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REPORT ON THE ENVIRONMENTAL IMPACT ASSESSMENT OF THE BALTIC POWER OFFSHORE WIND FARM CONNECTION INFRASTRUCTURE

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Contractor	**MEWO S.A.**
	Maritime Institute **Gdynia Maritime University**
Subcontractors	**National Marine Fisheries Research Institute**
	EKO-KONSULT Sp. z o.o.

Declaration

I declare that I meet the requirements referred to in Article 74a.2 of the Act of 3 October 2008 on the provision of information on the environment and its protection, public participation in environmental protection and environmental impact assessments (Journal of Laws of 2008, No. 199, item 1227, as amended) and I am aware of criminal liability for making a false declaration.

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Abbreviations and definitions

AC	Alternating current
APV	Applicant Proposed Variant
AUXT	Auxiliary Transformer for supplying remote control and monitoring systems
Baltic Power OWF	Baltic Power Offshore Wind Farm
Bałtyk II	Offshore Wind Farm Polenergia Bałtyk II (previously Bałtyk Środkowy II)
Bałtyk III	Offshore Wind Farm Polenergia Bałtyk III (previously Bałtyk Środkowy III)
BE	Both-ends bonding of return wires
BOD_5	5-day biochemical oxygen demand
boomer	Low-frequency sediment profiler
BP OWF CI	Baltic Power Offshore Wind Farm Connection Infrastructure
BPA	Boneville Power Administration
CB	Cross-bonding of return wires
CDAS	Corona Discharge Acoustic Signal
CLV	Cable Laying Vessel
C-POD	Continuous Porpoise Detector
CTD	Conductivity, Temperature and Depth
DC	Direct current
DEC	Decision on Environmental Conditions
DP	Dynamic positioning
ECC	Earth Continuity Conductor
EHV	Extra high voltage
EIA Act	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 assessments (Journal of Laws of 2008, item 199, as amended)
EMF	Electromagnetic field
EU	European Union
GRS80H	Geodetic coordinate system
GWB	Groundwater Body
HDD	Horizontal Directional Drilling
HELCOM	Helsinki Commission – Baltic Marine Environment Protection Commission
IMO	International Maritime Organization
IMWM-NRI	Institute of Meteorology and Water Management – National Research Institute
IUCN	International Union for Conservation of Nature
LOI	Organic matter content in a sample, marked as loss on ignition
LUA	Limited Use Area
MFE	Mass Flow Excavator
MGWB	Major groundwater basins
MI GMU	Maritime Institute of the Gdynia Maritime University
MSFD	Marine Strategy Framework Directive

MTS	Main Transformer Station
NPS	National Power System
OWF	Offshore Wind Farm
OWT	Offshore Wind Turbines
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated biphenyls
PL-1992	Flat Rectangular Coordinate System
PLB	Cable Post Lay Burial
PMA	Polish Maritime Areas within the meaning of the Act of 21 March 1991 on the maritime areas of the Republic of Poland and maritime administration (Journal of Laws of 1991, no. 32, item 131 as amended)
POP	Persistent Organic Pollutants
PSD	Power Spectral Density – noise power spectral density level [dB re 1 $\mu Pa^2 \cdot Hz^{-1}$]
PSE	PSE S.A.
PTS	Permanent Threshold Shift
RDEP	Regional Directorate for Environmental Protection
RDSF	Regional Directorate of State Forests
RES	Renewable Energy Sources
RMS	Root Mean Square
ROV	Remotely Operated Vehicle
RWA	Rational Alternative Variant
SLB	Simultaneous Lay and Burial
SOV	Service Operation Vessel
SPB	Single Point Bonding of return wires
SPL	Sound Pressure Level in dB
SWB	Surface Water Body
TBT	Tributyltin
TN	Total nitrogen
TOC	Total Organic Carbon
TTS	Temporary Threshold Shift
UXO	Unexploded Ordnance
VMS	Vessel Monitoring System
W2W	Walk-to-Work Auxiliary Vessels
WB	Water bodies
WGS 84	World Geodetic System 1984

1 Introduction

1.1 Preface

This document constitutes the Environmental Impact Assessment Report for the Connection Infrastructure of the Baltic Power Offshore Wind Farm (hereinafter referred to as: BP OWF CI). The Applicant planning the implementation of the BP OWF CI is Baltic Power Sp. z o.o., a subsidiary of Polski Koncern Naftowy ORLEN and Northland Power NP BALTIC WIND B.V.

The planned project, BP OWF CI, shall be located in offshore area within the exclusive economic zone and territorial sea as well as the onshore territory of the Republic of Poland. The route of the BP OWF CI in the offshore and onshore area in presented in Figure 1.1.

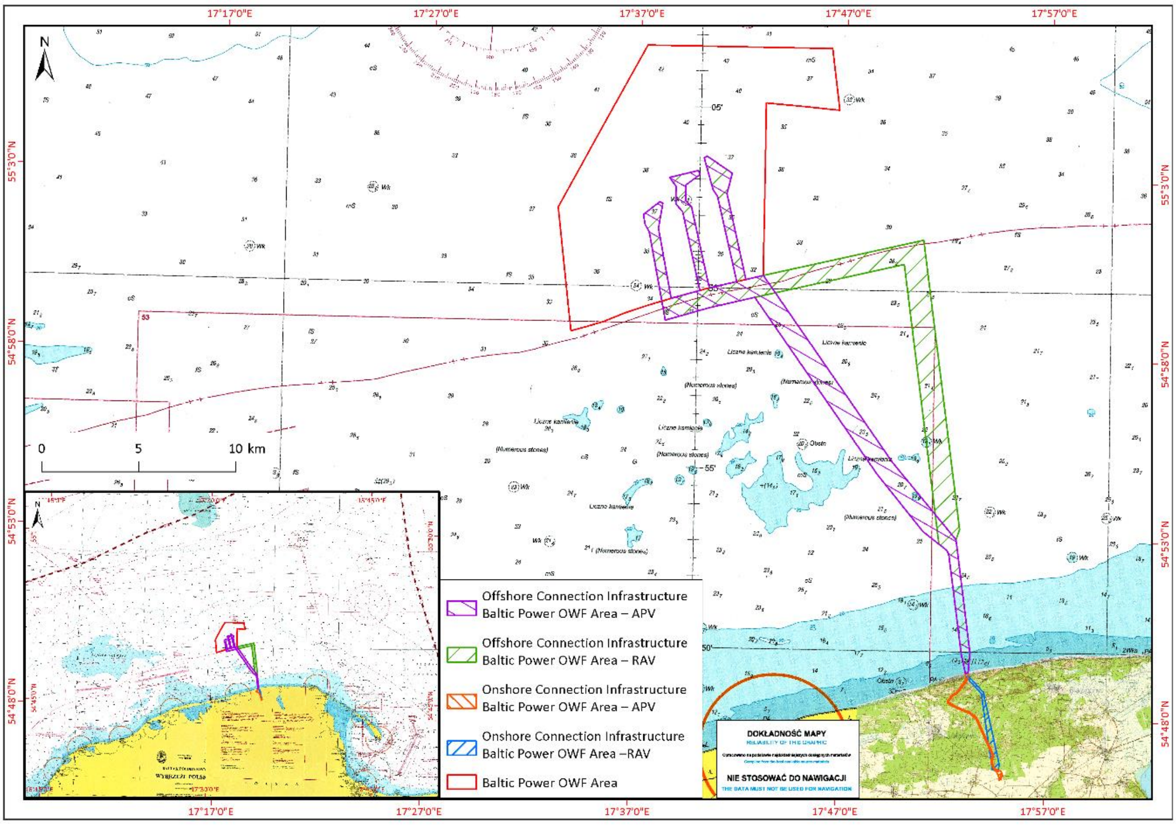


Figure 1.1. Location of the planned project – Connection Infrastructure of the Baltic Power Offshore Wind Farm [Applicant Proposed Variant (APV) and Rational Alternative Variant (RAV)] [Source: internal materials]

On 23 July 2020, Baltic Power Sp. z o.o. obtained the decision No. 1/K/20 of the Minister of Maritime Economy and Inland Navigation approving the location and methods of cable maintenance in the exclusive economic zone as part of the project named „Budowa przyłącza elektroenergetycznego Morskiej Farmy Wiatrowej Baltic Power do Krajowej Sieci Przesyłowej" [literally: "Construction of the Baltic Power Offshore Wind Farm power connection to the National Transmission Grid"] (ref. No. DGM.WZRMPP.3.430.24.2020.NZ.1). On 28 September 2020, the Director of the Maritime Office in Gdynia issued the Decision No. 5/20 permitting for the laying and maintenance of cables within the internal sea waters and territorial sea for the project named „Budowa przyłącza elektroenergetycznego Morskiej Farmy Wiatrowej Baltic Power do Krajowej Sieci Przesyłowej" [literally: "Construction of the Baltic Power Offshore Wind Farm power connection to the National Transmission Grid"] (ref. No. INZ1.1.8104.10.13.2019.MGw). Moreover, Baltic Power Sp. z o.o. has submitted an application to the Minister of Infrastructure for approving the location and methods of cable maintenance in the Baltic Power OWF Area.

The planned project consists in the construction and operation of the power transmission lines including customer substation and associated infrastructure. Table 1.1 summarises the basic parameters of the planned project in the Applicant Proposed Variant (hereinafter referred to as: APV).

Table 1.1. Basic parameters of the Connection Infrastructure of the Baltic Power Offshore Wind Farm in the Applicant Proposed Variant [Source: internal materials]

Parameter	**Parameter value**	
	Offshore part	**Onshore part**
Maximum voltage range (AC) [kV]	220 or 275	220 or 275
Maximum number of cables [items]	4	12 (4 circuits, 3 cables each)
Maximum cable line length [km]	46.8	6.5
Technical strip maximum width [m]	20	25

The purpose of the planned project is to connect the BP OWF to the National Power System (NPS).

This Environmental Impact Assessment Report comprises an Appendix to the application for a decision on environmental conditions based on the Act of 3 October 2008 on providing access to information about the environment and its protection, participation of the public in the environment protection and the environmental impact assessments (Journal of Laws of 2008, no. 199, item 1227, as amended). According to Article 75 section 1 point 1c, the Regional Director for Environmental Protection is the authority competent to issue the decision on environmental conditions for the planned project. Taking into account the location of the BP OWF CI, the competent authority is the Regional Director for Environmental Protection in Gdańsk.

The Environmental Impact Assessment Report for the BP OWF CI was prepared by the Consortium of MEWO S.A. and the Maritime Institute of the Gdynia Maritime University in cooperation with the following subcontractors: National Marine Fisheries Research Institute and EKO-KONSULT Sp. z o.o.

1.2 Project classification

Regional Director for Environmental Protection in Gdańsk on 22 July 2021 (ref. no.: RDOŚ-Gd-WOO.420.16.2021.AJ.9.) after analysing the application of the Investor – Baltic Power Sp. z o.o. (ref. no.: BP/4/2021 of 31 March 2021), supplemented on 8 June 2021 for the issuance of the Decision on environmental conditions for the project in question, acting on the basis of:

- the Resolution of the President of the National Water Management Authority, River Basin Management in Gdańsk (ref. no.: GD.ZZŚ.435.249.2.2021.AK) of 19 July 2021 (submitted on: 21 July 2021);
- the Resolution of the Director of the Maritime Office in Gdynia (ref. no.: INZ.8103.39.2021.AD) of 30 April 2021 (submitted on: 11 May 2021);
- the Opinion of the State Border Sanitary Inspector in Gdynia (ref. no.: SE.ZNS.80.4910.16.21) of 4 May 2021 (submitted on: 11 May 2021)

decided to recognise, due to the impact on the Natura 2000 sites, the necessity to carry out an environmental impact assessment.

The Regional Director for Environmental Protection in Gdańsk specified the scope of the Environmental Impact Assessment Report compliant with Article 66 of the EIA Act including the impact assessment for Natura 2000 sites pursuant to Article 6.3 of the Council Directive 92/43/EEC in the scope of the construction project impact on the Natura 2000 sites subjects of protection (Białogóra PLH220003), and also species under legal protection, with particular reference to:

- the description of the planned project, and, in particular, the characteristics of the entire project and the conditions of land use during the performance of works, its implementation and operation; mainly, the characteristic features of the technological processes; the expected types and amounts of pollution resulting from the project implementation;
- the analyses of the impact on individual elements of the environment of the planned technological variants of the project;
- the natural characteristics of the project area and the area located in the vicinity of its impact, taking into consideration the species of plants, fungi and animals as well as their habitats, which are under protection pursuant to the provisions of the Nature Conservation Act of 16 April 2004 (Journal of Laws of 2004, No. 92, item 880), as well as the species and species habitats from Annex I of the Directive 2009/147/EC and the habitats from Annex I and the species from Annex II of the Habitats Directive 92/43/EEC, constituting the subject of protection in the Natura 2000 sites Białogóra (PLH220003) and Przybrzeżne wody Bałtyku (PLB990002), including the presentation of the issues in graphic and cartographic forms;
- the assessment of the direct and indirect impact of the project and the technologies applied therein, during the construction and operation phases, on the:
  - species and their habitats which are subject to protection in the Natura 2000 sites Białogóra (PLH220003) and Przybrzeżne wody Bałtyku (PLB990002),
  - natural habitats, habitats of species under protection pursuant to the above-mentioned Nature Conservation Act, occurring and potentially occurring in the project area and in its vicinity;
- the project impact assessment (in the construction and operation phases) after all possible measures mitigating the negative impact have been applied including the assessment of the impact significance for individual subjects of protection in the above-mentioned Natura 2000 sites, and also the possibilities of implementing protective measures and achieving protection objectives set out in the plans of protective tasks for these areas;
- the description of the hydrological system of the terrain covered by the project and the project impact range including the analysis of the project impact on that system;
- the analyses of the project cumulative impact with other planned and implemented projects of a similar character, located in the vicinity, on individual elements of the environment, including Natura 2000 sites Białogóra (PLH220003) and Przybrzeżne wody Bałtyku (PLB990002);
- a presentation of the detailed description of the methods and materials used when preparing the project Environmental Impact Assessment Report;
- an impact assessment of the planned project on the Coastal Protected Landscape Area;

- a description of the landscape, in which that particular project is to be located, including the project impact on the significance and perception of the landscape from the viewing points, exposition fields and viewing axes;
- an analysis of the planned project impact on wildlife corridors located within the range of its impact;
- an analysis of the planned project impact on the climate and its changes (mitigation, i.e. project alleviating the climate changes) and the impact of climate and its changes on the project (project adaptation to the climate changes), taking into consideration the changes of the site development covered by the application;
- the analyses of the potential social conflicts connected to the project implementation – determination whether the variant selected for implementation is the optimal one not only for the Investor, but also for the owners of the neighbouring properties, and determination of the manner in which the Investor plans to counteract social conflicts with reference to the planned investment.

Moreover, the environmental impact assessment is to include the scope indicated by the Director of the Maritime Office in Gdynia, with particular focus on:

- the analysis of impact and functioning of the BP OWF CI on the subjects of protection of the Natura 2000 sites Przybrzeżne wody Bałtyku (PLB990002) and Ławica Słupska (PLC990001);
- the analysis of the planned work impact on the coastal zone in the places of cable landfall, including morphological and lithodynamic processes taking place within the coastal zone and on the condition of the seashore protection system;
- determination of the species composition of benthic organisms and the planned work impact on benthos in the construction and operation phases;
- analyses of the electric field impact on ichthyofauna;
- analyses of the project impact on the resources and recruitment of fish important for fishery;
- analyses of the possibility of a collision with shipping routes and areas intended for fishing;
- analyses of the planned project impact cumulated with other designed, implemented and existing projects in the vicinity of the planned project, for example, OWFs, cables, and other infrastructure;
- suggested procedures to follow in the case of emergency situations taking place during the project implementation.

The main component of the planned project will be a multi-circuit power line connecting the Baltic Power OWF with the substation of Polskie Sieci Elektroenergetyczne S.A. (hereinafter referred to as: PSE). Along a section of up to 270 m – the connection of the customer substation with the PSE substation – the power line will take the form of overhead line, hence according to § 3(1)(7) of the Regulation of the Council of Ministers of 10 September 2019 on projects likely to have a significant impact on the environment (Journal of Laws of 2019, item 1839), the planned project is qualified as a project with a potentially significant impact on the environment, i.e. "overhead power lines with a voltage rating of not less than 110 kV, other than those listed in § 2(1)(6)".

As part of the planned project, paved access roads with a length of approx. 5 km will be constructed along the cable route, which pursuant to § 3(1)(62) of 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), are qualified as “roads with hard surface with a total length of the project exceeding 1 km other than those listed in § 2(1)(31) and (32) or bridge structures in the course of road with hard surface, excluding reconstruction of roads or bridge structures, used for the maintenance of power substations and located outside the areas under forms of nature protection, discussed in Article 6(1)(1)–(5), (8) and (9) of the Act of 16 April 2004 – Nature Conservation Act". In this legal act, the definition of a road with hard surface is not clearly specified. In the Polish Traffic Law Act (Journal of Laws of 2020, item 1517, as amended), a road with a hard surface is defined as a road with a bituminous, concrete, cobblestone, clinker or block paving, as well as concrete slabs or stone and concrete slabs, if the length of the road surface exceeds 20 m. Other roads are considered dirt tracks. In accordance with the definition of the Central Statistical Office, this is a road with an improved hard surface (with cobblestone, clinker, concrete, stone and concrete slabs, bitumen) or a road with an unimproved surface (crushed stone or block paving). As a result, depending on the definition adopted, this element of the planned project can be classified or not.

The construction of a power substation also qualifies this project as potentially having a significant impact on the environment, in accordance with the wording of §3(1) (54)(b)) 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), i.e. "industrial development, including photovoltaic system or warehouse development, including the accompanying infrastructure, with a development surface area not smaller than 1 ha in the areas other than those referred to in (a)."

The implementation of the planned project in the onshore area will require a permanent deforestation of an area larger than 1 ha, which also qualifies the project as potentially having a significant impact on the environment, in accordance with § 3(1)(88) of the above-mentioned regulation, i.e. "modification of a forest, other soil with a contiguous surface area of at least 0.10 ha covered with forest vegetation – trees and shrubs as well as forest litter – or a wasteland into an agricultural use or deforestation intended to change the manner of land use: (…) e) with a surface area of at least 1 ha, other than listed in letter a–d."

The planned project is a public purpose investment pursuant to Article 6 of the Act of 21 August 1997 on real estate management (Journal of Laws of 1997, no. 115, item 741 as amended) and with Article 2(5) of the Act of 27 March 2003 on spatial planning and development (Journal of Laws of 2003, No. 80, item 717 as amended). Pursuant to Article 6(2) of the Act on real estate management, the public purpose is the construction and maintenance of wires and equipment intended for the transmission or distribution of electricity, as well as other facilities and equipment necessary for the use of those wires and equipment.

Article 2(5) of the Act of 27 March 2003 on spatial planning and development (Journal of Laws of 2003, No. 80, item 717, as amended) defines public purpose investment as: "(…) activities of local (municipality) and supra-local (district, voivodeship and national), as well as national (also including international and supra-regional investments) and metropolitan (including the metropolitan area) importance, regardless of the status of the entity undertaking those activities and the sources of their financing, constituting the implementation of the objectives referred to in Article 6 of the Act of 21 August 1997 on real estate management (Journal of Laws of 2020, item 65)."

Pursuant to Article 3a of the Act of 24 July 2015 on the preparation and implementation of strategic projects in the scope of transmission networks (Journal of Laws of 2015, item 1265, as amended), the planned project constitutes a strategic project in the scope of transmission networks. Such projects, in accordance with Article 80.2 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 (Journal of Laws of 2008, No. 199, item 1227, as amended) are not subject to the requirement of ascertainment, by the authority issuing the decision on environmental conditions, of conformity of project location with the findings of the local spatial development plan, if such plan had been established.

1.3 The basis for the EIA Report

The basis for the preparation of this EIA Report were:

- the Applicant's Documentation:
  - Decision No. 1/K/20 of the Minister of Maritime Economy and Inland Navigation of 23 July 2020, approving the location and methods of cable maintenance in the exclusive economic zone as part of the project named „Budowa przyłącza elektroenergetycznego Morskiej Farmy Wiatrowej Baltic Power do Krajowej Sieci Przesyłowej" [literally: "Construction of the Baltic Power Offshore Wind Farm power connection to the National Transmission Grid"],
  - Decision No. 5/20 of the Director of the Maritime Office in Gdynia of 28 September 2020 for the laying and maintenance of cables and pipelines within the internal sea waters and territorial sea for the project named „Budowa przyłącza elektroenergetycznego Morskiej Farmy Wiatrowej Baltic Power do Krajowej Sieci Przesyłowej" [literally: "Construction of the Baltic Power Offshore Wind Farm power connection to the National Transmission Grid],
  - documentation containing the results of environmental surveys and inventory carried out in the period from 2018 to 2021 for the purpose of this EIA Report (Appendix 1 to the EIA Report);
- strategic documentation, programming and planning documents at international, national, regional and local levels;
- applicable legal regulations, including:
  - 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 assessments (Journal of Laws of 2008, item 199, as amended),
  - Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment (amended by the Directive of 16 April 2014),
  - other international, EU and national regulations.

Moreover, when preparing this EIA Report, sources of information specified in section 17 were used, in particular, reports on environmental impact assessment or other documentation for projects completed, implemented or planned, located closest to the planned project, such as:

- Offshore infrastructure for power transmission; Environmental Impact Assessment Report for Polenergia Bałtyk III Sp. z o.o.;
- Environmental Impact Assessment Report for the Baltic Power Offshore Wind Farm.

1.4 Findings of strategic and planning documents

1.4.1 International and EU documents

The Baltic region is characterised by a long-standing international cooperation in areas such as development and spatial planning (VASAB), marine environment protection (HELCOM) and energy (BASREC). In 2009, the European Union Strategy for the Baltic Sea Region (EUSBSR) was adopted, being the first EU macro-regional intra-EU strategy.

VASAB — intergovernmental cooperation between Baltic Sea Region states responsible for development and spatial planning. In its strategic document VASAB Long-Term Perspective for the Territorial Development of the Baltic Sea Region (2009) sets out the directions of the development until 2030. One of them is to strengthen internal and external availability, and the development of offshore wind energy is indicated as a way to achieve the energy independence of the Baltic region. Measure 18 of the LTP directly indicates the need to exploit potential in Polish Maritime Areas (PMA) in the short term. The planned project is part of the development directions for the Baltic Sea region suggested by VASAB.

Directive 2014/89/EU of the European Parliament and of the Council establishing a framework for maritime spatial planning is a document that specifies the framework for planning in the Baltic Sea area, which was adopted on 23 July 2014, considering, among others, the increased and fast growing demand on the maritime space to be used for various purposes, such as installations generating power from renewable sources, prospecting and exploration of crude oil and natural gas, marine transport and fishing activity, protection of the ecosystem and biodiversity, tourism, aquaculture devices and underwater cultural heritage, as well as the presence of multiple pressures on coastal resources, requiring an integrated planning and management approach.

As the main objective of maritime spatial planning, Directive 2014/89/UE determines: "promotion of sustainable development and defining the use of maritime areas for various purposes as well as managing the methods of space use and the conflicts in the maritime areas" (19 and Article 1(1)). This directive sets out the framework for maritime spatial planning aimed at propagating sustainable development in the maritime economy, sustainable development of the maritime areas as well as sustainable use of the marine resources.

The result of the maritime planning should be a "comprehensive plan, presenting various methods of using maritime space that takes into consideration the long-term changes caused by climate change," which specifies "the spatial and temporal arrangement of significant, already implemented or future actions as well as methods of use of marine waters."

Marine Strategy Framework Directive (MSFD)

The principles of conservation and objectives for the marine waters have been specified in the Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy – the so-called Marine Strategy Framework Directive (MSFD).

The objective of the directive is for the Member States to take the necessary measures to achieve or maintain good environmental status in the marine environment until 2020 at the latest. MSFD is the first comprehensive legal act of the EU with an objective to especially protect the marine environment and natural resources as well as create framework for the sustainable use of marine waters.

MSFD regulations were implemented into the Polish legal order, first of all, through the Water Law Act (Journal of Laws of 2017, item 1566, as amended). Pursuant to Article 145 of this Act, the environmental objectives for marine waters are achievable by taking measures specified in the marine water protection programme. National Marine Waters Protection Programme (NMWPP) was adopted by the Council of Ministers by the resolution of 11 December 2017 (Journal of Laws of 2017, item 2469). NMWPP is a strategic document, the development of which is imposed on the Member States under MSFD. The objective of NMWPP is to specify the optimal set of measures, which will lead to the achievement of good environmental status of marine waters within a given period of time.

Within the NMWPP framework, the basic measures will include the following categories: legal, administrative, economic, educational, and control measures.

Bearing in mind the contents of Article 144 of the Act of 20 July 2017 – Water Law (Journal of Laws of 2017, item 1566, as amended), to protect the marine waters environment, a maritime strategy is developed and implemented, which includes the following actions:

- development of the preliminary environmental assessment of the marine water status;
- development of a set of properties typical of good environmental status of marine waters;
- development of a set of environmental objectives for marine waters and the related indicators;
- development and implementation of the marine waters monitoring programme;
- development and implementation of the marine waters protection programme.

The set of environmental objectives for marine waters is specified in the Regulation of the Minister of Infrastructure of 25 February 2021 on the adoption of a set of environmental objectives for marine waters (Journal of Laws of 2021, item 569), issued under Article 157(8) of the Act of 20 July 2017 – Water Law Act (Journal of Laws of 2017, item 1566, as amended). This act specifies the environmental objectives for 11 categories of characteristics – descriptive indicators, which pursuant to the provisions of MSFD constitute the assessment criteria of the marine environment good status (Annex I to MSFD).

In accordance with the requirements of MSDF, Member States were obliged to carry out the preliminary environmental assessment of marine waters until 2012. The preliminary environmental assessment of marine waters was prepared in 2013 by the State Inspection of Environmental Protection and adopted by the Council of Ministers on 10 November 2014. This assessment is used for obtaining information on the current status of the marine environment, and thus, is the starting point for the determination of the direction of actions that are necessary to implement for the objectives set out in MSDF to be achieved. The methodological criteria and standards for the measurement of the achievement of good environmental status of marine waters are set out in the European Commission Decision 2017/848/EU.

Poland is a signatory to the **1992 Convention for the Protection of the Marine Environment of the Baltic Sea Area** (Helsinki Convention). Under the Helsinki Convention, actions for the Conservation of the Baltic Sea focus on the implementation of the Baltic Action Plan (BAP), adopted at the HELCOM Ministerial Meeting in 2007. The Baltic Action Plan assumes that good ecological status of the Baltic

Sea will be achieved by 2021 and sets out the areas of action to achieve this. The paramount strategic objective of segment IV "Maritime activities" is that maritime transport and economic activities are carried out in the Baltic Sea in an environmentally friendly manner. One of the priorities is the minimum risk from offshore constructions. The countries have agreed within the BSAP that they will follow appropriate procedures and make efforts to eliminate, reduce or redress the potential negative environmental impacts that may be caused by offshore constructions. The 2013 Ministerial Conference in Copenhagen adopted **Recommendation 34E/1** for safeguarding important bird habitats and migration routes in the Baltic Sea from negative effects of wind and wave energy production at sea. The document emphasises a positive aspect of the development of wind energy in the context of climate change, recommending specific steps that may help to reduce the negative impact of the project on the environment. It should be emphasised that the planned project will be implemented in accordance with the Recommendation 34E/1 of HELCOM. The provisions of this recommendation refer mainly to the activities of the States Parties to the Helsinki Convention and as such do not concern the planned project, but the Applicant assumes that the project will be conducted so as to avoid or minimise the impact of the project on the environment, including, in particular, on important bird habitats and their migration routes.

The Convention on the Protection of Migratory Species of Wild Animals – CMS Convention

The international treaty concluded as part of the UN environmental programme – the Convention on the Protection of Migratory Species of Wild Animals (Journal of Laws of 2003, No. 2, item 17) (Bonn Convention), was drawn up in Bonn on 23 June 1979. Poland has been a party to the convention since 1 May 1996, a member of the Standing Committee and party to the agreements on the protection of bats (EUROBATS) and small cetacean (ASCOBANS).

The objective of the convention is the protection of wild migratory animals, which constitute an irreplaceable element of the natural environment. Migratory species (or lower taxonomic groups) are considered those, a large number of which crosses state borders in various life cycles in a cyclical and foreseeable manner. A series of agreements concerning migratory species were included in the convention.

The only species of cetacean living in the Baltic Sea is the harbour porpoise (*Phocoena phocoena*). The harbour porpoise is included in Annex II, listing migratory species with inadequate conservation status, for which international agreements on protection and management should be concluded. In 1997, the parties to ASCOBANS adopted a Resolution on the by-catch of small cetacean, in which the parties to the agreement and the states from the agreement impact area were invited to develop a plan of the harbour porpoise restitution in the Baltic Sea, one element of which should be to identify the types of human activity that pose a potential danger to the restoration of the population of this species in the Baltic Sea. The final plan, the so-called "Jastarnia Plan," was adopted by the parties to ASCOBANS in 2009. Poland, which is a party to the ASCOBANS agreement, actively participating in its development since 1995, has also approved this plan for implementation.

A temporary objective specified by ASCOBANS is to restore the harbour porpoise population in the Baltic Sea up to at least 80% of the environment capacity level.

The European Green Deal constitutes a set of political initiatives of the European Commission, the main objective of which is to achieve climate neutrality in Europe by 2050. Specific actions have been taken for each area, for example, for climate the new, more ambitious objective concerning the net emission of greenhouse gases has been set out – a reduction by at least 55% until 2030 in comparison to the levels from 1990. The European Green Deal focuses on the three main principles of a clean energy transition that will help reduce greenhouse gas emissions and the quality of life. These are:

1. ensuring a secure and affordable EU energy supply;
2. developing a fully integrated, interconnected and digitalised EU energy market;
3. prioritising energy efficiency, improving the energy performance of our buildings and developing a power sector based largely on renewable sources.

To achieve this, the Commission has set out the following main objectives:

- building interconnected energy systems and better integrated grids to support renewable energy sources;
- promoting innovative technologies and modern infrastructure;
- boosting energy efficiency and eco-design of products;
- decarbonising the gas sector and promoting smart integration across sectors;
- empowering consumers and helping EU countries to tackle energy poverty;
- promoting EU energy standards and technologies at global level;
- developing the full potential of Europe's offshore wind energy.

The planned project is in line with the above-mentioned objectives.

Europe 2020 strategy

The Europe 2020 strategy was adopted on 3 March 2010 by the European Commission to stimulate the development of the European Union's economy. Europe 2020 was presented as the Commission Communication in document COM(2010)2020. It is a continuation of the Lisbon Strategy from 2000–2010 and is oriented towards smart, sustainable and inclusive growth with enhanced coordination at EU and national level.

The strategy identifies five principle objectives for the European Union to strive for, in order to boost the economic growth and employment level, including, for example, the reduction of greenhouse gases by at least 20% in comparison to the levels from 1990, or even by 30% at favourable conditions, an increase in the renewable energy share in the total energy consumption up to 20% as well as a rise of the effective use of energy by 20%. The planned project is in line with this objective.

EU strategy on adaptation to climate change

The objective of the EU strategy on adaptation is making Europe more resilient to climate change. This means increasing preparedness and response to the impacts of climate change at a local, national and EU level, preparing a coherent approach and improving coordination of actions through the implementation of the following environmental objectives: integrating climate change adaptation into regional and other development projects and ensuring resilient infrastructure. The planned project is in line with the objective of the EU strategy.

The main legal acts concerning environmental protection in the maritime transport sector and divided into hazard groups at an international and EU level:

- The International Convention for the Prevention of Pollution from Ships, 1973, drawn up in London on 2 November 1973, modified by the supplementary Protocol drawn up in London

on 17 February 1978 (Journal of Laws of 1987, No. 17, item 1010 and the supplementary Protocol drawn up in London on 26 September 1997 (Journal of Laws of 2016, item 761) (MARPOL Convention);
- 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) (the Helsinki Convention).

In the scope of air emissions in maritime areas, the following legal acts are in force at an international and EU level:

- Directive 2012/33/EU of the European Parliament and of the Council of 21 November 2012 amending Directive 1999/32/EC of the Council on the content of sulphur in marine fuels (Official Journal of the European Union L 327/1 of 27 November 2012);
- Regulation of the European Parliament and the Council (EU) 2015/757 of 29 April 2015 on the monitoring, reporting and verification of carbon dioxide emissions from maritime transport, and amending Directive 2009/16/EC (Official Journal of the European Union L 123/55 of 19 May 2015);
- Commission Implementing Regulation (EU) 2016/1927 of 4 November 2016 on templates for monitoring plans, emissions reports and documents of compliance pursuant to Regulation (EU) 2015/757 of the European Parliament and of the Council on monitoring, reporting and verification of carbon dioxide emissions from maritime transport (Official Journal of the European Union L 299/1 of 5 November 2016);
- Commission Implementing Regulation (EU) 2016/1928 of 4 November 2016 on determination of cargo carried for categories of ships other than passenger, ro-ro and container ships pursuant to Regulation (EU) 2015/757 of the European Parliament and of the Council on the monitoring, reporting and verification of carbon dioxide emissions from maritime transport (Official Journal of the European Union L 299/22 of 5 November 2016);
- Commission Delegated Regulation (EU) 2016/2071 of 22 September 2016 amending Regulation (EU) 2015/757 of the European Parliament and of the Council as regards the methods for monitoring carbon dioxide emissions and the rules for monitoring other relevant information (Official Journal of the European Union L 320/1 of 26 November 2016);
- Commission Delegated Regulation (EU) 2016/2072 of 22 September 2016 on the verification activities and accreditation of verifiers pursuant to Regulation (EU) 2015/757 of the European Parliament and of the Council on the monitoring, reporting and verification of carbon dioxide emissions from maritime transport (Official Journal of the European Union L 320/5 of 26 November 2016).

Combating hazards and pollution at sea is regulated by the International Convention on oil pollution preparedness, response and cooperation, (OPRC Convention), adopted in London on 30 November 1990 (Journal of Laws of 2004, No. 36, item 323) together with the Protocol on Preparedness, Response and Co-operation to Pollution Incidents by Hazardous and Noxious Substances (OPRC-HNS Protocol) adopted in London on 15 March 2000 (Journal of Laws of 2007, No. 167, item 1173).

1.4.2 Documents at national and regional levels

The planned project, being an inseparable part of an offshore wind farm (OWF), directly implements the goals described in the national and regional documents referenced below. These objectives are mainly aimed at avoiding harmful gas emissions in various ways, increasing the share of energy from renewable energy sources (RES) in energy production and increasing the level of energy security.

National documents

Maritime Policy of the Republic of Poland until 2020 (with an outlook to 2030)

The document was adopted by resolution No. 33/2015 of the Council of Ministers of 17 March 2015 on the maritime policy of the Republic of Poland until 2020 (with an outlook to 2030).

The planned project is in line with objective 8. Strengthening the country's energy security, according to which the following measures were adopted to achieve the objective:

1. Creating conditions for the use of renewable energy sources at sea, i.e. wind, sea currents and wave motion energy.
2. Construction and modernisation of the offshore transmission infrastructure […].

The Maritime Policy of the Republic of Poland until 2020 (with an outlook to 2030), specifies that the real potential of development of offshore wind energy in Poland, which may bring the greatest benefits for the Polish energy balance and the Polish economy, amounts to 6 GW of power installed in the OWF until 2030. Creating conditions for the construction of offshore wind farms has been identified as an action to improve energy security.

The main legal acts concerning environmental protection in the maritime transport sector and divided into hazard groups:

- the Act of 16 March 1995 on preventing pollution of seas by ships (Journal of Laws of 1995, No. 47, item 243, as amended);
- the Regulation of the Minister of Infrastructure and Development of 20 October 2015 on the inspections, surveys and international certification in the scope of prevention of marine pollution by ships (Journal of Laws of 2015, item 1806).

In the scope of air emissions in maritime areas, the following legal acts are in force at a national level:

- Provisions of the Act of 15 May 2015 on the substances that deplete the ozone layer and on some fluorinated greenhouse gases (Journal of Laws of 2017, item 1951), in the scope of operation of equipment and installations containing controlled substances on ships;
- the Regulation of the Minister of Infrastructure and Development of 7 October 2015 on the inspections, surveys and international certification in the scope of prevention of marine pollution by ships (Journal of Laws of 2015, item 1665);
- the Regulation of the Minister of Infrastructure and Development of 20 October 2015 on the inspections, surveys and international certification in the scope of prevention of marine pollution by ships (Journal of Laws of 2015, item 1806).

Combating hazards and pollution at sea at a national level is regulated by the Regulation of the Council of Ministers of 8 August 2017 on the organisation and combating of hazards and pollution at sea (Journal of Laws of 2017, item 1631).

Coastline protection programme, adopted by Act of 28 March 2003 establishing a multi-annual programme “Coastline protection programme” (Journal of Laws of 2003, No. 67, item 621, as amended), contains a list of projects intended for coastline protection. The planned project will be implemented near 160.5 km of the coastline (according to the chainage of the Maritime Office), for which no tasks have been foreseen for implementation until 2023.

The National Spatial Development Concept 2030 was adopted by Resolution No. 239 of the Council of Ministers of 13 December 2011. (M.P.2012.252). It is the main document on spatial development in the long term, defining the objectives and directions of the spatial development policy of the country. It takes into account the need to develop OWFs and the connection infrastructure in order to solve the problem of underinvestment in the energy infrastructure and improve the energy security of the country. The development of offshore wind energy will contribute to the reduction of CO_2 emission in accordance with the arrangements of the European Union. The concept specifies that the wind energy will constitute 45% of the energy obtained from RES. The need to build new transmission lines with accompanying infrastructure, the need to take into account air corridors of bird migration and landscape protection as well as weather variability were considered as barriers to RES development in Poland. In accordance with the arrangements of the National Spatial Development Concept (NSDC) 2030, the planned project is located in the development zone of the distributed renewable wind energy sector. The NSDC 2030 sets 6 objectives pursuing the strategic objective. The planned project is part of objective 5: "Increasing the resilience of the spatial structure to natural hazards and loss of energy security and shaping spatial structures supporting the country's defensive capabilities.” One of the directions of the actions implementing this objective is ”increasing the use of renewable energy sources by building new capacities that will reduce losses related to energy transmission and improve energy security at the national, regional and local level.” “One of the elements of support for diversification of energy sources, which also has positive effects on the reduction of CO_2 emissions, is to increase the generation of energy from renewable sources. In Polish conditions, this type of sources with the greatest economic potential should include wind energy (…).” ”It is planned that by 2020 at least 15% of final gross energy consumption will come from renewable energy sources.”

On 14 April 2021, the Maritime Spatial Plan of Polish Sea Areas (MSPPSA) was adopted by the Regulation of the Council of Ministers of 14 April 2021 (Journal of Laws of 2021, item 935). The document covers the necessity to provide sea space for the construction and maintenance of the OWF connection infrastructure. Its location is possible in those sea areas, the main function of which is the “technical infrastructure” (sea areas with letter designation I) and in the sea area with a different main function, but in which the technical infrastructure has been indicated as an acceptable function. In some sea areas with a main function other than “technical infrastructure”, sea subareas have been determined for the laying of this type of infrastructure. The location and construction method of the technical infrastructure, including the connection infrastructure, in the sea areas and subareas, is subject to bans and restrictions indicated in the detailed arrangements of the Plan.

The detailed characteristics of the subareas and the location of the planned project against MSPPSA is presented in subsection 3.9.

In the **Energy Policy of Poland until 2040** adopted by the Council of Ministers on 2 February 2021, it has been indicated that the implementation of offshore wind energy, together with the implementation of nuclear energy and increasing the role of distributed and civic energy, will be the primary way to decarbonise the energy sector. In accordance with the provisions of the Policy, OWFs will play a special role in achieving at least 23% share of RES in gross final energy consumption in

2030. The incorporation and transmission of the power generated by OWFs will be achieved through the expansion of the transmission grid in northern and north-western Poland.

Long-term National Development Strategy. Poland 2030. Third Wave of Modernity

Long-term National Development Strategy Document. Poland 2030. Third Wave of Modernity was adopted by Resolution No. 16 of the Council of Ministers of 5 February 2013 (M.P. of 2013, item 121). Pursuant to Article 9(1)[1] of the Act of 6 December 2006 on the principles of conducting development policy (Journal of Laws of 2006, No. 227, item 1658), it constitutes a document specifying the main tendencies, challenges and scenarios of the social and economic development of the country as well as the directions of the national spatial development, considering the principle of sustainable development, covering a period of at least 15 years. It constitutes the broadest and most general element of the new system of the country's development management, the assumptions of which have been specified in the Act on the principles of conducting development policy and in the document Assumptions of the Development Management System of Poland adopted by the Council of Ministers on 27 April 2009.

The Strategy sets out 11 strategic objectives and directions of intervention in the area of competitiveness and innovativeness of the economy. One of them is ensuring energy security and the protection and improvement of the environment. The intervention direction adopted is the modernisation of infrastructure and energy security, as part of which the projects modernising the electricity, oil and gas infrastructure should be implemented and financed.

The planned project is in line with the above-mentioned objectives and is consistent with the Long-term National Development Strategy 2030.

The Strategy for Responsible Development until 2020 (with an outlook until 2030) also addresses the provisions of EUROPE 2020 Strategy. It specifies that the modernisation of generation sources and innovative solutions in the economy, along with the development of the capacities available from renewable sources, will contribute to the reduction of greenhouse gas emissions. The Strategy states that RES sources are mostly non-controllable sources. Continuous subsidisation of RES causes serious disturbances in the functioning of energy markets – causing an increase in energy prices. Therefore, the following issues, among others, have been identified as necessary in the Strategy:

- ensuring the possibility of balancing and interaction of RES sources with other sources (not subject to limitations by forces of nature);
- the evolutionary process of changes.

National Energy and Climate Plan for the years 2021–2030 (NECP PL)

On 30 December 2019, the Minister of State Assets handed to the European Commission the National Energy and Climate Plan for the years 2021–2030, thus, fulfilling the obligation imposed on Poland under the provisions of the Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the Governance of the Energy Union and Climate Action, amending Regulations (EC) No. 663/2009 and (EC) No. 715/2009 of the European Parliament and of the Council, Directives 94/22/EC, 98/70/EC, 2009/31/EC, 2009/73/EC, 2010/31/EU, 2012/27/EU and 2013/30/EU

[1]paragraph repealed in the current version of the act

of the European Parliament and of the Council, Council Directives 2009/119/EC and (EU) 2015/652 and repealing Regulation (EU) No. 525/2013 of the European Parliament and of the Council.

The National Energy and Climate Plan for the years 2021−2030 (NECP PL) was adopted by the Committee for European Affairs at a sitting on 18 December 2019.

NECP PL presents the assumptions and objectives as well as policies and measures intended to implement 5 dimensions of the Energy Union, i.e.:

1. energy security;
2. internal energy market;
3. energy efficiency;
4. decarbonisation of the economy, and
5. research, innovation and competitiveness.

The National Energy and Climate Plan for the years 2021–2030 sets out the following climate and energy targets for 2030:

- 7% reduction of greenhouse gas emissions in the sectors not covered by the ETS system in comparison to the level from 2005;
- 21–23% share of RES in the gross final consumption of energy (target 23% will be possible to achieve when Poland is awarded additional EU funds, including those intended for equitable transformation), taking into consideration:
    - 14% share of RES in transport,
    - annual increase in the share of RES in heating and cooling by 1.1 percentage points on average per year;
- increase in energy efficiency by 23% compared to the PRIMES2007 projections;
- reduction of the share of coal in electricity production to 56–60%.

The planned project is in line with the main objective of energy policy, which is energy security while ensuring the competitiveness of the economy, energy efficiency and reducing the environmental impact of the energy sector and the optimum use of own energy resources.

The development of offshore wind energy was also taken into account in the **Transmission Network Development Plan for the 2018−2027,** prepared by Polskie Sieci Elektroenergetyczne S.A. (PSE). The part concerning the potential directions of transmission network extension ensuring the reliability of the power system indicates the performance of analytical works in the scope of offshore transmission network construction and indicates that among the expected system effects of the development of the extra high voltage networks (NN) is the preparation of the capability for connection and output of the installed power on wind farms at the level allowing to meet the RES share in the energy balance of the country. The document also presents various OWF connection scenarios.

The **National Program for Low-Emission Economy Development** determines the need for greater diversification of the energy mix. Mainly coastal areas were identified as the location of wind farms. It was also specified that modernisation and extension of the NPS is required to meet the requirements of the RES market. It was stated in the document that the maximum productivity of the OWF in the PMA is estimated at 12 GW of installed capacity and 48−56 TWh of energy per year. The real investment plans until 2030 amount to 6 GW. The document specifies that for the development of offshore wind energy in Poland, it is necessary, among others:

- to conduct analyses in the scope of the grounds for the OWF development in Poland;
- to develop offshore power networks.

The Study of Conditions for the Maritime Spatial Plan of Polish Sea Areas

On commission from the Directors of the Maritime Offices in Szczecin and Gdynia, the Study of Conditions for the Maritime Spatial Plan of Polish Sea Areas including spatial analyses were developed in 2015.

The study has a different character than the study of conditions and directions for commune spatial development, specified in the Act of 27 March 2003 on spatial planning and development (Journal of Laws of 2003, No. 80, item 717, as amended).

Its aim was to collect and analyse information for the purposes of preparing spatial development plans for the Polish Sea Areas. The Study compiled information on the state of the marine ecosystem and the use of maritime areas.

The Vistula River Basin Management Plan was adopted by the Resolution of the Council of Ministers of 18 October 2016 (Journal of Laws of 2016, item 1911). River basin management plans are used as the basic planning document for achieving environmental objectives. The river basin water resources include: inland surface and groundwater, marine inland waters as well as transitional and coastal waters located in the river basin area, divided into surface water bodies (SWB).

The planned project is located within the direct catchment area of the sea CWDW1801, surface water body (SWB) the Piaśnica River from where it flows out of Lake Żarnowieckie to where the Białogórska Struga joins it RW200023477289 as well as the Bychówska Stream RW200025477249.

Regional documents

The **2030 Pomorskie Voivodeship Development Strategy** adopted by the Regional Council of the Pomeranian Voivodeship in Resolution No. 376/XXXI/21 of 12 April 2021 is the basic strategic document setting out the directions of development of the Pomeranian Voivodeship. The Strategy sets three key objectives: Sustainable Security, Open Regional Community and Resilient Economy. These are operationalised through 12 operational objectives. The planned project contributes to the achievement of operational objective 1.2. “Energy security” through the development of the offshore wind energy. The Regional Strategic Programme for energy and environment **Eco-efficient Pomerania** (2018) identifies the development of low-emission energy sources as one of the priorities.

The **Spatial Management Plan for the Pomeranian Voivodeship 2030** was adopted by resolution No. 318/XXX/16 of the Regional Council of the Pomeranian Voivodeship of 29 December 2016. In the field of spatial policy, the focus is, among others, on the growth of electricity production and transformation of the region into the national leader in renewable energy production. The spatial policy activities and projects included in the Pomeranian Voivodeship Spatial Development Plan 2030 (PVSDP) include, among others: “(…) the construction of transmission and distribution systems as well as power stations for power evacuation from the new and renewable energy sources systems (wind farms, including offshore.… (…) the extension of 400/110 kV substation Żarnowiec for the possibility of connecting the offshore wind farms to the National Power System NPS (…).” The

Pomeranian Voivodeship Spatial Development Plan 2030 (PVSDP) outlines the vision of spatial transformations of the region. One of the elements of the vision is the thesis that as a result of installation of large power capacities within the voivodeship, in the form of a nuclear power plant, coal-fired power plant and an offshore wind turbine (OWT), as well as due to the development of distributed power sector, the security of energy supply of Northern Poland will be improved and the voivodeship will become energetically self-sufficient. It is indicated that in the ports of Łeba, Ustka and Władysławowo, the shipyard areas should be activated for the activities related to the management of maritime areas (e.g. logistic and service and maintenance centre for the OWF and associated connection infrastructure).

The planned project is situated within the Northern Infrastructure Corridor with a latitudinal orientation, connecting the potential Pomerania fuel and energy hub with the western part of the country, in which the planned line and hub power infrastructure is mainly situated, including the one connected with the offshore and onshore wind farms [Figure 1.2].

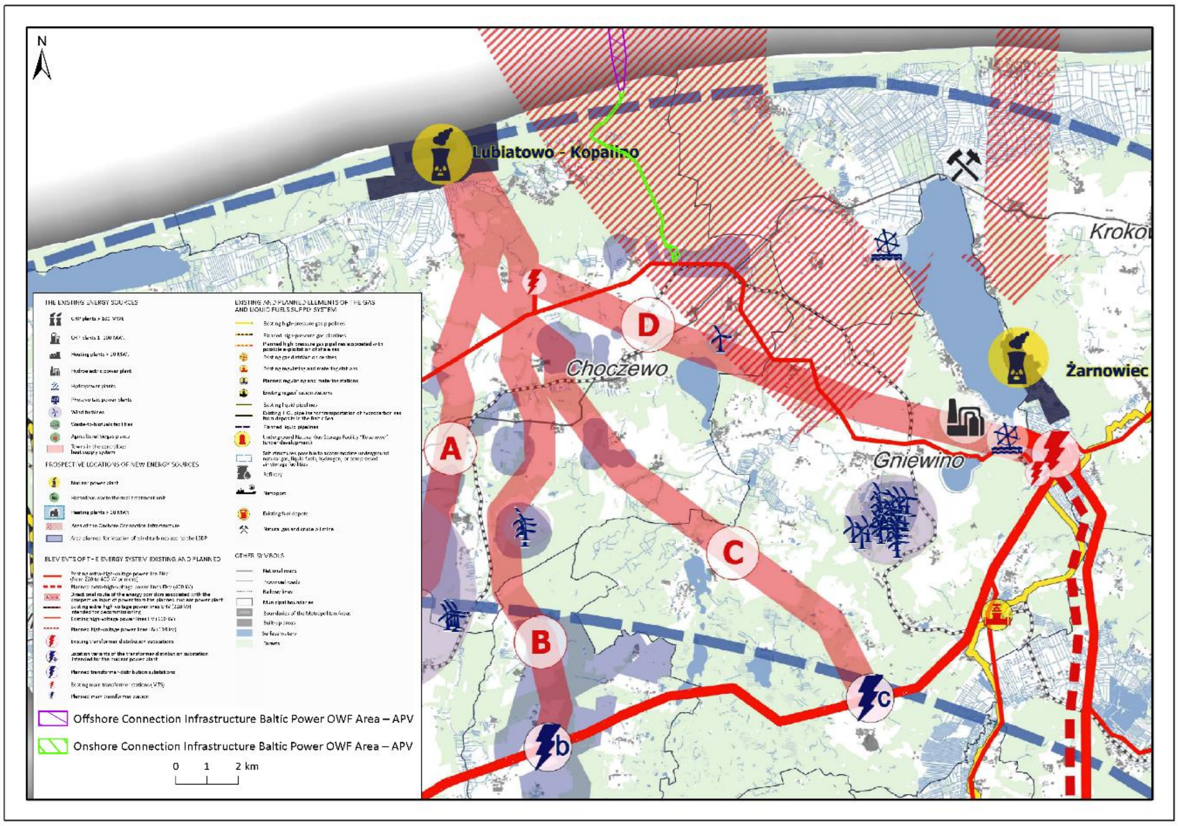


Figure 1.2. Location of the Baltic Power OWF CI within the Northern Infrastructure Corridor {Source: internal materials based on the Pomeranian Voivodeship Spatial Development Plan; https://pbpr.pomorskie.pl/plan-zagospodarowania-wojewodztwa/]

Pomerania Voivodeship Environmental Protection Plan for the years 2018–2021 with an outlook to 2025 was adopted by resolution No. 461/XLIII/18 of the Pomeranian Voivodeship Regional Assembly of 26 February 2018. One of the objectives is the "Improvement of air quality" and the adopted direction of intervention is the development of renewable energy. The type of tasks implemented as part of this direction are, for example, the generation of energy from renewable sources and promoting renewable energy sources.

The study of conditions and directions for the Choczewo commune spatial development adopted by resolution No. XXVIII/220/2021 of the Choczewo Commune Council of 26 January 2021 mentions the favourable climatic conditions within the coastal strip, which have contributed to the establishment of several wind turbines in the Pomerania Voivodeship, including also the Choczewo commune area. In the study, there is no mention about the location of wind farms at sea, however, the information on the search for the location of energy parks on land is included.

On 26 October 2020, the Choczewo Commune Council adopted Resolution No. XXV/188/2020 on the commencement of the modification of the Study of conditions and directions for the Choczewo commune spatial development in part 2, to enable the development of power infrastructure connected to handling energy generation from renewable sources.

Local Spatial Development Plan

Partially, the area of the customer substation and completely the planned 400 kV line are included in the provisions of the local spatial development plan ”Wiatraki w Lublewie“ (“Windmills in Lublewo“), Choczewo commune, (Resolution No. XIV/144/2008 of the Choczewo Commune Council of 19 March 2008, Official Journal of the Pomerania Voivodeship No. 58 of 24 June 2008, item 1658). There are agricultural areas and areas for the location of electrical power equipment there.

Pursuant to Article 3a of the Act of 24 July 2015 on the preparation and implementation of strategic projects in the scope of transmission networks (Journal of Laws of 2015, item 1265, as amended), the planned project constitutes a strategic project in the scope of transmission networks. Such projects, in accordance with Article 80.2 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 (Journal of Laws of 2008, No. 199, item 1227, as amended) are not subject to the requirement of ascertainment, by the authority issuing the decision on environmental conditions, of conformity of the project location with the findings of the local spatial development plan, if such plan had been established.

Choczewo Commune Development Strategy adopted by Resolution No. VIII-62/1999 of the Commune Council in Choczewo on 15 October 1999. The project is in line with strategic objective 3: Maintaining a clean environment through the development of sewage infrastructure and the use of clean energy sources, subsection 1. "Construction of wind power turbines". In the SWOT analysis, one of the development opportunities for the commune is the trend towards new energy sources – wind.

Draft assumptions for the plan of supply with heat, electrical energy and gas fuel for the Choczewo commune published in August 2015 by the “Fundacja Poszanowanie Energii” [Respect Energy Foundation] assumes measures and tasks of the commune energy policy that involve: enhancing local energy security through the use of renewable energy resources and the development of renewable energy sources, reducing the environmental impact of energy and reducing energy costs, in particular improving air quality.

Low-emission Economy Plan for Choczewo Commune adopted by Resolution no. XXVI/150/16 of the Choczewo Commune Council of 23 March 2016. One of the additional strategic objectives of the plan is to increase energy production from renewable sources by a minimum of 80% compared to 2014, i.e. to a level of approximately 1170 GJ (without taking into account electricity production from the system wind turbines, i.e. producing electricity for the NPS). The planned project is in line with specific objective no. 3 “Improvement of RES use in individual households and enterprises”. The document mentions issues of promoting and supporting the use of renewable energy.

The Environmental Protection Plan for Choczewo Commune for the years 2019–2022 with an outlook to 2025 underlines the most important issues for the Choczewo commune, resulting from the analysis of the status and dangers to the environment, which are the investments, administrative and organisational actions in the scope of, for example, heating sources, introduction of renewable energy, modernisation of the communication system to enhance air quality and the environmental status within the entire zone. Strategic objective: ”Improving air quality to the levels required by law, meeting emission standards from installations“ is included in the specific objective no. 3, which talks about ”Increasing the use of unconventional energy sources,” which the planned project is in line with.

1.4.3 Summary of findings of the strategic and planning documents

The planned project remains in line with the arrangements of many policies and strategies, in particular, the ones concerning environmental protection (reduction of pollution emissions), sustainable development (use of renewable energy sources) and energy security (independence from external energy sources). **The planned project is consistent with the environmental objectives of the applicable strategic and planning documents analysed.**

1.5 Methodology of the environmental impact assessment

In preparing this EIA Report, the results of the 2020−2021 environmental surveys and inventories carried out for the BP OWF CI. The study also takes into account the results of the information meetings, which were used to clarify the issues of public interest and to develop the part of the Report dedicated to the analysis of possible social conflicts. Moreover, the study was based on the agreements made by the Investor with the Choczewo Forest Inspectorate on the course of the connection infrastructure on land as well as the information submitted to PSE on the location of the connection point.

The work was carried out in accordance with the method of preparation of the EIA Report, which involved:

- using the results of environmental surveys and environmental inventories;
- establishing the program and planning documents at international, national and regional level and the results of the environmental impact forecasts for these documents which may have an impact on the planned project;
- the concept of the project, including the determination of activities in the following phases: construction, operation and decommissioning, including the determination of risks to the environment and their potential effects;
- the results of information meetings.

When preparing the EIA Report, the following were used primarily:

- guidelines, manuals and other materials concerning the preparation of the EIA Report;
- experience of the authors’ team and good practice in the scope of the creation.

Three phases of the planned project were considered in the EIA Report:

- construction;
- operation;
- decommissioning.

The purpose of the EIA Report is to determine the potential impacts of the planned project on the environment. The assessment is a study and analytical work performed by a team of specialists. When preparing the EIA Report, analyses of descriptive and cartographic materials were carried out, the impact assessment methodology was applied, as well as the interpretation of the results of the surveys and inventories conducted.

When preparing the Report, the main analyses regarded:

- technical and technological aspects of the planned project affecting the size of the impact;
- environmental, spatial and social conditions of the planned project;
- variant preparation possibilities (in terms of location, technical, process, organisation and logistic possibilities);
- size and significance of potential environmental impacts;
- possibility of avoiding and reducing adverse environmental impacts;
- the scope of monitoring.

The EIA Report contains an analysis of the planned project in terms of techniques and technologies applied as well as operating conditions. Among others, the information contained in the documentation of the planned project was used and the potential impact of similar activities that may accumulate was analysed.

On the basis of the data available, results of environmental surveys and environmental inventories, significant environmental, spatial and social conditions were determined. On this basis, potential impacts and risks related to the planned project were identified. The scope and reach of the expected environmental impact were also determined. Comparisons were made with analogous cases in terms of environmental conditions and the size and nature of impacts.

The approach used to assess the scale and significance of impacts results from the authors' experience gained during the environmental impact assessments of projects planned to be implemented in offshore areas, including cable and pipeline projects.

The approach adopted allowed identifying comprehensive actions aimed at avoiding, preventing and limiting negative impacts related to the planned project.

Figure 1.3 presents a diagram of the methods of preparation of the EIA Report in relation to the data concerning the planned project and the environmental surveys conducted. Environmental surveys mean that the report on the planned project impact on the environment used both the environmental surveys and environmental inventories carried out for the purpose of this document, as well as the results of other surveys, e.g. ones conducted for the projects located closest to the planned project, in connection with the development of such documents as protection plans for protected areas (resulting from environmental monitoring or monitoring/surveys carried out in connection with other activities or projects), available to the public or in literature.

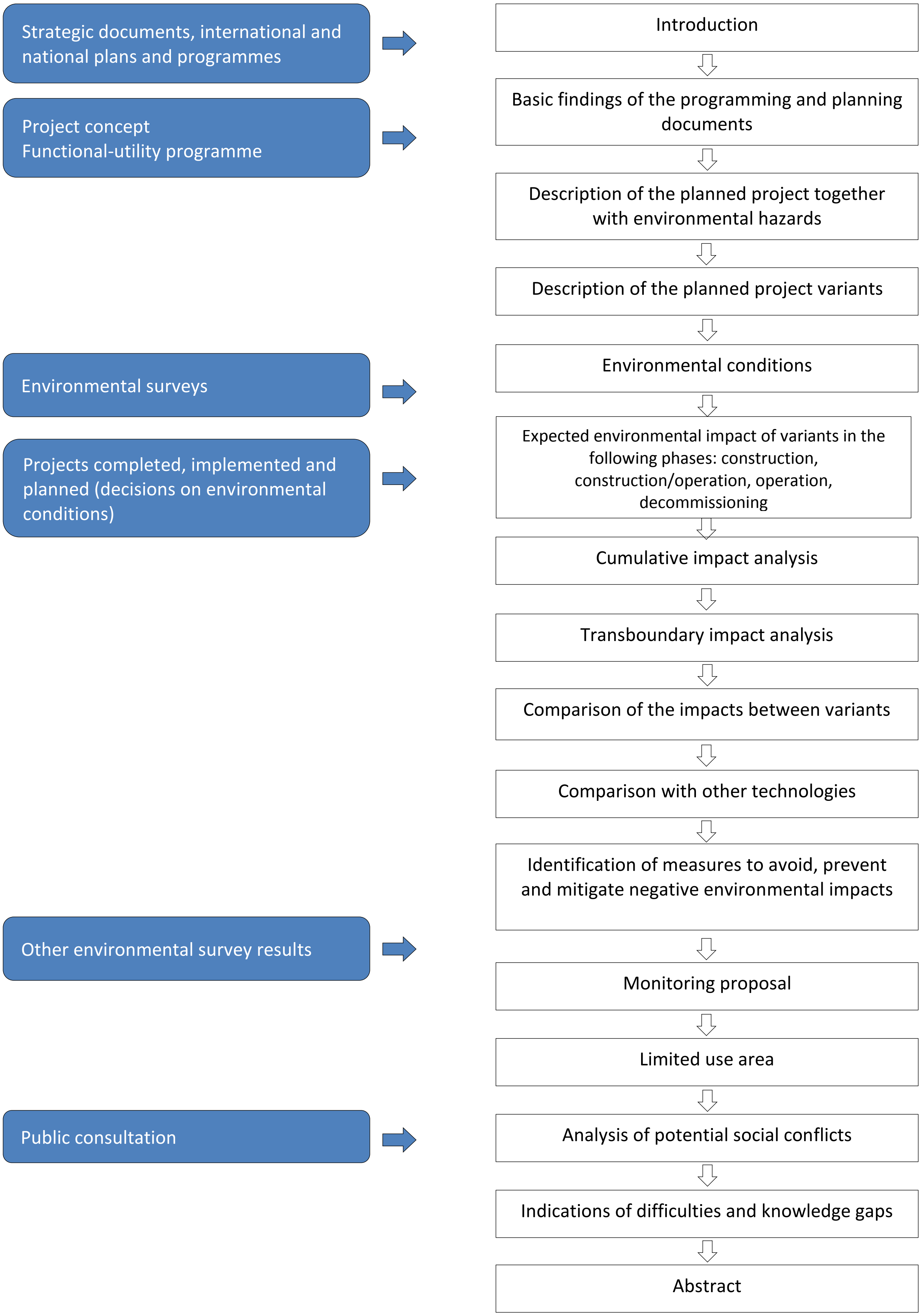


Figure 1.3. Outline of the Environmental Impact Assessment Report preparation [Source: internal materials]

Table 1.2 presents the characteristics of the marine and land environment surveys carried out for the purpose of the EIA Report preparation. Detailed testing methods for individual elements are presented in the inventory report constituting Appendix 1 to this Report.

Table 1.2. Characteristics of the marine and terrestrial environment abiotic and biotic element surveys [Source: internal materials]

Survey type	Survey dates	Range of surveys	Scope of surveys
Marine environment			
Abiotic elements			
Geophysical surveys	03.2020–01.2021	Area along the routes of the two variants of the subsea cable connection	Geophysical surveys were carried out on parallel profiles spaced every 50 m [the bathymetric profiles (MBES) in the near-shore zone were made every 10 m]: • Sonar (side scan sonar); • Magnetometer; • Seismo-acoustic and seismic (two sediment profilers operating at different frequencies, high and low); • Visual inspection carried out using an ROV. After collection, the geophysical data was processed and an analysis of the collected material performed. After the analysis of bathymetric, sonar and magnetometer data, items for inspection have been identified; subsequently, a visual inspection of the items identified was carried out. *In situ* resistance measurement at 10 stations.
Hydrological	03.2020–03.2021	Area along the routes of the two variants of the subsea cable connection	Measurements using two kits for hydrological measurements within the area of the BP OWF CI at water depths of 10 and 15 m. Registration of: • wave height, period and direction; • the levels of the free surface of the sea; • velocities and directions of sea currents (in near-surface, middle and near-seabed layers); • water temperature and turbidity above the seabed. Measurement of water temperature and salinity in the water depth using CTD sensors during water and sediment sampling.
Geochemical	03.2020–08.2020	Area along the routes of the two variants of the subsea cable connection	Collecting 46 samples of surface sediments (during the winter campaign) and 46 samples of surface sediments (during the summer campaign) in an even grid with an average density of 1 sample per 1 km^2. Laboratory tests based on PN-EN-ISO standards or, in the absence thereof, in accordance with test procedures prepared by an accredited laboratory or applicable test methods.
	02–07.2019 08–10.2019	OWF survey area	
Hydrochemical	07.2020–01.2021	Area along the routes of the two variants of the subsea cable connection	Collecting 9 seawater samples from the surface layer and 9 samples from the near-seabed layer (in the summer and winter campaign). Furthermore, collecting seawater samples supplementing vertical profiles (total of 8 samples) at two survey points. Sampling in an evenly spaced grid with a density of 1 station per 5 km^2, along the centre line of the cable route. Such seawater sampling arrangement was applied also during the winter campaign. Laboratory tests based on PN-EN-ISO standards or, in the absence thereof, in accordance with test procedures prepared by an accredited laboratory or applicable test methods.
	06–09.2019 12.2019–01.2020	OWF survey area	

Survey type	Survey dates	Range of surveys	Scope of surveys
Acoustic surveys	03.2020–04.2021	Area along the routes of the two variants of the subsea cable connection	Ambient noise measurements using 2 hydrophones.
Biotic elements			
Phytobenthos	06.2020	Area along the routes of the two variants of the subsea cable connection	Analysis of bathymetric and sonar data. Visual inspection carried out using an ROV along 4 transects. Analysis of video material.
Macrozoobenthos	06.2020	Area along the routes of the two variants of the subsea cable connection	Collecting 74 quantitative samples from a soft bottom with an average density of 1 sample per 1 km^2. Collecting 4 samples from a hard bottom. Laboratory tests of: • taxonomic composition; • abundance; • biomass.
	06.2019	OWF survey area	
Ichthyofauna	03.2020–02.2021	Area along the routes of the two variants of the subsea cable connection	Hydroacoustic survey using a survey echosounder. Collecting ichthyofauna samples (adult specimens) using a pelagic trawl, sets of survey nets and beach seine net. Ichthyoplankton (fish larvae and eggs) sample collection with a Bongo net. Ichthyological analysis in terms of: • taxonomic composition; • length and mass of specimens; • sex and gonadal maturity; • degree of stomachs filling; • age. Ichthyoplankton analysis in terms of: • taxonomic composition; • abundance; • larvae and fry lengths.
Marine mammals	03.2020–04.2021	Area along the routes of the two variants of the subsea cable connection	Passive acoustic monitoring of porpoises using 3 underwater continuous porpoise detectors (C-PODs).
	03.2020–04.2021	Route along the seashore	Observations of marine mammals along the shore (3.8 km long section).
Seabirds	10.2018–11.2019	OWF survey area	
Land environment			
Sand hopper	05.2020–09.2020	Survey profiles on the seashore in the area of the planned landing of the power connection	Qualitative and quantitative analyses of the sand hopper across 8 survey profiles located on the beach perpendicular to the shoreline.
Biota of non-lichenised fungi *Macromycetes*	04–06.2020, 09–11.2020	Area 38.2 km^2	Line plot survey method. Collecting samples of thalli for laboratory tests.

Survey type	Survey dates	Range of surveys	Scope of surveys
Biota of lichenised fungi (lichens)	Observations (after leaves have been shed by phorophytes)	Area 38.2 km^2	Line plot survey method. Collecting samples of thalli for laboratory tests.
Mosses and liverworts	04–05.2020, 06–08.2020	Area 38.2 km^2	Line plot survey method. Identification of taxa on the basis of morphological features inspected using a 14x magnifying glass.
Plants and natural habitats	03–08.2020	Area 38.2 km^2	Line plot survey method.
Invertebrate fauna	04−10.2020	Area 38.2 km^2	Spotting method. Apart from the spotting method, the following methods, are applied: • capturing with a butterfly net – an important method for all invertebrate taxa with active flight capacity; • extensive scooping of grass and herb vegetation patches; • inspecting spider nets; • Beating off trees and bushes onto beating sheet (Japanese umbrella); • using a U-type insect net for collecting information on invertebrates penetrating tree trunks, including the cracked outer bark; • searching through sheltering and feeding grounds, e.g. dead wood, tree hollows and other microhabitats on trees, aimed at the detection of species such as e.g. hermit beetle (*Osmoderma eremita*) or rusty click beetle (*Elater ferrugineus*); • grab sampling from bed sediments and aquatic plants (aquatic invertebrates); • using traps, e.g. modified Barber traps (jar pitfall trap); • analysis of microbiotopes of anthropogenic origin (e.g. waste bottles, tin cans, plastic films, etc.) to detect the location of e.g. beetles from the *Carabus* genus (*Carabus* spp.).
Ichthyofauna	03.2020−02.2021	Watercourses: Bezimienna, Lubiatówka, the Biebrowski Canal and its tributary (tributary from Kierzkowo)	Identification of protected species of lampreys and fish based on field observations, interviews with anglers, available literature, data from the Polish Anglers Association, documentation from the municipality and other documents obtained. Additionally, selected habitat components, such as food availability (amount), the number of hiding places, shading of individual sections, the amount of deposited organic matter lying at the stream bed, the type and thickness of the substrate, the watercourse depth, degree of naturalness of the stream bed (regulation of the stream bed and banks, impounding structures, weirs etc.) were evaluated. Electrofishing for fish with direct and impulse current in selected locations using a backpack electrofishing kit. Measurements of oxygenation, pH and temperature of water.
Herpetofauna	03−10.2020	Area 38.2 km^2	Survey performed by direct observation (binoculars, telescope), acoustic monitoring and voice stimulation method, also during night time. The work was carried out in the entire survey area, as well as along survey transects and at observation points.
Avifauna	03.2020−	Area 38.2 km^2	Direct observation (binoculars, telescope), acoustic

Survey type	Survey dates	Range of surveys	Scope of surveys
	04.2021		monitoring and voice stimulation method, also during night time. The work was carried out in the entire survey area, as well as along survey transects and at observation points.
Mammals	03.2020–02.2021	Area 38.2 km^2	Spotting method consisting in active spotting of animals in the environment and searching for signs of presence (among others faeces, feeding grounds, tracks, etc.). Apart from the spotting method, whenever necessary, carrying out acoustic monitoring, including ultrasound detectors for bats; searching for and searching through potential shelter, hibernation and feeding locations; roadside inspections for dead individuals, etc. Survey using camera traps and survey consisting in capturing small mammals in live traps.

Table 1.3 presents the methodologies of the calculations performed for the purposes of the environmental impact assessment for the BP OWF CI.

Table 1.3. List of the methodologies of the calculations performed for the purpose of the environmental impact assessment of the Baltic Power OWF Connection Infrastructure

Parameter	Methodology
Air pollution	The emission figures of individual pollution types caused by combustion of fuel in combustion engines of machines are provided in the "EMEP/EEA air pollutant emission inventory Guidebook" (2007) published by the European Environment Agency. The highest figures were adopted for the two groups of machines referred to as industrial and forestry machines. These indicators reflect the quantity of pollution caused as a result of combustion of 1 kg of fuel (diesel oil density of 0.820 g/litre was adopted in the calculations). In accordance with the EMEP/EEA air pollutant emission inventory Guidebook (2007) published by the European Environment Agency, it was adopted that the share of NO_2/NO_x is 55%. Moreover, it was adopted that the mean daily fuel consumption by all machines used will be 100 litres per hour (82 kg). It was adopted that all machines will work for a maximum of 8 hours per day (non-stop) for 252 business days per year.
Noise from the overhead EHV power line	None of the available calculation software, including the application most often used for the calculation of forecast noise levels, i.e. HPZ'2001 Windows (Acoustics Laboratory of the Building Research Institute) does not allow for performing forecast noise calculations caused by high voltage overhead power lines wherein the source of noise is the electric discharge. Therefore, the calculations of the noise levels will be carried out with proprietary software the algorithm of which is based on an acoustic model of an overhead power line based on the model described in the paper by T. Wszołek [Wszołek T. *Modelowanie zjawisk wibroakustycznych w systemach przesyłowych najwyższych napięć* (literally: Modelling vibroacoustic phenomena in extra high voltage transmission systems)] [433] and adapted to domestic conditions. This model constitutes an extension of the model provided in the standard PN-N-01339:2000 Noise – Methods for measurement and evaluation of high voltage power line noise. A developed version of this model can be found in the study by Wszołek *Ustalenie standardowych szerokości pasów technologicznych dla istniejących linii 220 i 400 kV* (literally: Determining standard widths of technical strips for the existing 220 and 400 kV power lines) [435].
Noise from a customer substation	Regulation of the Minister of the Environment of 1 October 2012 amending the regulation on the permissible noise levels in the environment (Journal of Laws of 2012, item 1109), indicates that the following values should be used when assessing the acoustic nuisance of a project or installation: • Indicator of the environmental noise level assessment, which is the equivalent sound level "A" – L_{Aeq} [dB], which is a measure of the average sound energy over the observation time; • Equivalent sound level at a given observation point, which shall be determined as the sum of the (logarithmic) levels relating to the different noise sources.

Parameter	Methodology
	• Equivalent level (L_{AeqT}), which is determined for a given noise source according to the formula: $$L_{AeqT} = 10 \log \left(\frac{1}{T} \sum_{i=1}^{n} t_i 10^{0,1 L_{Ai}} \right) \text{ [dB]}$$ in which: ○ L_{Ai} – average level of sound "A" occurring within time t_i [dB], ○ t_i – exposure time for noise level L_{Ai} [s], ○ T – reference time, for which the equivalent sound level value [s] is determined, ○ T = 8 most unfavourable consecutive hours for day-time and the 1st most unfavourable hour for the night.
Electromagnetic field	Applicant Proposed Variant (APV) High-voltage power cables, due to the presence of a cable operating wire screening sheaths, are not a source of magnetic field, since its normal (radial) component disappears completely as a result of the presence of a semiconductive screen surrounding the operating wire, copper or aluminium as well as the presence of a conductive screen surrounding the electrical insulating sheath. Therefore, estimating the levels of the electric field component outside the cable is unjustified. • All magnetic field intensity distribution calculations were performed with PoIE-M software the algorithm of which has the following input assumption: • 4 cable circuits, each comprising 3 single AC cables with the following voltage values: ○ U_{n1} – 220 kV with permitted cable current-carrying capacity of $I_{(220 kV)}$ = 830 A, ○ U_{n2} – 275 kV with permitted cable current-carrying capacity of $I_{(275 kV)}$ = 890 A, • Distance between cable circuits (circuit centrelines): ○ 5.0 m – for most of the circuit length, ○ 17 m – near cable chambers; • cable burying depth onshore: 2.0 m under soil surface; • cable arrangement within a circuit: levels, with a distance between cables of 0.3 m; • arrangement of phases in each cable circuit: L1 L2 L3. • Calculations of magnetic field distribution for individual solutions (variants) were performed by identifying the value of the quantity mentioned at the height of: 0.2; 1.0 and 2.0 MAGL in accordance with the recommendation indicated in the Regulation of the Minister of Climate of 17 February 2020 on the methods of checking compliance with permissible levels of electromagnetic fields in the environment (Journal of Laws of 2020, item 258). Rational Alternative Variant (RAV) • It follows from the analysis of theoretical dependencies determining the computational algorithm that the maximum value and distribution of an electric (E) and magnetic (M) field around an overhead power line is mainly affected by the following line parameters: • phase voltage of respective power line circuits (it affects only the distribution of electric field intensity); • line ampacity (it affects only the distribution of magnetic field intensity); • the distance of phase conductors from the ground; • the intervals between the phase circuits; • arrangement of phase conductors (phase configuration) in multi-circuit power line (two-circuit line). • Other structural components of a power line have a lesser impact on the electric field intensity distribution. Furthermore, the electric field intensity distribution near a power line is affected by its direct surroundings, such as trees (forest), buildings, etc. and the determination of impact of such surroundings on the field distribution is only possible by measurements. • Depending on the arrangement of phases in individual circuits of an overhead power line the distribution of both the electric and magnetic field changes. Therefore, the arrangement of phases in respective circuits (single-sign arrangement) for the

Parameter	Methodology
	calculation of both field component distributions was adopted as proposed in the technical documentation. • With the power line design (tower series and type) determined and the adopted phase configuration and phase voltage value, the electric field intensity around the power line depends, therefore, mainly upon the distance of phase conductors from the earth. The field intensity increases as this distance decreases and reaches its highest value within the cross section in which the distance of phase conductors from the earth is the smallest – typically in the middle of a power line span. The calculations of the electric field distribution (similarly to magnetic field) were carried out for a representative span of the analysed 4-circuit power line routed on towers. Such span is representative in the respect that it illustrates a case (of a location near the power line) in which the electric (and magnetic) field intensity may reach the maximum values near the entire line. As a result, the intensity of both field components at any other power line span will surely not exceed those determined in the representative span.
Thermal conditions	The computational model has been developed on the basis of the so-called method of mirror images, Kennelly formula assuming the existence of two linear heat sources, i.e. the actual source representing the power loss due to operating wire resistance and dielectric losses in power line primary insulation and its symmetrical, with regard to the earth surface, representation with identical power value as the actual source adopted with negative sign.

The actions resulting from the implementation of the planned project in its particular phases, i.e. construction, operation and decommissioning, have been defined in the first stage of the assessment. On the basis of environmental and inventory surveys carried out for the purposes of the EIA Report, the elements of the environment (receivers) which may be affected by these activities were also determined. At the second stage of the assessment, links between the sources of potential impacts and individual receivers were identified on the basis of literature and the experience of experts [Figure 1.4].

Specific impacts have been assigned characteristics in four categories:

- the nature of impacts (positive or negative);
- the type of impacts (direct, indirect, secondary/primary, cumulative/reversible, permanent);
- impact range (local, regional) and determining whether the impact is of transboundary nature;
- the time span of impacts (short-term, medium-term, long-term, permanent, temporary).

At the same time, the resistance of receptors to individual impacts in the cases when a possible interaction between the impact and the receptor was determined. Taking into account the characteristics of impacts assigned and the determined resistance of the receptor to them, the scale (size) of impacts, specific for individual relations between the impact and the receptor, was established. The size (scale) of the impact was described according to a five-point scale: (1) irrelevant, (2) low, (3) moderate, (4) high, and (5) very high.

Taking into account the prevalence of a given receptor occurrence, its significance and role in the environment, and, in particular, its conservation status, individual receptors, treated as an environmental resource, were assigned a value (significance), also determined on a five-step scale: (1) irrelevant, (2) low, (3) moderate, (4) high and (5) very high.

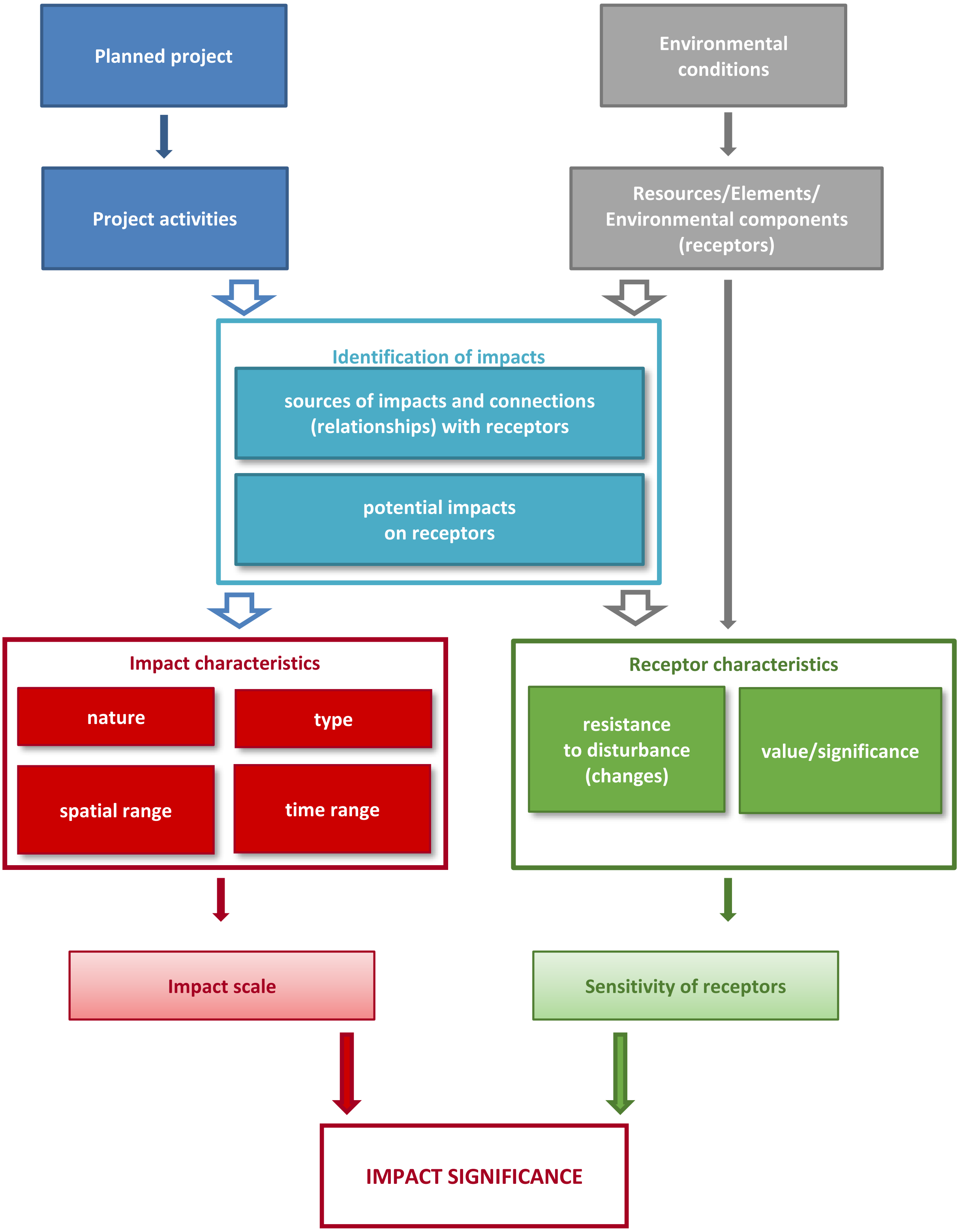


Figure 1.4. Diagram of the environmental impact identification and assessment including the determination of the impact significance [Source: internal materials based on the ESPOO REPORT (2017) [95]]

At the next stage of the assessment, taking into account the size (scale) of the impact assigned and the receptor sensitivity, the impact significance was also determined on a five-point scale [Table 1.4]:

- negligible impact;
- low impact;

- moderate impact;
- important impact;
- significant impact.

