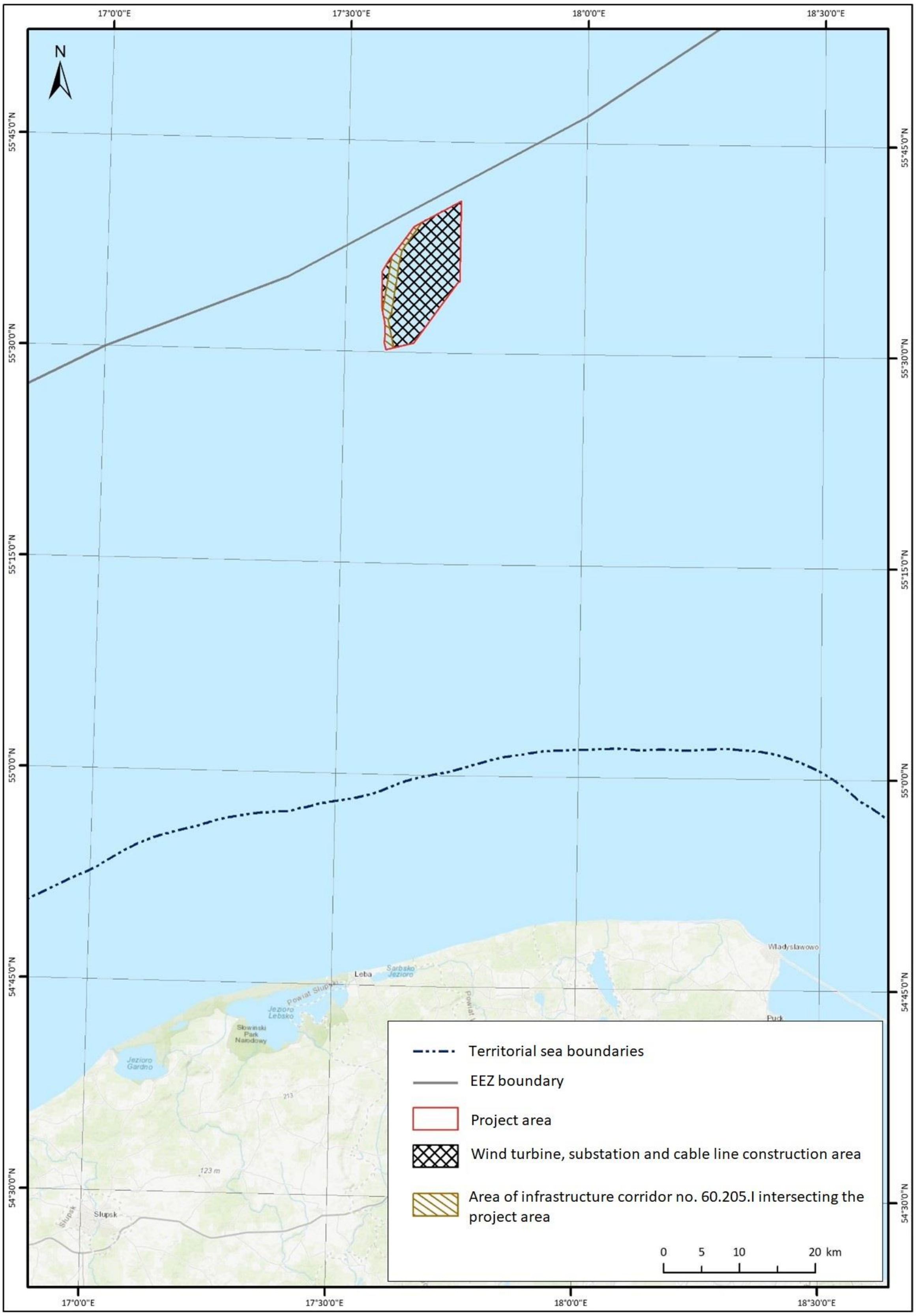


Figure 1.1. Location of the Baltica 1+ OWF area within Polish sea areas [source: internal materials]

The Baltica 1+ OWF boundary element is considered to be the point of connection of the offshore substation(s) with the transmission cables exporting the electricity produced by the Baltica 1+ OWF ashore.

1.2 PROJECT SCALE AND CHARACTERISTICS

The basic infrastructure of the Baltica 1+ OWF includes:

- offshore wind turbines – a nacelle with a rotor and supporting structure (the above-water part, transition elements and underwater part);
- offshore substation or offshore substations comprised of offshore transformer substations and, in the case of the HVDC solution, also offshore converter substations;
- medium- or high voltage subsea cable lines together with accessories, connecting the wind turbines with the OSS.

The maximum rated capacity of the Baltica 1+ OWF will be 1185 MW. At the current stage of the Project advancement and the development of offshore wind farm technology, it is assumed that electric power will be generated by wind turbines with capacities ranging from 15 to 25 MW. The construction period of the Baltica 1+ OWF is estimated at approximately 2 years.

The Project comprises a set of offshore wind turbines with a unit power of 15 to 25 MW. Assuming the generation of 1185 MW of electricity and the application of units with capacities from 15 to 25 MW, the maximum number of turbines is up to 79 15 MW wind turbines with a rotor diameter of up to 236 m and up to 47 25 MW turbines with a rotor diameter of up to 310 m.

The selection of the target wind turbines will take place at later stages of the Project and will be guided by the productivity calculations and wind conditions within the Baltica 1+ OWF Development Area, as well as by the developments in wind turbine construction and operation technology, economic analysis and availability of equipment at the contracting stage. The target number and location of the wind turbines will only be known once the design works have been completed. The wind turbines will be installed on or in the seabed using one of the widely applied foundation technologies. Subsection 3.3 contains a description of the types of foundations possible to be used in the Project.

At this stage, a maximum of five OSSs are assumed to be constructed.

The OSSs will be situated within the development area resulting from the PSzW permit and their location will result from the optimised layout of cable connections between wind turbines. The target number and location of the substations will only be known once the design works have been completed. A technical description of the OSSs is provided in Subsection 3.4.

The inter-array cable system within the Project area will consist of medium voltage (MV) or high voltage (HV) offshore cable systems connecting the wind turbines into assemblies (circuits/sections) with one or several OSSs, as well as the necessary teletechnical and telecommunication connections in the form of fibre optic lines, integrated into the three-core power cables or in separate teletechnical lines, laid in parallel with the power cables. The number of cable lines and their length will depend on the number of offshore wind turbines, their capacity, location and their interconnections. A description of the cable connections within the Baltica 1+ OWF is provided in Subsection 3.5.

In order to determine the technical and technological limits of the Project, it was assumed that the minimum rated capacity of the wind turbines will be 15 MW and the maximum capacity – 25 MW. At this stage, it is assumed that HVDC or HVAC transmission will be feasible. Table 1.1 presents data characterising the key technical parameters of the Baltica 1+ OWF, which take into account the above-mentioned envelope assumptions, adopted for further proceedings, from which the target parameters will be selected at the stage of building permit design.

Section 3 contains a description of the technologies to be implemented in the Project implementation.

Table 1.1. Key technical parameters of the Baltica 1+ OWF infrastructure (source: internal materials)

Parameter	Data characterising the parameter
Wind turbines	
Maximum rated capacity of the OWF	1185 MW
Single wind turbine capacity	from 15 to 25 MW
Maximum number of wind turbines	up to 47, if 25 MW units are selected; up to 79, if 15 MW units are selected
Maximum wind turbine rotor diameter	up to 236 m, if 15 MW units are selected; up to 310 m, if 25 MW units are selected
Minimum rotor blade tip clearance above the water surface	20 m
Maximum height of a wind turbineabove sea level	330 m
Offshore substations	
Maximum number of offshore substations MV/HV	5 pcs
Parameters of power cable lines within the OWF power transmission system – array cables connecting groups of turbines and linking the turbines to the OSS	
Power transmission technology	HVAC or HVDC
Power cable type	three-core with aluminium and/or copper power conductors and optical fibres inside the cable structure
Rated voltage of the power cable phase conductor	66 kV or 170 kV
Maximum cross-sectional area of the power cable phase conductor	2500 mm^2
Maximum depth of cable burial in the seabed	6 MBSB or, exceptionally, laid on the seabed with permanent protective solutions
Maximum length of cable lines	165 km

Prior to the beginning of the Baltica 1+ OWF construction, it may be necessary to clear the seabed of obstacles preventing the installation of wind turbine and OSS support structures, as well as the construction of cable lines, and to deepen the seabed surface before the cable lines are laid. The cable line route will be prepared before cable line construction, in accordance with the requirements developed at the designing stage.

The lifetime of the Baltica 1+ OWF is expected to be a maximum of 35 years. After this period, two possible options are considered: further operation with the possibility of upgrading the Baltica 1+ OWF infrastructure, or decommissioning of the Project. Decommissioning assumes dismantling of the wind farm structure and leaving in the environment those components, the removal of which would be too expensive and/or might generate stronger negative impacts on the environment than leaving them in place. This applies especially to the parts of the foundations below the seabed surface and the buried power cables.

1.3 Project classification

In order to classify the Project, each element of the Baltica 1+ OWF infrastructure was verified in terms of compliance with the criteria set out in the Regulation of the Council of Ministers of 10 September 2019 *on projects that may have a significant impact on the environment* (Journal of Laws of 2019, item 1839, as amended).

The planned total capacity of the Baltica 1+ OWF will be 1185 MW. Pursuant to § 2 section 1, point 5 (b) of the above-mentioned Regulation, "*plants using wind energy for electricity generation, located in maritime areas of the Republic of Poland*" are classified as projects that are always likely to have a significant impact on the environment.

The possibility of installing a helipad on the OSS platform is assumed. According to § 3 section 1, point 61 of the aforementioned regulation, "*airports other than those mentioned in § 2 section 1, point 30 or landing areas, with the exception of landing areas referred to in the Regulation of the Minister of Health of 27 June 2019 on the hospital emergency department (Journal of Laws, item 1213)*" are among projects that may have a potentially significant impact on the environment.

The proposed Project is a public purpose project in accordance with Article 6, point 4a of the Act of 21 August 1997 *on real estate management* (consolidated text: Journal of Laws of 2023, item 344), a public purpose is "*the construction and maintenance of an offshore wind farm within the meaning of the Act of 17 December 2020 on promoting energy production in offshore wind farms (Journal of Laws of 2022, items 1050 and 2687) including a set of devices for power evacuation within the meaning of this Act*."

Substations and cable lines located within the offshore area are not included in the above-mentioned regulation as projects likely to have a significant impact on the environment.

2 AREA OF THE PROPERTY OCCUPIED AND OF THE CIVIL STRUCTURE, AS WELL AS THEIR EXISTING USE AND VEGETATION COVER ON THE PROPERTY

2.1 AREA OF THE PROPERTY OCCUPIED

The Baltica 1+ OWF Area covers a surface area of approximately 131.2 km^2, the estimated OWF Development Area is approximately 115.5 km^2, the sub-basin 60.205.I area (located within the Baltica 1+ OWF Area), in which constructions are limited to internal submaster stations which enable connection of multiple generation sources, covers an area of 15.6 km^2. Table 2.1 contains the geocentric coordinates of boundary corner points of the Baltica 1+ OWF Area, while Table 2.2 contains the geocentric coordinates of boundary corner points of the Development Area.

Table 2.1. Geocentric coordinates of the Baltica 1+ OWF Area boundary corner points [source: Act on promoting... or PSzW]

Point no.	Geodetic Reference System GRS80h	
	ϕ – geodetic latitude	**λ – geodetic longitude**
1	55°42'03.578" N	17°44'14.504" E
2	55°41'42.750" N	17°44'15.274" E
3	55°35'07.271" N	17°44'15.288" E
4	55°35'02.979" N	17°44'01.016" E
5	55°30'41.569" N	17°38'35.575" E
6	55°30'12.088" N	17°35'07.822" E
7	55°30'43.741" N	17°34'54.415" E
8	55°30'50.044" N	17°34'55.640" E
9	55°30'51.960" N	17°34'56.012" E
10	55°31'03.386" N	17°34'58.233" E
11	55°31'18.831" N	17°35'01.235" E
12	55°32'00.143" N	17°34'57.333" E
13	55°32'06.143" N	17°34'55.243" E
14	55°32'55.258" N	17°34'38.489" E
15	55°33'21.993" N	17°34'29.364" E
16	55°34'32.451" N	17°34'29.913" E
17	55°35'45.433" N	17°34'31.685" E
18	55°36'30.395" N	17°35'14.925" E
19	55°38'22.098" N	17°37'38.792" E
20	55°40'06.245" N	17°39’43.134” E
21	55°40'42.880" N	17°40'06.677" E
22	55°40'46.332" N	17°40'09.008" E
23	55°40'49.222" N	17°40'18.179" E
24	55°40'52.370" N	17°40'28.173" E
25	55°40'52.946" N	17°40'30.000" E
26	55°40'55.518" N	17°40'38.168" E
27	55°40'58.667" N	17°40'48.162" E

Point no.	Geodetic Reference System GRS80h	
	ϕ – geodetic latitude	λ – geodetic longitude
28	55°41'01.815" N	17°40'58.158" E
29	55°41'04.962" N	17°41'08.153" E
30	55°41'08.110" N	17°41'18.150" E
31	55°41'11.257" N	17°41'28.146" E
32	55°41'14.404" N	17°41'38.143" E
33	55°41'17.551" N	17°41'48.141" E
34	55°41'20.697" N	17°41'58.139" E
35	55°41'23.844" N	17°42'08.137" E
36	55°41'26.990" N	17°42'18.136" E
37	55°41'30.136" N	17°42'28.136" E
38	55°41'33.281" N	17°42'38.135" E
39	55°41'36.427" N	17°42'48.136" E
40	55°41'39.572" N	17°42'58.136" E
41	55°41'42.717" N	17°43'08.137" E
42	55°41'45.862" N	17°43'18.139" E
43	55°41'49.006" N	17°43'28.141" E
44	55°41'52.151" N	17°43'38.143" E
45	55°41'54.127" N	17°43'44.430" E
46	55°41'55.295" N	17°43'48.146" E
47	55°41'58.438" N	17°43'58.150" E
48	55°42'01.582" N	17°44'08.153" E

Table 2.2. Geocentric coordinates of the boundary corner points of the construction area of the offshore wind turbines, offshore substations and cable lines within the boundaries of the Project area [source: internal materials]

Boundary marker symbol	Geocentric geodetic coordinates within the ETRS89 reference system	
	Geodetic latitude Φ	Geodetic longitude λ
1	55°30'20.610" N	17°36'07.799" E
2	55°30'12.088" N	17°35'07.822" E
3	55°30'43.741" N	17°34'54.415" E
4	55°31'18.832" N	17°35'01.234" E
5	55°32'00.014" N	17°34'57.332" E
6	55°32'06.143" N	17°34'55.242" E
7	55°32'55.258" N	17°34'38.488" E
8	55°33'21.993" N	17°34'29.364" E
9	55°34'32.451" N	17°34'29.913" E
10	55°35'45.433" N	17°34'31.685" E
11	55°36'30.395" N	17°35'14.925" E
12	55°36'49.169" N	17°35'39.084" E
13	55°38'22.098" N	17°37'38.791" E
14	55°38'39.732" N	17°37'59.828" E

Boundary marker symbol	Geocentric geodetic coordinates within the ETRS89 reference system	
	Geodetic latitude Φ	Geodetic longitude λ
15	55°38'58.575" N	17°38'22.315" E
16	55°40'49.761" N	17°44'15.277" E
17	55°35'07.271" N	17°44'15.288" E
18	55°35'02.979" N	17°44'01.016" E
19	55°30'41.569" N	17°38'35.575" E

Figure 2.1 illustrates the boundaries of the Project area, determined by the coordinates provided in Table 2.1 as well as the boundaries of the Development Area, determined by the coordinates provided in Table 2.2.

Figure 2.1 presents the preliminary delineation of the section of the area where offshore wind turbines and OSSs will be located, as well as the section (sub-basin 60.205.I) in which constructions are limited to internal submaster stations which enable connection of multiple generation sources

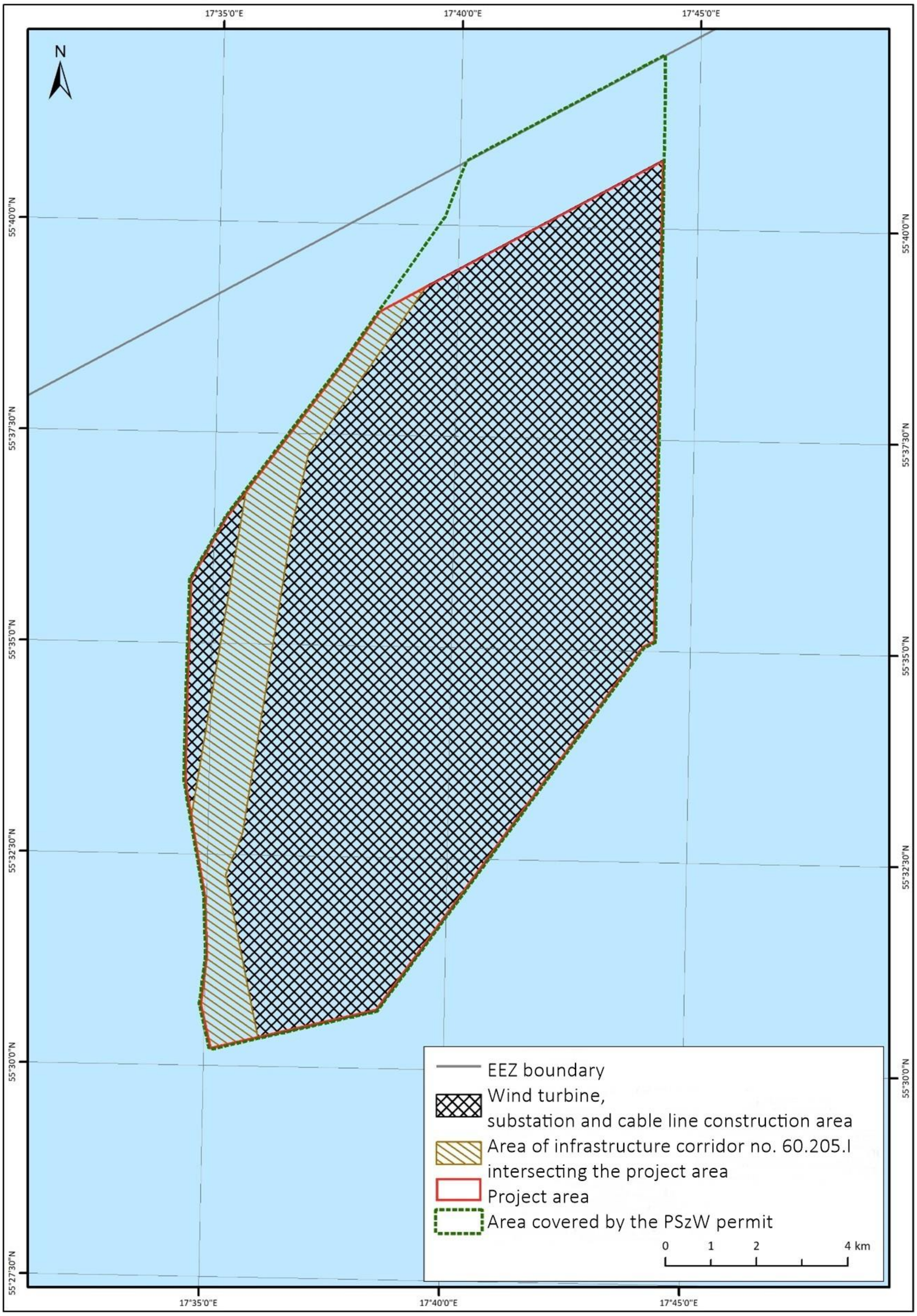


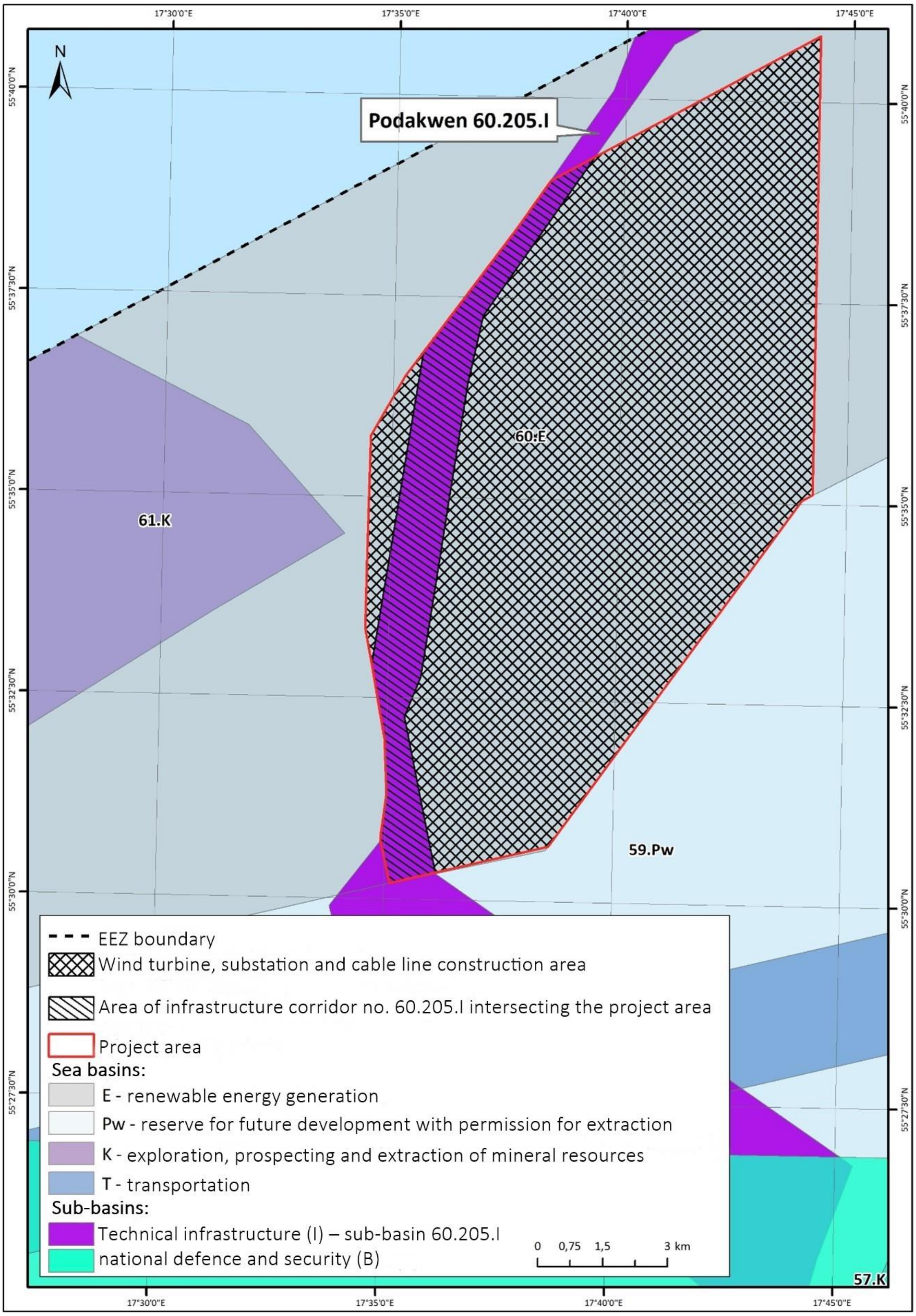
Figure 2.1. Baltica 1+ OWF Area [source: internal materials]

Final location of offshore wind turbines and OSSs will be known after the completion of the design process. Offshore wind turbines and OSSs will be located within the area designated for development in the PSzW permit, taking into account the permit provisions. The Project implementation will follow the remaining restrictions resulting from separate provisions, such as the Regulation of the Council of Ministers of 14 April 2021 *on the adoption of the Maritime Spatial Plan for Internal Sea Waters, Territorial Sea and Exclusive Economic Zone* at a scale of 1:200 000 (Journal of Laws of 2021, item 935, as amended), which forbids the construction of artificial islands and structures within the sea basin POM.60.E where the Project is located, and within the area less than 2 km from the boundary of the Natura 2000 site "*Hoburgs bank och Midsjöbankarna*" (SE0330308).

2.2 EXISTING USE OF THE AREA

2.2.1 Maritime Spatial Plan of Polish Sea Areas

The sea area in which the proposed Project is located fulfils various functions resulting from the existing human activity and the natural resources present there. The Baltica 1+ OWF Area is located entirely within the boundaries of the sea basin POM.60.E, the boundaries of which are specified in Annex 1 to the Regulation of the Council of Ministers of 14 April 2021 *on the adoption of the Maritime Spatial Plan for Internal Sea Waters, Territorial Sea and Exclusive Economic Zone at a scale of 1:200 000* (Journal of Laws of 2021, item 935, as amended) [Figure 2.2].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17°35'0"E
17°40'0"E
17°45'0"E
55°40'0"N
55°37'30"N
55°35'0"N
55°32'30"N
55°30'0"N
55°27'30"N
N
Podakwen 60.205.I
60.E
61.K
59.Pw
57.K
EEZ boundary
Wind turbine, substation and cable line construction area
Area of infrastructure corridor no. 60.205.I intersecting the project area
Project area
Sea basins:
E - renewable energy generation
Pw - reserve for future development with permission for extraction
K - exploration, prospecting and extraction of mineral resources
T - transportation
Sub-basins:
Technical infrastructure (I) – sub-basin 60.205.I
national defence and security (B)
0 0,75 1,5 3 km

Figure 2.2. Location of the Baltica 1+ OWF Area in relation to the sea basins and sub-sea basins resulting from the Maritime Spatial Plan of Polish Sea Areas [source: internal materials based on the spatial data from the Maritime Administration Spatial Information System]

The sea basin card provided in Annex 2 to the above-mentioned regulation defines the principal use of the given sea basin, i.e. its basic function which governs the remaining forms of use, called the allowed functions. The set of sea basin functions results from its existing and planned use. The sea basin card also includes the prohibitions and restrictions (Table 2.3) as well as conditions for the sea basin usage (Table 2.4), which mainly regulate the possibility of implementing the allowed functions along with other forms of shared use, in order to subordinate them to the basic function.

The sea basin card does not cover the conditions of the sea basin usage in terms of: “environment and nature conservation”, “national defence and security” as well as “cultural heritage,” which are fully governed by separate regulations.

Table 2.3. Prohibitions or restrictions in the use of particular areas within the allowed functions of the sea basin POM.60.E [source: Annex 2 to the Regulation of the Council of Ministers of 14 April 2021 on the adoption of the Maritime Spatial Plan for Internal Sea Waters, Territorial Sea and Exclusive Economic Zone at a scale 1:200 000 (Journal of Laws of 2021, item 935, as amended)]

Allowed function of the sea basin	Prohibitions or restrictions in the use of particular basins
aquaculture	the implementation of the function within the entire sea basin is limited only to projects agreed upon with the relevant offshore wind farm project owner
scientific research	within the entire sea basin, scientific research is restricted to methods that: – do not disturb the linear elements of technical infrastructure; – do not endanger the ecological function of spawning grounds and the survival of the early development stages (eggs and larvae) of commercial species
cultural heritage	not determined
technical infrastructure	within the entire sea basin: – laying linear elements of technical infrastructure is restricted to infrastructure necessary for the performance of the energy extraction function; – the implementation of the function is limited to methods which do not endanger the ecological function of spawning grounds and the survival of the early development stages (eggs and larvae) of commercial fish species; linear elements of the technical infrastructure are required to be laid in a space-efficient manner, below the seabed surface, and if this is impossible, other permanent safeguards should be applied to allow the safe use of anchored gillnets
exploration and prospecting of mineral resources, as well as extraction of minerals from deposits	the implementation of the function in the entire sea basin is limited to the following methods which: – do not disturb the linear elements of technical infrastructure; – do not endanger the ecological function of spawning grounds and the survival of the early development stages (eggs and larvae) of commercial fish species; extraction of minerals from deposits in the entire sea basin is limited only to projects agreed upon with the relevant project owners of offshore wind farms
fishing	not to be determined until the commencement of the erection of offshore wind turbines; during operation of offshore wind farms, until the development of principles for fishing in the sea area, it is prohibited to conduct fishing in each of the safety zones of individual structures as well as in places where the safety of internal connection infrastructure may be at risk
artificial islands and structures	it is prohibited to construct artificial islands, structures and equipment for hydrocarbon extraction in the entire sea basin;

Allowed function of the sea basin	Prohibitions or restrictions in the use of particular basins
	it is prohibited to construct artificial islands and structures at a distance smaller than 2 km from the boundaries of the Natura 2000 site "Hoburgs bank och Midsjöbankarna" (SE0330308); the implementation of functions in the remaining part of the sea basin is restricted to: – for the purpose of aquaculture only in places at which the linear elements of technical infrastructure shall not be disturbed; – such project planning so as to make it possible for vessels up to 250 m performing aggregate extraction in the sea basin POM.61.K to pass safely through during the concession period; - methods which do not endanger the ecological function of spawning grounds and the survival of the early development stages (eggs and larvae) of commercial fish species; in sub-basin 60.205.I constructions shall be limited to internal submaster stations which enable connection of multiple generation sources
transport	not to be determined until the commencement of the erection of offshore wind turbines; during the operation of offshore wind turbines, until the establishing of conditions for safe navigation by means of a decision of the territorially competent director of the maritime office, sailing is restricted to vessels up to 50 m in length, with the exception of vessels related to the service and maintenance of offshore wind farm structures and equipment as well as aquaculture
tourism, sports and recreation	not determined
other	after the project implementation, in the sub-basins intended for laying and maintenance of linear elements of technical infrastructure, it is required that a safety zone around them is established by the territorially competent director of the maritime office. Within the zone, anchoring will be prohibited, except for emergency anchoring and anchoring related to installation and maintenance works.