Table 1.4. Matrix defining the significance of the impact in relation to the scale of impact and the value of the resource [Source: internal materials]

Impact significance		**Receptor sensitivity**				
		Irrelevant	**Low**	**Moderate**	**High**	**Very high**
Scale (size) of impact	Irrelevant	Negligible	Negligible	Negligible	Negligible	Low
	Low	Negligible	Negligible	Low	Low	Moderate
	Moderate	Negligible	Low	Low	Moderate	Moderate
	High	Negligible	Low	Moderate	Important	**Significant**
	Very high	Low	Moderate	Moderate	**Significant**	**Significant**

In accordance with the methodology of environmental impact assessment described above, a significant impact may occur if a “very high” scale of impact is determined and at the same time at least a “high” sensitivity of the receptor and a “high” scale of impact with a “very high” sensitivity of the receptor is stated.

2 Description of the planned project

2.1 General characteristics of the planned project

2.1.1 Subject and scope of the project

The planned project involves the construction and operation of the BP OWF CI in the offshore and onshore area of the Republic of Poland [Figure 2.1]. The planned BP OWF CI will allow the inclusion of the electricity produced by the OWF into the NPS.

The project will consist of the following elements:

- EHV power cable lines, located in the offshore area within the boundaries of the exclusive economic zone, the territorial sea and the internal sea waters;
- crossing the shoreline in the area of 160.5 km of the seashore (according to the Maritime Office chainage) using a trenchless method;
- cable chambers located on land, where subsea and underground cable lines are to be connected;
- EHV power lines, located in the onshore area in the Choczewo commune (Wejherowo district, Pomeranian voivodeship);
- customer substation;
- 400 kV overhead power line connecting the customer substation with the PSE substation.

The scope of the planned project includes three main phases: construction, operation, and decommissioning, which in this case will consist in the discontinuation of the operation of the BP OWF CI.

Transformers supported on three export platforms located at a maximum distance of approx. 30 km from the shore shall constitute the starting point of the planned project (km 0+0).

The land-sea interface, i.e. the cable line landfall, is placed in plots no. 3/7 and 3/6, Kierzkowo precinct, Choczewo commune (Wejherowo district, Pomeranian voivodeship) (km 33+400). The corridor through which the BP OWF CI will switch from the offshore onto the onshore area shall be located in the area of 160.5 km of the sea shore (according to the Maritime Office chainage). Pursuant to the Act of 21 March 1991 on the maritime areas of the Republic of Poland and maritime administration (Journal of Laws of 1991, no. 32, item 131 as amended), the planned project shall be implemented within the boundaries of the coastal strip [Figure 3.27, subsection 3.12]. The route of the underground cable line will lead through the forests administered by the Regional Directorate of State Forests (RDSF) in Gdańsk, within the boundaries of the Choczewo Forest District, in the forest subdistricts of Szklana Huta and Białogóra.

The final element of the BP OWF CI will consist in connecting it to the customer substation with an input voltage of 220 kV or 275 kV and output voltage of 400 kV (km 40+0). The planned substation is located in plot no. 17/129, Kierzkowo precinct, Choczewo commune. The customer substation shall be connected to the PSE substation via an overhead 400 kV power line.

The current terminals on the PSE substation (km 41+0) constitute the endpoint of the planned project.

The basic parameters characterising the planned project implemented according to the APV are provided in Table 2.1. A detailed description of the technologies to be used in the project implementation is included in subsection 2.2. The differences between the APV and the Reasonable Alternative Variant (hereinafter referred to as: RAV) are described in subsection 2.3.

Table 2.1. List of key parameters of the planned project [Source: internal materials]

Parameter	Value/description
Length of the grid connection line in the offshore area (assuming that the export cables are led from each of a maximum of three Baltic Power OWF substations)	Approx. 46.8 km
Length of the HDD or HDD Intersect trenchless technology landfall section between the offshore and onshore power cable route (including the offshore and onshore sections)	Approx. 1.5 km
Length of the grid connection line in the onshore area	Approx. 6.5 km
Type of power cables in the offshore area	Three-core AC subsea cables
Type of power cables in the onshore area	Single-core AC earth cables
Operating voltage of power cables	220 kV or 275 kV
Maximum number of cables in the offshore area	4 single cable lines
Maximum number of cable lines in the onshore area	12 cables arranged in 4 circuits, 3 cables per circuit
Cable landfall method	Trenchless method – horizontal directional drilling (HDD or HDD Intersect)
Method of power cable laying in the offshore area	Buried in the seabed or laid on the seabed surface, secured
Method of power cable laying in the onshore area	Buried in the ground
Method of connecting the customer substation to the PSE substation	Overhead power line
Length of the overhead power line	Up to 270 m

The concept for the planned project was developed on the basis of information on the commonly used technological and technical solutions for the implementation of such projects. The information and data collected on the environment allowed the verification of the assumptions made in order to minimise the impact on the natural environment and other users of the area in which the construction of the BP OWF CI is planned. The technological and technical solutions adopted will maintain their state-of-the-art status at least for several years after the project commencement. It is unlikely that power line construction technologies that would significantly differ from those used today will emerge within the next few years.

The information and data characterising this project and included in this section are as accurate and precise as is reasonably possible. In the situation when this was not possible, the conservative approach was applied, i.e. all possible implementation methods of a particular project component were described. In the impact analysis, the worst-case scenario of the implementation method was adopted in terms of environmental impact, assuming that the adoption of the implementation method less oppressive to the environment would not result in different impacts, but would only mitigate or reduce their negative effect. Such an approach guarantees that the worst-case scenario in terms of environment of the project implementation has been adopted in the EIA Report.

2.1.2 Project location and the sea and land area occupied by the project

The Development Area of the BP OWF CI is located within the maritime area of the Republic of Poland – in the exclusive economic zone, in the area of the territorial sea and internal sea waters, as well as onshore, in the Choczewo commune area (Wejherowo district, Pomeranian voivodeship).

In the offshore area, the BP OWF CI Development Area is described using the coordinates given in Table 2.2. In the area stretching from the southern boundary, the OWF does not reach beyond the coordinates specified in Decision no. 1/K20 of the Minister of Maritime Economy and Inland Waterways of 23 July 2020 and the Decision no. 5/20 of the Director of the Maritime Office in Gdynia of 28 September 2020, whereas for the OWF internal area, the Applicant has submitted a request for issuing an appropriate decision for the area specified below.

The location of the planned project within the Choczewo Forest Inspectorate has been a subject of discussions and agreements with the Forest Inspectorate authorities. On the basis of the comments and recommendations of the Choczewo Forest Inspectorate, a project of the BP OWF CI route has been prepared which is to minimise the negative environmental impacts, by:

- minimising the tree felling surface area by routing the connection infrastructure of various investors within a single, common cable tray;
- bypassing the environmentally valuable areas indicated by the Choczewo Forest Inspectorate at the stage of agreements;
- using the cable technology and horizontal directional drilling to mitigate the pressure on the environment.

Figure 2.1 and Figure 2.2 show the location of the BP OWF CI Development Area, the boundaries of which are defined by the coordinates provided in Table 2.2. The scope of the figures and coordinates in the table covers the above-mentioned planned changes of the project location in the offshore area.

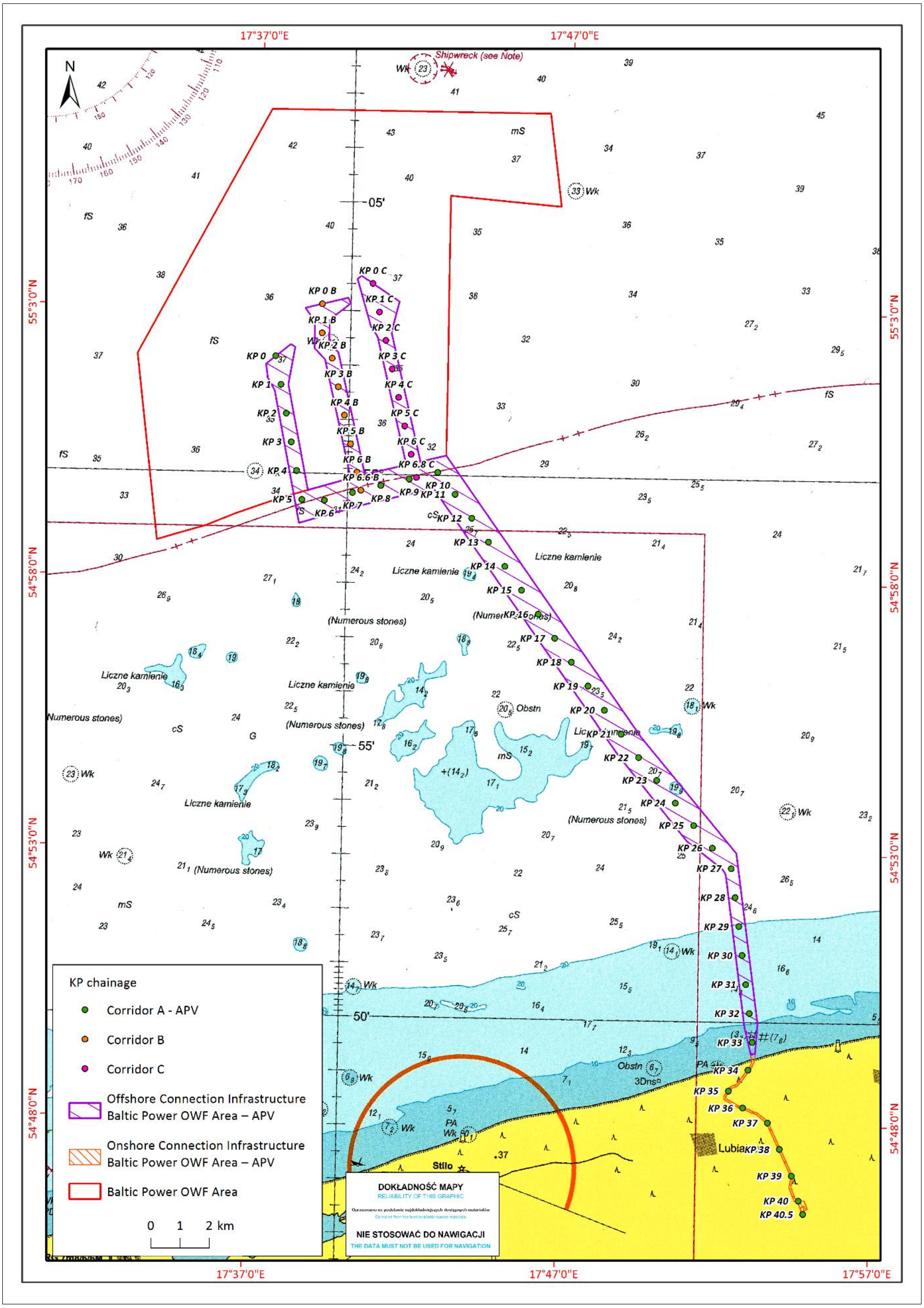


Figure 2.1. Location of the planned project – Baltic Power OWF Connection Infrastructure [Source: internal materials]

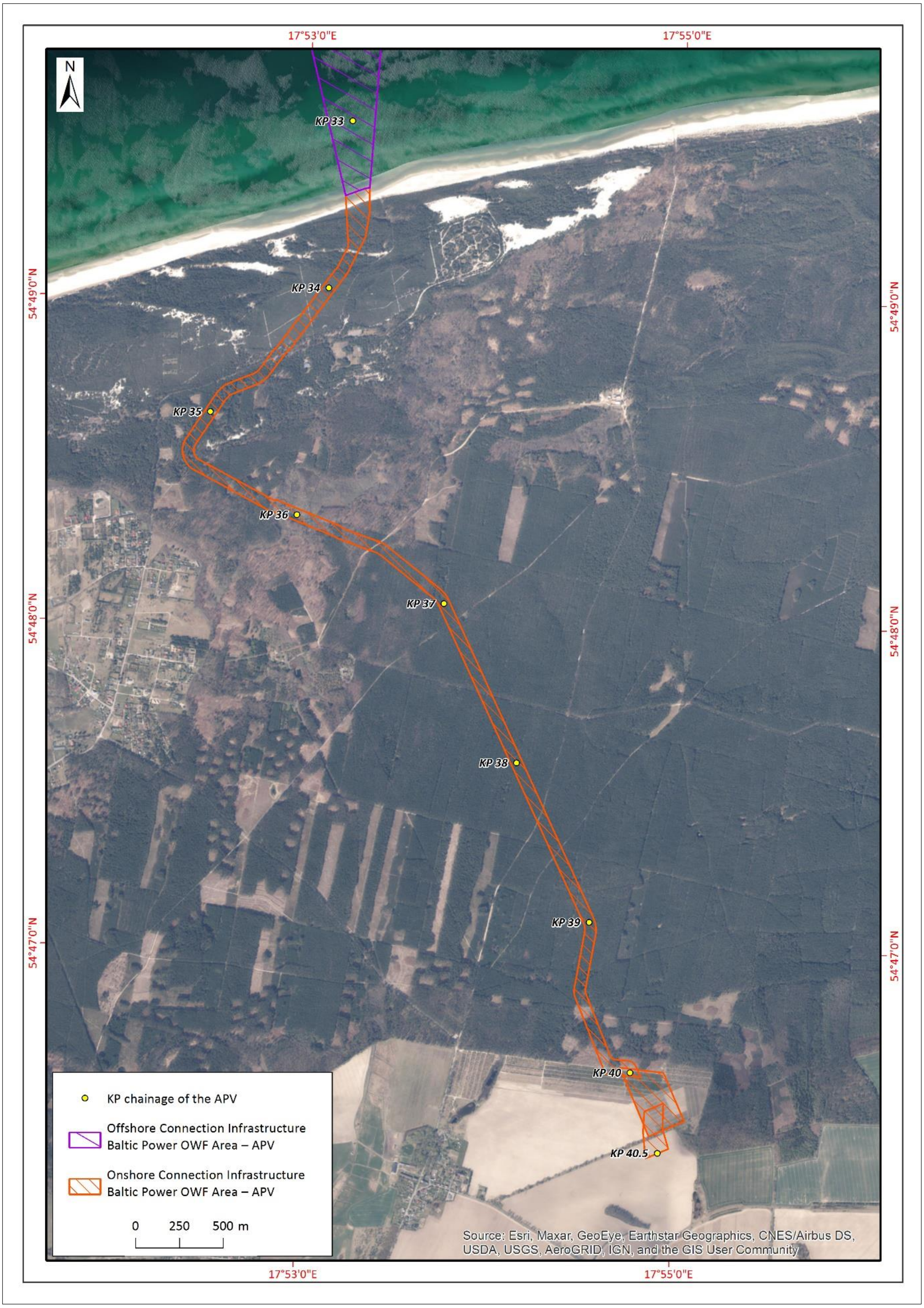


Figure 2.2. Location of the planned project – Baltic Power OWF Connection Infrastructure close-up view of the onshore part [Source: internal materials]

Table 2.2. Geographical coordinates of the Development Area of the Baltic Power OWF Connection Infrastructure in the offshore area and in the onshore area [Source: internal materials]

Point no.	Coordinate system			
	flat cartesian PL-1992 [m]		geodetic GRS80H [DD°MM'SS.SSS"]	
	X	y	φ	λ
Offshore area				
1	794064.9	417158.3	55°00'10.851''	17°42'15.978''
2	794268.1	418044.4	55°00'17.953''	17°43'05.643''
3	784616.4	424714.3	54°55'09.476''	17°49'30.211''
4	780624.8	427982.3	54°53'02.064"	17°52'37.370"
5	774784.9	428701.0	54°49'53.482''	17°53'22.901"
6	773768.4	428618.9	54°49'20.549''	17°53'19.203"
7	773762.0	428588.4	54°49'20.328''	17°53'17.496"
8	773724.0	428481.4	54°49'19.041''	17°53'11.536"
9	774667.9	428262.0	54°49'49.469''	17°52'58.401"
10	779807.7	427629.5	54°52'35.444"	17°52'18.307"
11	779932.8	427597.3	54°52'39.472"	17°52'16.388"
12	780046.1	427533.6	54°52'43.106"	17°52'12.713"
13	780139.2	427442.9	54°52'46.071"	17°52'07.538"
14	781049.1	426289.6	54°53'14.901"	17°51'01.981"
15	784009.2	423919.1	54°54'49.395''	17°48'46.120''
16	793142.5	417607.4	54°59'41.277''	17°42'42.211''
17	792605.7	415277.7	54°59'22.503''	17°40'31.687''
18	792129.1	413559.6	54°59'06.021''	17°38'55.533''
19	791963.9	412995.3	54°59'00.324''	17°38'23.969''
20	796508.0	412166.9	55°01'26.807"	17°37'32.345''
21	796946.6	411930.8	55°01'40.846"	17°37'18.561''
22	797426.8	411871.2	55°01'56.343"	17°37'14.669''
23	798089.6	412718.1	55°02'18.325"	17°38'01.643''
24	797997.8	412870.2	55°02'15.449"	17°38'10.310''
25	796717.8	412636.9	55°01'33.895"	17°37'58.580''
26	793093.6	413297.6	54°59'37.061''	17°38'39.744''
27	793502.0	414769.8	54°59'51.188''	17°40'02.147''
28	797571.5	413890.9	55°02'02.299"	17°39'08.271"
29	797960.0	413534.8	55°02'14.644"	17°38'47.789''
30	798854.8	413548.3	55°02'43.603"	17°38'47.574''
31	799338.5	413223.0	55°02'59.048"	17°38'28.717''
32	799677.5	414691.8	55°03'10.929"	17°39'51.117"
33	799487.3	414781.0	55°03'4.830"	17°39'56.348"
34	798931.0	414049.5	55°02'46.380"	17°39'15.731"
35	798151.2	414037.7	55°02'21.146"	17°39'15.913"
36	797809.5	414351.0	55°02'10.284"	17°39'33.931"

Point no.	Coordinate system			
	flat cartesian PL-1992 [m]		geodetic GRS80H [DD°MM'SS.SSS"]	
	X	y	φ	λ
37	793626.2	415254.5	54°59'55.504''	17°40'29.291''
38	793861.4	416271.0	55°00'03.734''	17°41'26.248"
39	793953.1	416671.0	55°00'06.943''	17°41'48.665"
40	798349.9	415690.5	55°02'28.592"	17°40'48.812''
41	798696.4	415459.9	55°02'39.663"	17°40'35.449''
42	800334.3	415007.2	55°03'32.373"	17°40'08.186''
43	800434.4	415147.2	55°03'35.699"	17°40'15.967''
44	799551.4	416442.2	55°03'07.922"	17°41'29.894"
45	798499.6	416169.4	55°02'33.728"	17°41'15.633"
Onshore area				
Construction area of cable chambers and the cable line				
1	771665.9	428684.4	54°48'12.556''	17°53'24.738"
2	771671.0	428677.7	54°48'12.717''	17°53'24.360"
3	771675.6	428670.8	54°48'12.862''	17°53'23.965"
4	771679.7	428663.5	54°48'12.992''	17°53'23.554"
5	771683.4	428655.9	54°48'13.105''	17°53'23.128"
6	771686.5	428648.2	54°48'13.202''	17°53'22.690"
7	771693.1	428629.8	54°48'13.407''	17°53'21.658"
8	771763.3	428435.5	54°48'15.580''	17°53'10.711"
9	771775.4	428418.4	54°48'15.962''	17°53'09.739"
10	771910.1	428091.2	54°48'20.150''	17°52'51.294"
11	771916.6	428060.1	54°48'20.345''	17°52'49.547"
12	771919.8	428052.5	54°48'20.445''	17°52'49.118"
13	771923.5	428045.1	54°48'20.561''	17°52'48.701"
14	772156.9	427615.8	54°48'27.892''	17°52'24.443"
15	772161.4	427608.3	54°48'28.031''	17°52'24.017"
16	772166.3	427601.1	54°48'28.188''	17°52'23.609"
17	772171.8	427594.2	54°48'28.360''	17°52'23.221"
18	772177.7	427587.8	54°48'28.548''	17°52'22.854"
19	772184.0	427581.8	54°48'28.749''	17°52'22.511"
20	772190.7	427576.2	54°48'28.964''	17°52'22.193"
21	772197.8	427571.1	54°48'29.192''	17°52'21.902"
22	772205.3	427566.5	54°48'29.430''	17°52'21.638"
23	772213.0	427562.4	54°48'29.678''	17°52'21.404"
24	772221.0	427558.9	54°48'29.935''	17°52'21.200"
25	772229.2	427556.0	54°48'30.200''	17°52'21.027"
26	772237.7	427553.6	54°48'30.471''	17°52'20.886"
27	772246.2	427551.8	54°48'30.747''	17°52'20.779"
28	772254.9	427550.6	54°48'31.026''	17°52'20.705"

Point no.	Coordinate system			
	flat cartesian PL-1992 [m]		geodetic GRS80H [DD°MM'SS.SSS"]	
	X	y	φ	λ
29	772263.6	427550.1	54°48'31.308''	17°52'20.664"
30	772272.3	427550.1	54°48'31.591''	17°52'20.657"
31	772281.1	427550.7	54°48'31.873''	17°52'20.685"
32	772289.7	427551.9	54°48'32.154''	17°52'20.746"
33	772298.3	427553.8	54°48'32.431''	17°52'20.841"
34	772306.6	427556.2	54°48'32.704''	17°52'20.968"
35	772314.9	427559.2	54°48'32.972''	17°52'21.129"
36	772322.8	427562.7	54°48'33.232''	17°52'21.321"
37	772330.6	427566.8	54°48'33.484''	17°52'21.543"
38	772338.0	427571.5	54°48'33.726''	17°52'21.796"
39	772587.5	427739.3	54°48'41.887''	17°52'30.977"
40	772597.4	427746.5	54°48'42.210''	17°52'31.368"
41	772606.8	427754.3	54°48'42.517''	17°52'31.798"
42	772615.6	427762.7	54°48'42.807''	17°52'32.262"
43	772623.8	427771.8	54°48'43.078''	17°52'32.760"
44	772631.4	427781.3	54°48'43.328''	17°52'33.289"
45	772638.3	427791.4	54°48'43.557''	17°52'33.845"
46	772644.5	427801.9	54°48'43.763''	17°52'34.428"
47	772650.0	427812.8	54°48'43.946''	17°52'35.034"
48	772654.7	427824.0	54°48'44.105''	17°52'35.660"
49	772700.0	427943.2	54°48'45.633''	17°52'42.298"
50	772702.9	427950.2	54°48'45.731''	17°52'42.687"
51	772706.3	427957.0	54°48'45.842''	17°52'43.064"
52	772710.0	427963.6	54°48'45.967''	17°52'43.429"
53	772714.2	427969.9	54°48'46.104''	17°52'43.779"
54	772718.7	427976.0	54°48'46.254''	17°52'44.114"
55	772723.6	427981.7	54°48'46.416''	17°52'44.432"
56	772728.9	427987.2	54°48'46.589''	17°52'44.733"
57	772734.4	427992.3	54°48'46.772''	17°52'45.014"
58	772740.3	427997.0	54°48'46.965''	17°52'45.274"
59	772844.5	428075.7	54°48'50.376''	17°52'49.591"
60	772861.8	428092.1	54°48'50.944''	17°52'50.494"
61	773297.4	428421.4	54°49'05.209''	17°53'08.556"
62	773306.2	428429.7	54°49'05.497''	17°53'09.013"
63	773314.3	428435.9	54°49'05.764''	17°53'09.351"
64	773318.6	428439.1	54°49'05.904''	17°53'09.527"
65	773321.3	428440.8	54°49'05.993''	17°53'09.621"
66	773432.6	428496.7	54°49'09.620''	17°53'12.654"
67	773724.0	428481.4	54°49'19.041''	17°53'11.536"

Point no.	Coordinate system			
	flat cartesian PL-1992 [m]		geodetic GRS80H [DD°MM'SS.SSS"]	
	X	y	φ	λ
68	773762.0	428588.4	54°49'20.328''	17°53'17.496"
69	773768.4	428618.9	54°49'20.549''	17°53'19.203"
70	773623.3	428617.6	54°49'15.855''	17°53'19.255"
71	773505.4	428598.4	54°49'12.029''	17°53'18.286"
72	773483.4	428593.8	54°49'11.314''	17°53'18.051"
73	773299.9	428501.8	54°49'05.332''	17°53'13.055"
74	773289.2	428496.7	54°49'04.981''	17°53'12.779"
75	773281.5	428493.1	54°49'04.730''	17°53'12.585"
76	773271.1	428486.8	54°49'04.393''	17°53'12.242"
77	772849.3	428167.9	54°48'50.578''	17°52'54.752"
78	772825.9	428141.9	54°48'49.807''	17°52'53.314"
79	772701.7	428048.1	54°48'45.743''	17°52'48.169"
80	772692.7	428040.8	54°48'45.448''	17°52'47.771"
81	772684.2	428033.0	54°48'45.168''	17°52'47.342"
82	772676.2	428024.7	54°48'44.904''	17°52'46.884"
83	772668.7	428015.9	54°48'44.658''	17°52'46.398"
84	772661.8	428006.7	54°48'44.429''	17°52'45.887"
85	772655.4	427997.0	54°48'44.219''	17°52'45.352"
86	772649.7	427987.0	54°48'44.028''	17°52'44.795"
87	772644.6	427976.6	54°48'43.858''	17°52'44.219"
88	772640.2	427966.0	54°48'43.709''	17°52'43.626"
89	772594.9	427846.8	54°48'42.181''	17°52'36.988"
90	772591.8	427839.5	54°48'42.079''	17°52'36.586"
91	772588.3	427832.6	54°48'41.962''	17°52'36.197"
92	772584.3	427825.8	54°48'41.830''	17°52'35.824"
93	772579.9	427819.4	54°48'41.683''	17°52'35.466"
94	772575.0	427813.2	54°48'41.522''	17°52'35.127"
95	772569.8	427807.5	54°48'41.349''	17°52'34.808"
96	772564.1	427802.0	54°48'41.163''	17°52'34.510"
97	772558.1	427797.0	54°48'40.966''	17°52'34.235"
98	772551.8	427792.4	54°48'40.758''	17°52'33.983"
99	772302.3	427624.5	54°48'32.598''	17°52'24.802"
100	772298.6	427622.3	54°48'32.478''	17°52'24.678"
101	772294.8	427620.3	54°48'32.355''	17°52'24.569"
102	772290.9	427618.5	54°48'32.226''	17°52'24.474"
103	772286.8	427617.0	54°48'32.095''	17°52'24.395"
104	772282.7	427615.8	54°48'31.961''	17°52'24.332"
105	772278.5	427614.9	54°48'31.824''	17°52'24.286"
106	772274.2	427614.3	54°48'31.686''	17°52'24.256"

Point no.	Coordinate system			
	flat cartesian PL-1992 [m]		geodetic GRS80H [DD°MM'SS.SSS"]	
	X	y	φ	λ
107	772269.9	427614.0	54°48'31.547''	17°52'24.242"
108	772265.6	427614.0	54°48'31.408''	17°52'24.245"
109	772261.4	427614.3	54°48'31.269''	17°52'24.265"
110	772257.1	427614.9	54°48'31.132''	17°52'24.302"
111	772252.9	427615.8	54°48'30.996''	17°52'24.355"
112	772248.7	427616.9	54°48'30.863''	17°52'24.424"
113	772244.7	427618.4	54°48'30.732''	17°52'24.509"
114	772240.8	427620.1	54°48'30.606''	17°52'24.609"
115	772237.0	427622.1	54°48'30.484''	17°52'24.725"
116	772233.3	427624.4	54°48'30.366''	17°52'24.854"
117	772229.8	427626.9	54°48'30.255''	17°52'24.998"
118	772226.5	427629.6	54°48'30.149''	17°52'25.154"
119	772223.4	427632.6	54°48'30.050''	17°52'25.323"
120	772220.5	427635.8	54°48'29.957''	17°52'25.504"
121	772217.8	427639.1	54°48'29.872''	17°52'25.695"
122	772215.4	427642.7	54°48'29.796''	17°52'25.895"
123	772213.2	427646.4	54°48'29.727''	17°52'26.105"
124	771982.5	428070.6	54°48'22.482''	17°52'50.077"
125	771983.2	428089.6	54°48'22.515''	17°52'51.140"
126	771833.7	428452.8	54°48'17.865''	17°53'11.618"
127	771821.0	428464.3	54°48'17.460''	17°53'12.274"
128	771753.3	428651.6	54°48'15.365''	17°53'22.823"
129	771746.7	428669.9	54°48'15.161''	17°53'23.855"
130	771746.7	428669.9	54°48'15.161''	17°53'23.855"
131	771741.9	428681.7	54°48'15.014''	17°53'24.519"
132	771736.4	428693.1	54°48'14.842''	17°53'25.164"
133	771730.2	428704.2	54°48'14.645''	17°53'25.788"
134	771723.2	428714.8	54°48'14.425''	17°53'26.387"
135	771715.5	428724.9	54°48'14.182''	17°53'26.959"
136	771509.3	428978.0	54°48'07.638''	17°53'41.322"
137	771475.5	429021.1	54°48'06.567''	17°53'43.763"
138	771468.6	429029.3	54°48'06.347''	17°53'44.232"
139	771461.1	429037.1	54°48'06.108''	17°53'44.674"
140	771453.1	429044.4	54°48'05.853''	17°53'45.087"
141	771444.6	429051.0	54°48'05.581''	17°53'45.468"
142	771435.7	429057.1	54°48'05.296''	17°53'45.817"
143	771426.3	429062.6	54°48'04.997''	17°53'46.130"
144	771416.7	429067.4	54°48'04.687''	17°53'46.408"
145	769594.3	429897.1	54°47'06.142"	17°54'34.464''

Point no.	Coordinate system			
	flat cartesian PL-1992 [m]		geodetic GRS80H [DD°MM’SS.SSS”]	
	X	y	ϕ	λ
146	769584.4	429901.2	54°47’05.823”	17°54’34.703’’
147	769574.2	429904.6	54°47’05.496”	17°54’34.904’’
148	769563.8	429907.3	54°47’05.161”	17°54’35.067’’
149	769553.3	429909.4	54°47’04.821”	17°54’35.189’’
150	769542.6	429910.7	54°47’04.477”	17°54’35.271’’
151	769531.9	429911.2	54°47’04.131”	17°54’35.313’’
152	769521.2	429911.1	54°47’03.784”	17°54’35.313’’
153	769510.5	429910.2	54°47’03.437”	17°54’35.273’’
154	769499.9	429908.6	54°47’03.093”	17°54’35.192’’
155	769231.2	429858.6	54°46’54.375”	17°54’32.626’’
156	769184.3	429849.8	54°46’52.851”	17°54’32.176’’
157	769182.2	429849.5	54°46’52.785”	17°54’32.160’’
158	769180.1	429849.3	54°46’52.718”	17°54’32.151’’
159	769178.1	429849.2	54°46’52.651”	17°54’32.149’’
160	769176.0	429849.3	54°46’52.584”	17°54’32.155’’
161	769173.9	429849.5	54°46’52.517”	17°54’32.168’’
162	769171.9	429849.8	54°46’52.451”	17°54’32.188’’
163	769169.9	429850.3	54°46’52.385”	17°54’32.215’’
164	769167.9	429850.9	54°46’52.321”	17°54’32.249’’
165	769165.9	429851.6	54°46’52.258”	17°54’32.290’’
166	768806.6	429993.0	54°46’40.703”	17°54’40.522’’
167	768804.7	429993.8	54°46’40.643”	17°54’40.569’’
168	768802.9	429994.8	54°46’40.585”	17°54’40.623’’
169	768801.2	429995.8	54°46’40.529”	17°54’40.683’’
170	768799.5	429997.0	54°46’40.476”	17°54’40.750’’
171	768797.9	429998.3	54°46’40.425”	17°54’40.823’’
172	768796.4	429999.7	54°46’40.378”	17°54’40.902’’
173	768795.0	430001.1	54°46’40.333”	17°54’40.986’’
174	768793.7	430002.7	54°46’40.292”	17°54’41.075’’
175	768792.6	430004.4	54°46’40.255”	17°54’41.169’’
176	768791.5	430006.1	54°46’40.221”	17°54’41.267’’
177	768790.5	430007.9	54°46’40.192”	17°54’41.368’’
178	768789.7	430009.8	54°46’40.166”	17°54’41.473’’
179	768789.0	430011.7	54°46’40.144”	17°54’41.581’’
180	768788.5	430013.6	54°46’40.127”	17°54’41.691’’
181	768788.0	430015.6	54°46’40.114”	17°54’41.802’’
182	768787.7	430017.6	54°46’40.106”	17°54’41.915’’
183	768784.0	430051.3	54°46’40.002”	17°54’43.803’’
184	768778.8	430096.0	54°46’39.856”	17°54’46.310’’

Point no.	Coordinate system			
	flat cartesian PL-1992 [m]		geodetic GRS80H [DD°MM'SS.SSS"]	
	X	y	ϕ	λ
185	768778.3	430099.5	54°46'39.841''	17°54'46.508''
186	768777.5	430103.0	54°46'39.818''	17°54'46.704''
187	768776.5	430106.5	54°46'39.788''	17°54'46.898''
188	768775.3	430109.8	54°46'39.750''	17°54'47.087''
189	768773.9	430113.1	54°46'39.706''	17°54'47.271''
190	768772.2	430116.3	54°46'39.654''	17°54'47.450''
191	768770.4	430119.3	54°46'39.595''	17°54'47.623''
192	768768.3	430122.3	54°46'39.530''	17°54'47.788''
193	768766.1	430125.0	54°46'39.459''	17°54'47.946''
194	768763.7	430127.7	54°46'39.382''	17°54'48.096''
195	768761.1	430130.1	54°46'39.300''	17°54'48.236''
196	768758.3	430132.4	54°46'39.212''	17°54'48.366''
197	768755.4	430134.5	54°46'39.119''	17°54'48.486''
198	768752.4	430136.4	54°46'39.022''	17°54'48.595''
199	768749.3	430138.1	54°46'38.921''	17°54'48.693''
200	768746.0	430139.6	54°46'38.817''	17°54'48.779''
201	768684.6	430165.3	54°46'36.843''	17°54'50.270''
202	768704.7	429964.4	54°46'37.392''	17°54'39.006''
203	769142.5	429792.0	54°46'51.470''	17°54'28.977''
204	769148.2	429790.0	54°46'51.653''	17°54'28.857''
205	769154.0	429788.3	54°46'51.840''	17°54'28.758''
206	769159.9	429787.0	54°46'52.031''	17°54'28.679''
207	769165.9	429786.0	54°46'52.224''	17°54'28.621''
208	769171.9	429785.4	54°46'52.419''	17°54'28.583''
209	769177.9	429785.2	54°46'52.614''	17°54'28.567''
210	769184.0	429785.4	54°46'52.810''	17°54'28.571''
211	769190.0	429786.0	54°46'53.005''	17°54'28.597''
212	769196.0	429786.9	54°46'53.199''	17°54'28.643''
213	769242.1	429795.5	54°46'54.697''	17°54'29.086''
214	769511.6	429845.7	54°47'03.441"	17°54'31.659''
215	769517.9	429846.6	54°47'03.646"	17°54'31.708''
216	769524.3	429847.2	54°47'03.852"	17°54'31.732''
217	769530.7	429847.3	54°47'04.058"	17°54'31.731''
218	769537.0	429846.9	54°47'04.264"	17°54'31.707''
219	769543.4	429846.1	54°47'04.469"	17°54'31.658''
220	769549.6	429844.9	54°47'04.671"	17°54'31.585''
221	769555.8	429843.3	54°47'04.870"	17°54'31.489''
222	769561.9	429841.3	54°47'05.064"	17°54'31.369''
223	769567.7	429838.8	54°47'05.254"	17°54'31.227''

Point no.	Coordinate system			
	flat cartesian PL-1992 [m]		geodetic GRS80H [DD°MM'SS.SSS"]	
	X	y	ϕ	λ
224	771390.2	429009.1	54°48'03.799''	17°53'43.169"
225	771395.9	429006.3	54°48'03.984''	17°53'43.004"
226	771401.4	429003.0	54°48'04.161''	17°53'42.817"
227	771406.8	428999.4	54°48'04.331''	17°53'42.610"
228	771411.8	428995.4	54°48'04.492''	17°53'42.383"
229	771416.6	428991.1	54°48'04.644''	17°53'42.138"
230	771421.0	428986.5	54°48'04.786''	17°53'41.875"
231	771425.2	428981.6	54°48'04.918''	17°53'41.596"
232	771459.0	428938.4	54°48'05.992''	17°53'39.147"
233	771459.4	428938.0	54°48'06.003''	17°53'39.122"
Customer substation construction area				
1	768711.3	430296.9	54°46'37.771''	17°54'57.616''
2	768740.3	430046.3	54°46'38.584''	17°54'43.563''
3	768347.9	430210.5	54°46'25.971''	17°54'53.091''
4	768432.7	430413.5	54°46'28.815''	17°54'04.381''
Construction area of the overhead line leading to the PSE substation				
1	768375.8	430178.4	54°46'26.857''	17°54'51.273''
2	768490.7	430186.2	54°46'30.580''	17°54'51.608''
3	768536.3	430295.0	54°46'32.107''	17°54'57.659''
4	768383.8	430291.9	54°46'27.174''	17°54'57.615''
5	768275.8	430323.5	54°46'23.695''	17°54'59.478''
6	768221.2	430193.0	54°46'21.864''	17°54'52.224''

The surface area of the BP OWF CI Development Area in the offshore area is 34.60 km^2 (including: 8.46 km^2 in the Exclusive Economic Zone, 27.57 km^2 in the territorial sea and 0.01 km^2 in the internal sea waters), as well as in the onshore area – 0.54 km^2 (including: 0.45 km^2 of the cable route construction area, 0.08 km^2 of the customer substation construction area and 0.003 km^2 of the construction area of the overhead cable line that connects the planned project with the PSE power substation).

The impact area of the construction works shall be limited to the necessary minimum within the Development Area boundaries. It is planned that in the offshore area, for each of a maximum of 4 cable lines, the construction belt shall be up to 20 m wide, thus, the largest acctual seabed surface area covered by the construction works (for all 4 cable lines) shall be up to 4.0 km^2, representing up to approx. 11.5% of the Development Area. In the onshore area, the width of the technical belt for the entire multi-circuit cable line shall be up to 25 m, i.e. the real surface area covered by construction works shall be approx. 0.16 km^2.

In the onshore Development Area, a land with a surface area of approx. 6000 m^2 (0.6 ha) shall be delineated, within which horizontal directional drilling will be conducted. A construction site and storage site for machinery and materials necessary for the drillings shall be organised. The subsea cables landed shall be connected to the onshore cables in cable chambers. After the construction site is closed down, a small surface area around the cable chambers shall be fenced off to ensure their protection. The maximum surface area covered by the protection area of each of a maximum of 4 cable chambers shall be approx. 80 m^2 (up to 320 m^2 in total).

For the purposes of this project implementation, technical belts have been delimited: permanent, temporary and additional [Table 2.3]. As presented in Table 2.3, in the permanent technical belt, the ground surface layer shall be permanently destroyed. It is estimated that the surface area permanently occupied by the planned project will be up to 15 ha. In the temporary technical belt used for the purposes of the construction works conducted, felling of trees and shrubs shall be carried out only if necessary.

Table 2.3. Characteristics of the permanent, temporary and additional technical belts in the Applicant Proposed Variant (APW) [Source: internal materials]

Technical belt	Width [m]	Characteristics
Permanent	25–80 (in the area of the cable chamber locations)	Area directly affected by the construction works, covers the places where the surface layer of the ground and groundcover will be destroyed, and the trees and shrubs are to be removed. The removal of trees and shrubs is permanent
Temporary	20 from the external cable lines	Constitutes the so-called “auxiliary belt”, in which environmental impact is possible during the construction phase, due to construction works, storage sites for excavated soil, vehicle parking areas and access roads
Additional	250 from the external cable lines	Area through which the access roads can be routed. If the work is properly organised, the project will not have a negative impact on the environment of the additional technical belt

2.1.3 Stages of the project implementation

In order to:

- minimise the risk of not fulfilling the time frames indicated in the Act of 21 March 1991 on maritime areas of the Republic of Poland and maritime administration (Journal of Laws of 1991, No. 32, item 131 as amended) to uphold Decision No. 1/K/20 of the Minister of Maritime Economy and Inland Waterways of 23 July 2020 and Decision No. 5/20 of the Director of the Maritime Office in Gdynia of 28 September 2020;
- optimise economically the entire project;
- enable the comprehensive contracting of the necessary services and supplies;
- consider limitations in the access to essential services and supplies (including: power cables, specialist vessels, port infrastructure and other components in the supply chain) related to the possible simultaneous implementation of similar investment plans in the sector of wind-generated electric power transmission by other entities;

the Applicant allows for the implementation of the project in a continuous process as well as in stages.

2.2 Description of technological solutions

The following sections describe the commonly used technological and technical solutions of electric power transmission from the OWF to onshore power grids, which are planned to be used in the implementation of this project.

2.2.1 Description of the production process

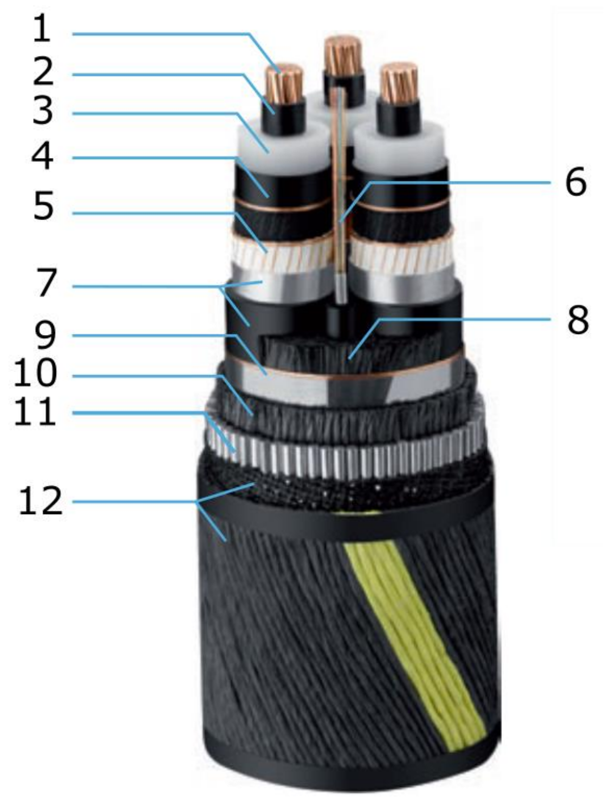
The planned BP OWF CI enables the transmission of electric power produced by the Baltic Power OWF to the NPS. The electric power transmission shall be carried out via a multi-circuit alternating current EHV cable line with an operating voltage of 220 kV or 275 kV. The export cables will connect the OWF with the customer substation which, in turn, will be connected to the PSE substation using a 400 kV overhead line. The demand for raw materials and energy, as in the case of other power installations, will be related to the construction process of individual BP OWF CI components. The operation of the connection infrastructure will not require providing energy from the combustion of fuels and the use of other raw materials for its proper functioning. It is predicted that with normal operation, the consumption of fuels and other raw materials will result only from the necessity to conduct overhauls or possible repairs, which, in the case of the offshore part of the BP OWF CI, shall be carried out at least once every 5 years, and for the onshore part – on *ad hoc* basis, in case of a suspected cable damage. There are no plans to excavate the export cables from the seabed and ground after the operation phase is finished. Therefore, the decommissioning phase shall involve the close-down of the infrastructure and it will not be necessary to use raw materials for the purposes of disassembly works.

2.2.2 Description of the technological solutions for individual elements of the project

2.2.2.1 Cable lines in the offshore area

Electric power shall be transmitted from the Baltic Power OWF using a maximum of four AC subsea EHV cables with an operating voltage of 220 kV or 275 kV. Three-core power cables of circular cross-section shall be used including a necessary telecommunication infrastructure, which will enable communication with the Baltic Power OWF infrastructure. Precise technical parameters of the subsea cables shall be specified at a later stage of the project implementation.

The typical subsea EHV power cable consists of three conductor cores, appropriately insulated and screened, armed with steel wires and synthetic materials, covered with a durable plastic sheath. There is an optical fibre inside the cable, which enables the measurements of the cable temperature and the communication with the wind farm infrastructure. The insulation material most commonly used in power cables transmitting current of extra high voltages (up to 500 kV) is the cross-linked polyethylene (XLPE), which is characterised by a very high operating temperature of the phase wire reaching up to 90°C. The exemplary structure of a three-core EHV cable is illustrated in Figure 2.3.



1. conductive copper/aluminium wire
2. extruded conductor screening
3. XLPE insulation (cross-linked polyethylene)
4. semi-conductive screening
5. screen made of copper wire with a moisture swelling agents (prevents longitudinal movement of moisture in case of local damage)
6. optical fibre
7. aluminium laminated sheath: aluminium tape adhered to the polyethylene covering plus conductive covering
8. cable filler: polypropylene yarn
9. binder tapes
10. substrate: polypropylene or polyester tape
11. armour made of galvanised steel braiding wire for protection against mechanical damage
12. outer sheath: bitumen bundles, jute tapes, braided polypropylene fibre

Figure 2.3. Construction of an exemplary extra high voltage subsea power cable [Source: internal materials on the basis of nexans.com]

The construction of up to 4 offshore cable lines transmitting power from the Baltic Power OWF to the land is planned. Each line will consist of a single subsea three-core cable. From a maximum of 3 substations located in the Baltic Power OWF Area, a maximum of 4 export subsea cables shall be led. In the OWF Area, the cable corridors will run at a distance of approx. 1.45 km apart. Outside the OWF boundary, up to a depth of approx. 22 m measured from the water surface to the seabed, the cable lines shall be laid at a distance of approx. 200 m apart. Next, after the bending of the route, the cables shall converge towards one another to a distance of approx. 100 m, up to the approx. 13 m isobath. Along the section from the substation to the approx. 13 m isobath, it is planned to bury the cables in the seabed sediment at a maximum depth of 4 m. The exceptions may be the areas of the seabed characterised by dense sediment structure or covered by numerous boulders, which would make it impossible to bury the cable. In such cases, the cables shall be laid on the seabed surface, properly secured against damage.

The commonly used technology of cable route construction in the offshore area, which is planned to be applied in this project, is described below.

2.2.2.1.1 Technologies of cable-laying in the seabed

The burying of a power cable in the seabed can be carried out using two main technologies:

- SLB – simultaneous lay and burial of the cable in the seabed sediment;
- PLB – post-lay burial of the cable.

In the case of the SLB technology, usually only a single vessel is used for cable laying – a Cable Laying Vessel (CLV). A device (most commonly a cable plough) dragged by the vessel buries the cable in the seabed without the necessity to first prepare an excavation and then bury the cable in it. The cable-laying rate depends mainly on the weather conditions and the characteristics of the seabed. It is approx. 1 km to maximally 9 km per day [268]. The drawback of the SLB technology is that an appropriately long period of favourable weather conditions must occur, which would allow constructing the entire cable line without interruptions which are not recommended in the case of this technology.

The PLB technology requires using at least two vessels for cable laying. One of them is a cable laying vessel or a towed cable barge which lays the cable on the seabed. The second one is most commonly a service vessel or other multi-purpose vessel equipped with a device for burying the cable, laid previously on the seabed, in the seabed sediment. Although the PLB method does not usually allow constructing the cable line as quickly as in the case of the SLB method, its advantage is the possibility to divide the cable line construction process, which is useful in the case of short-term periods with favourable weather conditions.

In addition, other vessels, which do not participate directly in the process related to power cable laying, such as: patrol vessels, service operation vessels (SOV), walk-to-work vessels (W2W) and flotels, where people involved in the construction phase may be accommodated, are allowed to participate in maritime operations.

2.2.2.1.1.1 Devices used for cable line laying in the offshore areas

The selection of the cable line construction technology, resulting from the seabed type, determines the types of devices that are used for cable laying on the seabed. In the case of the SLB technology, the most commonly used device is a cable plough, which allows simultaneous cable laying and burying in the seabed sediment [Figure 2.4]. The plough with the cable placed in the guide is deployed from the cable laying vessel to the seabed. The vessel sails away to a predetermined distance uncoiling the cable at the same time. The vessel is anchored or remains in a set position, which is maintained using the vessel dynamic positioning (DP) system, and the plough tow-line recovery begins. The towed plough buries the cable in the seabed sediment at a predetermined depth. After the plough approaches the vessel at a particular distance, the operation of sailing away to another position and tow-line recovery is repeated. At the end of the planned cable-laying section, the cable is released from the guide and the plough is recovered back onto the vessel deck. Plough cable-laying is the most common method of export cable laying, due to the cost-effectiveness of this method (single operating vessel, relatively short time of cable laying) and the possibility of applying it in a wide variety of seabed sediment types – from sands to loose tills. Some ploughs are equipped with additional accessories designed to loosen the structure of the substratum, and thus, facilitate the cable-laying process.

Figure 2.4. Exemplary subsea cable plough [Source: royalihc.com]

Other devices often used in the construction of subsea cable lines are the vehicles travelling on the seabed, equipped with accessories that enable injecting seawater under pressure into the sediment to a desired depth, i.e. water jetting. These vehicles can be divided into devices with simpler structure equipped with skids which move passively when pulled by a vessel or the ones used more often and with more advanced structures – self-propelled crawler vehicles controlled by an operator from aboard a vessel (ROV jet trencher) [Figure 2.5].

1

2

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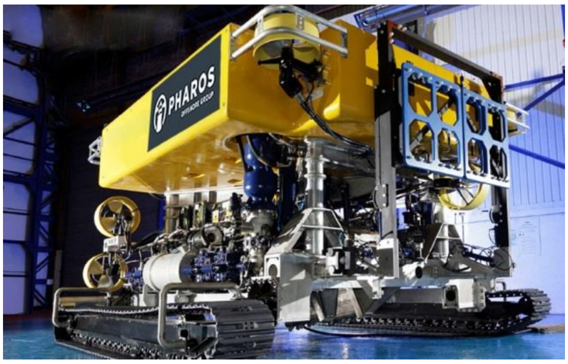

3

Figure 2.5. Exemplary ploughs (1, 2) and crawlers (3, 4) used for the construction as part of the water jetting and mechanical trenching technologies [Source: eta-ltd.com, ctoffshore.dgweb.dk, pharosoffshoregroup.com]

The water injected into the sediment under pressure results in a short-term fluidisation of the cohesive sediments, such as fine-grain sands and tills. The cable laid on the surface of the fluidised sediment sinks into it under its own weight and becomes automatically buried. As a result, the devices are most often used for burying the cable laid on the seabed, and not for constructing a trench in which the cable is to be laid later on.

Constructing a trench in soft sediments beforehand is done very rarely using high-capacity submersible water pumps (MFE, mass flow excavators). Such pumps are deployed from a vessel deck onto the seabed and after activation eject a stream of seawater under pressure towards it, which flushes away the seabed sediment to the depth of several meters along the vessel movement route. The use of MFE devices causes the stirring and lifting of large amounts of the seabed sediment, which leads to a temporary, strong water turbidity and suspended solids re-sedimentation over a large seabed area. The effects are usually unfavourable for the environment, therefore the use of MFE devices for the construction of cable trenches is occasional.

If the seabed is composed of compact tills or rocks, the self-propelled devices equipped with, for example, wheels or cutting chains are used for constructing cable trenches (e.g. ROV mechanical trencher). This device is used most often for constructing trenches before laying the cable, less often during its laying, due to a high risk of cable damage.

Some devices are equipped with complementary systems that take advantage of both of the technologies described above.

All the devices described above can be applied as part of the SLB and PLB technologies, however, in the case of the SLB technology, cable ploughs are used most commonly, and in the case of the PLB technology, the self-propelled, remotely controlled vehicles operating as part of the water jetting or mechanical trenching technologies are applied.

The selection of the appropriate cable line construction technology and devices depends mainly on the:

- technical parameters of the cable laid;
- complexity of the cable line route;
- type and depth of the seabed;
- cable burial depth;
- natural or man-made obstacles located along the cable line route;
- availability of vessels appropriate for the construction of a cable line;
- other logistic conditions;
- economic conditions.

In the case of the planned project, at the current stage of the work progress, it is impossible to precisely indicate the technologies and devices that will be used in the BP OWF CI construction phase in the offshore area. Hence, it has been assumed that the construction works in the offshore area can be carried out using any of the technologies described above, and the environmental impacts were assessed in the context of the application of the technology which is most unfavourable for the environment, i.e. the PLB technology, and the use of self-propelled remotely controlled devices operating in the water jetting and mechanical trenching technologies.

At the current stage of the project progress, the Applicant cannot exclude that some sections of the cable lines will not be buried but laid on the seabed instead. This shall result, for example, from the unfavourable environmental conditions that will preclude the cable from being buried. In such a case, the cable section shall be laid on the seabed and secured against damage or destruction using protective measures standard in such situations such as:

- concrete mattresses;
- sand bags;
- riprap;
- PVC pipe sheaths;
- concrete protections.

2.2.2.2 Cable line landfalls

Cable landfalls shall be constructed using a trenchless HDD or HDD Intersect method described in detail in subsection 2.2.2.3. Each of a maximum of 4 offshore cable lines shall be landed in a separate drilling made from land in the direction of the sea, or in an exceptional situation, from both sides, the land as well as the sea. Boreholes on land shall be located at a distance of up to 210 m from the shoreline and at a distance of approx. 20 m from one another. Each of a maximum of 4 trenches will have a maximum length of 1.5 km. The cable landfalls in the offshore area shall be located outside the near-shore zone, at a depth of approx. 13 m measured from the water table to the seabed. The distance between the drilling outlets in the seabed shall be approx. 100 m. The maximum depth of a drilling shall be approx. 50 MBGL. The trajectory of the drillings allows for the need to protect the dune system and the environment of the dynamic near-shore zone (sandbanks zone). The routing of cables below the seabed in the sandbanks zone will protect them against the negative impact of intensive hydrodynamic processes of this zone, which could result in the exposure of the cables buried in the seabed sediment and their damage. The detailed drilling parameters shall be known after the planned geotechnical surveys have been conducted. After the trenches are constructed and secured, the subsea cables shall be landed and connected to the onshore cable lines and optical fibres in cable chambers.

Cable chambers are rectangular objects with a side length of up to a few metres, located at a depth of approx. 2 m [Figure 2.6].

Figure 2.6. Exemplary cable chambers [Source: dunmain.com.au, sl-engineers.asia.com]

The functioning of the cable chambers is the result of the necessity to adjust the subsea cable construction parameters to the conditions onshore. Subsea cables are characterised by more robust armour due to more demanding environmental conditions and higher damage risk. In the cable chambers, the three-core subsea cables shall be connected with the single-core land cables and with an optical fibre cable.

Each cable chamber shall be equipped with an inspection hatch used also for the maintenance purposes. The cable chambers shall be designed in such a way as to ensure safe access to the devices inside them.

Table 2.4 contains a compilation of the technical parameters of the cable line construction in the offshore area, for which the environmental impacts are to be specified.

Table 2.4. Technical assumptions of the Baltic Power OWF Connection Infrastructure in the offshore area [Source: internal materials]

Technical assumptions behind the construction of cable lines in the offshore area	**Value/description**
Power cable type	Extra high voltage (EHV) alternating current power cables with an operating voltage of 220 kV or 275 kV in XLPE insulation (cross-linked polyethylene) including the necessary telecommunication infrastructure. The maximum temperature of the phase wire shall be up to 90°C
Cable line routes	Cable line routes are presented in Figure 1.1. Export cables shall be arranged at a distance of approx. 1.45 km apart in the Baltic Power OWF Area. Later, at a distance of approx. 200 m away from the exit of the Baltic Power OWF Area to the sea area with a depth of approx. 22 m measured from the water table to the seabed. Next, the cable lines will converge up to a distance of approx. 100 m at a depth of approx. 13 m measured from the water table to the seabed. To bypass the near-shore dynamic zone, from a depth of approx. 13 m, the cable landfall shall be installed using a trenchless method. The underground cables will converge towards one another up

Technical assumptions behind the construction of cable lines in the offshore area	Value/description
	to the depth of approx. 20 m in the location of the cable landfall
Maximum number of cable lines	4
Cable line construction technology	SLB (*simultaneous lay and burial*) or PLB (*post lay burial*) – laying cable by a Cable Laying Vessel or Cable Barge and subsequent cable burying using the devices operating in the jetting or mechanical trenching technologies along the entire route of a maximum of all 4 cable lines. In case it is impossible to bury the cable in the seabed, it is acceptable to lay its sections on the seabed with the cable appropriately protected using, for example, concrete mattresses or riprap. It is recommended that the cable laying should be carried out in accordance with applicable standards and the manufacturer's instructions as well as under ongoing supervision
Maximum depth of cable burial in the seabed sediment	4 m
Volume of sediment disturbed during the cable-laying works	A maximum of 36 m^3 of sediment per 1 cable running metre with an assumed trench depth of 4 m and a maximum slope gradient of 1:3
Maximum width of the seabed strip covered by the construction works of a single cable line	20 m
Date of cable line construction works	The Applicant’s intention is the possibility to conduct construction works during any period of the year selected
Cable line construction rate	It is assumed that the construction rate of each cable line should be a minimum of one complete cable section per day (this mainly concerns cables laid in pipes). If weather and other external conditions are favourable, the pace of work will be higher, which means reduced negative impacts and shorter construction time
Types of vessels involved in the construction of cable lines	For example: Cable Laying Vessel (CLV), Offshore Service Vessel (OSV), cable barge or barge towboat
Size of vessels involved in the construction of cable lines	The largest vessels that can be involved in the construction works are Cable Laying Vessels (CLV) with a max. length of 180 m. Cable barges and OSVs do not exceed the length of 100 m, whereas, the barge towboats do not exceed the length of approx. 50 m
Export cable landfalls	Trenchless method, e.g. horizontal directional drilling (HDD or HDD Intersect). Drillings shall be made from the onshore side or from two sides (onshore and offshore). The drilling outlets are located outside the dynamic zone of the near-shore waters at a depth of approx. 13 m measured from the water table to the seabed

It should be underlined that before the commencement of the construction of the multi-circuit cable line, a Geological Engineering Documentation shall be prepared on the basis of the results of geotechnical surveys conducted in accordance with the approved Geological Work Project the preparation of which is necessary pursuant to the Act of 9 June 2011 – Geological and Mining Law (Journal of Laws of 2011, No. 163, item 981 as amended). The Geological Engineering Documentation shall constitute the basis for specifying the more detailed construction solutions.

2.2.2.3 Cable lines in the onshore area

In the onshore part, electric power shall be transferred via underground single-core alternating current (AC) cables with an operating voltage of 220 kV or 275 kV. Cables shall be insulated with a cross-linked polyethylene (XLPE). Precise technical parameters of the subsea cables shall be specified at a later stage of the project implementation.

2.2.2.3.1 Technologies of laying an underground cable line

Four methods for laying EHV underground cable lines are distinguished [Figure 2.7].

1. Cable lines laid in the ground

The cables are laid in a trench in a wavy line on a layer of compacted bedding material with a thickness of at least 0.2 m. The minimum horizontal distance between the circuits shall be established on the basis of calculations concerning the mutual thermal interaction between the lines. After laying, cables are covered with a filling layer with a minimum height of 0.2 m above the level of the upper surface of the power cable placed the highest in the line route trench. Bentonite, which is a mix of sand and cement, is used as the bedding material. The structure of the filling material and the bedding material cannot cause the cable sheath damage. Concrete protective plates are placed on the filling layer over the cable line. A signalling cable tape is placed over the cable. The remaining part of the trench is filled with virgin soil cleared of debris and stones, which can be compacted to prevent soil sinking.

2. Cable lines laid in pipes

Pipes act as an element reinforcing the section of the cable being run, reducing the possibility of mechanical damage and protecting the insulation of the cable. They are most commonly used in the locations of cable line crossings with other objects, such as roads, rail tracks, other underground infrastructure elements, buildings, etc. Pipes can be erected using the open-pit, jacking or directional drilling methods. Smoothwall casing pipes made of high-density plastic with a diametral stiffness of the pipe appropriate to the location are used for the construction of the cable pipes. A single cable is laid in a single pipe. When pulling the cable in, care should be taken not to drag the virgin soil and contaminations inside the pipe together with the cable. It is acceptable to fill the pipes with a material of appropriate resistivity and thermal conductivity, e.g. bentonite. It is acceptable to leave at least one auxiliary pipe in the pipes for each section of the cable line track.

3. Cable lines laid in cable ducts

This technology is mainly used in the areas of power substations. The sizes of cable ducts are selected individually for specific cable lines, taking into consideration the possibility of heat dissipation. Cables belonging to a single line circuit are laid in a single cable duct. Laying a greater number of cables is permissible provided that there is no interaction between the individual current circuits. Cables are fastened using dedicated brackets to ensure their longitudinal movement under the influence of the temperature changes. Cable ducts have natural ventilation which ensures appropriate cable cooling conditions. Cable duct located above the groundwater level should have an absorbent bottom, whereas, the cable located below the groundwater level or in the area with unfavourable soil conditions (impermeable soils) should be equipped with a drainage system. Cables laid in ducts should have a flame retardant sheath.

4. Cable lines laid in cable trough/culvert

The requirements concerning the sizes of cable troughs and culverts, their structure, cable laying and fixing methods, specification of the forced cooling conditions and the accessibility for maintenance personnel, are determined individually for each cable line solution. Cable culverts should be equipped with precipitation and groundwater drainage systems, and the cable inlets and outlets should have systemic protections, for example, against water as well as natural ventilation ensuring appropriate cable cooling conditions, in accordance with the assumptions adopted for the calculations of the long-term line current-carrying capacity.

Regardless of the selected cable line laying technology including the installation of the cable accessories, it should be compliant with the recommendations of the cable and accessories manufacturer and should be done under their supervision.

Figure 2.7. Methods of laying underground cable lines: cable lines in the soil (1), cable lines in pipes (2), cable lines in a cable duct (3), cable culvert (4) [Source: dreamstime.com dunmain.com.au, e-cigre.org, nationalgrid.com]

No intersecting infrastructure on land has been identified for the APV. If a cable line and an optical fibre intersect with the existing underground infrastructure, it is a common practice to route the cable line below the underground facility or to conduct a reconstruction of the existing infrastructure. Where technically reasonable (e.g. in cases of deeply buried waterworks, sewage systems), it is acceptable to locate the cable line above the object intersected.

As part of the planned project, the 220 kV or 275 kV power cables, including an optical fibre, shall be laid in 4 cable circuits, 3 cables per circuit.

In practice, two variants of underground cable line arrangement are applied [Figure 2.8]:

- trefoil formation;
- flat formation.

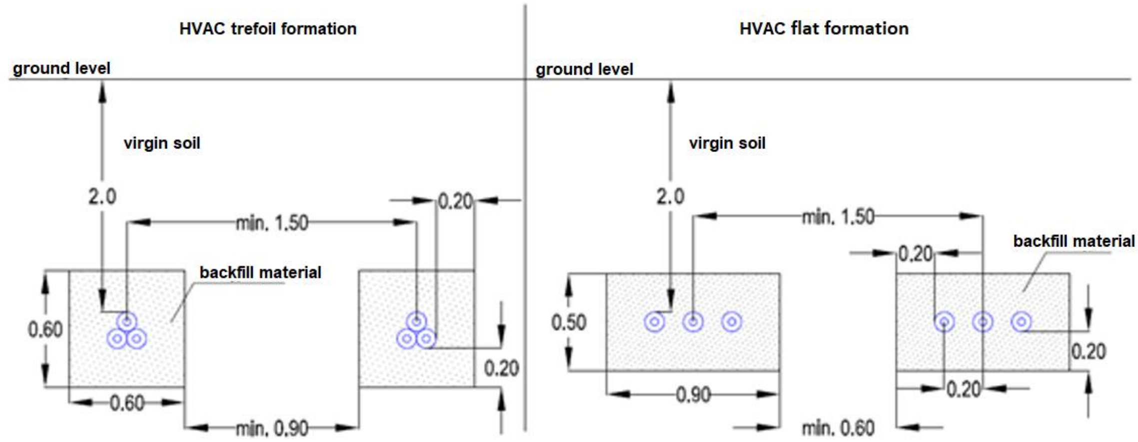

Figure 2.8. Example of an extra high voltage AC cable arrangement [Source: Conducting thermal calculations to determine the width of the strip of land for the cable lines transmitting power from the offshore wind farms, ENERGOPROJEKT-KATOWICE S.A., 2019]

As part of the planned project, it is envisaged to arrange the cables in a flat formation, which is characterised by more favourable conditions of heat dissipation to the soil, which enables the use of smaller cables with the same amount of current transmitted compared to the trefoil formation. 12 cables shall be laid onshore as part of the planned project implementation. Cable lines shall be laid in parallel, mainly in the form of an open trench, at a depth of approx. 2 m, and, if conditions require – a horizontal directional drilling shall be performed (upon agreement with competent authorities). Due to differences in topographic features (e.g. dunes), the depth of cable burial may exceed 2 m at some points.

The width of the cable corridor (permanent technical belt) in which a permanent deforestation will occur shall have a maximum width of 25 m. In the area of the cable chambers, the belt width shall be 80 m. At the sections, where the cable will be laid in the ground using trenchless methods, the removal of phanerophytes will not be necessary.

Cables shall be delivered to the construction site on drums, in approx. 1 km long sections. Cable drums [Figure 2.9] shall be delivered to the laying location on cable trailers. In case it is impossible to deliver the drum to the location of trenching, the drum can be rolled over short route distances.

1 2 3 4

Figure 2.9. Exemplary 220 kV cable drums (1), vehicles with a cable trailer (2), LV cable winching operation (3), exemplary cable winch (4) [Source: okorder.com, lancier-cable.de, rampionoffshore.com, watucab.pl]

Cables shall be laid in the cable trough located in the trench directly from the drum placed at one of the line section ends, and shall be moved by guides on cable rolls placed along the entire section length of the cable being laid. The trenches shall have a length of approx. 1 km, and the cable laying duration in that section shall be approx. 1 week. Rolls and guides are to prevent the cable from friction against the drum discs and the ground. Due to a mid-forest environment and the need to limit land occupation, the axis of the drum will run perpendicular to the route axis. The Applicant shall allow the drum to be positioned on the side in special cases when perpendicular positioning will not be possible. The cables shall be pulled mechanically using a cable winch located at the end of the line route [Figure 2.9]. The line of the winch shall be connected with the end of the cable laid using a rotary connector and pulling head or a cable grip mounted at the cable end. In the areas preceding the route offset, manual assistance of pulling by the workers positioned inside the trench is allowed. Furthermore, it is acceptable to use an auxiliary device placed on the route, i.e. a cable-pusher. After the planned cable section is laid, both its ends shall be secured against moisture. Individual cable section of an approx. length of 1 km shall be connected inside cable joints [Figure 2.10].

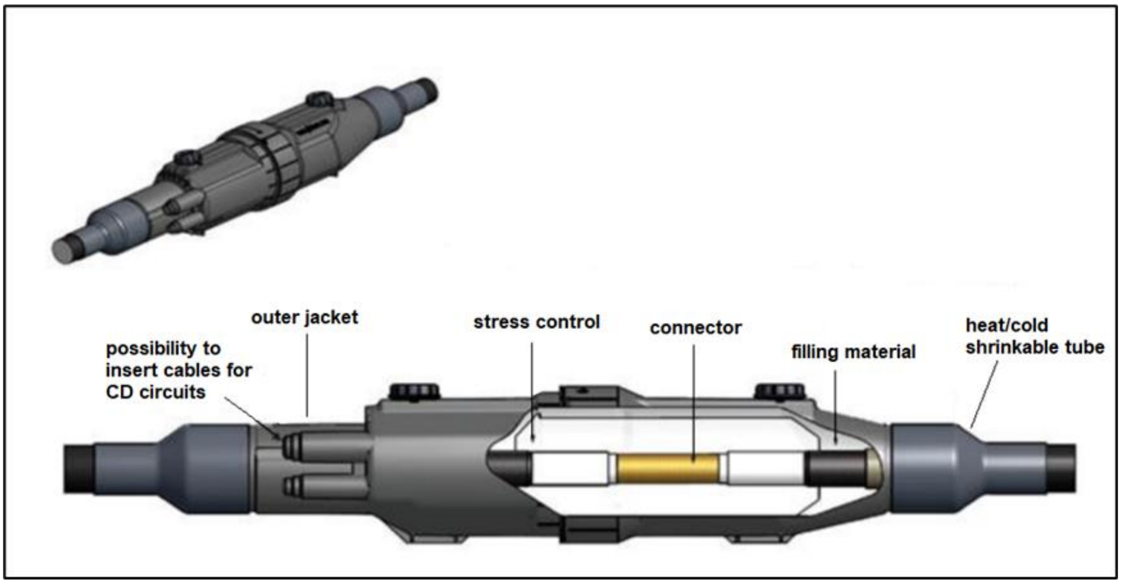

Figure 2.10. Cross-section of an exemplary cable joint [Source: Technical standard for the conditions of construction of electric power HV cable lines including cables and accessories, TAURON, 2018]

Cable laying shall be performed in such a manner as to prevent their excessive bending. The cable shall be inserted in such a way as to prevent its coating or sheath from rubbing against the trough openings and the dirt from the outside being dragged inside the pipe. If decreasing the force of friction of the cable against the internal pipe surface becomes necessary, a lubricating material should be inserted inside the pipe, which has no adverse impact on the cable coating or sheath. In accordance with the relevant literature, it is recommended to use paraffin oil as the lubricating material for cables with polyethylene coatings or sheaths or other special materials. In case cables with high-density polyethylene coating are inserted into pipes made of polyethylene, there is no need for a lubricating material to be used.

It shall be allowed to use bentonite (liquid substance) in pipes and drillings. Bentonite shall be delivered to the construction site in the form of a forced mixture and after fluidisation with water, pumped into the pipes with the cable inserted beforehand. Bentonite (a mixture of sand and cement), which increases the current-carrying capacity of cables laid in troughs and stabilises them, shall be used in places where pavement slabs and cable foil are located (in open trenches). Afterwards, composite or concrete plates shall be placed on the upper layer of bentonite. Perforated foil or plastic mesh shall be placed above the plates. The remaining part of the trench shall be backfilled with virgin soil [Figure 2.11].

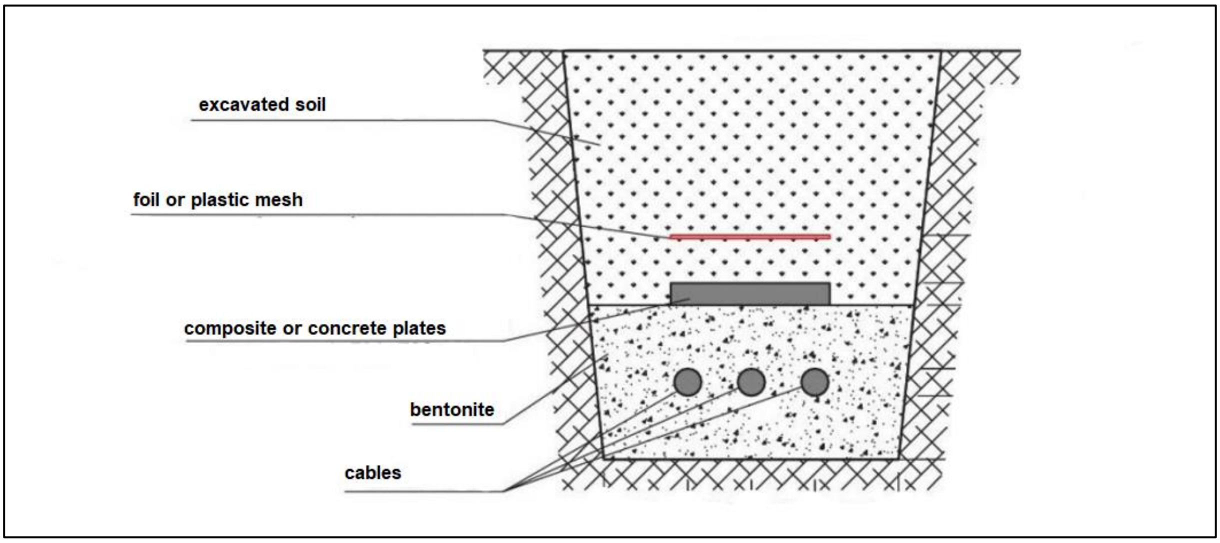

Figure 2.11. Arrangement of cables in a trench [Source: Technical standard for the conditions of construction of electric power HV cable lines including cables and accessories, TAURON, 2018]

In the naturally valuable areas that are difficult to cross with an open pit, and also due to the presence of watercourses and other natural obstacles, trenchless construction forms are planned such as horizontal directional drilling or molings (jacking). In the rest of the area, mainly an open trench is envisaged, and, if conditions require, a horizontal directional drilling shall be performed (upon agreement with competent authorities).

2.2.2.3.1.1 Horizontal directional drilling (HDD or HDD Intersect)

The curved trajectory of the horizontal directional drilling (HDD) enables routing cable lines under obstacles, starting at the ground level, thanks to which no deep trenches are required, as is the case in the horizontal drilling technique. In accordance with the horizontal directional drilling technique, a separate drilling shall be made for each cable trough.

The main stages of drilling include: 1) pilot drilling, 2) pilot hole widening, 3) pilot hole installation, 4) jacking pipes installation, 5) pulling cables into the pipes installed.

Pilot drilling involves the construction of a borehole along the trajectory assumed. At this stage, drilling is done along the curve designed. Before the drilling is conducted, the drilling route is analysed and verified with the actual geological conditions and the logistic as well as technical capabilities. The execution of a correct trajectory is crucial for the carrying out of directional drilling.

The aim of the second stage is to widen the pilot hole to the target diameter (usually 130–150% of the envelope diameter of the pipes installed), the drill pipe is replaced with a widening tool. The poles are replaced element by element, so that the complete drill pipe is inside the pilot hole at all times. The scrubber helps discharge the drill cuttings, excavate the pilot hole walls, cool the spreader and stabilise the walls.

After the pilot hole is widened, it should be filled with suspended solids of an appropriate specific weight to maintain the geometry (pilot hole stabilisation). A spreader with a swivel is used in the installation process, which enables transferring the maximum installation force possible to be achieved by the drilling machine.

The Applicant shall allow the use of bentonite for horizontal directional drilling.

2.2.2.3.1.2 Direct Pipe method

The Direct Pipe method enables excavating a borehole along with laying cable infrastructure in a one-step installation process. In this technology, the excavated material is cut by a microtunnelling head. Cable laying is controlled using a remote navigation with a gyrocompass. The excavated material is removed via a slurry circuit located inside the steel pipeline installed.

The soil excavation is done using a standard microtunnelling head. The pushing station located on the ground surface exerts pressure on the head via a steel pipeline. The transport of the excavated material is carried out via a slurry system, the pipes of which are located inside the steel pipeline. The slurry with the excavated material is treated in the solid phase separation system and used repeatedly. The steel pipeline installed is prepared beforehand – welded in one piece at the machinery side and tested accordingly.

The insertion of cable lines into the borehole is done directly during drilling, using the previously prepared chambers (inlet and outlet, e.g. steel sheet pile), which after the drilling is finished, are removed and the area is brought back to the original condition.

The cable line section with a borehole shall have the same cable laying arrangement along its entire length.

2.2.2.3.1.3 Horizontal moling

Horizontal moling can be divided into pneumatic and hydraulic moling.

Pneumatic moling involves driving pipes into the ground using a pneumatic punch. The pneumatic punch is positioned in the initial trench. When the diameters of the pipes driven is larger and at the same time when a heavy-duty puncher is used, the punch positioning is often supported using pneumatic cushions. The impact force is translated to the pipes driven via special intermediate rings, also called reduction cones. Individual pipe sections are joined by welding. After the pipes are driven into the ground along the entire section length, the soil core that is inside them is removed using compressed air, pressurised water, auger drill or other methods.

The hydraulic moling technology involves pressing of steel casing pipes into the ground using hydraulic actuators. Such pipes may be left in the soil as the so-called “lost pipes”, inside which the conduit pipes in the form of regular pipes are inserted, as used in the traditional trenching methods. The recovery of casing pipes enables the application of a more advanced method, in which, after hydraulic moling of steel casing pipes, the hydraulic moling of conduit pipes takes place. Casing pipes are then pushed out to the target trench.

2.2.2.3.1.4 HDD Intersect

The HDD Intersect variant assumes the pilot hole is made from both ends of the bore path. On the land side, the drill is positioned on the ground, and on the offshore side on a suitably prepared station, e.g. a jack-up platform. On the offshore side, between the jack-up platform and the seabed, a protective pipe is installed through which the pilot hole shall be made. To install a protective pipe a crane located on the platform or a support vessel is used. After a pilot hole is made, a device for widening the opening is installed at the offshore end. Following that, the technology continues according to the traditional variant (pilot drilling from one side). During the works related to the pilot hole, constant assistance of other vessels apart from the jack-up vessel is not necessary. Such a vessel will be necessary for transporting materials or exchanging the crew on the platform. The protective pipe is introduced into the pilot hole from the water side.

2.2.2.3.2 Arrangement of return wire bonding

Return wires are used for discharging short-circuit currents generated in the power system. The return wire earthing system shall result from the analyses conducted which take into consideration, for example: the length of the cable line, the method of cable arrangement, field conditions, short-circuit conditions, cable sheath electric strength, reduction of losses, etc. [319].

The selection of bonding arrangement shall be designed to limit the number of junction boxes containing the overvoltage arrester.

The following technologies of return wire bonding are used:

1. Single point bonding (SPB) of return wires

In this arrangement an additional EEC (earth continuity conductor) or EECs are used connected to the earthing systems of the objects at which the ends of the cable line are located. Halfway along the cable line length or in a different location selected on the basis of calculations, the EEC or EECs are shifted from one side of the line to the opposite side, maintaining the same distance from the line along the entire route.

2. Both-ends bonding (BE) of return wires

This technology is used only in justified cases for short sections of cable lines.

3. Cross-bonding (CB)

Involves the change of cable return wire bonding method and the resultant decrease in the induced current intensity in such wires, which reduces the losses in the cable line. Such technologies are recommended for the lines longer than 1 km.

The cross-bonding method is to be used for the planned project.

2.2.2.4 Customer substation

As part of the planned project, a customer substation with an input voltage of 220 kV or 275 kV and output voltage of 400 kV shall be erected.

The customer substation shall comprise:

- a 400 kV switchgear;
- 400/220/15 kV or 400/275/15 kV autotransformers or transformers;
- a 220 kV or 275 kV switchgear.

Auxiliary systems and equipment will include:

- medium-voltage switchgear;
- MV/0.4 kV transformers;
- devices for enhancing the quality of electricity;
- power generator.

The switchgears will be equipped with standard switching, metering and protection equipment, fulfilling the appropriate technical, environmental and the Transmission System Operator’s requirements.

Auxiliary elements shall include:

- buildings for: infrastructure, fire pump station, MV/0.4 kV auxiliary facility;
- cable ducts;
- indoor circulation;
- access road;
- fire water tank.

Water will be supplied from the nearest water supply system or local water intake in the station area. Sewage shall be disposed to an external sewage system or to a leakproof sewage tank. The construction of a station area drainage system is planned.

2.2.2.5 400kV power line

The customer substation shall be connected with a short, max. 270-metre section of an overhead 400 kV power line with the PSE substation. In this case, the technology commonly used in these types of projects is to be applied.

Initial technical parameters of a 400 kV power line:

- number of circuits: 2 with 3 three-core cables (18 conductors in total);
- design operating temperature of the phase conductors +80°C;
- lightning conductors;
- width of the line technological belt: 70 m (35 m on each side of the line axis).

At this stage of the project progress, the number of spans in the guy-wire section cannot be specified.

The current terminals on the PSE substation constitute the endpoint of the planned project. The technical assumptions of the BP OWF CI in the onshore area are provided in Table 2.5.

Table 2.5. Technical assumptions of the Baltic Power OWF Connection Infrastructure in the onshore area [Source: internal materials]

Technical assumptions behind the construction of cable lines in the onshore area	Value/description
Power cable type	Extra high voltage (EHV) alternating current power cables with an operating voltage of 220 kV or 275 kV in a XLPE insulation (cross-linked polyethylene) with an optical fibre used for measuring the cable temperature. The maximum temperature of the phase wire shall be 90°C. In order to enable communication between the stations, additional communication cables are required, one per circuit
Number and route of cable lines	The construction of a maximum of 12 cable lines, in a maximum of 4 circuits, 3 cables per circuit, in a flat formation, is planned. In the area of cable chambers, cable troughs shall be located at a distance of approx. 20 m from one another, which, further away, shall gradually converge reaching constant distances of approx. 4.5 m from one another
Maximum number of cable lines constructed simultaneously	12
Cable laying technique	Cables shall be inserted into the cable trough located in a trench directly from a cable drum. In the naturally valuable areas that are difficult to cross with an open pit, and also due to the presence of watercourses and other natural obstacles, trenchless construction forms are planned such as horizontal directional drills or molings

Technical assumptions behind the construction of cable lines in the onshore area	Value/description
Depth of the trenches	Approx. 2 m
Width of the trenches	Approx. 2 m for each of a maximum of four 4 cable troughs. In the area of cable jointing, the width may be up to 6 m
Technical belt width – permanent deforestation of the area	Max. 25 m along the majority of the section, reaching up to 80 m in the area of the cable chambers. At the sections, at which the trenchless methods are to be used, there will be no need for deforestation
Date of the beginning of the cable line construction	The Applicant's intention is to conduct construction works without limitation to a short period of the year
Cable line construction rate	It is assumed that the duration of inserting a cable into a cable trough in a trench of a length of approx. 1 km shall be approx. 1 week. Cable laying in the trench, pouring the bentonite, laying concrete plates and marking bands – approx. 15 months
Type of equipment used in the construction phase	Construction vehicles and machinery, lifts, cranes, hoists, specialised machinery for cable/conductor tensioning (cable trailer vehicle, cable winches, cable rollers, cable guides, cable grips/terminators, pulling heads, rotary connectors), drilling, moling, pumping, wellpoints, personnel transport vehicles
Insertion of power cables into the customer substation	Wall cable ducts
Insertion of power cables into the PSE substation	400 kV overhead line

2.3 Project variants considered

2.3.1 Approach to designating project variants

Analysis of alternative solutions of the planned project is conducted at the level of:

- determination of the project location;
- method of implementation of the project objective;
- determination of technological solutions of the project necessary to be included in the construction design, significant from the point of view of environmental protection;
- determination of project functioning methods that are essential from the point of view of environmental protection.

The key assumption in the design process is to determine the route of the BP OWF CI, taking into account environmental aspects, technical capabilities, minimising the risk of potential failures and social conflicts, as well as ensuring economic optimisation. As part of the planned project, variants were developed for the offshore and onshore sections. An analysis of potential conflicts and impacts as well as costs and risks were also taken into account. During the planning process, the project was consulted with relevant administrative authorities, institutions and stakeholders.

The variant analysis accounted for the following decisions:

- Decision no. 1/K/20 of the Minister of Maritime Economy and Inland Navigation of 23 July 2020, approving the location and methods of cable maintenance in the exclusive economic zone as part of the project named "Construction of the Baltic Power Offshore Wind Farm power connection to the National Power System"
- Decision no. 5/20 of the Director of the Maritime Office in Gdynia of 28 September 2020 for the laying and maintenance of cables and pipelines within the internal sea waters and

territorial sea for the project named “Construction of the Baltic Power Offshore Wind Farm power connection to the National Power System”

In the analysis, the agreements between the Applicant and the Choczewo Forest Inspectorate authorities on the onshore part of the route of the planned project within forest areas were also taken into consideration (see: subsection 2.1.2).

The basic criterion considered during the variant preparation was the comparison of viable location and technical and technological alternatives.

2.3.2 Variants of the project considered along with the justification for their selection

Both variants adopted for assessment are rational, i.e. feasible given the current legal status, technical and technological conditions as well as the current state of knowledge about environmental conditions. As regards the onshore part of the BP OWF CI, the design of variants was also guided by the necessity to ensure spatial continuity and to reduce spatial collisions with other stakeholders.

2.3.2.1 Applicant Proposed Variant

In the Applicant Proposed Variant, the starting point of the planned project is the entry of the export cables from the substations that constitute a part of the Baltic Power OWF. Electric power shall be transmitted from the Baltic Power OWF using a maximum of four subsea, three-core EHV cables with an operating voltage of 220 kV or 275 kV. The length of the grid connection line in the offshore area is approx. 46.8 km. Cable landfalls shall be constructed using a trenchless HDD or HDD Intersect method in the area of 160.5 km of the sea shore (according to the Maritime Office shoreline chainage). At the onshore section of the route, in 4 cable chambers, the subsea cable construction parameters shall be adjusted to the conditions onshore. Next, in the onshore part, electric power shall be routed via underground single-core alternating current cables with an operating voltage of 220 kV or 275 kV. The cables shall be laid in 4 cable circuits, 3 cables in each circuit. The route of the underground cable line will lead through the forests administered by the Regional Directorate of State Forests (RDSF) in Gdańsk, within the boundaries of the Choczewo Forest District, in the forest subdistricts of: Szklana Huta and Białogóra. The BP OWF CI will enter the customer substation with an input voltage of 220 kV or 275 kV and output voltage of 400 kV. The planned substation is to be located on arable lands of class 5. The customer substation shall be connected to the PSE substation via an overhead 400 kV power line with a length of approx. 270 m. The current terminals on the PSE substation constitute the endpoint of the planned project. The length of the grid connection line in the onshore area shall be approx. 6.5 km, while the width of the technical belt shall be approx. 25 m.

The Applicant Proposed Variant assumes the project implementation in accordance with the state-of-the-art and commonly applied technologies for the construction of EHV power lines. As regards the offshore area outside the OWF Area, the route of the project does not reach beyond the area indicated in the location decisions issued by the Minister of Maritime Economy and Inland Navigation and the Director of the Maritime Office in Gdynia [Figure 2.1]. The variant accounts for all environmental protection requirements as well as optimisation between planning, environmental, technical and economic conditions for energy transmission. This variant provides for the burial of the power cables in the seabed sediment and in the ground. A description of the technology and techniques of construction of the power connection in the APV can be found in subsection 2.2.

2.3.2.2 Rational Alternative Variant

The Rational Alternative Variant compared to the APV assumes extension of the multi-circuit cable line route in the offshore area [Figure 2.12]. An alternative cable line route may be determined by environmental considerations, e.g. unfavourable soil conditions and the presence of hazardous materials on the seabed, which shall be detailed after the geotechnical surveys and surveys on the presence of UXOs have been conducted. In the Rational Alternative Variant, the way of routing the BP OWF CI assumes transmitting electric power from the Baltic Power OWF using a maximum of four subsea three-core EHV cables with an operating voltage of 220 kV or 275 kV to the substations that constitute a part of the Baltic Power OWF – as in the case of the APV. The length of the grid connection line in the offshore area is approx. 53.6 km. Next, cable landfalls shall be constructed using a trenchless HDD or HDD Intersect method in the area of 160.5 km of the sea shore (according to the Maritime Office shoreline chainage). At the onshore section of the route [Figure 2.13], in 4 cable chambers, the subsea cable construction parameters shall be adjusted to the conditions onshore. Next, electric power in the onshore part shall be transmitted using a 4-circuit overhead, mid-forest power line. The route will lead through the forests administered by the RDSF in Gdańsk, within the boundaries of the Choczewo Forest District, in the forest subdistricts of: Szklana Huta and Białogóra – east of the APV. Later, it will enter the customer substation with an input voltage of 220 kV or 275 kV and output voltage of 400 kV. The planned substation is to be located on arable lands of class 5. The current terminals on the PSE substation constitute the endpoint of the planned project.

The length of the grid connection line in the onshore area shall be approx. 5.2 km, while the width of the technical belt shall be approx. 100 m.

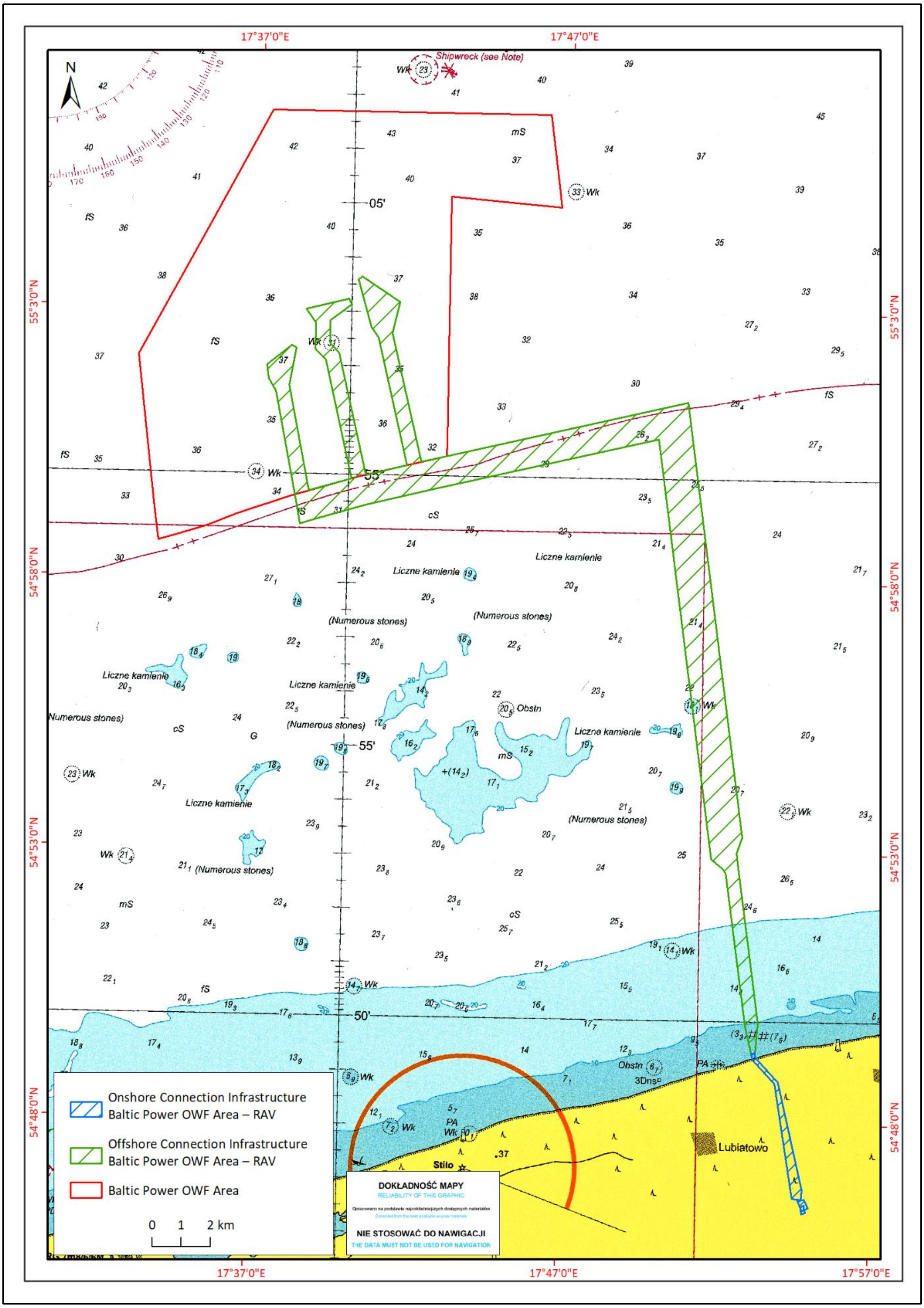

Figure 2.12. Location of the planned project – Rational Alternative Variant (RAV) [Source: internal materials]

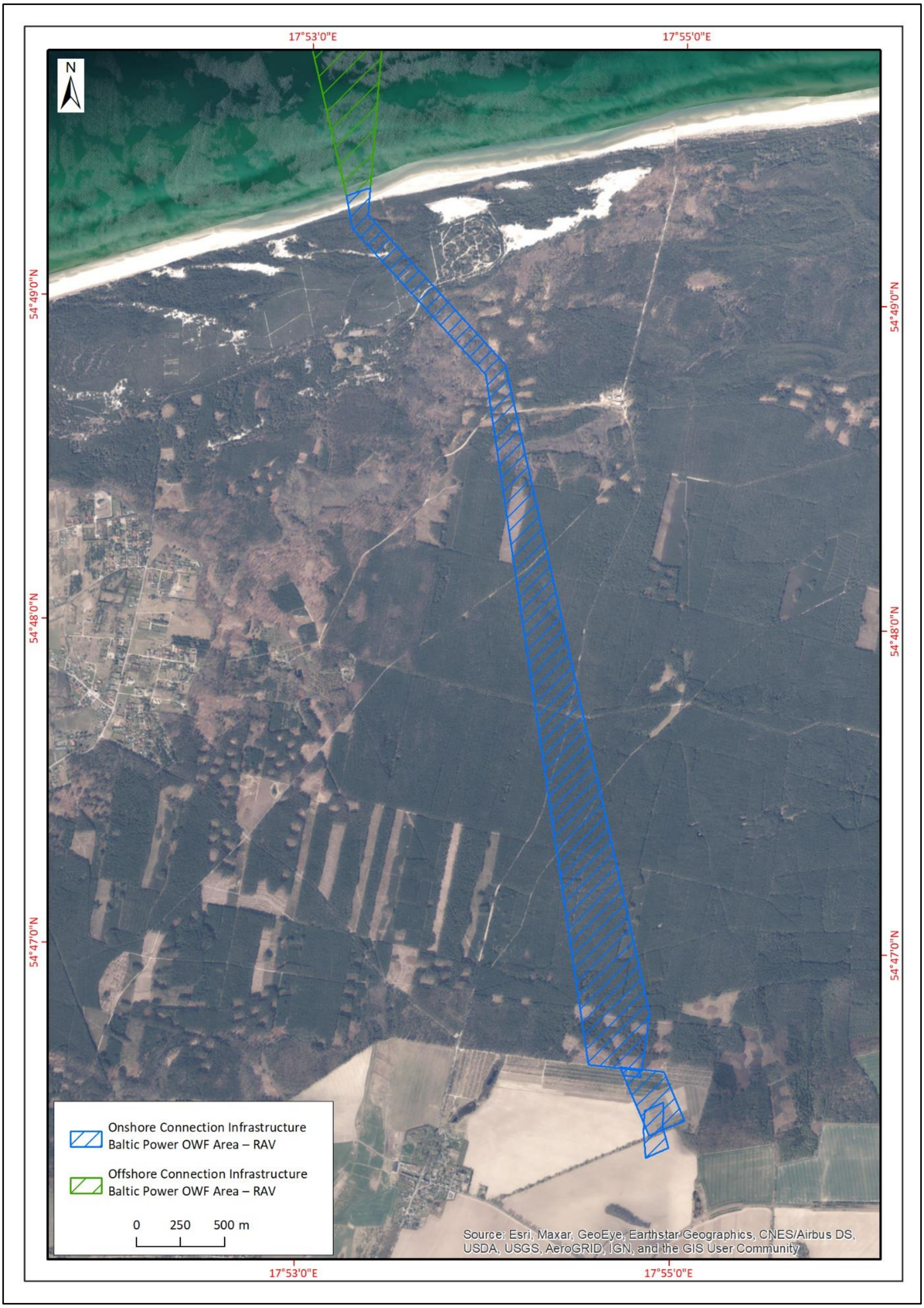

Figure 2.13. Location of the planned project – Rational Alternative Variant (RAV). Close-up view of the onshore part [Source: internal materials]

In the offshore part of the BP OWF CI, the change of the route, and thus, its extension are the only changes in relation to the APV. As for the onshore part, not only the route will be changed, but also the manner of power line construction. This will result in a different length of the onshore connection and the technology of implementation, as well as the technical parameters.

2.3.2.3 Compilation of the technical parameters of the project variants considered

Table 2.6 presents a summary of the technological and technical parameters of the planned project that differentiate the APV and the RAV.

Table 2.6. Technological and technical parameters differentiating the Applicant Proposed Variant (APV) and the Rational Alternative Variant (RAV) [Source: internal materials]

Technical parameters	Applicant Proposed Variant (APV)	Rational Alternative Variant (RAV)
Offshore area		
Length of the multi-circuit cable line (assuming that the export cables are led from each of a maximum of three Baltic Power OWF substations)	Approx. 46.8 km	Approx. 53.6 km
Onshore area		
Length of the cable line	Approx. 6.5 km	0 km
Length of the overhead line	Up to 270 m	Approx. 5.2 km and 270 m
Technical belt width	Cable line – approx. 25 m, cable chamber – 80 m	Approx. 100 m
Depth and width of the trenches	Depth approx. 2 m, width a maximum of 2 m for each of a maximum of 4 cable circuits. Due to differences in topographic features (e.g. dunes), the depth of cable burial may exceed 2 m at some points. In the area of cable jointing, the width may be up to 6 m	Trenches shall be excavated at tower deployment locations. Trench dimensions approx. 10 x 8 m, depth approx. 4 m
Technical characteristics of the cables	Alternating current single-core cables Cross-linked polyethylene (XLPE) insulation	-
Number of power lines	A maximum of 4 circuits, 3 cables each	A maximum of 4 circuits, 3 conductors each

2.4 Description of individual phases of the project

2.4.1 General information relating to all phases of the project

The planned project shall consist of three main phases: construction, operation, and decommissioning, which in the case of this project shall involve the termination of the BP OWF CI operation. It shall be implemented in the offshore and onshore areas, which will involve significant technological and technical differences in the implementation of each of these phases. The description of the planned activities for every phase takes into consideration the technological and technical differences, which differentiate the APV from RAV. Due to a significant difference in the implementation of activities for each phase, their description was divided into an offshore and onshore parts.

2.4.2 Construction phase

2.4.2.1 Offshore area

The construction phase shall consist in the following three main stages:

1. transport and arrangement of export cables on the seabed;
2. burying of export cables in the seabed sediment;
3. export cable landing.

These works shall be carried out sequentially. Before the commencement of construction, a detailed schedule of works shall be prepared, because they require the use of specialist vessels and equipment, which must be booked well in advance.

2.4.2.1.1 Construction works facilities

Construction works shall be carried out by specialist vessels, for example, cable laying vessels, service vessels, cable barges, and barge towboats. In addition, other vessels, which do not participate directly in the process related to power cable laying, such as: patrol vessels, walk-to-work vessels (W2W) and flotels, where people involved in the construction phase may be accommodated, are allowed to participate in maritime operations. Most probably, the power cable shall be loaded onto a Cable Laying Vessel or a cable barge in the harbour near the production location and transported by them to the laying location. To optimise the costs, it is not planned for a vessel to call at a port in normal operating conditions before the completion of construction works. Secondly, the Applicant plans to transport the cables from the place of production to a different port situated close to the planned project and to store them there until their installation. At the moment of the construction commencement, the cables stored in a port area shall be loaded onto a vessel and transported to the location of laying. Ensuring the proper functionality of the port shall be the responsibility of the port manager. The preliminary analysis has shown that the ports best suited to be an installation port are the ports of Rønne, Sassnitz-Murkan, Rostock, and Aalborg, however, the ports in Gdynia, Gdańsk, Karlskrona, Świnoujście, Klaipėda, and Szczecin are also taken into consideration.

It is assumed that the construction phase (the laying of up to 4 cable lines and cable landing) shall be implemented in the shortest possible time, in accordance with applicable standards and the manufacturer's instructions as well as under ongoing supervision. The cable line laying will be highly dependent on weather conditions. If weather conditions are favourable, it will be completed within a maximum of 12 months from its commencement. The Applicant’s intention is to be able to start the construction works irrespective of the season.

The levelling of the seabed along the cable line routes is not expected to be necessary. The seabed sediment which will be disturbed during the underwater works, shall be used only for burying the cables and shall not be transported to other places of the sea area or transported onto the land. It is expected that a part of the sediment disturbed will be subject to resuspension into the water depth and re-sedimentation at a certain distance from the location of the underwater works (see: section 4).

2.4.2.1.2 Noise emissions

Vessels and underwater vehicles involved in the construction of the cable lines will generate underwater noise. In the case of vessels, the noise will be generated by the engine running, the sound of the propeller and the operation of the steering engines. Large vessels equipped with DP systems, e.g. cable laying vessels, generate low frequency noise ranging from 30 Hz to 3 kHz, and sound pressure from 100 to 197 dB re 1 μPa at a distance of 1 m from the source [267]. The sound levels do not depend on the vessel speed nor the operating intensity of the DP systems that keep the vessel in a set position. Therefore, higher levels of the noise emitted by vessels will occur during unfavourable weather conditions, i.e. strong wave motion and wind. Smaller vessels not equipped with DP systems generate underwater noise with a frequency between 50 Hz and 2 kHz and a sound pressure from 170 to 180 dB re 1 μPa at a distance of 1 m from the source [267]. In contrast to the vessels equipped with DP systems, in this case the level of noise depends on the travel speed of such vessels.

The operation of underwater devices involved in the construction of the cable lines also entails the generation of noise into the environment. The highest noise levels will be generated by single underwater vessels operating in the mechanical trenching technology, which emit sounds with a sound pressure from 172 to 185 dB re 1 μPa at a distance of 1 m from the source.

2.4.2.1.3 Waste and waste management

In the BP OWF CI construction phase, various types of waste will be generated as a result of operation of vessels and equipment used for laying the cable line. The types and quantities of waste expected to be generated are provided in Table 2.7. Waste names and codes are in line 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 of waste generated nor their quantities; therefore, the table includes all theoretically possible types of waste and the estimates regarding their maximum quantities anticipated on the basis of the information on the assumed technology and the longest assumed duration of works in the offshore area. In the case of the RAV, the same types of wastes will be generated, however, their quantities will be greater because of the longer route of cable lines in this route variant.

Table 2.7. Compilation of the maximum quantities of waste estimated to be generated in the construction phase of the onshore part [Source: internal materials]

Waste code (*hazardous waste)	Waste type	Maximum quantity estimated [kg]
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	50
13 01 10*	Mineral based non-chlorinated hydraulic oils	50
13 01 11*	Synthetic hydraulic oils	50
13 02	**Waste engine, gear and lubricating oils**	
13 02 04*	Mineral-based chlorinated engine, gear and lubricating oils	50
13 02 05*	Mineral-based non-chlorinated engine, gear and lubricating oils	50
13 02 06*	Synthetic engine, gear and lubricating oils	50
13 02 07*	Readily biodegradable engine, gear and lubricating oils	50
13 02 08*	Other engine, gear and lubricating oils	50
13 04	**Bilge oils**	
13 04 03*	Bilge oils from other navigation	100
13 05	**Oil/water separator contents**	
13 05 02*	Sludges from oil/water separators	50

Waste code (*hazardous waste)	Waste type	Maximum quantity estimated [kg]
13 05 06*	Oil from oil/water separators	50
13 05 07*	Oily water from oil/water separators	50
13 07	**Wastes of liquid fuels**	
13 07 01*	Fuel oil and diesel	50
13 07 02*	Petrol	50
13 08	**Oil wastes not otherwise specified**	
13 08 80	Oily solid waste from ships	20
14	**Waste organic solvents, refrigerants and propellants (except groups 07 and 08)**	
14 06	**Waste organic solvents, refrigerants and foam/aerosol propellants**	
14 06 02*	Other halogenated solvents and solvent mixtures	50
14 06 03*	Other solvents and solvent mixtures	50
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	200
15 01 02	Plastic packaging	200
15 01 03	Wooden packaging	200
15 01 04	Metallic packaging	200
15 01 05	Composite packaging	200
15 01 06	Mixed packaging	200
15 01 07	Glass packaging	100
15 01 09	Textile packaging	100
15 02	**Absorbents, filter materials, wiping cloths and protective clothing**	
15 02 02*	Absorbents, filter materials (including oil filters not otherwise specified), wiping cloths, protective clothing contaminated by dangerous substances (e.g. PCB)	100
15 02 03*	Absorbents, filter materials, wiping cloths and protective clothing other than those mentioned in 15 02 02	100
16	**Wastes not otherwise specified**	
16 06	**Batteries and accumulators**	
16 06 01*	Lead batteries	100
16 06 02*	Ni-Cd batteries	100
16 06 04	Alkaline batteries (except 16 06 03)	100
16 06 05	Other batteries and accumulators	100
16 81	**Waste produced as a result of accidents and unexpected random incidents**	
16 81 01*	Wastes exhibiting hazardous properties	1
16 81 02	Wastes other than those mentioned in 16 81 01	1
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**	

Waste code (*hazardous waste)	Waste type	Maximum quantity estimated [kg]
19 08 05	Sludges from treatment of urban waste water	1000
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	100
20 01 02	Glass	100
20 01 08	Biodegradable kitchen and canteen waste	200
20 01 29*	Detergents containing hazardous substances	100
20 01 30	Detergents other than those mentioned in 20 01 29	200
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	10
20 01 34	Batteries and accumulators other than those mentioned in 20 01 33	10
20 01 35*	Discarded electrical and electronic equipment other than those mentioned in 20 01 21 and 20 01 23 containing hazardous component (1)	50
20 01 36	Discarded electrical and electronic equipment other than those mentioned in 20 01 21, 20 01 23 and 20 01 35	50
20 03	**Other municipal wastes**	
20 03 01	Mixed municipal waste	100

The waste and sewage generated during the construction phase shall be properly stored and secured on vessels, in accordance with a pollution prevention plan in force on each vessel, drawn up in accordance with the requirements of the Act of 16 March 1995 on the prevention of sea pollution from ships (Journal of Laws of 1995, No. 47, item 243 as amended). In harbours, waste and sewage shall be transferred to harbour reception facilities and handled in accordance with the applicable ship-generated waste and cargo residues management plan [Regulation of the Minister of Infrastructure of 21 December 2002 on ship-generated waste and cargo residues management plans (Journal of Laws of 2002, No. 236, item 1989, as amended)].

2.4.2.1.4 Power, raw material and water demand

The vessels and equipment involved in offshore work will consume electricity produced by the combustion of fuel – low sulphur diesel oil (<0.1%). The amount of fuel consumed will be influenced by many factors, among which the most important are the type and intensity of works, as well as weather conditions during their implementation – the scale of wave motion as well as the strength and direction of the wind, which to a large extent shape the way a vessel is manoeuvred as well as the load of the propulsion engines (including by DP systems). Since at this stage, the vessels that will be involved in the project implementation and the weather conditions of the construction phase are not known, it is also impossible to estimate the amount of fuel which will be consumed by the vessels in the construction phase. Table 2.8 contains the average values of fuel consumption per hour for vessels of various sizes, which gives a certain idea about the amount of fuel consumed during the construction works.

Table 2.8. Average fuel consumption for different types of vessels [Source: internal materials based on [37]

Vessel size	Purpose	Average fuel consumption (diesel) [$kg \cdot h^{-1}$]	Nominal daily working time [h]
Small vessels	Small supplies, personnel transport, one-day service, emergency operations – for each phase	50–200	8–10
Medium vessels	Supplies, construction works and support for construction works, towing operations, multi-day stationary service – for each phase	500–2000	12–18
Large vessels	Construction works, storage – construction phase	2500–5000	12–24

The application of the jet trenching technology for burying export cables will involve the use of seawater. Specialist devices shall collect the water from the environment and inject it under pressure into the surface layer of the seabed sediment in order to loosen its structure, which will enable cable laying. In this process, neither the chemical composition of the water nor its temperature will be changed. The entire water collected will be returned to the environment. Depending on the device used, it is expected that the water flow may reach from approx. 800 to approx. 5000 m^3/h [11]. The water will also be used for the everyday needs of the crews of vessels involved in the construction works. The drinking water tanks shall be refilled during port stopovers. After use, the water is stored in waste water tanks and handed over for treatment during the next port call.

2.4.2.2 Onshore area

For the purposes of the project implementation, the performance of the following work is predicted:

- felling of trees in the area planned for the location of the multi-circuit cable line;
- construction of access roads for the needs of the project;
- erection of trenches for the multi-circuit cable line;
- conducting horizontal directional drilling in the locations where the open trench will not be dug;
- laying of cable line and optical fibres in trenches;
- laying of cable line connections – cable joints, cable heads, feeding services to the customer substation;
- finishing works – backfilling, cable line marking, completion of communication system, ground levelling and reclamation.

The construction phase will require the occupation of a construction belt for earth and assembly works, with a maximum width of 25 m. The construction site shall be fenced.

In case it is necessary to carry out excavation drainage, pumps, wellpoints or additional drainage trenches shall be used.

Construction works in the forest areas will be preceded by the felling of trees and bushes. The work related to the removal of tress will include the felling and grubbing of shrubs and trees, the removal of tree stumps, the removal of the material excavated out of the construction site, as well as the backfilling of holes created by the tree stumps removed. The work and activities related to tree felling will be performed using power saws, wood choppers for crushing branches and boughs as well as cutting tools, such as axes, pruning shears, hand files, etc.

Construction vehicles and machinery normally used for this type of work shall be utilised during the construction phase: cranes, lifts, jib cranes, backhoe loaders, rolls, felling devices, crawler bulldozers, and specialist machinery for cable tensioning, boreholes, pumps, wellpoints, as well as vehicles for staff transportation.

Table 2.9 presents a compilation of specialist equipment types used for cable burying that can be used during the construction phase and their characteristics.

Table 2.9. Type of equipment used for cable laying in the onshore area [Source: internal materials]

Equipment	Characteristics
Cable winch	Used for laying and winching power cables along cable routes. Equipped with systems protecting the cable during winching as well as an electronic measuring system which monitors all cable winching parameters
Cable rolls	Used for cable shifting. Made of hard aluminium or galvanised steel. Roll axes should be mounted on rolling bearings, protected against water and contamination, especially soil
Cable guides	Made from two sections of metal pipes, mounted pivotally on rolling bearings on a common metal frame
Cable grips/terminators	Used for cable protection against fracture. Made of galvanized steel wire twisted lines braided in such a way that when a pulling force is applied the cable grip will clamp the surface of the cable or its protective tube covering
Pulling heads	Enable clamping of the ends of the cable phase wires and are adjusted to transmitting the pulling force. Made of metal
Rotary joints	Made of metal, equipped with a u-bracket at both ends. Both joint parts should be pivotally connected with each other using a rolling bearing, adjusted to transmitting the rotary movement from one part of the joint to another
Equipment for cleaning and inspecting the pipes	Brushes intended for removing possible debris, e.g. soil, from the inside of pipe should be made of plastic, cylindrical in shape, equipped with u-brackets for rope fastening
Pipe greasers	Intended for distributing the lubricant inside the protective pipe. Made of at least two polishing pads from cotton threads, mounted on a metal axle, on both sides, equipped with a u-bracket

It is expected that the construction phase may last up to 36 months.

2.4.2.2.1 Construction works facilities

During the project implementation, the construction site facilities shall be organised which will constitute a set of elements of material and technical resources, that are necessary for the task implementation. As part of the planned project, the following is envisaged:

- construction site facilities in the area of the planned customer substation;
- construction site facilities in the area of the village of Osieki Lęborskie;
- temporary construction site facilities in the vicinity of cable chambers.

In case it is necessary to use another location for the purpose of the construction site (after ground survey results are obtained and in the course of further design work), the Applicant shall use anthropogenic areas near the existing access roads.

The elements of the construction site back-up facilities include, for example: construction machinery, transport and construction equipment, construction material stockyard, temporary facilities with office and administrative and/or welfare facilities, fire protection and OHS equipment. The construction site facilities will be equipped with airtight and portable sanitary facilities.

2.4.2.2.2 Noise emissions

The operation of the heavy construction equipment used during construction will be the source of noise emission, the level of which will vary depending on the project implementation phase and the type of equipment used. Moreover, the noise connected to the transport of construction materials, equipment and personnel will cover both the area of direct construction works, as well as the areas surrounding the access roads.

Due to a linear character of the project and the specificity of the work implementation in an open space, the noise will be present only at the section, at which the work is carried out and will cease with the progress of the construction works.

The exemplary levels of noise (at a distance of 7 m from the operating device) emitted by the construction equipment and machinery are the following [154]:

- caterpillar excavator – 85 dB;
- bulldozer – 87 dB;
- power generator – 80 dB.

As part of the planned project, trenchless methods will be applied, which constitute an additional source of noise. In this case, there are more machines at the construction site, than in the case of the section erected using the open trench method. Additionally, the machinery involves pumps with a sound power level of approx. 93 dB, slurry recycling and recovery device with a sound power level of approx. 99 dB, slurry preparatory mixer with a sound power level of 89 dB and a drilling rig with a sound power level of approx. 108 dB.

The construction works shall be conducted using equipment that guarantees the possibly effective protection against noise, which meets the requirements of the binding legal regulations. In accordance with the guidelines included in the Regulation of the Minister of the Environment of 21 December 2005 on essential requirements for outdoor-use equipment regarding noise emissions into the environment (Journal of Laws of 2005, No. 263, item 2202 as amended), the sound power level of the equipment used in construction industry is subject to limitations depending on the type of equipment and the power installed.

2.4.2.2.3 Waste and waste management

The implementation of the planned project will be the source of waste generation from typical construction works related to the erection of trenches, construction of a customer substation and a 400 kV overhead line. The types and quantities of waste expected during the construction phase are included in Table 2.10. Waste names and codes are in line 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 work progress, it is impossible to determine precisely the types of waste generated nor their quantities; therefore, the table includes all theoretically possible types of waste and estimates regarding their maximum quantities anticipated, based on the information on the assumed technology as well as the longest assumed duration of works in the onshore area.

Table 2.10. Compilation of the maximum quantities of waste estimated to be generated in the construction phase of the onshore part [Source: internal materials]

Waste code (*hazardous waste)	Waste type	Maximum quantity estimated [kg]
08	**Wastes from the manufacture, formulation, supply and use (MFSU) of coatings (paints, varnishes and vitreous enamels), adhesives, sealants and printing inks**	
08 01 11*	Waste paint and varnish containing organic solvents or other hazardous substances	<200
13	**Oil wastes and wastes of liquid fuels**	
13 03 07*	Mineral-based non-chlorinated insulating and heat transmission oils	50
15	**Waste packaging**	
15 01 10*	Packaging containing residues of or contaminated by dangerous substances	3000
16	Wastes not otherwise specified	
16 10 02	Aqueous liquid wastes other than those mentioned in 16 10 01	950 000
17	**Construction and demolition wastes**	
17 04 01	Copper, bronze, brass	5
17 04 05	Iron and steel	5
17 04 11	Cables other than those mentioned in 17 04 10	5
17 09 03*	Other construction and demolition wastes (including mixed wastes) containing dangerous substances	150
20	**Municipal wastes**	
20 01 21*	Fluorescent tubes and other mercury-containing waste	20
20 03 01	Mixed municipal waste	550

During the construction phase, earth masses shall be managed under the conditions and in the manner specified in the decision on the construction permit. Pursuant to Article 2(3) of the Waste Act of 14 December 2012 (Journal of Laws of 2013, item 21, as amended), uncontaminated soil and other naturally occurring material excavated in the course of construction activities, in cases in which it is certain that the material will be used for the purposes of construction in its natural state on the site from which it was excavated, is not treated as waste. The trenches made in connection with the implementation of the planned project will be backfilled with the excavated soil. Small quantities of excess soil, if any, will be handed over to specialist companies in accordance with the applicable regulations.

The drilling fluid remaining after the drilling process shall be collected by a specialist company and treated off-site. The Applicant shall allow the use of biodegradable drilling fluid. The type of drilling fluid shall be specified at a later stage of the design work.

Pursuant to Article 2.3 of the Waste Act of 14 December 2012 (consolidated text: Journal of Laws of 2013, item 21), the contractor of works is regarded as the producer of waste generated during construction works. The contractor shall be obliged to manage the waste in accordance with the provisions of the above-mentioned Act, i.e. to prevent waste generation in the first place, and if waste is generated – for selective collection and transfer of such waste to entities holding permits for waste transport or collection.

2.4.2.2.4 Power, raw material and water demand

Due to its specificity, the planned project shall be implemented using ready-made devices, elements, and construction materials.

Approx. 930 000 l of water will be used for drilling fluid. The water used for the drilling fluid shall be treated as waste and transferred for disposal. Water will be used for the everyday needs of the staff in the expected quantity of approx. 4 m^3/day. During the construction phase, diesel oil will be used by the equipment operating at the construction site in an expected amount of approx. 2500 l/day.

2.4.3 Operation phase

2.4.3.1 Offshore area

In the operation phase, cyclical inspections of the particularly sensitive places (e.g. crossings with the existing infrastructure), as well as of the entire length of the cable lines, are expected to take place at least once every 5 years. Subsea cable inspections require the use of small vessels for inspecting the cable circuit, which may result in a periodical occurrence of vessels conducting the inspections. The inspections can be carried out using unmanned ROVs or by divers. Currently, due to the human safety reasons as well as the advancement of technology, unmanned vehicle inspections are preferred.

In the case of a cable line failure, a cable repair may be necessary. This will result in a periodical, increased traffic of vessels in the location of failure. The framework schedule of actions undertaken in the case of a broken subsea cable involves:

- tracking the damaged cable section and the type of damage;
- loading the cable that will replace the damaged section of the cable onto a Cable Laying Vessel;
- cable transport to the location of the repairs;
- recovery of the damaged cable section – operation time depends on the type and size of damage, as well as the conditions of cable burying in the seabed (depth of burial), usually the recovery operation lasts 1–2 weeks; the cable is excavated using mass flow excavators, the recovery and loading of the cable onto a repair vessel is carried out by divers;
- cable repair, including cable jointing and laying on the seabed;
- cable burying in the seabed;
- return of the Cable Laying Vessel to the port.

To minimise the risk of cable damage, and thus, the repair works, effective methods of cable protection shall be developed and implemented during the construction phase, the most important of which will be the burying of the entirety of cable lines in the seabed sediment or protecting them with permanent protective structures, if there is a need to lay line sections on the seabed surface and use the trenchless methods of construction of the cable landfall. The application of the commonly used and proven solutions protecting the subsea cable lines against damage significantly reduces this risk and makes its occurrence in the operation phase unlikely, not included in the normal scope of the project functioning.

The relatively small service vessels will be able to use the ports located at a smaller distance from the area of the planned project, i.e. the ports of Władysławowo, Ustka, Łeba, Hel, Darłówek and

Kołobrzeg or Dziwnowo, than the ports envisaged for the supporting of vessels during the construction phase.

2.4.3.1.1 Waste and waste management

Table 2.11 contains the predicted maximum quantities and types of waste generated by service vessels. Waste names and codes are in line with the Regulation of the Minister of Climate of 2 January 2020 on the waste catalogue (Journal of Laws of 2020, item 10). In the case of the RAV, the same types of wastes will be generated, however, their quantities will be greater because of the longer route of cable lines in this route variant.

Table 2.11. Compilation of the maximum quantities of waste estimated to be generated in the operation phase of the offshore part [Source: internal materials]

Waste code (*hazardous waste)	Waste type	Maximum quantity estimated [kg]
16 81	**Waste created as a result of accidents and unexpected random incidents**	
16 81 01*	Wastes exhibiting hazardous properties	1
16 81 02	Wastes other than those mentioned in 16 81 01	1
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	100
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
20 01 02	Glass	10
20 01 08	Biodegradable kitchen and canteen waste	20
20 01 29*	Detergents containing hazardous substances	5
20 01 30	Detergents other than those mentioned in 20 01 29	10
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	10
20 01 34	Batteries and accumulators other than those mentioned in 20 01 33	10
20 01 35*	Discarded electrical and electronic equipment other than those mentioned in 20 01 21 and 20 01 23 containing hazardous components (1)	50
20 01 36	Discarded electrical and electronic equipment other than those mentioned in 20 01 21, 20 01 23 and 20 01 35	50
20 03	**Other municipal wastes**	
20 03 01	Mixed municipal waste	100

The waste and sewage generated during the operation phase shall be properly stored and secured on vessels, in accordance with a pollution prevention plan in force on each of them, drawn up in accordance with the requirements of the Act of 16 March 1995 on the prevention of sea pollution from ships (Journal of Laws of 1995, No. 47, item 243, as amended). In ports, waste and sewage shall be transferred to port reception facilities and handled in accordance with the applicable ship-generated waste and cargo residues management plan [Regulation of the Minister of Infrastructure of 21 December 2002 on ship-generated waste and cargo residues management plans (Journal of Laws of 2002, No. 236, item 1989, as amended)].

2.4.3.1.2 Power, raw material and water demand

During the operation phase, the demand for power will result exclusively from the planned maintenance works of the BP OWF CI offshore part. As in the construction phase, the consumption of fuel will be mainly determined by the type and intensity of the work carried out, the size of wave motion as well as the strength and direction of wind, which affect the method of vessel manoeuvring as well as the load of power engines. Since at this stage, the vessels that will take part in the project implementation as well as the weather conditions in which the servicing work will be carried out are not yet known, it also impossible to estimate the quantity of fuel which will be consumed by the vessels in the operation phase. Table 2.8 contains the average values of fuel consumption per hour for vessels of various sizes, which gives a certain idea about the amount of fuel consumed during the servicing work.

In the operation phase, water will be used for the everyday needs of the service vessel crews. The drinking water tanks shall be refilled during port stopovers. Once used, the water is stored in waste water tanks and transferred for treatment during the next port call.

2.4.3.1.3 Electromagnetic field (EMF)

The operation of the power cables shall involve the generation of an electromagnetic field. Cable structure – steel wire reinforcement significantly reduces the range and power of the EMF, however, does not eliminate it completely. Eddy currents induced by an AC magnetic field in highly conductive protective materials will create an opposite magnetic field vector and will further increase the partial elimination of the magnetic field from the cable [265]. In order to significantly reduce the impact of the EMF on the marine environment, it is planned to bury the cables in the seabed sediment along its entire route up to a maximum depth of 4 m. The EMF intensity decreases with the distance from the conductor. As the analyses have shown, in the case of EHV alternating current export cables, already at a distance of approx. 1.5 m from the cable, the EMF intensity levels are negligible in the context of the impact on the marine environment [265]. The burial of the cable at this depth or greater will neutralise the impact of EMF on the benthic and pelagic marine organisms sensitive to EMF.

2.4.3.1.4 Heat dissipation of power cables

According to Joule's law, electric current flowing through a cable causes it to heat up as a result of power losses on the resistance. As the temperature of the cable increases above the ambient temperature, the transfer of heat from the cable to the surrounding environment commences. An accurate quantification of the heat emitted is difficult because of the following phenomena: heat radiation, conduction and convection, subject to different physical laws [358]. The heating of sediments may lead to a change in the taxonomic composition of the benthos living on and in the seabed in the immediate vicinity of the cables [245]. According to the Guidelines on Best Environmental Practice (BEP) in Cable Laying and Operation, adopted by the OSPAR Convention for the Protection of the Marine Environment of the North-East Atlantic [281], the burial of the cable at a depth of 1 to 3 m below the seabed is sufficient to ensure that 0.2 m below the surface of the seabed the rise in sediment temperature due to heat emission from the power cables under load is not greater than the recommended 2°C. The minimum burial depth should be determined on the basis of the type of sediments (their thermal conductivity) and the type of power grid (size and type of loads, thermal properties).

2.4.3.2 Onshore area

The operation phase of the underground cable line is a maintenance-free process. Due to the necessity to ensure access to the underground cable infrastructure, a permanent exclusion from forestry use in a strip of land with a width of approx. 25 m along the predominant section of the cable line as well as within an 80 m radius in the cable chamber area. This necessity is due to the risk of cables being damaged by the root systems and their possible failure. In this context, the access to cable chambers as well as joint stations shall be ensured.

The surface area of land occupied by the underground cable line during operation will be around 15 ha.

During the power connection operation phase, the servicing work will be carried out, which shall be detailed at a later stage of the project.

The visual inspections of cable lines constitute a part of the periodic technical condition assessment conducted for the purposes of meeting the requirements of the power grid maintenance standard and are conducted visually. During the visual inspections of cable lines, special attention shall be paid in particular to:

- the presence and condition of cable line markings and warning signs;
- the condition of the line routes and their surroundings;
- the condition of cable circuits;
- the condition of systems inside the cable circuits;
- the condition of cable chambers (covers whole and intact, flooding, backfilling with soil, storage of materials on manholes and the condition of bulkheads and firewalls);
- the technical condition and corrosion protection of the supporting structures of the cable lines in the troughs and external areas;
- the condition of the visible cable protection sheaths, including corrosion protection sheaths;
- the condition of cable sheaths protecting against mechanical damage and protections against the water infiltration;
- the condition of cable heads (fractures, leakages of the cable compound or oil, impregnant or oil level);
- the condition of earthing wire connections and cable terminals at heads;
- the condition of the overvoltage and shock protections by assessing the condition of the earthing conductors and terminals connections;
- whether there are no excavations near the cable line routes and whether large and heavy elements are not stored along the cable line routes, which could inhibit the access to the cable or induce its damage as a result of pressure of the elements possibly stored on the ground;
- the condition of the information and warning messages and markings, as well as their compliance with the technical documentation of the cable line.

The cable line inspections constitute activities included in the scope of the operation activities that are a set of technical procedures resulting from the assessment of the technical condition, aimed at maintaining the cable lines and associated facilities in a proper technical condition. The dates and scopes of inspections of individual cable lines of the distribution grid should result from the conducted technical condition assessment of the line preceded with a visual inspection. On the basis of the technical condition assessment, the maintenance and overhauls of the cable network are carried out.

In the case of an underground cable line failure, the framework schedule of activities involves the following:

- tracking the damaged cable section and determining the type of damage;
- removing the damaged cable section (if the repair on site is impossible, e.g. insulation breakdown);
- cable repair, including cable jointing and laying underground.

In case of minor mechanical damage, it is possible to repair the cable with no need to replace the entire section thereof. The work site for repairing the cable line will be prepared in such a way that the adopted repair technology is protected against the impact of harmful external factors, such as dirt, dust, vapours, and precipitation.

To reduce the cable line failure frequency, the technology that involves cable burying in the soil at a depth of approx. 2 m, covering it with concrete slabs and labelling with marking bands is used.

The customer substation shall not be intended for a permanent staff presence. The same people should not occupy it more than 4 hours per day, whereas, in emergency situations, this time may be extended in accordance with the relevant provisions. Regular inspections and servicing are envisaged as part of the substation and overhead power line operation.

2.4.3.2.1 Waste and waste management

Table 2.12 contains the maximum quantities and types of waste expected to be generated by the customer substation. Waste names and codes are in line with the Regulation of the Minister of Climate of 2 January 2020 on the waste catalogue (Journal of Laws of 2020, item 10). In the operation phase of the planned project, minor amounts of waste will be generated as a result of the operation of the substation. The operation of cable lines shall not involve the generation of waste.

Table 2.12. Compilation of the maximum quantities of waste estimated to be generated within one year of operation during the operation phase in the onshore part [Source: internal materials]

Waste code (*hazardous waste)	Waste type	Maximum quantity estimated [kg]
08	**Wastes from the manufacture, formulation, supply and use (MFSU) of coatings (paints, varnishes and vitreous enamels), adhesives, sealants and printing inks**	
08 01 11*	Waste paint and varnish containing organic solvents or other hazardous substances	<400
08 01 17*	Wastes from paint or varnish removal containing organic solvents or other hazardous substances	<200
13	**Oil wastes and wastes of liquid fuels**	
13 02 05*	Mineral-based non-chlorinated engine, gear and lubricating oils	50
13 02 07*	Readily biodegradable engine, gear and lubricating oils	<150
13 05 02*	Sludges from oil/water separators	40
13 05 06*	Oil from oil/water separators	20

Waste code (*hazardous waste)	Waste type	Maximum quantity estimated [kg]
13 05 07*	Oily water from oil/water separators	<1000
15	**Waste packaging, absorbents, wiping cloths, filter materials and protective clothing not otherwise specified**	
15 01 10*	Packaging containing residues of or contaminated by hazardous substances	500
15 02 02*	Absorbents, filter materials (including oil filters not otherwise specified), wiping cloths, protective clothing contaminated by hazardous substances	20
15 02 03	Absorbents, filter materials, wiping cloths and protective clothing other than those mentioned in 15 02 02	20
17	**Construction and demolition wastes**	
17 01 01	Waste concrete and concrete rubble from demolitions and renovations	5000
17 01 07	Mixtures of concrete, bricks, tiles and ceramics other than those mentioned in 17 01 06	500
17 02 01	Wood	550
17 04 01	Copper, bronze, brass	100
17 04 05	Iron and steel	2000
17 04 11	Cables other than those mentioned in 17 04 10	2000
17 09 03*	Other construction and demolition wastes (including mixed wastes) containing hazardous substances	<40

The customer substation does not generate typical process waste but is a source of negligible quantities of waste generated exclusively during its operation. This means that small quantities of both hazardous and non-hazardous waste will be generated during the operation phase of the substation. This will include waste generated from normal operation of the facility as well as waste generated from periodic maintenance and repair work. The amount of waste generated during the operation phase will be significantly smaller than during the construction phase.

2.4.3.2.2 Power, raw material and water demand

During the underground cable line operation phase, there will be no need for water, raw materials, other materials, fuels, and energy. As a result of the customer substation operation, the power demand will be satisfied internally by means of MV/0.4 kV transformers, external back-up supply by means of MV lines, emergency supply internally by means of a power generator. Heat supply will be satisfied by means of electric heaters powered from the station auxiliary system.

2.4.3.2.3 Electromagnetic field (EMF)

The underground cable line is a source of an EMF, which in certain situations, at significant values of the intensity of individual field components, may unfavourably affect the environment and the health of people [230]. An optical fibre line which is not a source of electromagnetic radiation shall be laid together with the cables. Electric fields with significant intensities are mainly generated by high-voltage system elements, whereas, the magnetic field component reaches relatively high values in the vicinity of high-current circuits. High-voltage power cables, due to the presence of the screening sheaths a cable phase wire, are not a source of magnetic field, since the electromagnetic field normal (radial) component – the only one present in the cable – disappears completely as a result of the presence of a semiconductive screen surrounding the phase wire, copper or aluminium as well as the presence of a conductive screen surrounding the electrical insulating sheath. As a result, estimations of the electric field component outside the cable are not based on any theoretical grounds. On the other hand, the electricity flowing through the cable core is the source of electromagnetic field of relatively high values. The value of this field, usually designated above the cable line, is greatly influenced by the depth of the cable line burial underground as well as the distances between individual cores (phases) constituting a common electrical circuit (cable supply circuit).

Similarly, as in the offshore part, in order to significantly reduce the impact of the EMF on the terrestrial environment, it is planned to install the cable line in trenches with a depth of approx. 2 m. Due to the differences in topographic features (e.g. dunes), the depth of cable burial may exceed 2 m at some points.

The cable lines shall meet the requirements specified in the Regulation of the Minister of Health of 17 December 2019 on the permissible levels of electromagnetic fields in the environment (Journal of Laws of 2019, item 2448).

During the operation phase, the customer substation will also be a source of the EMF, since electric and magnetic fields are generated inside it by the high-voltage systems and current circuits [55].

When analysing the electromagnetic hazards, attention should also be paid to the impact of the 400 kV overhead line section that connects the customer substation with the PSE substation. In this context, the values and distribution of the electromagnetic field intensity is influenced by:

- the operating voltage of the individual line circuits;
- the distance of the phase conductors from the ground;
- the intervals between the phase conductors;
- the arrangement of the phase conductors within the multi-circuit lines.

2.4.3.2.4 Heat dissipation of power cables

The thermal capacity of the conductors and the related rules for protecting the conductors against overloads and short circuits are related to the temperature increases permissible under the specified conditions of use and these, in turn, are related to the values of the initial and final temperatures, characterising the process of conductor heating [255]. The size of thermal emission that is generated by the cable lines depends on their arrangement method as well as the soil thermal resistivity and the cable backfill material used. The flat formation, which will be used as part of the planned project, is characterised by more favourable conditions of heat dissipation to the soil, which enables the individual circuits to be arranged closer to one another, and as a result, a narrower strip of land to be occupied.

To ensure the best conditions for cable heat dissipation into the environment, the cable lines will be arranged along their entire length in the immediate vicinity of the bentonite.

2.4.3.2.5 Noise emission by a substation

The operating HV power substation is characterised by an increased level of noise generated mainly by autotransformers as well as to a smaller degree by the corona effect from the busbar systems and linear insertions. The level and propagation conditions of the noise generated are affected by the condition of the environment, and in the case of a corona effect, the atmospheric conditions.

Numerous results of the noise measurements conducted on the 400 kV upper voltage power substations indicate that the level of the noise emitted from the substations is constant; whereas, the noise of low-level originating at the substation busbar systems as well as the linear insertions depends on the atmospheric conditions to a large degree.

2.4.4 Decommissioning phase

2.4.4.1 Offshore area

The operation of the BP OWF CI will be terminated as a result of the Baltic Power OWF decommissioning. After the operation is finished, there are no plans to disassembly the subsea cable lines – the power cables will remain buried in the seabed sediment. This is a common practice regarding power and telecommunication cables that are no longer used, which aims at avoiding the occurrence of negative environmental impacts, the scope and strength of which could exceed the impacts generated during the construction phase, for example, due to the necessity to use mass flow excavators (MFE) in order to uncover the cable lines in the offshore area, which causes strong water turbidity as well as re-sedimentation [160].

2.4.4.2 Onshore area

Similarly, as in the case of the offshore area, the Applicant is planning to leave the cable lines buried in the ground after they are no longer used. Also, the customer substation as well as the 400 kV overhead cable line are not expected to be dismantled.

2.5 Risk of major accidents or natural and construction disasters

2.5.1 Types of accidents resulting in environmental contamination

Pursuant to Article 3(3) of the Environmental Protection Law of 27 April 2001 (Journal of Laws of 2001, No. 62, item 627, as amended), a serious accident is understood as an event, in particular an emission, fire or explosion resulting from an 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 serious industrial accident pursuant to the Regulation of the Minister of Development of 29 January 2016 on the types and quantities of hazardous substances present in the industrial plants, which determine the plant classification as a plant with an increased or high risk of a serious industrial accident (Journal of Laws of 2016, item 138).

The main environmental hazards which may occur during the construction of the BP OWF CI will be the spillages of oil derivative substances, mainly diesel, hydraulic, transformer and lubricating oils from ships. To a lesser extent, the marine environment may incidentally be endangered with materials containing hazardous substances, if they were used. During the operation phase, the main cause of marine pollution can be oil spillages originating from service vessels. Both within the open sea waters and near the coast, they can constitute a problem with long-lasting effects on fauna, flora, fishery and beaches affected by the contamination. In order to address this risk, all vessels involved throughout the project shall meet the requirements and will comply with the regulations resulting from the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78), including in particular the procedures contained in "Shipboard Oil Pollution Emergency Plans."

The extent of oil pollution can be classified as follows:

- **1st degree (small spillage, up to 20 m^3)** – small spillages of petroleum products that do not require the intervention of external forces and resources and are possible to be removed with own resources. These spillages are of local character, their removal does not pose particular technical difficulties and they do not pose a significant threat to the marine environment;
- **2nd degree (medium-sized spillage, up to 50 m^3)** – spillages of oil derivative substances, the scale of which requires a coordinated counteraction within the maritime area under the authority of the Director of the Maritime Office who decides on the scale of the counteraction required;
- **3rd degree (catastrophic spillage, above 50 m^3)** – spillages of oil derivative substances 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.

2.5.2 Accident description with an assessment of potential impacts

2.5.2.1 Spillage of petroleum products (during normal operation of vessels)

Various petroleum products (lubricating and diesel oils, petrol) may spill during normal vessel operation. It should be assumed that these will be small (1st degree) spillages.

From the environmental point of view, the most sensitive areas in case of possible spillages will be the coastal area approximately between Ustka in the west and Dębki in the east. Taking into account the prevailing western winds and coastal currents, the endangered area is the coast with tourist destinations (Jarosławiec, Rowy) and small ports from Ustka and Łeba in the west to the town and port of Władysławowo.

The areas particularly vulnerable to the potential pollution are the conservation areas including the areas belonging to the NATURA 2000 network of protected areas [324].

It should be emphasised that the key issue here is not so much the size of the spillage as the place where it has occurred. There are known cases of high bird mortality due to small oil spillages into the sea. Extensive oil spillages drifting away from the coasts, on waters with very low numbers of birds do not cause as much loss in populations as smaller spillages in areas of high concentration of seabirds [243]. The area of the planned BP OWF CI runs through the Natura 2000 site Przybrzeżne wody Bałtyku (PLB990002), where large concentrations of wintering birds occur periodically. It should be emphasised, however, that in case of a 1st degree spill, 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.

The determination of the actual extent of spillage 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 contaminant. Therefore, at this stage of the project implementation, it is impossible to make a more detailed assessment of the impact on marine organisms that are the most exposed to the effects of oil spillages.

The number of potential leaks is proportional to the number of vessels used to carry out the project implementation and operation.

2.5.2.1.1 Spillage of petroleum products (during an emergency situation)

During the construction and operation of the BP OWF CI (the decommissioning phase does not involve any activities), a spillage of petroleum product may occur, the consequence of which will be water, seabed sediment, and coast contamination. A spillage may occur as a result of a breakdown or collision of vessels, their sinking or grounding, as well as during seepage and operational leaks from vessels, oil spillage related to maintenance and repair of cable lines. In the worst-case scenario, during the construction stage, 3rd degree spillages (catastrophic spillages) will occur. It has been calculated that the probability of serious accidents of vessels is very small, ranging from 10^{-5} (practically impossible – 1 in 100 000 years) to 10^{-2} (rare – 1 in 100 years).

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 5 to 20 km from the BP OWF CI Development Area.

2.5.3 Other types of releases

2.5.3.1 Release of municipal waste or domestic sewage

During the construction of cable lines, waste will be generated aboard vessels – mostly municipal and other waste, not related to the construction process directly – as well as domestic sewage. Waste and sewage can be accidentally released into the sea, e.g. during a collection by another vessel and in the case of breakdown, causing local increase of nutrient concentration and the deterioration of water and sediment quality.

It is estimated that the possible occurrence of the above-mentioned releases will not affect the structure and functioning of groups of marine organisms in the area of the project, nor will it contribute to their increased mortality.

2.5.3.2 Gas emissions to the atmosphere

A failure of the customer substation may result in emissions of gases, which are used as refrigerants in air conditioning systems. In the case of gas-insulated switchgears (GIS) insulated with SF_6, which is used as an insulating medium in the MV and HV apparatus, an emergency situation leading to a gas release into the atmosphere cannot be ruled out. Moreover, there may be exhaust emissions from power generators used at the substation.

With regard to the mitigation of accident effects, the following measures are assumed:

- in the case of transformers, autotransformers, and glands – the use of leakproof bunds connected to a rainwater pre-treatment system (oil separation) and an additional closure allowing the outflow to be shut off immediately to protect the sewerage system in the event of an oil leak or fire emergency;
- for batteries – use of trays or pans to contain the electrolyte in the event of spillage.

The release of insulating gases to the atmosphere shall be prevented thanks to automatic gas density monitoring. If the sensors detect a drop in the gas density below a permissible level, the control system of the switchgear is locked. Moreover, regular periodic checks of enclosure leak-tightness shall be carried out, along with gas leakage tests using a sensor, in case of suspected leakage.

The station will be equipped with a portable kit of sorbents and agents designed to handle the hazardous substances spilled and leaking – appropriate to the size of the facility and the number of devices containing such substances.

2.5.3.3 Contamination of water and seabed sediments with antifouling agents

In order to protect ship hulls against fouling, biocides are used, the composition of which may include for example: copper, mercury and tributyltin compounds (TBT). These substances can transfer into water and eventually be retained in the sediments. It should be assumed that emissions of these compounds will be insignificant. Among the substances listed, organotin compounds are the most harmful (toxic) to aquatic organisms. Currently, the usage of tributyltin (TBT) (the most harmful substance) in antifouling paints is prohibited. However, the presence of these compounds cannot be excluded in the protective coatings of older vessels. This impact can be reduced by controlling the type of protective coats applied on vessels that will be used to perform activities during the construction and operation phases.

It is estimated that the possible occurrence of the above-mentioned releases will not affect the structure and functioning of groups of marine organisms in the area of the project, nor will it contribute to their increased mortality.

2.5.3.4 Release of contaminants from anthropogenic objects on the seabed

It cannot be excluded that during the preparatory work to the BP OWF CI construction process, and especially during the seabed surveys on the occurrence of UXOs and chemical weapons, manmade 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). During geophysical surveys conducted in 2020, the BP OWF CI Development Area was inspected for the presence of man-made objects on the seabed, including packaging and containers that could contain hazardous chemical substances, and no such objects were found within the area. Before the commencement of the construction, the Applicant shall conduct detailed surveys on the presence of unexploded ordnances (UXO) on the seabed. In case any chemical warfare agents/UXOs are found during these surveys, the Applicant 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 Applicant will prepare a plan for handling dangerous objects, both from the point of view of operational work at sea (for example, rules for conducting works in the vicinity of potentially hazardous objects) and from the point of view of possible removal or avoidance 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.

2.5.4 Environmental threats

2.5.4.1 Construction phase

On the basis of the data obtained from other projects implemented in offshore areas and similar undertakings, as well as the authors’ knowledge and experience, the following potential environmental threats, which may become a source of negative impact of on the environment, have been identified for the construction phase:

- spillage of petroleum products as a result of a collision of ships in an emergency situation;
- accidental release of municipal waste or domestic sewage;
- accidental release of chemicals;
- contamination of water and seabed sediments with antifouling agents.

As a direct result of emergency situations and incidents, the abiotic environment, especially seawater and to a lesser extent, seabed sediments can become contaminated. On the other hand, these events can also indirectly affect living organisms, those inhabiting or otherwise using the seabed, water depth and the surface of the sea. The contamination of water or seabed sediments with municipal waste or domestic sewage is a direct negative impact, temporary or short-term, reversible and of local range. The scale of the impact is negligible.

The collision of ships (as a result of an emergency situation) and the resulting release of hazardous substances into the environment (especially petroleum product) is a factor which can cause increased mortality and diseases of marine organisms, including those that are subject to protection in such areas. The likelihood of such events can be considered small. The implementation of a collision and leakage management plan for the duration of the project, in accordance with the applicable laws, is aimed at minimising the impact of such events on marine organisms and the protected areas.

In the onshore part, during the construction phase of the planned project, the potential accidents may be related to the incidental pollution of soil caused by hazardous substances originating from the leakages from vehicles and equipment involved in the construction works, which may lead to local soil contamination. When analysing potential hazards consisting in contamination of soil by petroleum products from damaged machines and vehicles, it should be noted that the impact of this kind may only be of short-term character (even momentary) and actually one-off in terms of occurrence frequency. In such cases only small quantities of pollutants may be released to the environment and the spatial range of such impacts should be considered spot-like.

2.5.4.2 Operation phase

During the operation of the BP OWF CI, threats to the marine environment may result from the contamination of water and, to a lesser extent, sediments with:

- petroleum products
- antifouling agents;
- accidentally released municipal waste and domestic sewage;
- accidentally released chemicals.

Waste and sewage may be generated by people on service vessels, periodically performing inspections of the BP OWF CI.

The impacts caused by the occurrence of emergency situations during the operation phase are partially identical to those which may occur during the BP OWF CI construction phase. Only the aspect regarding the accidental release of chemicals and waste is slightly different. Periodic inspection of the cable lines will be carried out during the operation of the BP OWF CI. The possibility of small quantities of waste or operating fluids being accidentally released into the sea cannot be excluded. It is estimated that the possible occurrence of the above unexpected random incidents will not affect the structure and functioning of marine organisms in the project area, nor will it cause their mortality.

During the operation, harmful chemical substances may leak into the environment as a result of breakdowns of vessels involved in the project service, i.e. mainly fuels, motor oils or hydraulic fluids. Their impact on marine organisms can be an important pathogenic factor and result in increased mortality. However, the likelihood of such events can be considered small. The implementation of a proper **response plan** in case of collisions and spillages aims to limit the impact of such events. The threat from this event can be considered as negligible

Cable lines buried in the seabed sediment and soil – as opposed to those laid on the seabed without protection as well as overhead lines – are less exposed to adverse environmental factors, but their potential damage is usually permanent and their repair is more expensive and time-consuming. It should be noted, however, that the failure rate of underground cable lines is extremely low, considerably lower than that of overhead lines. The following cable line failures can be distinguished [294]:

- simple: single-, two- and three-phase earth faults; one-, two- or three-phase interruptions and transient short circuits;
- complex: including two or more simple failures, e.g. a single-phase short circuit with a simultaneous phase break.

Two types of causes of cable line damage are distinguished:

- external: all damages that arise as a result of other human activities (e.g. earthwork on land, and anchoring of vessels at sea as well as the use of active bottom-set fishing gear in the location of the cable line laying) and random incidents (sinkholes, ground settlement, damage caused by animals, etc.);
- internal:
  - design errors and technological defects not found upon acceptance,
  - incorrect installation and assembly errors,
  - electrical, including partial discharge,
  - ageing, material fatigue,
  - inadequate protection of lines against atmospheric and switching surges,
  - inadequate protection of lines against overcurrents (increase of electric current in the circuit above the permissible value),
  - inadequate protection of lines against corrosion.

Most often, damage to cable lines occurs as a result of a process consisting of many aspects occurring in succession. According to literature, electrical causes have the largest share (approx. 40% of failure incidents). These usually include lightning surges and overcurrents. Non-selective operation of the protection automatics during a short-circuit can cause thermal damage of the cable in many places [Figure 2.14], which makes the damage tracking difficult and lengthens the time required for rectifying the failures.

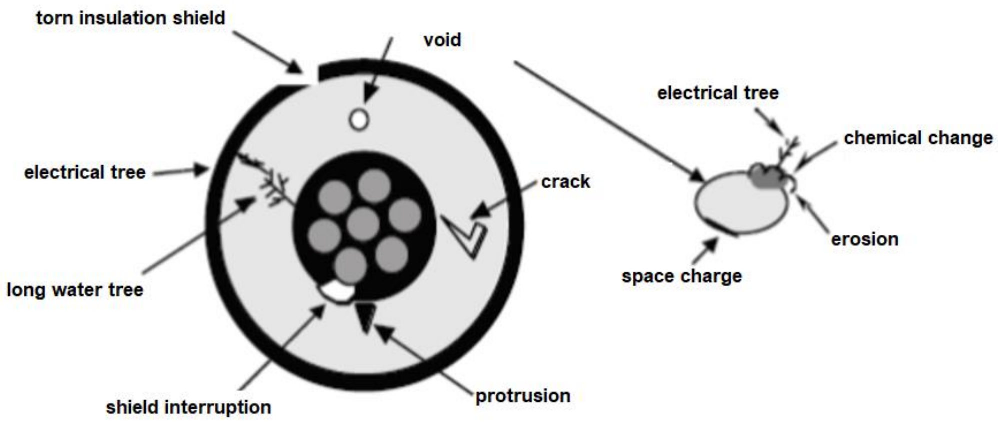

Figure 2.14. Examples of power cable defects [Source: http://www.kee.agh.edu.pl/EUI/pdf/2007/EUI2007_49.pdf]

During the operation phase, the substation will emit an EMF and noise resulting from the operation of the (auto)transformers and high-power reactors and, to a much lesser extent, the corona discharge. As a result of a failure, an additional emission of gasses to the atmosphere may occur (flue gases from the power generator activated in emergency situations, leaks of cooling agent from the cooling system or leaks of SF6 insulating gas if a gas-insulated switchgear is used). There is also a risk of leakage of electrolytes, fire extinguishing agents and the power generator fuel. Additionally, as a result of a double failure – a leak in the transformer or reactor tank and a leak in the oil sump – a leakage of oil to the soil may occur, as a result of which the soil and surface waters may become contaminated.

2.5.4.3 Decommissioning phase

The decommissioning phase of the Connection Infrastructure will not generate environmental hazards. Following the end of operation, the power cables will remain buried in the seabed sediment and soil. It is also not planned to disassembly the customer substation as well as the 400 kV overhead line.

2.5.5 Breakdown 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 the BP OWF CI. The highest risk of a breakdown resulting in a serious threat to the environment concerns the works performed in the offshore area. In order to eliminate or minimise such risks various actions will be taken, including among others:

- developing plans for the safe construction, operation and decommissioning of the BP OWF CI in accordance with the applicable legal regulations for the duration of the project implementation;
- developing rescue plans and training of crews and personnel, including the principles of updating and verification by conducting regular exercises, 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 and operation of the BP OWF CI;

- selecting suppliers as well as certified parts and components of the BP OWF CI;
- accurate marking of the BP OWF CI Area, its facilities and vessels moving within the area;
- planning offshore operations;
- applying the standards and guidelines of the International Maritime Organization (IMO), recognised classification societies and maritime administration recommendations;
- developing plans of safe navigation in the construction phase;
- 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 Automatic Identification System (AIS);
- continuous monitoring of vessel traffic regarding the vessels involved in the construction and operation phase;
- establishing a coordination centre supervising the respective phases of project implementation;
- maintaining regular communication lines between the BP OWF CI coordination centre and the coordinator of works at sea and other coordination centres (Maritime Rescue Coordination Centre in Gdynia and maritime administration).

The likelihood of a major accident in the onshore part of the BP OWF CI is lower than in the offshore section. In the event of a need to remove an accidental oil spillage from vehicles and equipment involved in construction and demolition works, construction and maintenance crews will be equipped with sorbents to absorb oil-derived substances, and construction workers will be required to permanently remove any small spills they notice. The used absorbents shall be collected and handed over for recovery or neutralisation by specialised companies. Such companies must have appropriate permits in accordance with the provisions of the Waste Act.

During the operation phase of the substation, in order to reduce system failure rates when transformers, autotransformers, and glands are used, the substation shall be equipped with oil bunds connected to a rainwater pre-treatment system and an additional closure enabling immediate shut-off of the outflow to protect the sewerage system in case of an oil spillage or fire emergency. Regular maintenance and servicing are intended to prevent failures.

Such situations involving equipment failures in substations are extremely rare, of low scale and are local in terms of impact. In the event of a failure, procedures are in place to limit the consequences by locating the site of the failure and controlling it as quickly as possible in order to secure the uninterrupted operation of the substation.

During the substation operation, a periodic inspection of the technical condition of equipment shall be carried out to detect irregularities and prevent technical failures that could cause adverse environmental impacts.

In case a SF6-insulated switchgear is used, the prevention of possible emissions of this gas to the atmosphere will be ensured thanks to an automatic gas density control. If the sensors detect a drop in the gas density below a permissible level, the control system of the switchgear is locked. Moreover, regular periodic checks of the enclosure leak-tightness will be carried out, along with SF6 gas leakage tests using a sensor, in case of a suspected leakage.

2.5.6 Design, technology and organisational security expected to be applied by the Applicant

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

- threats to human life – evacuation plans, search and rescue plans;
- fire risks on ships involved in the construction and operation phases;
- environmental pollution risks – action plan for counteracting threats and contamination from oil spillages by ships involved in the construction and operation phases.

2.5.7 Potential causes of breakdowns including extreme situations and the risk of natural and construction disasters

In the case of the offshore area, the greatest potential risks will occur during the construction phase; however, the risk of disaster is minimal due to the fact that the planning of offshore operations always takes into account weather conditions and the possibility of their change. Every offshore operation has its limitations in terms of visibility, wind speed, sea state or ambient temperatures. Adverse weather conditions such as too strong wind or too high waves can only result in the extension of the construction cycle and an increased demand for energy – fuel consumption. It is not expected that during the construction and operation phases extreme situations could occur that would result in serious damage to the export cables or to the vessels involved in the construction and maintenance work. The nature of the project – laying of cable lines – also excludes the possibility of a construction disaster.

In the operation phase, damage to the underground cable line may be caused by seismic shocks and landslides, i.e. as a result of a natural disaster within the meaning of the Act of 18 April 2002 on the state of natural disaster (Journal of Laws of 2002, No.62, item 558, as amended). However, these events are unlikely in the planned project location. As regards seismic phenomena, the territory of Poland is classified as aseismic (no tremors) and seismic zone II (rare and weak tremors), where earthquakes occur rarely and are not strong.

According to the Landslide Counteracting System SOPO (http://geoportal.pgi.gov.pl/portal/page/portal/SOPO/), the area of the planned project is situated beyond landslides and areas prone to mass movements. There is no flood hazard in the prevailing part of the area of the planned project (https://wody.isok.gov.pl).

Overhead lines are at much higher risk of damage, since their spans and towers can break and become overturned, in exceptional cases, during such unfavourable weather events as hurricanes and icing. Pursuant to Article 73 of the Construction Law of 7 July 1994 (Journal of Laws of 1994, No. 89, item 414, as amended), a construction disaster is understood as 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 this context, the planned project, due its specificity, the location of implementation and the construction of most part of the power line route in the form of cable lines buried at a shallow depth (the average depth of trenches will be 2 m), will be, to a very small degree, a potential source of construction disasters and threat to the immediate surroundings, including people present there. The construction of a short section of an overhead line (up to 270 m in length) will be conducted on a flat land, not overgrown with trees and shrubs, outside urbanised areas, which will favour its smooth and trouble-free implementation minimising the possibility of construction disasters.

2.5.8 Risk of major accidents and natural or construction disasters, taking into account the substances and technologies applied, including the risk related to climate change

The risk of a major accident, natural and construction disasters is minimal. The Applicant intends to use the state-of-the-art technologies to ensure high reliability of electricity transmission and to comply with the relevant environmental and economic standards and requirements. The implementation of these tasks will be affected through:

- the use of conductive, insulating and structural materials characterised by high operating parameters;
- selecting the most reliable and safest methods of constructing power lines;
- conducting maintenance operations.

The most significant risk may be related to the spillages of petroleum products at sea, which can adversely affect the marine and coastal environment. With the standard preventive measures applied and developed for the planned project, the risk of such a spillage will be minimal [324]. The probability of such events as ship collisions belongs to the category of very rare events (1 per 100 years). Taking into account the effects in the form of 200 m^3 of diesel oil emission, the risk level is within an acceptable range. Emission of 200 m^3 of diesel oil will cause insignificant damage to the environment because it will disperse within 12 hours [324].

The effects of climate change observed in recent decades are manifested in particular by an increase in temperature as well as in the frequency and severity of extreme events. Under the United Nations Framework Convention (the so-called Climate Convention) on Climate Change of 9 May 1992, in order to avoid the most serious threats from climate change, measures were agreed to reduce greenhouse gas emissions, which have a significant impact on the global energy balance of the climate system. The reduction of greenhouse gas emissions on a global scale is a complex issue. In the foreseeable future, greenhouse gas emissions will not be reduced sufficiently to contain climate change. In this situation, one of the priorities, apart from mitigating the effects of climate change, is a possible adaptation to it, also in the scope of the planned undertakings.

The climate change scenarios for Poland developed for the KLIMADA project (Strategic adaptation plan for sectors vulnerable to climate change by 2020 with the perspective by 2030, 2013) are descriptions of probable future climate conditions up to 2030. They are based on the results of hydrodynamic simulations of atmosphere and ocean models. Due to a significant level of uncertainty, they cannot be regarded as certain climate projections, but they represent the best available approximation of future change.

Extreme events (heavy rainfall, floods, deluges, landslides, heat waves, droughts, storms, landslides, etc.) resulting from climate change are projected to increase in frequency and intensity in the future. These phenomena will occur with increasing frequency and intensity and will affect larger areas of the country. Climate change is associated with adverse changes in hydrological conditions. Although the annual sums of precipitation do not change significantly, their character becomes more random and uneven, resulting in longer periods without rainfall, interrupted by sudden and heavy rainfalls.

Impacts of climate change in the coastal zone primarily include an increase in the frequency, intensity and duration of storms. This can be accompanied by an increased irregularity of these events, i.e. long periods of relative calm can be followed by repeated storms preventing coastal regeneration. An additional factor accelerating the process of coastal erosion is an increase in average winter temperatures, as a result of which a reduction in the ice cover protecting the beaches from storm surges, and thereby safeguarding them against coastal erosion, should be expected. The scenarios of sea level changes demonstrate that in the period 2011–2030 the average annual sea level along the entire coast will be approximately 5 cm higher compared to the values from the reference period, i.e. 1971–1990. An increase in the frequency of storm floods and more frequent flooding of low-lying areas, as well as the degradation of the coastal cliffs and sea shore, which will entail a strong pressure on the infrastructure located in these areas, are very important effects of the climate change.

The power connection line will be planned in such a way so as to prevent the ingress of water and mud inside the protective pipes. The cable entry points into protective tubes will be sealed and the cables will be protected against damage.

The power sector has been listed as one of the climate-sensitive sectors [361], due to the predominance of overhead lines in the Polish power system, which are highly vulnerable to failures caused by strong winds and excessive icing, as opposed to cable networks.

2.6 Relations between the parameters of the project and its impacts

The matrix of connections between the planned project parameters and the impacts for the offshore and onshore part is presented in Table 2.13 and Table 2.14.

Table 2.13. Matrix of connections between the project parameters and impacts – offshore part [Source: internal materials]

Parameter	**Type of emission or disturbance**													
	Heat	**EMF**	**Above-water noise**	**Underwater noise**	**Waste**	**Light effects**	**Seabed disturbances**	**Suspended solids**	**Resuspension of contaminants**	**Redeposition**	**Creation of an “ artificial reef”**	**Water contamination**	**Air pollutions**	**Increased traffic and collision risk**
Length and type of cables	X	X												
Method of cable line construction, construction belt width and depth of cable burying	X	X		X			X	X	X	X				
Cable laying on the seabed and their protection against damage and destruction											X			
Traffic of construction, inspection and service vessels			X	X	X	X						X	X	X
Horizontal drilling				X			X	X	X	X		X	X	

Table 2.14. Matrix of connections between the project parameters and impacts – onshore part [Source: internal materials]

Parameter	**Type of emission or disturbance**							
	Destruction of the ground surface – tree felling	**New buildings**	**Noise**	**Waste**	**Sewage**	**EFM**	**Heat**	**Air pollutions**
Length and quantity of cables	X					X	X	
Voltage range						X	X	
Method of cable line construction, width of the permanent and temporary belts, depth of cable burying	X		X	X	X			X
Customer substation components		X	X	X	X	X		X
400 kV overhead line	X	X	X	X		X		
Horizontal drilling			X	X	X			X

3 Environmental conditions

OFFSHORE PART

3.1 Location, seabed topography

Both route variants (APV and RAV) in the offshore section are located between the Baltic Power OWF Area and the shore in the area of 160.5 km of the seashore (according to the Maritime Office shoreline chainage). They cover a part of the seabed with the depth from approximately 41.0 m to 0.0 MASL [Figure 3.1].

Based on the analysis of bathymetric data, the seabed relief was identified. The analysis of sonar data enabled the interpretation of seabed features. On the basis of seismo-acoustic data analysis and using literature data on the area surveyed [68, 69, 139, 208, 209, 210, 207, 252, 299, 297, 298, 395, 396, 397, 399, 400] the characteristics of the seabed and the main types of sediments forming the seabed were identified.

In the northern and central part of the BP OWF CI area, the seabed surface takes the form of an accumulation plain with areas of kame terraces. They cover the seabed with a depth from approx. 20.0 to approx. 41.0 MBSL. The seabed is slightly undulated, there are slight height differences associated with the presence of sand formations and outcrops of older sediments. The seabed slopes reach 2–3°, up to a maximum of over a dozen degrees within the slopes of the outcrops of older sediments [Figure 3.2].

Parts of the seabed in the central part of the area analysed, along with seabed parts in the northern section of the area, take the form of an abrasion-accumulation plain. The plain covers the seabed with a depth from approx. 21.0 to approx. 27.0 MBSL (central part of the area) and 38.0 to approximately 41.0 MBSL (northern part of the area). The seabed is even with height differences of 0.5–1.0 m, maximally up to 3.0 m, associated with the presence of sand accumulations on the surface of cohesive sediments and the outcrops of older sediments. The seabed slopes reach 2–3°, up to a maximum of over a dozen degrees within the slopes of the outcrops of older sediments.

In the southern part of the area analysed, there is a foreshore slope. It covers the seabed with a depth from approx. 13 to approx. 25 MBSL. In the southern and central part of the foreshore slope, the seabed is located at a depth of approx. 13 to 19 MBSL. In the northern part, it gently inclines from approx. 16–17 m to approx. 25 m of depth. In this part of the foreshore slope, the seabed slope is approx. 1–2°. The seabed in the northern part is even, in the central and southern part – undulated with numerous sandy formations in the form of bars and domes with a relative height of up to 3 m above the surrounding seabed.

In the shallowest part of the seabed in the BP OWF CI route variants analysed there is the sandbank zone. It covers a strip of sandy seabed with a width of 1200–1300 m, stretching from the shore into the sea, up to a depth of approximately 13 m. Within this strip, three sandbanks have developed. The sandbank closest to the shore (sandbank 1) has the most varied, wavy course. At the time of the surveys, its ridge was at a depth of approximately 1–2 m and it was located 100–150 m from the waterline. The ridge of the sandbank 2 was approximately 300–400 m from the waterline at a depth of 3.5 to 4 m. The ridge of the sandbank 3 was located 800–900 m from the shore at a depth of 5–6 m.