Table 2.4. Conditions for using the sea basin POM.60.E [source: Annex 2 to the Regulation of the Council of Ministers of 14 April 2021 on the adoption of the Maritime Spatial Plan for Internal Sea Waters, Territorial Sea and Exclusive Economic Zone at a scale 1:200 000 (Journal of Laws of 2021, item 935, as amended)]

Form of the sea basin shared use	Conditions for using the sea basin
environmental protection	not determined
national defence and security	not determined
cultural heritage protection	not determined
fishing and aquaculture	an agreement with the relevant project owner of an offshore wind farm should be secured at the stage of issuing an administrative decision which would permit the development of aquaculture in the sea basin. Detailed location and both technological and technical solutions should be indicated at the building permit design stage; during operation, it is required to implement restrictions on fishing in the safety zones determined for each project by means of a decision of the territorially competent director of the maritime office
renewable energy generation	an area intended for wind power generation by offshore wind turbines. Both the internal and external technical infrastructure are integral parts of a project; upon commencement of a project involving the construction of artificial islands and structures, the requirement arises to impose, by a decision of the territorially competent director of the maritime office, restrictions on fishing and navigation in the sea basin in which construction activities take place, which also applies to a 500-metre safety zone around the sea basin, throughout the duration of the construction works; during the operation of offshore wind turbines it is required to implement, by a decision of the territorially competent director of the maritime office, a prohibition to conduct

Form of the sea basin shared use	Conditions for using the sea basin
	fishing and sea navigation in the safe zones determined for each structure as well as in places where the safety of the internal connection infrastructure may be at risk
prospecting and exploration of mineral deposits, and extraction of minerals from deposits	prospecting and exploration of mineral deposits is allowed in the entire sea basin; extraction of minerals from deposits is permitted in accordance with the restrictions in section 7, points 5 and 7

The most important forms of the use of the maritime space in the Baltica 1+ OWF Area are described below.

2.2.2 Technical and linear infrastructure

There are no objects of technical nor linear infrastructure present in the Baltica 1+ OWF Area.

2.2.3 Fisheries

The Development Area is located within the boundaries of three statistical rectangles: N11, O11 and O12 [Figure 2.3], covering 76.27 km^2 (19.58%) and 52.87 km^2 (13.57.1%) and 2.11 (0.54%) of their surface, respectively.

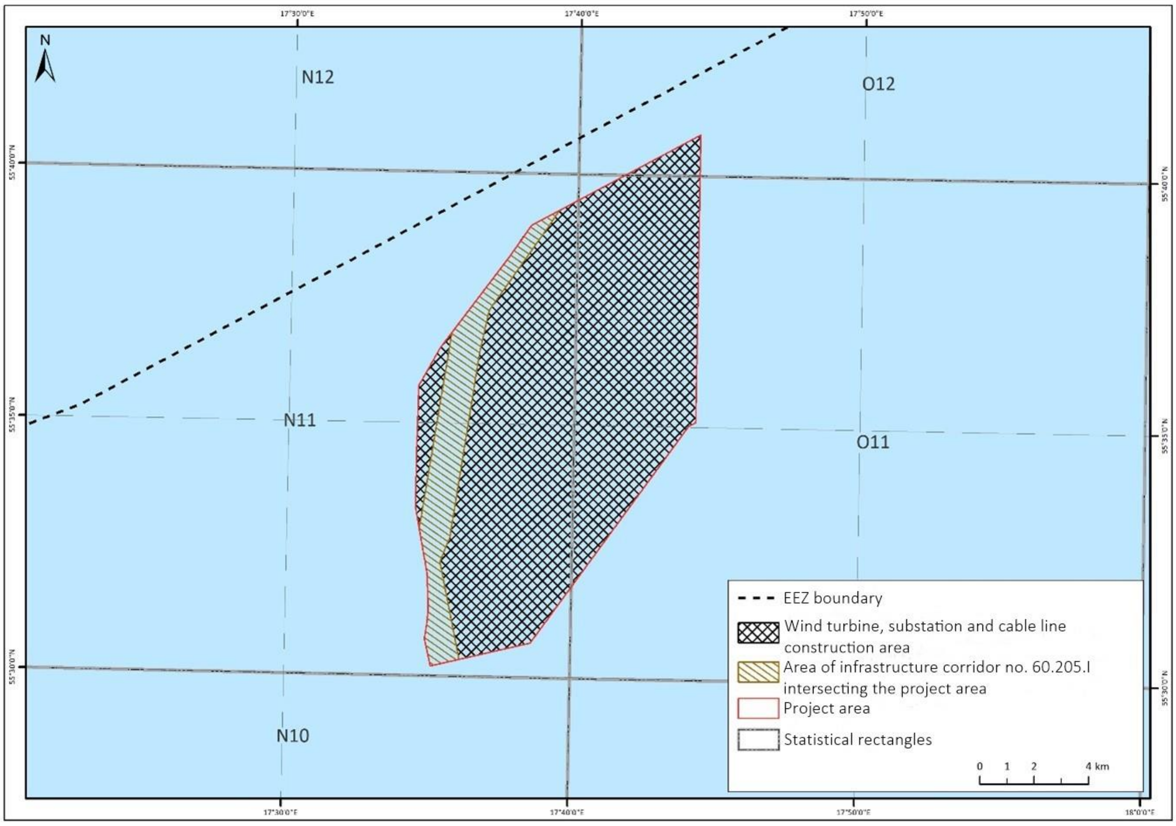

Figure 2.3. Location of the Baltica 1+ OWF relative to statistical rectangles [source: internal materials]

Table 2.5 and Table 2.7 contain data characterising the volume of fish catches in N11, O11 and O12 statistical rectangles in the years 2020–2022, including the relation to the total catches of all the species caught.

Table 2.5. The volume of fish catches [kg] in N11 statistical rectangle in 2020–2022 in relation to the catches in the entire Polish sea areas [%] [source: internal materials based on data made available by the Fisheries Monitoring Centre at the Fisheries Department of the Ministry of Agriculture and Rural Development].

Species	Catches in rectangle N11 [kg]			Proportion of catches in reference to the total catches [%]		
	2020	2021	2022	2020	2021	2022
cod	60	-	-	0.01	-	-
plaice	-	30	20	-	0.01	0.01
flounder	1500	230	640	0.01	0.00	0.01
sprat	5300	-	6000	0.01	-	0.01
herring	132 925	119 920	76 550	0.38	0.48	0.50
turbot	412	220	430	0.94	0.31	1.21

Table2.6. The volume of fish catches [kg] (Atlantic salmon in pieces) in O11 statistical rectangle in 2020–2022 in relation to the catches in the entire Polish sea areas [%] [source: internal materials based on data made available by the Fisheries Monitoring Centre at the Fisheries Department of the Ministry of Agriculture and Rural Development]

Species	Catches in rectangle O11 [kg, salmon in pieces]			Proportion of catches in reference to the total catches [%]		
	2020	2021	2022	2020	2021	2022
Atlantic salmon	17	2	-	0.23	0.02	-
sprat	43 135	72 670	419 700	0.06	0.09	0.55
herring	441 050	110 855	156 150	1.27	0.45	1.01

Table 2.7. The volume of fish catches [kg] (Atlantic salmon and sea trout in pieces) in O12 statistical rectangle in 2020–2022 in relation to the catches in the entire Polish sea areas [%] [source: internal materials based on data made available by the Fisheries Monitoring Centre at the Fisheries Department of the Ministry of Agriculture and Rural Development]

Species	Catches in rectangle O12 [kg, salmon and sea trout in pieces]			Proportion of catches in reference to the total catches [%]		
	2020	2021	2022	2020	2021	2022
cod	60	-	-	0.01	-	-
plaice	60	-	-	0.02	-	-
Atlantic salmon	20	14	-	0.27	0.12	-
sprat	6050	11 150	-	0.01	0.01	-
herring	104 775	52 975	6000	0.30	0.21	0.04
sea trout	-	1	-	-	0.009	-

In the years 2020–2022, the species most commonly caught in N11 statistical rectangle was herring, whose proportion of catches in relation to the total PSA in individual years was in the range of 0.38–0.50%. The volume of turbot catches is also noteworthy – its proportion in relation to the total PSA catches in 2020, 2021 and 2022 was 0.94%, 0.31% and 1.21%, respectively.

In the years 2020–2022, the catches of only three species in O11 statistical rectangle were reported, of which the most abundant was herring, whose catch volumes were the highest among the three rectangles in which the Baltica 1+ OWF is to be located. The proportion of herring catches in relation to the total PSA was in the range of 0.45–1.27%.

Herring was the most abundantly caught species in O12 statistical rectangle, while its volume of catches was the lowest among the three statistical rectangles analysed. The remaining fish species caught in O12 statistical rectangle were caught in considerably smaller quantities.

2.2.4 Navigation

The proposed Baltica 1+ OWF Area is located outside the main Baltic navigation routes; however, a customary navigation route leading to the port of Klaipėda runs through its southern part [Figure 2.4].

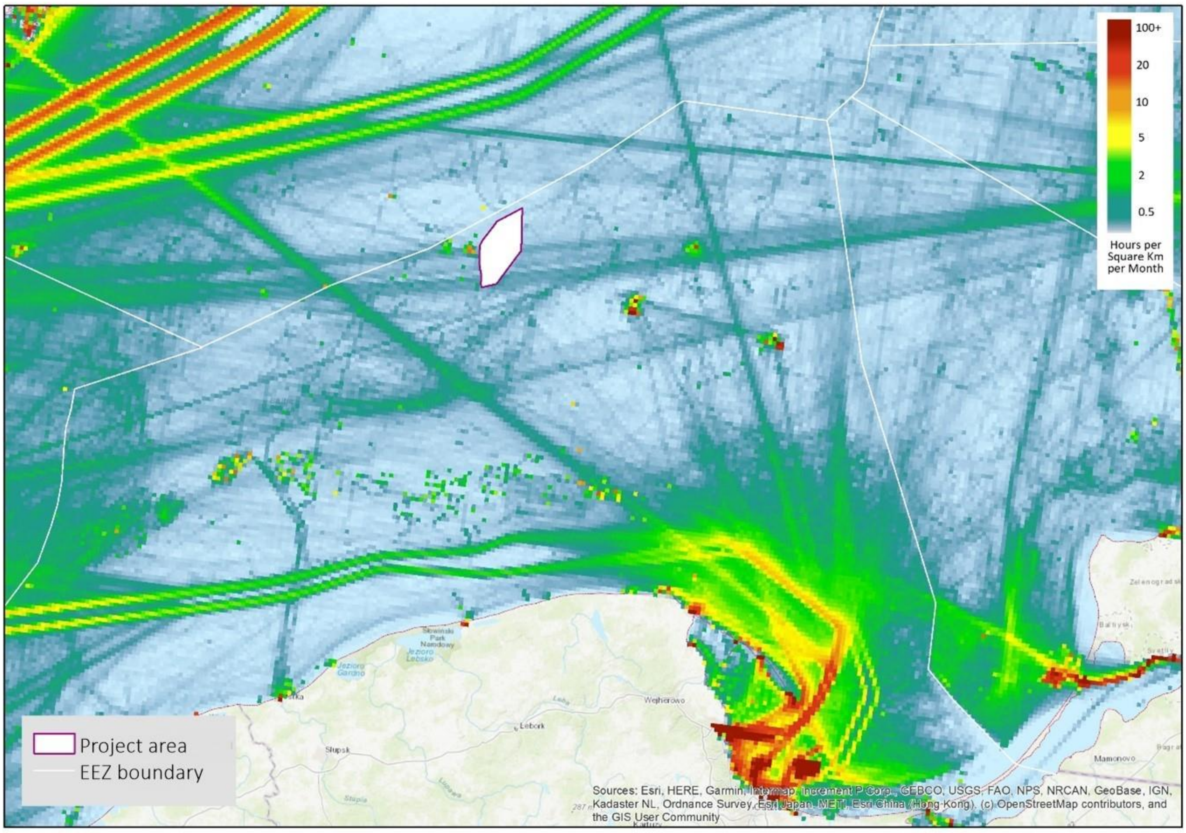

Figure 2.4. Location of the Baltica 1+ OWF relative to navigation routes on the Baltic Sea (vessel density annual average − all types – in 2022) [source: internal materials based on the data from the European Marine Observation and Data Network (EMODnet)]

The AIS data analysis indicated that traffic along this route is generated mostly by cargo and passenger ships [Figure 2.5 and Figure 2.6].

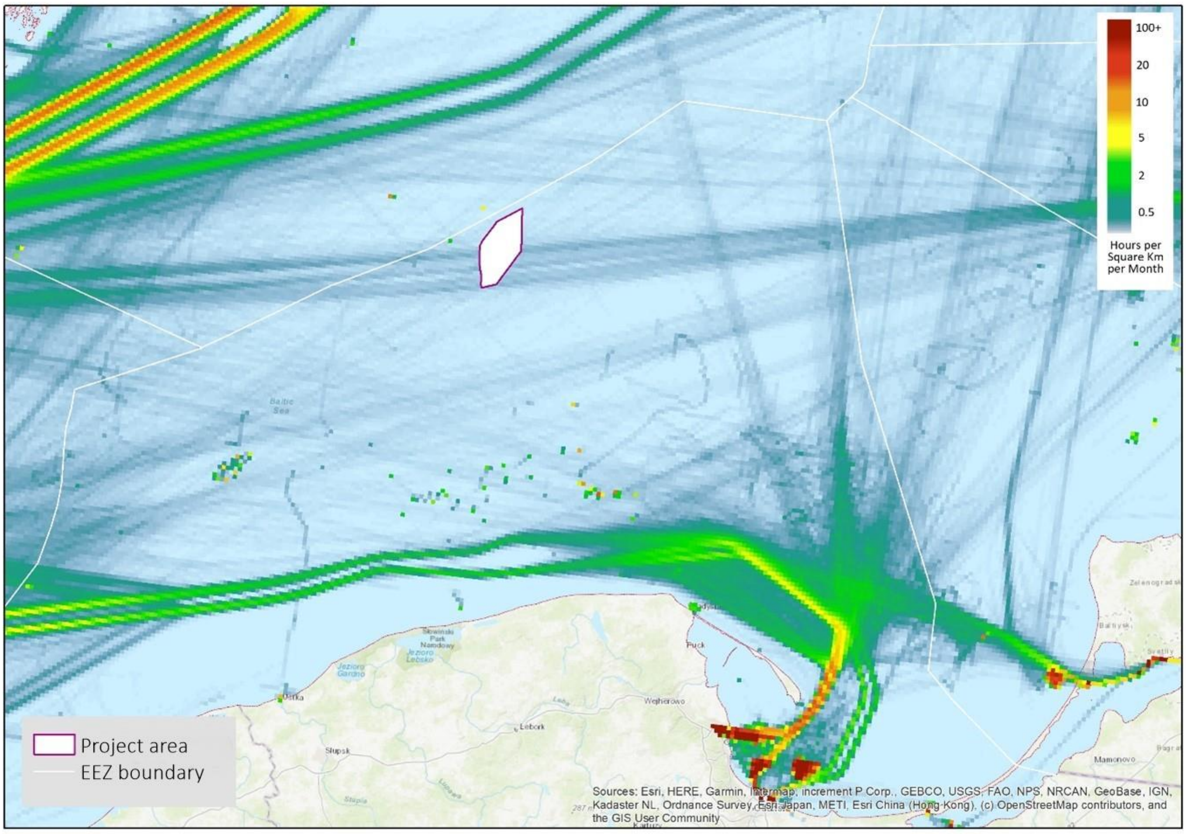

Figure 2.5. Location of the Baltica 1+ OWF relative to navigation routes of cargo ships on the Baltic Sea (vessel density annual average – cargo – in 2022) [source: internal materials based on the data from the European Marine Observation and Data Network (EMODnet)]

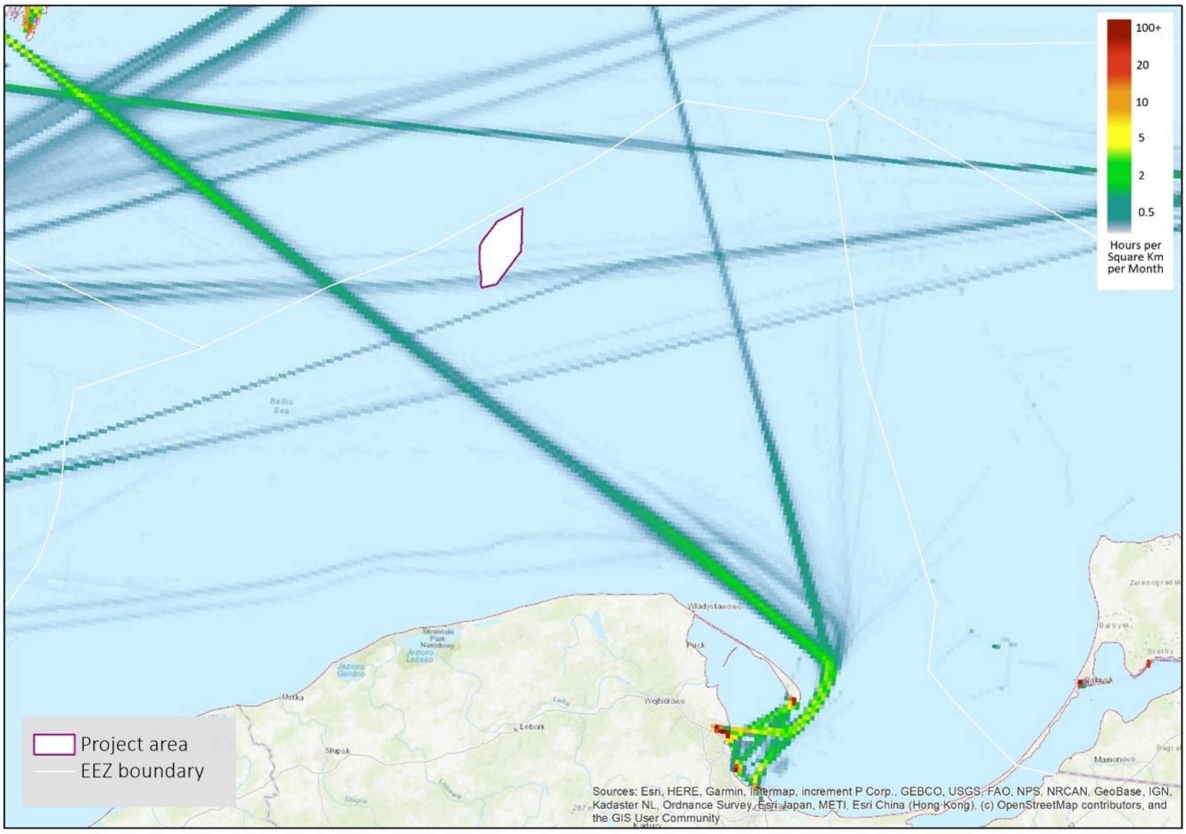

Figure 2.6. Location of the Baltica 1+ OWF relative to navigation routes of passenger ships on the Baltic Sea (vessel density annual average – passenger – in 2022) [source: internal materials based on the data from the European Marine Observation and Data Network (EMODnet)]

In accordance with the detailed provisions contained in § 69 of Annex 2 to the Regulation of the Council of Ministers of 14 April 2021 *on the adoption of the Maritime Spatial Plan for Internal Sea Waters, Territorial Sea and Exclusive Economic Zone, at a scale 1:200 000* (Journal of Laws of 2021, item 935, as amended) (hereinafter referred to as: MSPPSA), navigation (defined in the regulation as "transport") in sea basin 60.E, within the boundaries of which the Project is located, is not subject to restrictions until the commencement of operation of the OWF. From then on, in accordance with the MSPPSA, navigation will be restricted to vessels up to 50 m in length, until the conditions for safe navigation have been established by a decision of the territorially competent director of the maritime office, with the exception of vessels involved in the service and maintenance of OWF structures and equipment as well as aquaculture (if carried out within the farm area).

2.2.5 Cultural heritage and other objects of anthropogenic origin

No objects of cultural heritage nor objects of anthropogenic origin, including wrecks, have been identified within the Baltica 1+ OWF Area boundaries (based on the SIPAM data).

No conventional warfare agents from the period of either world war have been identified in the Baltica 1+ OWF Area either. However, their presence on the seabed of the area analysed cannot be ruled out. A similar approach should be taken to the potential occurrence of containers with chemical weapons, which were dumped after World War II, mainly in the Baltic deeps – the Gotland Deep, the Bornholm

Deep and the Gdańsk Deep, as well as in the Skagerrak and the Little Belt [Knobloch *et al.* 2013, Bełdowski *et al.* 2014]. In the light of the recent analytical results and incidental discoveries, it is known that some chemical warfare agents were dumped from ships into the sea during transfer to their intended deposition sites [Knobloch *et al.* 2013]. Taking a precautionary approach, it should therefore be assumed that conventional and unconventional warfare agents from the periods of warfare may also be deposited on the seabed in the Baltica 1+ OWF Area, posing a potential threat to the safety of the project implementation. Before the commencement of the construction, the Project Owner will conduct detailed surveys on the presence of unexploded ordnance and duds (UXO surveys) on the seabed. In case any chemical warfare agents / UXOs are found during these surveys, the Project Owner shall notify the relevant authorities and institutions of that and shall comply with their instructions.

2.2.6 National defence

The planned Project area is not located within the boundaries of the zones permanently or periodically closed for navigation and fishing activity, as established by the Minister of National Defence by way of a regulation, in accordance with the Act of 21 March 1991 *on the marine areas of the Republic of Poland and maritime administration* (consolidated text: Journal of Laws of 2023, item 960). The area is not crossed by any of the Polish Navy fairways either.

2.2.7 Exploration, prospecting and extraction of mineral resources

The analysis of the data available in the Central Geological Database revealed that there are no mining areas or sites, nor any natural resource deposits located within the boundaries of the planned Project area. The boundary of the "Southern Middle Bank – Southern Baltic" mining area and site is located on the western side of the Project boundary, at a distance of approximately 600 m while the boundary of the sand and gravel deposit, the resources of which were employed by designating three mining areas contained within one mining site [Figure 2.7]. The deposit development concession expires on 15 November 2031.

There are no areas indicated for prospecting the deposits of sand for artificial shore nourishment within the Baltica 1+ OWF Area.

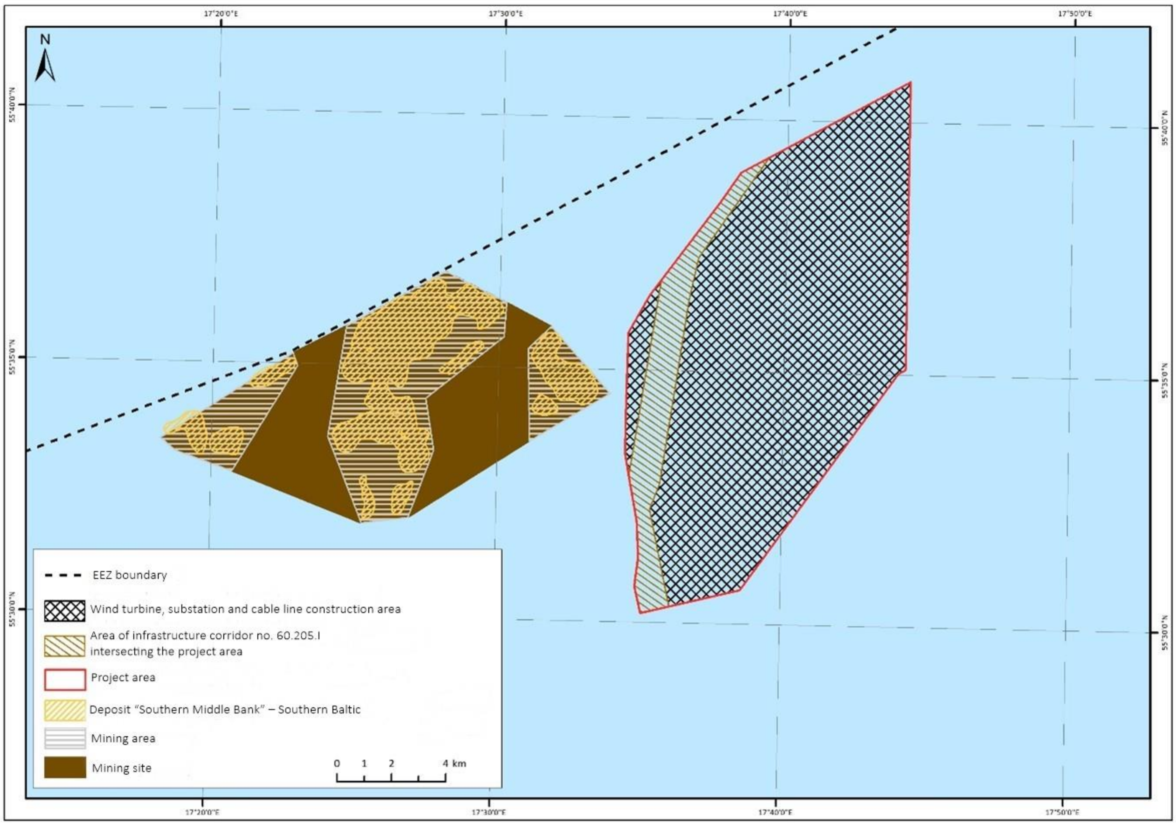

Figure 2.7. Location of the Baltica 1+ OWF Area relative to mineral resource deposits as well as mining areas and sites [source: internal materials based on the data from the Central Geological Database]

2.3 PROPERTY COVERAGE WITH VEGETATION

It is assumed that the depth range of the occurrence of vascular plants within the PSA is 10 m at maximum, while the extent of occurrence of macroalgae growing on hard surfaces is identical to the extent of the euphotic zone, i.e. up to a depth of approximately 22 m [Feistel *et al.* 2010]. Deeper, up to approximately 25 m, macroalgae were identified very rarely, usually as single specimens attached to mussel shells and rocks or in the form of free-floating thalli [Błeńska *et al.* 2014, Błeńska *et al.* 2015 a and b]. It should be assumed that the occurrence of macroalgae below a depth of 22 m is strictly incidental, i.e. they grow on small pebbles, as well as on mussel shells and detached, free-floating thalli carried by near-seabed sea currents from the shallower regions of the sea.

The minimum depth of the Baltica 1+ OWF Area is approximately 30 m, so it is impossible for macroalgae to occur within its boundaries, even if hard substrates, such as boulder areas, boulders, mussel beds or anthropogenic structures, are present on the seabed. The occurrence of macrophytes within the Baltica 1+ OWF Area will be verified during environmental surveys conducted for the purpose of obtaining the decision on environmental conditions.

3 TYPES OF TECHNOLOGIES

This section describes the technologies involved in the implementation of the Baltica 1+ project, broken down by their most important components and activities foreseen for each phase of the Project.

3.1 PREPARATORY WORKS – SEABED CLEARING, DREDGING AND LEVELLING

Before the construction of the Baltica 1+ OWF is commenced, preparatory works will be carried out, including for example:

- identification of the seabed morphology (survey engineering), which involves determining the position of natural and man-made elements on the seabed surface or below it, and using that information for planning, designing and constructing elements of the farm;
- seabed surveys aimed at identifying the presence of hazardous objects (UXO) using bathymetric, sonar and magnetometer surveys;
- works involving soil investigation to determine its strength and rate of settlement (consolidation);
- dredging works aimed at removing unwanted seabed sediments prior to the installation of gravity-based structures (if used for the foundation of support structures) of OSSs and wind turbines;
- seabed clearance to remove obstacles in the areas of support structure erection and jack-up vessel installation, as well as along cable laying routes;
- seabed levelling to remove irregularities in order to prepare the seabed using one or more dredgers so that equipment can be positioned on the seabed;
- preparation of the locations of cable crossings with third-party infrastructure (if detected in the area on the basis of magnetometer survey results).

During the first stage, before the seabed clearance, a survey campaign will be carried out during which a scan of the area will be conducted in search of anomalous objects, e.g. UXO. Works involving the clearing of the seabed from obstacles will be carried out in the locations of support structures, from which boulders that hinder work will be removed. Clearing works will also be conducted within the installation strip for cable lines using one of the methods described below:

- removal of stones or boulders using a specialist pre-lay plough;
- removal of stones or boulders using a grappler.

Ploughs are mechanical devices that move passively on the seabed pulled by a vessel along a designated route. The plough blades, angled towards the direction of pull, push stones and boulders on the seabed to the sides. A common practice is to simultaneously dig a trench with a plough and lay a power cable in that trench. Figure 3.1 presents an example of a plough used for seabed clearing.

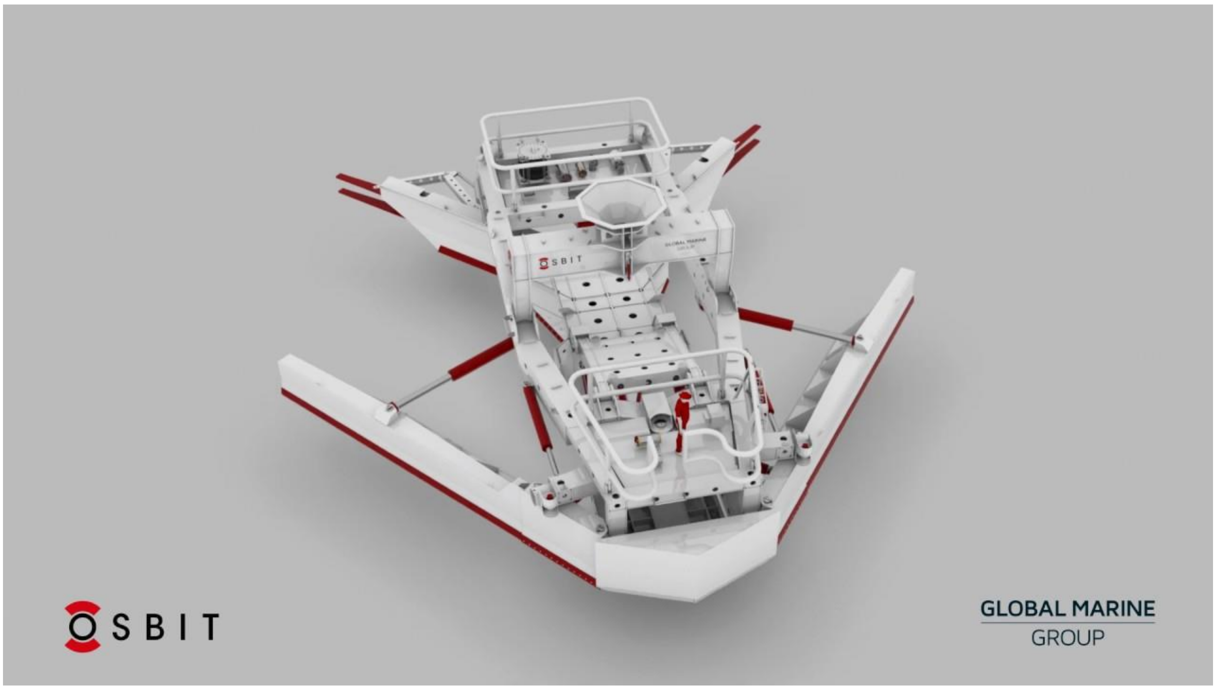

Figure 3.1. Example of a pre-lay subsea plough (source: https://www.osbit.com/)

Another method of removing and transferring boulders from the cable corridor is to grab large boulders or to collectively grab groups of smaller boulders [Figure 3.2].

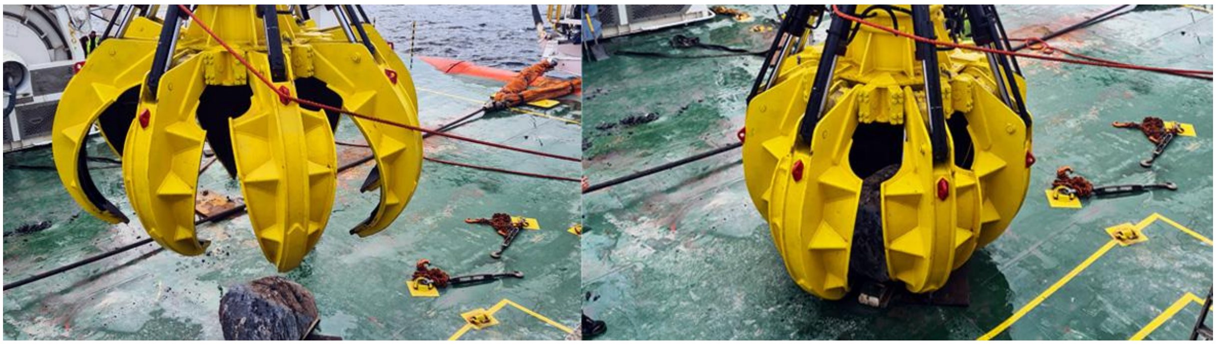

Figure 3.2. Example of a grappler used to remove boulders from the seabed (source: https://www.assogroup.com/)

In the areas with obstacles other than boulders and other hard spatial structures present on the seabed, e.g. ropes, cables and fishing gear, etc., preliminary seabed clearance is performed with anchors dragged behind vessels and other hooking tools that can be combined into multifunctional systems, e.g. PLGR – pre-lay grapnel run [Figure 3.3]. The tools ensure effective removal of this type of obstacles from the seabed surface and up to a depth of 0.5 m into the sediment.

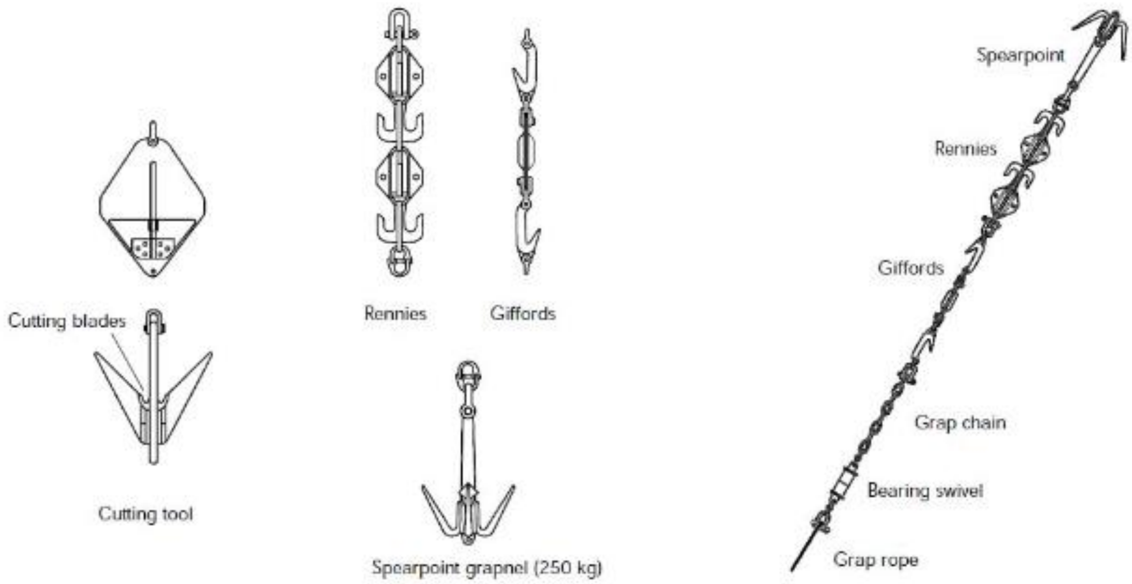

Figure 3.3. Examples of dragged tools for the seabed pre-lay clearance (source: HKA Submarine Cable -Chung Hom Kok, Project Profile)

Clearing the seabed of obstacles will be carried out only in the locations where the wind turbine and OSS foundations are erected directly in the seabed. Also, in the case of cable lines, the seabed clearance will be carried out only along those route sections at which obstacles will be identified.

In case a decision is made to use foundation types that require preparatory works, such as seabed dredging and levelling in the location of the foundation construction, these operations will be assisted by specialist vessels – dredgers and rock-dumping vessels. Seabed levelling will also be carried out in the possible locations of the power cable intersections with other linear infrastructure, if identified within the Baltica 1+ OWF Area.

3.2 OFFSHORE WIND TURBINES

In compliance with Article 3 point 4 of the Act of 17 December 2020 on promoting energy production in offshore wind farms (consolidated text: Journal of Laws of 2023, item 1385), an offshore wind turbine is a single, standalone assembly of devices used for electricity generation exclusively from the wind power at sea.

The main components of wind turbines are:

- support structure erected on a foundation on the seabed;
- transition piece connecting the support structure with the tower;
- boat-landing platform for mooring vessels that transport personnel involved in periodic servicing and repair works;
- wind turbine tower;
- nacelle with a generator inside, among others;

- rotor, usually with three blades installed on a rotor hub attached to the nacelle.

Figure 3.4 presents a schematic diagram of an offshore wind turbine structure with an example of a monopile foundation most commonly used in OWF construction.

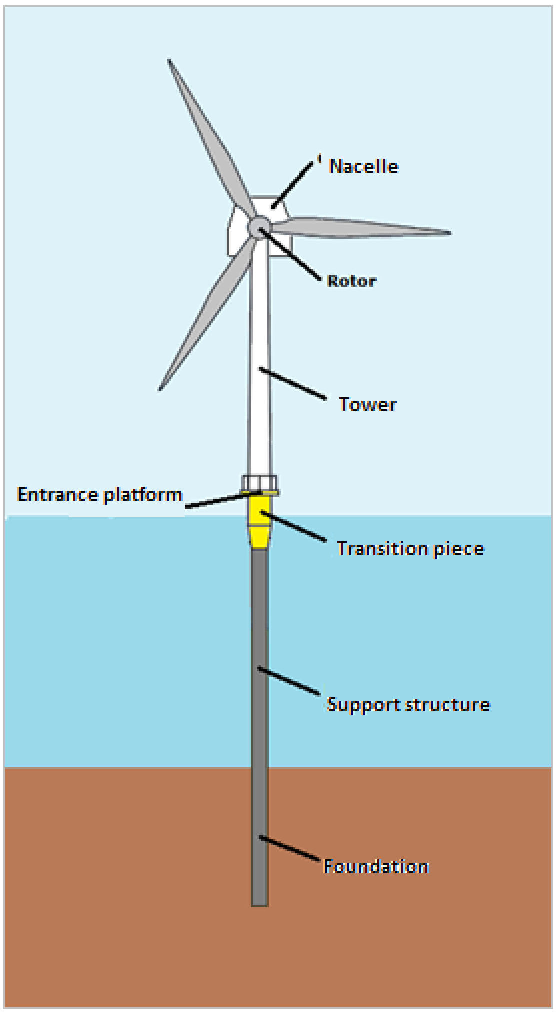

Figure 3.4. Schematic diagram of a single wind turbine with an example of a monopile foundation (source: internal materials)

The development of the offshore wind turbine technology makes it impossible to define the detailed technical and structural parameters of wind turbines that will be used at the Baltica 1+ OWF at this stage of the Project implementation.

Offshore wind turbines that are currently installed have a rated capacity of 12–15 MW, with turbines above 15 MW in the implementation phase. The analysis of the rate of increase in the nominal capacity of offshore wind turbines over the last 10 years allows assuming that at the moment of contracting the delivery of components for the construction of the Baltica 1+ OWF, wind turbine designs with a capacity from 15 MW to 25 MW may be available. As a result, the use of offshore wind turbines with a capacity from 15 to 25 MW is assumed for the Baltica 1+ OWF.

Considering the possibility of using 25 MW units, the maximum diameter of the rotor is anticipated to be 310 m. Assuming that the rotor blade tip clearance above the water surface will be 20 m, the maximum height of a single wind turbine will be 330 MASL. Therefore, it has been assumed that regardless of the wind turbine type selected, the maximum height of the structure will not exceed 330 MASL, and the distance of the rotor blade from the sea surface will not be smaller than 20 m.

The maximum number of offshore wind turbines comprising the Baltica 1+ OWF will depend on the rated capacity of the selected units and will be up to 47 25 MW units and up to 79 15 MW units, or a correspondingly different number of units if turbines with a capacity less than 25 MW and more than 15 MW are selected.

Wind turbines are delivered by the manufacturer to the quay of an installation port. Individual sections of the tower, the blades and the nacelle are transported and stored in a designated harbour area. If the characteristics of a particular installation vessel allow, individual sections of the tower and, independently, the rotor assembly are assembled on the quay and transported as a whole unit to the installation location by the installation vessel. Typically, the installation vessels are/will be capable of delivering up to seven such assembly sets simultaneously.

The operations associated with the pre-assembly and storage of offshore wind turbine elements in installation ports require heavy-duty lifting and cargo handling equipment, i.e. caterpillar cranes, self-propelled platforms, specialist trucks with flatbed trailers for the transport of blades, specialist forklifts, etc.

At the same time, foundation works can be carried out in the location intended for the OWF. Depending on the type of the solution selected, the ready-made prefabricated elements are transported from the port to the installation location. Transport is carried out on board installation vessels, by barges or the submerged elements are towed by vessels to the installation site (so-called wet tow), and afterwards the foundations are installed by the installation vessels on the previously prepared seabed – gravity-based foundations. The monopiles and jacket piles are either driven or vibrated into the substrate with a pile driver. Depending on the technology adopted, the next stage is the assembly of the transition piece, which constitutes the connection between the foundation installed in the seabed and the wind turbine tower and generator mounted in the next step, or the direct installation of the tower on the foundation integrated with the transition piece (a TP-less design). Depending on the depth of the sea basin and the forecast hydrodynamic conditions, the construction of a seabed erosion protection/reinforcement may be necessary. Such works are carried out using a specialist rock-dumping vessel, which dumps aggregate or rip-rap precisely on the seabed around the already erected foundation. The estimated duration of foundation work for a single wind turbine is 2–4 days.

3.3 FOUNDATIONS AND SUPPORT STRUCTURES

So far, a vast majority of offshore wind turbines and other structures comprising an OWF – mainly OSSs – are installed on foundations embedded in the seabed, which involves transferring the weight of the equipment (the wind turbines and OSS platforms) to the seabed. The foundations are designed to safely carry the loads exerted by the turbines, exceptional loads, as well as loads exerted on the entire turbine structures by the environment (movement of water and air masses) for the entire design life of an offshore wind farm. Nowadays, steel foundations are the most commonly used, however, concrete foundations are also in use. A different solution for the wind turbines installation are floating foundations; however, they are usually used in sea basins with depths exceeding 60 m. In shallower waters, foundations embedded in the seabed remain the least costly solution.

The following subsections present the parameters of individual foundation types that could potentially be used in the Project regarding the construction of offshore wind turbines. Their description includes the maximum values of individual parameters that result from the installation of 25 MW generators, which are characterised by the greatest dimensions and mass. For the purposes of the environmental impact assessment, it must be taken into consideration that the most unfavourable values of the individual parameters will not occur simultaneously for different cases.

Monopile, gravity-based or (piled or suction bucket) jacket foundations are planned to be used to construct the OSSs. The technical description of these types of foundations, including information on the duration of their construction and footing, is contained in the subsections below. Subsection 3.4 contains information on the foundation parameters in reference to the OSSs.

The selection of the foundation type for the wind turbine and the OSS support structures will be made at later stages of the Project implementation, after the geotechnical surveys of the OWF Area have been performed and the target type of wind turbines and OSSs have been selected.

3.3.1 Monopile foundations – monopiles

Monopiles are usually structures comprised of tubular steel sections, which are drilled, piled or vibrated into the seabed using a hydraulic pile driver. Piling and vibrating monopiles into the seabed can be carried out in the seabed with different types of sediments – sands, tills, or soft solid rock. However, if the seabed is formed by hard rock, the monopile (reinforced concrete in that case) is installed after drilling a borehole, which takes place inside the rings forming the pile. No previous preparatory works of the seabed in the location of a monopile installation are necessary, except for a situation, in which there are boulders or debris on the seabed, in which case such obstructions should be removed prior to foundation installation or, if the problem is local in scale, the location of individual wind turbine foundations should be changed. Additionally, the seabed may need to be cleared, if a jack-up vessel is used.

In locations where the seabed is affected by hydrodynamic processes, i.e. shallow areas and areas with near-seabed currents, and where there is a risk of sediment scour around the foundations, scour protection on the seabed surface should be applied around the pile, for example using rip-rap. The monopile protrudes above the sea level and is connected to the tower with a transition piece [Figure 3.5]. The transition piece, which can have varying lengths, is installed on the outer surface of the monopile (the most common solution) or inside it. The monopile and the transition piece are usually bonded together with grout. At first, the transition piece is placed on temporary supports and aligned to a vertical position, Next, the bonding agent is pumped between the foundation surface onto the transition piece surface and left to solidify. Those elements can also be screwed together using a flanged connection or welded. Currently, a technology of a transition piece integrated with a monopile (TP-less) is being introduced, which accelerates the installation and reduces the amount of work at sea.

Figure 3.5. Example of a monopile foundation including a scour protection layer (source: Ramboll)

The monopile foundations are installed using a trenchless method by mechanically driving the element into the seabed. For that reason the volume of spoil obtained during the erection of foundations is negligible.

In the case the installation of the foundation is hindered by the seabed structure, drilling may be necessary. Estimation of the drilling duration is impossible before soil conditions are determined in detail – this requires the information on the thickness of the soil / rock layers that need to be drilled as well as their geotechnical parameters and the depth of their deposition. Drilling is carried out inside a casing pipe and the spoil generated remains on the seabed.

In order to protect it against corrosion, the monopile surface is covered with protective coatings in the area of the water surface fluctuations and above; passive and active corrosion protection systems are also used.

The most common corrosion protection method used in the marine environment is cathodic protection, which is a passive corrosion protection. It can be implemented as galvanic or electrolytic protection. Galvanic anode cathodic protection (GACP) involves the installation of aluminium or zinc anodes on the foundations and/or support structures. The anodes gradually wear out and the aluminium or zinc is transferred to water and accumulates in the seabed sediments. In the initial operation period, no emission of zinc and aluminium from anodes will take place. This process will take place over time and will progress with the increasing degree of damage to the protective coating on the components subject to corrosion protection. It is assumed that the total dissolution of the anodes takes place over a period of 35 years and will be similar to the design life of the Project.

Impressed current cathodic protection (ICCP) is an option of an active corrosion protection system that involves supplying electric power to the system. The ICCP (impressed current cathodic protection) system consists of protective anodes connected by a system of cables and connectors to an external electrical power source and then to the structure to be protected (the cathode). When an electrical voltage is applied to the resulting system, a potential difference is induced, thus creating a forced cell. Such a system does not emit ions like the GACP system does, however, it entails some potential operational issues. The ICCP system may work with less coating than the GACP system (case by case), which can be generally considered environmentally beneficial.

3.3.2 Piled jacket foundation

Jacket foundations are load-bearing foundations consisting of three or four steel pipes joined together using steel connectors. A complete jacket structure, including the transition piece / connector, is assembled on land and transported on a vessel to the installation location, where it is mounted on piles, previously driven into the seabed [Figure 3.6]. The piles are driven into the seabed using a hydraulic pile driver. Prior preparation of the seabed before piling is not required, except where there are boulders or debris on the seabed. In such a case, the obstacles should be removed, and if this is impossible, the foundation location should be changed. Additionally, the seabed may need to be cleared, if a jack-up vessel is used.

Two types of pile driving approaches can be distinguished for jacket foundations, i.e. pre-piled jacket and post-piled jacket methods. Post-piled jacket method requires the use of special flanges which usually entails an increased consumption of steel. Pile driving prior to the installation of a jacket structure requires the use of an additional structure, the so-called seabed template, which facilitates piling works, especially when there are numerous foundations of similar dimensions.

In the case the installation of the foundation is hindered by the seabed structure, drilling may be necessary. Drilling is carried out inside a casing pipe and the spoil generated remains on the seabed.

If the installation takes place on soft sediments with a large thickness, it is possible to install jacket foundations in the seabed using suction caissons mounted at the end of the load-bearing pipes. In that case, the foundation is initially driven into the seabed under the structure's own weight and at the target depth, thanks to the vacuum force inside the caissons, the pressure differential across the top plate effectively “pulls” the caissons into the seabed. The suction pump is mounted on the installation vessel and pumps the water and air from inside the caisson. The possible noise comes from the pump on board the vessel; no spoil is generated.

As is the case with monopiles, the seabed around the jacket foundation legs can be secured against erosion with a protective layer, for example, rip-rap; and to protect the surface of the jacket structure against corrosion, protective coatings will be applied in the area of water surface fluctuations and above as well as a passive or active corrosion protection system will be used.

In the case of jacket foundations, corrosion protection will be provided in the form of protective coatings (in the area of water surface fluctuations and above) and passive or active corrosion protection systems (sacrificial anodes and ICCP system).

The most common corrosion protection method used in the marine environment is cathodic protection, which is a passive corrosion protection. It can be implemented as galvanic or electrolytic protection. Galvanic anode cathodic protection (GACP) involves the installation of aluminium or zinc anodes on the foundations and/or support structures. The anodes gradually wear out and the aluminium or zinc is transferred to water and accumulates in the seabed sediments. In the initial operation period, no emission of zinc and aluminium from anodes will take place. This process will take place over time and will progress with the increasing degree of damage to the protective coating on the components subject to corrosion protection. It is assumed that the period of anode dissolution is similar to the design life of the Baltica 1+ OWF, i.e. 35 years. The metals in question will first pass into the water, in which they can undergo precipitation and accumulate in the sediment.

ICCP is an option of an active corrosion protection system that involves supplying electric power to the system. The ICCP (impressed current cathodic protection) system consists of protective anodes connected by a system of cables and connectors to an external electrical power source and then to the structure to be protected (the cathode). When an electrical voltage is applied to the resulting system, a potential difference is induced, thus creating a forced cell. Such a system does not emit ions like the GACP system does, however, it entails some potential operational issues. The ICCP system may work with less coating than the GACP system (case by case), which can be generally considered environmentally beneficial.

Figure 3.6. Example of a piled jacket foundation (source: Ramboll)

3.3.3 Suction Bucket Jacket Foundation

The SBJ structures (Suction Bucket (Caisson) Jacket Foundation) are constructed from a steel jacket structures (consisting of tubular steel elements and welded connections) attached to the seabed using suction buckets, inside which underpressure is present when they are buried in the seabed. They are installed under each leg of the foundation structure. Those elements, i.e. caissons, play a role similar to piles in a standard jacket foundation. Three-legged and four-legged SBJ foundations are used. Hammer is not used for installing this type of foundations. The possibility of using SBJ foundations depends largely on soil conditions.

In the case of caisson jacket foundations, the foundation is preliminary driven into the ground under the own weight of the structure. Then, it is driven into the seabed to the target depth with underpressure (suction), which is created inside the caissons. The pressure difference on the upper plates effectively drives the structure into the seabed to the design depth. The suction pump can be located on the installation vessel or directly on the caissons.

When preparing the seabed, it may be necessary to remove boulders and partially level the area. The spoil generated during the seabed preparation for foundations will be spread across the wind farm area or will be managed in accordance with the decision of the territorially competent director of the maritime office.

Figure 3.7. Example of a Suction Bucket (Caisson) Jacket Foundation [source: DNV report “Assessment of Offshore Wind Farm Decommissioning Requirements”]

3.3.4 Gravity-based structures

A gravity-based structure [Figure 3.7] requires the seabed substrate to be prepared in a special way and is used on very rigid and high-bearing capacity soils. The preparation of the seabed consists of possible removal of boulders at the foundation location, excavation to get rid of the top non-bearing layer of sediment and levelling of the substrate. The spoil generated during the seabed preparation for foundations will be spread in the OWF Area or will be managed in accordance with the decision of the territorially competent director of the maritime office. The seabed dredging depth for the purposes of the gravity-based foundations is usually several meters. Additionally, in the immediate vicinity of the foundation, sea currents are subject to modification – the effects of possible sediment scour are offset by the shape of the foundation footing and possible erosion protection systems. Gravity-based structures are prepared (levelled) on land and, after being towed to the correct location, they are sunk and placed on the seabed. Therefore, jack-up vessels are not planned to be used for the foundation installation. However, this type of vessel can be utilised at the stage of turbine assembly. If there are any boulders on the seabed, it may be necessary to clear it in order to enable the use of the vessel discussed (HLJV).

High-cement content concrete with improved strength parameters is used for constructing gravity-based structures. Corrosion protection in the form of protective coatings is used in the area of the water surface fluctuations and above. Secondary steel elements are also protected using anti-corrosion coatings.

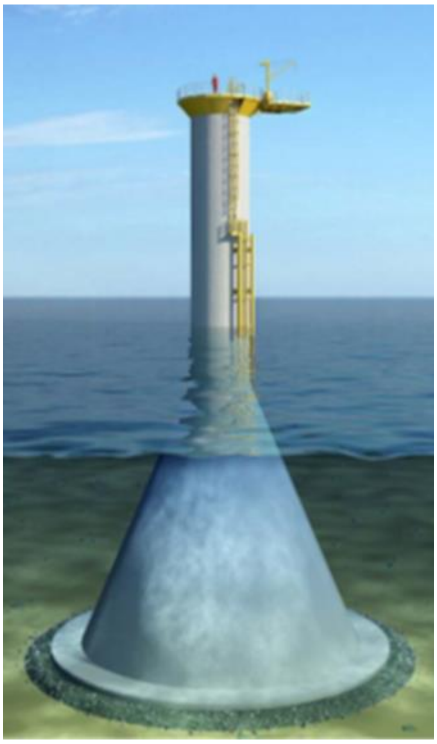

Figure 3.7. Example of a gravity-based structure (source: Ramboll)

3.4 OFFSHORE SUBSTATIONS

Offshore substations have various dimensions, depending on the amount of power collected and exported by a given substation. It is assumed that the Baltica 1+ OWF will consist of a maximum of five (transformer or converter) substations; however, in order to optimise costs and enhance the rational use of the sea basin, the construction of one large substation has not been ruled out.

The number of OSSs is, on the one hand, dictated by economic factors and, on the other, depends on the technology of electricity transmission from an OWF to land. Two basic technologies for energy transmission to shore are distinguished, involving alternating current (HVAC) and direct current (HVDC) technology. In the case of the HVAC technology, transformer substations are installed, whereas in the case of the HVDC technology, converter substations are installed (also equipped with transformers, but additionally fitted with converter systems).

Usually, OSSs are equipped with devices and systems necessary for voltage conversion and power transmission, such as:

- transformers,
- instrumentation and controls,
- control and communication equipment,
- backup power systems including fuel,
- reactive power compensation systems,
- and other systems for the operation and maintenance of the substation (e.g. helipad, crane, and others as required).

As an option, it is permitted to install dwelling spaces on selected substations to enable short-term stay of maintenance crews, for example, in the case of sudden weather events or failures that impede the immediate transfer of maintenance crews to the shore after the work has been completed. OSSs will not be designed as permanent maintenance substations.

One of the possible OSS types to be used in the Project location is a MV/EHV or HV/EHV AC substation with a voltage of up to 275 kV on the high voltage side of the transformer/transformers located on that substation. Although, at this stage, the use of a DC system substation is not excluded.

Since it is possible to evacuate power from wind turbines using the HVDC technology, the construction of converter substations in a DC system with converter systems is not ruled out either. As a result, the possibility of converting alternating current, used in the OWF inter-array connections, into direct current and exporting direct current to land is also not excluded.

In the case of the HVAC technology, the number of OSSs can be more than one (a maximum of 5), depending on cost analyses as well as availability and reliability assumptions. A maximum of one converter substation with the possibility of up to three transformer substations is foreseen for the HVDC technology.

The possibility of executing power transmission from the OWF to the onshore grid using HVDC technology is assumed. To implement such a solution it is necessary to use a converter substation that includes systems that convert alternating voltage (AC) to direct one (DC). The converter substation can be executed as a separate substation, constructed independently of the OSS, but can also be integrated with the OSS after being fitted with the necessary voltage converting systems.

On the basis of the above examples, the expected maximum dimensions of an offshore converter substation possible to be applied in the Applicant's Proposed Option (APO) are presented below:

The converter substation typically consists of the following elements:

1. transformer and thyristor or transistor system,
2. harmonic filters,
3. capacitor banks,
4. shunt reactors,
5. cooling system,
6. instrumentation and controls,
7. control and communication equipment,
8. backup power systems including fuel.

If the DC technology is utilised, HVAC transformer substations, connected with the converter substation, can be used.

During the construction, operation and decommissioning phases, access to substations will be from vessels conducting construction and installation works. During the operation phase, access will be from vessels, SOVs, via walk-to-work gangways, or from CTVs, or by helicopter.

The OSSs will be installed on foundations and support structures adjusted to their structural parameters (dimensions, loads), the geological conditions of the seabed as well as the hydrometeorological and environmental conditions present in that location (depth, sea currents, wave motion parameters, ice conditions, etc.). It is possible to use monopile, jacket as well as gravity-based foundations. In the case of large converter stations, installation is possible on more than one foundation. In addition, it may be necessary to reinforce the seabed around the foundation with rip-rap.

The following installation sequence is observed for the OSSs erected near the OWF:

- preparation of the OSS foundations / support structures and their installation in the target location.
  The foundations are transported to the target location by a suitable vessel or barge. Next, they are installed in the seabed using a heavy lift crane vessel (HLCV). The method used for foundation installation depends on the type of foundation selected;
- transport of the OSS platform with an appropriate installation vessel or barge to the target location, and its installation on the foundation / support structure prepared in the target location, using an HLCV,
- installation of a self-supporting OSS structure including topside;
- installation and connection of MV and HV cables;
- commissioning.

3.5 Cable lines – inter-array cables between offshore wind turbines as well as between the turbines and offshore substations

3.5.1 Characteristics of power cable lines

The system of inter-array connections of offshore wind farms consist of medium voltage (MV) or high voltage (HV) offshore cable systems connecting the wind turbines into assemblies (circuits/sections) with one or several MV/HV or HV/LV offshore substations, as well as the necessary teletechnical and telecommunication connections in the form of fibre optic lines, integrated into the power cables or in separate teletechnical lines, laid in parallel with the power cables.

Three-phase cables with three copper or aluminium conductors, operating in AC technology, will be used in the construction of the Baltica 1+ OWF inter-array lines. Conductors inside the cables are covered with a multilayer sheath that fulfils insulating, shielding and protective functions. Fibre optic bundles may also be present inside the cable [Figure 3.8]. The cables will meet standards and certifications confirming approval for use in the marine environment.

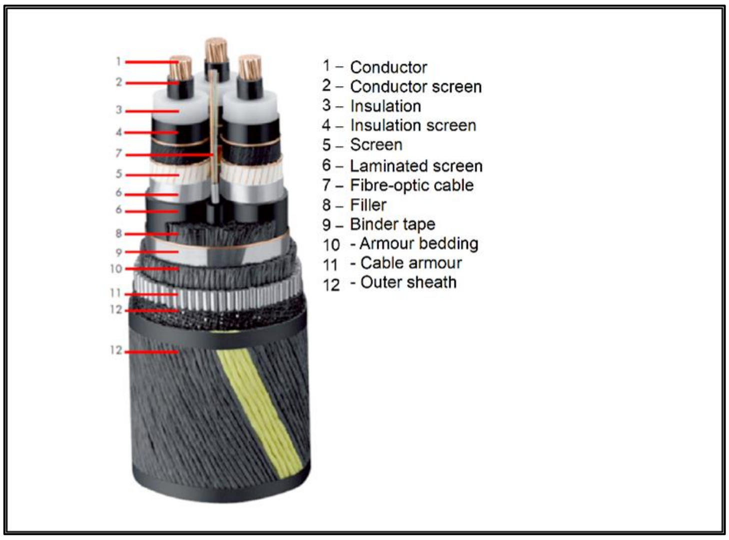

Figure 3.8. Design of a typical three-phase AC power cable (Source: internal materials)

At the current stage, it is impossible to determine detailed rated parameters of subsea cables, taking into consideration the unknown rated capacity of the offshore wind turbines planned to be installed and their mutual configuration in the Baltica 1+ OWF Area and the location of the OSSs. Depending on the wind turbines used and the power take-off solutions adopted, AC multi-conductor subsea cables with cross-sections depending on the design load – up to a maximum of 2500 mm^2, with a maximum rated voltage of 66 kV or 170 kV – can be used. The actual voltage and size of the cables will be determined with the progress of work and optimisations implemented in the Project.

The method of laying cable networks that are part of the inter-array system of wind turbines and the OSSs will depend on the technical requirements and the requirements of the manufacturer of the cable system used as well as the parameters and the topology of the cable route, as well as the geophysical, geotechnical and environmental conditions associated with the route selected.

The decision regarding the selection of the technology for laying and protecting the inter-array cables will be made at the stage of the detailed design for the cable lines, after the Cable Burial Risk Assessment (CBRA) has been developed.

Individual power cables, which will be used to connect individual wind turbines with OSSs, will join up to a maximum of 6 wind turbines in a series, assuming that alternating current (AC) technology cables with a 66 kV rated voltage are used. For the 66 kV AC cables, the maximum load capacity is 90 MW. The possibility of using a cable technology with a rated voltage of 170 kV is also assumed; in that case, a maximum of up to 10 wind turbines with a capacity of 15 MW can be connected in a series. The maximum operating temperature of power cable main conductors will be 90°C.

The depth of power cable burial in the seabed along the majority of the cable route is expected to be approximately 3 MBSB. Considering local conditions associated with the structure of the seabed, the cables may be buried deeper – up to 6 MBSB.