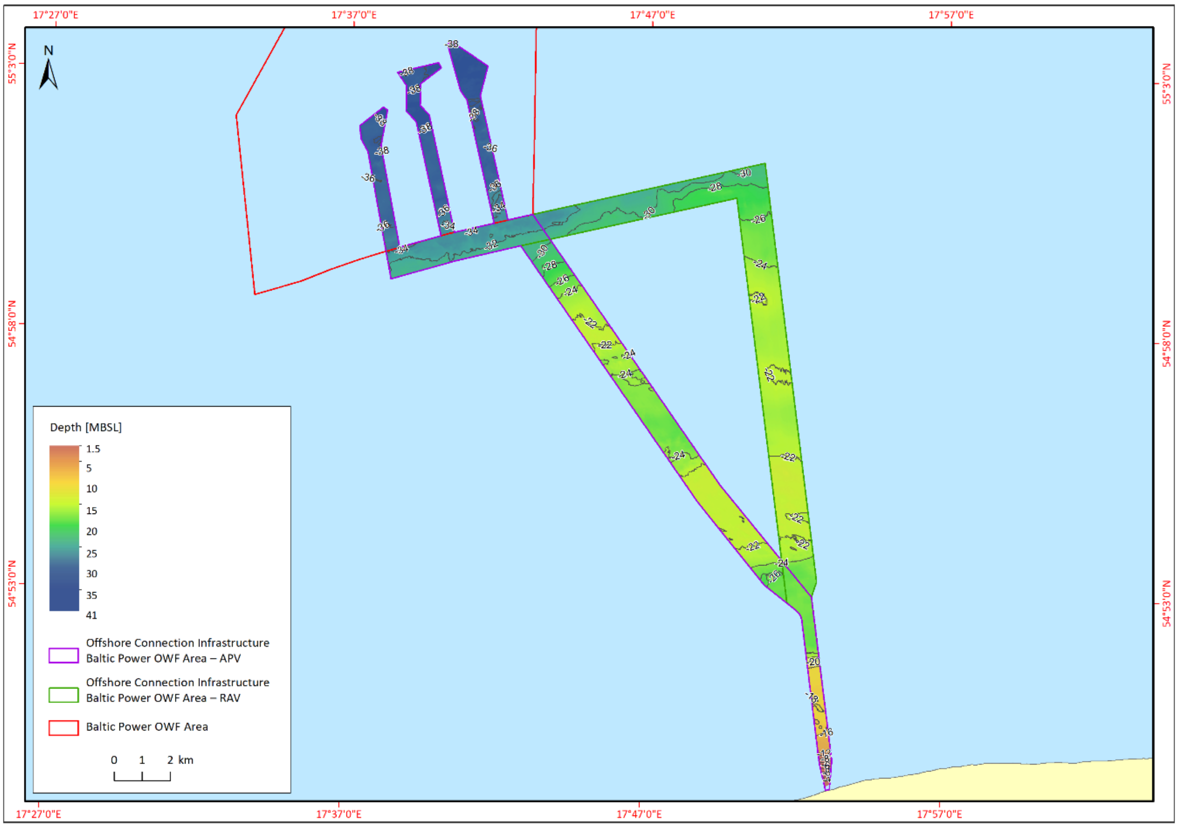

Figure 3.1. Bathymetric map of the offshore area of the planned Baltic Power OWF Connection Infrastructure [Source: internal materials]

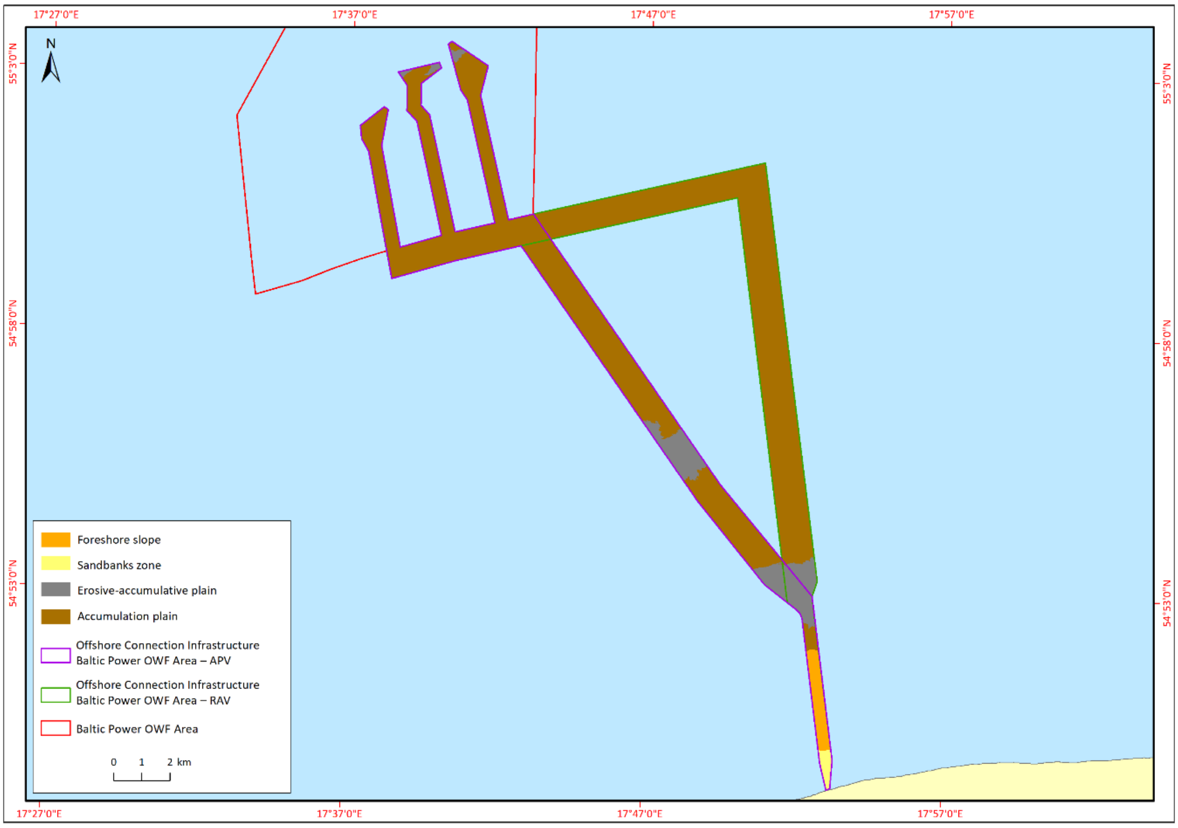

Figure 3.2. Seabed types in the offshore area of the planned Baltic Power OWF Connection Infrastructure [Source: internal materials]

3.1.1 Description of route variants

3.1.1.1 Applicant Proposed Variant

The first section of the route comprises three parallel legs, aligned in the NNW–SSE direction, with the lengths varying from approx. 5 km (western leg), through approx. 6 km (central leg), to approx. 7 km (eastern leg), passing through the central and southern part of the Baltic Power OWF Area [Figure 1.1]. They are planned in the area of the seabed with the depth from approx. 39–41 m in the northern part of the legs to approx. 32–33 MBSL in the southern part. They cover the seabed taking the form of an accumulation plain with areas of kame terraces.

The second section of the route running in the WSW–ENE direction is 10.0 km long and covers a strip of the seabed in the vicinity of the Stilo Bank with the depth of approximately 35 to 32 MBSL (the depth decreases eastwards). The seabed is even, the slight differences within its area are related to the presence of sandy formations moving over clayey-silty substrate. Locally, multi-grained sands and gravel are present on the seabed. The thickness of the sand ranges from 1 to 2 m, up to 3 m in some places. The sand layer is discontinuous, in places, clays and silts (glaciolacustrine sediments) may become exposed on the surface, with till outcrops occurring less often in this part of the route [208, 209, 210, 299, 399, 400]. The sandy formations layout indicates the predominant direction of the sediment transfer to the east [399, 400].

The presence of numerous small sandy formations proves the accumulative, in places erosive, nature of the area with the dominant processes being the sediment transport to the east. This is an area of a slow movement of sand formations over the seabed.

The third section running in the NW–SE direction is approx. 17.3 km long and covers a seabed area with a depth from approx. 32 to approx. 21 MBSL within the accumulation platform and abrasive-accumulative plain of the Stilo Bank with the same characteristics as in the first section. In the central and southern part of the section, outcrops of till with pavement and boulders on the surface as well as glaciolacustrine sediments may occur.

The fourth section, running in the N–S direction, is 5.8 km long. It covers a strip of the seabed of about 25 MBSL deep, with the depth decreasing gently towards the shore. It covers two geomorphologically and dynamically different areas: the foreshore slope and the sandbank zone. The foreshore slope is slightly inclined to the north and covers the seabed with a depth at which significant (storm) waves affect the seabed. In the northern part of the slope, the seabed is even and in the central and southern parts, it has a diversified relief. The wide variety of sand formations and their layouts indicate their changeability and instability. This area is abundant in sandy material with a dominant eastward direction of the bedload transfer. The thickness of sand in this part of the route exceeds 5 m in places. As a result of the impact of storm waves on the seabed, local exposures of the rocky substratum are possible. These can be both till outcrops with pavement and boulders on the surface, as well as glaciolacustrine sediments, which are the remains of former reservoirs developing on land at a time when the sea level was lower than the present one by approximately 15–25 m (before the Littorina transgression).

In the strip with a width of 1200–1300 m, up to a depth of 13 from the shore, there is a sandbank zone with a series of three sand bars. The sandbanks run parallelly to the shore. The sandbanks consist mostly of fine- and medium-grained sand. In the depressions between the sandbanks, accumulations of sand and gravel or gravelly material may occur. In places, glaciolacustrine sediments (sands, silts, clays) and occasionally also peats may be present within the sandbanks structure. These sediments may be exposed on the seabed in the depressions between sandbanks [425, 437, 438, 442, 444].

3.1.1.2 Rational Alternative Variant

The first section of the route comprises three parallel legs, aligned in the NNW–SSE direction, with the lengths varying from approx. 5 km (western leg), through approx. 6 km (central leg), to approx. 7 km (eastern leg), passing through the central and southern part of the Baltic Power OWF Area [Figure 1.1]. They are planned in the area of the seabed with the depth from approx. 39–41 m in the northern part of the legs to approx. 32–33 MBSL in the southern part. They cover the seabed taking the form of an accumulation plain with areas of kame terraces.

The second section of the route running in the WSW–ENE direction is 18.6 km long and covers a strip of the seabed from the depth of around 35 to 27 MBSL (the depth decreases eastwards). The seabed is even, the slight differences within its area are related to the presence of sandy formations moving over clayey-silty substrate. Locally, multi-grained sands and gravel are present on the seabed. The thickness of sands is from 1 to 2 m, exceeding 5 m in places (depressions in the top of ice-marginal and lacustrine sediments). The layer of sands is discontinuous, in places, clays and silts may become exposed (glaciolacustrine sediments), while till outcrops are less common in this part of the route [208, 209, 210, 299, 399, 400]. The sandy formations layout indicates the predominant direction of the sediment transfer to the east [399, 400].

The presence of numerous small sandy formations proves the accumulative, in places erosive, nature of the area with the dominant processes being the sediment transport to the east. This is an area of a slow movement of sand formations over the seabed.

The third section, running in the N–S direction, is approx. 21.9 km long. It covers a strip of the seabed of about 29–30 m deep, with the depth decreasing gently towards the shore. It includes three geomorphologically and dynamically different areas: the seabed within the Stilo Bank with a character of an accumulation platform, abrasive-accumulative plain in places, the foreshore slope and the sandbank zone [68, 69, 299, 399, 400]. In the northern part of this section, the seabed is even, with a thin, discontinuous sandy cover with a few sand accumulations moving over clayey-silty substratum in the northern part and over till substratum in the central and southern part of the section. The sandy formations layout indicates the predominant direction of the sediment transfer to the east [399, 400]. The southern part of the section, from a depth of about 22–23 m to a depth of approx. 13 m, is located within the foreshore slope. It is a fragment of the sandy seabed gently inclining to the north within which there are elongated lowerings and washouts. This area is characterised by a diverse seabed relief. The wide variety of sand formations and their layouts indicate their changeability and instability. This area is abundant in sandy material with a dominant eastward direction of the bedload transfer. The thickness of sand in this part of the route exceeds 5 m in places. As a result of the impact of storm waves on the seabed, local exposures of the rocky substratum are possible. These can be both till outcrops with pavement and boulders on the surface, as well as glaciolacustrine sediments, which are the remains of former reservoirs developing on land at a time when the sea level was lower than the present one by approximately 15–25 m (before the Littorina transgression) [191, 398].

In the strip with a width of 1200–1300 m, up to a depth of 13 from the shore, there is a sandbank zone with a series of three sand bars. The sandbanks run parallel to the shore. The sandbanks consist mostly of fine- and medium-grained sand. In the depressions between the sandbanks, accumulations of sand and gravel or gravelly material may occur. In places, glaciolacustrine sediments (sands, silts, clays) and occasionally also peats may be present within the sandbanks structure. These sediments may be exposed on the seabed in the depressions between sandbanks [425, 437, 438, 442, 444].

3.2 Geological structure, seabed sediments, raw materials and deposits

3.2.1 Geological structure, geotechnical conditions

Within the area analysed, the crystalline basement is located at a depth of approximately 3000 m. In the crystalline basement, in the western part of the area discussed, there is the Białogóra fault, renewed only in the Palaeozoic sediments (Cambrian-Silurian). The sedimentary cover is made up of Cambrian, Ordovician, Silurian and Permian formations. These are mainly Cambrian sandstones and silt-clay sediments, Silurian clays and Zechstein dolomites, anhydrites and rock salts. Mesozoic is represented by the Triassic and Cretaceous sediments. These are mainly Triassic claystones, siltstones and sandstones as well as Cretaceous quartz-glauconite sands and sands with phosphorites. Quaternary formations lie directly on the Paleogene and Neogene sediments represented by sands and silty clays, often mixed with carbonaceous substances [68, 69, 207, 208, 208, 209, 210]. The top of the Paleogene and Neogene formations is erosive in nature and is located at a depth of approx. 2 to more than 40 m.

The thickness of the Quaternary formations in the survey area is between 20–30 m on average. These are mainly glacial till and sandy-till sediments, fluvioglacial sandy and sandy-gravelly sediments, as well as local accumulations of clays, silts and fine-grained sands of glaciolacustrine origin covered with modern marine sands [252, 395, 396, 397].

3.2.1.1 Sub-Quaternary formations

The oldest, identified on the basis of the analysis of seismo-acoustic data, is the top of the sediments classified as Silurian sediments top. Above the Silurian sediments, Mesozoic sediments are deposited, covered by a layer of approx. 30 to approx. 90 m thick Paleogene and Neogene sediments. The Paleogene and Neogene sediments are mainly fine-grained sediments (sands and silts). Their top is uneven, erosive, with valley-like incisions. They are deposited on the entire surface of the area analysed. The unit was identified on the basis of the analysis of the multi-channel seismic profile carried out along the central line and the analysis of the boomer data.

3.2.1.2 Quaternary formations

The thickness of Quaternary sediments is approx. 20–30 m. Based on a detailed analysis of seismo-acoustic data, three main groups of sediments were distinguished within the Quaternary formations:

- glacial and fluvioglacial deposits with a predominant share of tills in the top part. The top surface is diverse, without significant height differences. The sediments of this Unit were identified in the greater part of the area analysed. In the central part of the route of the BP OWF CI, in the APV, an outcrop of glacial and fluvioglacial sediments is visible on the seabed;
- glaciolacustrine deposits, mainly clays, silts, fine sands of the Pleistocene and Holocene. They form a discontinuous layer with a thickness of approx. 20 m in the northern part of both route variants, in a vast lowering in the top of glacial sediments and in the southern part of the routes, where they create an accumulation with a thickness of approximately a dozen meters;

- fine- and medium-grained sands, in some places multi-grained sands and gravels, and locally Pleistocene silts as well as modern fine- and medium-grained sands (Holocene). They create a discontinuous layer. Their greatest thickness was identified within the foreshore slope and the sandbank zone, where it reaches up to 5 m, as well as at several points along the route, in places of depressions in the top of glaciolacustrine sediments.

3.2.2 Seabed sediments and their quality

On the basis of the analysis of bathymetric and sonar data, a map of surface sediments was prepared [Figure 3.3]. Two predominant types of sediments were identified: fine- and medium-grained sands as well as seabed areas consisting of cohesive sediments with a sandy cover.

Almost the entire seabed of the area analysed is covered with a discontinuous layer of fine- and medium-grained sands. In places, accumulations of multi-grained sediments, boulder clusters and cohesive sediment outcrops occur on the surface. The cohesive sediments are mainly Pleistocene glacial tills and glaciolacustrine sediments (Pleistocene/Holocene).

The fine- and medium-grained sands form covers with flat, locally rippled surfaces. Within their area, the sand layer thickness is up to several meters. Below sandy sediments, glaciolacustrine sediments are deposited (northern part of the area analysed as well as the sections of routes in the southern part) as well as local glacial and fluvioglacial sediments (mainly till, sand and gravel) in the southern part. Below the glaciolacustrine sediments, glacial and fluvioglacial Pleistocene sediments are predominant in the substratum structure.

In places, peats may occur within the sandbank zone. On the basis of the surveys conducted, no peat was confirmed; however, as the experience of the EIA Report authors' shows, their presence cannot be excluded. Peats, occurring in the sandbank zone, in terms of their origin, are related to the development of glaciolacustrine reservoirs and peat bogs on land prior to the Littorina transgression. Along with the development of the Baltic Sea, after the Littorina transgression, these areas were covered by the waters of the transgressing sea. The glaciolacustrine sediments and peatland sediments were covered with migrating barrier formations of the coastal zone, and later, the latter were covered with the sands of the sandbanks zone.

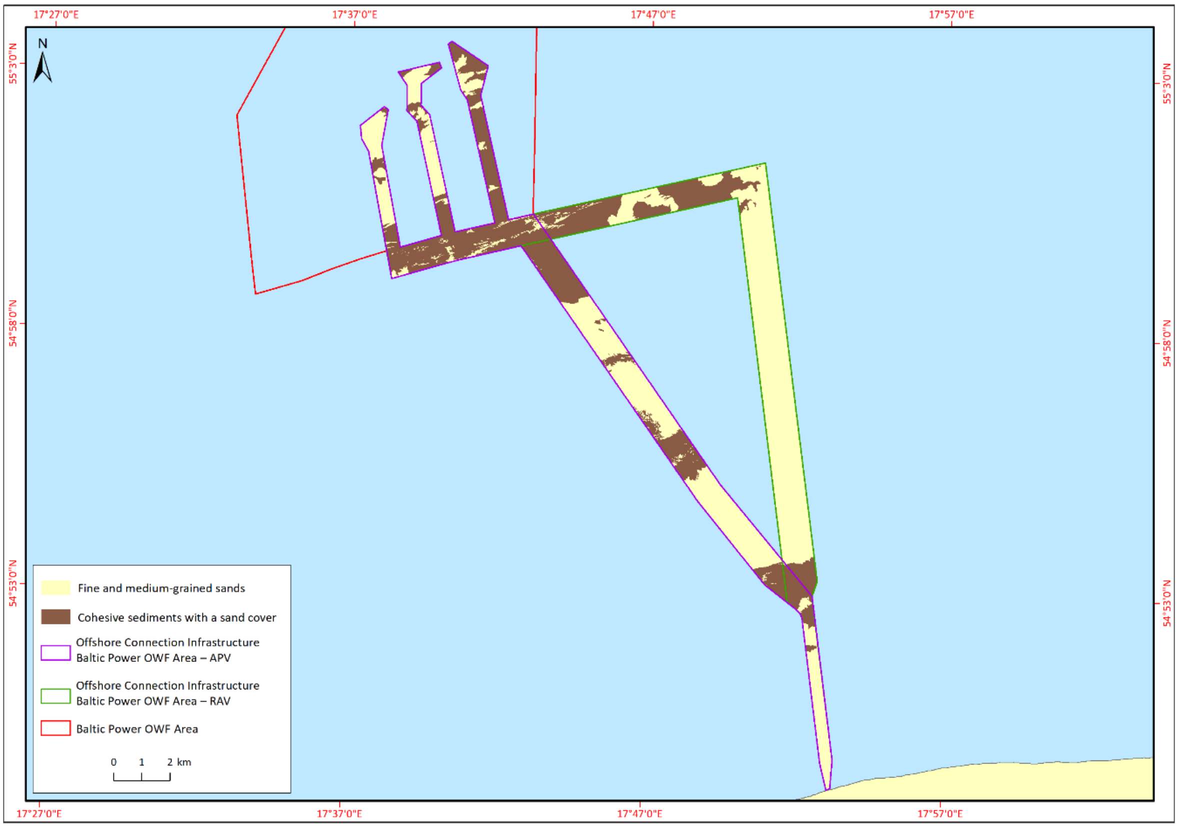

Figure 3.3. Surface sediments in the offshore area of the planned Baltic Power OWF Connection Infrastructure [Source: internal materials]

Seabed sediments constitute a very important element of the aquatic ecosystem of the Baltic Sea, which is a shallow sea, with limited water exchange and a surface area approximately four times smaller than its catchment area. Such conditions mean that every interference in the marine environment, including the exploitation and development of the seabed, affects the delicate ecological balance of the marine ecosystem.

The transfer of contaminants from the sediment into the water (and thus, the change of water quality), and the formation of suspended solids that remain suspended in the water for a long time, depends on the type of sediment. The most contaminants and nutrients will be transferred into the water from a sediment with an increased amount of organic matter (e.g. silty, clayey sediments, characterised by higher concentrations of metals and persistent organic pollutants). Such sediments facilitate the formation of a greater amount of suspended solids, which will remain suspended in the water for a long time. Intense resuspension may cause the release of nutrients immobilised in the sediment and contribute to eutrophication. In the case of sandy deposits with low organic matter content (e.g. coarse sandy sediments), the processes described will be less intense. These sediments are generally characterised by a small number of fine fractions and low concentrations of metals and persistent organic pollutants.

The analysed surface seabed sediments from the BP OWF CI area belong to the inorganic deposits with organic matter content (expressed as loss on ignition (LOI)) of less than 10%.

The seabed sediment samples collected during the environmental surveys were analysed in terms of the content of nutrients, persistent organic pollutants (POPs) (i.e. PAHs, PCBs, TBT, mineral oils) and metals.

None of the sediment samples tested exceeded the limit values specified for the concentration of metals, polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs), according to the Regulation of the Minister of the Environment of 11 May 2015 on the recovery of waste outside installations and facilities (Journal of Laws of 2015, item 796), which allows the classification of a sediment as clean in the context of practical applications, and although it does not apply to a sediment transferred within water, they may form the basis for assessing the seabed sediment contamination with chemical compounds.

Primary processes influencing the **nutrient** content in the sea are the geophysical and geochemical processes, which control not only the supply of such elements to seawater but are also responsible for the dispersion and removal of such compounds.

Nitrogen compounds present in the seabed sediments undergo cyclical changes as a result of biogeochemical processes. Oxidation of ammonia and its compounds by the nitrifying bacteria leads to formation of nitrogen oxides, and later nitrates. Too intense nitrification, however, is not desirable, as nitrates are more easily eluted from sediments than ammonium ions. The processes related to cable burial or vessel anchoring can result in a better oxygenation of sediments, and consequently an intensification of nitrification processes and an increased release of nitrates into the water. This can also affect the balance of the general scheme of nitrogen cycle by reducing the intensity of denitrification processes that occur under anaerobic conditions and involve the conversion of nitrates into molecular nitrogen [270, 386].

In the Baltic Sea sediments, nitrogen occurs mainly in organic form and its regional variability is analogous to the variability of carbon [49]. Usually, inorganic forms of nitrogen constitute no more than 10% of the total nitrogen (TN) in the sediments [50]. An increase in the percentage share of inorganic nitrogen forms is possible in the area of erosion and transport of fine particle dispersion sediments [394].

Due to the fact that the circulation of nitrogen in the environment is a very complex process, and its intensity depends on numerous factors (e.g. oxygenation, temperature, season, primary production, etc.) as well as on the volume of nutrient supply from isolated spots, diffused sources and the deposition from the atmosphere [41, 108], a precise calculation of the nitrogen load, which would enter the water column from the sediment during construction works is impossible. The mean concentration of nitrogen in the seabed sediments analysed was below the limit of quantification, i.e. 200 mg $N \cdot kg^{-1}$ DW. According to the data from literature, the nitrogen content in the Southern Baltic sediments ranges between: 98–2604 mg $N \cdot kg^{-1}$ DW in sandy sediments, 1106–3094 mg $N \cdot kg^{-1}$ DW in sandy-clayey sediments, 1904–9506 mg $N \cdot kg^{-1}$ DW in clays and 1694–4606 mg $N \cdot kg^{-1}$ DW in tills [293], and in the own studies, the total nitrogen content both in summer, as well as in winter was below the limit of quantification of the method applied i.e. below 200 $mg \cdot kg^{-1}$ DW in the sandy seabed sediments of the central coast. Considering the above data, it can be concluded that the amount of nitrogen that could transfer from the sediment into the water depth during construction works will be negligible in comparison to approx. 190 000 tonnes of TN supplied to the Baltic Sea each year with the inflowing river waters [394].

Phosphorus (P) in the seabed sediments is conventionally divided into labile (mobile, reactive) and refractive. Refractive forms are a combination of phosphorus with calcium, aluminium and clay minerals, as well as degradation-resistant organic forms of this element. Refractive phosphorus is subject to deposition, and thus, is removed from the circulation in the water depth. Labile phosphorus is the phosphorus contained in fresh organic matter, phosphates present in the interstitial waters, the combinations of phosphorus with Fe^{3+} and phosphates loosely bound by adsorption with different elements of the sediment. Such forms easily re-enter the circulation in the water depth, mainly due to the mineralisation of organic matter and the dissolution of combinations of phosphorus with Fe^{3+} as a result of the decrease in the value of the redox potential [4, 394]. Phosphorus can act as a productivity-limiting factor for the marine ecosystems [410]. In aquatic environment, when the primary production is limited by the quantity of phosphorus, an introduction of 1 mg of phosphorus means a 100 mg growth of algae dry weight per single biological cycle [85].

The nutrient content (here – the total phosphorus content) in the area surveyed did not exceed the values typical for the sediments of the Southern Baltic. The amount of phosphorus that may be released into the water (the so-called available phosphorus) is estimated at 10 to 20% of the total amount of phosphorus contained in the sediments [423]. The mean concentration of phosphorus in the seabed sediments analysed was 298 $mg \cdot kg^{-1}$ DW for the entire survey period.

The concentrations of persistent organic pollutants (**PAHs, PCBs**) and harmful substances such as metals or mineral oils, in the area surveyed were low and did not exceed the values typical for the sandy sediments of the Southern Baltic.

PAHs and PCBs present in the sediments may undergo numerous transformations and have a significant impact on the environment. The scope of impact depends on the transformations that these compounds undergo. These can be abiotic processes such as sorption, elution, oxidation, photodegradation, reactions with other compounds, and biological processes such as microbiological transformations. They may inhibit or stimulate the growth of microorganisms, have a phytotoxic or stimulating impact on the growth of plants, as well as be toxic to fauna [113]. The accumulation of PAHs and PSBs in sediments is promoted by, among others, a high percentage of silt and clay fractions with the size of sediment particles <0.063 mm and characterised by a large specific surface area and significant ability for adsorption of hydrophobic pollutants and organic compounds of phosphorus, sulphur, and nitrogen.

Pyrogenic PAHs as well as PCBs, exhibit an exceptionally high persistence in seabed sediments, which is caused by the occlusion of these chemical compounds in very fine sediment particles [35]. Therefore, the phenomenon of desorption of these substances from the sediments into the water is limited. Usually, it is at most 0.5% for PCB congeners, and up to 5% for the analytes from the PAH group [116, 115]. Assuming that such amounts of these substances will transfer to the water, it can be concluded that the risk of water contamination related to the remobilisation of PAHs and PCBs in the area surveyed is insignificant.

The concentrations of PAHs and PCBs in the sediments analysed and their availability are presented in Table 3.1.

Table 3.1. Concentrations of PAHs and PCBs in the seabed sediments analysed [Source: internal materials]

Indicator	**Mean concentrations in the sediments analysed (calculated as dry weight) [$mg \cdot kg^{-1}$ DW]**	**Available form [%]**
Congeners from the PCB group	0.0002	0.5
Analytes from the PAHs group	0.025	5

Metal concentrations in the sediments analysed from the BP OWF CI were low. Additionally, their availability (i.e. the ability to permeate into the water depth), which depends on their physico-chemical form, should be taken into consideration [347]. Metals permanently bound in the crystalline structure of minerals are immobilised and will not transfer into the water in natural conditions. While, metals in the mobile (labile) form are prone to permeating into the water from the sediment [347, 80, 81].

The labile form of metals may constitute (depending on the type of sediment in the case of individual metals) from 30 to 80% [378, 290, 347, 393, 80, 74]. The results of the analysis of the labile form of metals in the sediments analysed showed that in unfavourable conditions approx. 70% of lead, approx. 46% of copper and approx. 46% of zinc can transfer from the sediment into the water. In the case of nickel and chromium, which are more permanently bound with the sediment, this can occur in approx. 40% and approx. 25%, respectively.

The mean concentrations of metals in the sediments analysed and the concentrations of the labile form are presented in Table 3.2.

Table 3.2. Mean concentrations of metals in the seabed sediments analysed [Source: internal materials]

Metal	Mean concentration of the total content in the sediments surveyed (calculated as dry weight) [mg·kg^{-1} DW]	Mean concentration of the available (labile) form [mg·kg^{-1} DW]
Lead (Pb)	3.10	1.76
Copper (Cu)	0.85	0.58
Zinc (Zn)	8.20	5.10
Nickel (Ni)	1.27	0.55
Chromium (Cr)	3.30	0.79

The concentrations of arsenic (LOQ <1.25 mg·kg^{-1} DW), cadmium (LOQ <0.05 mg·kg^{-1} DW), mercury (LOQ <0.01 mg·kg^{-1} DW) and TBT in the sediment surveyed were insignificant, usually below the lower limit of quantification. Consequently, the risk of water contamination related to the remobilisation of such chemical compounds from the seabed sediment during the construction of the BP OWF CI was acknowledged as negligible and no further analyses were conducted.

The sediments analysed were also characterised by a low activity of the radioactive isotope of caesium ^{137}Cs, typical for sandy sediments.

3.2.3 Raw materials and deposits

In order to identify the potential areas of the presence of raw materials useful for the future exploitation of the BP OWF CI, the seismo-acoustic and bathymetric data were analysed.

Based on the analyses of bathymetric and seismo-acoustic data, it is impossible to obtain information on the parameters of accumulations of fine and medium-grained sands, which could constitute a mineral deposit [within the meaning of the Act of 9 June 2011 – Geological and Mining Law (Journal of Laws of 2011, No. 163, item 981, as amended) and the Regulation of the Minister of the Environment of 1 July 2015 on the geological documentation of the mineral deposit, excluding hydrocarbons (Journal of Laws of 2015, item 987)]. In the majority of the seabed surface identified as a seabed with a sandy cover, sands form a layer with a thickness from 0.5 to 0.2 m; locally, in the northern and central parts of both route alternatives and within the foreshore slope and the sandbank zone, the sand thickness exceeds 2 m. Sands are deposited on a silty-clayey substrate, locally on a till substrate.

According to the Regulation of the Minister of the Environment of 1 July 2015 on the geological documentation of the mineral deposit, excluding hydrocarbons (Journal of Laws of 2015, item 987), a deposit should have a thickness of at least 2 m (limit values for the parameters defining a deposit and its boundaries for individual minerals – gravel deposits, gravelly-sand and sandy-gravel with a sand point below 75% – these parameters could not be determined from analyses of bathymetric and seismo-acoustic data alone).

On the basis of the data obtained, as part of the environmental surveys conducted, the presence of mineable clastic deposits cannot be excluded. Such an identification requires conducting core sampling to specify the geotechnical parameters of the sediments forming the seabed in the area analysed.

3.3 Seawater quality

The results of tests of individual chemical parameters of water in the BP OWF CI area, such as pH level, oxygenation, 5-day biochemical oxygen demand (BOD_5), TOC, nutrients, PCBs, PAHs, mineral oil, cyanides, metals, phenols, caesium, and strontium, did not essentially deviate from the values typical for the waters of the Southern Baltic.

These waters were characterised by an alkaline pH (approx. 8.04), alkalinity of approx. 1.7 $mmol \cdot dm^{-3}$ and relatively good oxygenation, with a seasonal variability characteristic of the Southern Baltic waters. The assessment of the water quality index for the BP OWF CI area, on the basis of the oxygen content in the near-seabed layer in summer indicates a good water status (no oxygen deficit). The mean contents of dissolved oxygen during this period were above the limit value of 6.0 $mg \cdot dm^{-3}$ [216].

Within the entire survey period (summer and winter 2019 and 2020), the mean biochemical oxygen demand (BOD_5) in the water samples collected from the BP OWF CI area in individual measurement periods was below 2.00 $mg \cdot dm^{-3}$. Also, the content of suspended solids in particular measurement periods was at a level typical for the waters of the Southern Baltic. The lowest mean concentrations of suspended solids in the area surveyed was in the winter period, whereas the highest concentrations were recorded in the summer, which could have been caused by the increased primary production, as well as in December due to the agitation and mixing of waters in the storm period.

The concentrations of nutrients, such as total nitrogen, mineral nitrogen (total nitrates, nitrites and ammonia), phosphates and total phosphorus in the waters surveyed were characterised by seasonal variability typical for the waters of the Southern Baltic. The lowest concentrations of the substances surveyed were recorded in the summer period, whereas in the winter months their significant increase was observed, in accordance with the seasonal trend of nutrient pool recovery.

The waters of the region surveyed were characterised by low concentrations of particularly harmful substances. Trace concentrations of the following substances were present: PCBs, mineral oils (mineral oil index), free and bound cyanides, metals [Pb, Cd, Cr, Cr(VI), As, Ni, Hg] and phenols.

The waters tested were also characterised by low values of caesium ^{137}Cs and strontium ^{90}Sr activity, typical for the waters of the Southern Baltic, which confirms a slow downward trend of ^{90}Sr and ^{137}Cs concentrations in the Baltic Sea area [441].

In the BP OWF CI area, marginally higher PAH concentrations were observed, compared to the ones specified by the data from literature [147, 424], which may have resulted from differences at the stage of sample preparation for analyses (PAHs were determined in water without the separation of suspended solids).

Comparing the results obtained for the indicators of the waters surveyed with the limit values specified in the Regulation of the Minister of Maritime Economy and Inland Navigation of 11 October 2019 on the classification of ecological status, ecological potential, chemical status and the method of classifying the status of surface water bodies as well as environmental quality standards for priority substances (Journal of Laws of 2019, item 2149), the physico-chemical elements analysed in the BP OWF CI area surveyed can be classified as having water quality class 1 (very good status) due to the concentrations of dissolved oxygen near the seabed, BOD_5, inorganic nitrogen compounds, total phosphorus and total organic carbon (TOC), free and bound cyanides, phenols, mineral oil index, as well as metals [As, Cr (VI), Cu]. The mean concentrations of the total nitrogen and the pH level place the area surveyed in water quality class 2. On the other hand, due to the phosphate phosphorus content (the mean concentration in the water column was 0.016 $mg \cdot dm^{-3}$), the waters tested do not reach a good status level. Nevertheless, the exceedance is slight and oscillates around the threshold value set for water quality class 2 ($<0.015\ mg \cdot dm^{-3}$).

Despite a small difference in concentrations, in comparison to the 2002 data from literature [424], no exceedance of limit values was found regarding the water quality indicators specified in the above-mentioned Regulation for PAHs [anthracene, fluoranthene, naphthalene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene]. Moreover, no exceedances were found regarding the limit values of such indicators as cadmium, lead, mercury and nickel.

Given that the BP OWF CI area crosses the Jastrzębia Góra – Rowy (CWIIIWB5) SWB, the range of the impacts of this project and its possible impact on that SWB should be examined. Following the analysis of the test results of water quality indicators and seabed sediments in the development area, it should be assumed that the implementation of the BP OWF CI will not affect the achievement of environmental objectives for this SWB.

3.4 Climatic conditions and air quality

3.4.1 Climate and the risk related to climate change

The area of the Southern Baltic is located in the humid temperate climate zone with the influence of the Atlantic climate due to prevailing oceanic winds. The vicinity of the Atlantic Ocean, due to the large air masses inflow, largely determines the climate of the Baltic Sea. As a result, the winters are mild and warmer, while the summers are cooler. In addition, the climate is characterised by the presence of strong winds from the west and south-west direction, and high humidity.

Within PMAs and in the coastal zone, long-term recordings of atmospheric parameters (mainly air pressure, temperature and humidity, wind conditions and insolation as well as precipitation size and type) and water parameters (sea level, water temperature and salinity and dynamic conditions – flows and wave motion) are carried out both at onshore stations as well as on the high seas. In particular, the comprehensive surveys that have been performed operationally for several decades now by IMWM-NRI at stations and monitoring points, and for several years also on buoys anchored in the sea could be mentioned here. In addition, IMWM-NRI performs monitoring surveys in the Southern Baltic area several times a year, recording the hydro-physical and physico-chemical parameters of the sea within a designated grid of points. Hydrological and meteorological surveys are also carried out by other scientific and research units. Wind, air temperature and humidity, and also the mean sea level are measured at the Coastal Research Station (CRS) Lubiatowo, owned by the Institute of Hydro-Engineering of the Polish Academy of Science (IHE PAS), while the Institute of Oceanology of the Polish Academy of Sciences with a monitoring station located at the Sopot Pier monitors air temperature, pressure and humidity, insolation, as well as seawater temperature and salinity. As part of the SatBałtyk project carried out in 2010–2015, satellite measurements were conducted enabling the determination of the characteristics of the sea and atmosphere in the form of maps presenting, for example, temperature distributions, ice covers, instantaneous water flow velocity, water mixing and turbidity. Within the last dozen years or so, at various locations within the Polish Exclusive Economic Zone of the Baltic Sea, recordings of the near-water layer parameters as well as hydro-physical and dynamic quantities in the entire water depth have been conducted by the MI GMU as part of various research projects and at the request of investors.

The surveys presented, which are associated with similar recordings conducted by the neighbouring Baltic countries, allow determining the current trends and the anticipated directions of changes in the basic climatic parameters of the Southern Baltic. Additionally, the information from the simulation calculations of the climatological numerical models of the Global Atmospheric Circulation Model available, for example, from the research conducted as part of the BALTEX Assessment of Climate Change for the Baltic Sea Basin are used for the above-mentioned determinations.

The climate typical of the coast and the adjacent sea areas can be classified as coastal type climate, with small amplitudes of air temperature, high humidity, mild winters, cooler summers and strong winds. Winds from the west and south-west directions prevail. In the open sea areas, climatic conditions are characterised by smaller air temperature amplitudes and mean wind velocities higher than in the adjacent land areas [8, 104, 149, 202, 376, 225].

On the basis of the data and analyses available, it is possible to present the most important forecasts regarding changes of particular elements of the atmosphere and water in the Baltic Sea region:

- the increase in air temperature is faster here than the average global increase, this trend will continue;
- the increase in surface water temperature is greater than in its deeper layers, this may result in stronger thermal stratification and the stabilisation of the thermocline throughout the year;
- the predicted salinity changes are not clearly defined and depend, on the one hand, on the changes in the air circulation conditions and the volume of water exchange with the North Sea and, on the other hand, on the volume of river water inflow; a decrease in salinity level is predicted;
- an increase in atmospheric precipitation is forecast for the entire Baltic Sea basin in winter, while in summer only in the northern part; the prevalence of extreme precipitation will increase;
- in terms of forecasting the changes in sea level, the effects of its global increase will not be felt to a significant extent. This is due to the fact that the Baltic Sea, which is a relatively small and shallow shelf sea, is connected with the North Sea by the rather narrow Danish straits, through which an exchange of oceanic waters (the so-called inflows) takes place only incidentally. Moreover, most of its area (in the northern part) is located within the

Scandinavian plate, which is characterised by visible uplift processes (so-called isostatic rebound), which result in a decrease of the mean sea level. In the southern part, the impact of these processes is practically negligible, and the water level is determined mainly by the atmospheric circulation conditions;

- forecasts of wind climate changes are subject to considerable uncertainty, it is assumed that with the increase in the average surface water temperature, the average wind velocity over sea areas will increase;
- changes in wave climate are mainly related to the increase in the frequency and intensity of storms – an increase in the number of extreme phenomena is forecast;
- model calculations indicate that there will be an increase in the surface area of low oxygen content areas and anaerobic areas near the seabed [8, 104, 149, 202, 376, 225].

Forecasts of climate change for Poland, including the coastal zone and sea areas under the jurisdiction of the Polish state, as well as scenarios of adaptation activities aimed at mitigating and counteracting the effects of changes are the subject of intensive work carried out by the Ministry of the Environment and the Institute of Environmental Protection, as part of the "Polish National Strategy for Adaptation to Climate Change by 2020 with forecasts until 2030” and the KLIMADA project.

Taking into account the conclusions and recommendations relating to the coast and the adjacent areas of the Baltic Sea, it has been found that the observed and predicted climate changes will have a negative impact on the functioning of the coastal zones. An adverse influence of the periodic sea level rises is predicted here, resulting mainly from the increase in frequency and intensity of heavy storms. In the case of the Baltic Sea, this refers to a possible increase in the number, intensity and duration of storms, with an increasingly irregular occurrence, i.e. long periods of relative calm may be followed by series of rapidly succeeding storms of considerable force.

An additional factor that accelerates the process of coastal erosion is the warming of winters, the expected result of which will be a reduction in the ice cover protecting the beaches from storm surges, and thereby safeguarding them against coastal erosion. The scenarios of sea level changes demonstrate that in the years 2011–2030 the mean annual sea level along the entire coast will be by approx. 5 cm higher in comparison to the values from the reference period, i.e. 1971–1990. An increase in the frequency of storm floods and more frequent flooding of low-lying areas, as well as the degradation of the coastal cliffs and seashore, which will exert a strong pressure on the infrastructure located in these areas, are very important effects of the climate change.

Due to the increase in the mean water temperature and an increased influx of biogenic pollutants (nitrogen and phosphorus compounds) into the sea, a negative phenomenon that will occur will be the progressive eutrophication, especially on the water surface (algae blooms).

The activities undertaken as part of the nearshore zone adaptation to the climate change concern the areas situated along the Baltic Sea coastline. Except for the nearshore zone, there are no detailed guidelines and recommendations relating to sea areas in the context of counteracting the effects of the projected climate condition changes.

3.4.2 Meteorological conditions

Meteorological conditions are characterised by wind velocity and direction, as well as air temperature, pressure and humidity in the coastal zone above an open sea surface. In 2020, the mean wind speed over the sea area surveyed was approx. 6.6 $m \cdot s^{-1}$, with the maximum reaching 20.7 $m \cdot s^{-1}$. The prevailing winds were from the south-west direction. Air temperature ranged from approx. -2°C in the winter to approx. 27°C in the summer. Atmospheric pressure varied between 977 and 1043 hPa. Relative humidity was characterised by high variability, oscillating between 25% and 100%.

3.4.3 Air quality

Due to the lack of detailed information on the current parameters of the air quality over the sea areas intended for the construction of the BP OWF CI, the air quality assessment of the atmosphere layer near the water surface is compared with the information obtained as part of the measurements carried out by the Inspection for Environmental Protection under the State Environmental Monitoring for the nearest coastal research station (Łeba). However, it should be noted that due to the lack of significant pollution emission sources over the sea area, parameters of air quality should not be worse than those measured at the shore.

The assessment of air quality in Poland, including coastal stations, was carried out on the basis of the Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe. In Poland, the tasks related to conducting surveys and assessments of the state of the environment, including air quality monitoring, are carried out by the Inspection for Environmental Protection under the State Environmental Monitoring, whose program is developed by the Chief Inspector for Environmental Protection and approved by the Minister of the Environment. As part of this program, the tasks related to the fulfilment of the requirements contained in EU regulations and in Polish law as well as in international conventions signed and ratified by Poland are implemented.

Due to the fact that the monitoring of air quality is conducted only in onshore areas, the results obtained from the measurements for the Pomeranian Voivodship, and in particular for the coastal zone, have been taken as the reference level for the offshore areas. In 2015, for the majority of the substances measured by the Inspection of Environmental Protection the concentration criteria corresponding to class A quality were obtained.

In the sea areas covering the territory of the planned connection, no measurements have been made to assess the air quality in terms of greenhouse gas content, dust concentrations and other hazardous volatile substances. The nearest location, at which the monitoring of the above-mentioned air pollutants was conducted, was the coastal research station in Łeba. On the basis of the survey data for 2018 provided by the Voivodeship Inspectorate for Environmental Protection (VIEP) in Gdańsk, the following concentrations of substances were found:

- sulphur dioxide (SO_2) – the fourth maximum 24-hour concentration in 2018 amounted to 5 $\mu g \cdot m^{-3}$ with a permissible value of 125 $\mu g \cdot m^{-3}$; this is the second lowest value recorded in the Pomeranian Voivodeship after Szadółki;
- nitrogen dioxide (NO_2) – the average 24-hour concentration in 2018 amounted to 5 $\mu g \cdot m^{-3}$ with a permissible value of 40 $\mu g \cdot m^{-3}$; this is the lowest value recorded in the Pomeranian Voivodeship;
- ozone (O_3) – the number of days with an exceedance of the 8-hour average was 12, with the assumed target value of 120 $\mu g \cdot m^{-3}$ – this is the second highest value recorded in the Pomeranian Voivodeship.

In accordance with the assessment contained in the VIEP report, the applicable criteria concerning the target level for the protection of human health and plant protection are met in the Pomeranian Voivodeship.

Such level of the parameters recorded means that the onshore area in the coastal zone near Łeba has air quality class A. Similar values should be expected for the nearshore areas. As these sea areas are located away from onshore SO_2 and NO_2 emission sources, these substances are emitted solely by ships while ship traffic intensity is relatively low. The offshore areas surveyed are free from any terrain obstacles impeding the spread of these substances. Therefore, the mean concentrations of the above-mentioned compounds in the air should have significantly lower values.

3.5 Ambient noise

Ambient noise components

Ambient noise is the combination of biological, geophysical, and anthropogenic sounds in the environment.

The ambient noise in the area of the planned project was determined on the basis of surveys conducted in 2020–2021 for the purpose of the EIA Report preparation (Appendix 1. Report on inventory surveys).

The planned project is located in the area of the ambient noise dominated by anthropogenic acoustic sources such as vessels and fisheries (and the associated fishing vessels). Natural sound sources i.e. wave motion, currents, turbulence, marine organisms are so diverse and dependent on numerous factors that their separation in the environment of intense human activity is very difficult.

Due to the importance of areas in the vicinity of the planned project route, for activities related to the implementation of OWFs and linear infrastructure as well as commercial fishing, the levels of underwater noise in the environment are likely to increase when compared to areas with less industrial activity.

The results of the analysis of the acoustic data collected indicated that the ambient noise levels in individual frequency bands (and their variability ranges) showed values characteristic for the area of the Southern Baltic [180, 380].

Most of the ambient noise energy in the survey area is concentrated in the frequencies below 2 kHz. Power Spectral Density (PSD) was the lowest in the winter. The average sound level in the frequency band of 200–20 000 Hz was lower in summer and higher in winter.

Underwater noise

Noise is defined as sounds undesired by the receiver, which interfere with the detection of necessary sounds.

The most important underwater noise characteristics applied include:

- duration – the noise sources analysed are divided into impulsive and continuous sounds;
- frequency range in Hz;
- Sound Pressure Level (SPL) in dB;
- impulse – the sum of the pressure over the duration of a sound wave, expressed in Pa s;
- Sound Exposure Level (SEL), which is an indicator of the total energy of sound – dB;

- Power Spectral Density (PSD), which is the distribution of the signal power at different frequencies;
- Root-mean-square sound pressure (RMS) – dB re 1 μPa.

The temporal and spatial variability of the sound pressure level in the southern part of the Baltic Sea is greater than in deep waters. Moreover, a cut-off phenomenon limiting the sound propagation at lower frequencies is assumed.

The main anthropogenic component of the Baltic Sea ambient noise is the continuous sound generated by vessel traffic. OSPAR [279, 283] introduces the following division:

- small vessels and recreational boats: <50 m – noise with a variable intensity 160–175 dB re 1 μPa at a distance of 1 m;
- medium-sized vessels: 50–100 m; 165–180 dB re 1 μPa at a distance of 1 m;
- large ships: >100 m; 180–190 dB re 1 μPa at a distance of 1 m.

The frequency of this noise is mostly below 1 kHz [328] but high frequency components are also present [155]. The centre frequency of 2 kHz is within the hearing range of the harbour porpoise, the grey seal, the ringed seal, and the Atlantic herring [384]. Thus, continuous underwater noise containing energy in this frequency band is audible to all marine mammals inhabiting the Baltic Sea and to a fish species of commercial and biodiversity importance.

Links to other environmental features

In the context of the EU Marine Strategy Framework Directive (MSFD), energy inputs, including underwater noise, should not reach levels that adversely affect the marine environment. Several groups of marine animals are known to use sound for foraging, communication, reproduction and movement. Therefore, an increase in ambient noise levels over a wide spectrum as a result of the introduction of anthropogenic noise exerts a significant pressure on the marine environment, with probable adverse effects.

In the area of the planned project, animals live in an environment with a relatively constant ambient noise level, in which the potential impact increases with the increasing frequency. However, the total noise levels are most likely not high enough to lead to any impact on hearing [189].

Surveys of the effects of ship-generated medium- to high-frequency noise components in Danish waters show that noise from different types of ships significantly increases ambient noise levels across the frequency spectrum recorded from 0.025 to 160 kHz at distances of 60 m and 1000 m from the passing vessels. Ships passing at a distance of 1190 m reduce the hearing threshold by more than 20 dB (at 1 and 10 kHz), while ships passing at 490 m or less cause a reduction of over 30 dB (at 125 kHz) [133]. Therefore, although there may be masking effects due to high frequencies, the range of these impacts is low. Dyndo *et al.* [87] found that porpoises held in semi-natural conditions showed a response even to low levels of high-frequency noise from passing ships.

A black line (audiogram) indicating the threshold of sounds audible to the harbour porpoise [189] is visible in Figure 3.4. This indicates that the harbour porpoise in the survey area should not be able to hear even the loudest sounds below 200 Hz (below or to the left of the audiogram line). In contrast, most sounds above 1250 Hz (above the line) will be clearly audible to these mammals.

Most recordings captured at the stations in the survey area do not exceed the harbour porpoise hearing threshold. These results are similar to predictions proposed in other studies [87].

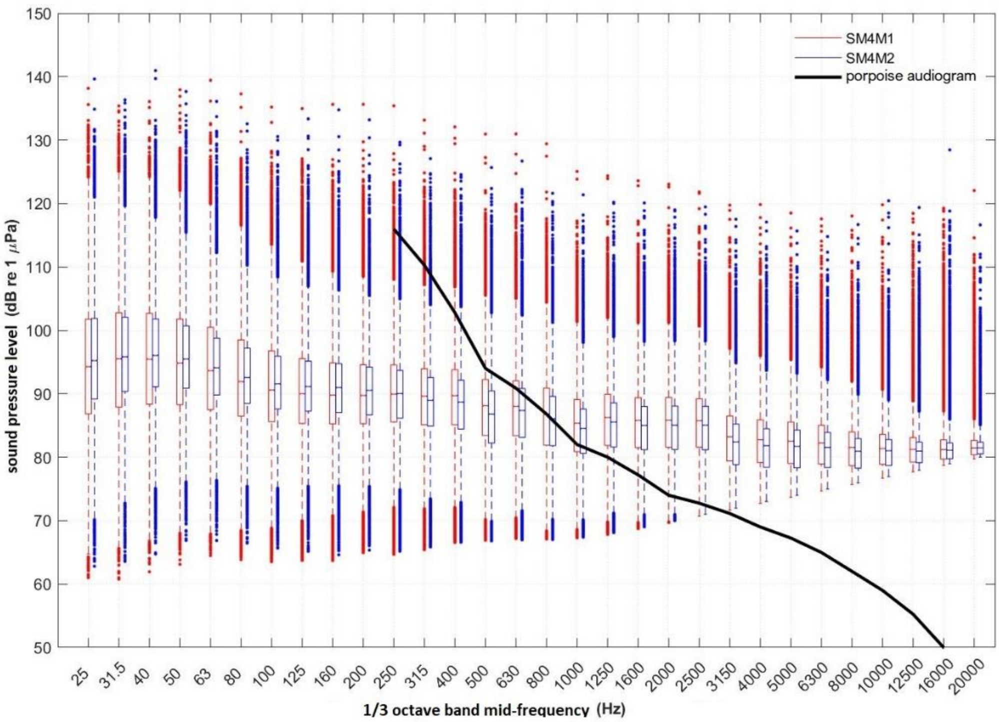

Figure 3.4. Comparison of sound pressure level distributions in 1/3-octave bands for ambient noise recorded at CPOD_1_SM4M_1 and CPOD_3_SM4M_2 monitoring stations during the survey period. The black line on the chart indicates the harbour porpoise audiogram [Source: internal materials]

3.6 Electromagnetic field

Electromagnetic fields in the environment can be divided into natural fields and fields of anthropogenic origin (called artificial fields). Among the natural fields, the geomagnetic field of the Earth, the intensity of which ranges from 16 to 56 $A{\cdot}m^{-1}$, is best recognised. On the surface of the Earth, an electric charge is accumulated, which is the source of the natural electric field. The intensity value of the Earth's natural electric field at moderate weather conditions is approximately 120 $V{\cdot}m^{-1}$.

In the marine environment, the values of the electric field and the geomagnetic field are similar. In the vicinity of the BP OWF CI, there are no artificial sources of electromagnetic field. The existing DC transmission system between Poland and Sweden (SwePol Link) is located at a distance of several dozen kilometres from the planned project location.

Changes in the natural electric fields do not have a direct impact on the living organisms. Natural magnetic fields show differences depending on the geographical location. They have a significant impact on some living organisms.

Electromagnetic fields created as a result of electric current flow can change the natural migratory behaviour of marine mammals and fish, they can also be the source of thermal energy introduced into the marine environment. No indicators have yet been developed for the assessment of the state of the marine environment for the descriptor W11, including indicator 11.4.1 “Strength and spatial range of electromagnetic and electric fields”. These factors are not currently monitored in the PMA [2].

3.7 Description of natural elements and protected areas

3.7.1 Biotic elements in the maritime area

3.7.1.1 Phytobenthos

The phytobenthos inventory survey conducted in June 2020 showed that in the APV of the BP OWF CI there were no vascular plants in the sandy nearshore zone (4.7–6.1 m). However, the following macroalgae were found in the depth range 20.6–23.3 m: filamentous red algae (probably a species of the family Rhodomelaceae) and filamentous brown algae (probably *Pylaiella littorali*s and/or *Ectocarpus siliculosus*). The macroalgae overgrew boulder surfaces very scarcely (macroalgal cover of the seabed <1%). It should be noted that the hard bottom (boulders and cobbles), to which macroalgae can attach, occupies less than 1% of the total area of the APV.

Within the boundaries of the RAV of the BP OWF CI, no phytobenthos occurrence was recorded.

Lack of vascular plants in the nearshore zone and lack or scarce occurrence of macroalgae in deep water areas (>20 m) is typical for Polish maritime areas.

3.7.1.2 Macrozoobenthos

Macrozoobenthos (benthic macrofauna) is a group of invertebrate organisms inhabiting the seabed sediments (infauna) or the surface layer of the seabed sediments (epifauna), as well as the hard substratum (boulders, stones), which remain on a sieve with a 1 mm mesh size during sediment rinsing. These are mostly sessile organisms with a life-cycle of at least one year. The macrozoobenthos composition includes marine, brackish water and fresh water species mainly of the Bivalvia, Crustacea, Polychaeta, Oligochaeta and the Gastropoda divisions. Moreover, periphytic organisms such as bryozoans (Bryozoa) or hydrozoans (Hydrozoa) appear often on the hard substrate. Macrozoobenthos plays an important role in the trophic network of marine ecosystems as food for many species of fish and seabirds. The eggs and larvae of bivalves are food for zooplankton and fish larvae. Benthic fauna shapes the living conditions of other organisms and positively affects the state of the environment, e.g. due to bioturbation of burrowing organisms or biofiltration of suspended solids from the water by bivalves [447, 373, 408, 248, 414, 278, 369].

For the purpose of this EIA Report, separate macrozoobenthos surveys were conducted on the soft bottom (mainly sand and gravel sediments; 74 stations) and hard bottom (rocks; 4 stations) in June 2020.The BP OWF CI includes the coastal and open waters of the eastern Gotland Basin, within which soft-bottom stations were designated. The hard-bottom stations were located in the open waters of the Southern Baltic. During the course of the project, the initial shape and boundaries of the BP OWF CI, within which the environmental surveys were performed, changed. The current survey area is shown in Figure 1.1 and Figure 3.5.

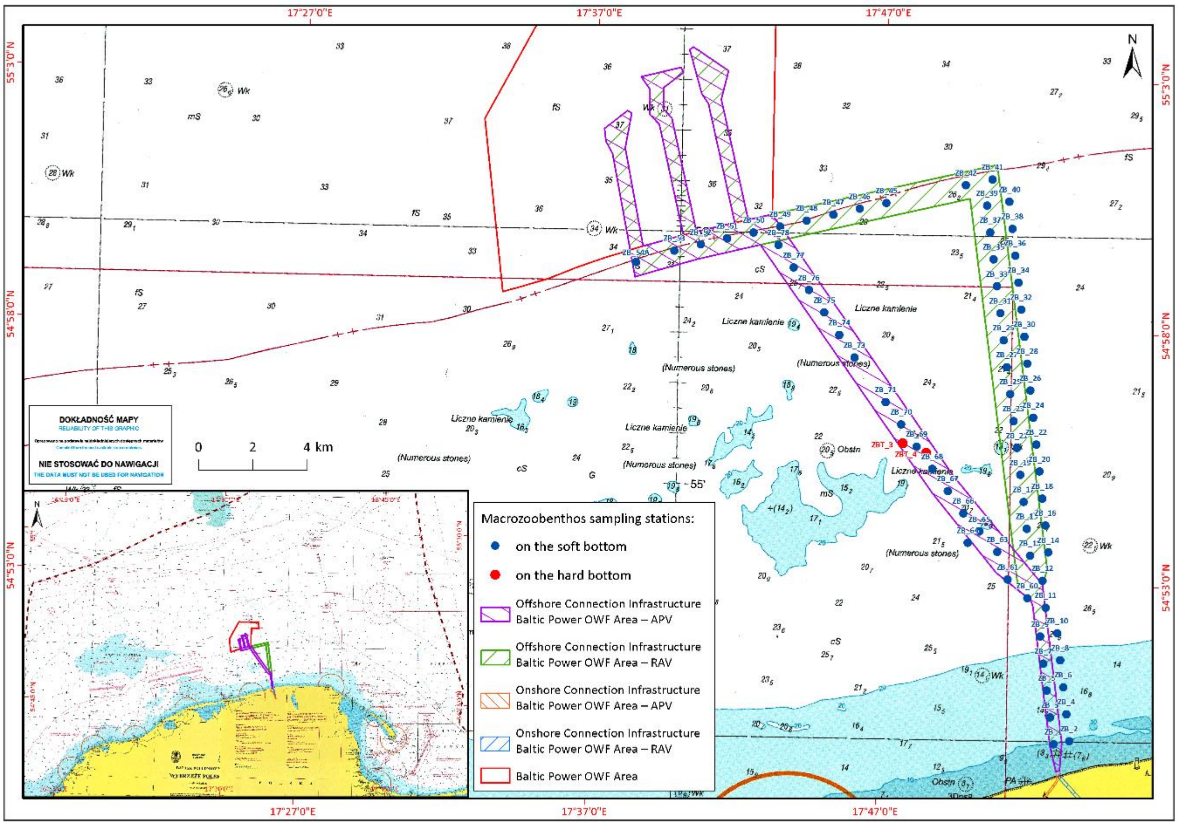

Figure 3.5. Location of the macrozoobenthos survey stations in the Baltic Power OWF Connection Infrastructure area [Source: internal materials]

Therefore, data from 61 stations were used to characterise the macrozoobenthos on the soft bottom (50 stations within the BP OWF CI area with the data collected during the 2020 environmental surveys, excluding corridors A, B and C, as well as 11 stations within corridors A, B and C, covering the data collected during the 2019 environmental surveys in the BP OWF area) [Figure 3.6]. The soft-bottom stations in the entire BP OWF CI area (including corridors A, B, and C) were in the depth range from 7.6 to 33.4 m, while the two hard-bottom stations, representing less than 1% of the survey area, were located in depths ranging from 22.4 to 22.7 m.

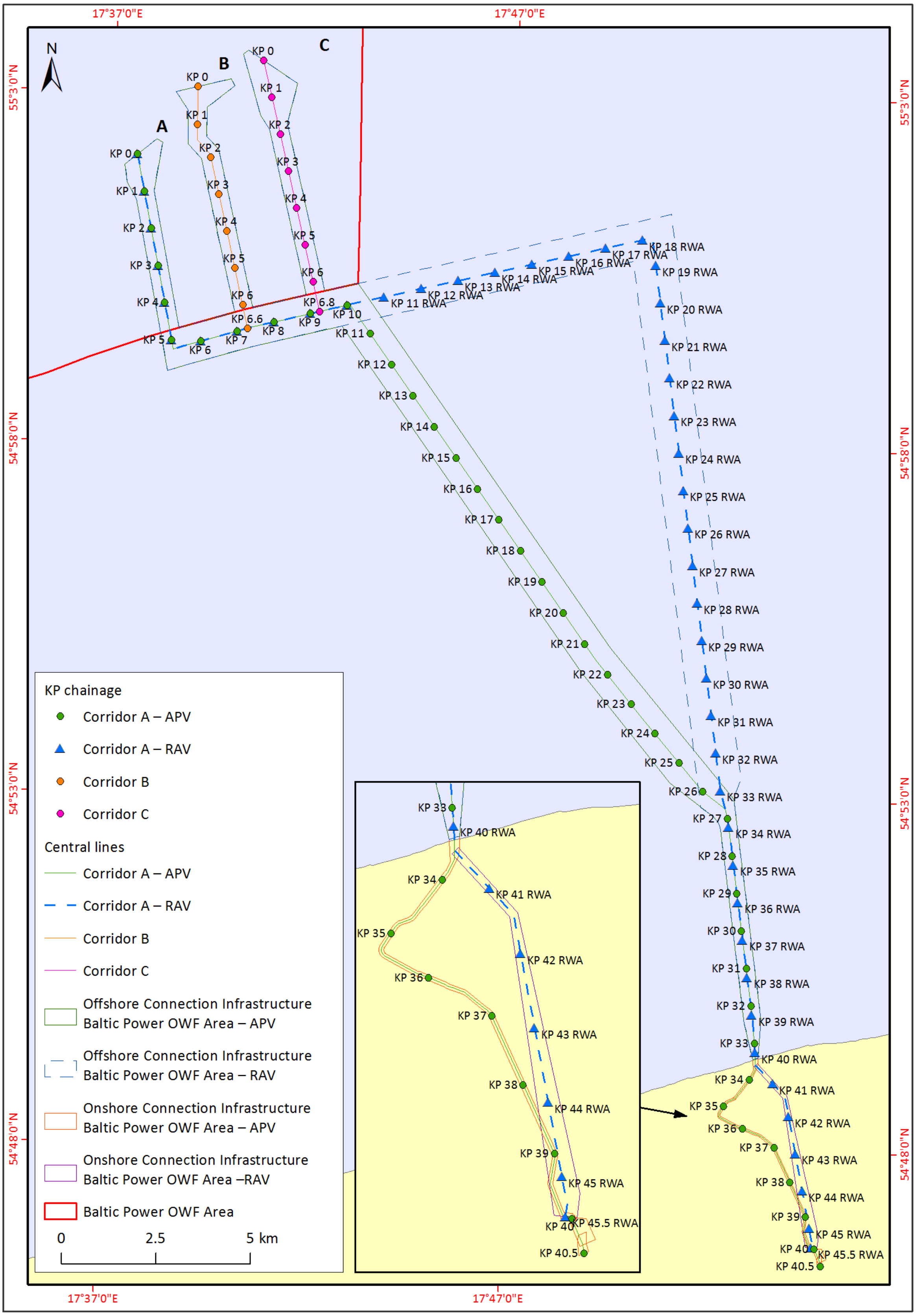

Figure 3.6. Location of corridors A, B and C within the offshore area of the Baltic Power OWF Connection Infrastructure along with the chainage of individual project variants [Source: internal materials]

Table 3.3 presents the chainage of each BP OWF CI variant.

Table 3.3. Chainage of the individual variants of the Baltic Power OWF Connection Infrastructure [Source: internal materials]

Name	Length [m]
Corridor A	5.2
Corridor B	6.6
Corridor C	6.8
APV – offshore part (without corridors A, B, C)	28.2
APV – offshore part + corridors A, B, C	46.8
RAV – offshore part (without corridors A, B, C)	34.9
APV – offshore part + corridors A, B, C	53.5

23 species and units of higher taxonomic level of macrozoobenthos (unidentified as to species) were found in the macrozoobenthos samples collected on the soft bottom in the BP OWF CI area. Among them, the psammophilous polychaetes *Pygospio elegans* and *Marenzelleria* sp. were constantly present. These two taxa also dominated in terms of abundance. On the other hand, the Baltic clam (*Limecola balthica*) had the biggest share in the biomass. On the hard bottom, among the maximum of 14 taxa of benthic macrofauna, the bay mussel (*Mytilus trossulus*), which was also one of the 6 most common species in this community, definitely dominated both in terms of abundance and biomass. Other permanently resident species include: *Gonothyraea loveni*, *Einhornia crustulenta*, polychaetes *Bylgides sarsi* and *Pygospio elegans*, as well as the juvenile individuals of the genus *Gammarus*.

Benthic invertebrates can be a sensitive bioindicator of the environment, since the taxonomic diversity, abundance, biomass and sensitivity of individual taxa composing the benthic organism complex indicates the ecological quality of the seabed [278]. Pursuant to the Regulation of the Minister of Maritime Economy and Inland Navigation of 11 October 2019 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 2019, item 2149) as well as the classification used in the Water Framework Directive, soft-bottom macrozoobenthos is one of the elements used in assessing the quality status of the seabed, rated with index B on a 5-degree scale. Given such an assessment of the condition of sea water environment on the basis of macrozoobenthos, the distribution of the quality of macrozoobenthos communities in the BP OWF CI area indicates that the predominant surface of the planned project area is characterised by a moderate condition of the seabed fauna, including the area of corridors A, B and C, and poor quality condition of macrozoobenthos communities – especially in the northern section of the RAV, which is connected to the APV, where sand and gravel sediments occurred. On the other hand, areas of higher value (good and very good quality status of macrozoobenthos communities) cover only a small fragment of the soft bottom in isolated spots, e.g. the shallowest nearshore area of the corridor, shared by the APV and RAV variants (where no impacts on benthos are expected, as in this sea depth zone the cable lines will be brought ashore under the seabed, using a trenchless method) as well as two places on the route of the APV variant. Also the assessment of the water quality in the BP OWF CI area, based on the oxygen content in the near-seabed layer in the summer period, indicated good condition (no oxygen deficit) (Appendix 1. Report on inventory survey). On the other hand, the hard bottom, which was identified on a very small surface of the survey area (less than 1%), located in the central part of the corridor of the APV, is distinguished by very good quality of macrozoobenthos [Figure 3.7]. Therefore, the area of the BP OWF CI in the APV (along with corridor B) is characterised by slightly better macrozoobenthos quality than the RAV variant and corridors A and B, due to the presence of spots where the overall condition of macrozoobenthos was classified as good and very good.

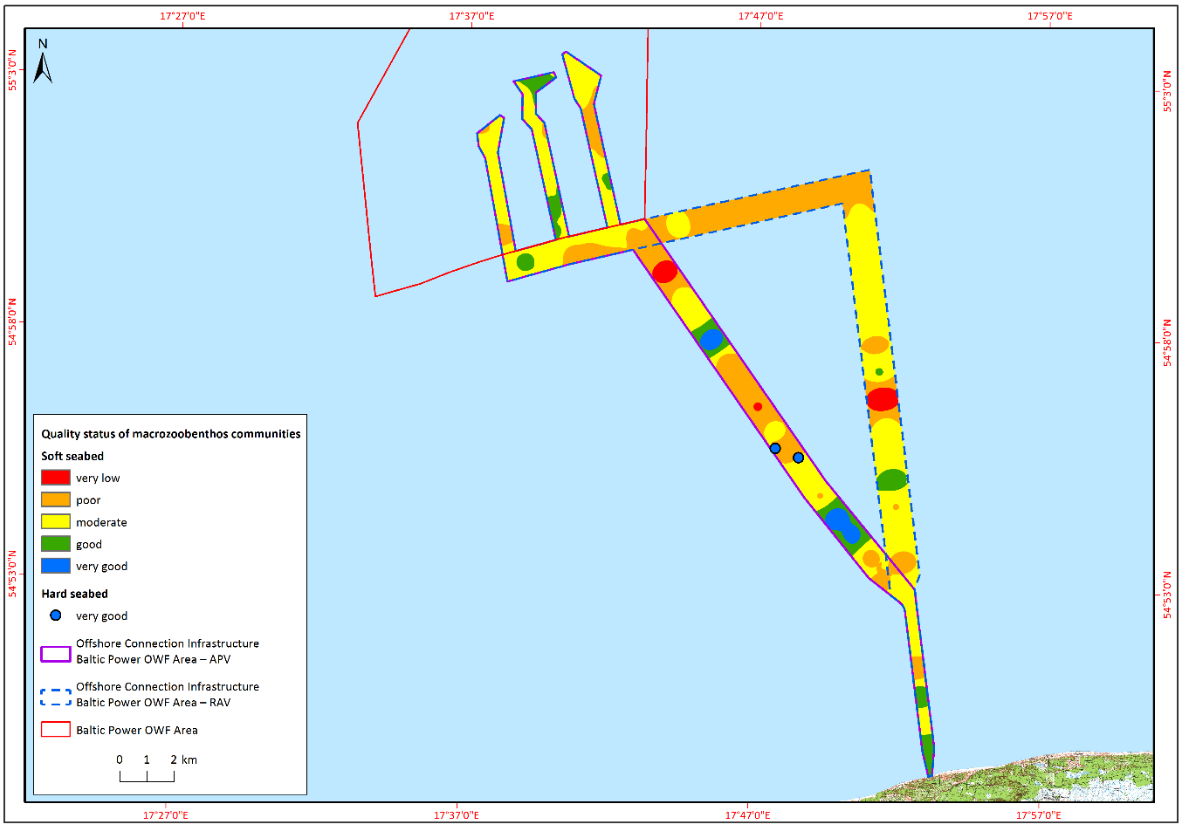

Figure 3.7. Spatial distribution of the quality status of the soft-bottom and hard-bottom macrozoobenthos communities in the offshore area of the Baltic Power OWF Connection Infrastructure [Source: Internal materials]

The results of previous macrozoobenthos surveys within the survey area have not been published in the scientific literature yet. Therefore, the survey in the BP OWF CI provided the necessary data for a precise determination of the surface distribution of the macrozoobenthos quality status in this area. Based on the interpretation of the qualitative and quantitative structure of macrozoobenthos of the survey area against the 2013 results of the macrozoobenthos of the soft bottom in the Marine Transmission Infrastructure area of Bałtyk II and Bałtyk III OWFs [32, 90; Appendix 1. Report on inventory survey], it should be concluded that the BP OWF CI area is slightly poorer in terms of taxonomic diversity and quantitative structure features, in comparison with the results from the adjacent area, and does not have any special natural values due to the moderate and poor quality status of macrozoobenthos communities.

3.7.1.3 Ichthyofauna

The ichthyofauna surveys were conducted in the BP OWF CI area to determine the species composition, abundance and distribution of ichthyofauna, the structure and biological characteristics of the species of fish occurring there, including also the species composition and abundance of ichthyoplankton.

The ichthyofauna surveys were conducted in a one-year cycle and included 5 survey campaigns covering all seasons of the year.

In the course of ichthyoplankton surveys carried out in the BP OWF CI area, the roe of a single fish species and larvae belonging to 12 taxa were caught.

During pelagic control catches, in addition to herring and sprat, a few individuals of garfish, three-spined stickleback, great sand eel, mackerel, flounder, lesser sand eel and sea trout were caught.

The result of demersal fishing in the BP OWF CI area using set nets is fish belonging to 15 taxa. Flounder and cod dominated, whereas other species constituted small by-catches (great sand eel, plaice, shorthorn sculpin, mackerel, perch, zander, scarp, sprat, herring, lumpfish, lesser sand eel, viviparous eelpout and whiting).

Fish belonging to 19 taxa were caught using beach seine nets. The catches were dominated by lesser sand eel, followed by herring, great sand eel, flounder, and perch.

Fish belonging to 31 taxa were caught in all the survey gear in the BP OWF CI area [Table 3.4].

Table 3.4. Specification of the taxa recorded in the course of survey catches in the Baltic Power OWF Connection area [Source: internal materials]

No.	Taxon		Pelagic catches	Demersal catches	Seine net catches	Ichthyoplankton catches
	Species name	Binomial nomenclature				
1.	Round goby	*Neogobius melanostomus*			X	
2.	Garfish	*Belone belone*	X		X	
3.	Three-spined stickleback	*Gasterosteus aculeatus*	X		X	
4.	Common seasnail	*Liparis liparis*				X
5.	Great sand eel	*Hyperoplus lanceolatus*	X	X	X	X
6.	Cod	*Gadus morhua*		X		
7.	Plaice	*Pleuronectes platessa*		X		
8.	Broad-nosed pipefish	*Syngnathus typhle*			X	
9.	Ide	*Leuciscus idus*			X	
10.	Shorthorn sculpin	*Myoxocephalus scorpius*		X		X
11.	Longspined bullhead	*Taurulus bubalis*				X
12.	Common bream	*Abramis brama*			X	
13.	Mackerel	*Scomber scombrus*	X	X		
14.	Fourbeard rockling	*Enchelyopus cimbrius*				X
15.	Rock gunnel	*Pholis gunnellus*				X
16.	Perch	*Perca fluviatilis*		X	X	
17.	Zander	*Sander lucioperca*		X	X	
18.	European whitefish	*Coregonus lavaretus*			X	
19.	Turbot	*Scophthalmus maximus*		X	X	

No.	Taxon		Pelagic catches	Demersal catches	Seine net catches	Ichthyoplankton catches
	Species name	Binomial nomenclature				
20.	Flounder	*Platichthys flesus*		X	X	X
21.	Smelt	*Osmerus eperlanus*			X	
22.	Sprat	*Sprattus*	X	X	X	X
23.	Herring	*Clupea harengus*	X	X	X	X
24.	Lumpfish	*Cyclopterus lumpus*		X		
25.	Lesser sand eel	*Ammodytes tobianus*	X	X	X	X
26.	Sea trout	*Salmo trutta*	X		X	
27.	Common bleak	*Alburnus alburnus*			X	
28.	Viviparous eelpout	*Zoarces viviparus*		X		
29.	Straight-nosed pipefish	*Nerophis ophidion*				X
30.	Whiting	*Merlangius merlangus*		X		
31.	Gobies	Gobiidae				X

The qualitative and quantitative composition of the ichthyofauna in the BP OWF CI area is typical of the Southern Baltic waters, with a clear predominance of cod and flounder in demersal catches, as well as herring and sprat in pelagic catches.

The results obtained indicate that during the survey period the area of the planned project provided a habitat for **herring**, being particularly important for the juvenile stages of this species, and it also was an area coinciding with migration routes leading towards wintering grounds, as well as with spawning and feeding migration routes.

The area of the planned project constitutes a part of a sea area, in which temporary spawning as well as feeding ground migrations of **sprat** took place, and the latter migrations intensified in autumn.

Taking into account the information from literature and the results of the surveys conducted, it can be assumed that sprat spawning does not take place in the BP OWF CI [25, 308, 211, 138, 135, 136, 137].

The area of the planned project is the location of the occurrence of cod with a varied seasonal abundance. Moreover, it is situated on the spawning and feeding migration routes of **cod**.

The area of the planned project provides temporary habitat for adult **flounder**. Flounder do not spawn directly within the survey area, since the salinity prevailing there is too low to enable successful fertilisation [253, 262, 260, 261]. Shallow waters (up to 1 m in depth) at the very shore are the habitat and feeding area of the flounder fry.

The BP OWF CI area is also a habitat for Ammodytidae and the freshwater species migrating periodically from the inland surface waters, such as roach, bream, perch and zander.

The presence of small numbers of the larvae of ammodytids, shorthorn sculpin, longspined bullhead, rock gunnel and turbot in the samples collected indicates that spawning of these taxa may occur in the nearshore area. This is confirmed by the data from literature, pointing to shallow nearshore areas with the seabed covered with sandy or gravelly sediment as a natural environment conducive to the reproduction of these fish.

Concluding, out of 31 taxa observed during the ichthyofauna surveys carried out for the purpose of the planned project, 4 are of particular economic importance in terms of commercial fishing. These are: sprat, herring, cod, and flounder. Salmon and eel were not observed during the survey fishing (no standardised survey methods, low density), although these two species are found in commercial fishing.

In survey fishing conducted in the BP OWF CI area, the most abundant species were: sprat, herring, cod and flounder, which form the basis of industrial fishing.

Three out of the taxa recorded, i.e. gobies, common seasnail, and straight-nosed pipefish, belong to **partially protected species** pursuant to the Regulation of the Minister of the Environment of 16 December 2016 on the protection of animal species (Journal of Laws of 2016, item 2183, as amended). Although the gobies have not been identified to species, but on the basis of the knowledge from literature and random observations, it can be assumed that the sand goby was the dominant species in the samples collected.

To assess the significance of the BP OWF CI area with respect to ichthyofauna, its following characteristics were considered: taxonomic diversity, occurrence of protected and endangered as well as commercial species, the presence of feeding or spawning grounds, and migration routes. On the basis of the above-mentioned functions, the natural values of this area were assessed to be moderate. This evaluation was made on the basis of an expert assessment.

3.7.1.4 Marine mammals

3.7.1.4.1 Species and occurrence

There are four species of marine mammals found in the Baltic Sea: the grey seal (*Halichoerus grypus*), the harbour seal (*Phoca vitulina*), the ringed seal (*Pusa hispida*) and the harbour porpoise (*Phocoena phocoena*).

The **grey seal** can be found throughout the Baltic Sea, concentrating in the northern and north-western parts of the area where it forms colonies. The total population in the Baltic Sea is estimated to be 40 000 individuals. In the Polish part of the Baltic Sea, grey seals are observed along the entire coastline; with several hundred cases of live or dead animals recorded in recent years. The only place where a group of grey seals can be observed for most of the year is the area of the Mewia Łacha Nature Reserve near the Vistula Estuary, which is a resting place for over 100 individuals [300]. There are no colonies of this species on the Polish coast, understood as resting, moulting and breeding areas.

Grey seals breed in undisturbed resting places in February and March. They travel up to several hundred kilometres to reach their feeding grounds. They feed on fish, in the Baltic Sea their main food source is herring, but sprat and Atlantic cod are also important food sources. In recent years, the presence of seals in the Vistula Estuary has become a cause of increasing conflict with fishing activities [3].

In the BP OWF CI area, seals can dive to all depths (they can dive down to 200 m). No surveys have been conducted regarding the sense of sight and hearing of the grey seal, but it is generally assumed that these senses function similarly to those of the harbour seal.

The **harbour seal** is rare in Polish waters, and the Vistula Estuary (Vistula Cut) is the only place where this species has been observed in recent years. The population in the Baltic Sea was 1700 individuals in 2016. Feeding grounds of the harbour seal are usually not very far from the colonies, which are located in the western Baltic Sea and in the Danish Straits; occasionally, individuals are recorded feeding at greater distances.

The harbour seal mates in May/June and the young are born in August/September. Notably, pups are sensitive to disturbance near the colony in June/July because they need resting areas where they suck their mothers' milk. They feed on fish, squid and crustaceans. Seals' eyes are adapted to see underwater and above water. Their hearing is better adapted to marine than terrestrial environments. Vibrissae, i.e. whiskers distributed around the snout, are important for their tactile sense; the animals can dive to depths reaching 100 m.

Due to a shortage of surveys on the impacts of offshore linear infrastructure projects on individual seal species in the Baltic Sea, further impact assessment was carried out jointly for both species together, i.e. the grey seal and the harbour seal, assuming that animal responses will be similar.

The ringed seal is an Arctic species occurring in the north-eastern part of the Baltic Sea: the Gulf of Bothnia, the Archipelago Sea, western Estonia (Gulf of Riga and Estonian coastal waters) and the Gulf of Finland, where they find resting, moulting and haul-out grounds, whereas breeding areas of this species are strictly limited to the ice cover. The areas occupied by ringed seals have declined in comparison to those previously observed, and the population status in previous centuries declined due to intense hunting and environmental degradation; currently, the population status is described as unsatisfactory [148].

Ringed seals are not observed in Polish waters, no impacts on this species are anticipated during the BP OWF CI implementation, and therefore it is not included in the further assessment.

The **harbour porpoise** is the only cetacean species present in the Baltic Sea. Two populations of this species are distinguished: the Baltic Sea (or Baltic Proper) population and the Belts population. The Baltic Sea porpoise population is an endangered population, with an estimated number of animals living in the Baltic Proper being 447 individuals (95% confidence interval: 90–997). In 2012, the abundance of the Belts Sea population was estimated at approximately 18 500 individuals [367], and during SAMBAH survey it was estimated at over 20 000 individuals [340]. The two populations are clearly separated in the summer, with a north-south boundary of occurrence along the eastern coast of Bornholm. In winter, the animals are more dispersed. Areas of particular importance for this species are, therefore, mainly based on their distribution in the summer. In the SAMBAH project, a concentration of the harbour porpoise was found to develop in the summer, in the areas of the Middle Bank and Hoburgs Bank in the Baltic Proper. This concentration coincides with the birthing time and the mating season [340]. Porpoise breeding in the Baltic Sea takes place from mid-June to the end of August, calving – between May and June, and mating – in July and August. Females give birth to one calf, which is dependent on the mother during the lactation period that lasts 8–11 months.

The main food source of the harbour porpoise is a variety of fish species, especially cod, herring and sprat. The diving depth generally does not exceed 50 m, which means that harbour porpoises can dive at all depths in the BP OWF CI area.

Porpoises use sound for echolocation and communication. Their acute sense of hearing is one of the key characteristics of the harbour porpoise species, but this species is also known to have good underwater vision.

According to SAMBAH project data, the area of the planned project is characterised by low detection, which indicates a low occurrence of these animals in the area [340] [Figure 3.8]. In 2020, a harbour porpoise monitoring project commenced, with 60 C-PODs being deployed in the coastal water belt between the eastern and western borders of the country. The detectors deployed in pairs at 1 and 3 NM from the shore will record the presence of the harbour porpoise for 12 months and are expected to provide more detailed information on the use of Polish coastal waters by porpoises [385].

In 2016–2018, under the project entitled "Pilot implementation of species and marine habitats monitoring in 2015–2018", surveys were carried out regarding the occurrence of the harbour porpoise in the Pomeranian Bay and in the Stilo Bank area. The results of these surveys also showed that the presence of the harbour porpoise is characterised by seasonality – in the Pomeranian Bay, The highest number of detections was recorded in summer months, while in the Stilo Bank – in spring [300].