The maximum total length of cable lines within the OWF is anticipated to be 165 km.

Since cable lines are to be laid in the seabed using remotely operated vehicles (ROVs) that will bury the cable in the seabed using the technique of seabed fluidisation or ploughing with simultaneous cable burial using the excavated material, no excavations in the seabed are anticipated.

3.5.2 Cable line construction technologies in the Baltica 1+ OWF Area

Inter-array cables, which constitute part of the system connecting wind turbines and OSSs, are laid after the installation of the wind turbine and OSS foundations including the connector sections.

Laying of MV or HV inter-array cables on the seabed is carried out using a specialist cable layer. For that type of work, trenching and burial equipment is used, which is deployed to the seabed from aboard the cable layer. The operation of such devices is monitored using an ROV. The cable itself is laid from aboard a cable layer; the cable is uncoiled from the reel (carousel) mounted on the vessel [Figure 3.9].

Depending on the geological conditions, the length of the sections to be laid and the cable parameters, other cable-laying methods can also be used, including trenchless methods and typical methods used for laying HV export cables, for example, ploughing that involves a plough dragged behind the vessel, from which the cable is supplied and inserted directly into the seabed to the required depth behind the ploughshare. After laying, cables are pulled into the wind turbines and the OSSs, where they are installed in electrical switch rooms.

Figure 3.9. Example of a cable layer conducting complex operations related to the laying of subsea cable lines (source: https://www.nexans.com/)

When laying cable lines in the seabed or on its surface, various types of machinery and equipment which bury the cable in the seabed are used to construct a cable trench of an appropriate depth. The first group is jetting equipment with heavy-duty seawater pumping systems. This equipment uses seawater which is pumped under pressure into the sediment and washes away a trench the route of which coincides with the trajectory of the equipment. They are also used to bury a cable previously laid on the seabed into soft sediments such as silt or loose and medium-grained sand. Such equipment can be installed on sledges or self-propelled crawlers [Figure 3.10]. The lances of the jetting equipment have numerous nozzles generating water jets and loosening the seabed sediment in which the cable is buried, as shown in Figure 3.11.

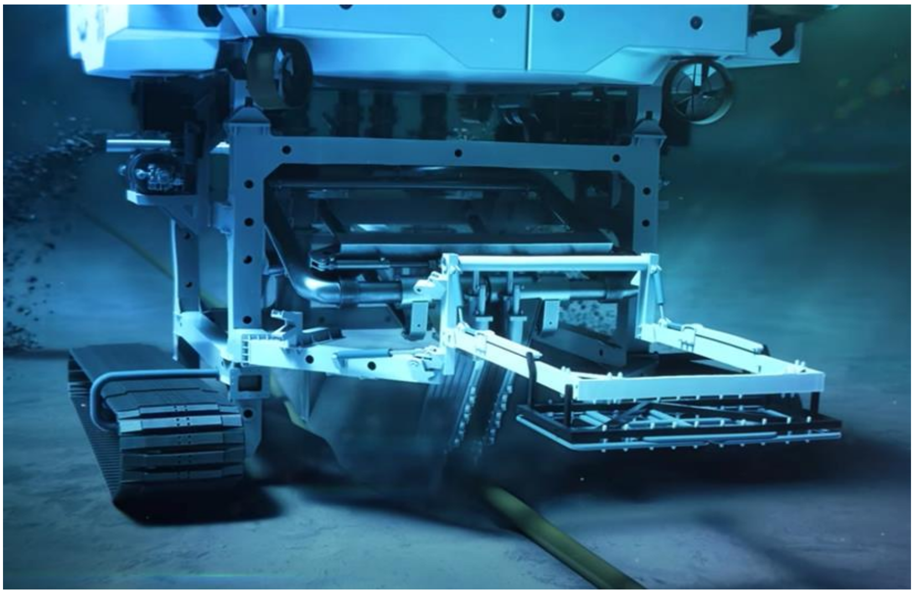

Figure 3.10. Jetting equipment example (Source: https://www.youtube.com/watch?v=wblle4zRA2M)

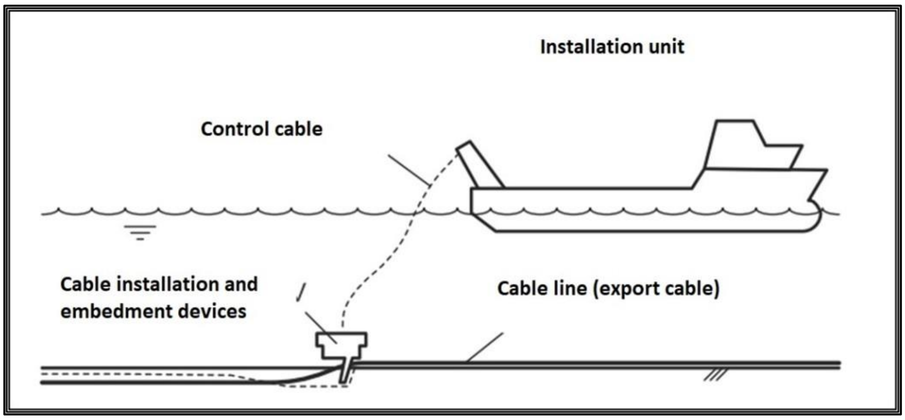

Figure 3.11. Cable line laying technology – burial of a cable previously laid on the seabed (Source: https://rules.dnv.com)

Another group of equipment used for laying subsea cables are mechanical dredgers excavating trenches in the seabed, which can be used for simultaneous cable laying and burial, the burial of cable previously laid on the seabed, as well as the excavation of trenches before cable laying in harder sediments, such as till or compact fine-grained sand [Figure 3.12]. The device is equipped with a movable chain with blades that cut a narrow trench in the seabed. The blades are replaceable and can be adjusted to specific soil conditions. When a trench is excavated along a seabed section with hard (rocky) bottom or in compact boulder areas, an attachment with a cutting wheel is used in mechanical dredgers. A diagram of a trench excavated with a mechanical dredger for cable burial is shown in Figure 3.13.

Figure 3.12. Example of a mechanical dredger (source: www.boskalis.com)

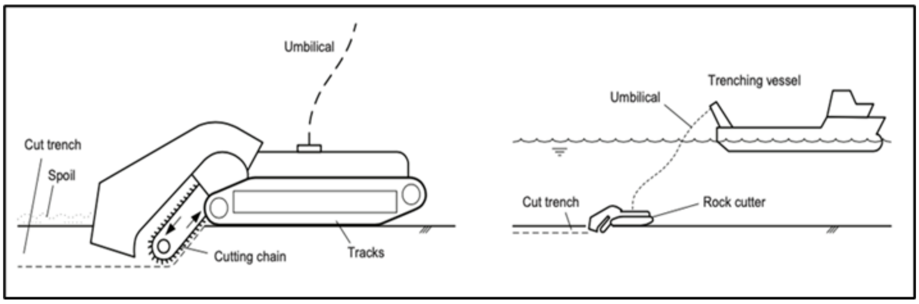

Figure 3.13. Mechanical dredger (source: https://rules.dnv.com)

The last group of equipment used during the construction of cable lines are cable ploughs [Figure 3.14]. Such devices enable simultaneous cable laying and burial in the seabed sediment. Thanks to this, they are commonly used to optimise costs and work time. The cable plough dragged behind the moving vessel on a line creates a hollow in the seabed, at the same time laying a cable inside it using a depressor [Figure 3.15]. Some devices have additional systems for injecting water into the sediment, which makes it easier for the ploughshare to penetrate it.

Figure 3.14. Example of a submarine cable plough (source: https://www.youtube.com/watch?v=wblle4zRA2M)

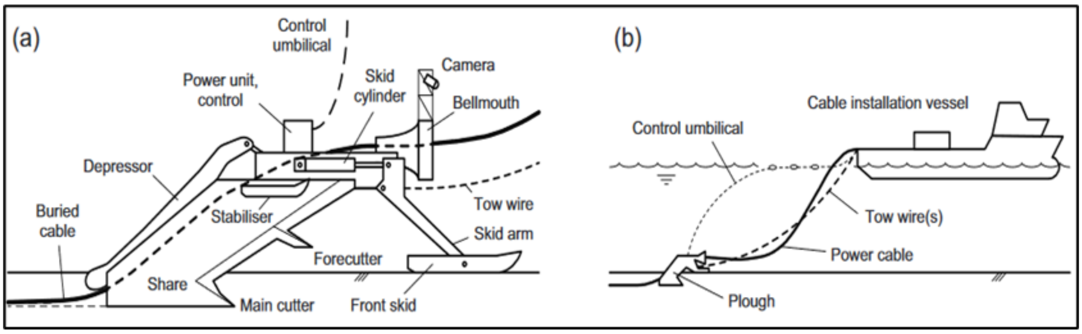

Figure 3.15. Technology of cable line laying using a cable plough (source: https://rules.dnv.com/)

3.5.3 Technical solutions in the case of intersections with a third-party infrastructure

There is a likelihood that it may not be possible to bury power cables in the seabed along the entire route. If it is impossible to change the cable line route in order to avoid an obstacle located on or below the seabed, for example, if a third-party linear infrastructure is present, it will be necessary to lay sections of the cable line on the seabed surface and provide it with appropriate protection systems.

Four main methods for protecting cables laid on the seabed surface and at intersections with third-party infrastructure can be distinguished, as described below:

- rock dump;
- rock bags;
- concrete mattresses;
- reinforced concrete half-shells, casing pipes, and protective HDPE fittings.

3.5.3.1 Rock dump

This method involves levelling the substrate in/at which the third-party infrastructure is located and covering it with a rock layer. The cable line is laid on an aggregate substrate prepared in that way, and then it is secured by rock dumping from the top. This is a universal method for protecting subsea cables; however, its disadvantage is a risk of the cable line being washed out if the dump volume or rock grading is incorrect. Figure 3.16 illustrates a rock dump structure and Figure 3.17 presents its construction method.

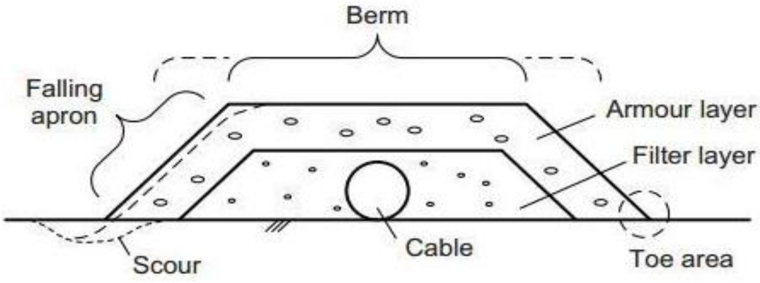

Figure 3.16. Cross-section of a rock dump used for protecting a subsea cable laid on the seabed surface (source: internal materials)

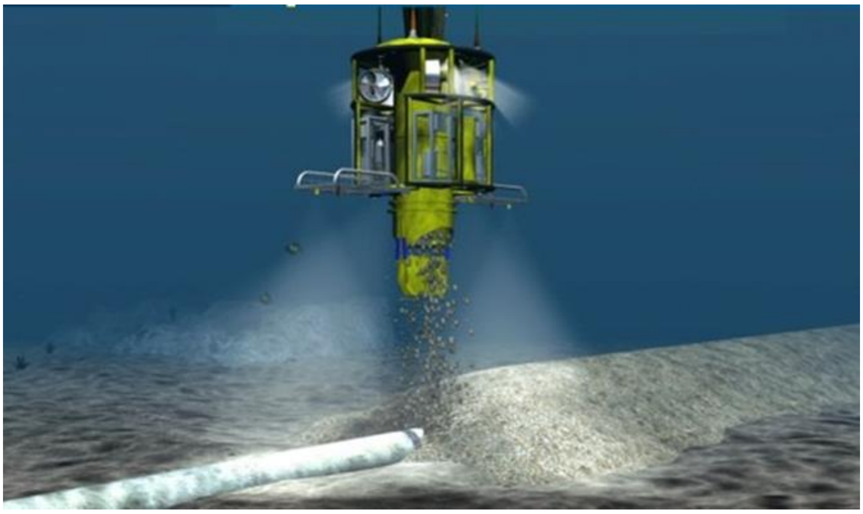

Figure 3.17. Visualisation of a rock dump construction (source: www.offshore-fleet.com/data/rock-dumping-vessel.htm)

3.5.3.2 Rock bags

Rock bags can be used in the same way as rock dumps, but usually smaller grade stones wrapped with durable fibre nets are used [Figure 3.18]. The applications include protection against seabed scrubbing (e.g. by bottom trawls) around cable routes leading to offshore structures. The vessels installing rock bags can differ from fall pipe vessels used for placing rock material on the seabed. This method is universally applied. Compared with rock dumping, its advantage is that the aggregate is enclosed in durable nets preventing the aggregate as well as the protected infrastructure and cable lines from being washed away from the seabed.

Figure 3.18. Method for constructing and laying rock bags on a cable line (source: www.bluemont.com.au/erosion/kyowa-rock-filter-bags/offshore-subsea)

3.5.3.3 Concrete structures

Concrete structures are a solution in which prefabricated concrete elements are used to provide protection of crossings; they are arranged specifically to separate the existing third-party infrastructure from the cable lines being laid [Figure 3.19]. The advantage of this method is a short execution time. Its disadvantage is the limited applicability due to the geometry, dimensions and angle of intersection with the third-party infrastructure. Crossings constructed with the use of concrete prefabricates can also be secured by rock dumping.

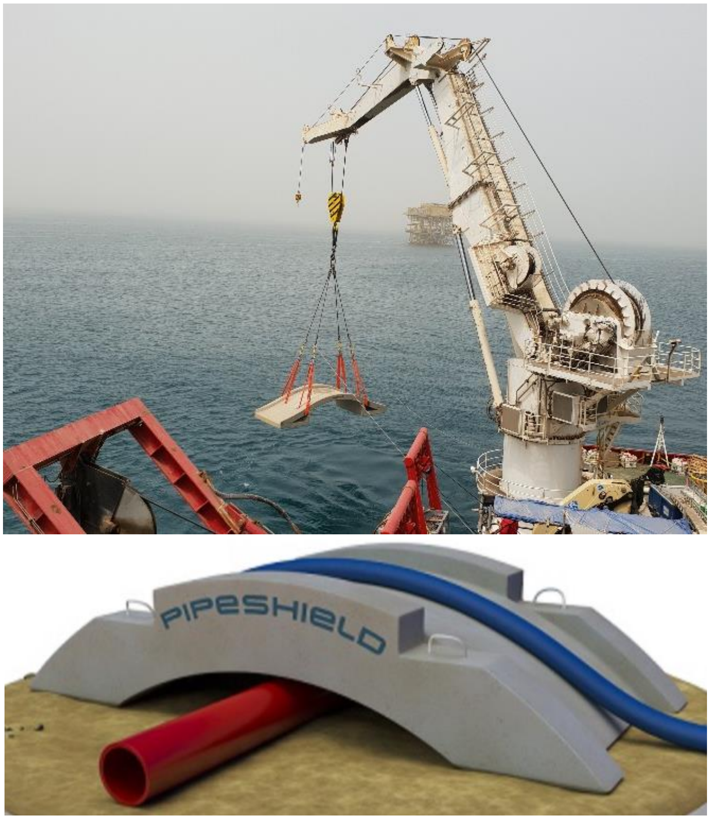

Figure 3.19. Method for constructing and laying concrete structures on a cable line (source: www.pipeshield.com/products/concrete-structures)

3.5.3.4 Reinforced concrete half-shells, casing pipes, and protective HDPE mouldings

In certain circumstances, rock protection may not be optimal due to such factors as velocity of near-seabed currents, bathymetry, and type of seabed sediments. An alternative to this form of cable protection can be the use of half-shells (articulated pipes) or a modern equivalent of hybrid polyurethane pipes [Figure 3.20]. Apart from cable protection, these structures provide ballast and stability for the pipes laid on the seabed.

Protective HDPE mouldings are a solution intended for cable line protection involving the installation of polyethylene flanges, which enables line protection and separation at infrastructure crossings. Moulding systems connected to one another and to the cable in a flexible manner that prevents them from moving along the cable allow the creation of flexible flowlines of desired length. If necessary, the protective mouldings can be additionally supplied with concrete or lead ballast systems. The solution is used in situations when it is impossible to lay the cable below the seabed level.

Figure 3.20. Reinforced concrete half-shells, casing pipes, and protective HDPE mouldings used for protecting power cables laid on the seabed (source: www.crpsubsea.com/products/product-families/bend-fatigue-protection/polyspace/)

3.6 Types and number of vessels involved in offshore operations

The specialist vessels that will operate during the construction of the Baltica 1+ OWF can be divided into three main groups:

- small-sized vessels (ships), e.g.: CTV, guard vessels, and tugs[1];
- medium-sized vessels (ships), e.g.: SOV, specialist vessels, cable layers[2];
- large-sized vessels (ships), e.g.: installation vessels supporting the installation of foundations and elements of wind turbines, such as: HLCV, HLJV, and rock dumping vessels[3].

For the installation of foundations on the seabed, usually heavy-duty installation vessels are used. In the past, such operations were also carried out by vessels intended for turbine installation; however, as foundations increased in size and companies from the offshore wind energy supply chain expanded their investments, various vessels have been designed that are better suited to the above purposes

[1] The group includes: CTV, vessels supporting coordination tasks, commissioning, light installation works, tugs and guard vessels.
[2]The group includes: vessels used for transporting elements, vessels used for noise reduction solutions.
[3] The group includes: HLCV, JUV, CLV, vessels supporting the construction of scour protection systems.

and do not require leg installation on the seabed. Examples of new generation vessels, available on the market or currently under construction include:

a) DEME “Orion” – specification provided on the shipowner’s website: length 216.50 m, crane with a capacity of 5 000 tonnes, accommodation for 160 persons (extendable to 239 persons), equipped with a dynamic positioning system; available on the market;
b) “Seaway Alfa Lift” – specification provided on the shipowner’s website: length of 217.88 m, crane capacity of 3000 tonnes, accommodation for 100 persons, equipped with a dynamic positioning system; vessel under construction;
c) Jan de Nul “Les Alizes” – specification provided on the shipowner’s website: length 236.80 m, crane with a capacity of 5 000 tonnes, accommodation for 120 persons, equipped with a dynamic positioning system; under mobilisation for the project.

In the process of transporting foundations to an OWF area, both installation vessels as well as barges and tugs of various sizes are used depending on the dimensions of the structural elements, the logistic strategy and the available equipment base. In order to provide scour protection, auxiliary vessels are used that enable the transport and installation of the structural grout. Additionally, one or two vessels with appropriate installation capabilities are used in the cable laying process, depending on the scope of work adopted.

To provide scour protection, a supporting rock dumping vessel is used that is capable of transporting and dumping aggregates around the foundation constructed. The rock dumping vessel is equipped with at least one cargo hold for aggregates, auxiliary cranes and a dynamic positioning system.

Usually, the turbine installation is carried out using a heavy lift jack-up vessel (HLJV), which, depending on the size of the deck available and the size of turbine elements, can transport several turbine assemblies (up to 7) and install them in the farm area in a single cycle. Next, the vessel returns to the installation port for re-loading. This type of vessel navigates within the farm area and to the installation port using its own propulsion. The jack-up vessel, using a dynamic positioning system, reaches the target position for lowering the supports (legs) to the seabed in order to install the wind turbines.

Other types of vessels can also be used for turbine installation, for example semi-submersible heavy-lift vessels or other vessels equipped with cranes with a capacity of several thousand tonnes.

In the process of installing foundations or wind turbine elements, consideration should be given to the hydrological and meteorological conditions that could cause potential delays in the installation process.

Vessels with the above-described parameters will be sufficient during both the construction and decommissioning of the wind farm, considering that the weight and dimensions of the wind turbine elements will remain the same throughout all phases of the wind farm life cycle (construction, operation, and decommissioning).

Used operating fluids will be stored in sealed vessel hull tanks or in tanks on board the vessel intended for that purpose. Operating fluids belonging to various waste groups will not be mixed. Next, they will be transported to land and handed over to a recipient authorised to provide services of professional disposal of liquid waste – either directly or using an intermediary.

4 POSSIBLE PROJECT OPTIONS

The implementation of the Baltica 1+ OWF Project is characterised by a long, lasting up to 10 years, investment process. With the development of the technologies used in the offshore wind power sector being highly dynamic, it is impossible to specify the target parameters of all the elements comprising the Project. Therefore, in the Scoping Report, the Project is described using the so-called boundary condition envelope, i.e. the minimum and maximum requirements for the technological and technical conditions of its implementation.

Two baseline feasible Project options – the one preferred by the Project Owner, ensuring the most efficient use of the area covered by the PSzW permit, called the Applicant's Proposed Option (APO) and the Reasonable Alternative Option (RAO) – have been adopted, with both the APO and the RAO being feasible and in line with the requirements resulting from the PSzW permit.

It is not possible to vary the location of the Project, as its location has been determined by the permit for the construction and use of artificial islands. At the same time, the possible locations of offshore wind farms in PSA have been specified in the Regulation of the Council of Ministers of 14 April 2021 *on the adoption of the Maritime Spatial Plan for the Internal Sea Waters, Territorial Sea and Exclusive Economic Zone at a scale of 1:200 000* (Journal of Laws of 2021, item 935, as amended), however, the implementation of the Project in another part of the basins intended for offshore renewable energy is impossible without obtaining a permit as part of the settlement procedure, under which the Minister of Infrastructure, after evaluating competing applications, grants permits to the project owner who receives the highest number of points. Therefore, at this stage, any other location variant cannot be considered rational, as their implementation does not depend only on the Project Owner's decision.

Regardless of the option chosen for the implementation, the Project maximum boundary conditions have been set:

- the total capacity of the Baltica 1+ OWF will not exceed 1185 MW;
- the Baltica 1+ OWF will comprise a maximum of 79 wind turbines of 15 MW capacity each; if a capacity of 25 MW is selected, there will be a maximum of 47 wind turbines;
- the maximum total height of the wind turbine, including the rotor (measured from the sea level), will not exceed 330 MASL;
- the maximum diameter of the wind turbine rotor will not exceed 310 m;
- the maximum number of OSSs will be 5.

The main elements subject to optioneering regarding the Baltica 1+ OWF include:

- the maximum number of wind turbines – the parameter resulting from the rated capacity of a single turbine. The rated capacity of a single wind turbine determines the key parameters regarding the environmental impact, i.e.:
    - wind turbine height;
    - wind turbine rotor diameter;
    - swept area of the wind turbine;
    - number of support structures and the area covered by them within the OWF;
    - maximum length of cable lines within the OWF.

Table 4.1 presents information on the key differences between the technical parameters in the APO and the RAO of the Baltica 1+ OWF.

In the APO, the technical parameters are presented in the form of a matrix referring to the expected unit capacities of a single turbine, in the range of 15 to 25 MW, which have been adopted as extreme values, the use of which will generate the greatest, in envelope concept terms, environmental impacts. It should be noted that one turbine type will be used as part of the Project, however, in view of the dynamic technological development, the selection thereof will be possible at a later stage. In the case of the RAO, units with a rated capacity of 14 MW were indicated for implementation. Turbines of this type are currently being installed in the offshore wind farms under construction and will be used on a large-scale basis within the next few years. Although at the stage of wind turbine selection, it is highly probable that higher-performance structures will be available, turbines with a capacity of 14 MW will be still common on the market, and, due to a decline in project owners' interest in the units of this capacity, they will be easiest to procure. For this reason, the use of 14 MW turbines provided the grounds for giving preference to the RAO.

In order to fully clarify the relevance of the matrix, two extreme cases involving the use of 15 and 25 MW turbines should be considered for the APO. Assuming that the Baltica 1+ OWF will have a maximum total capacity of 1185 MW and generators with a capacity between 15 and 25 MW will be used, the maximum number of turbines will be up to 75 15 MW wind turbines with a rotor diameter of up to 236 m and up to 47 25 MW turbines with a rotor diameter of up to 310 m. Nevertheless, in the case of a single 25 MW turbine, the swept area (rotor zone) will be markedly larger (75 500 m^2 max) than the swept area of a single 15 MW turbine (44 000 m^2 max).

Given the above assumptions, it is envisaged that it is possible to build a maximum of 79 wind turbines, while at the same time reducing a maximum total swept area for the entire wind farm to 3 548 500 m^2. Therefore, to describe the APO, a matrix was used, which enables an effective presentation of the parameters required to perform an impact assessment depending on the type of impact.

Table 4.1. Comparison of the basic technical parameters for the Baltica 1+ OWF in the APO and RAO (source: internal materials)

Parameter	APO		RAO
Specific capacity of the wind turbine [MW]	from 15	to 25	14
Maximum number of wind turbines [pcs]	79	47	84
Maximum total height of wind turbines [MASL]	330		266
Maximum diameter of the rotor [m]	236	310	236
Maximum zone of a single rotor [m^2]	44000	75500	44000
Maximum total rotor zone [m^2]	3476000	3548500	3696000
Maximum area of the seabed occupied by one gravity-based structure, including erosion protection [m^2]	11300	14300	11300
Maximum area of the seabed occupied by all gravity-based structures, including erosion protection [m^2]	900000	667000	950000
Maximum OWF cable infrastructure length [km]	165	140	165

4.1 Applicant's Proposed Option

The Applicant's Proposed Option (APO) is an option assuming the application, to the greatest extent possible, of state-of-the-art technologies available at the time of developing the building plans for each construction stage of the Project, including, in particular, for wind turbines larger than those available in the market at the time of submitting the application for the issuance of a decision on environmental conditions for the Project.

The APO envisages the possibility of using turbines with specific rated capacities ranging from 15 to 25 MW. Even though the turbines with the capacity indicated are not yet available on the market, this option will be considered reasonable, since turbines with a capacity of 15 MW and higher are already in the certification phase and will be available at the stage of applying for a building permit. However, this option fairly envisages the possibility of using higher capacity turbines in accordance with the current knowledge about the technological development planned by leading manufacturers.

The APO takes account of the fact that offshore wind farm technologies are expected to be constantly developed, not only towards increasing sizes of rotors, generators and towers, but also in terms of the effectiveness of the technical solutions applied. This will allow the implementation of the Project using the parameters with lower environmental impact, particularly thanks to:

- fewer wind turbines;
- smaller seabed area occupied by the wind turbine foundations and OSSs, including erosion control systems;
- fewer power cables and their shorter total length within the Baltica 1+ OWF.

In this way, the Project would be implemented in a shorter time frame and using less raw materials and fuels.

4.2 Reasonable Alternative Option

The Reasonable Alternative Option (RAO) has been selected as a variant based on existing technologies that are currently applied and available on the market. Wind turbines with rated capacities of 14 MW are envisaged. Envisaging the application of a unit with such a capacity, taking account of the Baltica 1+ OWF capacity being at a maximum level of 900 MW, means constructing a maximum of 84 wind turbines. This option will be implemented within the same area, however, due to a larger number of wind turbines planned, it will require a different turbine layout within the area boundaries.

5 AMOUNTS OF WATER, RAW MATERIALS, CONSUMABLES, FUEL AND POWER EXPECTED TO BE USED

5.1 ESTIMATED AMOUNTS OF FUEL, RAW MATERIALS AND CONSUMABLES

5.1.1 Fuel consumption

The sections below present the estimated fuel consumption for different phases of the Project implementation. The consumption values provided will be considered as indicative only – more accurate determination of fuel consumption will be possible once the building plan has been developed, the number and type of vessels involved in the operations determined and the target vessels contracted. Calculations of the amount of fuel used in each phase of the Project refer to the vessels described in Subsection 3.6.

5.1.1.1 Fuel consumption during the construction phase

During the construction phase, fuel will be consumed by the vessels involved in the construction of the Baltica 1+ OWF infrastructure. Table 5.1 presents preliminary information regarding the type and number of vessels to be engaged in the construction works, along with the information regarding their expected daily fuel consumption.

Table 5.1. Estimated fuel consumption for the vessels involved in the Baltica 1+ OWF construction phase (source: internal materials)

Vessel size	Expected fuel consumption [kg/h]	Expected daily operation time [h]	Expected number of vessels [pcs]	Expected total daily fuel consumption [Mg]
Large	1000–2000	12–24	7	85–340
Mean	500–1000	12–24	5	30–120
Small	50–500	12–24	10	6–120
Total:				121–580

For transporting technical personnel for the purpose of e.g. crew changes, it is also allowed to use a helicopter with average fuel consumption of approximately 500 kg per flight-hour.

5.1.1.2 Fuel consumption during the operation phase

The number of vessels expected to be involved in the planned as well as ad hoc maintenance and repair operations will be significantly smaller than during the construction phase. The following is preliminary information regarding the type and number of vessels to be engaged as service support for the Baltica 1+ OWF during the operation phase, along with the information regarding their expected daily fuel consumption required for providing maintenance services [Table 5.2] and repair services [Table 5.3].

Table 5.2. Estimated fuel consumption for the vessels involved in providing service support for the Baltica 1+ OWF during the operation phase, annually – maintenance activities (source: internal materials)

Vessel size	Expected fuel consumption [kg/h]	Expected number of vessels providing service support for the Baltica 1+ OWF per year [pcs]	Expected total annual vessel operation time [h]	Expected total annual fuel consumption [Mg]
Mean	500–1000	2	3500	3500–7000

Vessel size	Expected fuel consumption [kg/h]	Expected number of vessels providing service support for the Baltica 1+ OWF per year [pcs]	Expected total annual vessel operation time [h]	Expected total annual fuel consumption [Mg]
Small	50–500	2	8000	800–8000
Total:				4300–15000

Table 5.3. Estimated fuel consumption for the vessels involved in providing service support for the Baltica 1+ OWF during the operation phase, annually – repair activities (source: internal materials)

Vessel size	Expected fuel consumption [kg/h]	Expected number of vessels providing service support for the Baltica 1+ OWF per year [pcs]	Expected total annual vessel operation time [h]	Expected total annual fuel consumption [Mg]
Large	1000–2000	2	400	800–1600
Small	50–500	1	500	25–250
Total:				825–1850

If a decision is made to build a helipad on the OSS, helicopters can be used for transporting maintenance and repair personnel. It is assumed that the maximum annual operation time of a helicopter will not exceed 400 hours. Given that 500 kg of fuel is burned per flight-hour, the total annual fuel consumption for helicopters will be up to 200 Mg.

5.1.1.3 Fuel consumption during the decommissioning phase

If a decision is made to decommission the Project, fuel will be consumed by the vessels involved in dismantling the Baltica 1+ OWF. Table 5.4 presents the preliminary information regarding the type and number of vessels to be engaged in the dismantling works, along with the information regarding their expected daily fuel consumption. The number of vessels involved in the decommissioning phase will probably be lower than the number of vessels to be engaged in the construction of the Baltica 1+ OWF, since only part of the OWF structure is to be dismantled – it is not envisaged that the power cables and parts of foundation piles installed in the seabed will be removed.

Table 5.4. Estimated fuel consumption for the vessels involved in the Baltica 1+ OWF decommissioning phase (source: internal materials)

Vessel size	Expected fuel consumption [kg/h]	Expected daily operation time [h]	Expected number of vessels [pcs]	Expected total daily fuel consumption [Mg]
Large	1000–2000	12–24	2	24–96
Mean	500–1000	12–24	3	18–72
Small	50–500	12–24	8	5–96
Total:				47–264

For transporting technical personnel for the purpose of e.g. crew changes, it is also allowed to use a helicopter with average fuel consumption of approximately 500 kg per flight-hour.

5.1.2 Consumption of water, consumables and raw materials

Table 5.5 presents an estimation of the consumption of water and raw materials during the Baltica 1+ OWF construction phase.

Table 5.5. Types and estimated amounts of water and raw materials to be used during the Baltica 1+ OWF construction phase (source: internal materials)

Marine aggregates	Description of the process/technology	Expected consumption
Water	For domestic uses of the personnel	approx. 1.3 thousand m^3 (APO) approx. 1.6 thousand m^3 (RAO)
Aggregate	Creating erosion protection for foundations	47 turbines with a capacity of 25 MW: – 300 000 m^3 (monopile foundation) – 2 000 000 m^3 (gravity-based structure) 79 turbines with a capacity of 15 MW: – 250 000 m^3 (monopile foundation) – 2 650 000 m^3 (gravity-based structure) 84 turbines: – 270 000 m^3 (monopile foundation) – 2 800 000 m^3 (gravity-based structure)

During the operation phase, potable water will be required solely for domestic uses of the maintenance personnel staying on service vessels. It can be assumed that the volume of freshwater used on the vessels will be 60 l/person/day. Water consumption will be similar during the decommissioning phase, i.e. 60 l/person/day.

5.1.3 Electricity demand

During the construction and possible decommissioning phase, it is not expected that electricity will be drawn from the grid. Energy will be produced from the combustion of fuels by vessels and machinery.

During the operation phase, the electricity demand for the Baltica 1+ OWF will be:

- approximately 1% of the total capacity for the purpose of auxiliary power consumption during the Baltica 1+ OWF downtime;
- a maximum of 3% of the total annual power generation during the Baltica 1+ OWF operation.

6 ENVIRONMENTALLY-FRIENDLY SOLUTIONS

The basic solution to protect the environment will be such design and implementation of the Project which will minimise the number and size of the negative impacts generated. In the case of the construction and decommissioning phase, which in this type of projects are characterised by the largest negative environmental impacts, the Project Owner assumes the use of the most environmentally beneficial technologies and techniques for their implementation.

At each stage of the Project implementation, the Project Owner shall use equipment, machinery and vessels complying with the applicable environmental standards. All activities will be monitored for possible spills, emissions and other accidents that could lead to environmental condition deterioration. An action plan for counteracting threats and contamination from oil spills by ships involved in each phase of the Baltica 1+ OWF implementation will be developed and implemented.

To minimise the risk of contamination with oil from the equipment installed in substations, installations with separators and leak-proof tanks will be used to collect the substance in case of failure. Transformers and reactors will be equipped with oil trays with a capacity of at least 10% larger than the volume of oil contained in them.

The plan specifying the protective measures will be based on the results of the environmental surveys to be carried out by the Project Owner for the purpose of environmental impact analysis and preparation of the EIA Report.

7 TYPES AND AMOUNTS OF SUBSTANCES OR ENERGY EXPECTED TO BE RELEASED INTO THE ENVIRONMENT WHEN USING SOLUTIONS PROTECTING THE ENVIRONMENT

The main sources of substances entering the environment will be exhaust emissions from the engines of the vessels involved in the construction and decommissioning of the offshore wind farm and, to a lesser extent, the vessels involved in the operation phase. In terms of energy emissions, underwater sound generated during the piling of the wind turbine and OSS support structures by vessels servicing the construction phase of the Project should be considered the most important.

7.1 EXHAUST EMISSIONS TO AIR

During the construction and possible decommissioning phases, vessels at sea will generate exhaust emissions to the atmosphere. High-performance vessel engines produce significant amounts of exhaust gases, the quality of which is determined by the quality of the fuel. Fuel and exhaust gas quality standards are specified in the International Convention for the Prevention of Pollution from Ships (MARPOL Convention) as well as in Directive 2016/802 of the European Parliament and of the Council of 11 May 2016 relating to a reduction in the sulphur content of certain liquid fuels (the so-called "Sulphur Directive"). The provisions of those documents were implemented into the national law by the Act of 16 March 1995 *on prevention of maritime pollution from ships* (consolidated text: Journal of Laws of 2023, item 1072). The quality of exhaust gases from vessels has improved significantly over the last ten years. In the report of the European Commission on the effects of the implementation of the Sulphur Directive, it has been indicated that the reduction of the content of sulphur in vessel fuels resulted in a decrease in the concentration of sulphur oxides in the air in the areas near ports or along intensive shipping routes by several dozen percent, significantly improving air quality (Commission Report 2018). The vessel fumes will not concentrate due to the favourable wind conditions on the open sea, which will cause the fumes to disperse in a short time. Air quality standards in Poland are regulated by the Act of 27 April 2001 *Environmental Protection Law* (Journal of Laws of 2022, item 2556) through executive acts, the most important of which are: the Regulation of the Minister of Climate of 24 September 2020 *on emission standards for certain types of installations, fuel combustion sources and waste incineration or co-incinerations equipment* (Journal of Laws of 2020, item 1860), the Regulation of the Minister of the Environment of 26 January 2010 *on reference values for certain substances in the air* (Journal of Laws of 2010, No. 16, item 87) and the Regulation of the Minister of the Environment of 24 August 2012 *on the levels of certain substances in the air* (consolidated text: Journal of Laws of 2021, item 845).

Exhaust gas quantities emitted into the air will result from the number and types of vessels involved in the various stages of the Project as well as the duration of the offshore works planned. As the Project is in the early pre-development phase, i.e. before a detailed work schedule has been prepared and before suitable vessels have been selected and contracted, it is at most possible to present the quantities of gases and pollutants emitted into the atmosphere as estimates, as provided in Table 7.1.

Table 7.1. Estimated data on the types and amounts of gases and solid pollutants emitted to the atmosphere during diesel oil combustion on vessels engaged in the construction phase of the Baltica 1+ OWF, per day (source: internal materials)

Substance	Emission factor [g/kg of fuel][4]	Emissions per day of work [Mg]
Nitrogen oxides (NO_x)	72.20	8.7–41.9
Non-Methane Volatile Organic Compounds (NMVOC)	2.64	0.3–1.5
Carbon oxide (CO)	7.40	0.9–4.3
Total suspended particulate (TSP), including up to 100% of PM10 and PM2.5	5.21	0.6–3
Sulphur dioxide (SO_2)	0.02	<0.02
Aliphatic hydrocarbons (HC al.)	1.72	0.2–1
Aromatic hydrocarbons (HC ar.)	0.92	0.1–0.5
Carbon dioxide (CO_2)	3206	388–1860

During the operation phase of the Project, exhaust fumes will be emitted by vessels engaged in maintenance and repair works. Table 7.2 provides the estimated quantities of gases and solid pollutants emitted into the atmosphere by vessels during the operation phase, on an annual basis.

Table 7.2. Estimated data on the types and amounts of gases and solid pollutants emitted to the atmosphere during diesel oil combustion on vessels engaged in the operation phase of the Baltica 1+ OWF, per year (source: internal materials)

Substance	Emission factor [g/kg of fuel][4]	Emission factor per year of operation [Mg]	
		for service operations	for repair operations, if any
Nitrogen oxides (NO_x)	72.20	310.5–1083	59.6–133.6
Non-Methane Volatile Organic Compounds (NMVOC)	2.64	11.4–39.6	2.2–4.9
Carbon oxide (CO)	7.40	31.8–111	6.1–13.7
Total suspended particulate (TSP), including up to 100% of PM10 and PM2.5	5.21	22.4–78.2	4.3–9.6
Sulphur dioxide (SO_2)	0.02	0.1–0.3	<0.02
Aliphatic hydrocarbons (HC al.)	1.72	7.4–25.7	1.4–3.2
Aromatic hydrocarbons (HC ar.)	0.92	4.0–13.9	0.8–1.7
Carbon dioxide (CO_2)	3206	13 785.8-48 090.0	2645.0–5931.1

[4] Sulphur content in fuel – 10 $mg \cdot kg^{-1}$ according to the Regulation of the Minister of Economy of 9 October 2015 on the quality requirements for liquid fuels (Journal of Laws of 2015, item 1680, as amended). Total oxidisation of sulphur to SO_2 in the combustion process – emission factor SO_2 0.02 g SO_2/kg of fuel was assumed. Unit emissions of nitrogen oxide, NMVOC and dust from combustion of 1 kg of diesel oil were adopted on the basis of the EMEP/EEA air pollutant emission inventory guidebook 2019 (emission factors for the group 'Navigation shipping'); in order to estimate the emission range, the maximum factor values were assumed, without taking account of recreational crafts. It was assumed that 100% of NMVOC will consist of a mixture of hydrocarbons (HC) contained in the fuel, which were not combusted. It was assumed that the emission of aromatic hydrocarbons may constitute up to 35% of the sum of hydrocarbons (HC), the remaining 65% will be aliphatic hydrocarbons [Merkisz 1998]. The carbon monoxide emission factor was adopted on the basis of „Emission estimate methodology for maritime navigation" by Carlo Trozzi – conference materials – 19th Annual International Emission Inventory Conference „Emissions Inventories – Informing Emerging Issues – San Antonio, Texas – September, 2010. The carbon dioxide emission factor was adopted in accordance with Istrate, I.R., Iribarren, D., Dufour, J., Ortiz Cebolla, R., Arrigoni, A., Moretto, P. and Dolci, F., Quantifying Emissions in the European Maritime Sector, EUR 31050 EN, Publications Office of the European Union, Luxembourg, 2022.

If the offshore wind farm is completely dismantled after the end of the operation phase, exhaust gases will be the only substances permanently introduced into the environment. If the decommissioning phase involves leaving parts of wind turbine support structures and associated infrastructure as well as power cables in the seabed, the materials used for their construction should also be considered as substances permanently introduced into the environment. Also in this case, the estimation of the quantities of these substances will only be possible at later stages of the Project, after the selection of the type of support structures and the type of power cables. Table 7.3 provides the estimated quantities of gases and solid pollutants emitted into the atmosphere by vessels during the decommissioning phase, on a daily basis.

Table 7.3. Estimated data on the types and amounts of gases and solid pollutants emitted to the atmosphere during diesel oil combustion on vessels engaged in the decommissioning phase of the Baltica 1+ OWF, per day (source: internal materials)

Substance	Emission factor [g/kg of fuel][4]	Emissions per day of work [Mg]
Nitrogen oxides (NO_x)	72.20	3.5–19.1
Non-Methane Volatile Organic Compounds (NMVOC)	2.64	0.1–0.7
Carbon oxide (CO)	7.4	0.4–2
Total suspended particulate (TSP), including up to 100% of PM10 and PM2.5	5.21	0.3–1.4
Sulphur dioxide (SO_2)	0.02	<0.02
Aliphatic hydrocarbons (HC al.)	1.72	0.1–0.5
Aromatic hydrocarbons (HC ar.)	0.92	0–0.2
Carbon dioxide (CO_2)	3206	153.9–846.4

If a helicopter is used, aviation fuel consumption is estimated at 500 kg/h. The use of a helicopter during the construction phase is acceptable at up to 30 h/month, and during the operation phase the annual operating time of the helicopter should not exceed 400 hours [Table 7.4].

Table 7.4. Emission factors for aviation fuel and estimated emissions per hour during the construction and operation phases (source: internal materials)

Substance	Emission factor [kg/kg of fuel]	Emission factor per hour of helicopter flight [kg/h]
Carbon dioxide CO_2	3.21	1600
Nitrogen oxides NO_x	0.008	4
Carbon oxide CO	2.4	1200
Non-Methane Volatile Organic Compounds (NMVOC)	0.038	19
Sulphur oxides SO_x	0.002	1

7.2 NOISE EMISSIONS

Noise will be emitted to the atmosphere and to the water column during the construction and dismantling of the Baltica 1+ OWF. Noise emitted to the atmosphere will not be associated with sound levels that could adversely affect the environment, so mitigation measures are not anticipated.

Operating vessels also emit underwater noise, the parameters of which correspond to the type of manoeuvres carried out. The frequency of this sound is usually 63 Hz and 125 Hz. Sounds in these bandwidths are received by fish and marine mammals and, at high intensities, may cause their behavioural response – escape from the emission area. Noise emissions from vessels will be minimised by limiting the number of vessels to the number necessary to ensure that the work can be carried out efficiently and safely. This is the only anticipated manner of minimising the above-mentioned impact. The greatest negative impacts on the marine environment are related to the noise generated during the piling of support structures of wind turbines and OSSs.

In the case of large-diameter pile driving, underwater noise at the source can reach instantaneous values of more than 230 dB at 1 m. This means that piling operations without noise reduction measures have a negative impact on marine mammals and fish. Therefore, a noise reduction system will be applied that will reduce the noise levels and the range of underwater noise impacts. A common method of underwater noise attenuation is a bubble curtain. The method consists of pumping air through diffusers installed on the seabed. In addition, a "soft start" procedure can be applied, i.e. a gradual increase in piling energy to allow mobile marine organisms to leave the zone of direct impact. This procedure does not reduce noise levels but helps effectively reduce the number of marine organisms exposed to underwater noise. The “soft-start” procedure involves gradually increasing the noise source energy, which results in a gradual increase in the environmental noise, and thus the extent of the impact, up to the target level assumed. During that time, the organisms that could be exposed to underwater noise have a chance to leave the significant impact zone, in which, after the “soft start” procedure is finished, the noise level will increase to levels that are likely to cause a significant impact. The duration of the “soft-start” procedure is determined with reference to the level of noise emitted by the source and the underwater noise level predicted after the application of a given noise reduction system and after taking into account the environmental conditions, such as the threshold level for the underwater noise causing a significant negative impact, its extent and the speed at which marine organisms would have to move in the environment so they would be able to leave the zone exposed to the noise.

In order to conduct a detailed noise analysis, it is necessary to prepare a dedicated model accounting for hydrological conditions, seabed relief, ambient noise conditions, etc. Only after modelling is it possible to specify accurately the acoustic impact and the range of impact mitigation measures to be applied.

An analysis of the extent of underwater noise impact on marine mammals and fish, as well as the theoretical effectiveness of noise level reduction after the application of an air curtain, was prepared for the Baltic Power OWF EIA Report [Sarnocińska *et al.* 2020]. The analysis indicated that the piling sound (multiple piling operations) emitted without the application of mitigating measures may cause a permanent shift in the hearing threshold (PTS) of harbour porpoises and seals at a distance of 42.4 km and 13.1 km from the Baltic Power OWF area, respectively, and a temporary threshold shift (TTS) at a distance of 129.1 km and 59.2 km, respectively. With an air curtain shielding the piling site, the PTS range will not extend beyond 9.1 km for porpoises and 0.8 km for seals, while the TTS will not reach beyond 20.0 km and 6.1 km, respectively, whereas, according to the calculations for the Baltic Power OWF [(Balicka *et al*. 2022], if a reduction system comprised of a HSD (Hydro Sound Damper) and DBBC (Double Big Bubble Curtain) is applied, the PTS and TTS ranges for porpoise are limited to 0.2

and 2.8 km, respectively. For fish with and without swim bladders, the estimated thresholds resulting in the PTS were 4.6 km and 0.8 km, respectively, whereas the TTS – 20.9 km for both fish types. The use of an air curtain will reduce the range of PTS to 0.6 km for fish with a swim bladder and 0.1 km for fish without a swim bladder. As regards the TTS, the range will be reduced to 6.3 km for both fish types.

The intensity and frequency of noise generated by ships depends primarily on their size and speed. Larger, slower moving vessels generate noise at lower frequencies, whereas smaller and faster vessels generate noise characterised by higher energy at higher frequencies. It is assumed that small vessels and recreational boats up to 50 m in length will generate a sound power of 160–175 dB; medium-sized vessels 165−180 dB; and large vessels (>100 m) will have a sound power of 180–190 dB.

According to the study entitled *Sounds from Submarine Cable & Pipeline Operations, International Cable Protection Committee* (2018), the noise frequency associated with cable laying will be concentrated in the 1–15 kHz range.

Table 7.5 contains literature data on noise emitted by vessels used for underwater works that will also result from the implementation of the Project. According to the study cited in the table, noise generated by vessels is primarily concentrated at frequencies below 1 kHz.

Table 7.5. List of underwater noise sources by operation (source: internal materials based on NaiKun Offshore Wind Energy Project, Volume 4 – Noise and Vibration, JASCO Applied Sciences, March 2009)

Noise source	Operation	Sound level dB re 1 µPa at 1 m from the source
e.g. cable layer, support vessel	dynamic positioning	177.9
e.g. cable layer, support vessel	standby	174.9
tug	seabed clearance	193.2
tug	maintaining position	179.0
barge for rock material tipping (rock dumping vessel)	loading aggregate fractions	188.4
e.g. cable layer, support vessel, tug)	vessel underway “half ahead”	184.9

The sound power level emitted by an operating helicopter engine should not exceed 107 dB.

During the operation phase, operating wind turbines and OSSs will also be the sources of noise. The sound power level of wind turbines depends on the wind speed, but it is estimated that the sound power of a single wind turbine will not exceed 120 dB. For OSSs, on the other hand, it is estimated that the acoustic power level of transformers will not exceed 100 dB.

7.3 ELECTROMAGNETIC FIELD

During the operation phase, operating power cables and the operation of the OSS will involve the emission of electromagnetic fields (EMF). There are no regulations governing EMF emission levels in offshore areas. The power cables will be buried in the seabed sediment at depths reaching 6 m to minimise the impact on the marine environment. Additionally, the OSS design will take into account the minimisation of EMF emissions to the environment but it should be noted that EMF emissions to the air above the sea surface will not involve negative environmental impacts.

Electromagnetic fields created by the flow of electric current can change the natural migration behaviour of marine mammals, they can also be a source of thermal energy introduced into the sea.

However, the impact of subsea cables buried in the seabed on the electromagnetic field is negligible. Depending on the distance from a cable buried in the seabed at a depth of 1 m under the seabed, the strength of the electric component of the field is up to $8 \cdot 10^{-4}$ $V \cdot m^{-1}$ on the seabed, $3.4 \cdot 10^{-5}$ $V \cdot m^{-1}$ in the water column 5 m above the seabed and $1.24 \cdot 10^{-5}$ $V \cdot m^{-1}$ in the water column 10 m above the seabed. The magnetic field strength induced by AC cables is 0.89 $A \cdot m^{-1}$ on the seabed, $4 \cdot 10^{-2}$ $A \cdot m^{-1}$ in the water column 5 m above the seabed and $1.5 \cdot 10^{-2}$ $A \cdot m^{-1}$ in the water column 10 m above the seabed.

8 POSSIBLE TRANSBOUNDARY ENVIRONMENTAL IMPACT

The Baltica 1+ OWF Area is situated in the north-central part of the EEZ of the Republic of Poland, at a distance of approximately:

- 2 km from the boundary of the Swedish EEZ;
- 73 km from the boundary of the Danish EEZ;
- 78 km from the boundary of the Russian EEZ;
- 86 km from the boundary of the Lithuanian EEZ;
- 94 km from the boundary of the Latvian EEZ;
- 214 km from the boundary of the German EEZ.

The boundary of the Development Area is located 2.0 km m from the boundary of the Swedish EEZ. Therefore, the occurrence of transboundary impacts resulting from the construction, operation and decommissioning of the Baltica 1+ OWF is therefore very likely within the Swedish EEZ, considering the type and scale of anticipated construction activities and existing knowledge on the environmental impacts of offshore wind farms. A preliminary list of potential transboundary impacts resulting from the implementation of the Baltica 1+ OWF, and the characteristics of their environmental impact, is presented in Table 8.1. The actual extent of the impacts of the Baltica 1+ OWF, including their potential transboundary character, will be determined on the basis of the completed environmental surveys and indicated in the Environmental Impact Assessment Report.

Table 8.1. Preliminary list of potential transboundary impacts resulting from the implementation of the Baltica 1+ OWF (source: internal materials)

Environment or human activity subject to transboundary impact	Effect of impact
Protected areas	To the north, at a distance of 2 km from the Baltica 1+ OWF Development Area, there is the Natura 2000 site *Hoburgs bank och Midsjöbankarna* (SE0330308) designated within the Swedish EEZ. According to the Standard Data Form for the site, the subjects of protection within the area include two natural habitats – Sandbanks which are slightly covered by sea water all the time (code: 1110) and Reefs (code: 1170); three bird species: the black guillemot (*Cepphus grylle*), the common eider (*Somateria mollissima*) and the long-tailed duck (*Clangula hyemalis*), as well as the harbour porpoise (*Phocoena phocoena*) (SDF 2016). A number of threats with negative impacts on the site were identified in the SDF, of which the following were considered the most significant: shipping lanes (D03.02), professional active fishing (F02.02), oil spills in the sea (H03.01). The following medium-level threats were considered: netting (F02.01.02), pollution to surface waters (limnic, terrestrial, marine and brackish) (H01), and nitrogen inputs (H04.02), as well as low-level threats: invasive non-native species (I01).
Birds	The complex of wind turbines, the structures of which will rise to a maximum height of 330 m above sea level, may pose a permanent obstacle to bird migrations.
Benthic organisms	Sedimentation of the seabed sediment lifted into the water column during the construction of the support structures and linear infrastructure of the Baltica 1+ OWF may adversely affect the functioning of plant and animal benthic communities within the sedimentation range, which is likely to extend beyond the boundary of the EEZ of the Republic of Poland.
Underwater sound	Activities related primarily to the construction of support structures (mainly piling) generate noise that may extend beyond the EEZ of the Republic of Poland. The negative impact of underwater noise will be especially significant for marine mammals and fish with a swim bladder.

Environment or human activity subject to transboundary impact	Effect of impact
Navigation	The Baltica 1+ OWF Area will constitute an obstacle to navigation and will cause a permanent change in shipping routes – the usual route to and from Klaipeda port currently runs through the area.
Fisheries	The Baltica 1+ OWF Area may be entirely or partially excluded from commercial fishing, which may result in lower catch volumes in this area of the Baltic Sea.

9 AREAS SUBJECT TO PROTECTION UNDER THE NATURE CONSERVATION ACT OF 16 APRIL 2004 AND THE WILDLIFE CORRIDORS SITUATED WITHIN THE RANGE OF THE SIGNIFICANT IMPACT OF THE PROJECT

The Baltica 1+ OWF Area was not located within the boundaries of any area subject to protection under the *Nature Conservation Act* of 16 April 2004 (consolidated text: Journal of Laws of 2022, item 916). The analysis of the results of environmental impact assessments for projects involving OWF construction showed that impacts characterised by the greatest spatial extent are those relating to underwater noise generated during the piling of foundations of support structures during the construction phase. The impacts are most pronounced in the immediate area of these works. However, in the absence of noise reduction systems, significant impacts on marine mammals and fish (especially species with a swim bladder) may occur in the area even more than one hundred kilometres away from the noise source. In order to determine which protected areas may be affected by significant impacts, analyses were carried out on the basis of the results of underwater noise propagation modelling carried out for the Baltic Power Offshore Wind Farm and included in the study entitled "Results of model calculations of underwater noise propagation during piling" constituting Appendix 3 to the Baltic Power OWF EIA Report [Sarnocińska *et al.* 2020]. The paper indicates that the maximum extent of the significant impacts affecting fish and marine mammals – permanent (PTS) and temporary threshold shifts (TTS), while applying standard mitigating measures, i.e. big bubble curtains, will be PTS − 9.1 km and TTS − 20 km for porpoise, while for fish, PTS will be 0.6 km and TTS 6.3 km. However, when using a combination of mitigating measures, e.g. DBBC and HSD, the PTS and TTS ranges for porpoise is limited to 0.2 and 2.8 km respectively from the noise source (see Subsection 7.2). Assuming the said values, it was determined that there are no areas affected by significant impacts that are protected under the *Nature Conservation Act* of 16 April 2004 (consolidated text: Journal of Laws of 2022, item 916).

Pursuant to the *Nature Conservation Act* of 16 April 2004 (consolidated text: Journal of Laws 2022, item 916), a wildlife corridor is an area enabling the migration of plants, animals or fungi. A network of wildlife corridors connecting the Natura 2000 European network of protected areas in Poland was developed in 2011 [Jędrzejewski *et al.* 2011]; however, no wildlife corridors within the PSA were indicated therein. Krost *et al.* (2017) emphasise the necessity to indicate wildlife corridors for benthic organisms. However, this is a relatively poorly recognised issue. There are also no relevant studies on the Southern Baltic in that scope.

According to the general classification of the migration system of aquatic and wetland birds in Eurasia, Poland, including its sea areas, is located within two large flyways: the East Atlantic and the Mediterranean/Black Sea flyways. The migration tactics, as well as the flyways of seabirds in the Baltic region are very poorly recognised. In summer (July and August), the flight of sea ducks (mainly the common scoter males) from the Gulf of Finland in the direction of the moulting grounds located in the Danish straits is observed. They are accompanied by the common eiders and velvet scoters, however, the abundance of these two species is much lower than that of the common scoter. These birds make a stop in the sea areas of the Southern Baltic only in exceptional cases. The period of autumn migration of seabirds is greatly extended in time. Starting in August, a number of water bird species can be observed within the PSA. Some of them are only passing and do not winter there (e.g. the terns of the

Sterna and *Chlidonias* genera), others are observed throughout the entire migration and wintering periods (sea ducks, razorbills, divers, grebes). In spring, large flocks of sea ducks (the long-tailed duck, the velvet scoter and the common scoter) moving towards feeding grounds make a stop in the Polish zone of the Baltic Sea [Sikora *et al.* (eds), 2011].

Also, for the marine mammals occurring in the Southern Baltic, no areas that could meet the criteria for wildlife corridors can be identified. Both the seals and the porpoises travel in search of food with no preference for specific routes.

At this stage, it is impossible to determine whether the wind turbine complex of the Baltica 1+ OWF will be a source of significant impacts on migratory seabirds, considering that offshore wind farms are mentioned as potential obstacles preventing or limiting migrations. Such an analysis will be carried out after targeted environmental surveys have been conducted at the stage of environmental impact assessment.

10 PROJECTS BEING IMPLEMENTED AND COMPLETED, LOCATED WITHIN THE AREA WHERE THE PROJECT IMPLEMENTATION IS PLANNED AND WITHIN THE AREA OF THE PROJECT IMPACT OR THE IMPACTS OF WHICH FALL WITHIN THE AREA OF THE PROPOSED PROJECT – TO THE EXTENT TO WHICH THEIR IMPACTS MAY LEAD TO THE CUMULATION OF IMPACTS WITH THE IMPACTS OF THE PROPOSED PROJECT

No other projects have been implemented within the Baltica 1+ OWF Area. Within its boundaries lies sub-basin 60.205.I. Structures there shall be limited to internal submaster stations which enable connection of multiple generation sources.

In the future, the development area for the construction of power cable lines for the evacuation of the electricity produced by the Baltica 1+ OWF wind turbines ashore will be located within the Baltica 1+ OWF boundaries.

The application for issuing the decision on environmental conditions for the construction of power cable lines for the evacuation of the electricity from the Baltica 1+ OWF ashore will be subject to a separate administrative procedure.

In order to select projects the impacts of which can at least coincide with the impact range of the Project in question, the first step was to determine the maximum distance from the Baltica 1+ OWF Area boundaries in which the impact areas of other projects that may accumulate with the Baltica 1+ OWF impacts leading to the generation of cumulative impacts can be found. According to the available environmental impact assessment reports, the greatest spatial range with significant environmental impact results from the propagation of underwater noise of particularly high intensity levels generated during underwater works on the piling of the foundations of supporting structures of e.g. wind turbines, substations and survey platforms. Taking into consideration that while applying standard underwater noise attenuation measures the range of this type of strong impact is up to 20 km (Subsection 7.2), it was decided that projects located up to 20 km from the boundaries of the Baltica 1+ OWF Area will be taken into account. The underwater noise generated during the construction of linear projects, such as power cables and pipelines, is characterised by much lower noise levels and spatial extent, which is why these sort of projects were limited to up to 10 km from the boundary of the Baltica 1+ OWF Area.

In order to select projects the impacts of which can at least coincide with the impact range of the Project in question, the kinds of projects, the development advancement of which allows for the acknowledgement of their implementation (e.g. an ongoing application for the decision on the environmental conditions) and which are located up to 20 km from the boundaries of the Baltica 1+ OWF Area, were identified. On the basis of the available information on the type and range of actual and theoretical impacts generated by different kinds of offshore projects, a group of projects was selected, the development of which is very likely to cause cumulative impact with the Baltica 1+ OWF impacts.

Table 10.1 includes the information on the current potential projects in the vicinity of the proposed Project, the area of which may be affected by the impacts generated by the Baltica 1+ OWF, or the impacts of which may accumulate with the impacts of the planned Project. Figure 10.1 shows the location of these projects in regards to the Baltica 1+ OWF Area.

Three projects, the development of which may cause the emission of strong underwater noise, were identified within the area defined by the 20 km width range zone. These are the three planned wind farms: the Baltica 1 OWF, the Bałtyk I OWF and the Södra Victoria OWF as well as a project involving the construction of two gas rigs located on the B4 and B5 natural gas reservoirs. In the case of linear projects, there is one project within the 10 km wide zone, i.e. the connection infrastructure evacuating power from the Baltica 1 OWF ashore. The Owner of this project is Elektrownia Wiatrowa Baltica 1 Sp. z o.o. The study does not include the Bałtyk I OWF power evacuation area, which is also located in this zone, due to the fact that the issuing of a decision on environmental conditions procedure has not been initiated. Moreover, the list includes a project involving the extraction of aggregates in the Polish Exclusive Economic Zone in the Southern Middle Bank area.