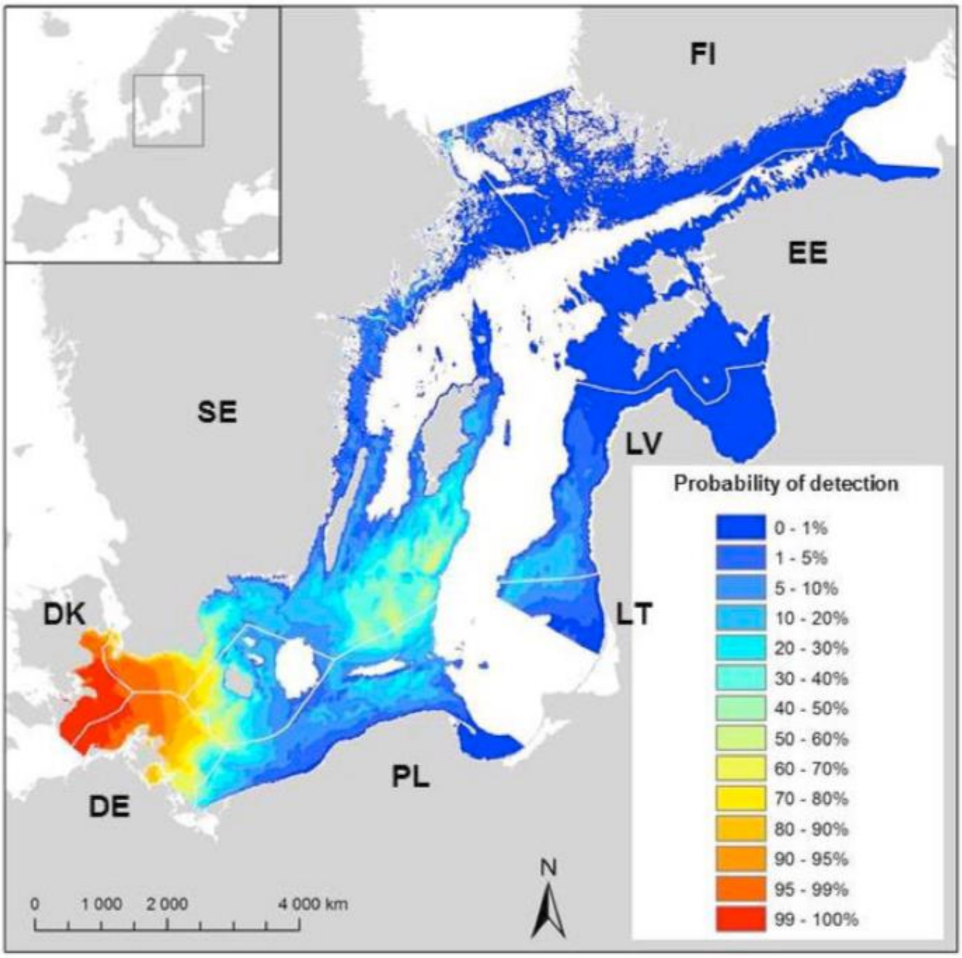

Figure 3.8. Probability of the harbour porpoise detection in the Baltic Sea in August [Source: SAMBAH, 2015 [341]]

3.7.1.4.2 Anticipated environmental developments

Marine mammals are negatively affected by anthropogenic activities: by-catch, reduced food supply, noise and toxic pollution.

The seal is not considered to be an animal sensitive to anthropogenic activities [31], except during breeding and moulting periods. In these periods, the animals are sensitive to physical disturbance, especially on land near the colony. The key factor affecting the mortality of seals and porpoises in the Baltic Sea is by-catch. Even minimum by-catch estimates exceed the limits of the small Baltic Proper population of the harbour porpoise, preventing recovery of abundance. By-catch of all Baltic seal species is estimated to remain significant, exceeding 2% of their population, if the current structure of fishery is not changed. The situation may improve with a replacement of fishing methods with ones that do not pose a by-catch risk.

The decreasing food supply associated with overfishing and the destruction of fish habitats is deteriorating the health of seals and porpoises. Action should be taken towards ecosystem-based management of fish stocks. Animal health is also deteriorating due to the influx of pollutants from land.

As the climate warms and sea-ice cover declines, there is a threat of increased seal mortality from hunting due to the concentration of individuals in less dispersed colonies.

Despite the slow increase of the seal population in the Baltic Sea, its status is unsatisfactory. Achieving a good status for all seal species requires the introduction of protected areas and a reduction of human impacts.

The Baltic Proper population of the harbour porpoise has a critically endangered status and, despite the lack of accurate information on its abundance, a further decline is probable [148].

3.7.1.4.3 Monitoring results in the area of the planned project

Between April 2020 and March 2021, passive acoustic monitoring of marine mammals was conducted in the BP OWF CI area, and observations of marine mammals along the shore were carried out (Appendix 1. Report on inventory survey).

From among the four species of marine mammals occurring in the Baltic Sea, during the period of monitoring in the survey area, sporadic occurrence of porpoises (8 DPD) and a one-off observation of a harbour seal was found.

The monitoring results obtained are consistent with the results of other surveys. They confirm low detection rate of harbour porpoise in the area of the planned project and a lack of important breeding, moulting or resting areas of these mammals in the sea and on the beach [148, 340].

3.7.1.4.4 Specific sensitivity of marine mammals to potential impacts

3.7.1.4.4.1 Noise

Animals are sensitive to different frequencies, which makes frequency an important parameter when assessing acoustic signals in relation to animal responses.

The ears of the harbour porpoise are far better adapted to functioning underwater than in the air. The harbour porpoise has exceptionally good hearing in the ultrasonic range from 10 kHz to 160 kHz. By contrast, seals cannot hear well above 50 kHz but have much better hearing than porpoises at lower frequencies.

Porpoises use sounds, clicks at very high frequencies for echolocation and communication. Due to the high frequency (above 100 kHz) these sounds diminish rapidly as the distance increases, and the maximum communication range for porpoises is less than 1 kilometre. Also seals vocalise underwater but at the other end of the frequency spectrum than porpoises. They emit harsh grunting or barking sounds with the main energy of approx. a few hundred Hz. The use of these sounds is probably limited to attracting females or competition between males [153].

When swimming at the water surface, seals may reduce their exposure to underwater sounds because sound pressure levels (SPL) are often lower just below the surface than deeper in the water. Seals may adapt physiologically so that they can switch between the maximum sensitivity to sounds from the air or from the water. This may mean that hearing sensitivity to underwater sounds is lower when swimming at the water surface (when hearing can be focused on airborne sounds) than when swimming at depth [188].

Potential impacts

In extreme cases, within a short distance of high-intensity impulsive noise, there is a risk of physical injury to animals, including organ damage (not only hearing damage) or death. Another effect of exposure to loud sounds is temporary or permanent hearing damage known as temporary threshold shift (TTS) and permanent threshold shift (PTS). It can last from a few minutes to several hours or even days. Although TTS is reversible and generally considered to have little direct impact on the animal, repeated TTS is known to eventually lead to PTS, which can affect the ability to communicate, move and feed. Threshold shifts caused by anthropogenic sound sources mainly affect hearing at lower frequencies. An important type of impact is masking, where the signal detection threshold is raised due to the presence of another sound. Masking means, among others, that as the masking noise increases, animals will be able to communicate over shorter distances. However, the masking sound must have the appropriate intensity and direction, overlapping in time and frequency with the animal's communication sound. The most common impact of underwater noise on marine mammals is a change in the animals’ behaviour, also caused by lower intensity sounds.

Little is known about the response of the harbour porpoise to vessel noise. There is currently no evidence that the harbour porpoise generally avoids shipping routes or areas with commonly intense vessel traffic but there are no reliable surveys available on this subject.

It is highly unlikely that low-frequency vessel noise is able to mask echolocation of the harbour porpoise. Ship noise may affect the detection of other low-frequency sounds that may be important to the harbour porpoise for the purpose of orientation and navigation. Seals that use sounds in exactly the same frequency range where vessel noise is the most intense are potentially more susceptible to masking. Whether or not they actually experience the masking of their mating calls depends on how close ships pass to their mating areas [153].

Impact scale

The level of sound impact depends, among other things, on the distance from the sound source. As the distance from the noise source increases [Figure 3.9], the severity and number of different impacts experienced by the animal decreases. Injuries and PTS (dark red in Figure 3.9) only occur closest to the sound source. Temporary threshold shift (red), behavioural reactions and stress (orange) can also occur further away, along with masking (yellow), and at the furthest distance from the sound source the animal is simply able to detect the sound (blue). However, these ranges are not strictly defined, some of them overlap to a large extent and depend on sound characteristics and receiver properties [153]. The boundaries between individual impact zones are not clear-cut and the zones overlap to a large extent. Impulse noise practically does not cause any masking [233], whereas the noise associated with increased ship traffic may have such an effect [87, 156].

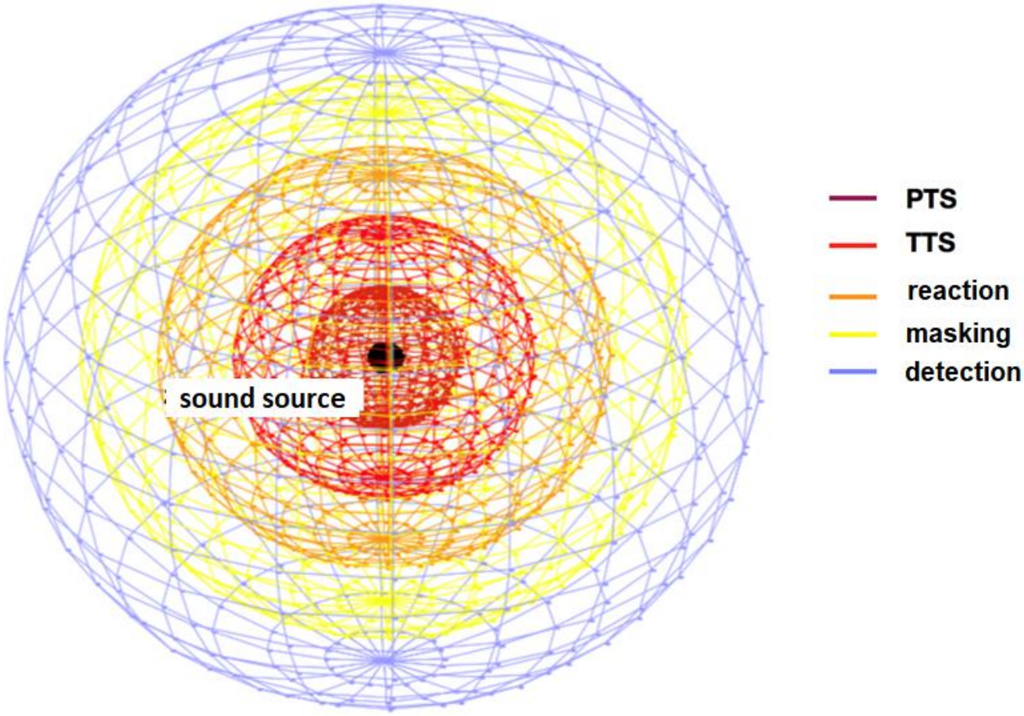

Figure 3.9. Scope of noise impact in space [Source: [153]]

Table 3.5 provides a description and thresholds of potential noise impacts on marine mammals, based on surveys conducted to date. Due to the differences in the propagation of sound components at different frequencies, noise may cause different impacts under varying conditions. Exposure criteria must account for the dependence of hearing sensitivity to sounds at different frequencies. The actual scale of impacts on marine mammals is characterised by considerable uncertainty.

Table 3.5. Potential impacts of noise on marine mammals by response, based on surveys conducted to date [Source: internal materials]

Potential impact	**Description of potential impact**			
	Effects	**Range**	**Potential sources**	**Threshold values**
Physical injury	Direct: permanent or temporary tympanic membrane rupture caused by shock wave, death Indirect: reduced viability and reproductive capacity *The harbour porpoise does not have a functional tympanic membrane, so the threshold measured does not apply to the porpoise	Immediate vicinity, several dozen metres or several kilometres	Detonation of unexploded ordnance, seismic surveys for oil and gas, driving of steel piles for offshore wind farm foundations, single sounds and series of sounds	280 dB re 1 µPa²s – high risk of moderate to severe injury (including tympanic membrane rupture) 140 dB re 1 µPa²s – high risk of minor injury, including tympanic membrane rupture 70 dB re 1 µPa²s – low risk of injury; no rupture of eardrum [436]
Permanent threshold shift (PTS)	Irreversible hearing loss. Damage to the hearing organ. The hearing threshold does not return to normal level after the exposure to noise. Reduced vitality, which may even lead to death.	Up to 1 km (greater in the case of repetitive sounds)		Harbour seal: 185 dB re 1 µPa²s Harbour porpoise: 155 dB re 1 µPa²s [263]
Temporary Threshold Shift (TTS)	Temporary hearing loss. Depending on the level of exposure, hearing ability returns within minutes or hours. As the impact is relatively short term, the viability of marine mammals is not compromised to a high degree.	Several km (greater in the case of repetitive sounds)		Harbour seal: 170 dB re 1 µPa²s Harbour porpoise: 140 dB re 1 µPa²s [263]
Behavioural response	The behavioural response can range from flight to distress and change in swimming patterns [352]. A strong response may be related to a serious impact, from by-catch to becoming stranded in the shallows, which may result in the death of the individual. Behaviours such as flight or distress may result in reduced foraging or feeding time, negatively affecting the condition of the species.	Several dozen km	Vessel traffic, underwater equipment, single sounds.	Harbour seal: 170 dB re 1 µPa²s Harbour porpoise: 140 dB re 1 µPa²s [70, 263]
Masking	Masking occurs when the noise generated due to a project prevents other sounds from being received and identified. Masking is relevant in the context of continuous noise and must occur at the same time and in the same frequency band as the continuous noise. The impact of masking on marine mammals has not been assessed in the scientific literature.			No threshold values for construction activities have been determined in the literature.
Detection	Reactions to noise detection are difficult to predict and to assess.			No threshold values for construction activities have been determined in the literature.

3.7.1.5 Seabirds

The bird inventory in the BP OWF CI area was conducted from 15.10.2018 to 26.11.2019. The survey area consisted of 8 survey transects, 4 of which partially crossed the Natura 2000 site Przybrzeżne wody Bałtyku (PLB990002). Transect locations are presented in Table 3.6 and in Figure 3.10. 41 survey campaigns were conducted in total.

Table 3.6. Location of seabird survey transects in the area of the Baltic Power OWF Connection Infrastructure [Source: internal materials]

Transect	Coordinate system								Length [m]
	flat cartesian PL-1992 [m]				WGS 84				
	Beginning		End		Beginning		End		
	y	x	y	x	Longitude	Latitude	Longitude	Latitude	
T01	406402.41	787927.46	406392.66	799928.29	17.538289	54.945955	17.53421	55.053795	12
T02	407629.17	786757.23	411172.19	800298.65	17.557817	54.935668	17.608912	55.058001	14
T03	415667.11	788982.63	415680.87	799980.97	17.682621	54.957091	17.679592	55.055932	11
T04	418155.67	789682.65	420972.6	800314.24	17.721284	54.963797	17.762344	55.059798	11
BA20	406780.36	769822.84	391130.47	784970.21	17.55004	54.78333	17.301017	54.916283	21.78
BA21	407283.28	770113.25	418886.61	791865.46	17.557767	54.786033	17.732083	54.983533	24.65
BA22	433659.73	776818.62	419888.72	793627.76	17.966433	54.850483	17.74725	54.999533	21.73
BA23	435006.79	776370.6	445433.53	793534.3	17.987517	54.846633	18.146667	55.00215	20.08
Total									**136.24**

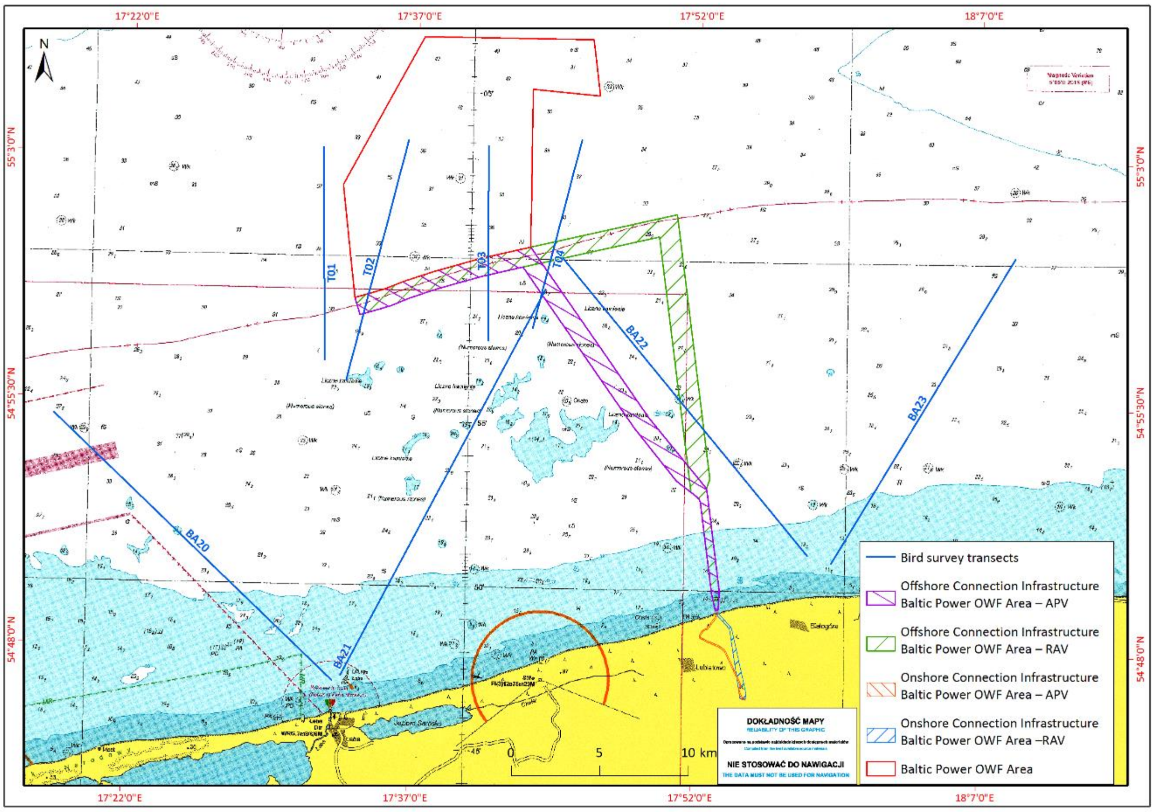

Figure 3.10. Location of the Baltic Power OWF Connection Infrastructure variants against the background of the Natura 2000 site Przybrzeżne Wody Bałtyku (PLB990002) [Source: internal materials]

3.7.1.5.1 Natura 2000 site Przybrzeżne Wody Bałtyku (PLB990002)

The area of the BP OWF CI crosses the Natura 2000 site Przybrzeżne Wody Bałtyku (PLB990002). The area includes a strip of the Southern Baltic coastal waters with a depth from 0 to 20 m and a length of approx. 200 km, which begins at the base of the Hel Peninsula and ends in the Pomeranian Bay. The seabed here is uneven with height differences reaching 3 m. Small crustaceans dominate in the benthic fauna. Two bird species listed in Annex I to the Birds Directive winter in in this area, namely the black-throated diver and the red-throated diver. In winter, more than 1% of the long-tailed duck migratory route population and at least 1% of the black guillemot and velvet scoter migratory route population are present there. From among the species included in the BP OWF CI impact assessment on seabirds within the Przybrzeżne wody Bałtyku site (PLB990002), the wintering populations of the long-tailed duck, the velvet scoter, the razorbill and the European herring gull are subject to protection. It is estimated that 90–120 thousand individuals of the long-tailed duck, 14–20 thousand individuals of the velvet scoter, and 8–15 thousand individuals of the European herring gull winter in this area [242]. The abundance of the razorbill population wintering in the area is estimated at 500–1000 individuals [117]. In the Przybrzeżne wody Bałtyku site (PLB990002), the wintering and passing population of the common scoter and the wintering population of the black guillemot are also under protection. There is no protection plan available for this site.

3.7.1.5.2 Survey results

During the transect surveys, 22 bird species were found sitting on the water. Due to the scope of potential impacts and the nature of the project, birds recorded in flight were not included in the analysis. The survey results are summarised in Table 3.7.

Table 3.7. Abundance and percentage share in the grouping of individual bird species sitting on the water, found in the Baltic Power OWF Connection Infrastructure area along the survey transects within the entire period between October 2018 and November 2019 [Source: internal materials]

Species	Number of individuals observed [ind.]	Share in the group [%]
Seabirds		
Velvet scoter *Melanitta fusca*	17 872	59.4
Long-tailed duck *Clangula hyemalis*	10 946	36.4
European herring gull *Larus argentatus*	528	1.8
Razorbill *Alca torda*	326	1.1
Common guillemot *Uria aalge*	226	0.8
Little gull *Hydrocoloeus minutus*	17	0.1
Common scoter *Melanitta nigra*	37	0.1

Species	Number of individuals observed [ind.]	Share in the group [%]
Red-throated diver *Gavia stellata*	13	+
Black-throated diver *Gavia arctica*	11	+
Great black-backed gull *Larus marinus*	8	+
Lesser black-backed gull *Larus fuscus*	5	+
Caspian gull *Larus cachinnans*	2	+
Red-breasted merganser *Mergus serrator*	1	+
Black guillemot *Cepphus grylle*	1	+
Common eider *Somateria mollissima*	1	+
Waterbirds rarely encountered at sea away from the coast		
Great black cormorant *Phalacrocorax carbo*	9	+
Common gull *Larus canus*	8	+
Great crested grebe *Podiceps cristatus*	6	+
Greater white-fronted goose *Anser albifrons*	2	+
Eurasian coot *Fulica atra*	1	+
Black-headed gull *Chroicocephalus ridibundus*	1	+
Arctic tern *Sterna paradisaea*	1	+
Birds unidentified as to species		
Razorbill or a common guillemot *Alca torda/Uria aalge*	61	0.2
Unidentified specimen of gaviiformes *Gavia* sp.	5	+
Total	**30 091**	**100**

+ – percentage share smaller than 0.1%

A total of 30 091 birds were found sitting on the water within the project area during the surveys, of which 95.8% were velvet scoters (17 872 ind. – 59.4%) and long-tailed ducks (10 946 ind. – 36.4%).

A share above 1% was also recorded for the European herring gull (528 ind.) and the razorbill (326 ind.). The share of all other species amounted to only 1.2%. Variability of the grouping in individual phenological seasons is presented in Table 3.8.

Table 3.8. Abundance and percentage share in the grouping of individual bird species sitting on the water, found in the Baltic Power OWF Connection Infrastructure area along the survey transects in respective phenological periods [Source: internal materials]]

Species	**Autumn migration period – maximum during inspections [ind.]**	**Percentage share [%]**	**Winter period [ind.]**	**Percentage share [%]**	**Spring migration period [ind.]**	**Percentage share [%]**	**Summer period [ind.]**	**Percentage share [%]**
Seabirds								
Velvet scoter *Melanitta fusca*	4473	73.0	13 311	69.1	88	2.0	0	0.0
Long-tailed duck *Clangula hyemalis*	1170	19.1	5725	29.7	4051	89.8	0	0.0
European herring gull *Larus argentatus*	192	3.1	115	0.6	136	3.0	85	42.3
Razorbill *Alca torda*	120	2.0	58	0.3	140	3.1	8	4.0
Common guillemot *Uria aalge*	95	1.6	14	0.1	16	0.4	101	50.2
Little gull *Hydrocoloeus minutus*	3	0.0	0	0.0	14	0.3	0	0.0
Common scoter *Melanitta nigra*	2	+	2	+	33	0.7	0	0.0
Red-throated diver *Gavia stellata*	4	0.1	8	+	1	+	0	0.0
Black-throated diver *Gavia arctica*	4	0.1	2	+	5	0.1	0	0.0
Great black-backed gull *Larus marinus*	6	0.1	2	+	0	0.0	0	0.0
Lesser black-backed gull *Larus fuscus*	1	+	0	0.0	3	0.1	1	0.5
Caspian gull *Larus cachinnans*	1	+	0	0.0	0	0.0	1	0.5
Red-breasted merganser *Mergus serrator*	1	+	0	0.0	0	0.0	0	0.0
Black guillemot *Cepphus grylle*	1	+	0	0.0	0	0.0	0	0.0

Species	Autumn migration period – maximum during inspections [ind.]	Percentage share [%]	Winter period [ind.]	Percentage share [%]	Spring migration period [ind.]	Percentage share [%]	Summer period [ind.]	Percentage share [%]
Common eider *Somateria mollissima*	1	+	0	0.0	0	0.0	0	0.0
Waterbirds rarely encountered at sea away from the coast								
Great black cormorant *Phalacrocorax carbo*	2	+	3	+	3	0.1	1	0.5
Great crested grebe *Podiceps cristatus*	0	+	5	+	1	+	0	0.0
Common gull *Larus canus*	4	0.1	0	0.0	3	0.1	1	0.5
Greater white-fronted goose *Anser albifrons*	1	+	0	0.0	0	0.0	1	0.5
Eurasian coot *Fulica atra*	1	+	0	0.0	0	0.0	0	0.0
Black-headed gull *Chroicocephalus ridibundus*	1	+	0	0.0	0	0.0	0	0.0
Arctic tern *Sterna paradisaea*	0	0.0	0	0.0	0	0.0	1	0.5
Birds unidentified as to species								
Razorbill or a common guillemot *Alca torda/Uria aalge*	40	0.7	6	+	13	0.3	2	1.0
Unidentified specimen of gaviiformes *Gavia* sp.	1	+	1	+	3	0.1	0	0.0
Total	**6126**	**100**	**19 253**	**100**	**4511**	**100**	**201**	**100**

+ – percentage share smaller than 0.1%

3.7.2 Protected areas, including Natura 2000 sites

The southern part of the offshore area of the planned project, stretching over 11.1 km, crosses the eastern part of the Natura 2000 site Przybrzeżne wody Bałtyku (PLB990002) in the north-south axis [Figure 3.10].

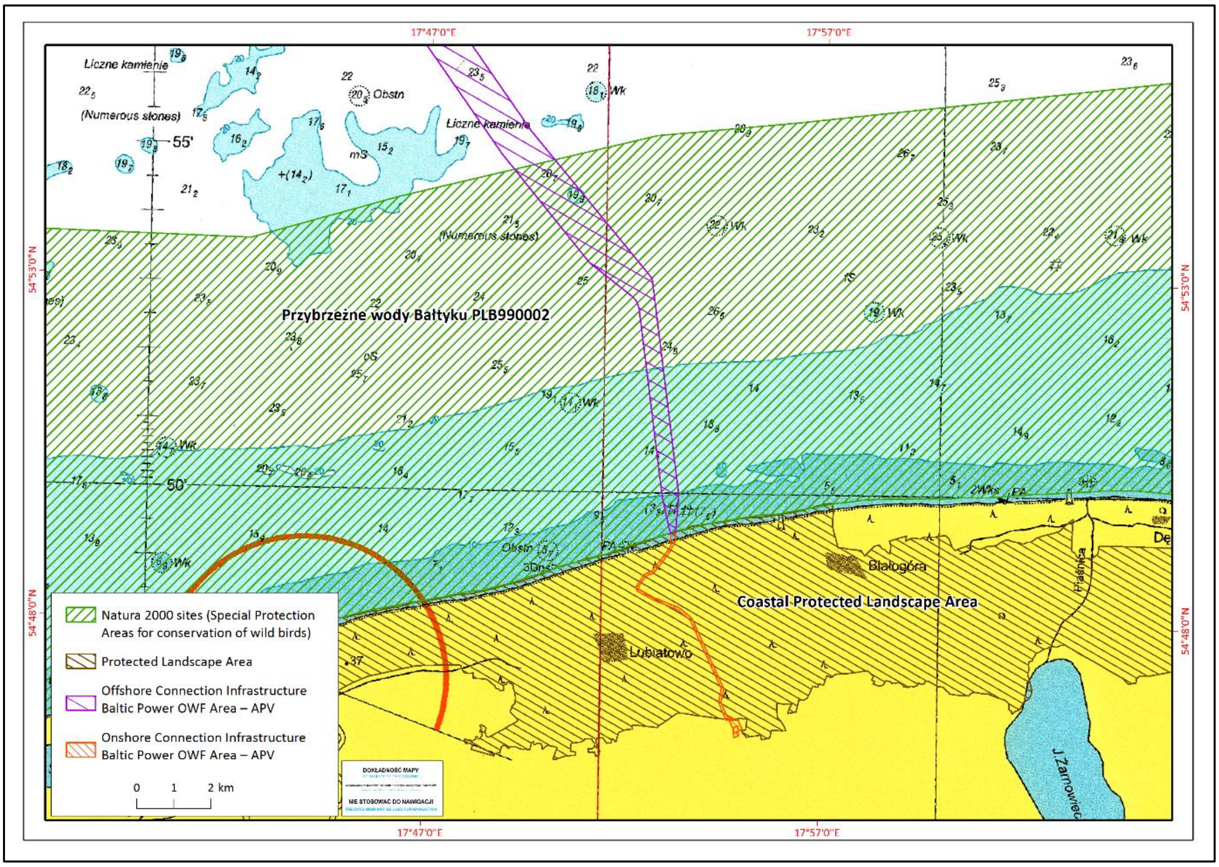

Figure 3.11. Location of the Baltic Power OWF Connection Infrastructure in relation to the Natura 2000 site Przybrzeżne Wody Bałtyku (PLB990002) [Source: internal materials]

The **Natura 2000 site Przybrzeżne Wody Bałtyku (PLB990002)** was established by the Regulation of the Minister of Environment of 21 July 2004 on the Natura 2000 special protection areas for birds (Journal of Laws 2004, No. 229, item 2313). The primary function of the site is to provide protection for birds wintering in the nearshore zone of the Baltic Sea, mainly the long-tailed duck (*Clangula hyemalis*), the velvet scoter (*Melanitta fusca*), the common scoter (*Melanitta nigra*), the black guillemot (*Cepphus grylle*), the razorbill (*Alca torda*) and divers (Gaviiformes) [242]. The surface of the area is 194 626.73 ha, covering coastal waters of the Baltic Sea up to a depth of approximately 20 m, and its boundaries extend for 200 km, from the tip of the Hel Peninsula, to the eastern border of the Pomeranian Bay [118, 242].

Approximately 12% of the velvet scoter, 2% of the common scoter and 35% of the long-tailed duck wintering in the Polish maritime areas gather within the area [242, 118]. Due to its importance for wintering birds, the Przybrzeżne Wody Bałtyku PLB990002 site is classified as a bird refuge of European significance (refuge code E 80). In the short-term, high abundances of gulls may be recorded in the area, mainly the European herring gull [242, 118]. It is a phenomenon of synanthropic origin – gulls appear in large numbers over the sea area when they accompany fishing boats in search for easily accessible food source [381, 349].

6 species of birds listed in Annex I to the Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds are subject to protection in the area [Table 3.9]. Most of them are the species wintering in the Polish Baltic area, with the exception of the European herring gull, which may appear over the sea area throughout the year [381, 349].

Table 3.9. Bird species subject to protection in the Przybrzeżne Wody Bałtyku site (PLB990002), as listed in Annex I to the Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds [Source: Standard Data Form, updated on: 10.2020]

No.	**Species**	
	Name of species	**Binomial nomenclature**
1.	Razorbill	*Alca torda*
2.	Black guillemot	*Cepphus grylle*
3.	Long-tailed duck	*Clangula hyemalis*
4.	European herring gull	*Larus argentatus*
5.	Velvet scoter	*Melanitta fusca*
6.	Common scoter	*Melanitta nigra*

In the SDF of the Natura 2000 site Przybrzeżne wody Bałtyku (PLB990002), two negative impacts on the site were identified [118]. The first one is: "Other urbanisation, industrial and similar activities" (code E06), and the other is: "No threats and pressures" (code X). The impact labelled "No threats and pressures" was also indicated in the SDF of the area as a positive impact. Three impacts are classified as the "medium" level (M), meaning a "moderate direct or immediate influence, predominantly indirect and/or relating to approximately half of the area" [167]. Regarding impact E06, it was indicated that the impact is internal (generated within the site boundary), whereas the sources of impact X are classified as internal and intrinsic [118]. No protection plan has been prepared for the Przybrzeżne wody Bałtyku (PLB990002) area.

3.7.3 Wildlife corridors

A wildlife corridor, pursuant to the Nature Conservation Act of 16 April 2004 (Journal of Laws of 2004, No. 92, item 880, as amended), is an area enabling the migration of plants, animals or fungi. A network of wildlife corridors connecting the European Ecological Network Natura 2000 in Poland was developed in 2011 [179], however, no wildlife corridors for the PMA were indicated therein. Krost *et al.* [212] emphasise the necessity to indicate wildlife corridors for the 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 marine areas, is located within two large flyways: the East Atlantic and the Mediterranean/Black Sea flyways. The migration tactics, as well as 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 (*Somateria mollissima*) 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 seabird autumn migration is very extended in time. Starting in August, a series of water bird species can be observed within the PMA. 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 [349].

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

3.7.4 Biodiversity

3.7.4.1 Phytobenthos

The macroalgae found in the APV of the BP OWF CI were characterised by very low species diversity – probably one species belonging to the family *Rhodomelaceae* and *Pylaiella littoralis* and/or *Ectocarpus siliculosus* occurred. In the Polish maritime areas, in areas where macroalgae have been identified so far, i.e., the boulder area of the Słupsk Bank, the boulder area of Rowy and the stony seabed near the Orłowo Cliff in the Bay of Puck, the number of species is significantly higher, amounting to 12, 12 and 23, respectively [288, 213, 47].

Phytobenthos is not present in the RAV of the BP OWF CI.

3.7.4.2 Macrozoobenthos

In the area of the BP OWF CI, 23 macrozoobenthos taxa were found on the soft bottom (sand and gravel settlements). On the basis of data covering the APV and RAV corridors (excluding corridors A, B and C), the presence of 21 taxa (18 species and 3 higher taxonomic units) of benthic macrofauna belonging to 8 divisions: Hydrozoa, Polychaeta, Clitellata, Hexanauplia, Malacostraca, Gastropoda, Bivalvia and Gymnolaemata was found. The most abundant were Malacostraca and Polychaeta. The most common taxa were the two species of psammophilous polychaetes: *Marenzelleria* sp. and *Pygospio elegans*. Two additional invertebrate species were identified within corridors A, B and C: *Halicryptus spinulosus* and *Priapulus caudatus* representing the division *Priapulida*. The quantitative analyses of the soft bottom showed that the taxa typical of the shallow and medium-deep seabed (up to 35 MBSL) of nearshore and open waters of the Southern Baltic (eastern Gotland Basin) dominated in the survey area. In terms of abundance, the group of polychaetes dominated, including the psammophilous *Pygospio elegans*, which is common in the PMA, and *Marenzelleria* sp. In terms of biomass, on the other hand, the division of bivalves was clearly dominant, with the highest share of *Limecola balthica*, characterised by a wide range of tolerance to environmental factors.

In the two samples collected from the hard bottom (stone surface) in the BP OWF CI area, the presence of 14 taxa (11 species and 3 higher taxonomic units) belonging to 8 divisions: Hydrozoa, Polychaeta, Clitellata, Hexanauplia, Malacostraca, Gastropoda, Bivalvia and Gymnolaemata was found. The most taxa were the representatives of Malacostraca. In terms of occurrence, as many as 6 taxa were constant. These included the representatives of the periphytic fauna, such as the bay mussel (*Mytilus trossulus*), *Gonothyraea loveni* and *Einhornia crustulenta* as well as the accompanying fauna: polychaetes *Bylgides sarsi* and *Pygospio elegans* and the juvenile specimens of the genus *Gammarus*. However, in the abundance and biomass structures of this community, the definite dominant was the bay mussel *Mytilus trossulus*, which is a component of the diet of benthivorous birds and fish, also playing an important habitat-forming role in the environment.

3.7.4.3 Ichthyofauna

The analysis of the catch results and catch efficiency for the fish community inhabiting the BP OWF CI area demonstrates that the area is typical for the Southern Baltic in terms of species diversity, with a distinct prevalence of cod and flounder in demersal catches and of herring and sprat in pelagic catches.

In total, 144 fish species, including 97 marine species, 7 migratory species and 40 freshwater species, were recorded in the Baltic Sea [377]. The fish species prevailing in the deeper waters of the western Baltic Sea are cod and flounder in the demersal zone as well as herring and sprat in the pelagic zone [10, 199, 163].

According to CIEP, a maximum of 44 fish species live in the open sea area, including the species occurring in the coastal and transitional waters.

A total of 31 fish species were observed in the BP OWF CI area during the surveys.

In the case of ichthyoplankton, during the entire survey period, the roe of one species of fish (sprat) and the larvae of 12 taxa were caught. These were gobies, sprat, flounder, herring, ammodytids, shorthorn sculpin, rock gunnel, common seasnail, long-spined bullhead, straight-nosed pipefish, fourbeard rockling and turbot.

During pelagic catches, 8 fish species were caught, 99% of the biomass being sprat and herring. The presence of garfish, three-spined stickleback, great sand eel, mackerel, lesser sand eel and sea trout individuals was also recorded.

During demersal fish catches, fish belonging to 15 taxa were recorded. Flounder and cod dominated, whereas other species constituted small by-catches (great sand eel, plaice, shorthorn sculpin, mackerel, perch, zander, scarp, sprat, herring, lumpfish, lesser sand eel, viviparous eelpout and whiting).

During catches using beach seine nets in the coastal zone, 19 fish taxa were recorded. The catches were dominated by lesser sand eel, followed by herring, great sand eel, flounder, and perch.

3.7.4.4 Marine mammals

The harbour seal is listed in Annexes II and V of the Habitats Directive. According to the HELCOM Red List, the Southern Baltic subpopulation is considered to be of least concern.

The grey seal is listed in Annexes II and V of the Habitats Directive. In the HELCOM Red List, the species is listed in the category of least concern, whereas at the national level in Poland it is considered endangered [217]. In addition, the grey seal is listed in Annex II of the Bonn Convention.

The harbour porpoise is strictly protected under Annex IV of the Habitats Directive (EU Directive on the Conservation of Natural Habitats and of Wild Flora and Fauna – 92/43/EEC). Additionally, the species is listed in Appendix II of the Bonn Convention. According to the HELCOM Red List, the Baltic Sea population is considered critically endangered, and the Belts Sea population is considered vulnerable. On the European Red List of Mammals, the harbour porpoise has a vulnerable (VU) status – the assessment applies to the entire European population, without separating the Baltic population [375]. The species is also listed in the "Polish Red Data Book of Animals" [218].

In Poland, the harbour porpoise is protected in four Natura 2000 sites of Community importance: Zatoka Pucka i Półwysep Helski (PLH220032), Ostoja Słowinska (PLH220023), Ostoja na Zatoce Pomorskiej (PLH990002) and Wolin i Uznam (PLH320019) [148].

Marine mammals found in the Baltic Sea are predators and play an important regulatory role in the trophic chain of the basin. They compete with humans for fish resources, which is associated with by-catch of porpoises and seals in fishing nets. This is one of the major threats, particularly to the small Baltic Proper population.

3.7.4.5 Seabirds

3.7.4.5.1 Species of seabirds included in the Environmental Impact Assessment

Birds sitting on the water along the transects during the survey campaigns conducted were included in the BP OWF CI Environmental Impact Assessment. The assessment does not include the results obtained from the radar surveys, which address the issue of avifauna migration in detail. In the case of the European herring gull, which was present during the surveys conducted with the application of both methods, the assessment scope of the potential BP OWF CI impacts is presented in the section covering seabirds. The European herring gull is a species that accompanies fishing boats at fishing grounds and its occurrence in the open sea is strongly conditioned by human activity. The assessment involved the most abundant species of seabirds, the share of which in the abundance of the entire grouping of birds observed in the BP OWF CI reached 1% within at least one phenological period and which are the subject of protection in the Natura 2000 site Przybrzeżne wody Bałtyku (PLB990002). Among the species identified, the proportion condition was met by: the long-tailed duck, the velvet scoter, the razorbill, the common guillemot, the European herring gull and the common scoter.

3.7.4.5.2 Comparison of project route variants

On the basis of the results collected, the modelling of seabird density was carried out for the area of the two cable route variants considered. The modelling results are presented in the figures below [Figure 3.12–Figure 3.16].

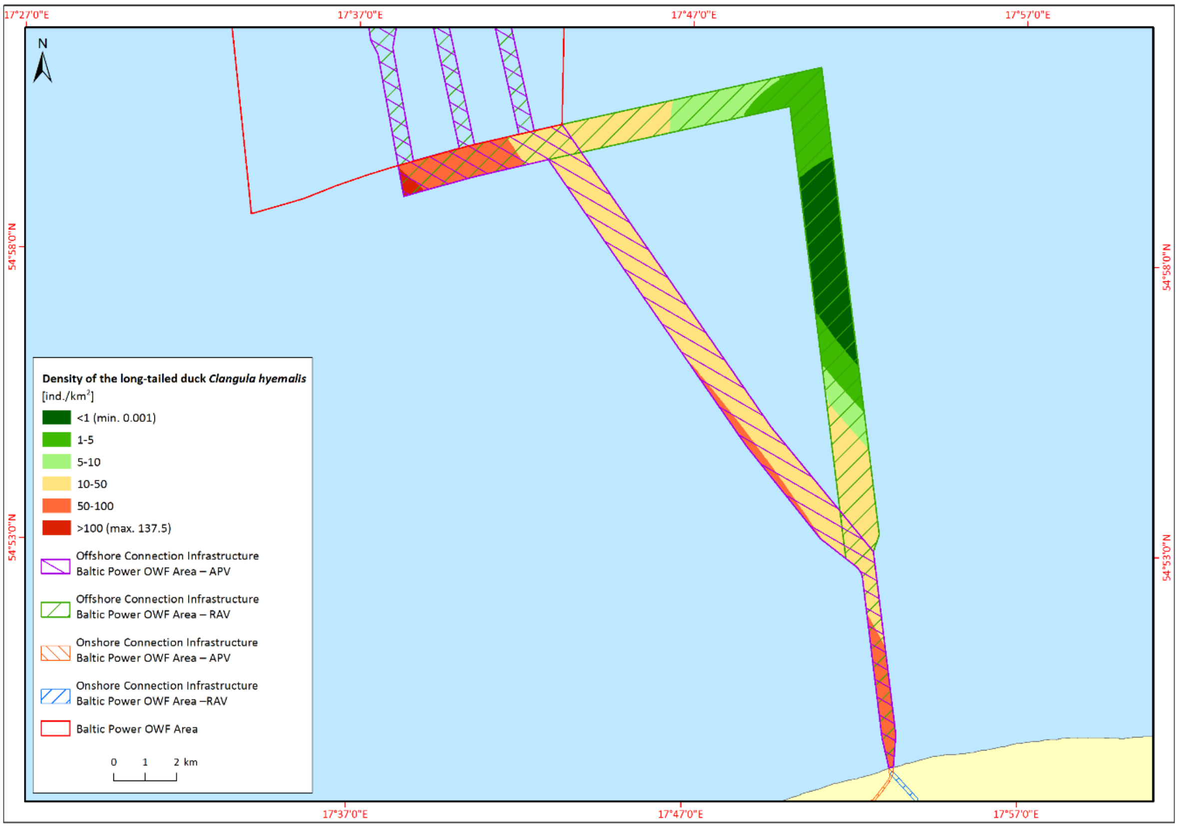

Figure 3.12. Results of density modelling of the long-tailed duck (Clangula hyemalis) [Source: internal materials]

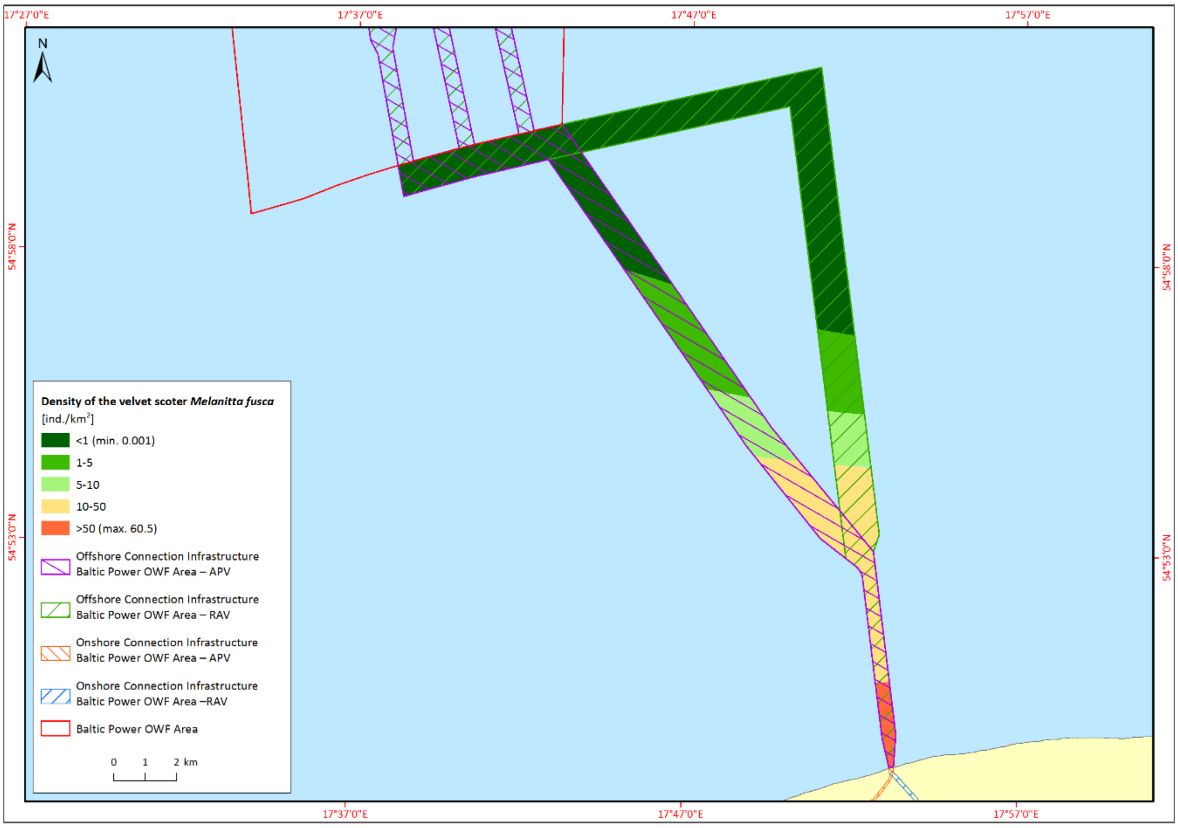

Figure 3.13. Results of density modelling of the velvet scoter (Melanitta fusca) [Source: internal materials]

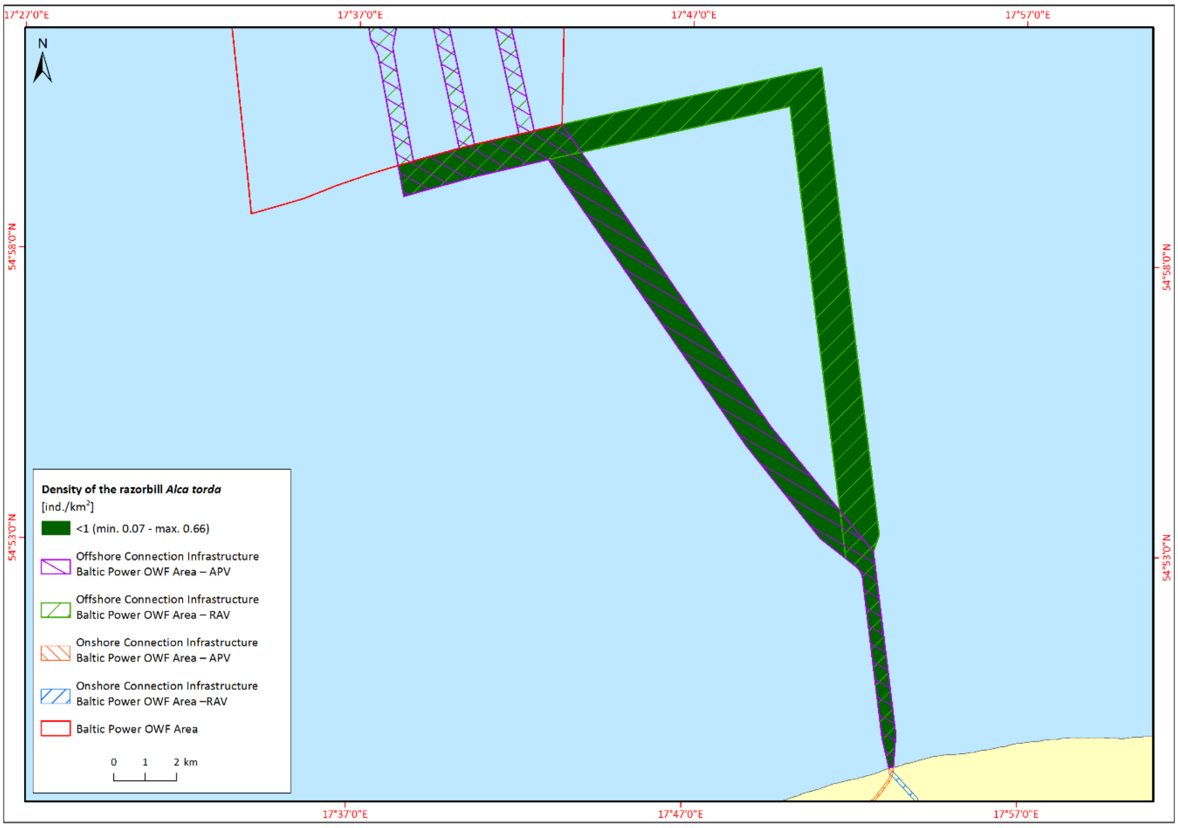

Figure 3.14. Results of density modelling of the razorbill (Alca torda) [Source: internal materials]

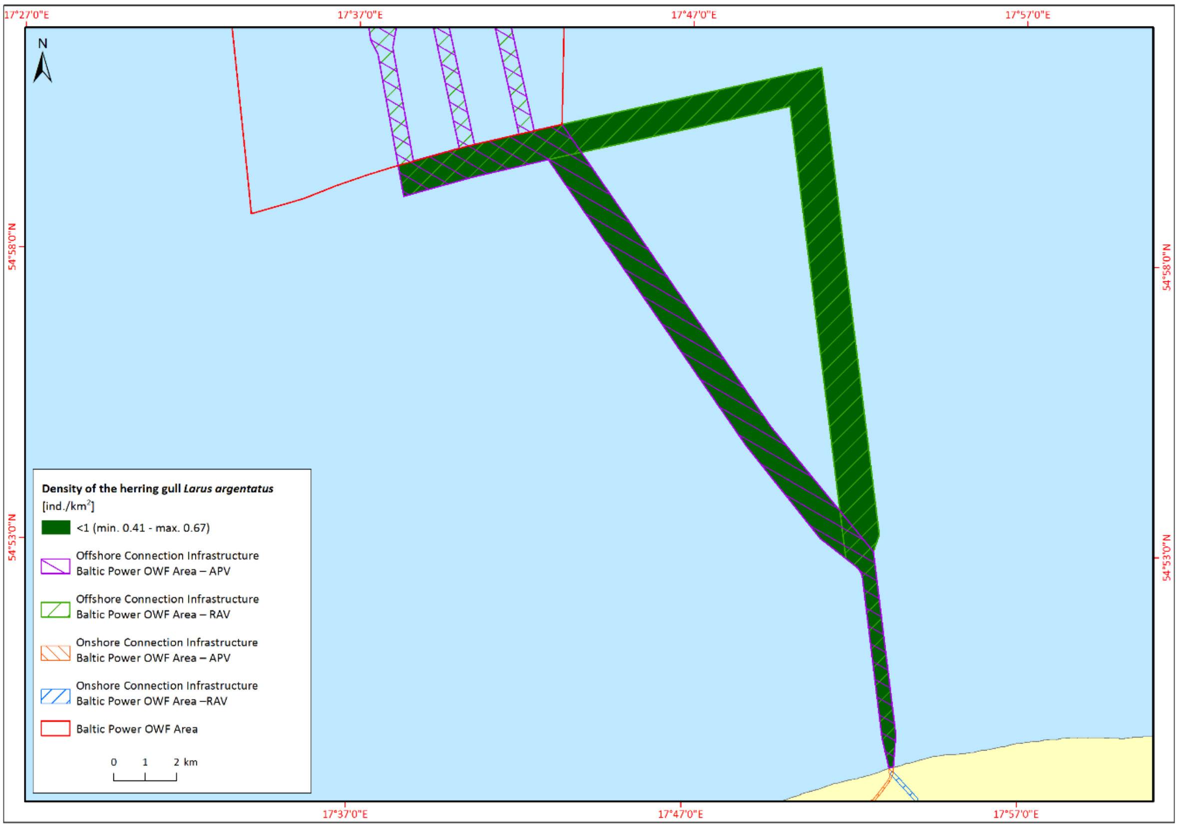

Figure 3.15. Results of density modelling of the European herring gull (Larus argentatus) [Source: internal materials]

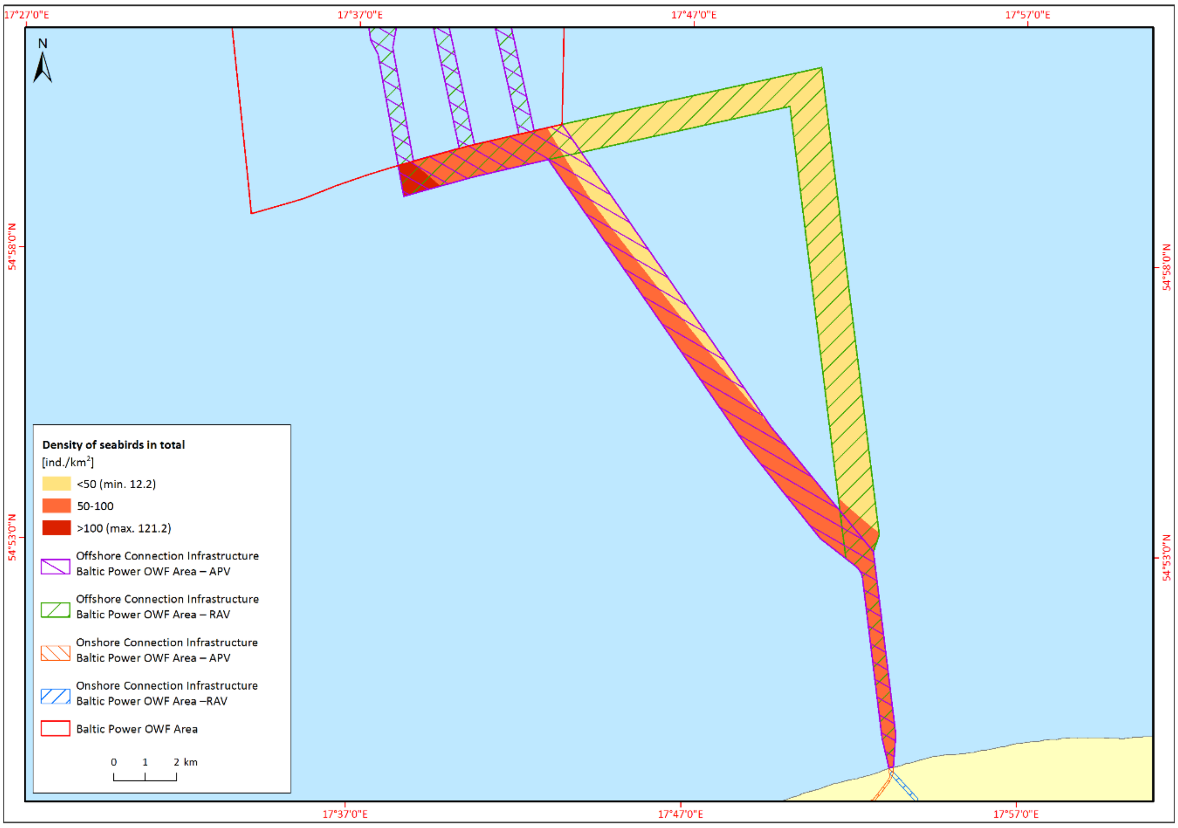

Figure 3.16. Results of seabird density modelling in total [Source: internal materials]

Table 3.10. Comparison of the mean densities of seabirds in the area of project route variants [Source: internal materials]

Species	Mean density of seabirds [ind. km^{-2}]	
	APV	RAV
Long-tailed duck *Clangula hyemalis*	32.7	61.7
Velvet scoter *Melanitta fusca*	11.7	15.9
Razorbill *Alca torda*	0.4	0.4
European herring gull *Larus argentatus*	0.5	0.5
Seabirds in total	52.0	74.9

The results obtained clearly show that the area covered by the RAV is more intensively used by seabirds compared to the APV [Table 3.10]. This is particularly relevant for the long-tailed duck and the velvet scoter. In the case of the razorbill and the European herring gull, no differences between the variants were identified regarding bird density.

In view of the above, it can be concluded that seabirds will be less impacted by the implementation of the APV than the RAV.

3.7.5 Environmental valorisation of the sea area

In the APV, there are no significant natural values in the context of phytobenthos occurrence in the project area. Trace amounts of macroalgae were found only on sparsely distributed boulders.

The environmental valorisation of the BP OWF CI area, in the context of macrozoobenthos, is presented in subsection 3.7.4.2. In summary, when assessed in terms of benthic fauna, the survey area is not particularly valuable due to the predominantly moderate and poor quality of macrozoobenthos communities.

To assess the significance of the BP OWF CI area with respect to ichthyofauna, its following characteristics were considered: taxonomic diversity, occurrence of protected and endangered species, the presence of feeding or spawning grounds, and migration routes. On the basis of the aforementioned functions, the natural qualities of this have been assessed as medium. The assessment has been based on experts' judgment. The characteristics of the above mentioned natural qualities have been as follows:

- the ichthyoplankton was characterised by medium taxonomic diversity;
- the occurrence of larvae of fish species under partial protection was recorded, as listed in the Regulation of the Minister of the Environment of 16 December 2016 on the protection of animal species (Journal of Laws of 2016, item 2183, as amended): these were the abundant gobies (probably the sand goby), common seasnail and straight-nosed pipefish;
- some of the species caught (6) are classified as LC, i.e. the least concern category, according to the IUCN. The LC category includes widely distributed and abundant taxa: herring, turbot, sprat, sand goby, European perch, ide;

- only Atlantic cod has vulnerable status according to the IUCN Red List. Atlantic cod was included in the VU category in 1996; it is a high-risk species and is endangered with extinction due to a population reduction below 50% in the recent time;
- the area can provide important feeding functions for such species as flatfish, cod, herring, sprat, sand eel, lesser sand eel as well as shorthorn sculpin, three-spined stickleback, lumpfish and viviparous eelpout;
- ichthyoplankton surveys indicate the occurrence of sprat spawning, however, the comparison of the numbers of larvae caught during the survey with the average number observed in the Southern Baltic area does not indicate the importance of this area as a spawning ground;
- in the case of gobies, the relatively large numbers of larvae found in July at the stations closest to the shore, indicate intensive spawning of this taxon taking place during this period;
- the presence of a few larvae of ammodytids, shorthorn sculpin, long-spined bullhead, rock gunnel and turbot in the samples collected indicates that spawning of these taxa may occur in the nearshore area.

The natural values of the BP OWF CI area for marine mammals were assessed as medium. In terms of food base or the presence of suitable resting and breeding sites for marine mammals, the project area is characterised by features typical of the Southern Baltic waters and has a medium value for them. The project area is not located within any conservation areas important for marine mammals, and the monitoring results showed sporadic occurrence of marine mammals in the area.

In terms of seabirds, the natural values of the BP OWF CI were assessed as high. The project area is a part of the Natura 2000 special protection area for birds – Przybrzeżne wody Bałtyku (PLB990002). 9 species of birds are under protection in the refuge area, namely the razorbill, the black guillemot, the long-tailed duck, the black-throated diver, the red-throated diver, the European herring gull, the common gull, the velvet scoter and the common scoter. During the avifauna inventory survey conducted in the area of the planned project, individuals representing all of the above-mentioned species were recorded; however, their density and abundance is low.

3.8 Cultural values, monuments and archaeological sites and objects

In the BP OWF CI area, one ship wreck has been identified to date, which is an object of historical importance [407]. It is located in the southern part of the section shared by the APV and RAV, at a distance of approximately 800 m from the shore and lying on the seabed at a depth of up to 10 m [Figure 3.17]. The object discovered in 2014 by the Maritime Institute in Gdańsk was identified as the Danish S/S Elie built in 1921 and sunk in 1944 by a sea mine [439, 304]. Another shipwreck, not constituting a cultural heritage asset, is situated in the RAV, approximately 12.4 km from the shore [407].

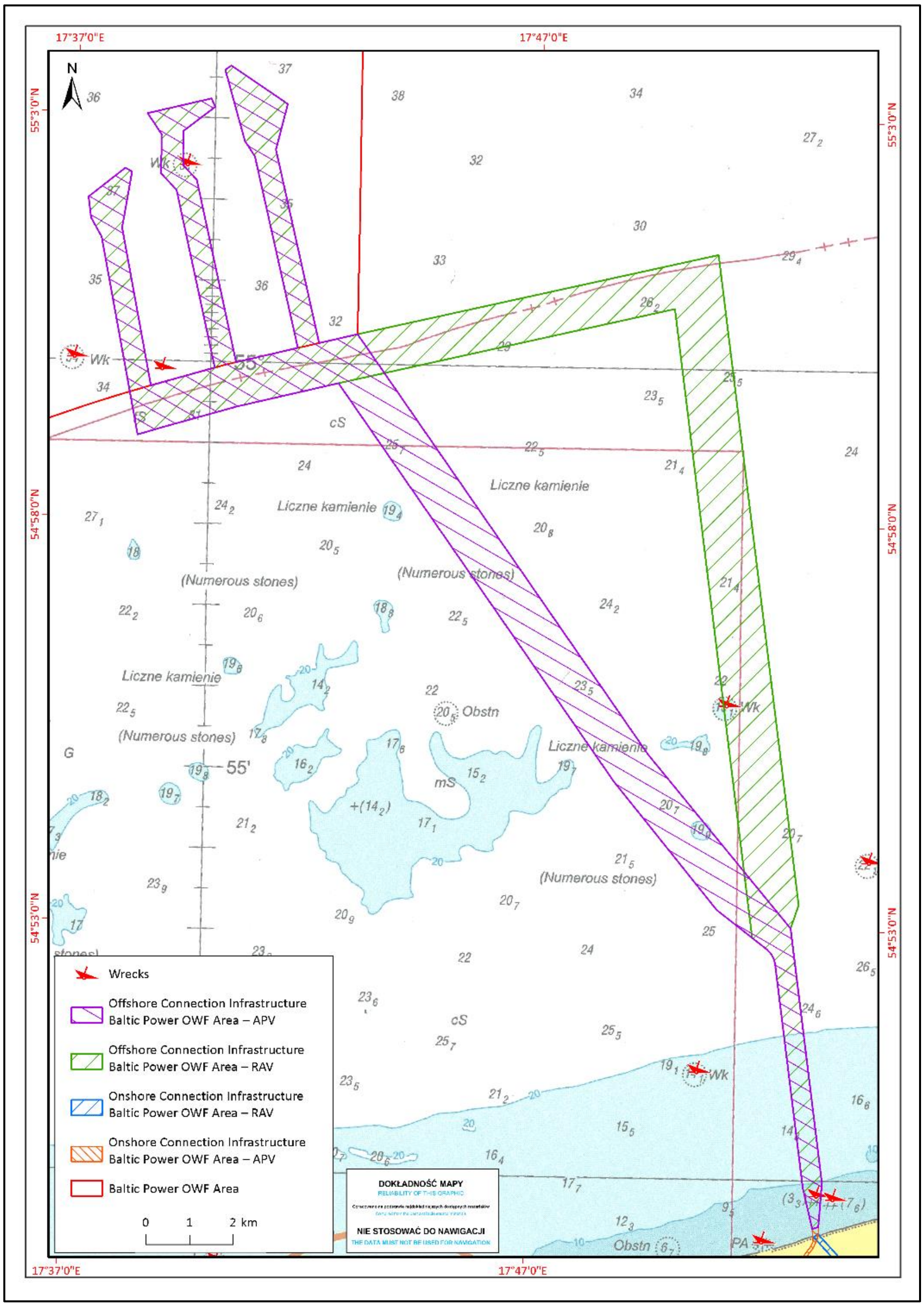

Figure 3.17. Location of the Baltic Power OWF Connection Infrastructure in relation to the wrecks identified [Source: internal materials based on the Maritime Administration Spatial Information System [407]]

3.9 Use and management of the water area and tangible property

The sea area in which the planned project is located fulfils various functions resulting from the hitherto human activity and the natural resources present there. The most comprehensive list of the forms of the current and planned future use of sea space has been developed for the purpose of the preparation of Maritime Spatial Plan of Polish Sea Areas (MSPPSA) (Journal of Laws of 2021, item 935).

According to the PMA division resulting from the MSPPSA, the offshore part of the BP OWF CI, both in the APV and RAV, is located in the following sea areas and sub-areas [Figure 3.18]:

1) sea area POM.46.E;

2) sea area POM.16.Pw, including:

   a. sub-area 16.201.I;

3) sea area POM.34.T, including:

   a. sub-area 34.926.B;

4) sea area POM.54.T, including:

   a. sub-area 54.926.B;

   b. sub-area 54.201.I;

5) sea area POM.41a.P, including:

   a. sub-area 41a.201.I;

   b. sub-area 41a.926.B;

6) sea area POM.40a.C, including:

   a. sub-area 40a.201.I;

   b. sub-area 40a.712.R.

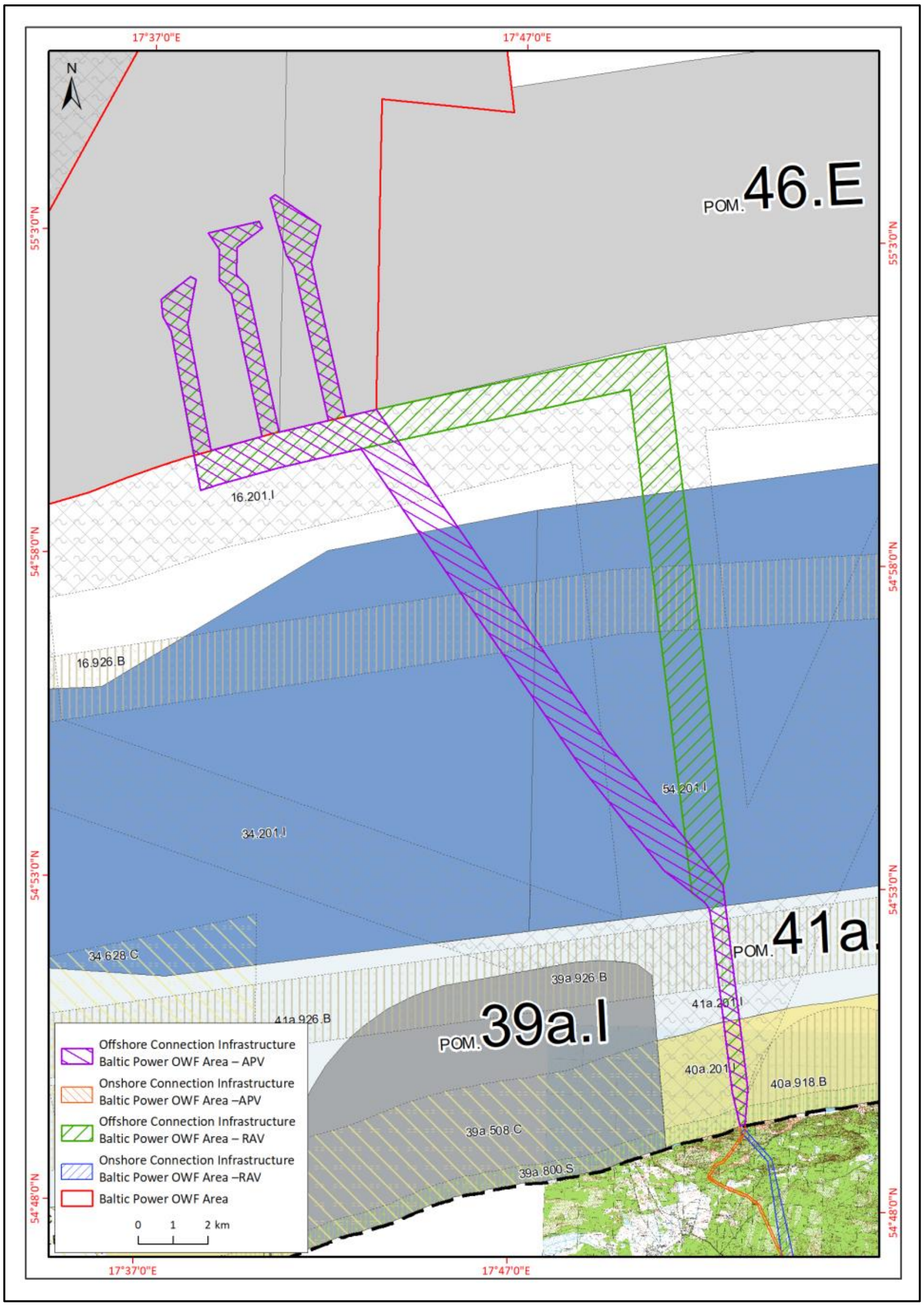

Figure 3.18. Location of the Baltic Power OWF Connection Infrastructure (in the APV and RAV) in relation to the sea areas and sub-areas designated in the Maritime Spatial Plan of Polish Sea Areas [Source: internal materials based on the drawing of MSPPSA]

Pursuant to par. 1, section 3, point 5 of Annex No. 1 to the MSPPSA, entitled "General considerations," the planned project has been classified as "technical infrastructure," i.e.

"function: technical infrastructure – means:

a) the possibility of locating telecommunications cables, substation infrastructure as well as laying and maintaining power cables, including internal and external connection infrastructure for offshore wind farms, (…)"

The following is a characterisation of the sea areas and sub-areas in the context of allowing the construction and operation of connection infrastructure within their boundaries.

POM.46.E sea area

Primary function: generation of renewable energy.

Permitted functions: aquaculture; scientific research; cultural heritage; technical infrastructure; exploration, prospecting and extraction of minerals from deposits; fisheries; artificial islands and structures; transport, tourism, sport and recreation.

Provisions pertaining to the location of technical infrastructure within the sea area:

"Within the entire sea area:

- *the implementation of the function is limited to:*
    - *the infrastructure essential for the implementation of the function of energy acquisition,*
    - *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 surface of the seabed, and if this is impossible due to environmental or technological constraints, other permanent safeguards should be applied to allow the safe use of anchored set nets."*

POM.16.Pw sea area

Primary function: reserve for future development with permission for extraction.

Permitted functions: aquaculture; scientific research; cultural heritage; technical infrastructure; defence and national security; exploration, prospecting and extraction of minerals from deposits; fisheries; artificial islands and structures; transport, tourism, sport and recreation.

Provisions pertaining to the location of technical infrastructure within the sea area:

- *"the implementation of the function is limited to the following methods which do not endanger navigational safety;*
- *the new linear elements of technical infrastructure are required to be laid under the seabed surface, and if it is impossible due to environmental or technological constraints, other permanent safeguards should be used to ensure navigational safety;*

*The sub-area **16.201.I** is designated for laying and maintenance of the linear elements of technical infrastructure – external connection infrastructure for offshore wind farms, including the planned DC connection between Poland and Lithuania."*

POM.34.T sea area

Primary function: transport

Permitted functions: scientific research; cultural heritage; technical infrastructure; seashore protection, defence and national security; exploration, prospecting and extraction of minerals from deposits; fisheries; tourism, sport and recreation.

Provisions pertaining to the location of technical infrastructure within the sea area:

"Within the entire sea area:

- *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;*
- *the new linear elements of technical infrastructure are required to be laid under the seabed surface, and if it is impossible due to environmental or technological constraints, other permanent safeguards should be used to ensure navigational safety;*

*The sub-area 34.923.B is designated as the training grounds P-22 and P-23 and the sub-area **34.926.B** as the fairways of the Polish Navy (0023, 0024, 0026, 0304, 0305)."*

POM.54.T sea area

Primary function: transport

Permitted functions: scientific research; cultural heritage; technical infrastructure; seashore protection, defence and national security; exploration, prospecting and extraction of minerals from deposits; fisheries; tourism, sport and recreation.

Provisions pertaining to the location of technical infrastructure within the sea area:

"Within the entire sea area:

- *the implementation of the function is limited to the following 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;*
- *the new linear elements of technical infrastructure are required to be laid under the seabed surface, and if it is impossible due to environmental or technological constraints, other permanent safeguards should be used to ensure navigational safety;*
- *it is forbidden to lay the linear elements of the technical infrastructure referred to in Annex 1, § 5 sec. 2 (i.e. Unless detailed decisions provide otherwise, the implementation of the remaining linear elements, other than those mentioned in section 1, is required to be carried out in the infrastructural corridors referred to in § 11 section 1 items 1–3, 5–7 and 9, with the exception of the situations where it is impossible for environmental, technological, economic or national security reasons), outside the designated sub-areas **54.201.I**, 54.202.I and 54.203.I, with the exception of the DC connection between Poland and Lithuania.*

*The sub-area 54.923.B is designated as the training grounds P-14, P-15, P-16 and P-18, and the sub-area **54.926.B** as the fairways of the Polish Navy (0301, 0302, 0303, 0304). The change of the existing state of development of the sea area requires obtaining the opinion of the minister responsible for national defence. During the activities carried out by the Polish Armed Forces, the implementation of other functions in sub-areas may be precluded;*

*The sub-area **54.201.I** is designated for laying and maintenance of the linear elements of technical infrastructure – including external connection infrastructure for offshore wind farms and the planned DC connection between Poland and Lithuania."*

POM.41a.P sea area

Primary function: reserve for future development.

Permitted functions: scientific research; cultural heritage; technical infrastructure; defence and national security; seashore protection; exploration, prospecting and extraction of minerals from deposits; fisheries; transport; tourism, sport and recreation.

Provisions pertaining to the location of technical infrastructure within the sea area:

"Within the entire sea area:

- *the implementation of the function is limited to the following methods which:*
  - *do not endanger navigational safety,*
  - *do not endanger the ecological function of spawning grounds and the survival of the early development stages (eggs and larvae) of commercial fish species,*
  - *do not have a significant negative influence on the welfare of birds wintering and resting during migration or in the period of their numerous occurrence from the beginning of November to the end of April.*
- *the new linear elements of technical infrastructure are required to be laid under the seabed surface, and if it is impossible due to environmental or technological constraints, other permanent safeguards should be used to ensure navigational safety;*

*The sub-area **41a.201.I** is designated for the laying and maintenance of the linear elements of technical infrastructure – external connection infrastructure for offshore wind farms and the planned DC connection between Poland and Lithuania;*

*The sub-area 41a.923.B is designated as the training ground P-15, while the sub area 41a.924.B is designated as the anchorages K-6 and K-7 and the sub-area **41a.926.B** as the fairways of the Polish Navy (0205, 0206). The change of their existing state of development must be agreed with the minister responsible for national defence. During the activities carried out by the Polish Armed Forces, the implementation of other functions in sub-areas may be precluded."*

POM.40a.C sea area

Primary function: seashore protection.

Permitted functions: scientific research; cultural heritage; a port or harbour operation; technical infrastructure; defence and national security; exploration, prospecting and extraction of minerals from deposits; fisheries; artificial islands and structures; transport, tourism, sport and recreation.

Provisions pertaining to the location of technical infrastructure within the sea area:

"Within the entire sea area:

- *the implementation of the function is limited to the following 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,*
  - *do not have a significant negative influence on the welfare of birds wintering and resting during migration or in the period of their numerous occurrence from the beginning of November to the end of April;*
- *the new linear elements of technical infrastructure are required to be laid:*
  - *perpendicularly to the shoreline, if possible,*
  - *under the seabed surface, and if it is impossible due to environmental or technological constraints, other permanent safeguards should be used to ensure navigational safety,*

  - *minimum 3 m below the mean depth of the bottom of depressions between the sandbanks;*
- *it is forbidden to cross the linear elements of technical infrastructure unless it is impossible due to technological constraints.*

*The sub-area **40a.201.I** is designated for laying and maintenance of the linear elements of technical infrastructure – external connection infrastructure for offshore wind farms and the planned DC connection between Poland and Lithuania;*

*The sub-areas **40a.712.R** (Piaśnica River estuary) and 40a.713.R (Czarna Woda watercourse estuary) are designated to protect the two-way migration of fish."*

From among the forms of use of the sea space in the area of the BP OWF CI, shipping and fishing will be those that will be under the potentially strongest impact from the planned project.

3.9.1 Navigation

The BP OWF CI area is located in the maritime area, which is intensively used for shipping [Figure 3.19]. In the section from the boundary of the territorial sea up to a distance of about 10 km from the shore, it crosses one of the most important in the Baltic Sea, the customary transport route, leading, among other, to the seaports in Gdynia and Gdańsk. The Maritime Spatial Plan of Polish Sea Areas takes into account the importance of this route, designating for it the sea areas with T category, in which the main function is transport (part of the planned project is located in the area marked as POM.54.T). The traffic of vessels in the sea area analysed is partly channelled by the areas of the VTS *Ławica Słupska* and VTS *Zatoka Gdańska* vessel traffic control services lying to the east and west. In addition to transport vessels in the BP OWF CI area, also other vessels such as fishing vessels which conduct catches in this sea area or sail to other fisheries, and small recreational units (e.g. sailing yachts) appear there.

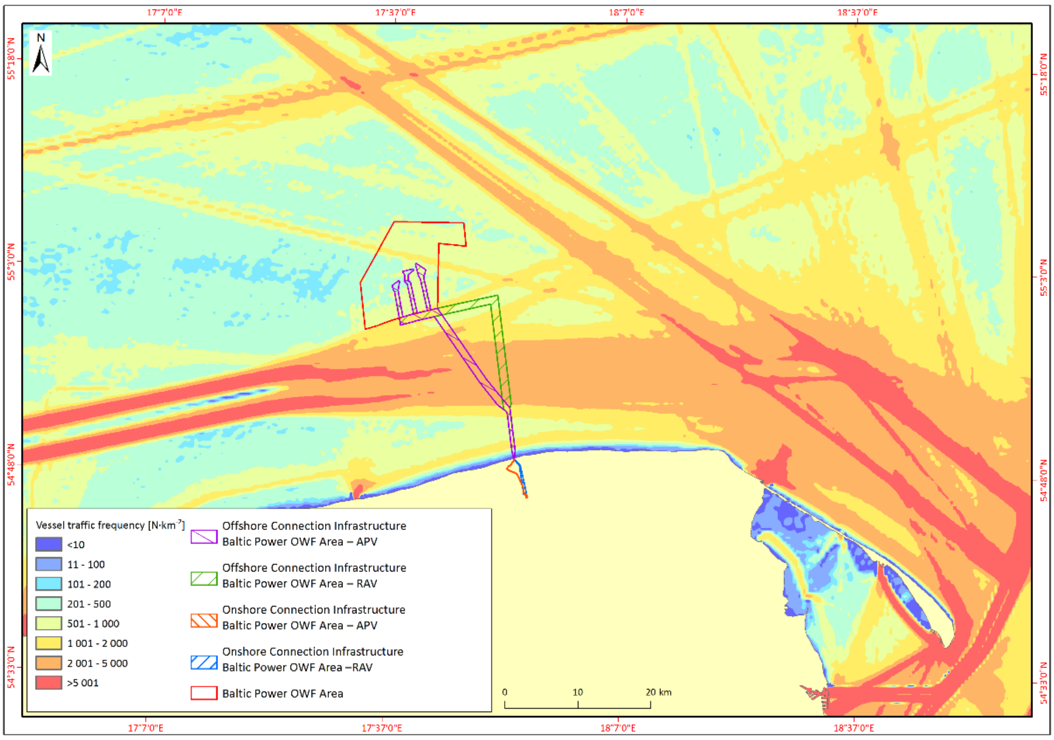

Figure 3.19. Location of the Baltic Power OWF Connection Infrastructure (in the APV and RAV) in relation to the shipping intensity in the Southern Baltic [Source: internal materials based on the data from HELCOM Map and Data Service]

3.9.2 Fishery

Surveys of fishing activity were conducted, including the volume and value of catches as well as the amount of fishing effort in the BP OWF CI area, taking into account the two variants of the connection route [Figure 3.20].

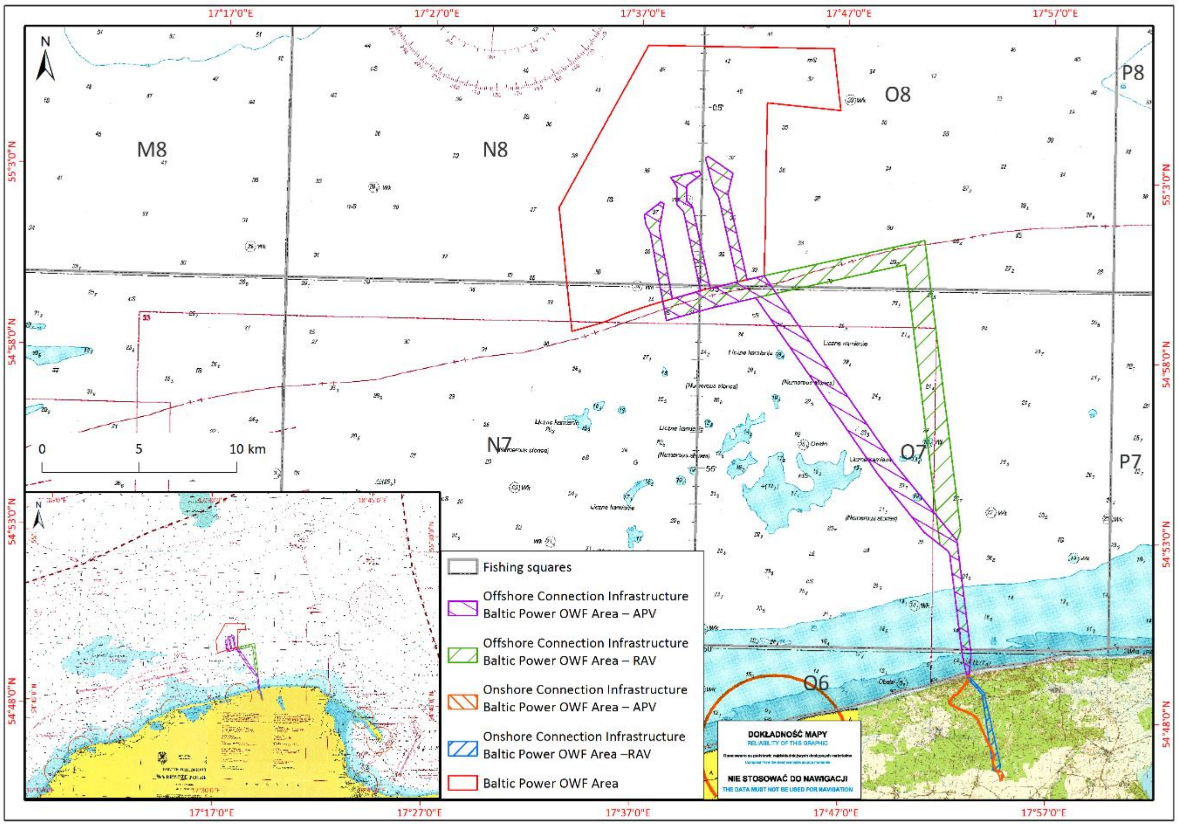

Figure 3.20. Location of the Baltic Power OWF Connection Infrastructure area against the background of statistical rectangles [Source: internal materials]

The analysis of the BP OWF CI impact on fisheries was conducted using the data on the volume and value of catches as well as fishing effort (catch days and number of fishing vessels) collected within the National Programme for Fisheries Data Collection (Polish: NPZDR) based on source information from fishing vessel catch reports including: location of catch (statistical rectangle or geographical position), fish species, month of catch and vessel type (vessels up to 12 m and over 12 m). The criterion of 12 m was adopted for the purpose of differentiating between the vessels which can be classified as small-scale coastal fishing vessel (<12 m) in accordance with the provisions of the Council Regulation (EC) No. 508/2014.

The data from the catch reports may differ from the landing (final) data; however, adopting them as a basis was necessary for preparing information on the geographical distribution of the fishing activity. Any possible differences are insignificant and do not affect the conclusions reached. The analysis includes a review of the catch data from the years 2016−2020. The value of catches was estimated on the basis of the average annual prices of the first sale of individual species of fish and the volume of catches.

Since more detailed data on the catches of the fishing fleet are available for the statistical rectangle areas (surface area of approx. 400 km^2) that do not coincide with the BP OWF CI area, the following was taken into consideration to determine, with the greatest possible accuracy, the impact of the project on the fisheries within the area of the transmission infrastructure itself:

- for fishing vessels exceeding 12 m in length, equipped with a Vessel Monitoring System (VMS), the daily catch volume was assigned to a particular statistical rectangle or the OWF area on the basis of the proportion of the number of vessel position reports provided within a particular statistical rectangle or within the area of the OWF itself to the general number of VMS reports within a day;

- for fishing boats below 12 m in length, for which the VMS data are not available, information on the catches in the area of the Baltic rectangle were used, whereas the estimation of the catch volume in the BP OWF CI area was carried out taking into consideration the relative share of their location area compared to the total surface area of the statistical rectangle. With this simplification, the possible diversification of the catch volumes within a particular statistical rectangle (for example, due to the differences in depth or type of seabed) is omitted; however, it is the only one possible enabling more precise reference to the location of the fish caught.

Both variants of the BP OWF CI route are located within the area of five statistical rectangles: O6, N7, O7, N8, O8 [Table 3.11].

Table 3.11. Surface of the Baltic Power OWF Connection Infrastructure area (catch volumes of vessels up to 12 m in length were used in the calculations for the OWF area) [Source: internal materials]

Statistical rectangle	Statistical rectangle surface occupied by the BP OWF CI	
	RAV [%]	APV [%]
O6	0.82	0.82
N7	0.58	0.58
O7	5.33	5.45
N8	1.32	1.32
O6	3.72	1.29
Total	**2.68**	**2.12**

3.9.2.1 Volume and value of fish catches

The average volume of fish catches in the area of the five rectangles analysed amounted to approx. 181 tonnes in 2016–2020, which constituted only 0.1% of the total volume of the Polish Baltic catches by the Polish fishery sector in those years [Table 3.12]. The mean value of catches amounted to approx. PLN 718 thousand, which accounted for 0.4% of the total value of landings from Polish catches in the Baltic Sea [Table 3.13].

In the years 2016–2020, the estimated volume of catches (calculated on the basis of the proportion of the surface area covered by the OWF in each statistical rectangle – for vessels with a length of <12 m, and on the basis of detailed VMS data – for vessels with a length of ≥12 m) narrowed down to the BP OWF CI area averaged only 2.4 t with a value of PLN 14.1 thousand in the APV, and 1.9 t worth PLN 9.9 thousand in the RAV [Table 3.14, Table 3.15].

The highest productivity was recorded in the area of rectangle O6 – nearly 500 kg with a value of approx. PLN 2.8 thousand. Nevertheless, of the 123 Baltic squares situated in the PMA (partially or entirely), the O6 square occupied a distant 88th position in terms of catch volume per km^2 of the surface area.

The average share of fish caught in the years 2016–2020 within the statistical rectangles located in the area of the planned project in relation to the total Polish catches in the Baltic Sea was negligible and equalled 0.1%, while for the surface area of the BP OWF CI itself it was close to zero (0.002% in the RAV or 0.001% in the APV).

The following tables [Table 3.12, Table 3.13, Table 3.14, Table 3.15] provide data on the relative significance of the area of the statistical rectangles which are to be partially occupied by the BP OWF CI as fishing grounds for fishing vessels located in various ports. The importance of the area of the planned project for fisheries is noticeable only at the level of the statistical rectangles for vessels registered in Łeba. The share of catches in the five rectangles analysed in relation to the average catches by vessels from Łeba, in the period between 2016 and 2020, was 2.9 and 7.3% in terms of quantity and value, respectively. The value of the indicator limited to the surface area of the connections alone is only 0.1 and 0.2%.

Table 3.12. The average volume of catches [t] in the statistical rectangles N7, N8, O6, O7, O8 in 2016−2020 in relation to the total Polish catches in the Baltic Sea, divided into registration ports – Rational Alternative Variant (RAV) [Source: internal materials]

Port	N7, N8, O6, O7, O8			BP OWF CI			Baltic Sea total	In the statistical rectangles [%]	In the BP OWF CI area [%]
	<12m	>12m	Total	<12m	>12m	Total			
Łeba	31.8	49.8	81.6	0.3	1.5	1.7	2837.4	2.9	0.1
Władysławowo	0.0	52.8	52.8	0.0	0.0	0.0	41 398.7	0.1	0.0
Ustka	11.3	11.5	22.8	0.2	0.2	0.4	16 531.6	0.1	0.0
Dziwnów	16.9	0.0	16.9	0.1	0.0	0.1	6086.2	0.3	0.0
Hel	0.5	0.0	0.5	0.0	0.0	0.0	12 273.6	0.0	0.0
Kołobrzeg	3.3	0.0	3.3	0.1	0.0	0.1	39 590.7	0.0	0.0
Świnoujście	0.0	0.2	0.2	0.0	0.0	0.0	3739.3	0.0	0.0
Other	2.0	0.6	2.6	0.1	0.0	0.1	18 947.3	0.0	0.0
Total	**65.8**	**114.9**	**180.7**	**0.7**	**1.7**	**2.4**	**141 404.8**	**0.1**	**0.002**

Table 3.13. Monthly value of catches [PLN thousand] in the statistical rectangles N7, N8, O6, O7, O8 in 2016−2020 in relation to the total Polish catches in the Baltic Sea, divided into registration ports – Rational Alternative Variant (RAV) [Source: internal materials]

Port	N7, N8, O6, O7, O8			BP OWF CI			Baltic Sea total	In the statistical rectangles [%]	In the BP OWF CI area [%]
	<12m	>12m	Total	<12m	>12m	Total			
Łeba	124.2	198.3	322.5	1.3	6.6	7.9	4423.9	7.3	0.2
Władysławowo	0.0	73.3	73.3	0.0	0.0	0.0	43 654.4	0.2	0.0
Ustka	100.5	129.2	229.6	1.8	3.4	5.2	24 965.9	0.9	0.0
Dziwnów	65.0	0.0	65.0	0.4	0.0	0.4	9213.7	0.7	0.0
Hel	2.3	0.0	2.3	0.1	0.0	0.1	11 612.9	0.0	0.0
Kołobrzeg	8.4	0.0	8.4	0.2	0.0	0.2	49 865.3	0.0	0.0
Świnoujście	0.0	0.9	0.9	0.0	0.0	0.0	6446.0	0.0	0.0
Other	11.4	5.0	16.4	0.3	0.0	0.3	44 879.3	0.0	0.0
Total	**311.6**	**406.7**	**718.3**	**4.2**	**9.9**	**14.1**	**195 061.2**	**0.4**	**0.01**

Table 3.14. The average volume of catches [t] in the statistical rectangles N7, N8, O6, O7 and O8 in 2016−2020 in relation to the total Polish catches in the Baltic Sea, divided into registration ports – Applicant Proposed Variant (APV) [Source: internal materials]

Port	N7, N8, O6, O7, O8			BP OWF CI			Baltic Sea total	In the statistical rectangles [%]	In the BP OWF CI area [%]
	<12m	>12m	Total	<12m	>12m	Total			
Łeba	31.8	49.8	81.6	0.3	1.2	1.4	2837.4	2.9	0.1
Władysławowo	0.0	52.8	52.8	0.0	0.0	0.0	41 398.7	0.1	0.0
Ustka	11.3	11.5	22.8	0.1	0.0	0.2	16 531.6	0.1	0.0
Dziwnów	16.9	0.0	16.9	0.1	0.0	0.1	6086.2	0.3	0.0
Hel	0.5	0.0	0.5	0.0	0.0	0.0	12 273.6	0.0	0.0
Kołobrzeg	3.3	0.0	3.3	0.1	0.0	0.1	39 590.7	0.0	0.0
Świnoujście	0.0	0.2	0.2	0.0	0.0	0.0	3739.3	0.0	0.0
Other	2.0	0.6	2.6	0.1	0.0	0.1	18 947.3	0.0	0.0
Total	**65.8**	**114.9**	**180.7**	**0.6**	**1.2**	**1.9**	**141 404.8**	**0.1**	**0.001**

Table 3.15. Monthly value of catches [PLN thousand] in the statistical rectangles N7, N8, O6, O7 and O8 in 2016–2020 in relation to the total Polish catches in the Baltic Sea, divided into registration ports – Applicant Proposed Variant (APV) [Source: internal materials]

Port	N7, N8, O6, O7, O8			BP OWF CI			Baltic Sea total	In the statistical rectangles [%]	In the BP OWF CI area [%]
	<12m	>12m	Total	<12m	>12m	Total			
Łeba	124.2	198.3	322.5	1.3	5.1	6.4	4423.9	7.3	0.1
Władysławowo	0.0	73.3	73.3	0.0	0.0	0.0	43 654.4	0.2	0.0
Ustka	100.5	129.2	229.6	1.2	1.4	2.5	24 965.9	0.9	0.0
Dziwnów	65.0	0.0	65.0	0.4	0.0	0.4	9213.7	0.7	0.0
Hel	2.3	0.0	2.3	0.0	0.0	0.0	11 612.9	0.0	0.0
Kołobrzeg	8.4	0.0	8.4	0.2	0.0	0.2	49 865.3	0.0	0.0
Świnoujście	0.0	0.9	0.9	0.0	0.0	0.0	6446.0	0.0	0.0
Other	11.4	5.0	16.4	0.3	0.0	0.3	44 879.3	0.0	0.0
Total	**311.6**	**406.7**	**718.3**	**3.4**	**6.4**	**9.9**	**195 061.2**	**0.4**	**0.01**

The volume and value of fish catches in the various statistical rectangles to be crossed by the transmission cables varies but a similar trend of declining catches is evident in all rectangles. The pattern observed was the result of the deteriorating state of cod stocks, particularly evident in the coastal zone.

The main fish species caught within the five rectangles analysed in the years 2016–2020 were cod and sprat, corresponding to 33% and 30% of the total catch volume, as well as 42% and 11% of the value of fish caught, respectively [Figure 3.21]. The remaining share was constituted by other fish, among which salmonids, turbots and herring prevailed.

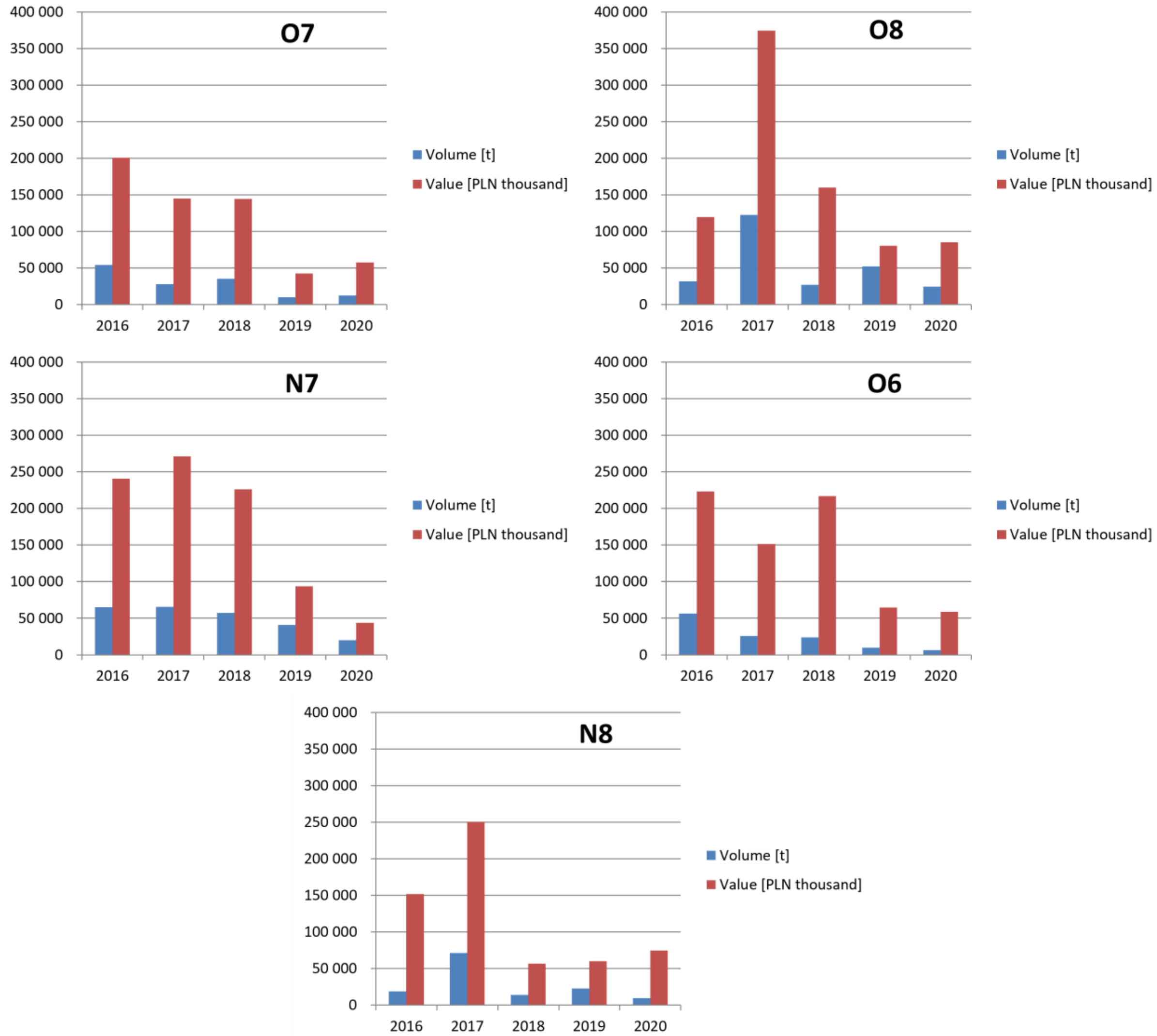

Figure 3.21. Volume [t] and value [PLN thousand] of fish catches in the statistical rectangles: N7, N8, O6, O7 and O8 [Source: internal materials]

Table 3.16. Volume [t] and value [PLN thousand] of fish catches in the statistical rectangles: N7, N8, O6, O7 and O8 in 2016–2020, by the most important species [Source: internal materials]

Species	**Catch parameter**	**Year**				
		2016	**2017**	**2018**	**2019**	**2020**
Cod *Gadus morhua*	Volume [t]	118.6	89.7	61.5	23.8	7.4
	Value [in PLN thousand]	569.9	446.2	311.2	123.1	50.7
Sea trout/salmon *Salmo trutta m. trutta /Salmo salar*	Volume [t]	4.5	8.8	10.0	1.6	5.5
	Value [in PLN thousand]	124.3	314.4	300.3	50.6	166.4
Flounder *Platichthys flesus*	Volume [t]	70.4	56.1	66.3	43.1	36.7
	Value [in PLN thousand]	94.2	91.7	107.4	63.7	49.9
Turbot *Scophthalmus maximus*	Volume [t]	14.8	149.3	10.5	57.7	20.4
	Value [in PLN thousand]	20.6	207.5	11.6	71.2	25.7
Herring *Clupea harengus*	Volume [t]	5.1	5.9	2.8	1.2	0.8
	Value [in PLN thousand]	97.2	116.9	56.3	21.3	15.4
Other	Volume [t]	12.2	2.8	6.4	7.6	2.1

Species	Catch parameter	Year				
		2016	2017	2018	2019	2020
	Value [in PLN thousand]	29.7	15.0	17.2	11.1	10.8
Total: volume [t]		**225.5**	**312.6**	**157.5**	**135.1**	**72.9**
Total value [in thousands of PLN]		**935.9**	**1191.6**	**804.1**	**341.1**	**318.9**

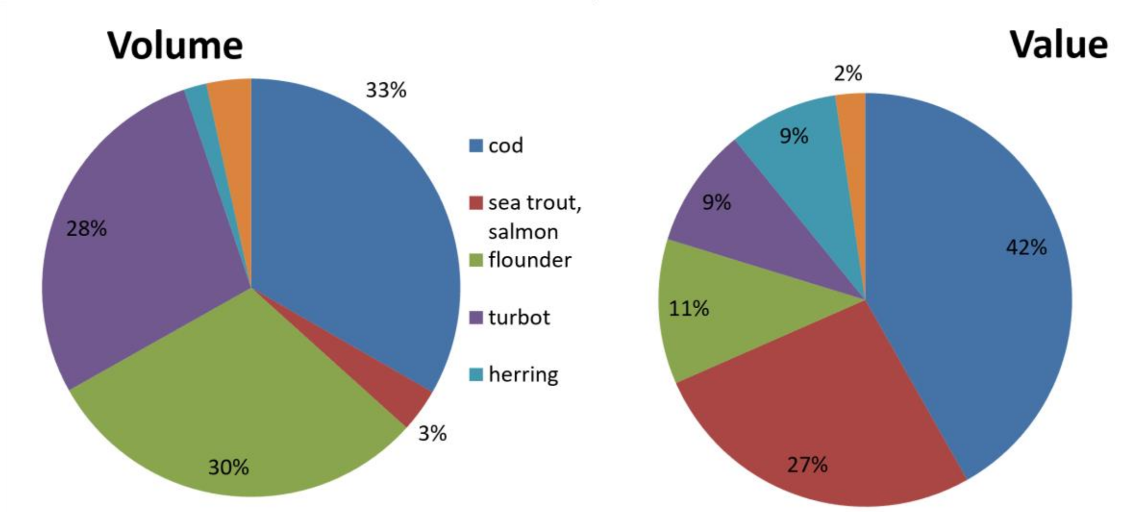

Figure 3.22. Species structure in the catches in the O8 and P8 statistical rectangles N7, N8, O6, O7 and O8 in 2016–2020, [Source: internal materials]

In the period under analysis, except for 2018, the vast majority of catches, both in terms of quantity and value, were made by fishing vessels longer than 12 m LOA [Table 3.17]. This was due both to the prevalence of large vessels as well as their higher fishing capacity. In the years 2016–2020, the mean share in the volume and value of catches of this vessel group was 64% and 57%, respectively.

Table 3.17. Volume [t] and value [PLN] of catches in the statistical rectangles: N7, N8, O6, O7 and O8 in 2016–2020, by vessel length [Source: internal materials]

Catch parameter	Vessel length [m]	2016	2017	2018	2019	2020
Tonnes	0-11.9	87.4	88.5	85.5	54.3	13.6
	12 and more	138.2	224.1	72	80.8	59.3
PLN	0-11.9	337.7	409.2	557.4	188.7	65
	12 and more	598.1	782.3	246.7	152.4	253.9
Total volume [t]		**225.5**	**312.6**	**157.5**	**135.1**	**72.9**
Total value [PLN]		**935.9**	**1191.6**	**804.1**	**341.1**	**318.9**

The decline in catches observed in 2018 and beyond, especially in the group of vessels over 12 m, was related to the deteriorating condition of cod stocks (which also occurred in other areas of the Baltic Sea). Lower catches also resulted from lower flounder catches, which was a side effect of the restrictions on targeted cod fishing, introduced in mid-2019 and continued in 2020 (which also negatively affected flatfish catches).

The calculation results for catch volumes in the respective statistical rectangles and values of catches conducted in the BP OWF CI area are presented in Table 3.18 and Table 3.19. In 2020, the estimated value of fish caught, narrowed down to the area to be occupied by the BP OWF CI, amounted to

PLN 0.5 thousand for the RAV and PLN 6 thousand for the APV. The average value of catches in the years analysed amounted to PLN 14.1 thousand and PLN 9.9 thousand for the RAV and APV, respectively.

Table 3.18. Value of catches [PLN thousand] in the statistical rectangles: N7, N8, O6, O7 and O8 in 2016–2020 [Source: internal materials]

Vessel length	Statistical rectangle	Years				
		2016	**2017**	**2018**	**2019**	**2020**
<12 m	N7	104.5	158.1	150.2	73.4	19.5
	N8	36.5	76.5	44.4	34.4	1.8
	O6	187.7	133.3	198.5	60.9	42.7
	O7	6.4	7.0	53.0	18.5	1.0
	O8	2.6	34.3	111.3	1.5	-
<12 m total		**337.7**	**409.2**	**557.4**	**188.7**	**65.0**
>12 m	N7	136.1	113.0	76.2	20.2	23.9
	N8	115.4	173.5	12.2	25.5	72.5
	O6	35.5	18.0	18.6	3.8	16.1
	O7	194.4	137.8	91.2	24.1	56.3
	O8	116.7	340.1	48.6	78.7	85.1
≥12 m total		**598.1**	**782.3**	**246.7**	**152.4**	**253.9**
Total		**935.9**	**1191.6**	**804.1**	**341.1**	**318.9**

Table 3.19. Value of catches [PLN thousand] in the statistical rectangles: N7, N8, O6, O7, O8 in 2016–2020, in the Baltic Power OWF Connection Infrastructure area [Source: internal materials]

Vessel length	Statistical rectangle	RAV					APV				
		2016	**2017**	**2018**	**2019**	**2020**	**2016**	**2017**	**2018**	**2019**	**2020**
<12 m	N7	0.6	0.9	0.9	0.4	0.1	0.6	0.9	0.9	0.4	0.1
	N8	0.5	1.0	0.6	0.5	0.0	0.5	1.0	0.6	0.5	0.0
	O6	1.5	1.1	1.6	0.5	0.4	1.5	1.1	1.6	0.5	0.4
	O7	0.3	0.4	2.8	1.0	0.1	0.3	0.4	2.9	1.0	0.1
	O8	0.1	1.3	4.1	0.1		0.0	0.4	1.4	0.0	-
<12 m total		**3.1**	**4.7**	**10.1**	**2.4**	**0.5**	**3.0**	**3.8**	**7.4**	**2.4**	**0.5**
>12 m	N7	0.0	2.3	0.0	0.2	0.0	0.0	2.3	0.0	0.2	0.0
	N8	1.3	1.0	0.0	0.7	0.0	1.3	1.0	0.0	0.7	0.0
	O6	0.1	0.0	0.0	0.0	0.9	0.1	0.0	0.0	0.0	0.9
	O7	10.3	9.9	2.4	0.9	2.7	4.8	13.8	1.5	1.2	1.3
	O8	6.6	5.8	2.0	0.2	2.5	1.8	1.0	0.1	0.0	0.0
>12 m total		**18.3**	**19.0**	**4.4**	**1.9**	**6.0**	**8.0**	**18.2**	**1.6**	**2.1**	**2.2**
Total		**21.4**	**23.7**	**14.5**	**4.4**	**6.6**	**11.0**	**22.0**	**9.0**	**4.5**	**2.8**

The analysis of monthly variability of fish catches in the area of the five rectangles analysed does not reveal any evident regularities. The catch volumes could vary considerably from one year to another for the same months. The only noticeable regularity in all the years analysed consists in the relatively lower catches in the summer, which can be related to the cod protection period in force during these months (from 1 July to 31 August) in line with the Regulation of the Maritime Economy and Inland Navigation of 16 September 2016 on the protected dimensions and protection periods of marine organisms and detailed conditions for commercial fishing (Journal of Laws of 2016, item 1494) [Figure 3.23].

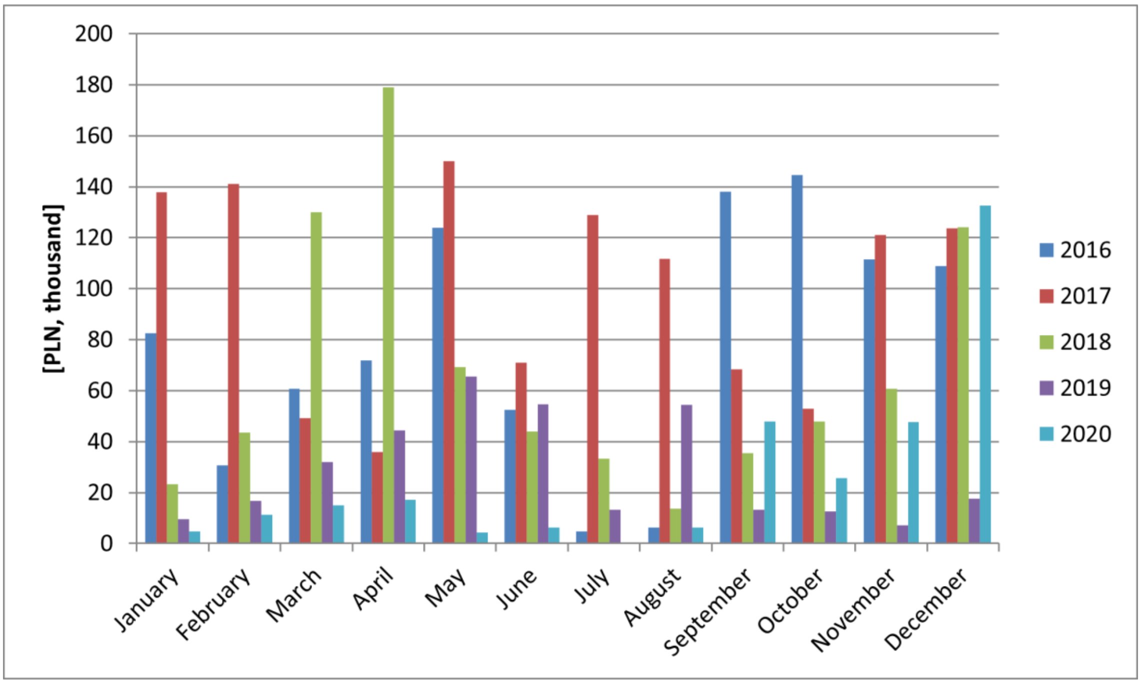

Figure 3.23. Monthly value [PLN thousand] of fish catches in the area of the N7, N8, O6, O7 and O8 rectangles in 2016–2020 [Source: internal materials]

In the catches conducted in the BP OWF CI area analysed, in the years 2016–2020, mostly anchored set gear (gillnets and longlines) was used, followed by pelagic trawls and demersal trawls. The share of fixed gear (mainly cod nets) was approx. 64% in total catches from the area of the 5 rectangles analysed. By contrast, the share of demersal trawl catches was 9%.

As shown in Figure 3.24, the use of fixed gear in the area of the rectangles to be crossed by the BP OWF CI route fluctuated in 2016−2020, similarly to other types of fishing gear. The variability in the share of pelagic trawls should be considered as largely random, depending on the activity of individual fishing vessels in the area analysed.

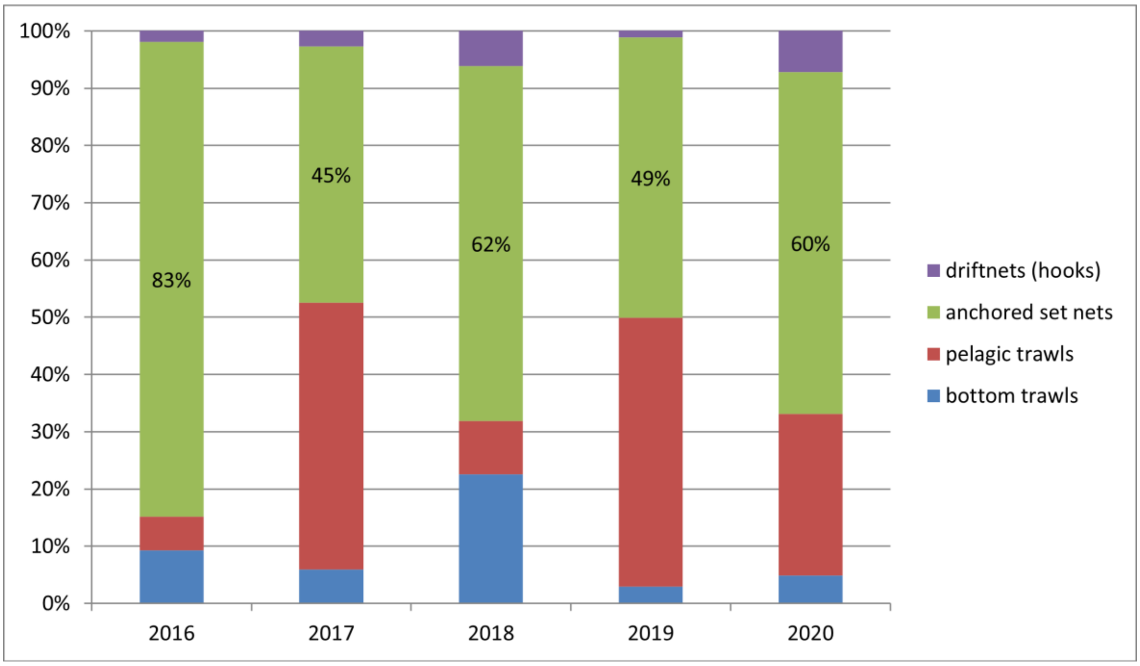

Figure 3.24. The share of individual types of fishing gear in the catches in the area of statistical rectangles N7, N8, O6, O7 and O8 in 2016–2020 [Source: internal materials]

3.9.2.2 Fishing effort

In 2016–2020, fish catches in the area of the N7, N8, O6, O7 and O8 statistical rectangles were carried out by 49, 60, 57, 45 and 37 vessels, respectively, compared to a total of 812, 797, 777, 786 and 799 Polish fishing vessels carrying out catches in the Baltic Sea. Fishing vessels with a length exceeding 12 m prevailed in terms of fishing effort, with an average share of approx. 63% in the entire period analysed; 34, 37, 30, 28, 27 vessels, respectively, in the years 2016–2020.

In the years 2016–2020, the total fishing effort (measured by the number of fishing days) in the area of the 5 rectangles ranged from 533 days (2016) to 206 days (2020) [Figure 3.25].

Fishing effort was mainly concentrated in rectangle O8 (with a total of 542 days in 2016–2020) followed by O7 (458 days) and N7 (441 days).

The relative significance of the area of the five rectangles analysed in the total fishing effort of the Polish fishing fleet conducting catches in 2020 in the Baltic Sea (36 thousand days) was negligible and amounted to 0.6%.

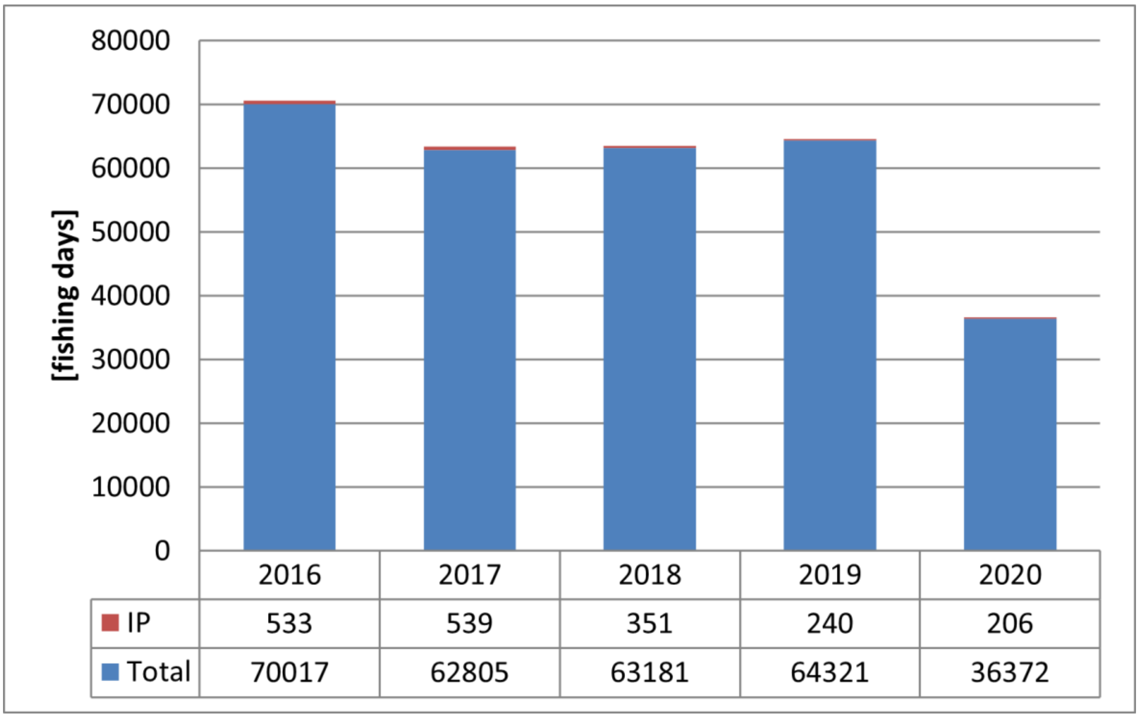

Figure 3.25. Number of fishing days in the area of statistical rectangles N7, N8, O6, O7, O8 and in the remaining fishing regions of the Baltic Sea, in 2016–2020 [Source: internal materials]

3.9.3 Other forms of development

The northern part of the BP OWF CI area is located within the area of the Baltic Power OWF with a capacity of 1200 MW, the construction of which is planned in the coming years.

In addition to shipping and fishing, the offshore Development Area of the BP OWF CI is also used sporadically for recreational purposes, e.g. yachting.

3.10 Landscape, including the cultural landscape

The BP OWF CI Development Area lies within the PMA, the Exclusive Economic Zone and the territorial sea and stretches from the shore up to the distance of approximately 29 km away from the shore. In the natural marine landscape of the sea area, commercial ships moving along the customary shipping route to and from the ports of Gdynia and Gdańsk, as well as other smaller vessels, e.g. recreational and fishing boats constitute the permanent structural element of anthropogenic origin. In the future, the northern part of the sea area will be developed with the wind turbines of the Baltic Power OWF. Also, there will be other OWFs in its region. The seashore in the cable landfall area is made of a sandy beach, several dozen meters wide.

3.11 Population and living conditions of people

The presence of people in the offshore Development Area of the BP OWF CI is only temporary, resulting from the current use of the basin (shipping). The BP OWF CI Development Area crosses at a distance of 10 km from the shore the customary shipping route to and from the ports of Gdynia and Gdańsk (see subsection 3.9.1). It is also located within five statistical rectangles: N7, N8, O6, O7 and O8, within which fishing activities are conducted (see subsection 3.9.2).

ONSHORE AREA

The characterisation of environmental conditions was carried out for both variants in the areas of their potential impact, covering areas of 250 m each from the external underground (APV) and overhead (RAV) cable lines.

The analysis of the relief character and contemporary changes within the Wydmy Lubiatowskie dunes, as well as of the contemporary shore changes required a wider view of the environmental conditions and was developed within the Wydmy Lubiatowskie dune boundaries.

3.12 Location, topography of the area

In administrative terms, the planned project in both variants is located in the north-eastern part of the Choczewo commune, Wejherowo district. The project is located in the Northern part of the Pomeranian Voivodeship [Figure 3.26].

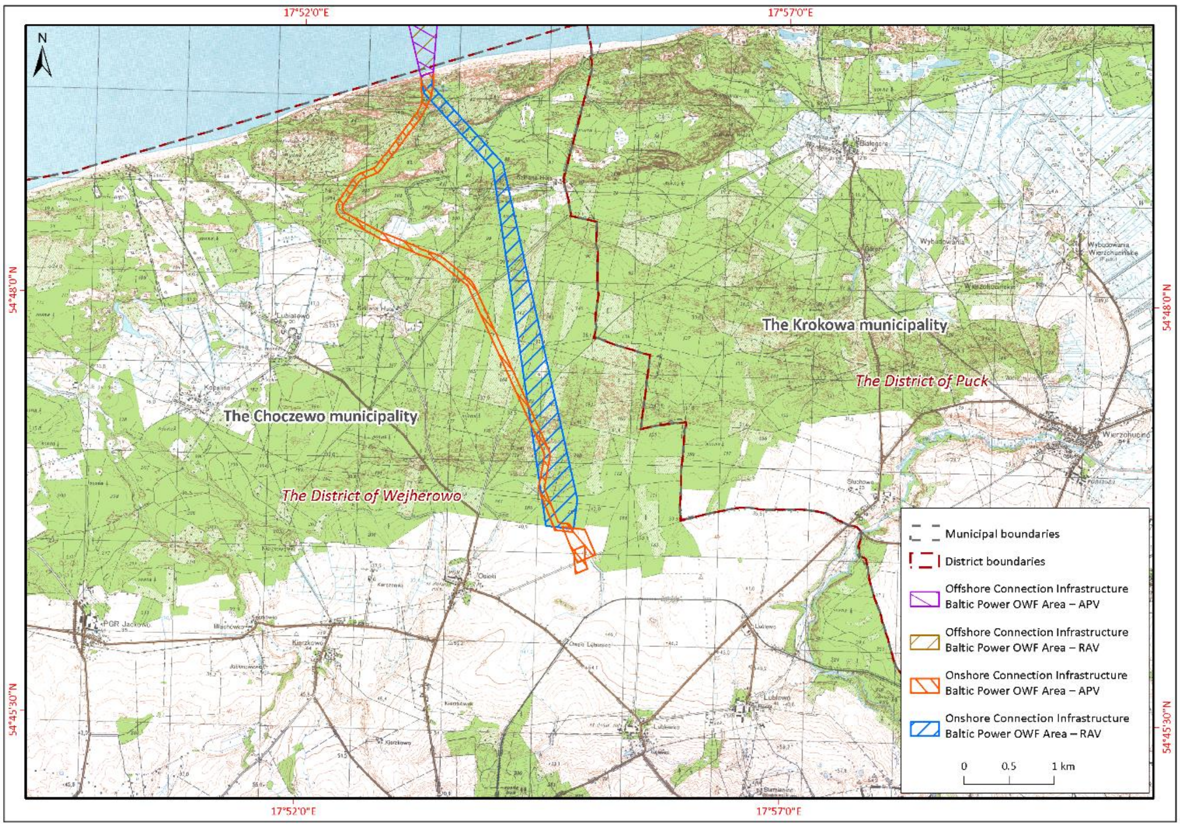

Figure 3.26. Administrative location of the planned project in both variants [Source: internal materials]

Pursuant to the Act of 21 March 1991 on the maritime areas of the Republic of Poland and maritime administration (Journal of Laws of 1991, No. 32, item 131 as amended), the planned project in both variants is located within the coastal strip [Figure 3.27], which includes:

- technical belt – which is a zone of direct interaction between sea and land. This area is intended for maintaining the coast in a condition compliant with the safety and environmental protection requirements;
- protective belt – covering the area where human activity has a direct impact on the condition of the technical belt.

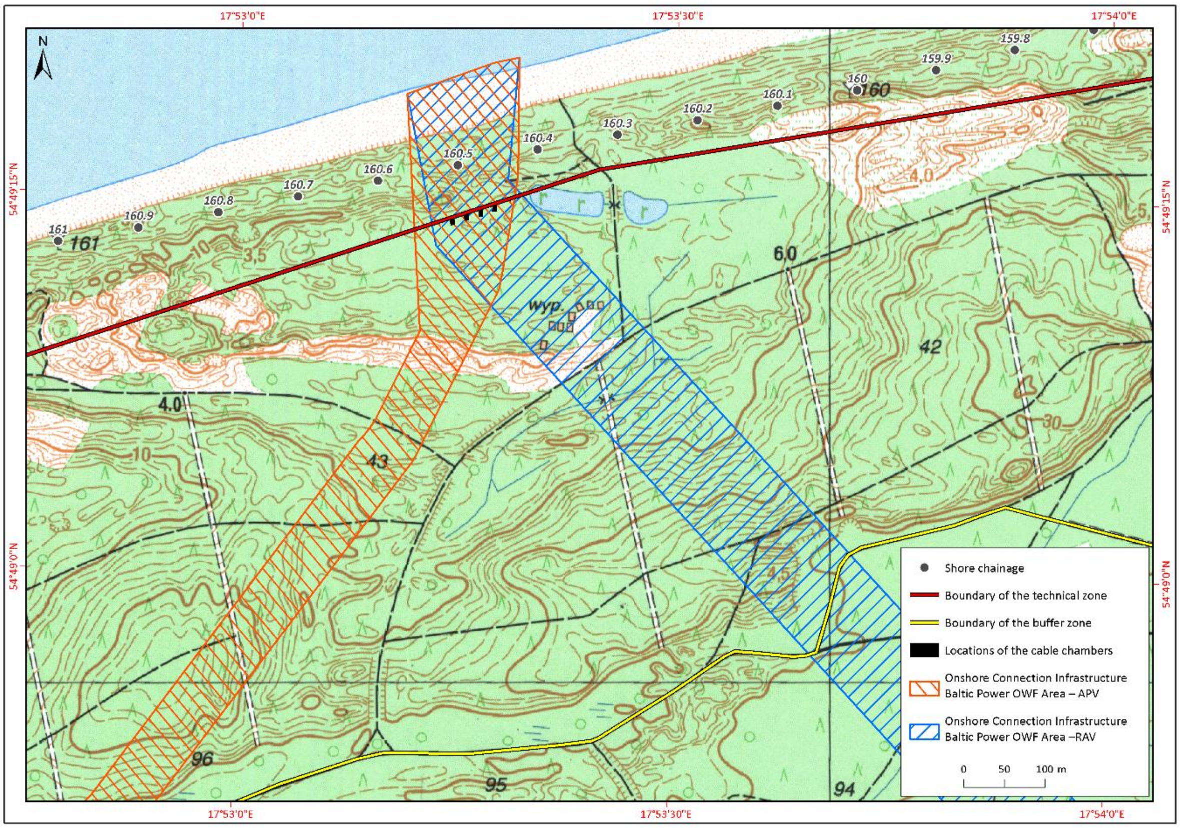

Figure 3.27. Position of the planned project in both variants against the coastal belt of the Maritime Office in Gdynia [Source: internal materials based on www.umgdy.gov.pl/]

The area of the planned project in both variants is located at the boundary between two mesoregions – the Słowińskie Coast and the Żarnowiecka Upland, constituting the Koszalin Coastland in accordance with the physical-geographic regionalisation [204].

The Słowińskie Coast is a narrow strip of land along the Baltic Sea coast, and its landscape includes: beach, dunes, coastal lakes and swamps as well as elements of post-glacial relief. This is a coastal valley of fluvial origin. It is made up of a series of accumulation and abrasive-accumulative terraces covered with dunes and re-deposited sand plains overgrown with pine forests. The forest complexes are divided by waterlogged meadows and peatlands. A characteristic natural geosystem can be found here, in which the terrestrial environment is affected by the sea (and vice versa), and the atmospheric processes play a major role here. This is manifested by sea and land breezes, warmer winters and cooler summer months than inland, a later spring and longer autumn. The wave movement which is the effect of wind activity, causes rapid shoreline changes, abrasion, bed load transport and accumulation.

The Żarnowiecka Upland constitutes a well-distinguished region, consisting of moraine formations, at an altitude of more than 100 MASL in places. There are several moraine mounds, divided by post-glacial furrows, partially filled with lakes (the biggest of them being Lake Żarnowieckie with a surface area of 14.32 km^2). In the upland area, agricultural lands with high quality class soils are dominant. Brown soils formed on till substratum as well as soils of organic origin accumulated mainly in the valleys prevail. Forests are mainly pine forests with admixtures of beech and birch.

The route of the planned project in both variants is characterised by considerable diversity in terms of terrain topography. In the location of cable landfall, at km 160.5 (according to the shoreline chainage of the Maritime Office), the beach has a width from approx. 30 to approx. 40 m. Directly at the back of the beach, there is a wide strip of spit, occupied by four dune forms of Wydmy Lubiatowskie, with a height of several to 35 MASL. In both variants, in the area of the planned project, there are mainly dune forms with a max. height of 23 MASL intersected by numerous lowerings and deflation monadnocks. At the back of the beach there is also a flat area of the upland foreground with a height of approx. 10 MASL. The Bezimienna stream valley is present there. Slightly further, an undulated moraine upland begins to form, the heights of which reach up to approx. 43.75 MASL in the area of the customer substation.

3.13 Geological structure, coastal zone, soils, and marine aggregates and deposits

3.13.1 Geological structure, geotechnical conditions

3.13.1.1 Sub-Quaternary formations

The planned project in both variants is located entirely within the Precambrian East-European platform within the boundaries of the Peribaltic Syneclise [336]. The Paleozoic sediment cover has a thickness of approx. 2500 m. The Mesozoic sediment cover with a thickness of approx. 400 m is deposited on it [114]. The Paleogene and Neogene sediments are represented by a series of sandy sediments, silts, tills, clays, mudstones and siltstones [336].

Sub-Quaternary sediments in the area of the planned customer substation are represented by Cretaceous formations, the top of which is located at a depth of approx. 160 MBGL. Eocene formations, represented mainly by mudstone and siltstone, are deposited on them. Their top is located at a depth of approx. 150 MBGL [336].

3.13.1.2 Quaternary formations

The route of the planned project in its initial section runs across aeolian sands on dunes, with local inserts of alluvial sands from valley bottoms.

In the **APV** at km 35+450 to 36+000 and from km 36+280 to 36+950, the route runs across residual glacial tills. At km 36+000 to 36+280, there are humus sands and alluvial muds of valley bottoms as well as endorheic depressions. After km 36+280, it leads across the areas of alluvial and aeolian sands.

In the **RAV**, after dunes and valley bottoms, the route runs across humus sands and alluvial muds as well as glacial till residuals. Further, it enters the area of alluvial and aeolian sands.

The area of the customer substation is located on glacial tills on fluvioglacial sands and gravels, as well as sandy-silty eluvia of glacial tills [336].

For both variants, the youngest formations are the Holocene dune and beach sands.

3.13.2 Topography and dynamics of the coastal zone

In the area of the planned project, there is a distinct strip-like relief arrangement including the beach, a series of dunes parallel to it and the coastal lowland areas directly at the back of the dune strip. The beach has a width of 30–60 m, periodically up to 100 m. At the back of the beach, there is a strip of dunes with a width of 450–750 m and the maximum height of dune formations of 35 MASL. Directly at the back of the beach there are series of longitudinal dunes parallel to the shore at the back of which, the series of arched and parabolic dunes have developed. These dunes are covered with pine forest and peat accumulations in the dune slacks. The top parts of the dunes reach a height of 20–25 MASL, while the areas of dune slacks are at a height of 3–5 MASL. At the back of this spit section there is an area of the upland foreground with height from 8 to 10–15 MASL, slightly rising to the south [Figure 3.28, Figure 3.29, Figure 3.30], with the relics of parabolic dune formations and peat bogs.

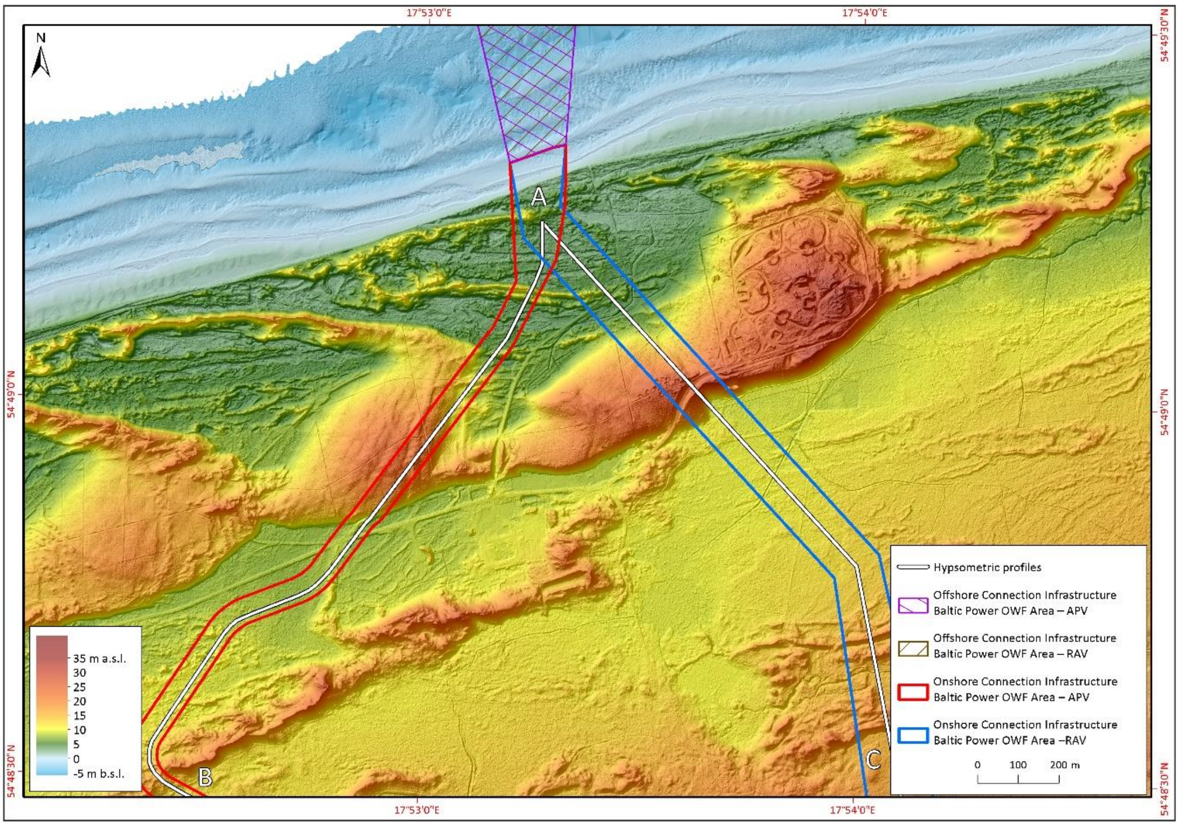

Figure 3.28. Hypsometric map with the bathymetry of the nearshore seabed in the area of the Wydmy Lubiatowskie dunes [Source: internal materials]

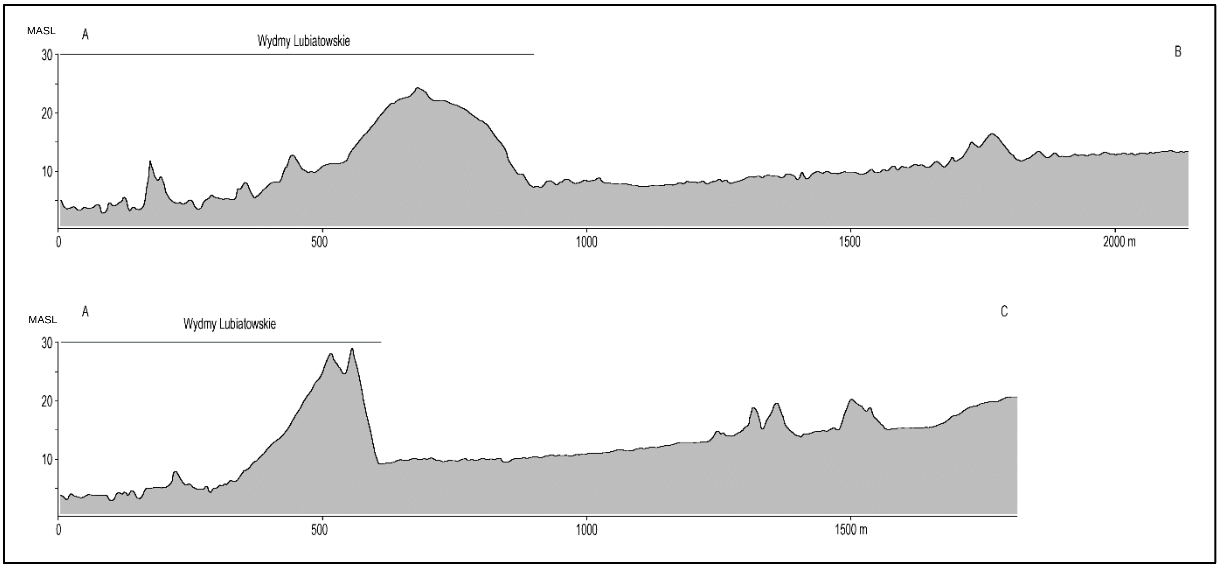

Figure 3.29. Hypsometric profiles along the planned routes, location of profiles in Figure 3.28 [Source: internal materials]

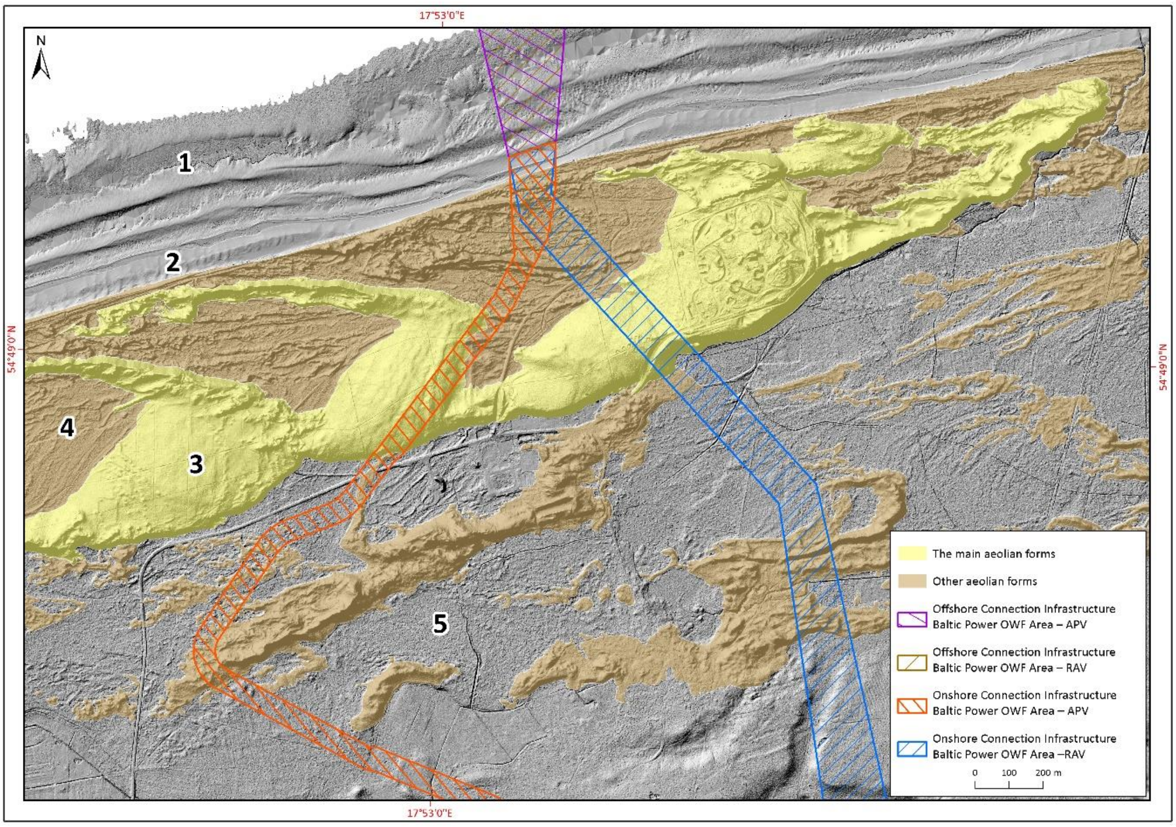

Figure 3.30. Area of the Wydmy Lubiatowskie dunes – geomorphological sketch; 1 – nearshore seabed, 2 – beach, 3 – main dune forms, 4 – other aeolian forms (dunes, deflation monadnocks, deflation troughs with local peat deposits), 5 – unseparated adjacent area of the Wydmy Lubiatowskie dunes (area of biogenic accumulation, single aeolian forms, in the southern part, glacial, fluvioglacial and fluvial landforms) [Source: internal materials]

The character of the dynamics of the shore section between km 159.5 and 161.5 prepared on the basis of lidar data as well as orthophotomaps from the years 2005, 2008, 2010, 2011, 2015, 2017, 2018, 2019 and 2020 is presented below.

3.13.2.1 Beach

In the area of the cable landfall (km 160.5), the beach has a width of approx. 30–40 m. Both, east and west of this location, the beach width increases and equals 50–60 m on average, periodically even approx. 100 m (area of km 159.9–160.1 and west of 161.3). On the basis of data from the period between 2005 and 2020, the width of the beach in the area of the cable landfall was from approx. 35 m (2020) to approx. 80 m (2010). Within the period analysed, the beach with the greatest width of approx. 100 m, was located near km 159.9–160.1 and km 161.3 – to the western-most boundary of the study. The beach smallest width, around 40 m was recorded near km 159.8, approx. 35 m near km 160.5 (2018) and 30 m near km 160.1 (2017 and 2018).

3.13.2.2 Location of dune baseline (2005−2020)

The chainage (km) from 159.5 to 159.9 km of the seashore (according to the shoreline chainage of the Maritime Office) is characterised by multi-directional changes, it is a section with abrasive tendencies; between 2005 and 2008, the dune baseline shifted towards land by approx. 31 m in the area of km 159.5 to approx. 4 m in the area of km 159.5; from 2008 to 2929, the waterline location changed in this section multi-directionally: approx. 10 m in the direction of the sea between 2008 and 2020 at km 159.9, it was stable at km 159.7, and in the area of km 159.5–159.6, between 2008 and 2010, the dune baseline shifted in the direction of the sea by approx. 3–4 m, whereas, between 2018 and 2020, the dune baseline shifted in the direction of land by approx. 6–7 m.

Km 159.9–160.4 is a stable section with accumulative tendencies. The location of the dune baseline changed gradually, between 2005 and 2020, the dune baseline moved towards the sea maximally by 18–20 m in the central part of the section.

Km 160.4–161.1 is an abrasive section. The construction of cable chambers is planned within the area of this section. Between 2005 and 2020, the dune baseline location varied unidirectionally landwards. Maximally, the dune baseline changed its position by 23–25 m in the area of km 160.6–160.7. In the area of the cable landfall (km 160.5), this change equalled approx. 15 m.

The average rate (between 2005–2020) of the dune baseline movement towards the land at this section was from 1 to 1.5 m per year. Currently, cable chambers are located at a distance of approx. 75 m (extreme west chamber) to 90 m (extreme east chamber) from the dune baseline (as at March 2020). With the direction and intensity of the process maintained, cable chambers will be within the impact zone of the storm waves in approx. 50 to 75 years.

Km 160.1–160.4 is a stable section, of variable, multi-directional features, with no distinct tendency. There is a change in the position of the dune baseline within a 10–11 m wide strip.

Km 160.4–161.5 is a stable section with accumulative tendencies. The dune baseline changed position within a strip up to 12 m wide in the direction of the sea (there was an accumulation of sand material and the development of young dune forms, which resulted in the movement of the dune baseline towards the sea).

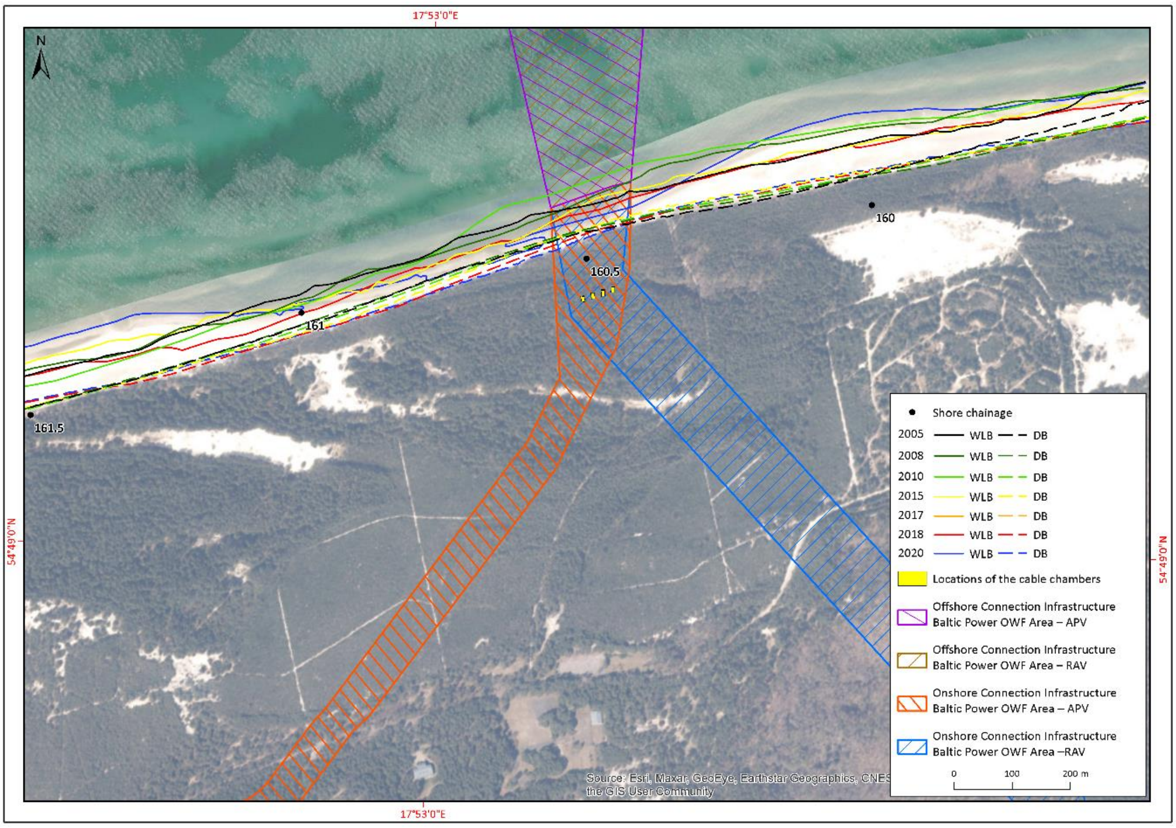

Figure 3.31. Location of selected waterline (LW) and dune (LPW) baselines between 2005 and 2020 against the orthophotomap from 2020; area of km 159.6−161.2 [Source: internal materials]

3.13.2.3 Shore dynamics – archive data

According to the data from literature [443] this area is located within the shore section described as stable. On the basis of the interpretation of cartographic data for the period 1875–1979, changes in the position of the shoreline were small. For the section between 158.0 and 161.5 km of the shore they were +0.4 m per year on average (movement of the shoreline towards the sea). According to the morphodynamic classification of dune shores based on the rate of a dune baseline movement [443], the section analysed should be classified as balanced, with possible occurrence of minor changes.

3.13.2.4 Areas of active aeolian processes

Near the beach surface, in the area analysed, there are several areas without vegetation or with scarce vegetation, within which the relief character changes as a result of aeolian processes. On the basis of archival data (orthophotomaps) analysis the extent of these type of areas was identified. Orthophotomaps form the years 2005, 2008, 2015, 2016 and 2019 were analysed; the orthophotomap from 2020 was not included due to excessive contrast of the areas with sand cover. On the basis of the analyses conducted, it has been found that the area of the Wydmy Lubiatowskie dunes uncovered by vegetation, has gradually decreased between 2005 and 2019. The dune areas without the vegetation cover or with a scarce plant cover, occupy the minimum surface area of both project variants considered [Figure 3.32].

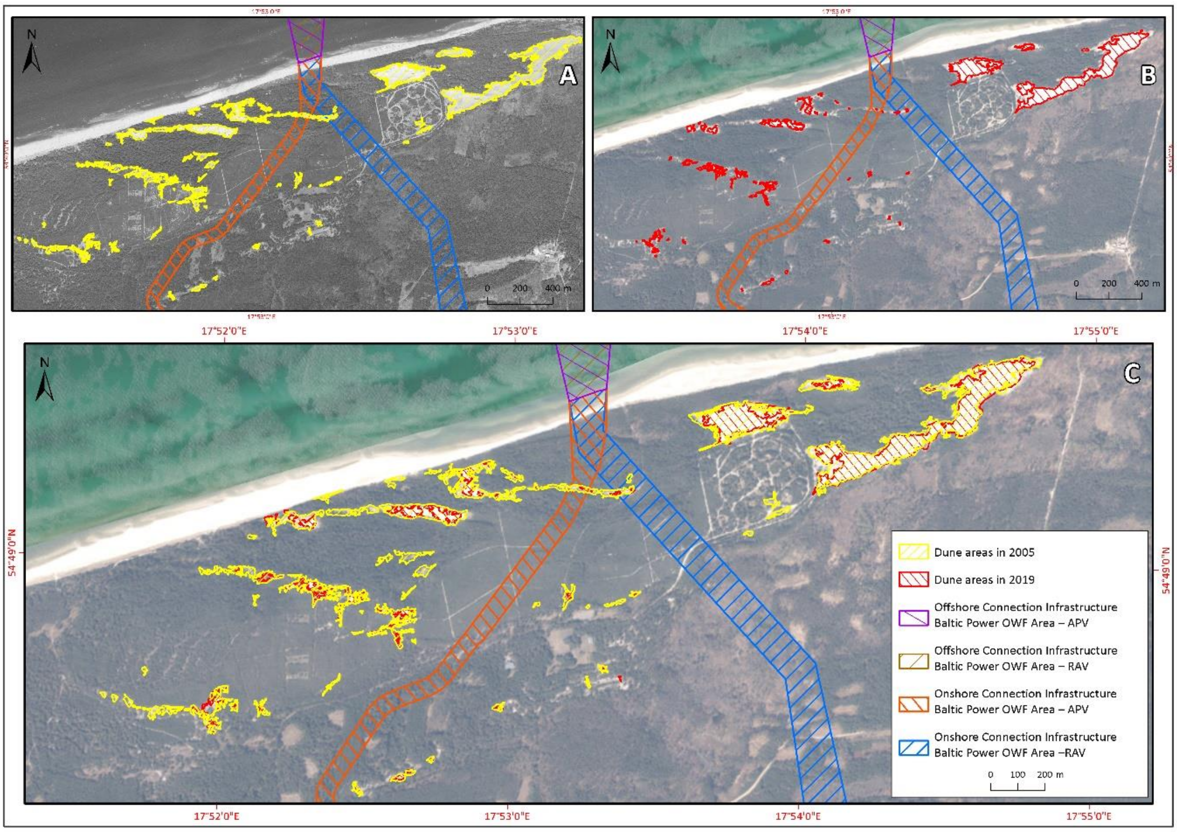

Figure 3.32. Areas without vegetation cover or with scant vegetation cover [Source: internal materials]

Orthophotomaps and lidar data (from 2008–2020) were analysed to identify areas in which aeolian processes noticeably contribute to changes in the relief character. These sites are presented on the map [Figure 3.33]. They are beyond the range of the planned project.

In those areas, the maximum average movement of dune slip faces were recorded in the period 2008–2020 and these were 1 m/year. These changes occur within small areas and short sections of dune slip faces in the eastern part of the area analysed. In the remaining sites, the average rate of the change of dune location was below 0.5 m/year. These changes largely affected the character of the windward slopes, rather than the movement of the dunes.

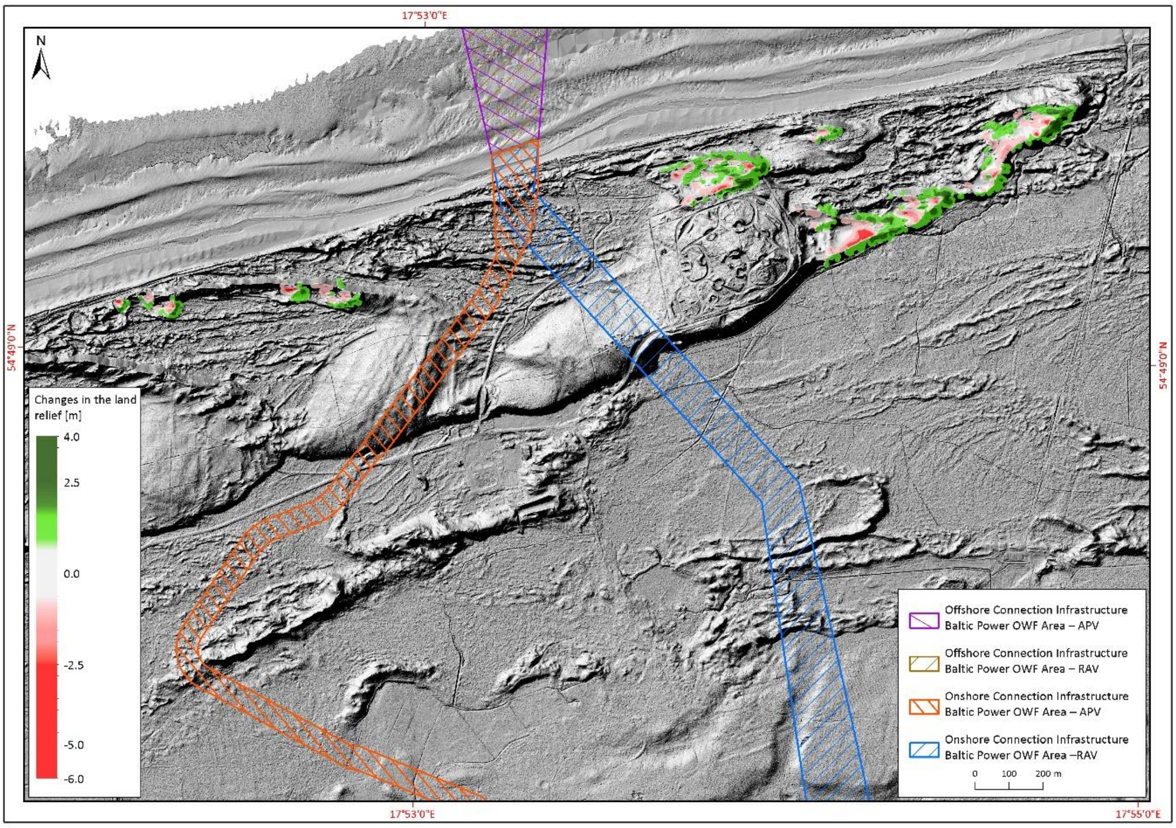

Figure 3.33. Differential map of the relief of the areas with active aeolian processes in the Wydmy Lubiatowskie dunes, developed by analysing lidar data from 2008 and 2020; against the background of the DTM from 2020 [Source: internal materials]

3.13.3 Soils

The soil characteristics was developed on the basis of soil maps obtained from the Institute of Soil Science and Plant Cultivation State Research Institute in Puławy (SSPC SRI) as well as spatial data provided by the State Forests.

3.13.3.1 Applicant Proposed Variant

The dominant type of soil within the area of the planned project potential impact in the APV are podzols (28.67%) and brunic podzols (22.53%). Arenosols (17.84%) as well as brunic brown (14.25%) and brown soils (11.87%) also account for a large share. Figure 3.34 presents the share of individual soil types within the area of the potential impact.

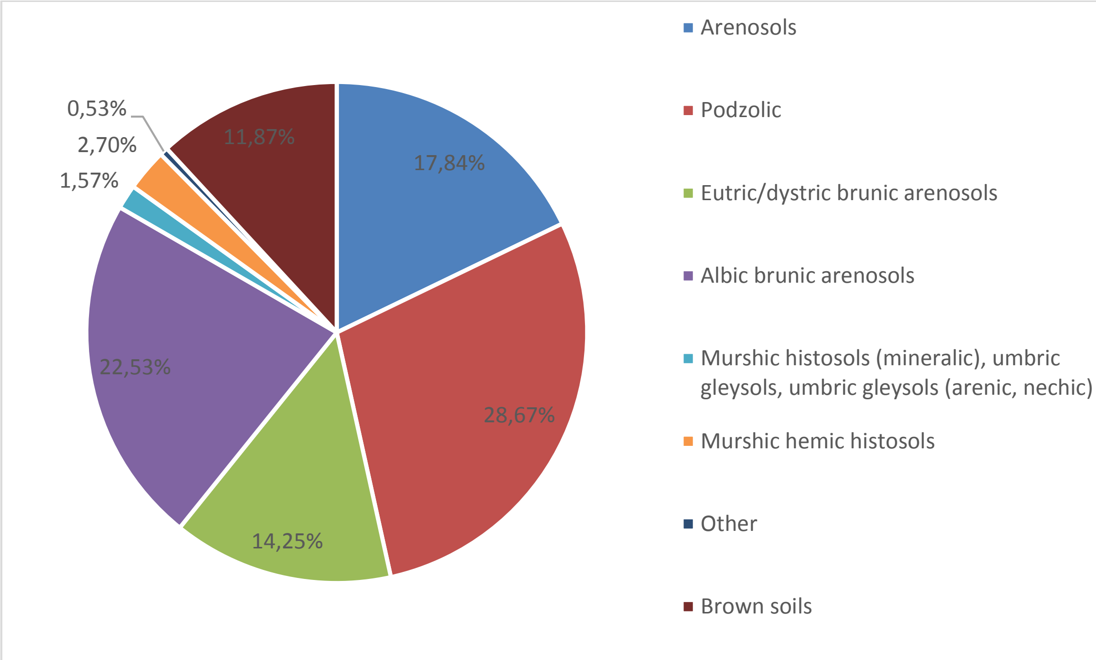

Figure 3.34. Share of individual soil types within the area of the planned project potential impact in the Applicant Proposed Variant (APV) [Source: internal materials on the basis of data from the SSPC SRI in Puławy and the State Forests]

The route of the planned underground cable lines runs mostly across soils of forest areas, only the customer substation and the 400 kV line are located in non-forest areas (from km 40+000).

Figure 3.35 presents the area of the planned project in the APV against individual soil types.

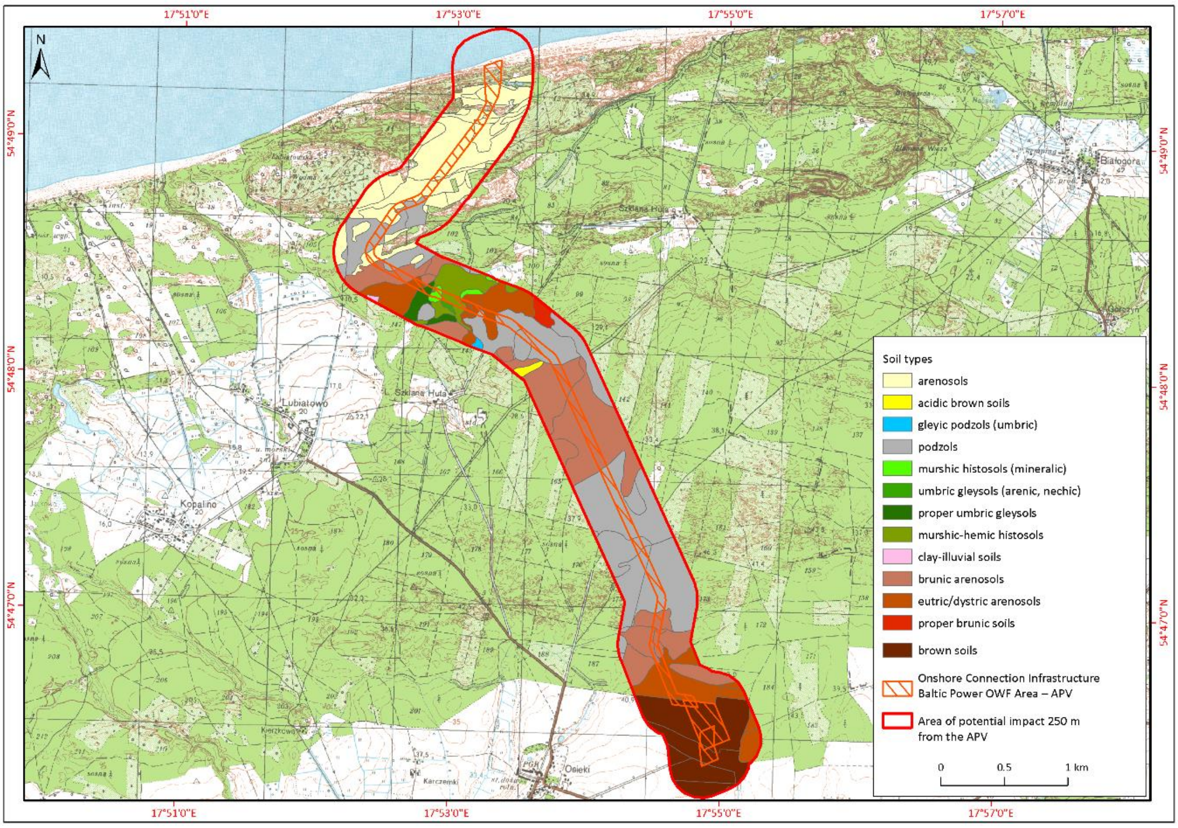

Figure 3.35. Planned project against individual soil types in the Applicant Proposed Variant (APV) [Source: internal materials on the basis of the data from the SSPC S RI in Puławy, the State Forests and OSM]

The cable route, downstream cable chambers, runs across areas of arenosols (from km 33+550 to 35+000 and from 35+250 to 35+350), and further across patches of podzolic and brunic soils, from km 35+750 to 36+250 it crosses a complex of muck soils and peat-muck soils. Further, running to the customer substation is crosses alternatively podzolic, brunic and brown soils. The planned customer substation and the 400 kV overhead line are located on brown soils that formed on loamy sands.

In the northern part of the area of the potential impact, in the area of coastal dunes, poorly developed soils are present, i.e. arenosols. The structure of the soil profile is usually simplified, the humus horizon is in the early stages of development. Initial arenosols are characterised by the most poorly developed humus horizon with a maximum thickness of 10 cm. Proper arenosols are characterised by a humus horizon with a thickness of approx. 10–30 cm, under which the parent rock is directly present. Dystric arenosols in contrast to proper arenosols are characterised by the presence of strata showing eluvial and illuvial features beneath the humus horizon [275].

Podzolic soils belong to the poorest soils, in trophic terms, among the mineral ones with a fully-developed profile. Only arenosol-type soils can be less fertile. Podzolic soils occur on sandy soil substrata with a strong precipitation type of water management. Above the mineral soil, acidic ectohumus is formed, as a result of its decomposition humus acids are produced which stimulate the podzolisation process. Proper gleyic podzols and umbric gleysols occur mainly in the dune slacks. Proper podzols have developed on loose sands without the admixtures of clay and silt fractions in a complex with brunic soils. Proper gleyic podzols have developed from loose sandy formations under the influence of the medium-height groundwater table. In the areas with an elevated groundwater table, umbric gleysols have developed [275].

Brunic soils form mainly from the poorly sorted sandy formations, they belong to the order of podzols. The basic soil-forming process in such soils is the brunification process. It involves the formation of immobile humus complexes, which together with iron and aluminium oxides do not move deeper, but remain in place and form rusty sheaths around silt an clay grains [275].

Brown soils have developed mainly from tills, deep and very deep loamy sands, and to a lesser extent from silt formations and loamy gravels. Brown soils are characterised by brown colour across the entire profile. The brownification horizon with a thickness of 30–50 cm transforms gradually into parent rock. Brown soils are characterised by a wide range of pH values, from acidic to neutral [275].

In endorheic areas, peat and muck soils are formed. Peatlands develop in the areas with high groundwater table. This can be stagnant or poorly flowing waters. Fens form in the areas with shallow groundwater, such as river valleys, springs, eutrophic water reservoirs and places of inflow and accumulation of surface waters. Muck soils are formed both from peat soils and silty soils as a result of dewatering of the organic horizon, whereby they become aerated and the moorshification process begins. The lowering of the groundwater level interrupts the marsh processes and instead of accumulation, which is characteristic for peat soils, the mineralisation and loss of organic matter commences. Degree of the moorshification process advancement depends of the type of peat and the depth and period of dewatering. Muck-peat soils have developed from bog-peat soils after dewatering which interrupted the peat accumulation process. Moorshification process begins with near-surface layers and covers deeper parts of the soil profile as the groundwater table decreases [275].

In the soil characteristics, particular attention was paid to hydrogenic soils, i.e. peats, muck soils, gleyic podzols and umbric gleysols, since they are the most sensitive to the potential impacts of the planned project (trench opening, excavation drainage). This type of soil is particularly sensitive to changes in water relations.

In the area of the planned project potential impact, hydrogenic soils occur at km from 35+750 and 36+500 – this is a complex of mineral and muck soils, umbrisoils, umbric gleysoils and peat-silt soils. Umbric gleysols are located at km 36+350, near the western boundary of the potential impact area.

3.13.3.2 Rational Alternative Variant

The dominant type of soil within the area of the planned project potential impact in the RAV are podzols (36.44%). Brunic podzols (17.87%) and brown soils (13.4%), brunic brown soils (10.49%) and arenosols (9.89%) also have a large share. Figure 3.36 presents the share of individual soil types within the area of the planned project potential impact.