Table 10.1. Projects planned for implementation outside the Baltica 1+ OWF Area, which may be located within the Project impact range or the impacts of which may accumulate with the impacts of the Baltica 1+ OWF [source: internal materials based on the Maritime Administration Spatial Information System]

Type/name of the project	Description
MFW Bałtyk I Offshore Wind Farm	Distance from the Baltica 1+ OWF Area: approximately 1.4 km. Maximum installed capacity: 1560 MW. Project Owner: Equinor Polska Sp. z o.o. and Polenergia S.A. The application regarding the issuing of the decision on environmental conditions for the project was filed in May 2022 at the Regional Director for Environmental Protection in Gdańsk. The boundary of the area is located approximately 1.4 km from the boundary of the Baltica 1+ OWF Area.
Baltica 1 Offshore Wind Farm	Distance from the Baltica 1+ OWF Area: The offshore wind farms are directly adjacent to each other. Maximum installed capacity: 900 MW. Project Owner: Elektrownia Wiatrowa Baltica-1 Sp. z o.o. The proceedings regarding the application filed by the Project Owner regarding the issuing of the decision on environmental conditions for the "MFW Baltica-1" project were initiated on 27 July 2023 by the Regional Director for Environmental Protection in Gdańsk. The boundary of the area is directly adjacent to the Baltica 1+ OWF Area on the western side.
Baltica-1 Offshore Wind Farm connection infrastructure	Distance from the Baltica 1+ OWF Area: The area where the connection infrastructure for the Baltica-1 OWF will be laid is directly adjacent to the western part of the Baltica 1+ OWF. Power from the Baltica-1 OWF will be evacuated landwards to the Choczewo onshore power substation. Project Owner: Elektrownia Wiatrowa Baltica-1 Sp. z o.o. The proceedings regarding the application filed by the Project Owner regarding the issuing of the decision on environmental conditions for the "Baltica-1 OWF CI" project were initiated on 18 August 2023 by the Regional Director for Environmental Protection in Gdańsk.
Södra Victoria Offshore Wind Farm	Distance from the Baltica 1+ OWF Area: approximately 16.8 km Maximum installed capacity: 1500–2000 MW Project Owner: RWE Renewables Sweden AB Project developed within the Swedish EEZ. In October 2022, the Regional Director for Environmental Protection in Szczecin informed about the transboundary assessment of the environmental impact for this project.

Type/name of the project	Description
The extraction of natural gas from the subsea hydrocarbon deposits B4 and B6 and its transmission to the installations of the combined heat and power station in Władysławowo	Distance from the Baltica 1+ OWF Area: – B4 mining area – approximately 10.4 km, – B6 mining area – approximately 11.3 km. Project Owner: Baltic Gas Sp. z o.o. i wspólnicy Spółka komandytowa (Baltic Gas) On 6 May 2014, the decision on the environmental conditions for the implementation of the project was issued by the Regional Director for Environmental Protection in Gdańsk.
Extraction of aggregates in the Southern Middle Bank area	A project involving the extraction of aggregates within the "Southern Middle Bank – Southern Baltic" sand and gravel deposit area, where aggregate extraction is currently taking place. The deposit development concession expires on 15 November 2031.

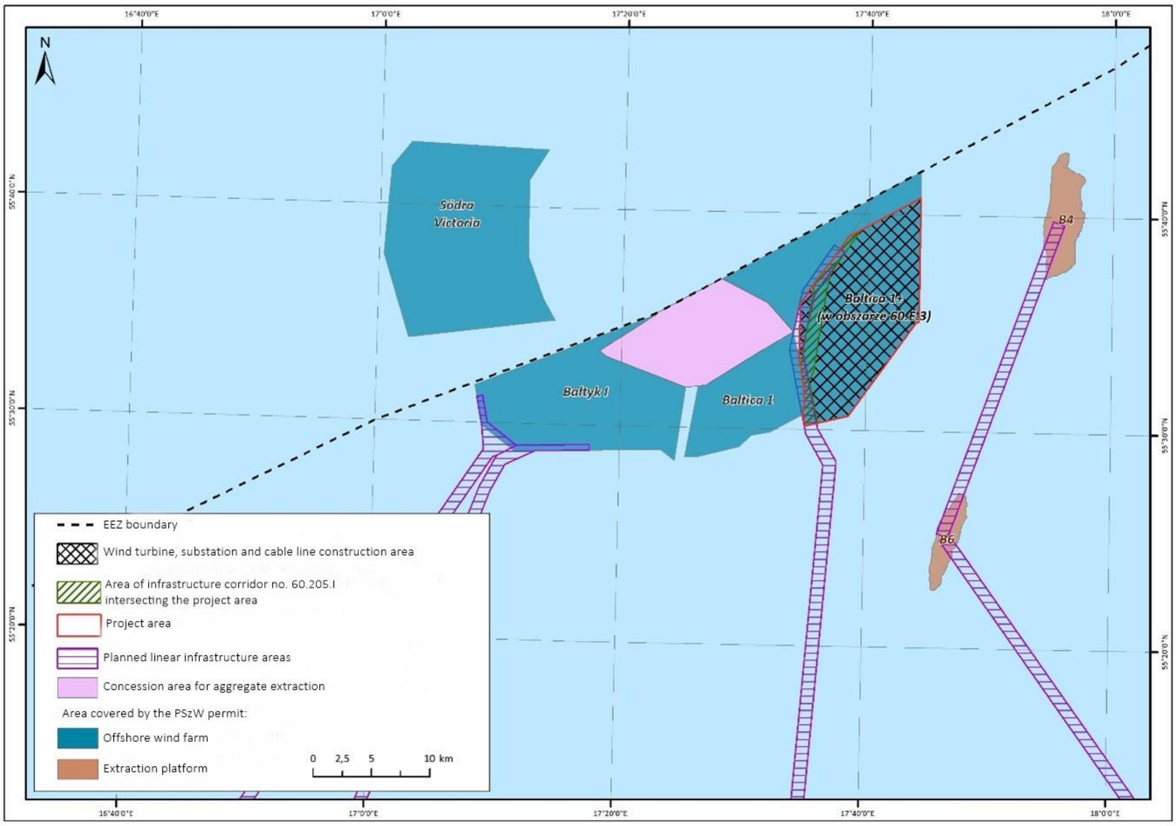

Figure 10.1. Projects planned for implementation outside the Baltica 1+ OWF Area, which may be located within the Project impact range or the impacts of which may accumulate with the impacts of the Baltica 1+ OWF [source: internal materials based on the Maritime Administration Spatial Information System]

11 Risk of major accidents or natural and construction disasters

11.1 Types and risk of major accidents

As defined in Article 3, point 23 of the Act of 27 April 2001 *Environmental Protection Law* (consolidated text: Journal of Laws of 2022, item 2556, as amended), a major accident is "an event, in particular an emission, fire or explosion happening during industrial process, storage or transportation, in which one or more dangerous substances are involved, resulting in an immediate threat to human life or health, or threat to the environment, or a delayed occurrence of such a threat."

The planned Project will not be a place of storage of substances determining the Project classification as a plant with an increased or high risk of a major industrial accident pursuant to § 1 of the Regulation of the Minister of Development of 29 January 2016 *on the types and quantities of hazardous substances present in an industrial plant, which determine the plant classification as a plant with an increased or high risk of a major industrial accident* (Journal of Laws of 2016, item 138).

In the case of the Baltica 1+ OWF, it is expected that the highest risk of a major accident will be connected to the construction and decommissioning phases, when the intensity of works and the participation of vessels in the project will be the highest. The spills of petroleum products, mostly diesel oil from a vessel/vessels, resulting from collisions with other vessels or OWF structures, are considered the highest risk of a major accident. Even though the risk of such an event is very low, it still cannot be completely dismissed. The number of potential leaks is proportional to the number of vessels used to carry out every phase of the Project implementation.

The magnitude of petroleum product contamination can be classified as follows:

- Tier 1 (small spill) – small spills of petroleum products that do not require the intervention of external forces and resources and are possible to be removed with own resources. These spills are of local character, their removal does not pose particular technical difficulties and they do not pose a significant threat to the marine environment;
- Tier 2 (medium-sized spill) – spills of petroleum products, the scale of which requires a coordinated counteraction within the maritime area under the authority of a director of the maritime office who decides on the scale of the counteraction required;
- Tier 3 (catastrophic spill) – spills of petroleum products that are extremely dangerous to the environment, the neutralisation of which involves forces and resources subordinate to more than one director of the maritime office.

During a normal operation of vessels, small spills of petroleum substances, i.e. fuel oils, lubricants and petrol, may occur. In most cases, the released petroleum products cause Tier 1 spills.

The largest petroleum product spills may occur as a result of serious vessel failure or collision of vessels and with OWF structures. In the worst-case scenario, during the construction and decommissioning stages, Tier 3 spills (catastrophic spills) might occur. The probability of a major vessel accident has been calculated to be very low, in the order of approximately 1/10 000 years (1/200 probability of an event occurring in 50 years) (Reszko, 2017).

Assuming the worst-case scenario and the release of several hundred cubic metres of diesel fuel into the marine environment, as well as taking into account its type, behaviour in seawater, the time of oil dispersion and drift, it is estimated that the range of pollution will not exceed the distance of 20 km from the Baltica 1+ OWF Area. The determination of an actual extent of a spill will be technically possible only during the event, on the basis of the current meteorological data and the data on the type and potential quantity of the contamination.

From the environmental point of view, the most sensitive area in case of possible spills will be the Middle Bank area, both in Polish and Swedish EEZ. It should be emphasised that the key issue here is not so much the size of the spill as the place where it has occurred. There are known cases of high bird mortality due to small oil spills into the sea. Extensive oil slicks drifting away from the coasts, in sea areas with very low numbers of birds, do not cause as high population losses as smaller spills in areas of large seabird concentrations [Meissner, 2005]. The Baltica 1+ OWF Area is located near the Swedish Natura 2000 site *Hoburgs bank och Midsjöbankarna* (SE0330308), which is not only an important wintering site for seabirds, but also the grey seal habitat and the main porpoise population area in the Baltic Sea. However, it should be emphasised, that in case of a Tier 1 spills, the dispersal of oil derivative substances threatening the protected areas and the objects of protection in those areas is unlikely, providing that proper organisation of prevention and counteraction is ensured.

Another cause for a major accident is the possibility of a release of hazardous substances from the objects of anthropogenic origin lying on the seabed surface or buried in the seabed sediment. It cannot be ruled out that during the preparatory work for the Baltica 1+ OWF construction process, and particularly during the seabed surveys focused on the presence of UXO and chemical weapons, man-made objects can be discovered, the disturbance of which could result in the release of contaminants contained therein (e.g. containers with chemicals or unexploded ordnance; Subsection 2.2.5). Before the commencement of the construction, the Project Owner shall conduct detailed surveys on the presence of UXOs and duds on the seabed. In case any chemical warfare agents/UXOs are found during these surveys, the Project Owner shall notify the relevant authorities and institutions of that, and shall comply with their instructions. In order to determine the way of dealing with such finds, the Project Owner will prepare a plan for handling dangerous objects, both from the point of view of operational work at sea (for example, rules for conducting work in the vicinity of potentially hazardous objects) and from the point of view of possible removal or avoidance of the locations of such objects. The basic assumption of the plan for dealing with dangerous objects is to avoid threats to human life and health and to avoid the spread of contaminants from such objects.

11.2 RISK OF A NATURAL DISASTER

As defined in Article 3, section 1, point 2 of the Act of 18 April 2002 *on the state of natural disaster* (consolidated text: Journal of Laws of 2017, item 1897), a natural disaster is "an event related to the action of natural forces, in particular lightning, seismic shocks, strong winds, heavy precipitation, extended periods of extreme temperatures, landslides, fires, droughts, floods, ice phenomena on rivers and sea as well as in lakes and water reservoirs, outbreaks of pests, plant/animal diseases or infectious human diseases, or the action of other element."

In the region of the planned Project – the sea area of the Republic of Poland – electric discharges, strong winds and intense precipitation may contribute to the occurrence of natural disasters listed in the quoted definition. Other events apply to land areas or do not apply to the Project at all. Ice phenomena on sea were also rejected due to the fact that the open waters in this part of the Baltic

Sea do not freeze, hence there is no floe drift. The development of wind turbines and the accompanying infrastructure will take into account the need to counteract extreme weather events over several decades of work. Wind turbines and OSS will be fitted with arresters and surge protections system (in accordance with the international standard IEC 61400-24) for protection against dischargers. Wind turbines have specified work ability in windy conditions. In the case of too strong winds, the rotor is automatically blocked, and its blades are set in such a way that the angle of onrush is as small as possible (offer the least resistance). Construction of wind turbines and OSS, as well as the security systems against the impact of extreme environmental phenomena make it almost impossible for a natural disaster to occur and cause damage to the OWF elements.

It is also not expected that the impact of extreme weather phenomena could lead to damage or destruction of vessels supporting the construction, operation and decommissioning of the Baltica 1+ OWF. Any work carried out at sea will be carried out within the conditions set out in the Project Execution Plan and stopped immediately when these conditions are exceeded.

11.3 Risk of a construction disaster

As defined in Article 73, section 1 of the Act of 7 July 1994 – *Construction Law* (consolidated text: Journal of Laws of 2023, item 682, as amended) a construction disaster is "an unintentional, sudden destruction of a civil structure or its part, as well as structural elements of scaffolding, elements of forming devices, sheet piling and excavation lining." In the case of the Baltica 1+ OWF, a construction disaster, the destruction of wind turbines and/or accompanying infrastructure, could result from an emergency situation, in that case as a result of a collision with a vessel or extreme weather phenomena. The probability of the occurrence of such situations will be very low, additionally eliminated and minimised by design solutions developed for the safe execution of work at sea.

11.4 Failure prevention

The prevention of breakdowns constitutes the whole range of activities related to the protection of human life and health, the natural environment and property, as well as the reputation of all participants in the processes related to the construction, operation and decommissioning of an OWF. These activities include, among others:

- developing plans for safe construction, operation and decommissioning of an OWF;
- developing rescue plans and training of crews and personnel, including the rules for updating and verification by conducting regular drills, in particular determining the procedures for the use of own vessels and external vessels, including helicopters;
- developing a plan for counteracting threats and pollution arising during the construction, operation and decommissioning of an OWF;
- selecting suppliers as well as certified parts and components of an OWF;
- designating protection zones;
- accurate marking of an OWF area, its facilities and vessels moving within the area;
- planning offshore operations;
- applying the standards and guidelines of IMO, recognised classification societies and maritime administration recommendations;
- developing plans of safe navigation within an OWF area and safe passages to ports;

- providing adequate navigational support in the form of maps and navigational warnings;
- providing direct or indirect navigational supervision using a surveillance vessel or remote radar surveillance and AIS;
- continuous monitoring of vessel traffic within an OWF, direct or remote throughout the entire period of the construction, operation and decommissioning of an OWF;
- establishing of a coordination centre supervising the construction, operation and decommissioning of an OWF;
- maintaining regular communication lines between an OWF coordination centre and the coordinator of works at sea and other coordination centres such as Maritime Rescue Coordination Centre in Gdynia and maritime administration.

11.5 Design, technological and organisational safety provisions expected to be applied by the Applicant

Design, technological and organisational safety mainly relies on carrying out navigational risk assessments and developing prevention plans against:

- threats to human life – evacuation plans, search and rescue plans;
- fire hazards;
- threats of environmental pollution – a plan to counteract the threats and contamination by oil. The principle of the obligation to have a plan will apply not only to the facility, but also to all large and medium-sized vessels involved in the construction, operation and decommissioning of the OWF;
- threats of construction disasters – all structures are designed taking into account possible extreme conditions for at least double the operation period.

In addition, the Minister of Infrastructure, in Decision No. MFW/60.E.3 of 8 August 2023, obligated the Project Owner to meet a number of conditions and requirements for the implementation of the Project, some of which relate to the protection of people and the environment against the negative impact of the Project, i.e. to:

- present in the application for a building permit a plan for waste management at the survey station and at the accommodation and service station, if they are planned by the Project Owner in the form of a working platform;
- implement measures and actions aimed at reducing possible adverse effects on the environment and preventing contaminants from entering the marine environment, particularly through:

  a) using fully operational machines and equipment by authorised persons,

  b) providing appliances and equipment used to limit and collect possible leaks of contaminants from vessels,

  c) carrying out works in a way that prevents contaminants from entering sea waters, in particular using techniques that minimise the increased concentration of suspended solids in the water during works related to disturbing the structure of the seabed sediments,

d) applying techniques that minimise the impact of underwater noise on ichthyofauna as a result of the works carried out as part of the construction, operation and decommissioning of the Project,

e) immediate and day-to-day removal of all contaminants from the water, caused by the works carried out as part of the construction, operation and decommissioning of the Project,

f) removing petroleum hydrocarbons from the water surface by means other than mechanical only after obtaining the approval from the director of the relevant maritime office,

g) informing immediately the director of the relevant maritime office and the relevant harbour master's office about the events related to contamination or threat of contamination of sea waters,

h) ensuring proper management of solid or liquid waste generated in connection with the construction, operation and decommissioning of the Project in a way that allows avoiding contamination of the marine environment (waste from ships should be delivered to harbour reception facilities, while each of these operations should be documented in accordance with the appropriate regulations);

- ensure that the construction, operation and decommissioning of the Project is carried out in a manner that does not threaten the ecological function of spawning grounds and the survival of the early development stages of fish (eggs and larvae) of commercial species, and in relation to the linear elements of the technical infrastructure – to arrange the linear elements in a way that ensure space-efficient use of the area under the surface of the seabed (recommended to lay the cable at a depth of at least 70 cm), and, if this is impossible for environmental or technological reasons, to use other permanent protection (e.g. in the form of covers, concrete mattresses, rock material), enabling safe anchoring and the use of anchored gillnets;
- develop a technical expertise on the assessment of the impact of the Project and the complex of facilities on the State defence systems, including the radar imaging system, technical observation, maritime radio communications and the air traffic control system of the Armed Forces of the Republic of Poland;
- develop a technical expertise on the assessment of the impact of the Project and the complex of facilities on the radar imaging, technical observation and maritime radio communication systems of the Border Guard;
- report to the President of the Civil Aviation Authority, the Minister of National Defence and the minister responsible for internal affairs the detailed location and total height of the wind turbines, in accordance with the regulations issued pursuant to Article 92, item 2 of the Aviation Law;
- mark the offshore wind turbines in accordance with the regulations issued pursuant to Article 92, item 2 of the Aviation Law;
- secure all floating elements and structures during the construction, operation and decommissioning stages of the Project in such a way that there is no risk of their release.
- before commencing the planned works, provide the director of the relevant maritime office and the Hydrographic Office of the Polish Navy with information in the form of geodetic

coordinates of the Project and give sufficient advance notice of the commencement of the works, the expected date of their completion and the scope of work;

- before commencing the planned works, conduct a bathymetric survey of the area and for the presence of hazardous materials, wrecks and other underwater obstructions, and submit the survey results to the director of the relevant maritime office and the Hydrographic Office of the Polish Navy in order to agree on further work;
- develop a navigational expertise on the assessment of the impact of the Project and the complex of facilities on the safety and efficiency of ship navigation within Polish sea areas,
- develop a technical expertise on the assessment of the impact of the Project and the complex of facilities on the Polish sea areas A1 and A2 of the Global Maritime Distress and Safety Communications System (GMDSS) and the Operational Communications System of the Maritime Search and Rescue Service,
- develop a technical expertise on the assessment of the impact of the Project and the complex of facilities on the National Maritime Security System (NMSS),
- develop an emergency plan specifying the types of threats to the health and life of the personnel involved in the construction, operation and decommissioning of the Project and the complex of facilities, methods and operational procedures in the event of these threats, and the forces and resources provided by the manufacturer to implement this emergency plan,
- develop a plan for combating threats and contamination for the Project and the complex of facilities;
- agree with the director of the relevant maritime office, after obtaining a building permit, but before commencing work, on navigation safety conditions for the duration of the construction of the Project;
- develop and implement solutions for vessels involved in the construction, operation and decommissioning of the Project, minimising the risk of collisions between them and with the vessels engaged in regular navigation;
- include in the construction design of the Project the spacing of towers, other structures and infrastructure facilities ensuring the possibility of movement between them of vessels up to 50 m long, until the conditions for safe navigation are established by order of the territorially competent director of the maritime office, with the exception of navigation of vessels related to the operation and maintenance of the structures and facilities of the offshore wind farms and aquaculture;
- ensure the location of individual elements of the Project in the construction design, so that the free movement of the Polish Maritime Search and Rescue Service units is possible;
- prepare and agree with the director of the relevant maritime office on the design of the navigation markings for the duration of works related to the construction of the Project and the ultimate navigation markings of the Project, in accordance with the Regulation of the Minister of Transport, Construction and Maritime Economy of 4 December 2012 on navigation markings in Polish sea areas (Journal of Laws of 2013, item 57);
- prepare and agree with the director of the relevant maritime office on a schedule of construction works and keep the relevant harbour master's office informed about the commencement and completion of each stage of works and about any deviations from the schedule;

- provide information to the director of the relevant maritime office about the vessels and specialised equipment used in the construction, operation and decommissioning of the Project on a daily basis, in order to enable the monitoring of vessel traffic and the development of guidelines for the Project Owner regarding the appropriate navigational marking of sea basins and facilities;
- during the construction, operation and decommissioning of the Project, use only vessels with valid documents required by law and meeting the requirements for navigation safety and environmental protection, appropriately marked and equipped with communication devices (operating in the marine radio frequency bands) allowing for maintaining direct communication with the appropriate harbour master's office (the vessels used should keep the AIS transponder in continuous operation);
- if necessary, install, for the purpose of the Project, a base station of an automatic identification system (AIS) for vessels on the offshore wind farm prior to the commencement of operation, in consultation with the director of the relevant maritime office;
- deliver, for the purpose of updating nautical charts and publications, to the Hydrographic Office of the Polish Navy and to the director of the relevant maritime office, after the completion of each stage of the Project implementation and before the commencement of operation of the Project or its part:
    - bathymetric plan of the area and the obtained certificate of cleanliness of the seabed within the Project area, confirming the absence of underwater obstacles,
    - geodetic as-built documentation, discussed in Article 27, item 2 of the Act ,
    - documentation concerning the location of navigation markings for newly constructed facilities, determined using geodetic coordinates, taking into account the height of the navigation lights in relation to the average water level.

In addition, the Minister of Infrastructure specified that:

- during work in the Polish sea areas, in the event of discovering an item that is a potential historical monument, the director of the relevant maritime office should be notified without delay, while the principles set out in Article 32, section 1, points 1–3 and section 10 of the Act of 23 July 2003 on the protection and maintenance of historical monuments (Journal of Laws of 2022, item 840, as amended) should be followed concurrently;
- in relation to § 69, point 7; point 7; point c); the second indent of Annex 2 of the Maritime Spatial Plan of Polish Sea Areas, the Project Owner is obliged, when implementing the Project, to allow for the possibility of the vessels up to 250 m carrying out aggregate extraction in the sea basin POM.61.K passing safely through during the concession period for the aggregate extraction.

11.6 Other releases and emissions

The vessels involved in the Project will be a place of temporary storage of different materials or substances, including municipal waste and sewage. In the case of their possible release into the sea, it may lead to its pollution and the deterioration of the environment condition. The intensity and spatial extent of a negative environmental impact depend on the type of substances or materials released and on their amount. It is also possible that small amounts of oil and lubricants may be released during normal operation of vessels. In order to protect the marine environment against pollution, the vessels involved in the Project shall meet the requirements and the rules set out in the MARPOL Convention and the national rules, as well as the requirements of the classification societies under whose convection supervision these vessels operate.

12 QUANTITIES AND TYPES OF WASTE EXPECTED TO BE GENERATED AND THEIR IMPACT ON THE ENVIRONMENT

During the construction and decommissioning phases of the Baltica 1+ OWF, various types of waste associated with the operation of vessels and equipment used for construction and disassembly of the offshore wind farm will be generated, while during the operation phase, waste will be generated by vessels performing inspections and maintenance work. The types and quantities of waste to be generated are provided in Table 12.1–Table 12.3 and relate to the construction, operation and decommissioning of an OWF based on 25 MW wind turbine units. The waste names and codes are compliant with the Regulation of the Minister of Climate of 2 January 2020 *on the waste catalogue* (Journal of Laws of 2020, item 10). At this stage of the Project development, it is impossible to determine precisely the types or the quantities of waste to be generated; therefore, the tables include all theoretically possible types of waste and the estimates of their maximum expected quantities based on the information regarding the technology assumed to be used.

During the different phases of the Baltica 1+ OWF implementation, domestic sewage will be generated by the personnel working on board the vessels. The number of personnel will vary depending on the phase and operations conducted. It is expected that during the construction phase, a maximum of 550 people will be involved in the implementation of a single operation. The estimated duration of the construction activities will depend on the type of the wind turbines to be installed, and thereby, on the number of the structures under construction – 460 days in the case of erecting 47 wind turbines with a capacity of 25 MW each and 620 days in the case of erecting 79 wind turbines with a capacity of 15 MW each, whereas for the option with 84 wind turbines (RAO), the construction will require 660 working days. However, it should be noted that some activities will be conducted simultaneously.

As far as the operation phase is concerned, the presence of the personnel will result from the planned or ad hoc maintenance and repair works. It is envisaged that within one year, a team of 3 people and 2 workdays of maintenance work will fall on one wind turbine. During the decommissioning phase, a maximum of 460 people will be simultaneously involved in the operations. The duration of the decommissioning activities will depend on the number of wind turbines. It is expected that the duration of the dismantling activities will be equal to the duration of the construction activities, i.e. it will be 460 days if turbines with a capacity of 25 MW are installed, and 620 days in the case of turbines with a capacity of 15 MW. Assuming that one person uses 60 litres of water daily, 90% of which are part of domestic sewage, the estimated volume of domestic sewage generated during each phase will be:

- construction phase: 14 000 m^3 in the case of turbines with a capacity of 15 MW and 7500 m^3 in the case of turbines with a capacity of 25 MW;
- operation phase (per year): up to 10 m^3;
- decommissioning phase: 13 100 m^3 in the case of turbines with a capacity of 15 MW and 7000 m^3 in the case of turbines with a capacity of 25 MW.

Table 12.1. Overview of the estimated maximum quantities of waste to be generated per year during the Baltica 1+ OWF construction phase (Source: internal materials)

Types and quantities of waste expected during the construction phase		APO 47 25 MW turbines	RAO 84 14 MW turbines
Waste code (*hazardous waste)	Waste type	Estimated maximum quantities of waste to be generated [Mg/year]	
08	Wastes from manufacture, formulation, supply and use (MFSU) of coatings (paints, varnishes and vitreous enamels), adhesives, sealants and printing inks		
08 01	Wastes from the manufacture, formulation, supply and use (MFSU) and removal of paint and varnish		
08 01 11*	Waste paint and varnish containing organic solvents or other hazardous substances	0.3	0.7
08 01 12	Waste paint and varnish other than those mentioned in 08 01 11	0.1	0.3
12	Wastes from shaping and physical and mechanical surface treatment of metals and plastics		
12 01	Wastes from shaping and physical and mechanical surface treatment of metals and plastics		
12 01 13	Welding waste	2.6	6.5
13	Oil wastes and wastes of liquid fuels (except edible oils, and those included in groups 05, 12 and 19)		
13 01	Waste hydraulic oils		
13 01 09*	Mineral-based chlorinated hydraulic oils	0.7	1.0
13 01 10*	Mineral based non-chlorinated hydraulic oils	0.1	0.3
13 01 11*	Synthetic hydraulic oils	2.6	4.0
13 01 12*	Readily biodegradable hydraulic oils	1.3	2.0
13 01 13*	Other hydraulic oils	0.7	1.3
13 02	Waste engine, gear and lubricating oils		
13 02 04*	Mineral-based chlorinated engine, gear and lubricating oils	1.3	2.6
13 02 05*	Mineral-based non-chlorinated engine, gear and lubricating oils	1.3	2.6
13 02 06*	Synthetic engine, gear and lubricating oils	1.3	2.6
13 02 07*	Readily biodegradable engine, gear and lubricating oils	1.3	2.0
13 02 08*	Other engine, gear and lubricating oils	0.7	1.3
13 03	Waste insulating and heat transmission oils		
13 03 01*	Insulating or heat transmission oils containing PCBs	1.3	2.0
13 04	Bilge oils		
13 04 03*	Bilge oils from other navigation	6.6	8.0
13 05	Oil/water separator contents		
13 05 02*	Sludges from oil/water separators	14.0	16.0
13 05 06*	Oil from oil/water separators	14.0	16.0
13 05 07*	Oily water from oil/water separators	6.6	8.0
13 07	Wastes of liquid fuels		
13 07 01*	Fuel oil and diesel	14.0	20.0
13 07 02*	Petrol	0.7	0.8
13 08	Oil wastes not otherwise specified		
13 08 80	Oily solid waste from ships	2.6	4.0
14	Waste organic solvents, refrigerants and propellants (except 07 and 08)		
14 06	Waste organic solvents, refrigerants and foam/aerosol propellants		
14 06 01*	Chlorofluorocarbons, HCFC, HFC	0.1	0.1
14 06 02*	Other halogenated solvents and solvent mixtures	1.3	1.6
14 06 03*	Other solvents and solvent mixtures	1.3	1.6

Types and quantities of waste expected during the construction phase		APO 47 25 MW turbines	RAO 84 14 MW turbines
Waste code (*hazardous waste)	Waste type	Estimated maximum quantities of waste to be generated [Mg/year]	
15	Waste packaging; absorbents, wiping cloths, filter materials and protective clothing not otherwise specified		
15 01	Packaging (including separately collected municipal packaging waste)		
15 01 01	Paper and cardboard packaging	14.0	16.0
15 01 02	Plastic packaging	20.0	27.0
15 01 03	Wooden packaging	53.0	66.0
15 01 04	Metallic packaging	27.0	40.0
15 01 05	Composite packaging	27.0	40.0
15 01 06	Mixed packaging	27.0	40.0
15 01 07	Glass packaging	14.0	16.0
15 01 09	Textile packaging	5.0	8.0
15 02	Absorbents, filter materials, wiping cloths and protective clothing		
15 02 02*	Absorbents, filter materials (including oil filters not otherwise specified), wiping cloths (e.g. rags, wipes), protective clothing contaminated by hazardous substances (e.g. PCB)	2.6	4.0
15 02 03*	Absorbents, filter materials, wiping cloths (e.g. rags, wipes) and protective clothing other than those mentioned in 15 02 02	6.6	10.0
16	Wastes not otherwise specified		
16 01 14	Antifreeze fluids containing hazardous substances	95	110
16 06	Batteries and accumulators		
16 06 01*	Lead batteries	0	0
16 06 02*	Ni-Cd batteries	14.0	16.0
16 06 04	Alkaline batteries (except 16 06 03)	0.7	1.3
16 81	Waste resulting from accidents and unplanned events		
16 81 01*	Wastes exhibiting hazardous properties	0.1	0.3
16 81 02	Wastes other than those mentioned in 16 81 01	0.0	0.0
17	Wastes from construction, renovation and demolition of construction works and road infrastructure (including excavated soil from contaminated sites)		
17 01	Waste materials and building elements as well as road infrastructure (e.g. concrete, bricks, tiles and ceramics)		
17 01 82	Wastes not otherwise specified	2.6	5.5
17 02	Wood, glass and plastic		
17 02 01	Wood	2.6	4.0
17 02 02	Glass	0.7	1.3
17 02 03	Plastic	2.6	5.5
17 04	Waste and scrap metal and metal alloys		
17 04 01	Copper, bronze, brass	7.0	11.0
17 04 02	Aluminium	14.0	16.0
17 04 04	Zinc	1.3	1.6
17 04 05	Iron and steel	27.0	33.0
17 04 07	Mixed metals	1.3	1.6
17 04 11	Cables other than those mentioned in 17 04 10	1.3	2.6
17 09	Other construction and demolition wastes		
17 09 03*	Other construction and demolition wastes (including mixed wastes) containing hazardous substances	0.7	1.3

Types and quantities of waste expected during the construction phase		APO 47 25 MW turbines	RAO 84 14 MW turbines
Waste code (*hazardous waste)	Waste type	Estimated maximum quantities of waste to be generated [Mg/year]	
17 09 04	Mixed construction and demolition wastes other than those mentioned in 17 09 01, 17 09 02 and 17 09 03	27.0	33.0
19	Wastes from waste management facilities, off-site waste water treatment plants and the preparation of water intended for human consumption and water for industrial use		
19 08	Wastes from waste water treatment plants not otherwise specified		
19 08 05	Sludges from treatment of urban waste water	35.0	55.0
20	Municipal wastes (household waste and similar commercial, industrial and institutional wastes) including separately collected fractions		
20 01	Separately collected fractions (except 15 01)		
20 01 01	Paper and cardboard	20.0	27.0
20 01 02	Glass	14.0	20.0
20 01 08	Biodegradable kitchen and canteen waste	35.0	55.0
20 01 10	Clothes	14.0	20.0
20 01 21*	Fluorescent tubes and other mercury-containing waste	0.1	0.1
20 01 29*	Detergents containing hazardous substances	0.7	0.8
20 01 30	Detergents other than those mentioned in 20 01 29	0.7	0.8
20 01 33*	Batteries and accumulators included in 16 06 01, 16 06 02 or 16 06 03 and unsorted batteries and accumulators containing these batteries	14.0	16.0
20 01 34	Batteries and accumulators other than those mentioned in 20 01 33	1.3	2.6
20 01 36	Discarded electrical and electronic equipment other than those mentioned in 20 01 21, 20 01 23 and 20 01 35	1.3	1.6
20 03	Other municipal wastes		
20 03 01	Mixed municipal waste	26	26

Table 12.2. Overview of the estimated maximum quantities of waste to be generated per year during the Baltica 1+ OWF operation phase (Source: internal materials)

Types and quantities of waste to be generated during the OWF operation phase		APO (47 25 MW turbines)	RAO (84 14 MW turbines)
Waste code (*hazardous waste)	Waste type	Estimated maximum quantities of waste to be generated [Mg/year]	
08	Wastes from manufacture, formulation, supply and use (MFSU) of coatings (paints, varnishes and vitreous enamels), adhesives, sealants and printing inks		
08 01	Wastes from the manufacture, formulation, supply and use (MFSU) and removal of paint and varnish		
08 01 11*	Waste paint and varnish containing organic solvents or other hazardous substances	1	2
08 01 12	Waste paint and varnish other than those mentioned in 08 01 11	1	2
12	Wastes from shaping and physical and mechanical surface treatment of metals and plastics		
12 01	Wastes from shaping and physical and mechanical surface treatment of metals and plastics		
12 01 13	Welding waste	1	2

Types and quantities of waste to be generated during the OWF operation phase		APO (47 25 MW turbines)	RAO (84 14 MW turbines)
Waste code (*hazardous waste)	Waste type	Estimated maximum quantities of waste to be generated [Mg/year]	
13	Oil wastes and wastes of liquid fuels (except edible oils, and those included in groups 05, 12 and 19)		
13 01	Waste hydraulic oils		
13 01 09*	Mineral-based chlorinated hydraulic oils	6	8
13 01 10*	Mineral based non-chlorinated hydraulic oils	6	8
13 01 11*	Synthetic hydraulic oils	10	12
13 01 12*	Readily biodegradable hydraulic oils	6	8
13 01 13*	Other hydraulic oils	6	8
13 02	Waste engine, gear and lubricating oils		
13 02 04*	Mineral-based chlorinated engine, gear and lubricating oils	1.5	3
13 02 05*	Mineral-based non-chlorinated engine, gear and lubricating oils	1.5	3
13 02 06*	Synthetic engine, gear and lubricating oils	32	40
13 02 07*	Readily biodegradable engine, gear and lubricating oils	1.5	3
13 02 08*	Other engine, gear and lubricating oils	01.5	3
13 03	Waste insulating and heat transmission oils		
13 03 01*	Insulating or heat transmission oils containing PCBs	0	0
13 03 06*	Mineral-based chlorinated insulating and heat transmission oils other than those mentioned in 13 03 01	5	5
13 03 07*	Mineral-based non-chlorinated insulating and heat transmission oils	5	5
13 03 08*	Synthetic insulating and heat transmission oils other than those mentioned in 13 03 01	5	5
13 03 09*	Readily biodegradable insulating and heat transmission oils	5	5
13 04	Bilge oils		
13 04 03*	Bilge oils from other navigation	1.0	2.0
13 05	Oil/water separator contents		
13 05 02*	Sludges from oil/water separators	5.0	7.0
13 05 06*	Oil from oil/water separators	5.0	7.0
13 05 07*	Oily water from oil/water separators	5.0	7.0
13 07	Wastes of liquid fuels		
13 07 01*	Fuel oil and diesel	1	1
13 07 02*	Petrol	1	1
13 08	Oil wastes not otherwise specified		
13 08 80	Oily solid waste from ships	1	2
14	Waste organic solvents, refrigerants and propellants (except 07 and 08)		
14 06	Waste organic solvents, refrigerants and foam/aerosol propellants		
14 06 01*	Chlorofluorocarbons, HCFC, HFC	0.1	0.2
14 06 02*	Other halogenated solvents and solvent mixtures	0.7	1.0

Types and quantities of waste to be generated during the OWF operation phase		APO (47 25 MW turbines)	RAO (84 14 MW turbines)
Waste code (*hazardous waste)	Waste type	Estimated maximum quantities of waste to be generated [Mg/year]	
14 06 03*	Other solvents and solvent mixtures	0.5	1.0
15	Waste packaging; absorbents, wiping cloths, filter materials and protective clothing not otherwise specified		
15 01	Packaging (including separately collected municipal packaging waste)		
15 01 01	Paper and cardboard packaging	5.0	7.0
15 01 02	Plastic packaging	10.0	15.0
15 01 03	Wooden packaging	20.0	25.0
15 01 04	Metallic packaging	15.0	20.0
15 01 05	Composite packaging	15.0	25.0
15 01 06	Mixed packaging	15.0	25.0
15 01 07	Glass packaging	10.0	15.0
15 01 09	Textile packaging	5.0	7.0
15 02	Absorbents, filter materials, wiping cloths and protective clothing		
15 02 02*	Absorbents, filter materials (including oil filters not otherwise specified), wiping cloths (e.g. rags, wipes), protective clothing contaminated by hazardous substances (e.g. PCB)	5	7
15 02 03*	Absorbents, filter materials, wiping cloths (e.g. rags, wipes) and protective clothing other than those mentioned in 15 02 02	5	7
16	Wastes not otherwise specified		
16 01 14	Antifreeze fluids containing hazardous substances	91	104
16 06	Batteries and accumulators		
16 06 01*	Lead batteries	0.0	0.0
16 06 02*	Ni-Cd batteries	4	6
16 06 03*	Mercury-containing batteries	0.0	0.0
16 06 04	Alkaline batteries (except 16 06 03)	1	2
16 06 05	Other batteries and accumulators	4	6
16 81	Waste resulting from accidents and unplanned events		
16 81 01*	Wastes exhibiting hazardous properties	0.1	0.2
16 81 02	Wastes other than those mentioned in 16 81 01	0.05	0.1
17	Wastes from construction, renovation and demolition of construction works and road infrastructure (including excavated soil from contaminated sites)		
17 01	Waste materials and building elements as well as road infrastructure (e.g. concrete, bricks, tiles and ceramics)		
17 01 01	Waste concrete and concrete rubble from demolitions and renovations	0.65	0.91
17 01 03	Tiles and ceramics	0.65	0.91
17 01 07	Mixed waste from concrete, brick rubble, ceramic materials and elements of equipment other than those listed in 17 01 06	0.65	0.91
17 01 82	Wastes not otherwise specified	1.5	3.0
17 02	Wood, glass and plastic		

Types and quantities of waste to be generated during the OWF operation phase		APO (47 25 MW turbines)	RAO (84 14 MW turbines)
Waste code (*hazardous waste)	Waste type	Estimated maximum quantities of waste to be generated [Mg/year]	
17 02 01	Wood	1.5	3.0
17 02 02	Glass	0.5	0.7
17 02 03	Plastic	1.5	3.0
17 04	Waste and scrap metal and metal alloys		
17 04 01	Copper, bronze, brass	2.5	3.0
17 04 02	Aluminium	5.0	7.0
17 04 04	Zinc	0.1	0.2
17 04 05	Iron and steel	15.0	20.0
17 04 07	Mixed metals	1.0	1.5
17 04 11	Cables other than those mentioned in 17 04 10	1.0	1.5
17 09	Other construction and demolition wastes		
17 09 03*	Other construction and demolition wastes (including mixed wastes) containing hazardous substances	0.2	0.5
17 09 04	Mixed construction and demolition wastes other than those mentioned in 17 09 01, 17 09 02 and 17 09 03	5.0	7.0
19	Wastes from waste management facilities, off-site waste water treatment plants and the preparation of water intended for human consumption and water for industrial use		
19 08	Wastes from waste water treatment plants not otherwise specified		
19 08 05	Sludges from treatment of urban waste water	15.0	20.0
20	Municipal wastes (household waste and similar commercial, industrial and institutional wastes) including separately collected fractions		
20 01	Separately collected fractions (except 15 01)		
20 01 01	Paper and cardboard	10.0	15.0
20 01 02	Glass	7.0	4.0
20 01 08	Biodegradable kitchen and canteen waste	2.0	5.0
20 01 10	Clothes	2.5	5.0
20 01 21*	Fluorescent tubes and other mercury-containing waste	0.05	0.1
20 01 23*	Discarded equipment containing chlorofluorocarbons	0.05	0.1
20 01 29*	Detergents containing hazardous substances	0.05	0.1
20 01 30	Detergents other than those mentioned in 20 01 29	0.1	0.5
20 01 33*	Batteries and accumulators included in 16 06 01, 16 06 02 or 16 06 03 and unsorted batteries and accumulators containing these batteries	0.2	0.4
20 01 34	Batteries and accumulators other than those mentioned in 20 01 33	0.5	0.7
20 01 35*	Discarded electrical and electronic equipment other than those mentioned in 20 01 21 and 20 01 23 containing hazardous components (1)	0.1	0.2

Types and quantities of waste to be generated during the OWF operation phase		APO (47 25 MW turbines)	RAO (84 14 MW turbines)
Waste code (*hazardous waste)	Waste type	Estimated maximum quantities of waste to be generated [Mg/year]	
20 01 36	Discarded electrical and electronic equipment other than those mentioned in 20 01 21, 20 01 23 and 20 01 35	0.5	0.7
20 03	Other municipal wastes		
20 03 01	Mixed municipal waste	20	30

Table 12.3. Overview of the maximum estimated quantities of waste to be generated per year during the Baltica 1+ OWF decommissioning phase (Source: internal materials)

Types and quantities of waste expected during the OWF decommissioning phase		APO (47 25 MW turbines)	RAO (84 14 MW turbines)
Waste code (*hazardous waste)	Waste type	Estimated maximum quantities of waste to be generated [Mg/construction year]	
12	Wastes from shaping and physical and mechanical surface treatment of metals and plastics		
12 01	Wastes from shaping and physical and mechanical surface treatment of metals and plastics		
12 01 13	Welding waste	4.0	6.5
13	Oil wastes and wastes of liquid fuels (except edible oils, and those included in groups 05, 12 and 19)		
13 01	Waste hydraulic oils		
13 01 09*	Mineral-based chlorinated hydraulic oils	0.3	0.4
13 01 10*	Mineral based non-chlorinated hydraulic oils	0.15	0.3
13 01 11*	Synthetic hydraulic oils	2.6	3.3
13 01 12*	Readily biodegradable hydraulic oils	1.3	2.0
13 01 13*	Other hydraulic oils	0.3	0.7
13 02	Waste engine, gear and lubricating oils		
13 02 04*	Mineral-based chlorinated engine, gear and lubricating oils	0.7	1.0
13 02 05*	Mineral-based non-chlorinated engine, gear and lubricating oils	0.15	0.3
13 02 06*	Synthetic engine, gear and lubricating oils	0.7	1.3
13 02 07*	Readily biodegradable engine, gear and lubricating oils	0.3	0.4
13 02 08*	Other engine, gear and lubricating oils	0.15	0.3
13 03	Waste insulating and heat transmission oils		
13 03 01*	Insulating or heat transmission oils containing PCBs	2	2.6
13 04	Bilge oils		
13 04 03*	Bilge oils from other navigation	6.5	10.0
13 07	Wastes of liquid fuels		
13 07 01*	Fuel oil and diesel	0.7	1.0
13 07 02*	Petrol	0.15	0.3
13 08	Oil wastes not otherwise specified		
13 08 80	Oily solid waste from ships	0.7	1.0
14	Waste organic solvents, refrigerants and propellants (except 07 and 08)		
14 06	Waste organic solvents, refrigerants and foam/aerosol propellants		

Types and quantities of waste expected during the OWF decommissioning phase		APO (47 25 MW turbines)	RAO (84 14 MW turbines)
Waste code (*hazardous waste)	Waste type	Estimated maximum quantities of waste to be generated [Mg/construction year]	
14 06 01*	Chlorofluorocarbons, HCFC, HFC	0.15	0.15
14 06 02*	Other halogenated solvents and solvent mixtures	0.3	0.7
14 06 03*	Other solvents and solvent mixtures	0.15	0.3
15	Waste packaging; absorbents, wiping cloths, filter materials and protective clothing not otherwise specified		
15 01	Packaging (including separately collected municipal packaging waste)		
15 01 01	Paper and cardboard packaging	2.6	4.6
15 01 02	Plastic packaging	2.6	4.6
15 01 03	Wooden packaging	6.5	10.0
15 01 04	Metallic packaging	9.2	13.0
15 01 05	Composite packaging	2.6	3.3
15 01 06	Mixed packaging	6.5	10.0
15 01 07	Glass packaging	2.6	4.6
15 01 09	Textile packaging	1.3	2.6
15 02	Absorbents, filter materials, wiping cloths and protective clothing		
15 02 02*	Absorbents, filter materials (including oil filters not otherwise specified), wiping cloths (e.g. rags, wipes), protective clothing contaminated by hazardous substances (e.g. PCB)	1.3	2.0
15 02 03*	Absorbents, filter materials, wiping cloths (e.g. rags, wipes) and protective clothing other than those mentioned in 15 02 02	2	2.6
16	Wastes not otherwise specified		
16 01 14	Antifreeze fluids containing hazardous substances	520	650
16 06	Batteries and accumulators		
16 06 01*	Lead batteries	0	0
16 06 02*	Ni-Cd batteries	10.0	13.0
16 06 03*	Mercury-containing batteries	0	0
16 06 04	Alkaline batteries (except 16 06 03)	0.7	2
16 06 05	Other batteries and accumulators	0.15	0.3
16 81	Waste resulting from accidents and unplanned events		
16 81 01*	Wastes exhibiting hazardous properties	0	0
16 81 02	Wastes other than those mentioned in 16 81 01	0	0
17	Wastes from construction, renovation and demolition of construction works and road infrastructure (including excavated soil from contaminated sites)		
17 01	Waste materials and building elements as well as road infrastructure (e.g. concrete, bricks, tiles and ceramics)		
17 01 01	Waste concrete and concrete rubble from demolitions and renovations	380,000**	550,000**
17 01 03	Tiles and ceramics	0.15	0.3

Types and quantities of waste expected during the OWF decommissioning phase		APO (47 25 MW turbines)	RAO (84 14 MW turbines)
Waste code (*hazardous waste)	Waste type	Estimated maximum quantities of waste to be generated [Mg/construction year]	
17 01 07	Mixtures of concrete, bricks, tiles and ceramics other than those mentioned in 17 01 06	0.1	0.15
17 01 82	Wastes not otherwise specified	0.7	1.3
17 02	Wood, glass and plastic		
17 02 01	Wood	1.3	2.6
17 02 02	Glass	0.7	1.3
17 02 03	Plastic	6750	9250
17 04	Waste and scrap metal and metal alloys		
17 04 01	Copper, bronze, brass	1750***	1750***
17 04 02	Aluminium	1750***	1750***
17 04 04	Zinc	0.7	1.0
17 04 05	Iron and steel	135,000**	200,000**
17 04 07	Mixed metals	2.6	3.3
17 04 11	Cables other than those mentioned in 17 04 10	5.0	7.5
17 09	Other construction and demolition wastes		
17 09 03*	Other construction and demolition wastes (including mixed wastes) containing hazardous substances	0.3	0.4
17 09 04	Mixed construction and demolition wastes other than those mentioned in 17 09 01, 17 09 02 and 17 09 03	6.5	10.0
19	Wastes from waste management facilities, off-site waste water treatment plants and the preparation of water intended for human consumption and water for industrial use		
19 08	Wastes from waste water treatment plants not otherwise specified		
19 08 05	Sludges from treatment of urban waste water	20.0	26.0
20	Municipal wastes (household waste and similar commercial, industrial and institutional wastes) including separately collected fractions		
20 01	Separately collected fractions (except 15 01)		
20 01 01	Paper and cardboard	6.5	10.0
20 01 02	Glass	10.0	13.0
20 01 08	Biodegradable kitchen and canteen waste	20.0	23.0
20 01 10	Clothes	6.5	10.0
20 01 21*	Fluorescent tubes and other mercury-containing waste	0.1	0.15
20 01 23*	Discarded equipment containing chlorofluorocarbons	0.1	0.15
20 01 29*	Detergents containing hazardous substances	0.7	1.0
20 01 30	Detergents other than those mentioned in 20 01 29	0.26	0.35
20 01 33*	Batteries and accumulators included in 16 06 01, 16 06 02 or 16 06 03 and unsorted batteries and accumulators containing these batteries	13.0	20.0
20 01 34	Batteries and accumulators other than those mentioned in 20 01 33	0.3	0.7

Types and quantities of waste expected during the OWF decommissioning phase		APO (47 25 MW turbines)	RAO (84 14 MW turbines)
Waste code (*hazardous waste)	Waste type	Estimated maximum quantities of waste to be generated [Mg/construction year]	
20 01 35*	Discarded electrical and electronic equipment other than those mentioned in 20 01 21 and 20 01 23 containing hazardous components (1)	0.7	1.0
20 01 36	Discarded electrical and electronic equipment other than those mentioned in 20 01 21, 20 01 23 and 20 01 35	0.3	0.7
20 03	Other municipal wastes		
20 03 01	Mixed municipal waste	6.5	10.0

***the maximum values for different foundation types were given, these values will not occur simultaneously*
****as the cable material will not be known until DEC has been obtained, cable weights in both cases (Al and Cu) have been taken into account, these values will not occur simultaneously*

The Applicant shall require the contractors of all works related to the construction, operation and decommissioning of the offshore wind farm to comply with the legal requirements and good practices regarding waste and sewage management, with a particular focus on the opportunities resulting from segregation of waste and possible recovery of some of them.

During various phases of the Baltica 1+ OWF life, hazardous materials, including lubricating, fuel and hydraulic oils, will also be applied. All the vessels involved in the Baltica 1+ OWF construction, operation and decommissioning as well as the Baltica 1+ OWF structures shall be appropriately equipped with protective measures against spillage of these substances (e.g. trays capturing possible spillages of transformer oil) and measures to eliminate the effects of spillage of these substances (e.g. sorbents). The oil-polluted water produced during the works (e.g. during equipment cleaning or deck washing activities) shall be collected and separated to obtain oil-derivative concentrations below 15 ppm (in accordance with the MARPOL Convention) and the oil obtained from the separation process shall be stored and transferred in appropriate containers to specialised waste disposal companies.

The same shall apply in the case of other waste, including other hazardous waste – it shall be sorted, collected in specially marked and secured containers, transported ashore and transferred to specialised companies for utilisation. The domestic sewage generated onboard the vessels and in the dwelling spaces available at the wind turbines or in other Baltica 1+ OWF structures for short-term OSS occupancy by maintenance personnel in case of emergency during the construction, operation and decommissioning of the OWF shall be stored, pre-treated and dumped into the sea or transferred onshore for disposal in accordance with the MARPOL 73/78 Convention and the related regulations aimed at reducing pollution discharges from ships. Comminuted food waste shall be the only waste allowed to be dumped from ships underway at sea (en route). It is allowed to dump such waste from a ship at a distance of more than 12 NM (nautical miles) from the shore.

The OWF construction process will be planned in such a way as to minimise the amount of work related to the levelling or local dredging of the seabed, therefore no significant amounts of dredged material are expected. If it is necessary to carry out such works, the material from the seabed dredging and levelling will be managed in accordance with the conditions of the permit of the territorially competent director of the maritime office, within the development area of the Project or in another part of the sea area indicated in the permit. Obtaining a permit for the disposal of material from dredging into the sea will be subject to a separate procedure resulting from the Regulation of the Minister of Transport and Construction of 26 January 2006 *on the procedure for issuing permits for sea disposal of dredged material and for dumping waste or other substances at sea* (Journal of Laws of 2006, No. 22, item 166). The sediment resulting from excavating trenches for laying cable lines will be used for burying the cable lines laid in trenches.

The techniques applied when laying (sinking) cable lines in the seabed – ploughing, fluidisation of the seabed or trench excavating – are not sources of dredged material, and the soil possibly removed from the seabed shall be automatically used for covering a cable.

13 Dismantling works in the projects that may significantly affect the environment

There are no structures or installations within the area intended for the construction of the Baltica1+ OWF. Therefore, it will not be necessary to perform any dismantling work prior to the commencement of the construction phase.

14 SCOPE OF ENVIRONMENTAL SURVEYS FOR THE PURPOSE OF PREPARING AN EIA REPORT

As part of the procedure of obtaining a decision on environmental conditions, including in particular for the purpose of preparing an EIA Report, the Project Owner shall implement the scope of the annual environmental surveys. The scope of the surveys has been developed on the basis of many years of experience gained rom the surveys and environmental impact assessments conducted as part of the procedure of obtaining decisions on environmental conditions for other offshore wind farms in PSA, including: Bałtyk Środkowy II OWF, Bałtyk Środkowy III OWF, Baltica OWF, Baltica-1 OWF, Baltic Power OWF, BC-Wind OWF and FEW Baltic II. At the same time, the scope of the planned surveys allows for the fact that the Project Owner conducted surveys in the period between the end of November 2022 and the end of November 2023, which to a large extent cover the Baltica 1+ Area and its vicinity; thus, only supplement surveys of the Baltica 1+ OWF Area including its vicinity, which have not been conducted so far, are required.

The environmental surveys for the Baltica 1+ OWF Area including its neighbouring area include the annual surveys conducted by the Project Owner between the end of November 2022 and the end of November 2023 for the purposes of the implementation of a neighbouring project Baltica 1 OWF, which partially covered the Baltica 1+ OWF Area as well as the annual environmental surveys which will cover the area not covered by the surveys conducted between the end of November 2022 and the end of November 2023. The surveys carried out so far and the planned supplementation, of both the abiotic and biotic environments, taking into consideration the character of the Baltica 1+ OWF location, allow conducting an environmental impact assessment of the Project discussed within the scope specified in Article 66 of the Act of 3 October 2008 *on the provision of information on the environment and environmental protection, public participation in environmental protection and on environmental impact assessment*s (consolidated text: Journal of Laws of 2023, item 1094). The surveys conducted between the end of November 2022 and the end of November 2023 and those planned to be begin in the fourth quarter of 2023, will be carried out using the same survey methods, thanks to which it will be possible to gather their results and carry out analyses necessary for the purpose of conducting an environmental impact assessment. The adopted period of 12 full months of surveys (hydrological and meteorological, ichthyological as well as avifauna, marine mammals and bats) will provide necessary and fully representative data to characterise and assess the status of individual components throughout the year and to determine their variability, which depends on the phenological phenomena or, in the case of animate nature components, on their behaviour and activity changing throughout the year within the Project area and its impact area.

The spatial extent of the surveys covers the Project implementation area and its surroundings [Figure 14.1]. Due to the varying spatial extent of the survey of individual elements of the environment, it was assumed that the surveys will be conducted in the following areas:

- the area of the Project planned location;
- Area A – covering the area of the Project planned location including the adjacent area within an approx. 1.3 km radius, however, in the northern part, covering the shallowest part adjacent to the Natura 2000 site *Hoburgs bank och Midsjöbankarna* (SE0330308), the survey area has been extended to approx. 1.8 km from the boundary of the planned Project location;

- Area B – covering the area of the Project planned location including the adjacent area within an approx. 3.5 km radius, however, in the northern part, covering the shallowest part adjacent to the Natura 2000 site *Hoburgs bank och Midsjöbankarna* (SE0330308), the survey area has been extended to approx. 4 km from the boundary of the planned Project location.

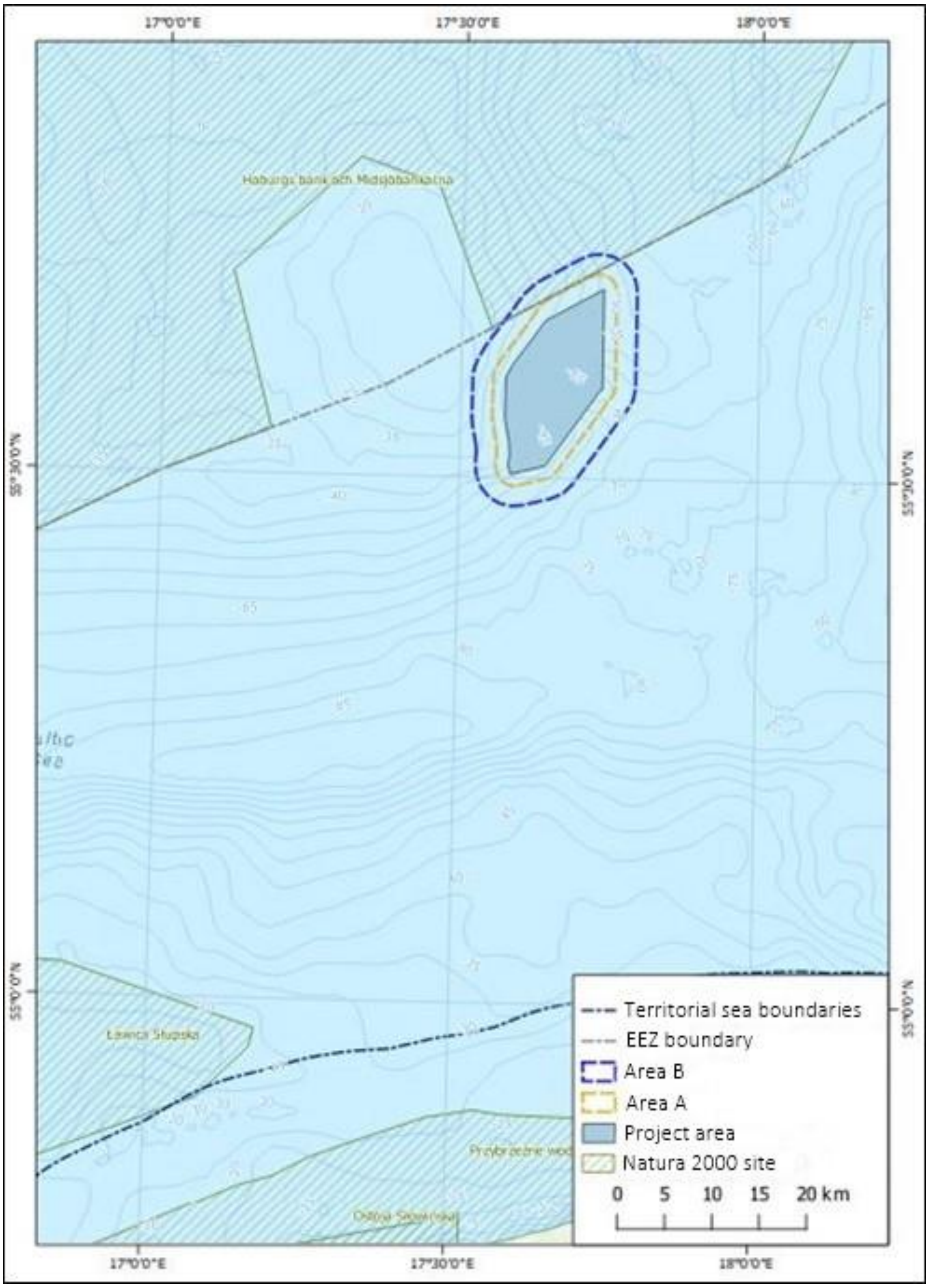

Figure 14.1. Location of the Baltica 1+ OWF Area including the survey area [source: internal materials]

The scope of surveys for Area A and Area B completed between the end of November 2022 and the end of November 2023 and the annual surveys planned to begin in the fourth quarter of 2023 is presented in Figure 14.2.