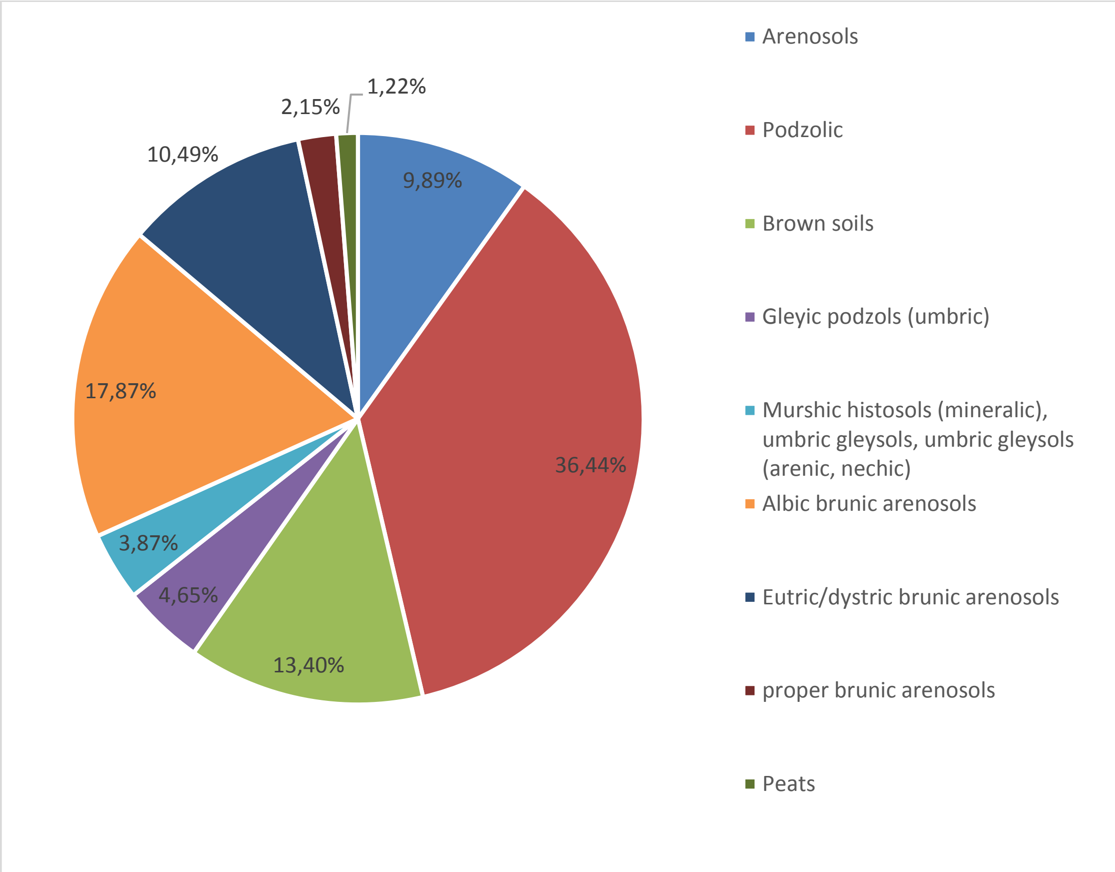

Figure 3.36. Share of individual soil types within the area of the planned project potential impact in the Rational Alternative Variant (RAV) [Source: internal materials on the basis of data from the SSPC SRI in Puławy and the State Forests]

The route of the planned project runs mostly across soils of forest areas, only the customer substation and the 400 kV line are located in non-forest areas (from km 45+500).

Figure 3.37 presents the planned project area against individual types of soil.

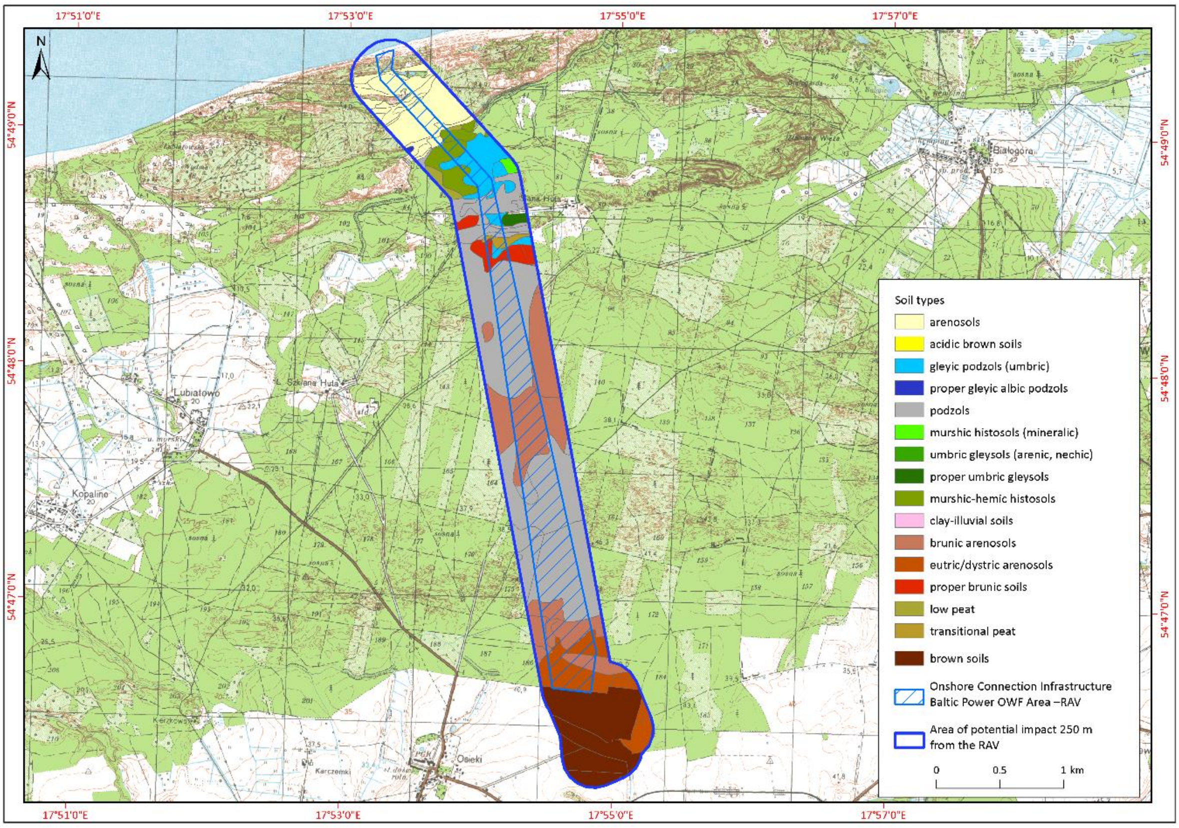

Figure 3.37. Planned project against individual soil types in the RAV [Source: internal materials on the basis of data from the SSPC SRI in Puławy and the State Forests and OSM]

The route of the planned project runs across an area of arenosols (from km 40+300 to 40+900), which transform into muck-peat soils and umbric gleysols (up to km 41+200 to 41+580). At km from 40+950 to 41+000 a fen is present. The fen is located also in the western part of the impact area at approx. km 41+100 to 41+500. From km 41+900 to 42+00 a poor fen is present. A large complex of umbric gleysols is located at km 41+200 to 41+580. In the remaining part of the planned project impact area, there are podzols and brunic soils. The planned customer substation is located on brown soils that formed on loamy sands.

Proper umbric gleysols have developed from loose formations under the influence of groundwater, the water table of which is located within the soil profile and fluctuates periodically. In umbric gleysols, the groundwater level is located even higher than in the gleyic podzols [275].

Hydrogenic soils, i.e. peat, muck, gleyic podzols and umbric gelysoils, the most sensitive to the potential impact of the planned project (trench opening, excavation drainage) occur in:

- fen: from km 40+950 to 41+000, in the western part of the impact area at approx. km 41+100 to 41+500;
- poor fen: from km 41+900 to 42+000;
- complex of gleyic podzols (umbric): from km 41+200 to 41+580, from km 41+750 to 41+800 and in the area of km 42+000.

3.13.4 Raw materials and deposits

The planned project in both variants is located entirely within the Żarnowiec concession No. 5/2019/Ł for the prospection, exploration and production of hydrocarbons of 13 June 2019, owned by ShaleTech Energy Sp. z o.o.

No mineral resource deposits nor mining areas are located within the boundaries of the planned project in neither of the variants considered nor the areas of their potential impact.

Figure 3.38 presents the location of resources in the vicinity of the planned project in both variants considered.

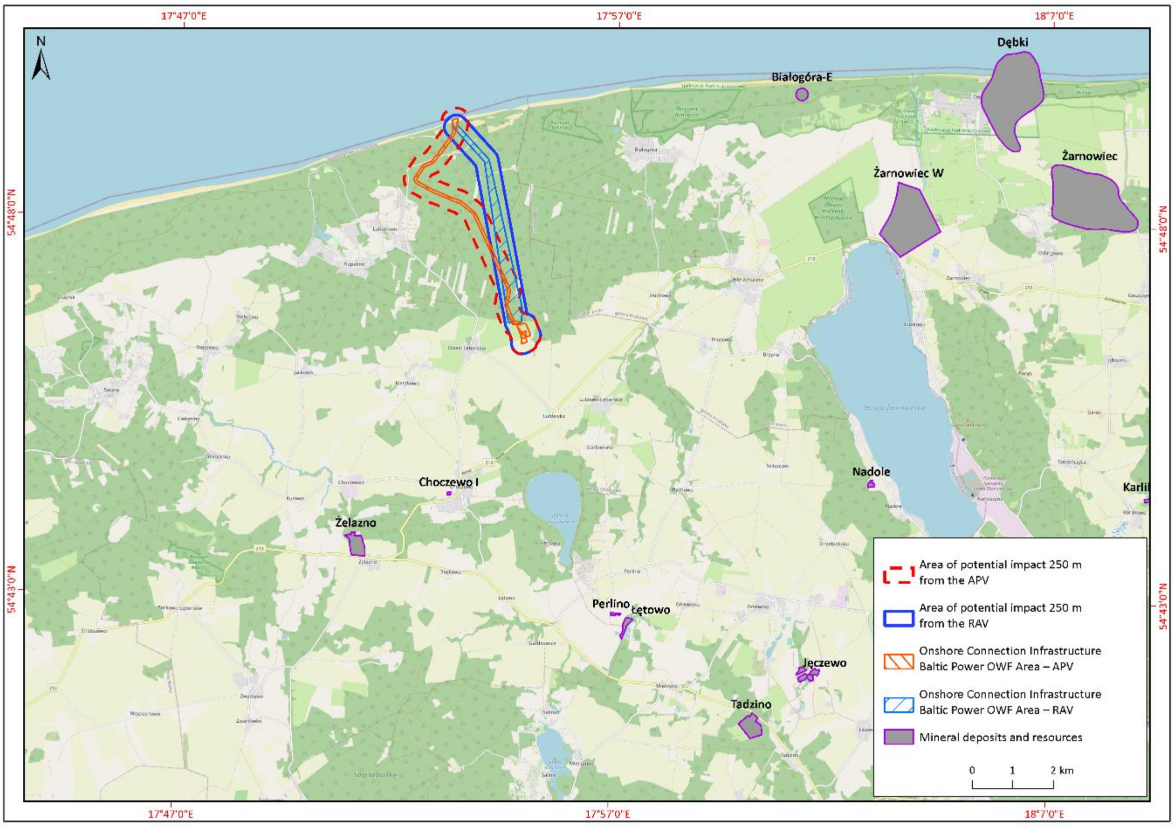

Figure 3.38. Location of the planned project in both variants against the occurrence of deposits and mineral resources [Source: internal materials on the basis of OSM and MIDAS shp base]

At a distance of up to 10 km from the area of the planned project potential impact in both variants, the following resources are deposited (MIDAS base, as of February 2021):

- natural aggregate deposit (sand) Chczewo I situated at a distance of more than 4 km south-east of the substation;
- natural aggregate deposit (sand) Żelazno situated at a distance of more than 6 km south-west of the substation;
- lake marl deposit Łętowo II situated at a distance of more than 7 km south of the substation;
- lake marl and peat deposit Perlino situated at a distance of more than 7 km south of the substation;
- sand and sand with gravel deposit Nadole situated at a distance of more than 9 km south-east of the substation;

- crude oil and condensate (natural gas) deposit Żarnowiec situated at a distance of more than 8 km east of the substation;
- crude oil deposit Białogóra E situated at a distance of more than 8 km east of the offshore chambers.

3.14 Surface waters and their quality (Water Framework Directive)

The planned project in both variants, according to the hydrographic division of Poland, is situated in the Vistula River basin, in the Lower Vistula water region; in most part in the direct catchment area of the sea and in the catchment area of the Łeba River. Forest-agricultural type of land use is dominant there.

In the surroundings of the planned project in both variants, the hydrographic network comprises of small water courses: Lubiatówka, Bezimienna, and the Biebrowski Canal with the tributary from Kierzkowo [Figure 3.39]. The Bezimienna watercourse is an approx. 4 km long mid-forest stream debouching into the Baltic Sea west of the village of Białogóra. It is fragmented due to two impounding structures. Bezimienna is under a strong influence of a migrating dune affecting the original stream bed and characterised by a significant drop in the water level. The Lubiatówka watercourse is a 3.6 km long stream, together with its tributaries forming a drainage system for the adjacent areas of fields and meadows around the village of Lubiatowo, where its waters also debouch into the Baltic Sea. Surrounding the village of Lubiatowo, together with its adjacent tributaries, it serves as a drainage system for the region and a potential discharge area for sewage from the camping sites located nearby. The Biebrowski Canal with its tributary constitutes a drainage system for Biebrowo and Kopalino, and it flows into the Chełst River and is characterised by fragmentation which is not favourable for the fish population.

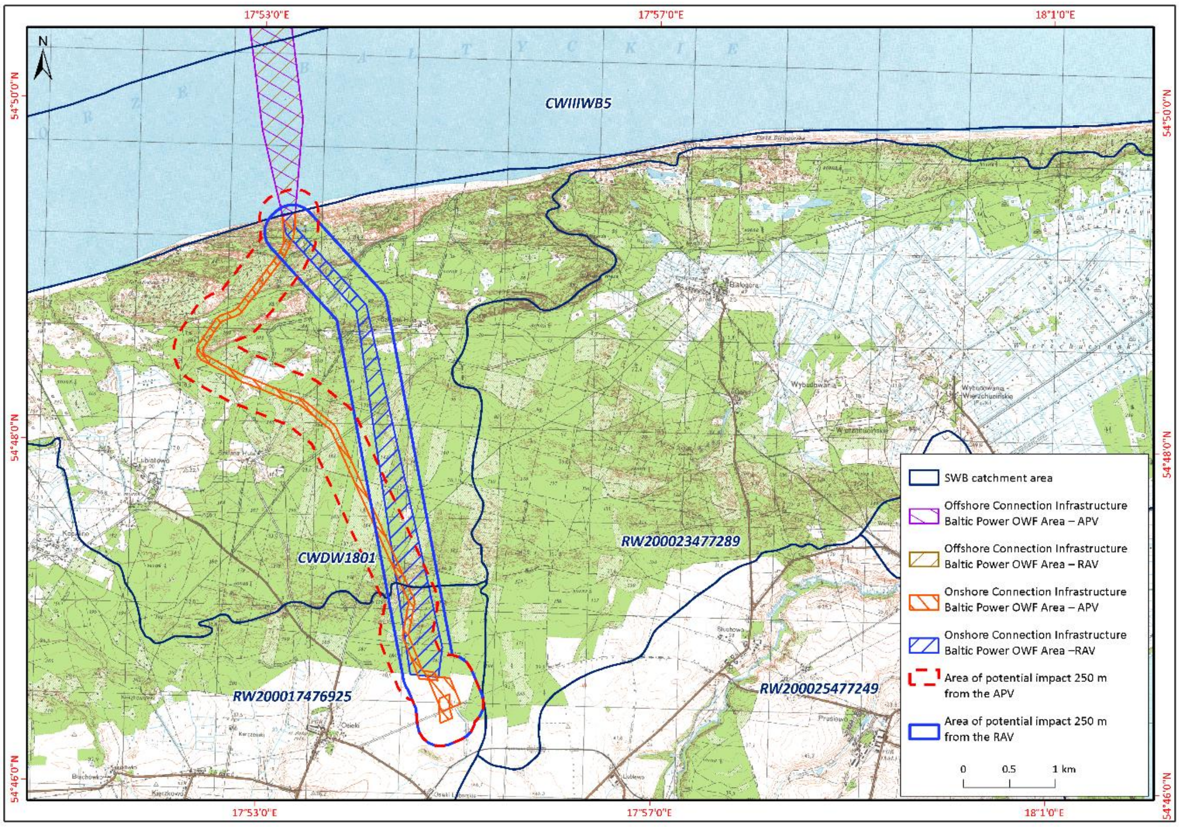

Figure 3.39. Location of the planned project against Surface Water Bodies (SWBs) [Source: internal materials]

3.14.1 Applicant Proposed Variant

In the area of the planned project potential impact in APV, surface waters are represented by:

- two ponds at a distance of approx. 20 m from the external (eastern) cable chamber at km 33+550 including related water courses;
- the waterlogged areas in the vicinity of ul. Spacerowa at km 34+400 to 34+800;
- the waterlogged valley with a system of watercourses constituting tributaries of the Bezimienna Stream at km 35+750 to 36+100;
- a drainage ditch in the area of the customer substation at km 39+500 to 39+900;
- a drainage ditch in the area of the 400 kV overhead line at km 40+400.

Ponds in the vicinity of the planned cable chambers are small (the “west” pond has approx. 0.25 ha, and the “east” pond – 0.15 ha). They are located in a dune slack at a height of approx. 3.75 MASL. A paved road leading to the beach runs between them. These reservoirs constitute a poor fen, which is protected as an ecological site “Torfowisko” [Peat bog] in Szklana Huta and are supplied mainly by precipitation and waters from the first aquifer.

The Bezimienna Stream tributaries occupy a small valley depression and constitute a system of connected water courses. The terrain lowers here to approx. 15 MASL. The waters flow eastwards.

Upstream the customer substation, the planned project intersects a drainage ditch, flowing at a height of approx. 40 MASL in the eastern and south-western directions, which is continued in the area of the planned 400 kV overhead line.

In the area of the planned project in the APV, there are no surface water intakes nor protection zones for surface water intakes established under local law.

3.14.2 Rational Alternative Variant

In the area of the planned project potential impact in RAV, surface waters are represented by:

- a watercourse at km 40+620;
- the Bezimienna Stream with its tributary at km 41+150;
- a water course (the Bezimienna Stream tributary) at km 41+730;
- a drainage ditch in the area of the customer substation at km 45+150 to 45+500;
- a drainage ditch in the area of the 400 kV overhead line at km 46+000.

The Bezimienna Stream with its tributaries flows in the eastern direction across a wide forest valley, at a height of approx. 10 MASL. Upstream the customer substation, the planned project intersects a drainage ditch, flowing at a height of approx. 40 MASL in the eastern and south-western directions.

In the area of the planned project in the RAV, there are no surface water intakes nor protection zones for surface water intakes established under local law.

The Water Framework Directive (Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy) obliges all Member States to take measures for the protection of inland surface waters, transitional waters, coastal waters, and underground waters. In this context, the Vistula River Basin Management Plan was adopted by the Resolution of the Council of Ministers of 18 October 2016 (Journal of Laws of 2016, item 1911) [334].

The planned project in both variants situated in the water area of the Lower Vistula, shall be implemented within the following boundaries [Figure 3.39]:

- immediate catchment area of the sea CWDW1801;
- River Water Body: the Chełst River to its outlet into Lake Sarbsko RW200017476925.

In accordance with the SWH Polish Waters data, for the SWBs of immediate catchment areas of the sea (including CWDW1801) no data sheets have been developed. The environmental targets for them should be adopted as for the “adjacent” Coastal Water Bodies or Transitional Water Bodies, which are the recipients of surface run-off from these areas. In this context, these are:

- Coastal Water Body: Jastrzębia Góra – Rowy CWIIIWB5;
- River Water Body: the Chełst River to its outlet into Lake Sarbsko RW200017476925;
- River Water Body: the Piaśnica River from its outflow from Lake Żarnowieckie to where it is joined by the Białogórska Struga RW200023477289.

Jastrzębia Góra – Rowy PLCWIIIWB5 is a natural water body. The assessment of the status for the years 2010–2012 indicates a bad ecological status, due to the determining indicators: chlorophyll *a*, transparency, total nitrogen and total phosphorus. Its chemical status was specified as good, and its general status as bad. Several decades of anthropogenic impact lead to the accumulation in this SWB of nutrients and contaminants, the supply of which from land continues. The environmental target for this SWB is the achievement of good ecological status and maintaining a good chemical status. The deadline for the targets assumed in 2016 was extended due to the lack of technical possibilities and bad weather conditions. This target is to be achieved in 2021.

For the SWB Jastrzębia Góra – Rowy PLCWIIIWB5 targets have been established for the following protected areas:

- Przybrzeżne wody Bałtyku (PLB990002);
- Ostoja Słowińska (PLH220023);
- Słowiński National Park.

In accordance with the Report on the State of Environment in the Pomeranian Voivodeship [322] in 2018, the status of the SWB Jastrzębia Góra – Rowy PLCWIIIWB5 was assessed. The ecological status was assessed as bad, chemical status – below good, and the general status of the SWB as bad [Table 3.20].

Table 3.20. Status of SWB Jastrzębia Góra – Rowy PLCIIIWB5 [Source: internal materials on the basis of http://www.gios.gov.pl/pl/stan-srodowiska/monitoring-wod]

Year	SWB status	Biological elements	Hydromorphological elements	Physico-chemical elements	Physico-chemical elements	Ecological status	Chemical status	General status
		Classes	Classes	Classes	Classes			
2017	NAT	V	-	>II	-	BAD	-	Bad
2018	NAT	V	-	>II	-	BAD	Below good status	Bad
2019	NAT	IV	I	II	II	POOR	Below good status	Bad

NAT – Natural Water Body; I – very good status/maximal potential, II – good status/potential, III – moderate status/potential, IV – poor status/potential, V – bad status/potential

On the basis of the surface water monitoring, in the years 2014–2019, an assessment was made of the Coastal Water Bodies Jastrzębia Góra – Rowy PLCWIIIWB5. In 2017 and 2018, the status of biological elements was bad, and in 2019, it improved to poor. The ecological status in 2017 and 2018 was assessed as bad. In 2017, no surveys of the chemical status were conducted, in 2018, it was assessed as below good. In 2019, the biological status of CWB improved from bad to poor, the status of hydromorphological elements was assessed as very good and the physico-chemical as good. The ecological status changed from bad to poor, the chemical status remained below good. The general status of the CWB has remained bad for the last three years.

The River Chełst to its outlet into Lake Sarbsko RW200017476925 belongs to highly modified water bodies. The status assessment for the years 2010–2012 indicates a good and above good ecological status as well as good chemical and general statuses. The environmental target for this RWB is the maintenance of good ecological potential and a good chemical status. The achievement of this target is not at risk.

For the RWB Chełst River to its outlet into Lake Sarbsko RW200017476925, the targets were established for the following protected areas:

- Choczewsko-Saliński Protected Landscape Area;
- Coastal Protected Landscape Area;
- Natura 2000 sites: Sarbska Spit (PLH220018), Lake Choczewskie (PLH220096);
- nature reserves: Sarbska Spit, Borkowo Gorges.

In the Report on the State of Environment in the Pomeranian Voivodeship [322] in 2018, the status of the RWB Chełst to its outlet into Lake Sarbsko RW200017476925 was assessed. The ecological status was assessed as moderate, chemical status – below good, and the general status of the RWB as bad. There are no data on the status of this RWB in the Reports of CIEP [Table 3.21].

Table 3.21. Status of RWB the Chełst River to its outlet into Lake Sarbsko RW200017476925 [Source: internal materials on the basis of http://www.gios.gov.pl/pl/stan-srodowiska/monitoring-wod]

Year	SWB status	Biological elements	Hydromorphological elements	Physico-chemical elements	Physico-chemical elements	Ecological status	Chemical status	General status
		Classes	Classes	Classes	Classes			
2019	HMWB	III	-	-	-	Moderate	Below good status	Bad

HMWB – Highly Modified Water Body; I – very good status/maximal potential, II – good status/potential, III – moderate status/potential, IV – poor status/potential, V – bad status/potential

The environmental target for this RWB is the maintenance of good ecological potential and a good chemical status. The achievement of this target is not at risk. For the RWB Chełst to where it flows into Lake Sarbsko RW200017476925**,** targets were set for, among others, the Coastal Protected Landscape Area, within which the planned project is located in both variants. These targets include:

- in forests, taking measures to stabilise the water relations, especially in moist and marshy habitats (i.e. marshy coniferous forests and birch forests, alder swamp forests and riparian forests) through the construction of small retention structures;
- preserving and maintaining the existing mid-field watercourses, wetlands, and peatlands in a state close to natural;
- in non-forest areas, maintaining mid-field peat bogs, swamps and other waterlogged areas as well as small ponds;
- shaping water relations in arable land permissible only as part of rational agricultural management, with absolute conservation of waterlogged areas, including peat bogs and swampy wetlands and headwater areas of watercourses;
- preservation and conservation of surface water ecosystems (natural and artificial, flowing and standing, including oxbow lakes) together with the strip of surrounding vegetation;
- maintaining and restorung biological patency of rivers as elements of wildlife corridors by discontinuing to construct new impending structures for power generation purposes as well as by constructing devices enabling the migration of water organisms in the locations of the existing bulkheads;
- creating buffer zones around water reservoirs in the form of tree or bush belts as well as permanent grasslands, to reduce nutrient run-off and increase biodiversity;
- reducing river regulation works only to the extent necessary for real flood protection;
- maintaining and restoring meanders on selected sections of watercourses;
- maintaining and facilitating the natural flow of water in the inter-embankment zone;
- gradual restoration of natural processes of formation and succession of oxbow lakes through natural flooding;

- increasing small water retention, restoration of the functions of headwater areas and other hydrogenic habitats of great retention capabilities;
- reducing the intensity of development in coastal zones, especially on river and lake slopes;
- protection of lake direct catchment areas – especially lobelia lakes – before investing and use causing intensification of eutrophication processes;
- preventing the lowering of groundwater table, in particular by limiting the erection of drainage devices and ditches in arable lands, meadows and pastures in lake or river valleys as well as on the edges of floodplains;
- fishery management in surface waters that supports the protection of endangered species and promotes species of local origin, leading to the achievement of fish species and age structure typical of a particular type of waters.

The Piaśnica River from its outflow from Lake Żarnowieckie to where it is joined by the Białogórska Struga RW200023477289 belongs to Highly Modified Water Bodies. As a result of the assessment for the years 2010–2012, its ecological, chemical and general statuses were assessed as good. The environmental target for this SWB is the maintenance of good ecological potential and a good chemical status. The achievement of this target is not at risk.

For the RWB Piaśnica River from its outflow from Lake Żarnowieckie to where it is joined by the Białogórska Struga RW200023477289, the targets were established for the following protected areas:

- Coastal Protected Landscape Area;
- Polish Coastal Landscape Park;
- Natura 2000 site Piaśnickie Łąki PLH220021;
- nature reserves: Piaśnickie Łąki, Długosz Królewski in Wierzchucino, Białogóra, Zielone, Babnica.

On the basis of the monitoring of surface waters in the years 2010–2015, an assessment of the Piaśnica River from its outflow from Lake Żarnowieckie to where it is joined by the Białogórska Struga RW200023477289 was carried out. On the basis of the surveys carried out in 2015, the biological status was assessed as good, hydromorphological elements and physico-chemical elements as very good. A good ecological and chemical statuses were determined for the RWB. The general assessment of the RWB is good [Table 3.22]. In the years 2016–2019, no surveys were conducted.

Table 3.22. Status of the RWB Piaśnica River from its outflow from Lake Żarnowieckie to where it is joined by the Białogórska Struga RW200023477289 [Source: internal materials on the basis of http://www.gios.gov.pl/pl/stan-srodowiska/monitoring-wod]

Year	**SWB status**	**Biological elements**	**Hydromorphological elements**	**Physico-chemical elements**	**Physico-chemical elements**	**Ecological status**	**Chemical status**	**General status**
		Classes	**Classes**	**Classes**	**Classes**			
2015	HMWB	II	I	II	I	Good	Good	Good

HMWB – Highly Modified Water Body; I – very good status/maximal potential, II – good status/potential, III – moderate status/potential, IV – poor status/potential, V – bad status/potential

In accordance with the flood hazard map, the planned project in both variants is located outside the areas, where there is a probability of flooding once in 10 years. The planned project in the area of small ponds, constituting the ecological area “Torfowisko” [Peat bog] in Szklana Huta, is located in the areas with low probability of flooding of once in 500 years and (Q = 0.2%) and once in 100 years (Q = 1%) (https://wody.isok.gov.pl/).

3.15 Hydrogeological conditions and groundwater

The occurrence of groundwater in the area of the planned project in both variants is connected to water-bearing formations in the Quaternary and Tertiary horizons. Within the Quaternary horizon, there are two aquifers: intermoraine and sub-till. The Tertiary formations are also characterised by the presence of two aquifers – connected to the Miocene and Oligocene formations. The intermoraine aquifer occurs in fluvioglacial sediments of the Middle Polish Glaciation and North Polish Glaciation, most often connected into a single water-bearing complex. In places, it is separated by a small layer of glacial till, forming a two-layer horizon, but with a close hydraulic connection. The maximum thicknesses of the zone of saturation exceed 40 m, however, most commonly they are 15–30 m, and the average value of the filtration coefficient is 32 m/24 h (161.6 m/24 h at maximum). The horizon top is located at a depth of 30–45 m, in the terrain lowerings – less than 15 m, whereas, locally below 50 m [228].

The chemical composition of the Quaternary aquifer are local circulation waters type HCO_3-Ca, moderately hard water (1–6 mval/dm^3), poorly mineralised (dry residues does not usually exceed 380 mg/dm^3). The content of 18 chlorides, sulphates as well as nitrogen compounds is slightly increased compared to the natural ambient conditions. This may indicate the influence of anthropogenic factors on groundwater chemistry. The iron compounds and the related manganese are most commonly within the following range: 0.01–0.6 mg/dm^3 and 0.01–0.1 mg/dm^3. No elevated levels of metals or other compounds were observed [228].

The ground waters present in dune areas in the region of both variants of the planned project are poorly-recognised. They are characterised by low mineralisation and increased iron content up to 0.8 mg/dm^3 [228].

Ground waters present in the direct vicinity of the seashore may be exposed to marine ingression. This situation may take place especially in the case of increased groundwater exploitation at the intake in Białogóra or Lubiatowo. However, increased contents of nitrogen compounds indicate that some of the pollutants are infiltrating into the groundwater.

The characteristics of hydrological conditions for the planned project in both variants were carried out on the basis of the sheet of hydrological map of Poland at a scale of 1:50 000 The first aquifer – occurrence and hydrodynamics (Choczewo sheet 0004) [Figure 3.40]. Moreover, as part of the assessment of the planned project impact on hydrogeological conditions in the area of the ecological area “Torfowisko” [Peat bog] in Szklana Huta 4 boreholes were made with a core drill to a depth of 2.5 m in the area of the planned cable chambers. No groundwater was found within the 2.5 m boreholes drilled. It was found that a free water table was present there at a depth of approx. 3–5 m in the area of cable chambers and at approx. 2–5 m near the ecological area. The run-off of waters of the first aquifer takes place here from the south-east in the direction of the seashore.

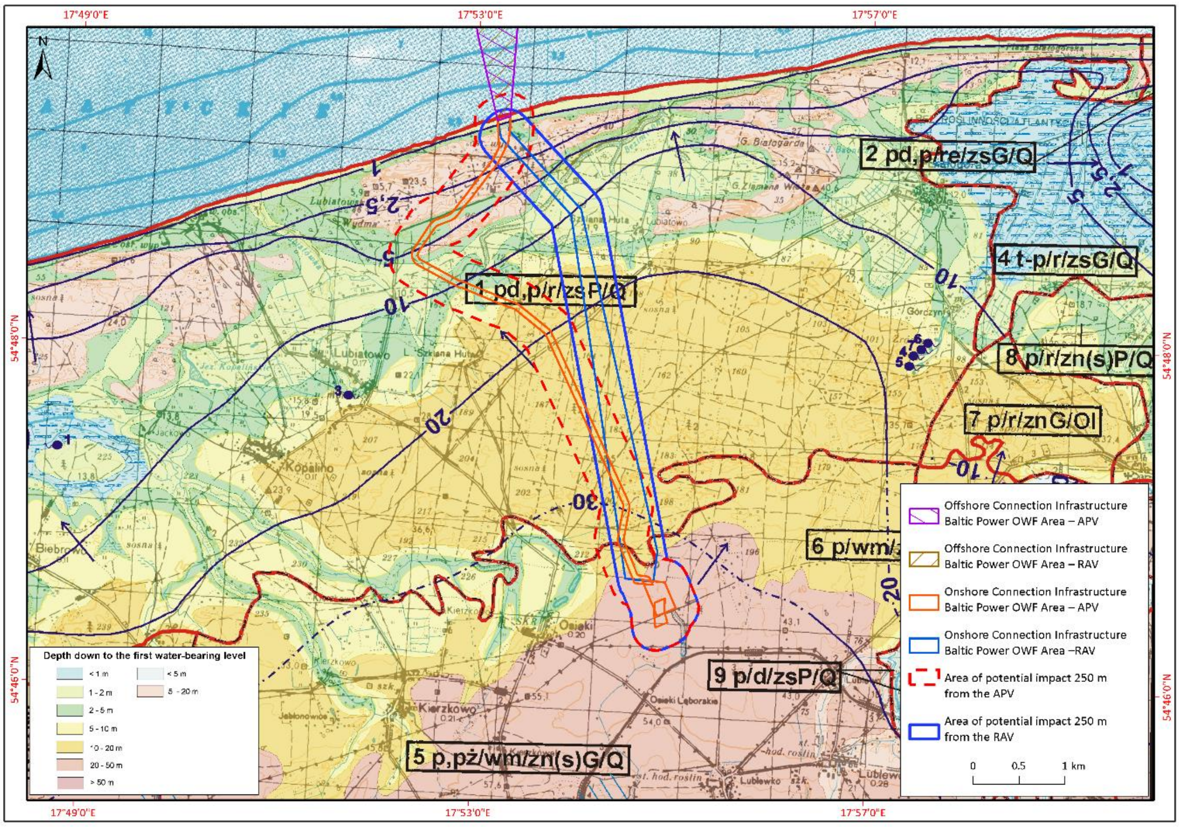

Figure 3.40. Location of the planned project in both variants against the hydrological map of Poland at a scale of 1:50 000. The first aquifer – occurrence and hydrodynamics (Choczewo sheet 0004) [Source: internal materials on the basis the hydrological map of Poland at a scale of 1:50 000 [228]]

3.15.1 Applicant Proposed Variant

Table 3.23 presents the depth of groundwater deposition in relation to the chainage of the underground cable line on the basis of the hydrological map of Poland at a scale of 1:50 000. The first aquifer – occurrence and hydrodynamics (Choczewo sheet 0004) [228].

Table 3.23. Depth to the first aquifer in the Applicant Proposed Variant (APV) [Source: internal materials on the basis of a hydrological map of Poland. Choczewo sheet (1:50 000) [228]]

Chainage [m]	Depth to the first aquifer [m]	Planned project – APV [m]
33+550 to 34+500	5–20	950
34+500 to 35+400	2–5	900
35+400 to 35+650	1–2	250
35+650 to 36+100	2–5	450
36+100 to 36+500	5–10	400
36+500 to 39+900	10–20	3400
39+900 to 40+500	20–50	600

Summing up, along the majority of the 3.4 km section, the planned project will be located in an area where the depth of the first aquifer is approximately 10–20 MBGL. Groundwater is located the lowest at km 35+400 m to 36+100 m, just before the waterlogged valley of the Bezimienna Stream, at a distance of 250 m. A low water level of 2–5 MBGL is also present along sections 34+500 to 35+400 and 35+650 to 36+100. Groundwater flow from south to north is dominant.

In accordance with the data from the Water Management Information System (SIGW) (http://www.smorp.pl/imap/) and on the basis of data from Regional Water Management Board in Gdańsk (https://wodypolskie.bip.gov.pl), the nearest groundwater intake point is the Lubiatowo intake (plot no. 171/15) at a distance of approx. 2.5 km from the APV. This intake is supplied by Quaternary waters and supplies the following towns: Kopalino, Lubiatowo and Jackowo.

3.15.2 Rational Alternative Variant

Table 3.24 presents the depth of deposition of ground waters in relation to the chainage of the overhead line on the basis of the hydrological map of Poland at a scale of 1:50 000. The first aquifer – occurrence and hydrodynamics (Choczewo sheet 0004) [228].

Table 3.24. Depth to the first aquifer in the Rational Alternative Variant (RAV) [Source: internal materials on the basis of the hydrological map of Poland. Choczewo sheet (1:50 000) [228]]

Chainage [km]	**Depth to the first aquifer [m]**	**Planned project – RAV [m]**
40+300 to 40+900	5–20	600
40+900 to 41+000	2–5	100
41+000 to 41+760	1–2	760
41+760 to 41+900	2–5	140
41+900 to 42+100	5–10	200
42+100 to 45+500	10–20	3400
45+500 to 46+000	20–50	500

Summing up, along the majority of the 3.4 km section, the planned project will be located in an area where the depth of the first aquifer is approximately 10–20 m. Groundwater is located the lowest at km 41+000 m to 41+760 m, in the area of the waterlogged valley of the Bezimienna Stream, along a section of approx. 760 m. Groundwater flow from south to north is dominant.

In accordance with the data from the Water Management Information System (SIGW)(http://www.smorp.pl/imap/) and on the basis of data from Regional Water Management Board in Gdańsk (https://wodypolskie.bip.gov.pl), the nearest groundwater intake point is the Lubiatowo intake (plot no. 171/15) at a distance of approx. 2.7 km from the RAV. This intake is supplied by Quaternary waters and supplies the following towns: Kopalino, Lubiatowo and Jackowo.

In accordance with the definition presented in Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy, GWBs were distinguished as individual areas of groundwater management. They involve ground waters occurring in the aquifers of characteristics enabling intake significant to the supply of water to the population or a flow significant to the desired surface water status and terrestrial ecosystems.

The planned project in both variants is located in the area of GWBs PLGW200013 and PLGW200011 [Figure 3.41].

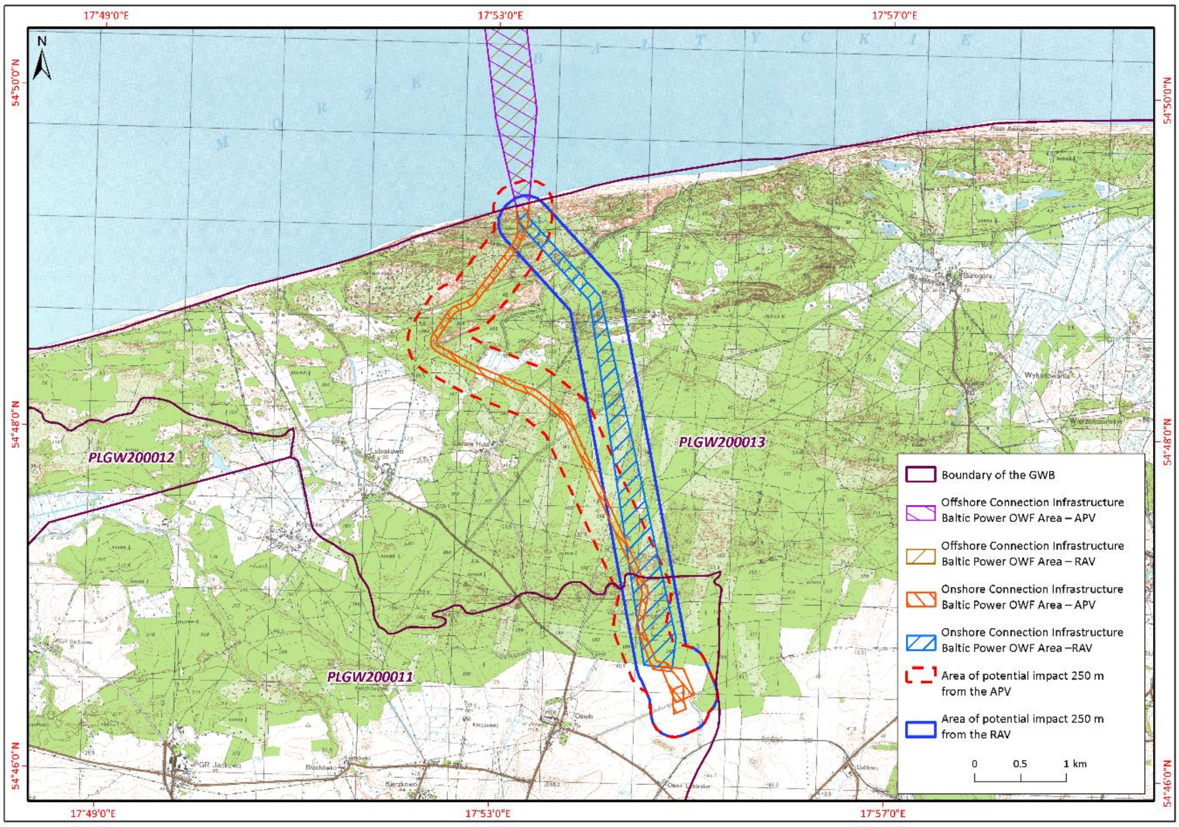

Figure 3.41. Location of the planned project against Ground Water Bodies (GWBs) [Source: internal materials]

The use status of PLGW200013 and PLGW200011 was specified as agricultural and forestry. The status assessment for 2012 for both GWBs indicated good chemical, quantitative and general statuses.

The environmental targets for PLGW200013 and PLGW200011 are good chemical and quantitative statuses. The achievement of the environmental targets is not at risk.

In accordance with the monitoring of groundwater quality conducted as part of the State Environmental Monitoring, the chemical and quantitative quality statuses of GWBs PLGW200013 and PLGW200011 were assessed as good [Table 3.25].

Table 3.25. Status of groundwater bodies (GWBs) no. 11 and no. 13 [Source: internal materials on the basis of http://www.gios.gov.pl/pl/stan-srodowiska/monitoring-wod]

GWB	Year	Chemical status	Quantitative status	General status
11	2012	Good	Good	Good
	2016	Good	Good	Good
	2019	Good	Good	-
13	2012	Good	Good	Good
	2016	Good	Good	Good
	2019	Good	Good	-

The area analysed in both variants is located outside the boundaries of the Main Groundwater Basins (MGWB). At a distance of approx. 2 km from the customer substation in a southerly direction there is

MGWB 108 Salino. Aquifers show moderate sensitivity to pollution. Ground waters run-off takes place in the northern direction.

3.16 Climatic conditions and air quality

3.16.1 Climate and the risk related to climate change

The planned project in both variants is located in the transitional climate zone in Pomerania region, the specificity of which involves high changeability of weather conditions. A typical maritime climate is present there, characterised by small annual seasonal and daily amplitude of air temperatures, high humidity and windiness. Short and mild winters, cool summers and significant amount of precipitation are typical there. As a result of its location in the Baltic Sea basin, on the migration route of active Atlantic lows the lowest atmospheric pressure values in Poland occur.

The effects of climate change observed in recent decades are manifested in particular by an increase in temperature as well as in the frequency and severity of extreme events. Under the United Nations Framework Convention (the so-called Climate Convention) on Climate Change of 9 May 1992, in order to avoid the most serious threats from climate change measures were agreed to reduce greenhouse gas emissions, which have a significant impact on the global energy balance of the climate system. The reduction of greenhouse gas emissions on a global scale is a complex issue. In the foreseeable future, greenhouse gas emissions will not be reduced sufficiently to contain climate change. In this situation, one of the priorities, apart from mitigating the effects of climate change, is a possible adaptation to it, also in the scope of the planned project.

The scenarios of climate change for Poland developed for the purposes of the KLIMADA project [361], constitute the description of the probable future climatic conditions until 2030. They are based on the results of hydrodynamic simulations of atmosphere and ocean models. Due to a significant level of uncertainty, they cannot be regarded as certain climate projections, but they represent the best available approximation of future change.

Extreme events (heavy rainfall, floods, deluges, landslides, heat waves, droughts, storms, landslides, etc.) resulting from climate change are projected to increase in frequency and intensity in the future. These phenomena will occur with increasing frequency and intensity and will affect larger areas of the country. Climate change is associated with adverse changes in hydrological conditions. Although the annual sums of precipitation do not change significantly, their character becomes more random and uneven, resulting in longer periods without rainfall, interrupted by sudden and heavy rainfalls.

Impacts of climate change in the coastal zone primarily include an increase in the frequency, intensity and duration of storms. This can be accompanied by an increased irregularity of these events, i.e. long periods of relative calm can be followed by repeated storms preventing coastal regeneration. An additional factor accelerating the process of coastal erosion is an increase in average winter temperatures, as a result of which a reduction in the ice cover protecting the beaches from storm surges, and thereby safeguarding them against coastal erosion, should be expected. The scenarios of sea level changes demonstrate that in the period 2011–2030 the average annual sea level along the entire coast will be approximately 5 cm higher compared to the values from the reference period, i.e. 1971–1990. An increase in the frequency of storm floods and more frequent flooding of low-lying areas, as well as the degradation of the coastal cliffs and sea shore, which will entail a strong pressure on the infrastructure located in these areas, are very important effects of climate change [432].

Minor future threats for the project is related to the shoreline dynamics of the analysed section of the Southern Baltic coast. As has been shown, the project location (cable chambers) is situated 75–90 m away from the current dune baseline. The shore section corresponding to the location of the cable chambers has an abrasive character. An analysis of high resolution lidar data and orthophotomaps from 2005−2020 demonstrated, that the average rate at which the dune baseline moves towards land is 1.0 to 1.5 m per year. Assuming this rate remains unchanged, the cable chamber area could be within the storm wave impact range in approx. 50–75 years. With the variable circulation in the Southern Baltic region and with the greater frequency and intensity of the storms forecast that rate may change. This does not mean that the changes forecast might speed up the process, however, it should be remembered that maintaining the current abrasion rate or even the process intensification is more probable than its significant slowdown, which cannot be ruled out either.

One of the climate-sensitive sectors is the power sector, due to the predominance of overhead lines in the Polish power system, which are highly vulnerable to failures caused by strong winds and excessive icing, as opposed to cable networks [313].

3.16.2 Meteorological conditions

3.16.2.1 Wind velocity and direction

In the area of the planned project, west and north-west winds predominate. In winter, south and south-eastern winds are common. In 2018, winds with average annual speed ranging from 4.0 to 4.25 $m \cdot s^{-1}$ [Figure 3.42] were predominant. The average number of days per year with strong wind (v >10 $m \cdot s^{-1}$) and very strong wind (v >15 $m \cdot s^{-1}$) may reach up to 70 here. Further inland, the number of days with strong and very strong wind decreases 5–6 times. Breezes as well as frequently passing low pressure areas causing strong winds, storms and heavy rainfall are all characteristic phenomena.

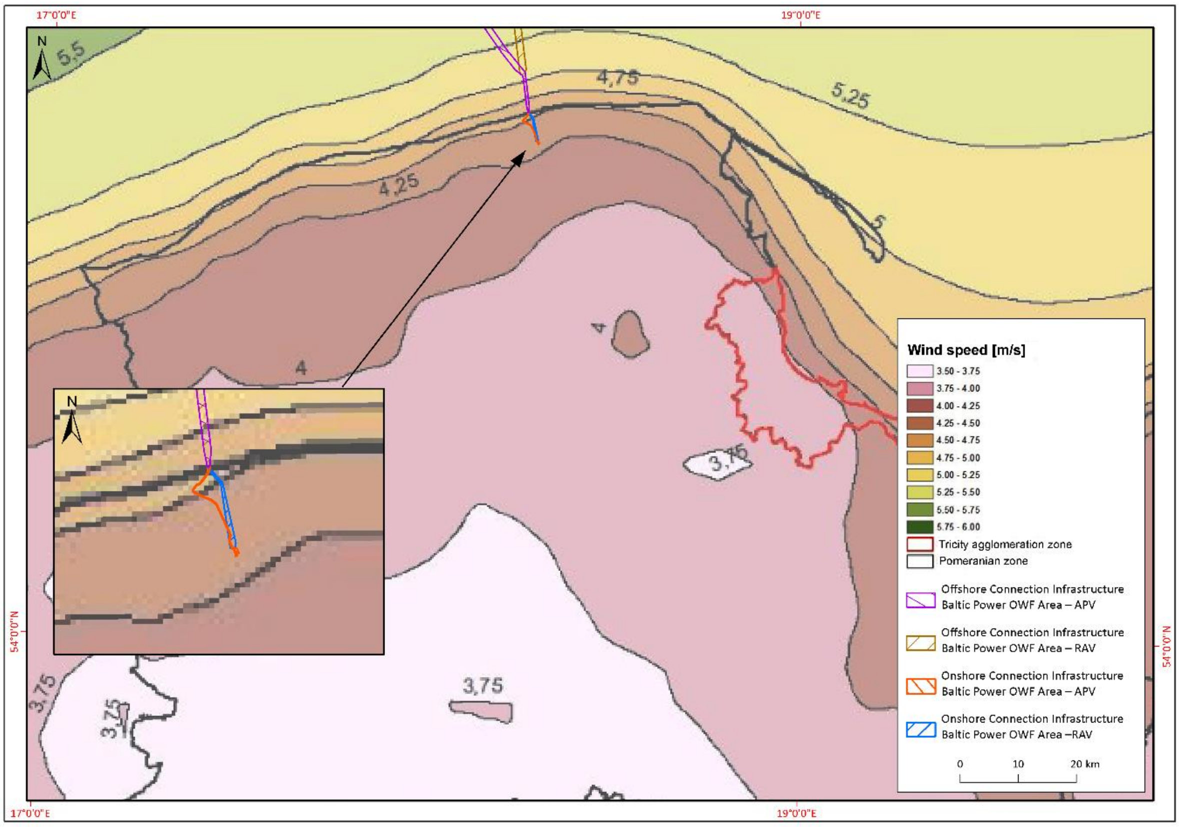

Figure 3.42. Spatial distribution of average annual wind speeds in the Pomeranian Voivodeship in 2018 [Source: Appendix no. 1 to the Resolution no. 308/XXIV/20 of the Regional Council of the Pomeranian Voivodeship of 28 September 2020]

3.16.2.2 Air temperature

In accordance with the data of the nearest weather station in Łeba in the Choczewo area:

- average annual air temperature is 7.2°C;
- average monthly in the hottest month, i.e. July, is 18°C;
- average monthly in the coldest month, i.e. January, is -1°C.

In the Pomeranian Voivodeship, a drop in the average annual air temperature with distance from the Baltic Sea coastline is visible. In the area of the planned project, the vegetation period is approx. 180 days.

3.16.2.3 Precipitation

The average annual sum of precipitation in the area of the planned project is approx. 500 mm, with a predominance of summer precipitation. In 2018, the sum of precipitation was approx. 650–700 mm. The annual sums of precipitation in the Pomeranian Voivodeship show a correlation with distance from the coastline and terrain relief.

3.16.3 Air quality

In accordance with the Report on the State of Environment in the Pomeranian Voivodeship [322], a zone classification was made in terms of health protection for 2018, with division into the Tri-City Agglomeration and the Pomeranian zone, in which the planned project is located. After the review and analysis of the monitoring data from the monitoring stations in the Pomeranian Voivodeship in 2018, exceedances of substance levels in the air in the Pomeranian zone were detected:

- target level for benzo(a)pyrene content in dust PM10;
- permissible level for PM10 suspended dust;
- level of long-term targets for ozone;
- level of long-term target for PM2.5.

No exceedance of target levels of substances in the air was recorded in terms of plant protection.

In accordance with the Low-emission Economy Plan for Choczewo Commune [302], the main sources of air pollution in the commune are:

- municipal and domestic sources: local heating plants, individual household hearths, emitters from public utility plants;
- transport sources;
- secondary dusting from exposed terrain surfaces;
- allochthonous pollution coming from outside the commune depending on the prevailing wind direction.

The Low-emission Economy Plan for Choczewo Commune [302], includes an action plan with regard to decarbonisation with division into priority action areas. The Pomeranian Province Regional Assembly has adopted new air protection programmes for all zones of the Pomeranian Voivodeship. The Air Protection Programme for the Pomeranian zone of 28 August 2020 indicates the types of remedy actions intended to improve the air quality and specifies the exceedance areas [1]. The Choczewo commune was not included in any of the areas specified. It should be remembered that the planned project is located far away from any objects that constitute source of air pollution. The cable line runs across forest areas, and as a result it should be assumed that there are no exceedances of pollution emission into the air. To confirm this information, an application was submitted to the Regional Department of Environmental Monitoring in Gdańsk for the provision of information on the current status of air quality in the Lubiatowo area. In accordance with the letter (ref. no.: DM/GD/063-1/362/20/KM) of 18 December 2020, there is no exceedance of permissible pollution concentrations in the air in the vicinity of the planned project [Table 3.26].

Table 3.26. Status of atmospheric air pollution in the town of Lubiatowo (annual average concentrations) [Source: CIEP, Environmental Monitoring Department. Regional Department of Environmental Monitoring in Gdańsk]

No.	Name of substance	Value [$\mu g \cdot m^3$]
1.	NO_2	5
2.	SO_2	2
3.	PM10	19
4.	PM2.5	13
5.	Benzene	1
6.	Lead	0.01

3.17 Ambient noise

The main acoustic nuisance in the Choczewo commune area is communication noise, mainly along the voivodeship road no. 213 Słupsk–Celbowo and along the district and commune roads.

An acoustic map was prepared for the voivodeship roads of the Pomeranian Voivodeship in accordance with the Act of 27 April 2001 – Environmental Protection Law (Journal of Laws of 2001, No. 62, item 627 as amended) which implemented the provisions of Directive 2002/49/EC of the European Parliament and of the Council of 25 June 2002 relating to the assessment and management of environmental noise. However, the Choczewo commune was not included in these studies.

The noise levels permissible in the environment caused by individual groups of noise sources, expressed with indicators L_{AeqD} and L_{AeqN}, are provided in the Resolution of the Minister of the Environment of 14 June 2007 on permissible noise levels in the environment (Journal of Laws of 2007, No. 120, item 826, as amended).

Indicators L_{AeqD} and L_{AeqN} are used to establish and control the conditions for the use of the environment with respect to a single day. For the noise generated by roads, the indicator L_{AeqD} refers to the time interval equal to 16 day-time hours, and indicator L_{AeqN} refers to the time interval equal to 8 night-time hours, whereas, for the installation noise, the indicator L_{AeqD} refers to the assessment time of 8 most unfavourable hours during the day, and L_{AeqN} refers to a single least favourable hour during the night. Permissible noise levels in the environment are specified in Table 3.27.

Table 3.27. Permissible noise levels in the environment [Source: Regulation of the Minister of the Environment of 14 June 2007 on permissible noise levels in the environment (Journal of Laws of 2007, No. 120, item 826 as amended)]

No.	Type of area	Permissible noise level [dB]			
		Railway roads or lines		Other noise source objects and activities	
		$L_{Aeq\ D}$ reference time interval equal to 16 hours	$L_{Aeq\ N}$ reference time interval equal to 8 hours	$L_{Aeq\ D}$ reference time interval equal to 8 consecutive least favourable day-time hours	$L_{Aeq\ N}$ reference time interval equal to 1 least favourable night-time hour
1.	a. Health resort protection zone “A” b. Hospital areas outside the city	50	45	45	40
2.	a. Single family housing areas b. Housing areas connected to permanent or temporary residence of children and young people c. Nursing home areas d. Hospital areas in cities	61	56	50	40

No.	Type of area	Permissible noise level [dB]			
		Railway roads or lines		Other noise source objects and activities	
		$L_{Aeq\ D}$ reference time interval equal to 16 hours	$L_{Aeq\ N}$ reference time interval equal to 8 hours	$L_{Aeq\ D}$ reference time interval equal to 8 consecutive least favourable day-time hours	$L_{Aeq\ N}$ reference time interval equal to 1 least favourable night-time hour
3.	Multi-family housing and collective housing areas Homestead housing areas Recreational and leisure areas Residential and commercial areas	65	56	55	45
4.	Inner city zone areas of cities with more than 100 000 inhabitants	68	60	55	45

Pursuant to Art. 114, section 1 of the Act of 27 April 2001 – Environmental Protection Law (Journal of Laws of 2001, No. 62, item 627, as amended), the basis for categorisation of areas subject to protection against noise are the provisions of local spatial development plans.

3.17.1 Applicant Proposed Variant

Within the area of the planned project potential impact, there are acoustically protected areas. This is the area of the Rehabilitation and Holiday Centre for disabled people (ul. Spacerowa 38, Lubiatowo). Pursuant to Resolution No. IX/76/2007 of the Choczewo Commune Council of 13 September 2007, the local spatial development plan for the Lubiatowo region, the Kierzkowo precinct, and the Choczewo commune is in force there (Official Journal of the Pomeranian Province No. 3 of 17.01.2008, item 92).

3.17.2 Rational Alternative Variant

In the RAV, within the area of the planned project potential impact, there are no acoustically protected areas. This variant is located at a distance of approx. 420 m from the area of the Rehabilitation and Holiday Centre for disabled people. At a distance of approx. 430 m in the eastern direction at km 41+720, there is a scout hall in Szklana Huta. Pursuant to Resolution No. XXII/263/2009 of the Choczewo Commune Council of 28 May 2009, the local spatial development plan for *Róża Wiatrów* in Szklana Huta in the Choczewo commune is in force there (Official Journal of the Pomeranian Province No. 106 of 11 August 2009, item 2074). In accordance with the site development plan, the area is intended for cultural, educational, pedagogical and recreational services – accommodation base, environmental education centre and scout hall without the proportions between the functions established. The plan does not contain records on the permissible noise level in the environment.

The buildings of the village of Osieki Lęborskie nearest to the planned customer substation and 400 kV line are situated at a distance of approx. 900 m to the west, and the buildings of the village of Lubiatowo approx. 530 m from the APV and approx. 1.7 km from the RAV. Single residential homestead housing in Szklana Huta is located at a distance of 630 m from APV and 1 km from the RAV.

3.18 Electromagnetic field (EMF)

EMF comprises the following fields: electric, magnetic, and electromagnetic with frequencies from 0 Hz to 300 GHz, which generate a range of non-ionising electromagnetic radiation. Its main sources are: high-voltage lines, mobile phone transmitting stations, radars, mobile phones, and electric devices, etc.

The Choczewo commune area is supplied from the NPS from a transformer station GPZ Jackowo 110/15 kV. The GPZ transformer station is supplied by two HV overhead power lines 110 kV, i.e.:

- HV 110 kV line Opalino;
- HV 110 kV line Wojciechowo.

Back-up supply for the MV lines is provided by 110/15 kV GPZ Opalino and Bożepole stations.

The commune power supply infrastructure system includes [302]:

- GPZ 110/15 kV Jackowo station (main transformer station);
- the transmitted 15 kV power supplying individual settlement units – 8 overhead lines;
- a series of 15/04 kV transformer stations supplying the end customers.

In accordance with the Environmental Protection Plan for Choczewo Commune [302], the majority of 15 kV stations was constructed in the 1970s and 1980s. They have been renovated or replaced and their technical condition is assessed as good. The existing low-voltage grid is well-developed and assessed as good. The street lighting network is a 0.4 kV separated network and should be partially modernised. The supplying of local customers takes place from medium to low voltage transformer stations, which are the source of power for the low-voltage customer and lighting networks. Transformer stations are usually erected aboveground as towers with transformers with a power of up to 600 kVa. The number of transformer devices and the MV and LV network lengths satisfy the demand of individual customers, small and medium enterprises.

Mobile phone network base stations are located in the Choczewo commune. They are transmission-receiving devices connecting the mobile phone network with mobile phones. The configuration of the base station antenna system cannot generate a non-ionising electromagnetic radiation with levels exceeding the permissible level (in areas accessible to humans), specified in the provisions of the Environmental Protection Law.

Pursuant to the Act of 27 April 2001 – Environmental Protection Law (Journal of Laws of 2001, No. 62, Item 627, as amended), since 2005, the Environmental Protection Inspectorate has been carrying out the assessments of the electromagnetic field levels in the environment as part of the State Environmental Monitoring. The monitoring measurements of the electromagnetic radiation were carried out in accordance with the Regulation of the Minister of the Environment of 12 November 2007 on the scope and method of periodic measurements of electromagnetic field levels in the environment (Journal of Laws of 2007, item 1645).

In accordance with the Report on the State of Environment in the Pomeranian Voivodeship [322], in the Choczewo commune, which was identified as a rural area, the EMF intensity measurements were carried out in the years 2017–2018. For all the rural areas inspected, the average intensity values of EMF in 2017 were 0.22 $V \cdot m^{-1}$ and in 2018 − 0.42 $V \cdot m^{-1}$.

3.19 Description of the natural environment components and protected areas

3.19.1 Biotic elements in the onshore area

3.19.1.1 Fungi

The characteristics of macroscopic fungi was developed on the basis of annual inventory surveys on abiotic and biotic resources of the BP OWF CI survey area (Appendix 1. Report on inventory survey) as well as data from literature and the Register of protected and endangered fungi – GREJ (http://www.grzyby.pl). The characteristics of fungi carried out in the area of the planned project potential impact in APV and RAV.

The biota of macroscopic fungi of high nature value in the area of the planned project in both variants is quite scarce and concentrated only in the northern part of the area [Figure 3.43].

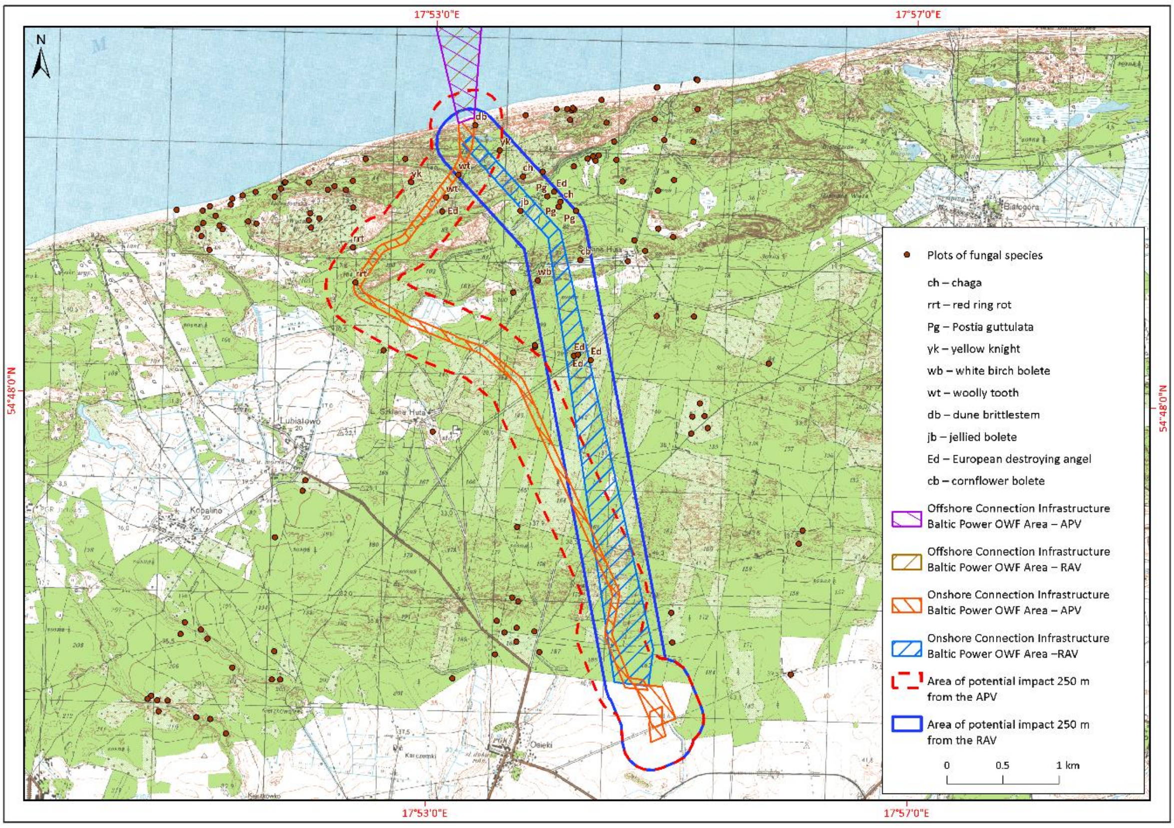

Figure 3.43. Plots of fungi species of high nature value [Source: internal materials]

3.19.1.1.1 Applicant Proposed Variant

The APV area is dominated by common species, widely distributed across coastal coniferous forests. In the recent years, in the area of the coastal coniferous forests (*Empetro nigri-pinetum*), the expansion of *Boletus projectellus* originating from North America is visible. For its proper development, this expansive fungus requires mycorrhiza with pine tree roots, which are the main forest-forming element. The areas around Lubiatowo and Białogóra were one of the very first areas of its occurrence in the Polish coastal coniferous forests.

The macroscopic fungi species listed here are quite common and widespread, with a high naturalness rate in the lowland forest areas.

The following species of high nature value should be mentioned:

- red ring rot (*Freefalling pini*), the shelf-shaped fruiting bodies of which grow on living pines, usually on a trunk above the height of 2 metres. Red List status: R – rare potentially endangered with extinction;
- yellow knight (*Tricholoma equestre*), the fruiting bodies of which grow on ground among the prostrate shrubs of the black crowberry and the cross-leaved heath. Red list status: U – of unidentified threat;
- woolly tooth (*Phellodon tomentosus*) – this species is rare in Poland, found in the survey area on needles and among the prostrate shrubs of the European blueberry (*Vaccinium myrtillus*). Red list status: E – dying out, critically endangered;
- dune brittlestem (*Psathyrella ammophila*), occurring on grey dune among the clumps of the European beachgrass (*Ammophila arenaria*). Red list status: E – dying out, critically endangered.

The above-mentioned species of macroscopic fungi of high nature value occurred in the northern part of the APV route at km up to 35+300 m. In the southern part of the route, during the environmental inventory conducted, no plots of macroscopic fungi species of high nature value were found.

3.19.1.1.2 Rational Alternative Variant

The biota of macroscopic fungi of high nature value is quite scarce and concentrated only in the northern part of the area, especially around springs and the upper reaches of the Bezimienna Stream. The entire RAV area is dominated by common species, widely distributed across coastal coniferous forests. Also, in this part of the coastal coniferous forests (*Empetro nigri-pinetum*), in the recent years, the expansion of *Boletus projectellus* originating from North America is visible. Along a section of the RAV route, there are pine (*Pinus mugo*) plantings, where a large populations of Greville's bolete (*Suillus grevillei*), Jersey cow mushroom (*Suillus bovinus*) and bluing bolete (*Gyroporus cyanescens*) were recorded. The presence of fruiting bodies of bay bolete (*Xerocomus badius*), suede bolete (*Xerocomus subtomentosus*), velvet roll-rim (*Paxillus atrotomentosus*) and others was observed. The species belonging to the Ascomycota found in the RAV area included: candlestick fungus (*Xylaria hypoxylon*), dead man's fingers (*Xylaria polymorpha*), coral spot (*Nectria cinnabarina*) and *Hypoxylon fragiforme*.

The macroscopic fungi species listed here are quite common and widespread, with a high naturalness rate in lowland forest areas.

The following species of high nature value should be mentioned:

- chaga (*Inonotus obliquus*) – species under partial protection. In the survey area, found in scattered plots, mainly in coniferous habitats, in the strip of coastal dune embankment, on medium-sized birch trees. Due to its medicinal properties, the species is under partial protection, which is aimed at limiting the excessive harvesting of fruiting bodies. Red list status: R – rare potentially endangered with extinction;
- *Postia guttulata*, the fruiting bodies of which were found in several plots, always on fallen pine trunks, in coniferous forest habitats. Red list status: E – dying out, critically endangered;

- yellow knight (*Tricholoma equestre*), in Pomerania, a species common in the areas of coastal coniferous forests, often in dry and sandy plots. In the survey area, found in two plots, however, it is probably underestimated. Red list status: U – species of unidentified threat;
- woolly tooth (*Phellodon tomentosus*) – this species is rare in Poland, found in the survey area on needles and among the prostrate shrubs of the European blueberry (*Vaccinium myrtillus*);
- *Leccinum niveum* – in the RAV area, the species was found in humid habitats, among the prostrate shrubs of the marsh Labrador tea (*Ledum palustre*) and the cross-leaved heath (*Erica tetralix*). This species, rare in Poland, is found in forests under birch trees, in marshy birch forests, humid coniferous forests and less often in riparian forests and raised forest peat bogs. It forms mycorrhizal associations with birch trees growing among peat mosses. Red list status: V – vulnerable;
- dune brittlestem (*Psathyrella ammophila*), occurring on grey dune among the clumps of the European beachgrass (*Ammophila arenaria*). Red list status: E – dying out, critically endangered;
- jellied bolete (*Suillus flavidus*) – species under partial protection. In Pomerania, it occurs along the seashore in the peaty outskirts of coastal coniferous forests. The fruiting bodies grow on acidic peat bogs, under the Scots pines and dwarf mountain pines (*Pinus sylvestris* and *Pinus mugo*). In the RAV area, it was found in one plot, in the area of the Bezimienna springs, among the shrubs of the marsh Labrador tea (*Ledum palustre*) and the cross-leaved heath (*Erica tetralix*). Presumably, it is more common in the area, especially in peat bog depressions, however, it is underestimated. Red list status: E – dying out, critically endangered;
- European destroying angel (*Amanita virosa*) – found in scattered plots in the area of coniferous forest habitats, especially in places with little access in the vicinity of the Bezimienna Stream. Red list status: V – vulnerable;
- cornflower bolete (*Gyroporus cyanescens*) – in the survey area, found in four plots. The species is probably common in the survey area, but underestimated.

The above-mentioned species of macroscopic fungi of high nature value occurred in the northern part of the RAV route up to km 42+600 m. In the southern part of the route, during the environmental inventory conducted, no plots of macroscopic fungi species of high nature value were found.

3.19.1.2 Lichens

A detailed characteristics invertebrates was developed on the basis of annual inventory surveys on abiotic and biotic resources of the BP OWF CI survey area (Appendix 1. Report on inventory survey) as well as data from literature. The characteristics of lichens was carried out in the area of the planned project potential impact in APV and RAV [Figure 3.44].

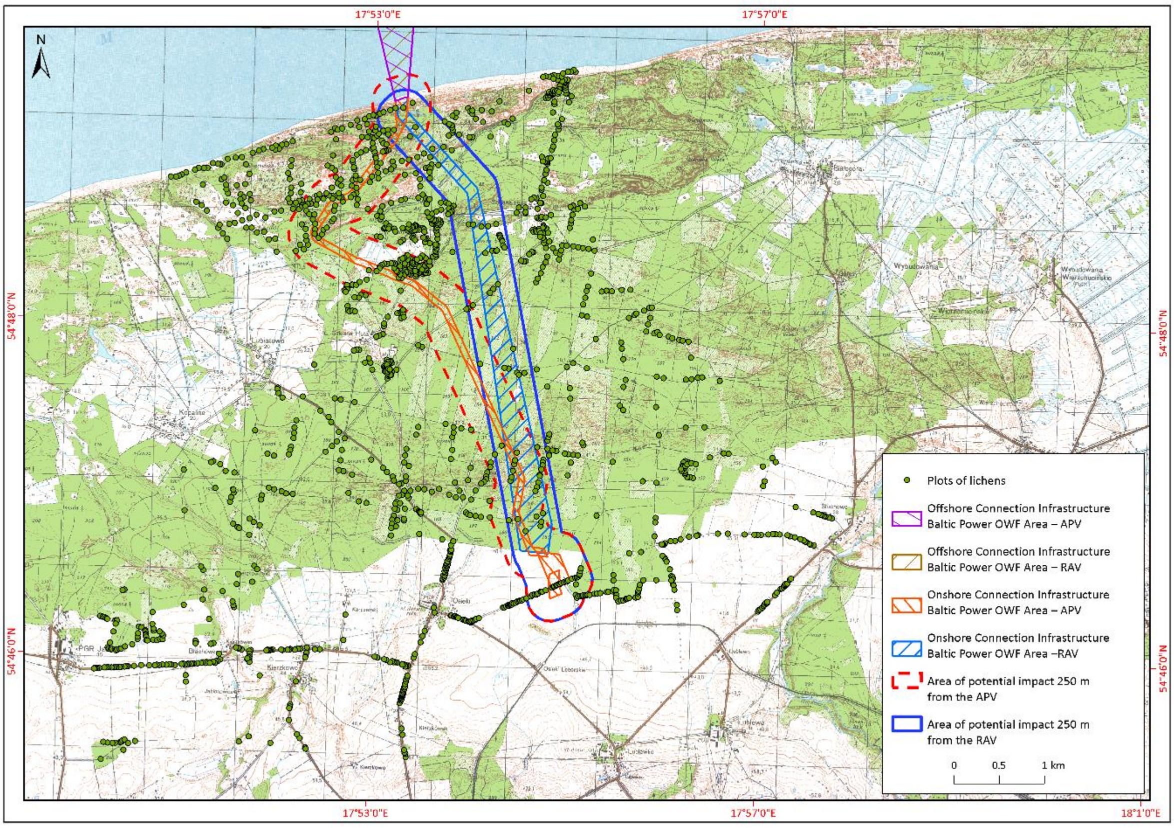

Figure 3.44. Plots of lichen species of high nature value [Source: internal materials]

3.19.1.2.1 Applicant Proposed Variant

The APV route crosses two areas characterised by a significant richness and diversity of lichen biota, with a large share of valuable species (protected, rare, endangered). The first one covers a strip of coastal coniferous forests between km 33+700 to 35+300, the second one – an impressive, over 100-year-old old beech forest with rare epiphytic lichen species between km 36+100 and 36+500. Moreover, roadside trees, south of the designed customer substation, were considered valuable plots for epiphytic lichen species.

The following lichen species should be mentioned:

- silver-lined wrinkle (*Tuckermanopsis chlorophylla*) – species under partial protection, considered as vulnerable (cat. VU) both in Poland and in Gdańsk Pomerania. Along a route section, in the pine forests in the coastal zone, it was found on the birch bark;
- bristly beard lichen (*Usnea hirta*) – a taxon under partial protection, vulnerable (cat. VU) in Poland. Occurring commonly on pines, birches, spruces, and other species of deciduous trees and also on wood;
- *Zwackhia viridis* – epiphytic species, vulnerable (cat. VU). In most cases, the lichen thalli grew on beech bark, rarely on other species of deciduous trees;
- tree reindeer lichen (*Cladonia arbuscula*) – terrestrial species, under partial protection in Poland. Within the survey area, very abundant, often massively overgrowing dunes in the coastal zone and the nearby pine forests;

- reindeer lichen (*Cladonia portentosa*) – taxon under partial protection in Poland. Within the inventory area, it is recorded much less frequently than the tree reindeer lichen, but occupies similar habitats (dunes and pine forests);
- grey reindeer lichen (*Cladonia rangiferina*) – terrestrial species, under partial protection in Poland. Most commonly encountered with the tree reindeer lichen, in pine forests and on dunes;
- Griffith's cliostomum lichen (*Cliostomum griffithii*) – epiphytic species, vulnerable (cat. VU). In most cases, the lichen thalli grew on beech bark, rarely on other species of deciduous trees;
- sulphured crimson dot lichen (*Pyrrhospora quernea)* – epiphytic species, critically endangered (cat. CR). In most cases, the lichen thalli grew on oak bark, rarely on other species of deciduous trees;
- rim lichen (*Lecanora intumescens)* – epiphytic species, in Poland endangered (cat. EN). In most cases, the lichen thalli grew on beech bark, rarely on other species of deciduous trees;
- eagle's claws lichen (*Anaptychia ciliaris)* – epiphytic species under strict protection, in Poland considered as endangered (cat. EN), in Gdańsk Pomerania – as vulnerable (cat. VU) and quite rare (cf. e.g. [102, 101]). Found in well-illuminated areas, rich in nutrients on roadside trees (usually poplars);
- cartilage lichen (*Ramalina fraxinea*) – species under strict protection, endangered (cat. EN), in Poland, vulnerable (cat. VU) in Gdańsk Pomerania. Along the route section, large specimens were found mainly on roadside trees;
- dotted ribbon lichen (*Ramalina fastigiata*) – in Poland under strict protection and considered as an endangered taxon (cat. EN), in Gdańsk Pomerania with vulnerable status (cat. VU). Found on the bark of deciduous trees, mainly roadside trees;
- farinose cartilage lichen (*Ramalina farinacea*) – a species under partial protection, considered endangered (cat. VU) in Poland. In Gdańsk Pomerania, a quite common taxon (cf. e.g. [102]). Along the planned APV route, the specimens grew on the bark of deciduous trees;
- *Varicellaria hemisphaerica* – epiphytic species, vulnerable (cat. VU). In most cases, the lichen thalli grew on beech bark, rarely on other species of deciduous trees;
- *Pyrenula nitida* – epiphytic species, vulnerable (cat. VU). In most cases, the lichen thalli grew on beech bark, rarely on other species of deciduous trees;
- pierced lichen (*Pertusaria pertusa)* – epiphytic species, vulnerable (cat. VU). In most cases, the lichen thalli grew on beech bark, rarely on other species of deciduous trees;
- covered lichen (*Pertusaria hymenea)* – epiphytic species, critically endangered in Poland (cat. CR). In most cases, the lichen thalli grew on pine and oak bark, rarely on other species of deciduous trees;
- *Pertusaria flavida* – epiphytic species, under strict protection, in Poland considered endangered (cat. EN), in Gdańsk Pomerania as vulnerable (cat. VU) and quite rare (cf. e.g. [102, 101]). Found on tree bark, mainly smooth bark (hornbeam, beech, rowanberry);
- Iceland moss (*Cetraria islandica*) – species under partial protection, vulnerable (cat. VU) in Poland. Along the section of the cable connection route, abundant on dunes and in pine forests in the coastal zone. Quite common in Western Pomerania (cf. [102, 231]), in coniferous forests, on dunes, and heathlands;

- salted starburst lichen (*Imshaugia aleurites*) – taxon under partial protection, belongs to species common in the region (cf. [102, 101]). Along the section of the cable connection route, found in pine forests in the coastal zone;
- powder-headed tube lichen (*Hypogymnia tubulosa*) – taxon under partial protection, considered near-threatened (NT) in Poland. Powder-headed tube lichen belongs to species occurring often in the region (cf. [102, 101]). In most cases, the lichen thalli grew on birch bark, rarely on other species of deciduous trees, on pines as well as wood;
- scribble lichen (*Opegrapha niveoatra*) – epiphytic species, vulnerable (cat. VU). In most cases, the lichen thalli grew on beech bark, rarely on other species of deciduous trees;
- *Opegrapha vermicellifera* – epiphytic species, in Poland considered endangered (cat. EN), in Gdańsk Pomerania as vulnerable (cat. VU) and quite rare (cf. e.g. [102, 101]). Found in a single plot, on birch bark;
- *Atrhonia didyma* – epiphytic species, endangered (cat. EN). Found exclusively on beech bark;
- chestnut wrinkle-lichen (*Cetraria sepincola)* – epiphytic species, under strict protection, across the entire country and in Pomerania endangered (cat. EN). Found exclusively on beech bark;
- salted starburst lichen (*Imshaugia aleurites*) – species under partial protection, observed on deciduous trees and also on wood;
- elegant camouflage lichen (*Melanohalea elegantula*) – species under strict protection, in Poland and in Gdańsk Pomerania with vulnerable (VU) status. Found on the bark of deciduous trees, mainly roadside trees;
- whiskered camouflage (*Melanelixia subargentifera*) – taxon considered vulnerable in Poland (cat. VU), in Gdańsk Pomerania as endangered (cat. EN) and quite rare (cf. e.g. [102, 101]). This species was found only in one plot, on the bark of a large Norway maple;
- abraded camouflage lichen (*Melanelixia subaurifera*) – species under partial protection, vulnerable (cat. VU) in Gdańsk Pomerania. Thalli of *Melanelixia subaurifera* were observed on deciduous trees, and also on wood;
- bark barnacle lichen (*Thelotrema lepadinum*) – epiphytic species, under strict protection, in Poland considered as endangered (cat. EN) and quite rare (cf. e.g. [102, 101]). Found on tree bark, mainly smooth bark (hornbeam, beech);
- green powdery stellated lichen (*Physconia distorta*) – epiphytic species, endangered (cat. EN). Found on the bark of deciduous trees, mainly roadside trees or growing alone;
- *Pleurosticta acetabulum* – species under partial protection, in Poland considered endangered species (cat. EN), in Gdańsk Pomerania as vulnerable (cat. VU). Along a section of the route, found on the bark of deciduous trees, mainly maple and ash trees, in good insulation conditions;
- *Gyalecta carneola* – epiphytic or epixylic species, lichen thalli grew on beech bark, less common on other deciduous tree species;
- speckled horsehair lichen (*Bryoria fuscescens*) – species under partial protection. Both in Poland and in Gdańsk Pomerania it is assigned a vulnerable status (cat. VU). Along a section of the route, thalli of this species predominantly inhabited the bark of birch trees;

- powdered sunshine lichen (*Vulpicida pinastri*) – species under partial protection, considered near-threatened (cat. NT) in Poland and vulnerable (cat. VU) in Gdańsk Pomerania. Individual thalli of this species were recorded on the bark of birch trees;
- common greenshield lichen (*Flavoparmelia caperata*) – epiphytic species, under strict protection, rare across the entire country. Included in the Red List of plants and fungi of Poland as endangered (cat. EN). EN). Found exclusively on pine bark.

3.19.1.2.2 Rational Alternative Variant

The RAV route is characterised by lichen biota less rich than in the case of APV and runs across two areas characterised by significant richness and diversity of lichen biota, both from the point of view of coniferous species and old-growth deciduous epiphytes. Roadside trees south of the designed customer substation were considered valuable plots for epiphytic lichen species. Along the RAV, it is difficult to indicate areas with strongly diversified lichen biota.

From the lichen species growing in this area, the following should be mentioned: silver-lined wrinkle (*Tuckermanopsis chlorophylla*), bristly beard lichen (*Usnea hirta*), *Zwackhia viridis*, tree reindeer lichen (*Cladonia arbuscula*), reindeer lichen (*Cladonia portentosa*), grey reindeer lichen (*Cladonia rangiferina*), Griffith's cliostomum lichen (*Cliostomum griffithii)*, farinose cartilage lichen (*Ramalina farinacea*), pierced lichen (*Pertusaria pertusa)*, covered lichen (*Pertusaria hymenea)*, Iceland moss (*Cetraria islandica*), salted starbust lichen (*Imshaugia aleurites*), abraded camouflage lichen (*Melanelixia subaurifera*), and *Gyalecta carneola*. Their characteristics are set out above, in the APV. Apart from these species, in the area of the RAV potential impact, powdered head tube lichen (*Hypogymnia tubulosa*) can be found – a taxon under partial protection, considered near-threatened (NT) in Poland. Powdered head tube lichen belongs to species occurring often in the region. In most cases, the lichen thalli grew on birch bark, rarely on other species of deciduous trees, on pines as well as wood.