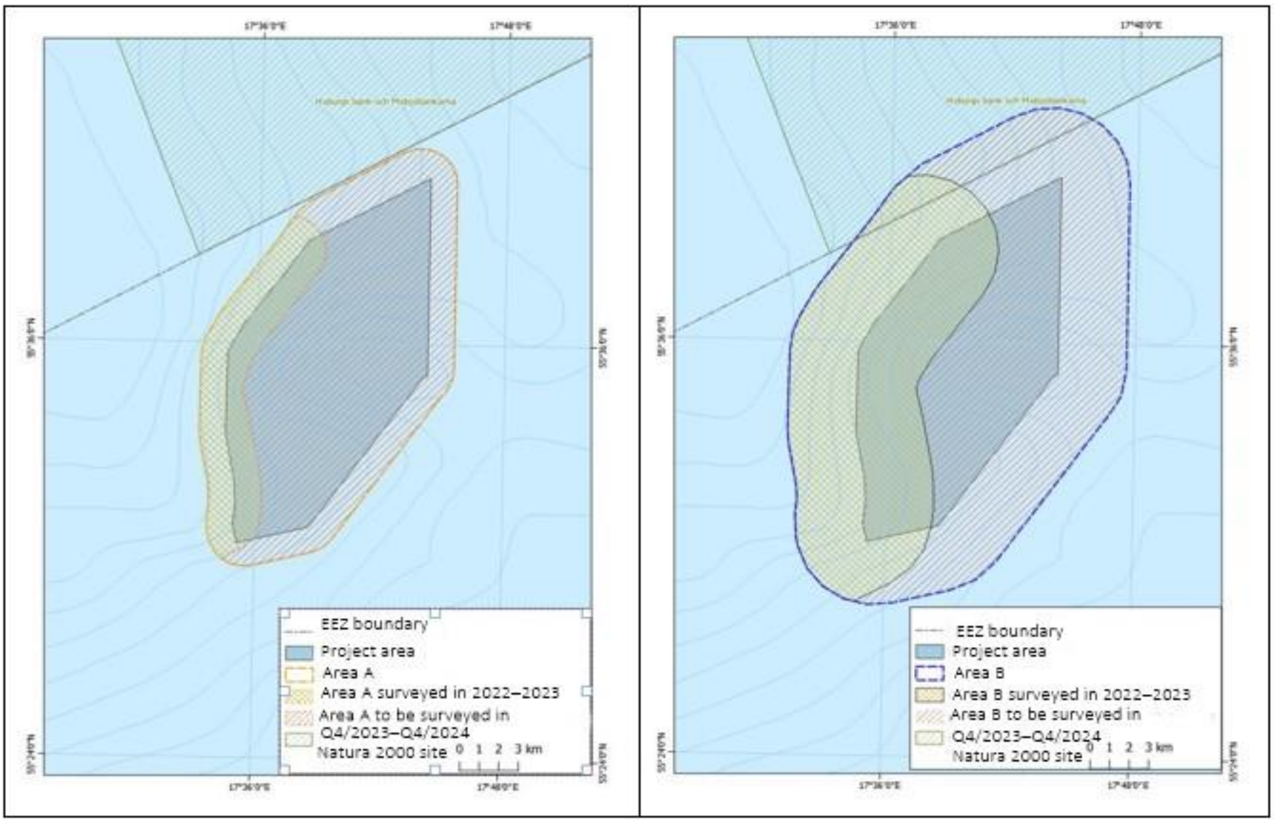

Figure 14.2. Spatial scopes of surveys conducted so far and planned to be conducted in Area A (left panel) and Area B (right panel) [source: internal materials]

The environmental survey results obtained will provide a complete set of data of sufficient representativeness, temporal and spatial resolution required to assess the environmental impact of the Project. The periods and frequency of the surveys conducted for the individual elements of the environment result from their character and temporal variability and take into consideration the phenological periods of animate nature components and the commonly used survey methodologies. The spatial scopes of the surveys conducted for individual elements have been based on the assumed scopes of the Project potential impact on such elements in each phase of the Project implementation. The results of the surveys conducted, including the available information and the literature data, will provide the basis for preparing a complete environmental characterisation for both the Baltica 1+ OWF Area as well as the Project potential impact area. The environmental status characterisation prepared in that way will allow conducting a complete impact assessment, in accordance with the methodological requirements concerning analyses and calculations necessary to determine the environmental effects, which could be caused by the implementation of the Baltica 1+ OWF. Ultimately, the results obtained from the environmental surveys and analyses as well as the assessments conducted will be sufficient to determine the potential activities that could minimise the Project impact and to indicate the scopes of surveys to be carried out in the Project construction, operation and decommissioning phases.

The environmental surveys conducted for the purpose of performing an environmental impact assessment as part of the procedure of obtaining the decision on environmental conditions will be carried out as part of individual survey blocks described below.

As part of the geophysical surveys within the area of the Baltica 1+ OWF location including an approx. 1.3 km (Area A) delineated around the Project area, the following surveys will be carried out once: bathymetric surveys, sonar surveys, magnetometer surveys, surveys of man-made objects and seabed sediment shallow seismo-acoustic profiling; whereas, within the Baltica 1+ OWF Development Area, the following surveys will be carried out: single- and multi-channel seismic surveys as well as soil core sampling and seabed sediment sampling. The results obtained from the geological surveys will allow developing bathymetric and sonar maps as well as identifying the objects in the seabed that could affect further implementation of the Project, in particular, the surveys will allow determining the seabed relief and structure as well as the geological structure of the area. On the basis of the geophysical data obtained and on the basis of the seabed sediment geological surveys, the potential raw material resources (natural aggregates) within the survey area will be identified. Moreover, the results of the geophysical surveys will constitute detailed information on the nature of seabed habitats, which will be used for the final determination of the benthic organism sampling locations and to interpret the results obtained from benthos surveys and seabird surveys, as well as to assess the impact of the suspended solids entered into the water column associated with the seabed interference. The environmental impact assessment will utilise the results of the surveys conducted between the end of November 2022 and the end of November 2023 by the Project Owner for the purposes of the neighbouring project Baltica-1 OWF.

As part of the hydrological and meteorological surveys including sea currents conducted during 12 full months, through continuous monitoring in the area of the Baltica 1+ OWF location including an approx. 1.3 km zone (Area A), the measurements of the following parameters will be carried out: water flow velocity and direction, wave height and period, water column thickness, water electrical conductivity, water turbidity and water temperature. Moreover, data on air humidity, atmospheric pressure, wind speed and direction as well as air temperature collected during the surveys (11.2022–11.2023) conducted for the Baltica-1 OWF will be used in the analyses made for the purposes of an environmental impact assessment. Additionally, survey data from the current profilers located within the Baltica-1 OWF Area, collected between the end of November 2022 and the end of November 2023, will be used to construct the model of wave motion and sea currents used to assess the suspended solids dispersion. Moreover, within the Baltica 1+ OWF Area, on the basis of the information available from the Baltic Sea ice services, the ice conditions will be determined for the period of the meteorological and hydrological parameter recording in winter. The obtained survey results will enable developing a detailed characterisation of the hydrological and meteorological conditions present in the Project area. The results of hydrological measurements will be used for modelling the suspended solids dispersal in the water column and their sedimentation as a result of the work conducted that disturbs the seabed sediments. Moreover, the results obtained will constitute sufficient information on the hydrological conditions, necessary for the analysis and interpretation of the results of biotic surveys with regard to benthic organisms and ichthyofauna.

As part of the water physico-chemical surveys in the area of the Baltica 1+ OWF Project location including an approx. 1.3 km zone delineated around the Project area (Area A), the oxygen conditions will be determined six times per year through the measurements of the dissolved oxygen content, five-day oxygen demand (BOD_5) and total organic carbon (TOC) concentration. Moreover, the measurements of the water acidity (pH) and alkalinity as well as the nutrient content (ammoniacal nitrogen, nitrate nitrogen, nitrite nitrogen, total nitrogen, mineral nitrogen, phosphates and total phosphorus as well as total suspended solids) will be carried out. The content of harmful substances, i.e. mercury, nickel, lead, cadmium, arsenic, total chromium (VI), phenols, cyanide, aluminium, mineral oils, polycyclic aromatic hydrocarbons (PAH), and polychlorinated biphenyls (PCBs) will be determined once. In summer, the activity of radioactive caesium (^{137}Cs) and strontium (^{90}Sr) isotopes will be measured. With regard to the spatial scope covering the Baltica 1+ Area including a zone with a width of not less than 1.3 km, the analysis will take into consideration the results of the surveys carried out by the Project Owner within that area between November 2022 and November 2023. The results obtained from the physico-chemical surveys of water will enable developing a detailed characterisation of the survey area, in the context of the Project environmental impact assessment. They will also allow the interpretation of the results obtained from the surveys on benthic organisms and ichthyofauna.

As part of the physico-chemical surveys of the seabed sediment in the area of the Project location, the measurements of the following parameters will be carried out in winter: humidity, loss on ignition (LOI), organic carbon content, heavy metal content (lead, copper, zinc, nickel, cadmium, chromium, arsenic, mercury and aluminium) as well as their labile form content; concentrations of polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs); content of nutrients (total nitrogen and total phosphorus), mineral oils, butyltin (BT) compounds and radioactivity of caesium (^{137}Cs). In summer, the content of nutrients (total nitrogen and total phosphorus) as well as *in situ* resistivity will be measured. The survey area was adjusted to the area in which the seabed interference would take place as a result of the work conducted, and thus suspended solids and substances contained within the sediments would be released to the water column The results obtained from the physico-chemical surveys of the seabed sediment will enable developing a detailed characterisation of the survey area, in the context of the Project environmental impact assessment. They will also be used to assess the risk of the release of the chemical compounds surveyed as a result of the seabed disturbance and the threat they will pose to the biotic elements of the marine environment.

Ambient noise measurements will be carried out at a single survey station within the Baltica 1+ OWF Area throughout a single year. The frequency band of the sounds recorded shall be from 2 Hz to at least 22 kHz. This range is sufficient to record the vast majority of underwater sounds, both of natural and anthropogenic origin. These include underwater explosions (6–21 Hz), seismic noise (10–120 Hz), pile-driving noise (100–1000 Hz), as well as noise generated by ship traffic (OSPAR, 2009; Van der Graaf *et al*., 2012). The devices will record sounds in a predetermined frequency range (from 2 Hz to at least 22 kHz) and at specified intervals. The monitoring cycle will consist of recording the acoustic signals for 1 minute, followed by a 9-minute break (6 recordings per 1 hour), i.e. the so-called 10% duty cycle or higher, e.g. 25% duty cycle. Such a time interval of recordings is intended to enhance the effectiveness of data collection (at different wind speeds). In accordance with the BSH guidelines (2011), ambient noise monitoring includes at least 3 hours of recordings for various wind speeds (corresponding to the sea state 1 and two selected higher sea states). The analysis of the results obtained will allow calculating the noise levels in 1/3 octave bands with 63 and 125 Hz centre frequencies, which are indicated in the Marine Strategy Framework Directive (MSFD) as ambient noise indicators in the marine environment. The results obtained from the measurements will allow developing a detailed characterisation of the survey area, also in the context of the Project environmental impact assessment.

Within the area of the Baltica 1+ OWF location including an approx. 1.3 km zone delineated around the Project location area (Area A), phytobenthos surveys will be carried out intended to verify its presence there. If phytobenthos is found and sampling is possible, its taxonomic composition and biomass will be determined. The results obtained will allow developing a characterisation of the survey area in the context of the assessment of the Project impact on phytobenthos communities. In order to characterise phytobenthos in the area analysed, data obtained by the Project Owner as part of the surveys conducted in 2023 will be used.

Zoobenthos surveys will be carried out within the area of the Baltica 1+ OWF location including an approx. 1.3 km zone delineated around the Project location area (Area A). As part of those surveys, the taxonomic composition, abundance and biomass of zoobenthos will be determined and bivalve lengths will be measured in the context of food supply for seabirds. The results obtained will allow developing a characterisation of the survey area in the context of the assessment of the Project impact on zoobenthos communities. Information on the abiotic conditions, i.e. hydrological, geochemical and geophysical conditions prevailing within the survey area, used for the interpretation of the results from zoobenthos surveys, will be determined on the basis of the results of surveys of those environmental elements carried out as part of the above-mentioned abiotic component surveys.

Within the area of the Baltica 1+ OWF location including a zone with a width of approx. 3.5 km (Area B), ichthyofauna surveys covering ichthyoplankton, pelagic fish and demersal fish, will be carried out four times (i.e. one survey covering all elements in each season of the year). In the case of ichthyoplankton, its taxonomic composition and abundance will be determined. In the case of fish, in the course of both pelagic and demersal catches, the following will be determined: taxonomic composition, number of fish from individual species, species distribution, density and catch efficiency. Biological data such as length, age, sex, weight, sexual maturity, degree of fish stomach fullness will also be acquired with particular focus on the target species. Moreover, surveys regarding the concentration of herring, including the determination of their weight and total length, will be carried out twelve times, i.e. 4 surveys in the period between March and April and 8 surveys in the period between August and November. The results obtained from the surveys, including the results of ichthyofauna surveys conducted by the Project Owner between the end of November 2022 and the end of November 2023 in part of Area B as well as an analysis of literature and the available data describing the results of the multi-annual ichthyofauna surveys, including, in particular, the surveys on fish stock status (ICES studies), migration, locations of fish spawning and feeding grounds (HELCOM studies), will allow developing a characterisation of the survey area in the context of the assessment of the Project impact on fish communities, including the locations significant for their functioning, i.e. feeding and spawning grounds.

The marine mammal surveys will be carried out by continuous monitoring using C-PODs and F-PODs for one year in the area of the Baltica 1+ OWF location and in the adjacent area at a distance of approx. 1.3 km (Area A). Additionally, the results of the surveys conducted between the end of November 2022 to the end of November 2023 within the area surrounding the Baltica 1+ OWF location, where C-PODs and F-PODs were deployed at a distance of 38 km from the area of the Baltica 1+ OWF location, will be used to characterise the activity of marine mammals. Passive acoustic monitoring will enable the assessment of the occurrence and activity of harbour porpoises in the survey area. On its basis, the variability in the occurrence of harbour porpoises throughout the year will be determined. For that purpose, the following indices will be determined: detection positive days (DPD) and detection positive minutes (DPM). Moreover, observations of marine mammals will be carried out eight times throughout the year. Additionally, the observations for the presence of marine mammals will be carried out from aboard vessels during the seabird surveys (twice a month throughout one year). The characterisation of the survey area will also include the literature data and the results of other international surveys, for example, SAMBAH *Static Acoustic Monitoring of the Baltic Sea Harbour Porpoise*. The data will also be used to indicate the possible routes of marine mammal movements. The significance of the Baltica 1+ OWF Area to individual species will be specified after the results from passive acoustic monitoring and marine mammal observations from air and from vessels have been taken into consideration. The results obtained will allow developing a characterisation of the survey area in the context of the assessment of the Project impact on marine mammals.

The avifauna surveys will cover seabirds (sitting on the water and in flight) and migratory birds. The survey area of the seabird surveys will cover the area of the Baltica 1+ OWF location including a zone with a width of approx. 3.5 km (Area B). In order to characterise the avifauna composition within the Baltica 1+ OWF Area, the results of the surveys conducted between the end of November 2022 and the end of November 2023 will be taken into consideration. In that period, the surveys cover the western part of the Baltica 1+ OWF Area. The surveys will be carried out twice per month throughout the year and will include determining the taxonomic composition, abundance and distribution of the birds sitting on the water as well as recording the birds in flight. The surveys of the migratory birds and the birds in flight will be carried out at two survey stations, from which visual observations will be conducted intended to determine the taxonomic composition, flight intensity and directions of bird flights. Moreover, at one survey station, two types of radars will be used a horizontal radar, used to determine the flight trajectory, and a vertical radar, used to determine the flight altitudes. Acoustic recordings will also be made during the migration periods in order to identify the taxonomic composition. The surveys of migratory birds will be carried out throughout a single year, including winter (December–February) – 9 all-day inspections; spring migration (March–May) and autumn migration (15 July–November) − 20 all-day observations in each migration period. The results obtained will allow developing a characterisation of the survey area in the context of the assessment of the Project impact on seabirds and migratory birds, including determining the significance of the survey area in terms of space used by birds. Moreover, they will be used for the analysis of bird collisions with the above-water structural elements of the Baltica 1+ OWF, the assessment of the barrier effect and the potential displacement of animals from the area as well as changes in bird density.

As part of the chiropterofauna surveys, the taxonomic composition and bat activity will be determined in the area of the Baltica 1+ OWF location including a zone with a width of approx. 1.3 km (Area A). The surveys will be carried out during two survey periods throughout one year, i.e. during the spring migration (April–May) and the autumn migration (August–October). At least seven all-night inspections along transects and two all-night inspections at survey stations will be carried out for both those migration periods. The surveys planned to be carried out in the eastern part of Area A at the survey stations and at the same time along the transects as well as the surveys carried out during the spring and autumn migrations in 2023 by the Project Owner in the western part of Area A will enable full spatial coverage of the entire Baltica 1+ OWF Area including its potential impact zone. The results obtained will allow developing a characterisation of the survey area in the context of the assessment of the Project impact on bats, including determining the significance of the survey area in terms of space used by them.

All surveys and measurements will be conducted in accordance with the applicable regulations, standards and methodologies as well as the existing literature on the subject, in particular, in the scope of:

1. geophysical surveys:

    - ASTM, D7128-05, Standard Guide for Using the Seismic-Reflection Method for Shallow Subsurface Investigation, 2010;
    - ASTM Annual Book of Standards – soil and rock investigations, vol. 4.08, 1999;
    - BS 1377-2 Methods of test for soils for civil engineering purposes. Classification tests;
    - IHO, Standards for Hydrographic Surveys, Special Publication of IHO No. 44, edition 6;
    - IMO, ISM Code with guidelines for its implementation, 1998, International Convention for the Safety of Life at Sea (SOLAS), (version of 1 January 2017);
    - ISO 9000: Standards on quality management and quality assurance;
    - UNESCO Convention on the Protection of the Underwater Cultural Heritage, adopted on 2 November 2001 at the 31st UNESCO General Conference in Paris;
    - International Convention for the Prevention of Pollution from Ships (MARPOL), 1973, adopted in London on 2 November 1973, (version of 1 November 2022);
    - PN-EN ISO 14688-1:2018-05, Geotechnical investigation and testing – Identification and classification of soil – Part 1: Identification and description;
    - PN-EN ISO 14688-2:2018-05, Geotechnical investigation and testing – Identification and classification of soil – Part 2: Principles for a classification;
    - PN-EN ISO 17892-1:2015-02, Geotechnical investigation and testing – Laboratory testing of soil – Part 1: Determination of water content;
    - PN-EN ISO 17892-12:2018-08, Geotechnical investigation and testing – Laboratory testing of soil – Part 12: Determination of liquid and plastic limits;
    - PN-EN ISO 17892-2:2015-02, Geotechnical investigation and testing – Laboratory testing of soil – Part 2: Determination of bulk density;
    - PN-EN ISO 17892-3:2016-03, Geotechnical investigation and testing – Laboratory testing of soil – Part 3: Determination of particle density;
    - PN-EN ISO 17892-4:2017-01, Geotechnical investigation and testing – Laboratory testing of soil – Part 4: Determination of particle size distribution;
    - PN-EN ISO 17892-6:2017-06, Geotechnical investigation and testing – Laboratory testing of soil – Part 6: Fall cone test;
    - PN-EN ISO 17892-8:2018-05, Geotechnical investigation and testing – Laboratory testing of soil – Part 8: Unconsolidated undrained triaxial test;
    - PN-EN ISO 19901-8 Petroleum and natural gas industries – Specific requirements for offshore structures – Part 8: Seabed surveys;

- BS 1377-3: 2018, Methods of test for soils for civil engineering purposes – Chemical and electro-chemical testing;
- ASTM D 5334-14, Standard Test Method for Determination of Thermal Conductivity of Soil and Soft Rock by Thermal Needle Probe Procedure;
- ASTM D4373-21, Standard Test Method for Rapid Determination of Carbonate Content of Soils;
- UKOOA, Guidelines for the use of DGPS in offshore surveying, September 1994, DGPS Guidelines – procedures and statistics, 1996;
- Regulation of the Minister of Maritime Economy and Inland Navigation of 13 April 2016 on submitting survey data to a hydrographic service;
- Act of 23 July 2003 on the protection and conservation of monuments;

2. hydrological and meteorological surveys including sea currents:

- Fofonoff N.P., Millard R.C. Jr., Algorithms for computation of fundamental properties of seawater, UNESCO technical papers in marine science, vol. 44, UNESCO/SCOR/ICES/IAPSO Joint Panel on Oceanographic Tables and Standards and SCOR Working Group 51, 1983;
- Manual for Marine Monitoring in the COMBINE Programme of HELCOM, HELCOM, 2013, Climate change in the Baltic Sea Area: HELCOM thematic assessment in 2013, Balt. Sea Environ. Proc. 2013, No. 137;
- World Meteorological Organization, Guide to wave analysis and forecasting, WMO-No. 8, Geneva 2018;

3. surveys of physico-chemical properties of water:

- Błeńska M., Bogdaniuk M., Brzeska P., Bubak I., Dembska G., Dubiński M., Kruk-Dowgiałło L., Michałek M., Nowacki J., Olenycz M., Opioła R., Sapota G., Tarała A., Wykonanie kompleksowych poinwestycyjnych badań i pomiarów w rejonie Mechelinek w celu monitorowania wód Zatoki Puckiej w związku ze zrzutem solanki pochodzącej z budowy PMG Kosakowo, L. Kruk-Dowgiałło, J. Nowacki, M. Błeńska (ed.), Internal Publications of the MI in Gdańsk No. 6732, 2010;
- HELCOM, Annex B-15. Technical note on the measurement of total alkalinity in seawater, 2012, § Guidelines for monitoring waterborne pollution loads to the Baltic – measurement of alkalinity, 2012;
- Manual for Marine Monitoring in the COMBINE Programme of HELCOM; HELCOM, Environment of The Baltic Sea area 1994-1998, Baltic Sea Environment Proceedings No. 82B, Helsinki Commission, 2002 – results of water monitoring;
- Miętus M., Sztobryn M. (eds.), Stan środowiska polskiej strefy przybrzeżnej Bałtyku w latach 1986–2005. Wybrane zagadnienia (edition 1), Institute of Meteorology and Water Management – National Research Institute 2011;
- Regulation of the Minister of Infrastructure of 13 July 2021 on the forms and methods of conducting the monitoring of surface and underground water bodies (Journal of Laws of 2021, item 1576);

- Zalewska T., Jakusik E., Łysiak-Pastuszak E., Krzymiński W. (eds.), Bałtyk Południowy w 2011 roku. Charakterystyka wybranych elementów środowiska (edition 1), Institute of Meteorology and Water Management – National Research Institute 2012;
- Regulation of the Minister for Infrastructure of 25 June 2021 on the classification of ecological status, ecological potential and chemical status and the method of classification of the status of surface water bodies and the environmental quality standards for priority substances (Journal of Laws of 2021, item 1475);

4. surveys of physico-chemical properties of sediment:

- Guidelines for the sampling and analysis of dredged material intended for disposal at sea, Section 5. "Building a sampling plan – detailed considerations", point 5.5, Sample number and location (OIMO, 2005);
- HELCOM Baltic Sea Action Plan, HELCOM Ministerial Meeting Cracow, 15.11.2007 – document "Indicators and targets for monitoring and evaluation of implementation of the Baltic Sea Action Plan";
- HELCOM Guidelines for the Management of Dredged Material at Sea and HELCOM Reporting Format for Management of Dredged Material at Sea, March 2015 (update in March 2020) – point 5. Dredged Material Sampling;
- The Convention on the Protection of the Marine Environment of the Baltic Sea Area signed in Helsinki on 9 April 1992 (Journal of Laws of 2000, No. 28, item 346) – Annex I Harmful substances;
- PN-EN ISO 5667-19:2006 Water quality – Sampling – Part 19: Guidance on sampling of marine sediments;
- PN-EN ISO 5667-1:2008 Water quality – Sampling – Part 1: Guidance on the design of sampling programmes and sampling techniques;
- PN-EN ISO 14688-1:2018-05 Geotechnical investigation and testing – Identification and classification of soil – Part 1: Identification and description;
- PN-EN ISO 14688-2:2018-05 Geotechnical investigation and testing – Identification and classification of soil – Part 2: Principles for a classification;
- PN-EN ISO 17892-4:2017-01 Geotechnical investigation and testing – Laboratory testing of soil – Part 4: Determination of particle size distribution;
- Regulation of the Minister of Maritime Economy and Inland Navigation of 1 March 2019 on priority substances (Journal of Laws of 2019, item 528);
- Regulation of the Minister of Infrastructure of 13 July 2021 on the forms and methods of conducting the monitoring of surface and underground water bodies (Journal of Laws of 2021, item 1576) – Annex 4 and Annex 8;
- Regulation of the Minister of the Environment of 11 May 2015 on the recovery of waste outside the installations and facilities (Journal of Laws of 2015, item 796);
- Waste Management Act of 14 December 2021 (consolidated text: Journal of Laws of 2021, item 779, as amended) – Annex 4. Components due to which waste is classified as hazardous.

5. surveys on the occurrence of raw materials:

- Dadlez R., Przekroje geologiczne, utwory przedkenozoiczne, [in:] Mojski J.E. (ed.), Atlas geologiczny południowego Bałtyku, Table X, Polish Geological Institute, Sopot-Warsaw 1995;
- Gudelis W. K., Jemielianow J. M., Geologia Morza Bałtyckiego, Wydawnictwa Geologiczne, Warsaw, 1982;
- Jurys L., Przezdziecki P., Metodyka dokumentowania bałtyckich złóż kruszywa naturalnego. Górnictwo Odkrywkowe 2006, 1–2: 166–173;
- Kramarska R., Jegliński W., Jurys L., Przezdziecki P, Uścinowicz S., Zachowicz J., Atlas parametrów litologicznych osadów powierzchniowych południowego Bałtyku ze szczególnym uwzględnieniem geologiczno-górniczych warunków występowania surowców okruchowych, Złoża i obszary perspektywiczne surowców okruchowych, Table XVII, Polish Geological Institute, Gdańsk 2005;
- Kramarska R., Krzywiec P., Dadlez R., Mapa geologiczna dna Bałtyku bez utworów czwartorzędowych, 1:500 000, Polish Geological Institute, Gdańsk–Warsaw 1999;
- Kramarska R., Osady na głębokości 1 m poniżej powierzchni dna, [in:] Mojski J.E. (ed.), Atlas geologiczny południowego Bałtyku, Table XXI, Polish Geological Institute, Sopot–Warsaw, 1995a;
- Kramarska R., Osady powierzchni dna, [in:] Mojski J.E. (ed.), Atlas geologiczny południowego Bałtyku, Table XXV, Polish Geological Institute, Sopot–Warsaw 1995b;
- Kramarska R., Przezdziecki P., Uścinowicz S., Zachowicz J., Przekroje geologiczne (I), [in:] Mojski J.E. (ed.), Atlas geologiczny południowego Bałtyku, Table XXIV, Polish Geological Institute, Sopot–Warsaw 1995;
- Mojski J.E. (ed.), Atlas geologiczny południowego Bałtyku, Polish Geological Institute, Sopot–Warsaw, 1995;
- Nieć M., Lamberger M., Radwanek-Bąk B., Górecki P., Metodyka dokumentowania złóż kopalin stałych, Part I, Poszukiwanie i rozpoznawanie złóż, Planowanie i organizacja prac geologicznych, Publishing House of the Mineral and Energy Economy Research Institute of the Polish Academy of Sciences, Krakow 2012;
- Pikies R., Morfogeneza dna, [in:] Mojski J.E. (ed.), Atlas geologiczny południowego Bałtyku, Table XXIV, Polish Geological Institute, Sopot–Warsaw 1995;
- Przezdziecki P., Seismostratigraphy of Quaternary Sediments in the Polish Part of the Baltic Sea, Bulletin of Polish Geological Institute 2004, 413: 8–126;
- Regulation of the Minister of the Environment of 1 July 2015 on the geological documentation of mineral deposits, excluding hydrocarbon deposits (Journal of Laws of 2015, item 987);
- Uścinowicz S., Miąższość plejstocenu, [in]: Mojski J.E. (ed.), Atlas geologiczny południowego Bałtyku, Table XIII, Polish Geological Institute, Sopot–Warsaw 1995;
- Uścinowicz S., Zachowicz J., Mapa geologiczna dna Bałtyku w skali 1:200 000, sheets: Łeba, Słupsk, PGI–NRI, Warsaw 1988;
- Uścinowicz S., Zachowicz J., Objaśnienia do mapy geologicznej dna Bałtyku w skali 1:200 000, sheets: Łeba, Słupsk, PGI–NRI, Warsaw 1991;
- Act of 9 June 2011 – Geological and Mining Law (Journal of Laws of 2022, item 1072, as amended);

6. ambient noise monitoring:

- Ainslie M., Dekeling R.P.A., Proposals for TG Noise 2019 update, TG-Noise meeting, Brussels, Belgium, 6 November 2018;
- ANSI, ANSI/ASA S1.11-2004 (R2009) Specification For Octave-band and Fractional-octave-band Analog and Digital Filters, American National Standards Institute, 2009;
- Betke K., Folegot T., Matuschek R. *et al.*, BIAS Standards for Signal Processing. Aims, Processes and Recommendations, Verfuss U.K., Sigray P. (eds.), amended version, 2015;
- Bundesamt für Seeschifffahrt und Hydrographie (BSH), Offshore-windparks. Messvorschrift für unterwasserschallmessungen. Aktuelle vorgehensweise mit anmerkungen. Anwendungshinweise, Hamburg 2011;
- Dekeling R.P.A., Tasker M.L., Van der Graaf A.J. et al., Monitoring Guidance for Underwater Noise in European Seas. Part I: Executive Summary, JRC Scientific and Policy Report EUR 26557 EN, Publications Office of the European Union, Luxembourg 2014;
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- IEC 61260-1:2014, Electroacoustics – Octave-band and fractional-octave-band filters. Part 1: Specifications, International Electrotechnical Commission, Geneva, Switzerland 2014;
- Johansson T.A., Andersson M.H., Ambient underwater noise levels at Norra Midsjöbanken during construction of the Nord Stream pipeline, Nord Stream AG and Naturvårsverket, Stockholm 2012;
- OSPAR, Overview of the impacts of anthropogenic underwater sound in the marine environment, Vol. OSPAR, Convention for the Protection of the Marine Environment of the North-East Atlantic, 2009;
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