3.19.1.3 Mosses and liverworts

A detailed characteristics of moss and liverwort species was developed on the basis of annual inventory surveys on abiotic and biotic resources of the BP OWF CI survey area (Appendix 1. Report on inventory survey) as well as data from literature. The characteristics of mosses and liverworts was carried out in the area of the planned project potential impact in APV and RAV [Figure 3.45, Figure 3.46].

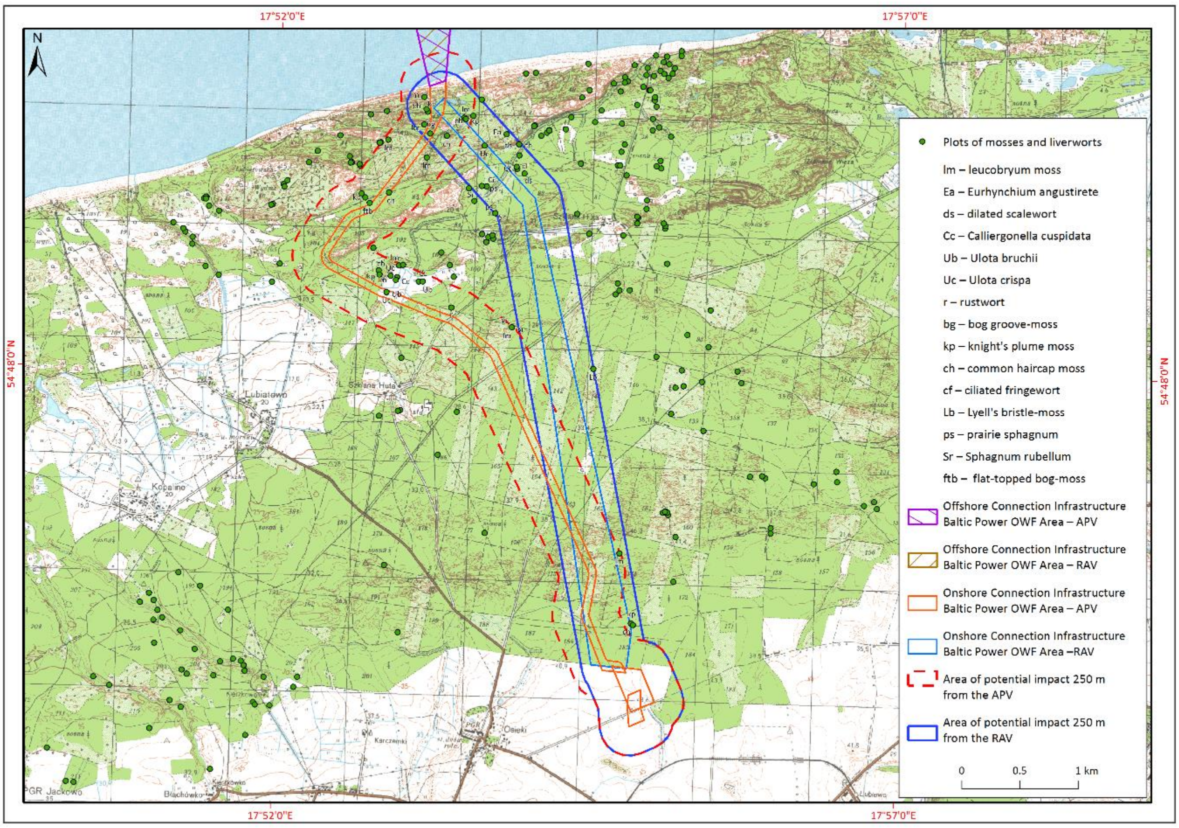

Figure 3.45. Plots of moss and liverwort species of high nature value [Source: internal materials]

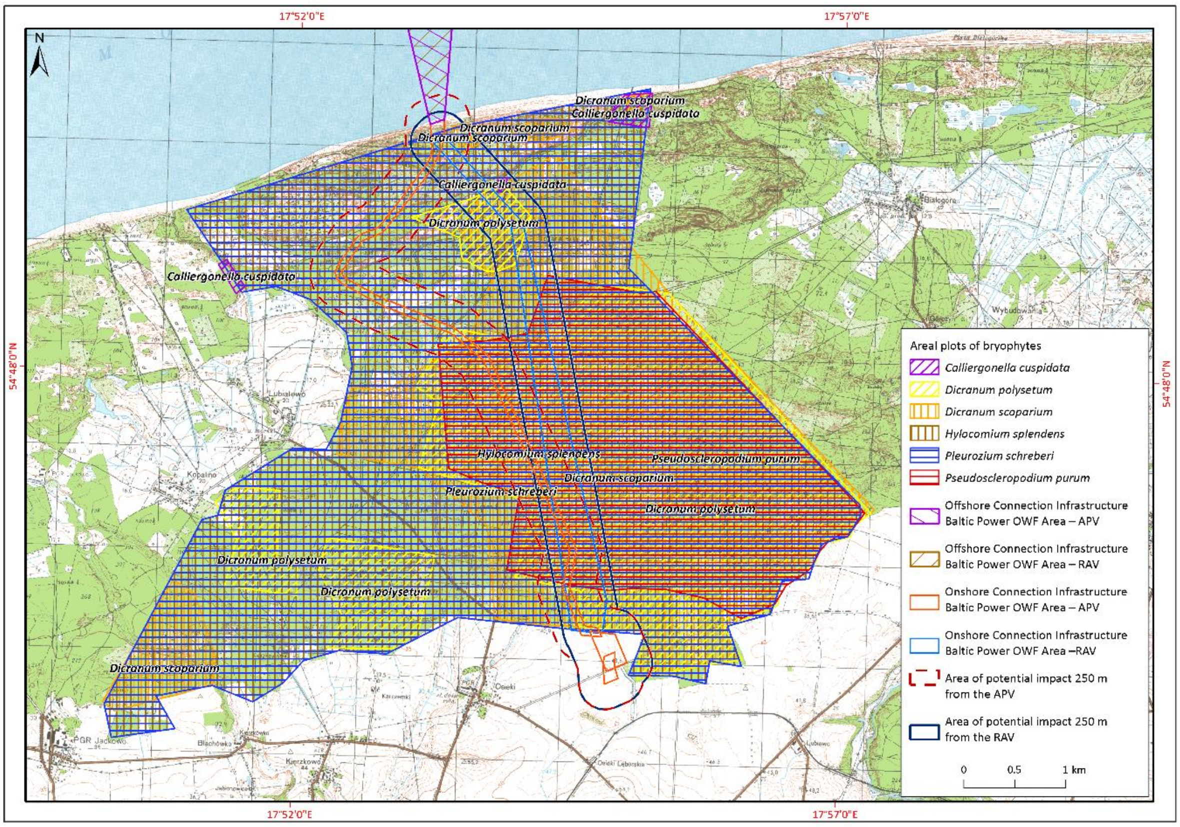

Figure 3.46. Plots of bryophyte species of high nature value. Species: mountain fern moss (Hylocomium splendens), pointed spear-moss (Calliergonella cuspidata), neat feather-moss

(Pseudoscleropodium purum), red-stemmed feathermoss (Pleurozium schreberi), wavy broom moss (Dicranum polysetum) and broom forkmoss (Dicranum scoparium) [Source:internal materials]

3.19.1.3.1 Applicant Proposed Variant

A vast majority of bryophytes typical for ground cover of deciduous and coniferous forests and forest peat depressions, which were recorded in the area of the APV potential impact, are species widespread in Poland and in Gdańsk Pomerania region. They are not endangered neither on the national nor regional scale. The group of species under partial protection includes common mosses and liverworts typical of the ground cover of coniferous forests and acidophilous deciduous forests. Locally rare species are epiphytes of old deciduous trees. Along the entire route of the APV, there are common terrestrial coniferous forest species, part of which is under partial protection.

Among the moss and liverwort species present there, the following should be mentioned:

- white pincushion moss (*Leucobryum glaucum*) – along the APV route, it is scattered across the entire area of coniferous forest habitats, both in the coastal strip as well as the inland coniferous forests in the western part of the survey area. Population in the survey area stable, unthreatened by increased tourist traffic.
- *Eurhynchium angustirete* – along the APV route, it grows in the vicinity of beeches in mixed forests, beech forests on acidic soils and young beech stands;
- mountain fern moss (*Hylocomium splendens*) – along the APV route, it grows commonly across the entire area of the coastal coniferous forest and mixed forests. Population in the survey area stable, unthreatened by increased tourist traffic. Occurs in patches in places;
- dilated scalewort (*Frullania dilatata*) – along the APV route, it occurs in scattered plots in the area of the Bezimienna Stream, the village of Szklana Huta and the Biebrowski Canal;
- pointed spear-moss (*Calliergonella cuspidata*) – -along the APV route, occurs in several plots, mainly in the area of the Bezimienna Stream and the Biebrowski Canal;
- Bruch's pincushion (*Ulota bruchii*) – along the route, it occurs in several scattered plots in coniferous forest habitats;
- crisped pincushion moss (*Ulota crispa*) – along the APV route, it occurred in several scattered plots in coniferous forest habitats;
- wood-rust (*Nowellia curvifolia*) – along the APV route, it occurs in scattered plots in the area of the Bezimienna Stream, the village of Szklana Huta and the Biebrowski Canal;
- neat feather-moss (*Pseudoscleropodium purum*) –along the APV route, it is common in the south-western area of the land inspected, mainly in coniferous forest and mixed forest habitats with a predominance of pine. Population in the survey area stable, unthreatened by increased tourist traffic.
- knight's plume moss (*Ptilium crista-castrensis*) – along the APV route, it is scattered across the entire forest area, both in the communities of coastal coniferous forest, as well as inland coniferous forest with a predominance of pine, at the edges of beech forests, in young pine and mixed stands;
- common hair-cap moss (*Polytrichum commune*) – in the survey area, scattered across the entire forest area, in moist and fresh places, often in the vicinity of peat moss. Population in the survey area stable, unthreatened by increased tourist traffic. Occurs in patches in places;

- bog groove-moss (*Aulacomnium palustre*) – along the APV route, it occurs in abundance in scattered plots in the area of the Bezimienna Stream;
- red-stemmed feathermoss (*Pleurozium schreberi*) – along the APV route, it is scattered across the entire forest area, both in the communities of coastal coniferous forest, as well as inland coniferous forest with a predominance of pine, at the edges of beech forests, in young pine and mixed stands. Population in the survey area stable, unthreatened by increased tourist traffic. Usually, occurs in patches in plots.
- ciliated fringewort (*Ptilidium ciliare*) – along the APV route area, it occurs mainly in its north-western part, on dune banks under pines and in the area of the Bezimienna Stream.
- Lyell's bristle moss (*Orthotrichum lyellii*) – along the APV route area, it occurs at several scattered plots on single old trees, mainly near access roads, in illuminated plots;
- blunt-leaved bog moss (*Sphagnum palustre*) – along the APV route area, it occurs in peat depressions within coniferous forests, especially in the northern part of the area. Usually, occurs in patches in plots.
- red bog-moss (*Sphagnum rubellum*) – along the APV route area, it occurs in peat depressions within coniferous forests, especially in the northern part of the area. Usually, occurs in patches in plots.
- flat-topped bog-moss (*Sphagnum fallax*) – along the APV route area, it occurs mainly in its north-western part, on dune banks under pines and in the area of the Bezimienna Stream;
- wavy broom moss (*Dicranum polysetum*) – along the route, it is scattered across the entire coniferous forest habitats, especially in the southern part of the area. Less common in other forest communities. Population in the survey area stable, unthreatened by increased tourist traffic. Occurs in patches in places;
- broom forkmoss (*Dicranum scoparium*) – along the route, it is scattered across the entire coniferous forest habitats, especially in the southern and western part of the area. Population in the survey area stable, unthreatened by increased tourist traffic. Occurs in patches in places.

3.19.1.3.2 Rational Alternative Variant

Similar as in the case of APV, a vast majority of bryophytes typical for ground cover of deciduous and coniferous forests and forest peat depressions, which were recorded in the area of the RAV potential impact, are species widespread in Poland and in Gdańsk Pomerania region. They are not endangered neither on the national nor regional scale. The group of species under partial protection includes common mosses and liverworts typical of the ground cover of coniferous forests and acidophilous deciduous forests. Locally rare species are epiphytes of old deciduous trees. Along the entire route of the RAV, there are common terrestrial coniferous forest species, part of which is under partial protection. In the area of the potential impact of the potential project RAV, the plots of the following species can be found: white pincushion moss (*Leucobryum glaucum*), *Eurhynchium angustirete*, mountain fern moss (*Hylocomium splendens*), pointed spear-moss (*Calliergonella cuspidata*), crisped pincushion moss (*Ulota crispa*), neat feather-moss (*Pseudoscleropodium purum*), common hair-cap moss (*Polytrichum commune*), red-stemmed feathermoss (*Pleurozium schreberi*), wavy broom moss (*Dicranum polysetum*), and broom forkmoss (*Dicranum scoparium*). Their characteristics are set out in the variant above. Apart from these species, in the area of the RAV potential impact, dilated scalewort (*Frullania dilatata*) can be found. Along the RVA route, it occurs in scattered plots in the area of the Bezimienna Stream and the village of Szklana Huta.

3.19.1.4 Vascular plants and natural habitats

A detailed characteristics of vascular plants and natural habitats was developed on the basis of annual inventory surveys on abiotic and biotic resources of the BP OWF CI survey area (Appendix 1. Report on inventory survey) as well as data from literature. The characteristics of plants and habitats was carried out in the area of the planned project potential impact in APV and RAV [Figure 3.47, Figure 3.48].

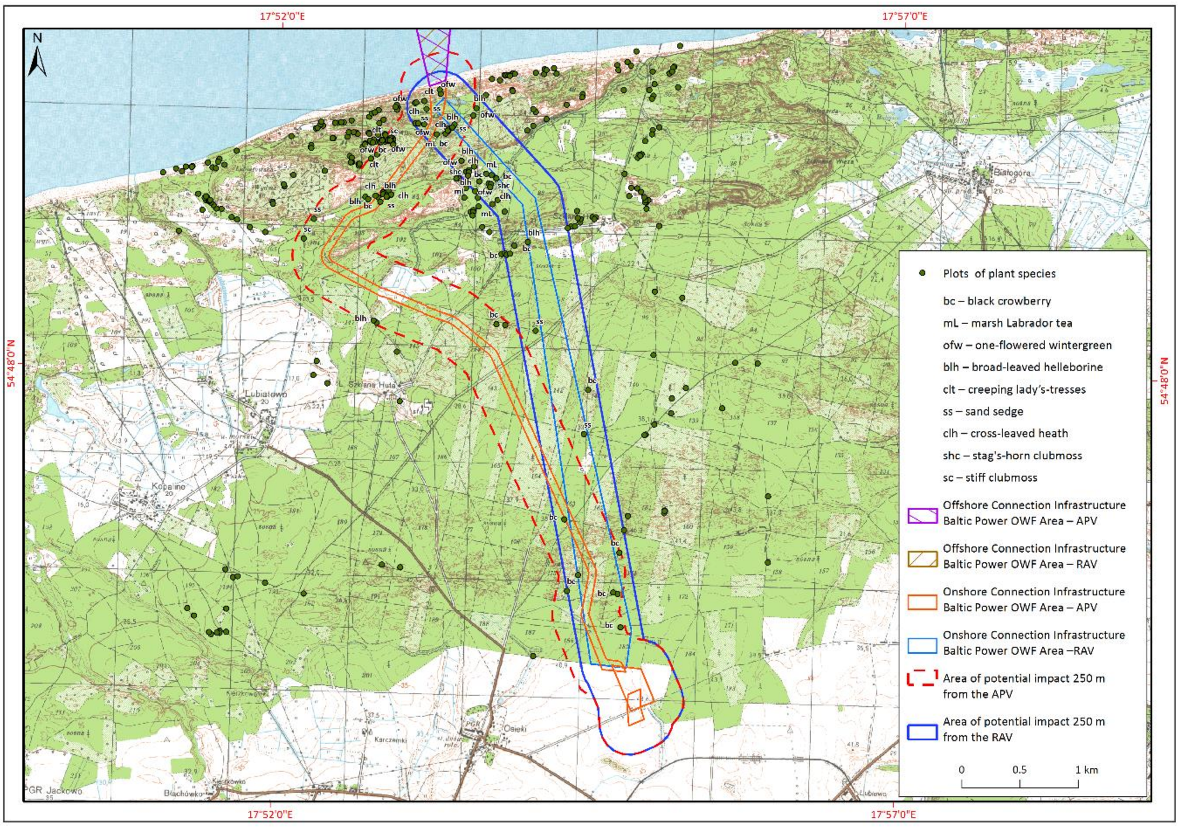

Figure 3.47. Plots of vascular plant species of high nature value [Source: internal materials]

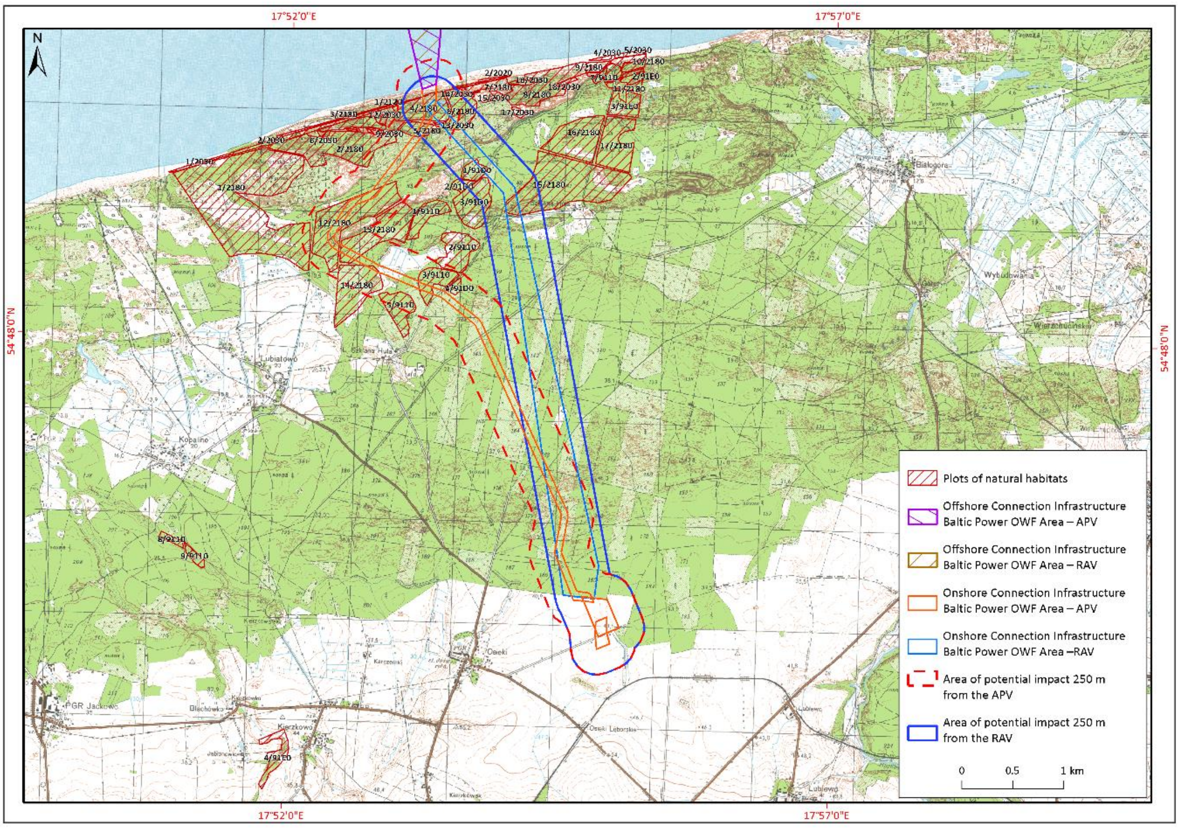

Figure 3.48. Plots of natural habitats [Source: internal materials]

3.19.1.4.1 Applicant Proposed Variant

The area that is crossed by this variant is characterised by a typical for Pomerania, strip-like arrangement of habitats, parallel to the seashore, with relatively well-preserved vegetation. The vegetation of the area builds communities of strips of white dunes, then grey dunes and coastal deciduous and coniferous forests, which then transform into fresh pine forests (*Leucobryo-Pinetum*) and mixed coniferous forests (*Betulo-Quercetum*). The variant proposed by the Applicant runs across white and grey dunes, which the project is to cross through horizontal drilling. The work on laying underground cables in the APV begin in the dry crowberry coniferous forest (*Empetro nigri-Pinetum*), in which the dominant species is pine. The species age was estimated at 81–106 years. Then, fragments of lowland acidophilous beech forests, where the age of beech was estimated at over 100 years, ash-alder forests with alder, beech, fresh mixed forests up to fresh mixed coniferous forests (*Betulo-Quercetum*) dominating in the southern part of the course and fresh pine forests (*Leucobrio-Pinetum*). Along the route of this variant, during the inventory survey conducted, 8 plant species of high nature value were found.

- marsh Labrador tea (*Ledum palustre*) – species under partial protection. Along the route, quite common, growing in waterlogged forest depressions often accompanied by black crowberry and cross-leaved heath. Population in the survey area stable, unthreatened by increased tourist traffic. Occurs in patches in places;
- black crowberry (*Empetrum nigrum*) – species under partial protection. Along the route, very common, growing across the entire area of coastal coniferous and mixed forests. Population in the survey area stable, unthreatened by increased tourist traffic. Occurs in patches in places;

- one-flowered wintergreen (*Moneses uniflora*) – species under partial protection, included in the Polish Red List [192] in category NT (near-threatened). Along the route in the crowberry coniferous forest habitats, this species grows among mosses of coniferous forests, usually in the vicinity of dune embankments often accompanied by creeping lady's-tresses. In the survey area, the population is relatively stable, although it is vulnerable to trampling and uprooting of showy flowers;
- broad-leaved helleborine (*Epipactis helleborine*) – species under partial protection. In the area, it was found mainly along forest roads and the surrounding ditches, which is probably connected to the anthropogenic enrichment of the substrate in nutrients. Due to not very showy white and green flowers, the species is not directly damaged. In places, it is fairly frequent with several to several dozens of flowering specimens. Population in the survey area stable, unthreatened by increased tourist traffic.
- creeping lady's-tresses (*Goodyera repens*) – species under strict protection, included in the Polish Red List [192] in category NT (near-threatened). Along the route, the range of the species coincides with that of crowberry coniferous forest, usually in the vicinity of scattered round-leaved wintergreen, usually a few specimens each. In individual plots, approximately half of them is apomictic. The population is relatively stable in the survey area, although it is vulnerable to trampling and destruction related to the commercial use of forests.
- sand sedge (*Carex arenaria*) – species under partial protection. Along the survey route, very common, growing across the entire area of coastal coniferous and mixed forests. Population in the survey area stable, unthreatened by increased tourist traffic. Occurs in patches in places;
- stiff clubmoss (*Lycopodium annotinum*) – species under partial protection, included in the Polish Red List [192] in category NT (near-threatened). Along the APA route, it occurs in plots within the coastal crowberry coniferous forest (*Empetro nigri-Pinetum*). The population is relatively stable in the survey area, although it is vulnerable to trampling and uprooting, as well as destruction related to the commercial use of forests;
- cross-leaved heath (*Erica tetralix*) – species under strict protection included in the Polish Red List [192] in category VU (vulnerable). Along the route, it is a common species growing within the crowberry coniferous forest. Population in the survey area stable, unthreatened by increased tourist traffic. Occurs in patches in places.

The inventory survey of natural habitats carried out in the survey area confirmed the presence of four natural habitats: 2120 – shifting dunes along the shoreline with *Ammophila arenaria* (“white dunes”), 2130 – Fixed coastal dunes with herbaceous vegetation (“grey dunes”), 2180 – wooded dunes of the Atlantic, Continental and Boreal region and 9110 – *Luzulo-Fagetum* beech forests.

- **The patches of habitat 2120 Shifting dunes along the shoreline with *Ammophila arenaria* (“white dunes”)** occur only in part of the coast along the APV route, first of all, due to the sea abrasion that in places reaches the embankments of the coastal forest and creates an undercutting of the shore, which eliminates the occurrence of white dunes and their initial stages. The patches of the white dune are additionally degraded by the increasing tourist pressure and by the use of dune embankment stabilisation measures in the form of erecting fascine fences and spreading branches across the dune. The plants cover the sand to a small degree, because they grow sparsely, and the grass specimens are only beginning to grow and spread vegetatively. The patches of dune do not indicate its contamination or littering by the tourists, although their conservation status should be considered unsatisfactory;

- **The patches of habitat no. 2130 Fixed coastal dunes with herbaceous vegetation ("grey dunes")** can be divided into two groups. The first one covers the phytocoenoses neighbouring in the north with the patches of white dune or directly with the beach including the older and less abraded dune formations. Their total surface area is not large due to destruction as a result of abrasion, trampling by tourists, as well as overgrowth by pine. This narrow strip adjacent to the crowberry coniferous forest to the south is discontinuous and its physiognomy is not very diverse. However, the conservation status and prospects of habitat 2130 patches are unfavourable due to the increasing human pressure connected to tourism and expansive overgrowth of pine.
- **Habitat 2180 Wooded dunes of the Atlantic, Continental and Boreal region**, occurs along the coast on dune embankments, in the entire survey area, and its width varies. These are properly developed phytocoenoses with a large proportion of plants from the heather family (*Ericaceae*), mainly the black crowberry (*Empetrum nigrum*), marsh Labrador tea (*Ledum palustre*), European blueberry (*Vaccinium myrtillus*), bog blueberry (*Vaccinium uliginosum*), lingonberry, (*Vaccinium vitis-idea*), common heather (*Calluna vulgaris*), and cross-leaved heath (*Erica tetralix*). The moss and lichen layer is also properly developed here. Therefore, the representativeness, species composition and physiognomy of the patches were rated highly. Taking into consideration the renewal of species as well as the limitation of human pressure to the paths leading to the beach and the wide forest roads, the patches of coastal coniferous forest in the survey area have a proper conservation status and parameters. The few threats may be connected to the increasing human pressure and intensive forest management;
- **Patches of the habitat 9110 *Luzulo-Fagetum* beech forests** – they are well-developed with a poor layer of herbaceous plants typical of this habitat but a well-developed moss layer. Beech (*Fagus sylvatica*) occurs here in all three layers and renews itself intensively. In places, especially on the border with the coniferous forests, the advancement of pine was observed, and thus, the widening of the forest fringe. Taking into consideration the renewal of species and the limitation of the human pressure to wide forest roads, the patches of acidophilous beech forests in the survey area have a proper conservation status and parameters. The few threats may be connected to the increasing human pressure and intensive forest management.

3.19.1.4.2 Rational Alternative Variant

The area that is crossed by the RAV, similarly to APV, is characterised by a typical for Pomerania, strip-like arrangement of habitats, parallel to the seashore, with relatively well-preserved vegetation. The vegetation of the area builds communities of strips of white dunes, then grey dunes and coastal deciduous and coniferous forests, which then transform into fresh pine forests (*Leucobryo-Pinetum*) and mixed coniferous forests (*Betulo-Quercetum*). The beginning of the overhead line is located in a dry crowberry coniferous forest (*Empetro nigri-Pinetum*), in which the dominant species is pine. The species age was estimated at 81–106 years. Then, it runs across fragments of marshy coniferous forests with an admixture of alder, birch and oak, fresh mixed forests up to fresh mixed coniferous forests (*Betulo-Quercetum*) dominating in the southern part of the course and fresh pine forests (*Leucobrio-Pinetum*). Along the RAV route, during the inventory surveys conducted, similarly as in the

APV, the following 8 plant species of high nature value were found: marsh Labrador tea (*Ledum palustre*), black crowberry (*Empetrum nigrum*), one-flowered wintergreen (*Moneses uniflora*), broad-leaved helleborine (*Epipactis helleborine*), creeping lady's-tresses (*Goodyera repens*), sand sedge (*Carex arenaria*), cross-leaved heath (*Erica tetralix*) and in contrast to the APV, the presence of common club moss (*Lycopodium clavatum*) was confirmed in this area. This species is under partial protection, included in the Polish Red List [192] in category NT (near-threatened). Along the RAV route, it occurs in 4 plots in the local coniferous forest habitat depressions. The population is relatively stable in the survey area, although it is vulnerable to trampling and uprooting, as well as destruction related to the commercial use of forests.

The inventory survey of natural habitats carried out in the survey area confirmed the presence of three natural habitats: 2130 – Fixed coastal dunes with herbaceous vegetation ("grey dunes"), 2180 – Wooded dunes of the Atlantic, Continental and Boreal region and 91D0 – Bog woodland. Their characteristics are included in the APV description.

3.19.1.5 Forest complexes

The planned project in both variants is located within the area of forests administered by the Regional Directorate for Environmental Protection (RDEP) in Gdańsk, within the boundaries of the Choczewo Forest District, the forestries of Szklana Huta and Białogóra [Figure 3.49]. The Forest District area is dominated by the potential natural vegetation of a complex of communities of the acidophilous oak forest type (*Fago-Quercetum*) as well as lowland acidophilic beech forests (*Luzulo pilosae-Fagetum*). The forest health status for pine and mixed stands with their share is good. The stands are characterised by good quality and health.

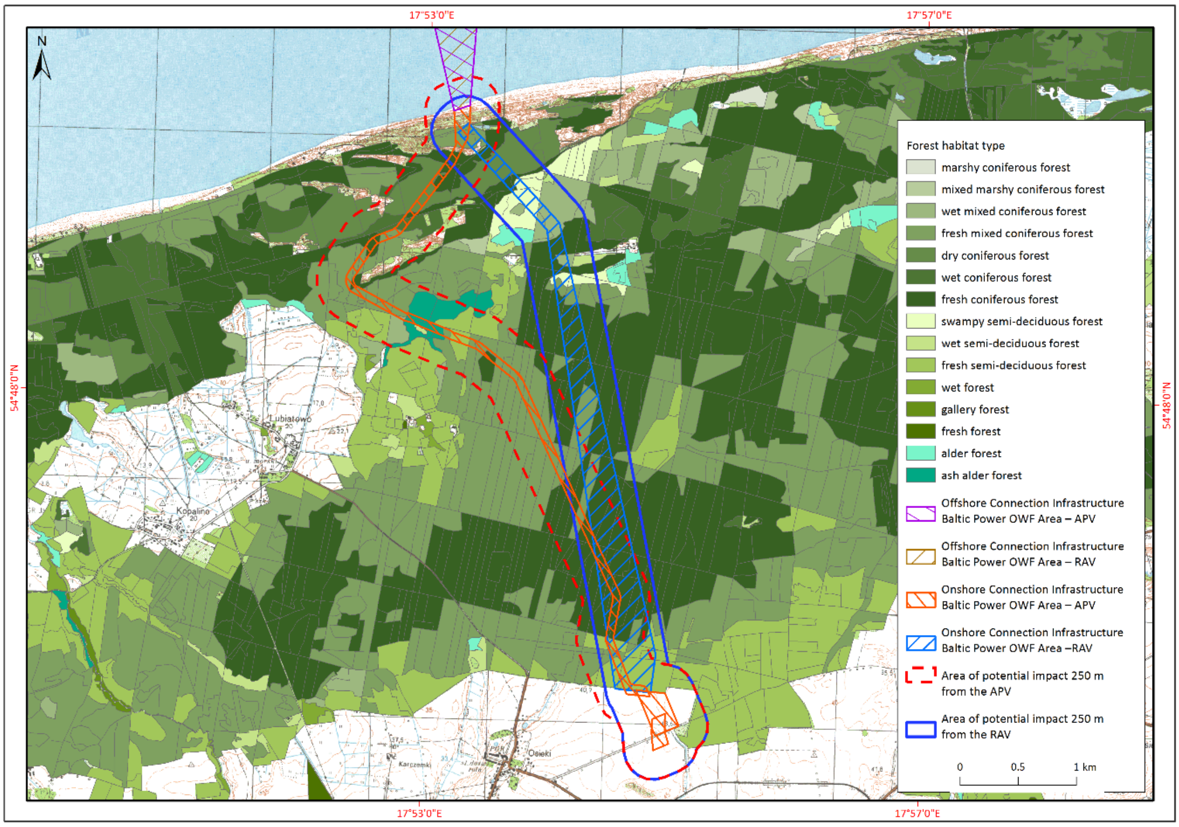

Figure 3.49. Location of the planned project in both variants against forest habitat types [Source: internal materials on the basis of https://www.bdl.lasy.gov.pl/portal/uslugi-mapowe-ogc – status as of 1 March 2021]

The characteristics of forest habitat types occurring in the planned project potential impact area in both variants, which was developed on the basis of data primarily from the environmental inventory survey conducted, but also on the basis of taxonomic description data from the forest data bank and the information obtained from the Choczewo Forest Inspectorate, is presented below.

The forests of the Choczewo Forest District, due to their physiognomy and direct relationship with the Baltic Sea coast, have already been studied several times, starting with the studies of Czubiński [63], Wojterski [426, 427] and Piotrowska [301], until the recent years [222]. They represent typical phytocoenoses of coastal forests located at the back of grey dunes, where habitats are shaped mainly by the influence of the sea, including sandy substrate, strong winds and reduced annual amplitude of temperature fluctuations. Apart from the natural dynamics associated with coastal processes, the element strongly influencing the local phytocenoses was the role of man in the formation of forest communities and their changes. Currently, forest management is compounded with elements of human pressure connected to tourism and leisure, which generates pressure especially on dune ecosystems, but also on the accompanying southern forest ecosystems. Human pressure connected to tourism is observed in the creation of new forest passages and roads, the widening of already existing tracts, as well as the development of widely understood agro-tourism and recreation centres at the back of forest phytocenoses.

Communities of coastal coniferous and deciduous forests are diversified both in terms of their dominant component (Scots pine, common beech) and water relations, dividing the main habitat types into dry and moist subtypes, conditioning biodiversity of species and habitats in individual plots. The forest habitat types will be discussed from the driest to the most moist facies.

3.19.1.5.1 Dry crowberry coniferous forest – *Empetro nigri-Pinetum* in the driest facies from *Carex arenaria* and *Vaccinium vitis-idaea*

Empetro nigri-Pinetum is the most strongly diversified sub-association within the coastal pine forests (cf. [426]). Floristic differences between individual facies of this sub-association are in principle of transitional nature and involve mainly the domination of individual species. In its driest variety of the facies with sand sedge (*Carex arenaria*) and lingonberry (*Vaccinium vitis-idaea*) in the area discussed, the patches of this community occupy mostly domed ridges and gently sloping dune slopes. The driest habitats are extremely poor, with very deep level of groundwater. They can be found on dunes that were afforested in the early 20th century and are largely covered by dwarf pine (*Pinus mugo*), Scots pine (*Pinus sylvestris*) and black pine (*Pinus nigra*). In most patches, tree trunks are clearly leaning and crowns are asymmetrical due to winds carrying sand clouds during storms. Some patches are overgrown with dwarf pine. They were formed as a result of artificial afforestation at the beginning of the 20th century, the main objective of which is the stabilisation of dunes. These tree stands have a very poor growth dynamics. They usually lack natural reforestation and undergrowth. In principle, lichens form the main background of the undergrowth in dry coniferous forest habitats. Thanks to the metabolic products of lichens and their ability to absorb water, they make an important contribution to the formation of the soil layer. About 300–400 species of invertebrates are associated with the presence of lichens. On poor sands of dry coniferous forest mainly lichens belonging to the genera of *Cladonia*, *Cetraria* and *Peltigera*, but also species with patchy and bushy thalli occurring as epiphytes on the branches of pines: bristlybeard lichen (*Usnea hirta*), monk's-hood lichen (*Hypogymnia physodes*), abraded camouflage lichen (*Melanelixia subaurifera*), common greenshield lichen (*Flvoparmelia caperata*) and other. Apart from lichens, species of common coniferous forest mosses are also sparsely distributed. Sand sedge (*Carex arenaria*), lingonberry (*Vaccinium vitis-idaea*), common heather (*Calluna vulgaris*) and crowberry (*Empetrum nigrum*) occur sporadically in the undergrowth. The habitats of dry coniferous forest located on dunes are entirely within the special management zone. These are soil-protective forests.

3.19.1.5.2 Fresh crowberry coniferous forest – *Empetro nigri-Pinetum typicum*

Communities of fresh crowberry coniferous forest (*Empetro nigri-Pinetum typicum*) occur in the area discussed in most of the coniferous forest areas north of Spacerowa street. The forest stand there consists mainly of Scots pine (*Pinus sylvestris*), of II.5 stand quality class on average. These are forest stands with poor growth dynamics, sometimes with a small admixture of silver birch (*Betula pendula*). Like the pine, it is not very tall and its crown is often deformed by the winds blowing from the sea. The layer of shrubs does not play any role in the typical coniferous forest, the following species can be found there sometimes: silvery creeping willow (*Salix arenaria*), common juniper (*Juniperus communis*) or rare alder buckthorn (*Frangula alnus*) and rowan (*Sorbus aucuparia*). The ground cover layer is lush and rich, formed mainly by black crowberry (*Empetrum nigrum*), common heather (*Calluna vulgaris*) and sometimes lingonberry (*Vaccinium vitis-idaea*). Among rare species of high nature value, the following species can be frequently found here: creeping lady's-tresses (*Goodyera repens*), umbellate wintergreen (*Chimaphila umbellata*) and one-flowered wintergreen (*Moneses uniflora*). Near them, the following species can be found most commonly: common woodrush (*Luzula multiflora*), common polypody (*Polypodium vulgare*) and hairy wood-rush (*Luzula *pilosa*). In the moss layer, the greatest role is played by: mountain fern moss (*Hylocomium splendens*), neat feather-moss (*Pseudoscleropodium purum*), red-stemmed feathermoss (*Pleurozium schreberi*), wavy broom moss (*Dicranum polysetum*), and broom forkmoss (*Dicranum scoparium*).

In accordance with the Habitat Survey Report of the Choczewo Forest District [275], on the high coastal dunes, due to their (soil-protective) nature, land use should be completely abandoned and in the case of very old stands which are in a state of decay, the existing pine and birch undergrowth should be used to the maximum and the old trees should be stimulated to natural reforestation. It should be considered to allow the stands to remain untouched until their physiological death. The habitats of fresh coniferous forest develop on poor sands. These soils are quite susceptible to chemical and biological degradation.

3.19.1.5.3 Subatlantic fresh pine forest – *Leucobryo-Pinetum*

Communities of fresh subatlantic coniferous forest (*Leucobryo-Pinetum*) occur in the area discussed in most of the coniferous forest areas north and north-east of the Osieczki village. The tree stand of this association consists of Scots pine (*Pinus sylvestris*) with an admixture of silver birch (*Betula pendula*), common oak (*Quercus petraea*) and spruce (*Picea abies*). The dominant species of the undergrowth are: common juniper (*Juniperus communis*), occasionally a single beech (*Fagus sylvatica*), common oak (*Quercus petraea*), alder buckthorn (*Frangula alnus*), and rowan (*Sorbus aucuparia*). Sometimes oak and beech were introduced as undergrowth, which create small umbrella-like forms at best. In illuminated places, good quality self-sown pine patches appear. The fundamental background of the ground cover is formed by black crowberry (*Empetrum nigrum*), European blueberry (*Vaccinium myrtillus*) and bent grass (*Deschampsia flexuosa*). The following acidophilous species with low requirements are predominant: chickweed-wintergreen (*Trientalis europaea*), and common cow-wheat (*Melampyrum pr*atense). In the moss layer, the following species play the biggest role: white pincushion moss (*Leucobryum glaucum*), cypress-leaved plaitmoss (*Hypnum cupressiforme*), knight's plume moss (*Ptilium crista-castrensis*), and wavy broom moss (*Dicranum polysetum*). The following species of terrestrial lichens can be found: grey reindeer lichen (*Cladonia rangiferina*), and tree reindeer lichen (*Cladonia arbuscula*).

3.19.1.5.4 Moist coniferous forest – *Empetro nigri-Pinetum ericetosum*

Communities of moist coniferous forest (*Empetro nigri-Pinetum ericetosum*) occur in the strip of land surrounding dunes and in dune slacks, forming small surface patches. The tree stand there consists mainly of pine (*Pinus sylvestris*), sometimes with a small admixture of silver birch (*Betula pendula*) and common white birch (*Betula pubescens*). These are low and poorly compacted stands with very poor growth dynamics. The proximity of open sea, associated with winds and large fluctuations in groundwater level caused by the influence of storms, as well as the extremely poor soil are the reasons for the oligotrophic nature of the moist coniferous forest habitat. The habitats of moderately moist coniferous forest lack the undergrowth layer except for a single juniper. Self-sown pine patches may occur occasionally in exposed locations. The following species can be found in the prostrate shrub layer: marsh Labrador tea (*Ledum palustre*), bog blueberry (*Vaccinium uliginosum*), and cross-leaved heath (*Erica tetralix*). Additionally, the species making the heavily moist coniferous forest diversified are: purple moor-grass (*Molinia caerulea*), stiff clubmoss (*Lycopodium annotinum*) and peat mosses (*Sphagnum rubellum*, *S. molle*, *S. fallax*, *S. palustre*). Apart from peat moss species, common hair-cap moss (*Polytrichum commune*) and bog groove-moss (*Aulacomnium palustre*) can be also found here.

3.19.1.5.5 Moist coniferous forest – *Molinio caeruleae-Pinetum*

The communities of *Molinio caerulea* moist coniferous forest (*Molinio caeruleae-Pinetum*) occur in small patches in the southern part of the area described, on isolated and distant from the sea old river terraces that formed from sand. They are overgrown with old tree stand with well-developed ground cover consisting of alder buckthorn (*Frangula alnus*), rowan (*Sorbus aucuparia*), and on the patches east of the Bezimienna Stream with a boreal species of bog-myrtle (*Myrica gale*) and marsh Labrador tea (*Ledum palustre*). The ground cover includes the yellow bird's nest (*Monotropa hypopitys*), serrated wintergreen (*Orthilia secunda*), European blueberry (*Vaccinium myrtillus*), chickweed-wintergreen (*Trientalis europaea*) and common cow-wheat (*Melampyrum pratense*). Common bracken (*Pteridium aquilinum*) is quite common. In the moss layer, the following species can be found: mountain fern moss (*Hylocomium splendens*), red-stemmed feathermoss (*Pleurozium schreberi*), broom forkmoss (*Dicranum scoparium*), knight's plume moss (*Ptilium crista-castrensis*) and bog groove-moss (*Aulacomnium palustre*).

3.19.1.5.6 Fresh mixed coniferous forest – *Betulo-Quercetum*

The communities of the fresh mixed coniferous forest (*Betulo-Quercetum*) are characterised by high variability and dynamics of phytocenoses intensified by forest management activities, although natural and near-natural habitats occupy about 65% of all coniferous forest habitats of the fresh mixed coniferous forest. The habitats of the fresh mixed coniferous forest deformed as a result of forest management concern mainly pine stands of younger age classes, devoid of any admixture in the stand composition, devoid of undergrowth, with a deteriorated form of forest humus. The main tree stand species in the fresh mixed coniferous forest habitat is pine (*Pinus sylvestris*) of an average stand quality class II. The admixture species in the second layer are: European beech (*Fagus sylvatica*), common oak (*Qurecus robur*), common aspen (*Populus tremula*), silver birch (*Betula pendula*) and European spruce (*Picea abies*). A high variety of shrubs is noticeable in the phytocoenoses. The following species can be found there: purging buckthorn (*Rhamnus cathartica*), alder buckthorn (*Frangula alnus*), rowan (*Sorbus aucuparia*), bird cherry (*Padus avium*) and common hazel (*Corylus avellana*). In the deformed habitats of the fresh coniferous forest, a solid pine tree stand without the undergrowth can be found. In terms of physiognomy and structure, deformed or strongly deformed fresh mixed coniferous forest habitats are similar to pine forests. The only elements indicating that it belongs to fresh mixed coniferous forest are the soil and the high proportion of tufted hair grass (*Deschampsia caespitosa*). The following species are present in the ground cover: common bracken (*Pteridium aquilinum*), bitter vetch (*Lathyrus montanus*), wall hawkweed (*Hieracium murorum*), pill sedge (*Carex pilulifera*), and creeping soft grass (*Holcus mollis*), as for the mosses, the most common is cypress-leaved plait-moss (*Hypnum cupressiforme*). From historical data it is known that the coastal area was artificially afforested at the beginning of the last century; naturally formed phytocoenoses are absent.

3.19.1.5.7 Moist mixed coniferous forest – *Pino-Quercetum populetosum tremulae*

On small surfaces of the area in question, patches of moist mixed coniferous forest, represented by moist forms of mixed pine-oak coniferous forest (*Pino-Quercetum populetosum tremulae*) can be found. In terms of fertility, these habitats are at the same level in the trophic network as the fresh mixed coniferous forest. The groundwater level facilitates the development of the tree stand and does not pose an obstacle to any activities, as is the case with the marshy habitats. Moist mixed coniferous forests occur mainly in a near-natural state. A small surface area is occupied by habitats deformed as a result of poor management. These are mainly deformed tree stands, with large amount of spruce or tree stands of younger age classes. In the area of the Choczewo Forest District, the moist mixed coniferous forest is overgrown mainly by tree stands of pine, less frequently birch and spruce trees of younger age classes with admixture of common aspen (*Populus tremula*). The habitat of moist mixed coniferous forest is clearly distinguishable from the other habitats of similar trophic nature due to the group of species differentiating it from fresh mixed coniferous forest. The presence of purple moor-grass (*Molinia caerulea*) indicates a high level of mesotrophic groundwater.

3.19.1.5.8 Fresh mixed forest – *Fago-Quercetum*

Patches of fresh mixed forest *Fago-Quercetum* occur scattered at the edges of the discussed area and belong to a group of moderately fertile (mesotrophic) habitats. The tree stand includes beech (*Fagus sylvatica*) with an admixture of common oak (*Quercus robur*) and silver birch (*Betula pendula*). The layer of shrubs is poorly developed, and its main components are rowan (*Sorbus aucuparia*) and alder buckthorn (*Frangula alnus*) as well as an undergrowth with species comprising the tree stand. The ground cover layer consists mainly of the following species: European blueberry (*Vaccinium myrtillus*), hairy wood-rush (*Luzula pilosa*), bent grass (*Deschampsia flexuosa*), common bracken (*Pteridium aquilinum*), and false lily of the valley (*Maianthemum bifolium*). A small group of the following differentiating species indicates that it is a fresh mixed forest: wood anemone (*Anemone nemorosa*), rough bluegrass (*Poa trivialis*), blue bugle (*Ajuga reptans*) and others. The moss layer is poorly developed.

3.19.1.5.9 Lowland acidophilous beech forest – *Luzulo pilosae-Fagetum*

In the western part of the area discussed, there are patches of lowland acidophilous beech forest characterised by the presence of over 115-year-old beeches (*Fagus sylvatica*). The tree stand consists mainly of beech with a small admixture of sessile oak (*Quercus petraea*). The shrub layer consists mainly of beech undergrowth. The ground cover is dominated by narrow-leaved grasses and mesotrophic species, such as: false lily of the valley (*Maianthemum bifolium*), germander speedwell (*Veronica chamaedrys*), heath speedwell (*Veronica officinalis*), wood sorrel (*Oxalis acetosella*), as well as a few species of fertile deciduous forests, such as: sweetscented bedstraw (*Galium odoratum*), early dog-violet (*Viola reichenbachiana*), yellow archangel (*Galeobdolon luteum*), and finger sedge (*Carex digitata*). The moss layer includes: bank haircap moss (*Polytrichum formosum*) and broom forkmoss (*Dicranum scoparium*). In some places, the massive occurrence of European blueberries of good vitality and an abundance of common cow-wheat (*Melampyrum pratense*) or common bracken (*Pteridium aquilinum*) signify the change of phytocenoses towards mixed beech-oak forests.

3.19.1.5.10 Moist mixed forest

The mixed forest habitats belong to the mesotrophic group, i.e. occupy an intermediate position in the typological grid between the peat and forest habitats. They occur in a complex with other moist or bog habitats. The habitats of moist mixed forest are usually overgrown by stands of pine, birch or mixed forest with the absence or slight admixture of native oaks. Artificial spruce stands are also present there. The habitats of heavily moist mixed forest are often overgrown with black alder (*Alnus glutinosa*). Common hazel (*Corylus avellana*) and alder buckthorn (*Frangula alnus*) are present in the undergrowth. In terms of fertility, the habitat of moist mixed forest occupies the same position in the typological grid as the fresh mixed forest but differs in the degree of moisture, i.e. the depth of the average groundwater level. A significant group of differentiating species are those occurring in the habitat of fresh mixed forest – orchard grass (*Dactylis glomerata*), greater stitchwort (*Stelaria holostea*) and wall lettuce (*Mycelis muralis*).

3.19.1.5.11 Alder-ash riparian forests with *Alnus glutinosa* and *Fraxino-Alnetum* and ash-alder forests

Alder-ash riparian forests with *Alnus glutinosa* and *Fraxino-Alnetum* develop in small areas in the vicinity of the Bezimienna Stream. The condition for the existence of this alder-ash riparian forests, as is the case with any other riparian forest, is the flow of surface and ground waters, though, no prolonged flooding is observed there. However, in the area of Szklana Huta, there are patches of alder-ash forests of a similar physiognomy, but with a different character of hydration and stagnation of water. The soils that form under this forest type are slightly swampy, silty, silty-peat and mucky. The tree stand consists mainly of the black alder (*Alnus glutinosa*), with a rare admixture of European ash (*Fraxinus excelsior*). The lack of ash trees is mainly related to their dieback caused by disease conditions. Over the last few years, ash trees have been attacked by pathogens that cause intensive separation regardless of age class. In many stands the ash tree is gradually disappearing. The alder stands are dominated essentially by the black alder (*Alnus glutinosa*). The European ash (*Fraxinus excelsior*) occurs most often as a co-dominant species and rarely comprises the main stand. As an admixture species it often occurs together with the common white birch (*Betula pubescens*). The following species is the most common in the shrub layer: bird cherry (*Padus avium*), whereas, the following species can be found less often: blackcurrant (*Ribes nigrum*), alder buckthorn (*Frangula alnus*), common spindle (*Euonymus europaeus*), guelder-rose (*Viburnum opulus*), and common buckthorn (*Rhamnus catharctica*). In spring, the ground cover is dominated by wood anemone (*Anemone nemorosa*) or lesser celandine (*Ficaria verna*). Common nettle (*Urtica dioica*) is usually dominant in high summer. The following species can also be encountered in the alder patches: alternate-leaved golden-saxifrage (*Chrysosplenium alternifolium*), wood stitchwort (*Stellaria nemorum*), hedge woundwort (*Stachys sylvatica*), and giant fescue (*Festuca gigantea*). Ground elder (*Aegopodium podagraria*), herb Paris (*Paris quadrifolia*), and woolly buttercup (*Ranunculus lanuginosus*) are more commonly encountered in riparian forests. The community is also penetrated by such species as: common oak (*Quercus robur*), Norway maple (*Acer platanoides*) and common hornbeam (*Carpinus betulus*). In extreme cases, where the shallow organic layer mineralizes rapidly, oak-hornbeam regeneration occurs. Such habitats change to moist forests with a higher proportion of common oak and hornbeam in the second tree layer.

3.19.1.5.12 Applicant Proposed Variant

In the northern part of the planned project in the APV, at km 33+550 to 33+730, there are, protective (soil-protective) **fresh mixed coniferous forests**, in which the dominant species is pine. The species age was estimated at 81–106 years. Further on, at km 33+800 to 34+100 there are also soil-protective fresh coniferous forests, with the dominant species of pine aged 76–91 years. At km 34+100 to 34+400, there is soil-protective **dry coniferous forest**, aged 71 years, and further on, a small fragment of fresh coniferous forest of a soil-protective function. Section from km 34+500 to 34+610 is overgrown with **moist coniferous forests** with the dominant species of pine aged 136 years. At km 34+610 to 34+800, there are soil-protective **fresh mixed coniferous forests**, with the dominant species of pine aged 136 as well as younger species – 18–30 years. At km 34+800 to 35+000, there are soil-protective **fresh coniferous forests**, aged 100 years with dominant pine. At km 35+000 to 35+850, there are soil-protective **fresh mixed coniferous forests**, with the dominant species of pine aged 136–166 as well as younger species aged 35–46 years, with a small fragment of a fresh coniferous forest of a soil-protective function. Further on, at km 35+850 to 36+200, there is an **ash-alder forest** with alder, beech and spruce. These are water-protective forests aged 16–86 years. Behind this complex, a small fragment of a fresh mixed coniferous forest is present. At km 36+270 to 36+450, there is a **fresh mixed forest**, aged approx. 100 years with dominant pine. This is a commercial forest. Further on, at km 36+450 to 37+920, there is a large complex of a **fresh mixed forest**, aged 44–77 years, intersected with a complex of fresh coniferous forests with a commercial function, aged – 56 years. Km 37+920 to 39+400 are occupied by fresh coniferous forests with a commercial function, aged 44–53 years, and from km 38+200 to 38+310, there is a small complex of fresh mixed coniferous forests, with a commercial function, aged 63 years. Further on, at km 39+400 to 45+500, there are **fresh mixed forests**, commercial, aged 96–111 years, with a small complex of a fresh mixed coniferous forest [Figure 3.50].

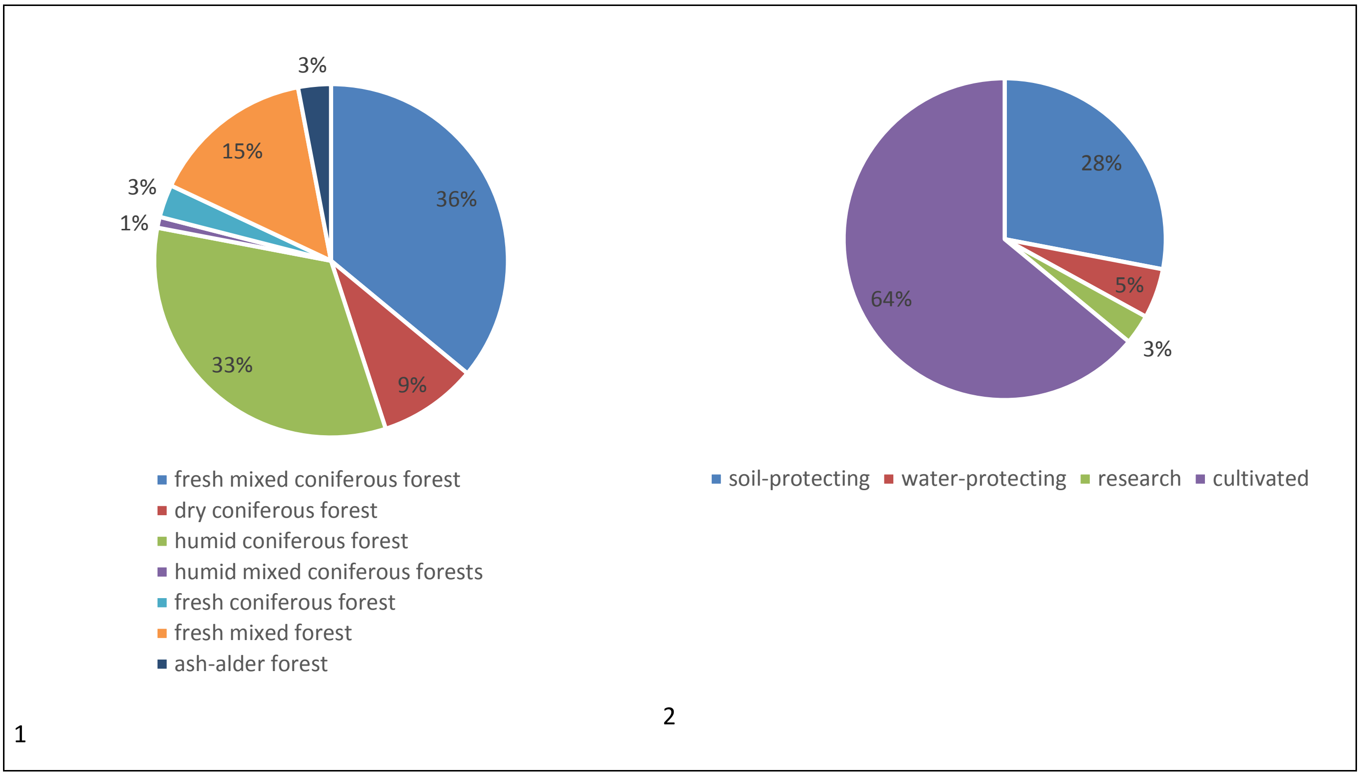

Figure 3.50. Forest habitat types (1) and forest protective types (2) within the impact area of the planned project in APV [Source: internal materials on the basis of: https://www.bdl.lasy.gov.pl/portal/mapy]

3.19.1.5.13 Rational Alternative Variant

The northern part of the planned project at km 40+300 to 40+500 is occupied by soil-protective **fresh mixed coniferous forest**, aged 81–105 years, with dominant pine. At km 40+600, there are soil-protective **fresh coniferous forests**, aged 76 years with dominant pine. Further on, at km 40+700 to 40+900 there is a soil-protective **dry coniferous forest**, aged 76 years and at km 40+900 to 41+000 again soil-protective **fresh coniferous forests**, aged 81–116 years with dominant pine. At km 41+000 to 41+300, there are soil-protective **bog mixed forests**, aged 51 years with a dominant birch. Further on, at km 41+300 to 41+600, there are soil-protective **moist mixed coniferous forests**, aged 116 years with a dominant pine. At km 41+600 to 41+700, there are soil-protective **fresh coniferous forests**, with a dominant pine aged 116 years, intersected with a small complex of moist mixed coniferous forests. At km 41+900, there is a water-protective **mixed bog forest**, with a share of alder aged 51–81 years. Further on, at km 42+000 to 42+100, there are **fresh coniferous forests**, with a commercial function, with a dominant birch and pine, aged 10–41 years. At km 42+170 to 42+900, there are **fresh coniferous forests**, with a commercial function, with a dominant pine aged 3–66 years, intersected in fragments by **fresh mixed coniferous forests**. Upstream the customer substation, at km 45+200 to 45+500, there are **fresh mixed forests**, commercial, aged 96 years [Figure 3.51].

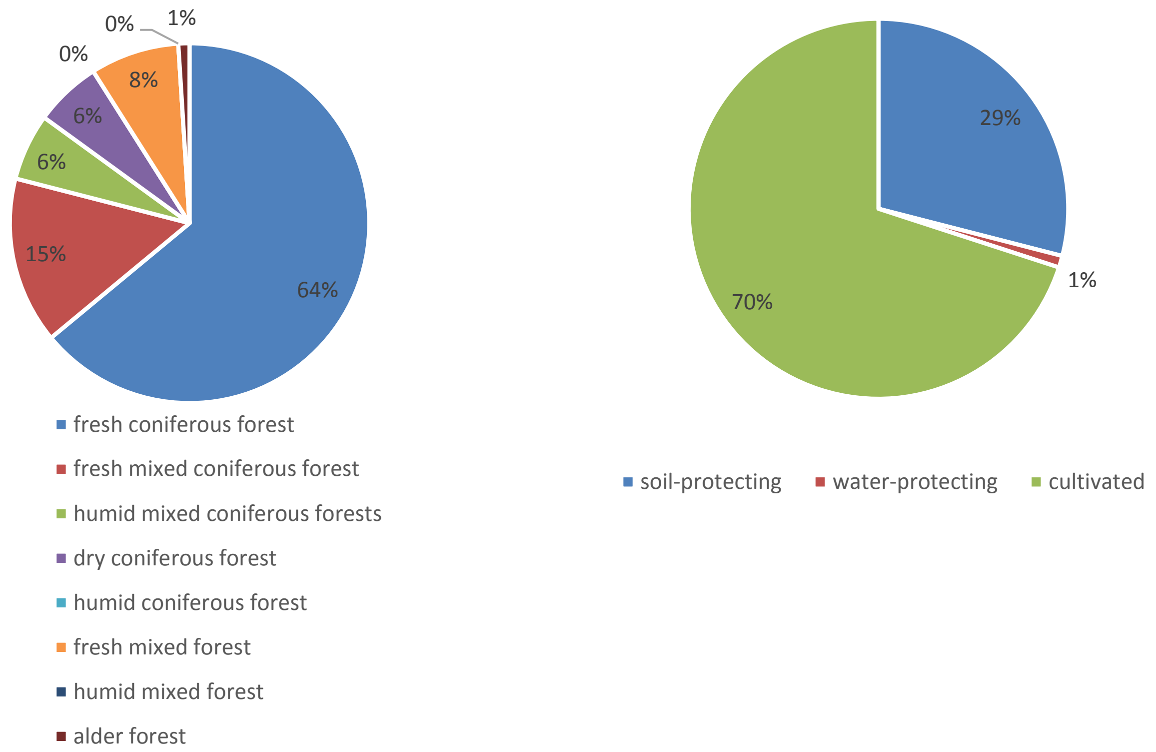

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Figure 3.51. Forest habitat types (1) and forest protective types (2) within the impact area of the planned project in the Rational Alternative Variant (RAV) [Source: internal materials on the basis of: https://www.bdl.lasy.gov.pl/portal/mapy]

Summing up, in both variants, fresh mixed coniferous forest and fresh coniferous forests, as well as dry coniferous forests are dominant, giving way in the southern part to fresh mixed forests. These are mainly commercial forests. In the northern part, forests with protective functions are dominant: mainly soil-protective and water-protective. Moreover, there are commercial forests and tree-felling is carried out there.

3.19.1.6 Invertebrates

Determining the fauna of invertebrate species along the planned project route is a very difficult task, because most of the invertebrate species, including those of high nature value, are mobile creatures; some of them actively fly (most insects) – the places (sites) of their observation in many cases do not coincide with their key occurrence location, e.g. a tree on which larval development takes place, a patch of streamside vegetation or herbal plants important for the feeding of imaginal forms.

Within the area of the APV potential impact, the following invertebrate species were found, for which there are additional indications of their presence in a given space, e.g. nests, feeding sites, larval occurrence, accumulation of individuals in a given space, etc:

- blue-winged grasshopper (*Oedipoda caerulescens*) – an Orthoptera species preferring dry-warm locations with very variable colouring, found in quite large numbers in Pomerania, however, its numbers are decreasing due to the reduction of suitable habitats. Threat category – NT. Found mainly on xerothermic grasslands, often in coastal coniferous forests on sandy roads and forest dunes;
- European paper wasp (*Polistes dominulus*) – a Hymenoptera from the Vespidae family. Quite common in Pomerania, found in warm, open spaces, mainly on xerothermic grasslands and psammophilic glades, at the edges of coniferous forests, dunes and glades.

3.19.1.7 Ichthyofauna

Due to the extremely low water levels, which have been observed for many years despite the presence of potential hiding places, shading, stream bed diversity etc., the watercourses surveyed are characterised by low ichthyological diversity.

Characteristics of the fish and lamprey species identified is presented below.

Three spined stickleback (*Gasterosteus aculeatus*) – inhibits mainly nearshore marine waters, river estuaries, lakes and lower and middle river reaches. It prefers quiet waters. It is divided into two forms: freshwater and saltwater, which are distinguished from each other by pelvic girdle spines (in the freshwater form, a significant asymmetry is observed and spines are smaller). Breeding takes place from May to August. The male creates the nest in a sandy pit made in the bed or low over the bed, among vegetation. The nest is built of plant remains held together by a secretion from the kidneys. Spawning occurs in batches. The female lays from 40 to 400 eggs. The male guards the fertilised eggs and fry until the yolk-sacs are absorbed and the fry start independent lives. Young individuals feed on zooplankton, whereas adults feed mostly on small aquatic invertebrates such as insect larvae and crustaceans as well as on eggs and fry of other fish.

The nine-spined stickleback (*Pungitius pungitius*) occurs in stagnant water bodies, meanders, where the river current is almost non-existing, small channels and streams with a silty bed, however, it is found also in fresh water. It typically reaches lengths of up to 6 cm. The body is elongated, bony plates are only found on the caudal peduncle, 7–12 spines are present on the dorsum. As in the case of the three-spined stickleback, males construct nests suspended on vegetation immediately above the bed, in which females lay eggs**.** Males take care of the nest until the fry hatch. However, it starts spawning somewhat earlier than the three-spined stickleback, since the first individuals may spawn as early as in April. It feeds mainly on zooplankton, fry, fish eggs and small crustaceans.

The brook lamprey (*Lampetra planeri*) is a protected species, listed in Annex II of the EU Habitats Directive and an endangered species (according to the Polish Red Data Book of Animals and the Red List of Threatened Animals – NT, the Red List of Fish and Lampreys – VU). The brook lamprey inhabits exclusively freshwater environments, mainly streams and smaller sand/gravel-bed rivers, muddy in places. It leads a non-parasitic life, as in the adult form into which it metamorphoses shortly before spawning, the digestive tract undergoes atrophy. It is a twin species of the river lamprey. Most probably, the inability to migrate (due to the presence of hydraulic structures or natural causes hindering the migration) contributed to the development of freshwater, stationary forms. It is also assumed to be a polyphyletic species representing a set of several genetic lines of the river lamprey. Populations differ in terms of morphology and genetics; nevertheless, subspecies have not been distinguished so far. The spawning season starts when the water temperature exceeds 9°C. River lampreys sometimes migrate short, several hundred metre distances upstream to spawn. In such a case, they form small aggregations consisting most often of several individuals. Males dig small pits, which serve as nests. Afterwards, eggs are laid by the female and are fertilised by the male. Larvae hatch 11–14 days after spawning. Once the yolk-sac is resorbed, they drift downstream and burrow in fine-grained silt. Adults usually die 2–3 weeks after spawning. Larvae stay burrowed in the mud, feeding on detritus, from 3 up to even 20 years. Complete metamorphosis occurs in late August and early September. After overwintering, they begin spawning.

A detailed characteristics of the watercourses present within the area of the planned project was developed on the basis of the results of annual inventory surveys on abiotic and biotic resources of the BP OWF CI survey area (Appendix 1. Report on inventory surveys).

3.19.1.7.1 Bezimienna

Due to the fragmentation of the watercourse caused by two impounding structures, the strong influence of the migrating dune on the original stream bed and a significant drop in the water level, the Bezimienna is not a favourable habitat for fish and lampreys. Considering the current situation, the process of gradual extinction of ichthyofauna is apparently inevitable. The presence of dwarfed adult forms of the nine-spined stickleback (individuals measuring approx. 2.3–3 cm) may also be indicative of scarce food resources and overpopulation. As was the case with the three-spined stickleback.

3.19.1.7.2 Lubiatówka

The Lubiatówka stream, surrounding the village of Lubiatowo, together with the adjacent tributaries, serves as the drainage system for the region and unfortunately a potential discharge area for the sewage from the camping sites located nearby. Nevertheless, the presence of the brook lamprey was recorded. Moreover, it cannot be excluded that due to the proximity of the estuary emptying into the Baltic Sea, the stream is a potential breeding ground for the brook lamprey. It has also lost its original properties as an ichthyofauna habitat due to the pollution and the water level declining annually. The presence of single nine-spined stickleback individuals seems to confirm the thesis that the stream is not useful as a fish habitat.

3.19.1.7.3 Biebrowski Canal

The sections of the right bank tributary of the Chełst River which were examined were characterised by high variability. During the first site inspection, a beaver dam was found in the upper section, where fish and/or lampreys could potentially occur. During the inventory surveys, it was found that the beaver lodge/dam had been destroyed, and the stream bed depth of the upper section did not exceed 20 cm. No ichthyofauna representatives were found. The second section was an interestingly meandering watercourse, providing numerous hiding places with a depth of over 70 cm. The brook lamprey was found in this section. By contrast, the next part surveyed was a shallow sand-bed stream, with a small number of hiding places. Unfortunately, such fragmentation does not favour the maintenance of the fish population, since too long, shallow and excessively exposed sections hinder safe migration of fish and lampreys.

3.19.1.7.4 Biebrowski Canal tributary

No fish or lampreys were found in the sections surveyed. Due to the extremely low water level, it seems unlikely that the canal tributary could be permanently inhabited by fish and lampreys and/or could serve as a potential rearing or breeding site.

3.19.1.8 Herpetofauna

Two species of amphibians were found in the survey area: the common toad and the common frog, and three species of reptiles: the sand lizard, the viviparous lizard and the slow worm. All of the amphibian species found in the area are protected as part of the Regulation of the Minister of the Environment of 16 December 2016 on the protection of animal species (Journal of Laws of 2016, item 2183, as amended) [Table 3.28].

Table 3.28. Amphibian species found in the project area with their conservations status in the Applicant Proposed Variant (APV) [Source: internal materials]

No.	Species/taxon	Species protection in Poland[1]
1.	Common toad *Bufo bufo*	PP
2.	Common frog *Rana temporaria*	PP
1	Slow worm *Anguis fragilis*	PP
2	Sand lizard *Lacerta agilis*	PP
3	Viviparous lizard *Zootoca vivipara*	PP

[1]Pursuant to the Regulation of the Minister of Environment of 16 December 2016 on the protection of animal species (Journal of Laws of 2016, item 2183, as amended): PP – species under partial protection

3.19.1.9 Birds

In the area analysed, a series of bird species in their breeding period as well as in the dispersal periods, migration and wintering, were found.

In the planned project potential impact area, in both variants, 63 bird species were found. Their list including the conservation status and the type of resources is presented in Table 3.29. A detailed characteristics is presented in the annual inventory surveys on abiotic and biotic resources of the BP OWF CI survey area (Appendix 1. Report on inventory surveys).

Table 3.29. Bird species found in the planned project potential impact area in both variants [Source: internal materials]

No.	Species		Status[1]	Protection[2]	IUCN[3]	Annex 1 BD[4]	PRDB[5]	PRLB[6]	SPEC[7]	Resource type[8]
	Species name	Binomial nomenclature								
1.	Stock dove	*Columba oenas*	LB, m	SP	LC	-	-	-	-	Low value
2.	Common wood pigeon	*Columba palumbus*	CB, m	G	LC	-	-	-	-	Low value
3.	European nightjar	*Caprimulgus europaeus*	LB, m	SP	LC	Yes	-	-	SPEC3	High value
4.	Common cuckoo	*Cuculus canorus*	LB, m	SP	LC	-	-	-	-	Low value
5.	Common crane	*Grus grus*	CB, m	SP	LC	Yes	-	-	SPEC2	Moderate value
6.	Eurasian woodcock	*Scolopax rusticola*	LB, m	G	LC	-	-	-	-	Low value
7.	Green sandpiper	*Tringa ochropus*	LB, m	Strict/active	LC	-	-	-	-	Moderate value
8.	Long-eared owl	*Asio otus*	CB, m	SP	LC	-	-	-	-	Low value
9.	Tawny owl	*Strix aluco*	CB, m	SP	LC	-	-	-	-	Low value
10.	Eurasian sparrowhawk	*Accipiter nisus*	LB, m	SP	LC	-	-	-	-	Low value
11.	Northern goshawk	*Accipiter gentilis*	LB, m	SP	LC	-	-	-	-	Low value
12.	Common buzzard	*Buteo buteo*	CB, m	SP	LC	-	-	-	-	Low value
13.	Eurasian wryneck	*Jynx torquilla*	LB, m	SP	LC	-	-	-	SPEC3	Low value
14.	European green woodpecker	*Picus viridis*	LB, m	Strict/active	LC	-	-	-	-	Low value
15.	Black woodpecker	*Dryocopus martius*	CB, m	Strict/active	LC	Yes	-	-	-	High value
16.	Great spotted woodpecker	*Dendrocopos major*	CB, m	SP	LC	-	-	-	-	Low value
17.	Eurasian hobby	*Falco subbuteo*	LB, m	Strict/active	LC	-	-	-	-	Low value
18.	Golden oriole	*Oriolus oriolus*	LB, m	SP	LC	-	-	-	-	Low value
19.	Red-backed shrike	*Lanius collurio*	CB, m	SP	LC	Yes	-	-	SPEC2	High value
20.	Eurasian jay	*Garrulus glandarius*	CB, m	SP	LC	-	-	-	-	Low value
21.	Coal tit	*Periparus ater*	LB, m	SP	LC	-	-	-	-	Low value
22.	European crested tit	*Lophophanes cristatus*	LB, m	SP	LC	-	-	-	SPEC2	Low value
23.	Marsh tit	*Poecile palustris*	LB, m	SP	LC	-	-	-	-	Low value
24.	Willow tit	*Poecile montanus*	LB, m	SP	LC	-	-	-	SPEC3	Low value

No.	Species		Status[1]	Protection[2]	IUCN[3]	Annex 1 BD[4]	PRDB[5]	PRLB[6]	SPEC[7]	Resource type[8]
	Species name	Binomial nomenclature								
25.	Eurasian blue tit	*Cyanistes caeruleus*	CB, m	SP	LC	-	-	-	-	Low value
26.	Great tit	*Parus major*	CB, m	SP	LC	-	-	-	-	Low value
27.	Woodlark	*Lullula arborea*	CB, m	SP	LC	Yes	-	-	SPEC2	High value
28.	Icterine warbler	*Hippolais icterina*	LB, m	SP	LC	-	-	-	-	Low value
29.	Wood warbler	*Phylloscopus sibilatrix*	LB, m	SP	LC	-	-	-	-	Low value
30.	Willow warbler	*Phylloscopus trochilus*	LB, m	SP	LC	-	-	-	SPEC3	Low value
31.	Common chiffchaff	*Phylloscopus collybita*	LB, m	SP	LC	-	-	-	-	Low value
32.	Long-tailed tit	*Aegithalos caudatus*	LB, m	SP	LC	-	-	-	-	Low value
33.	Eurasian blackcap	*Sylvia atricapilla*	CB, m	SP	LC	-	-	-	-	Low value
34.	Garden warbler	*Sylvia borin*	LB, m	SP	LC	-	-	-	-	Low value
35.	Lesser whitethroat	*Sylvia curruca*	LB, m	SP	LC	-	-	-	-	Low value
36.	Common whitethroat	*Sylvia communis*	LB, m	SP	LC	-	-	-	-	Low value
37.	Eurasian treecreeper	*Certhia familiaris*	LB, m	SP	LC	-	-	-	-	Low value
38.	Eurasian nuthatch	*Sitta europaea*	LB, m	SP	LC	-	-	-	-	Low value
39.	Eurasian wren	*Troglodytes troglodytes*	CB, m	SP	LC	-	-	-	-	Low value
40.	Common starling	*Sturnus vulgaris*	CB, m	SP	LC	-	-	-	SPEC3	Low value
41.	Mistle thrush	*Turdus viscivorus*	CB, m	SP	LC	-	-	-	-	Low value
42.	Song thrush	*Turdus philomelos*	CB, m	SP	LC	-	-	-	-	Low value
43.	Common blackbird	*Turdus merula*	CB, m	SP	LC	-	-	-	-	Low value
44.	Fieldfare	*Turdus pilaris*	LB, m	SP	LC	-	-	-	-	Low value
45.	Spotted flycatcher	*Muscicapa striata*	LB, m	SP	LC	-	-	-	SPEC2	Low value
46.	European robin	*Erithacus rubecula*	LB, m	SP	LC	-	-	-	-	Low value
47.	Thrush nightingale	*Luscinia luscinia*	LB, m	SP	LC	-	-	nt	-	Low value
48.	Red-breasted flycatcher	*Ficedula parva*	LB, m	SP	LC	Yes	-	-	-	High value
49.	European pied flycatcher	*Ficedula hypoleuca*	LB, m	SP	LC	-	-	nt	-	Low value

No.	Species		Status[1]	Protection[2]	IUCN[3]	Annex 1 BD[4]	PRDB[5]	PRLB[6]	SPEC[7]	Resource type[8]
	Species name	Binomial nomenclature								
50.	Common redstart	*Phoenicurus phoenicurus*	LB, m	SP	LC	-	-	-	-	Low value
51.	Goldcrest	*Regulus regulus*	LB, m	SP	LC	-	-	-	SPEC2	Low value
52.	Common firecrest	*Regulus ignicapilla*	LB, m	SP	LC	-	-	-	-	Low value
53.	Dunnock	*Prunella modularis*	LB, m	SP	LC	-	-	-	-	Low value
54.	Tree pipit	*Anthus trivialis*	LB, m	SP	LC	-	-	-	SPEC3	Low value
55.	Common chaffinch	*Fringilla coelebs*	CB, m	SP	LC	-	-	-	-	Low value
56.	Hawfinch	*Coccothraustes coccothraustes*	LB, m	SP	LC	-	-	-	-	Low value
57.	Eurasian bullfinch	*Pyrrhula pyrrhula*	LB, m	SP	LC	-	-	-	-	Low value
58.	Greenfinch	*Chloris chloris*	LB, m	SP	LC	-	-	-	-	Low value
59.	Common linnet	*Linaria cannabina*	LB, m	SP	LC	-	-	-	SPEC2	Low value
60.	Common redpoll	*Acanthis flammea*	LB, m	SP	LC	-	-	-	-	High value
61.	Red crossbill	*Loxia curvirostra*	LB, m	SP	LC	-	-	-	-	Low value
62.	Eurasian siskin	*Spinus spinus*	LB, m	SP	LC	-	-	-	-	Low value
63.	Yellowhammer	*Emberiza citrinella*	CB, m	SP	LC	-	-	-	SPEC2	Low value

[1]Species/taxon status: LB – likely breeding, CB – confirmed breeding (Wilk [419], Sikora et al. [348]), m – migrant, visitor or recorded in the survey area.

[2]Pursuant to the Regulation of the Minister of Environment of 16 December 2016 on the protection of animal species (Journal of Laws of 2016, item 2183, as amended): SP – strictly protected species; SP/active – strictly protected species, active protection permissible; pursuant to the Regulation of the Minister of the Environment of 11 March 2015 on the development of a list of game species (Plot of Laws of 2005, No. 45, item 433): G – game species

[3]IUCN – classification according to the International Union for the Conservation of Nature, the extinction risk of species: LC – least concern, NT – near-threatened (BirdLife 2020)

[4]Bird species listed in Annex I of the Birds Directive [89]

[5]Bird species listed in the Polish Red Data Book of Animals, concerns breeding birds: cr – species critically endangered, en – species strongly endangered, exp – extinct as a breeding species in Poland, lc – least-concern, nt – near-threatened, vu – vulnerable (Głowaciński [124])

[6]Polish Red List of Birds: cr – critically endangered; en – endangered, nt – near-threatened, re – regionally extinct, vu – vulnerable (Wilk et al. [418])

[7]The SPEC (Species of European Conservation Concern) categories of special concern assigned by the BirdLife International federation: SPEC1 – species of global conservation concern, SPEC 2 – endangered species, the European population of which exceeds 50% of the global population and their conservation status was assessed as unfavourable, SPEC 3 – endangered species, the European population of which does not exceed 50% of the global population and their conservation status was assessed as unfavourable (BirdLife 2020)

[8]Type of resources – compliant with the Environmental inventory (Appendix 1. Report on inventory surveys)

3.19.1.10 Mammals

Within the area of the planned project potential impact in both variants, mammals are represented by species quite common across the entire country. Most of them adapt well to the changes in the environment. With the exception of small mammals connected to a particular habitat, the remaining animals inhabiting the area analysed use large areas of land and many habitats and are not assigned to any specific site [Table 3.30].

Table 3.30. Mammal species found in the planned project potential impact area in both variants with the conservation status indicated [Source: internal materials]

No.	Species		Conservation status[1]	Threat category[2]	Comments
	Species name	Binomial nomenclature			
1.	Grey wolf	*Canis lupus*	S	NT	The species can potentially occur within the entire area connected to the project
2.	Eurasian otter	*Lutra lutra*	PP	LC	-
3.	Stoat	*Mustela erminea*	PP	LC	The species can potentially occur within the entire area connected to the project
4.	Northern white-breasted hedgehog	*Erinaceus roumanicus*	PP	LC	The species may occur in the areas connected to the project near the village of Osieki Lęborskie
5.	European beaver	*Castor fiber*	PP	LC	-
6.	European water vole	*Arvicola amphibius*	PP	LC	The species can potentially occur in the waterlogged parts of the area connected to the project
7.	Wood mouse	*Apodemus sylvaticus*	PP	LC	The species can potentially occur in the waterlogged or more heavily overgrown parts of the area connected to the project
8.	Red squirrel	*Sciurus vulgaris*	PP	LC	-
9.	Common shrew	*Sorex araneus*	PP	LC	The species can potentially occur in the waterlogged parts of the area connected to the project
10.	Eurasian pygmy shrew	*Sorex minutus*	PP	LC	The species can potentially occur in the waterlogged parts of the area connected to the project
11.	European mole	*Talpa europaea*	PP	LC	The species can potentially occur within the entire area connected to the project
12.	Bats	*Chiroptera*	SP	-	Can potentially occur within the entire area connected to the project
13.	Other mammal species	-	Not under protection	LC	Can potentially occur within the entire area connected to the project

[1]Pursuant to the Regulation of the Minister of Environment of 16 December 2016 on the protection of animal species (Journal of Laws of 2016, item 2183, as amended): SP – species under strict protection, PP – species under partial protection
[2]Classification according to the International Union for the Conservation of Nature, global category of threat to the species: NT – near threatened, LC – least concern

3.19.2 Protected areas, including Natura 2000 sites

Pursuant to Article 6(1) of the Act of 16 April 2004 – Nature Conservation Act (Journal of Laws of 2004, No. 92, item 880, as amended), the planned project in both variants discussed is located within the boundaries of the Coastal Protected Landscape Area, apart from the customer substation and 400 kV overhead line.

The **Applicant Proposed Variant** is located in direct vicinity to the Natura 2000 sites – special habitat protection area Białogóra (PLH220003) and special bird protection area Przybrzeżne wody Bałtyku (PLB990002), as well as the ecological area “Torfowisko” [Peat Bog] in Szklana Huta.

The **Rational Alternative Variant** is located in the vicinity of the Natura site – special bird protection area Przybrzeżne wody Bałtyku (PLB990002), it intersects in fragments the special habitat protection area Białogóra (PLH220003) and the ecological area “Torfowisko” [Peat Bog] in Szklana Huta.

The location of both variants against the environmental protection forms is presented in Figure 3.52.

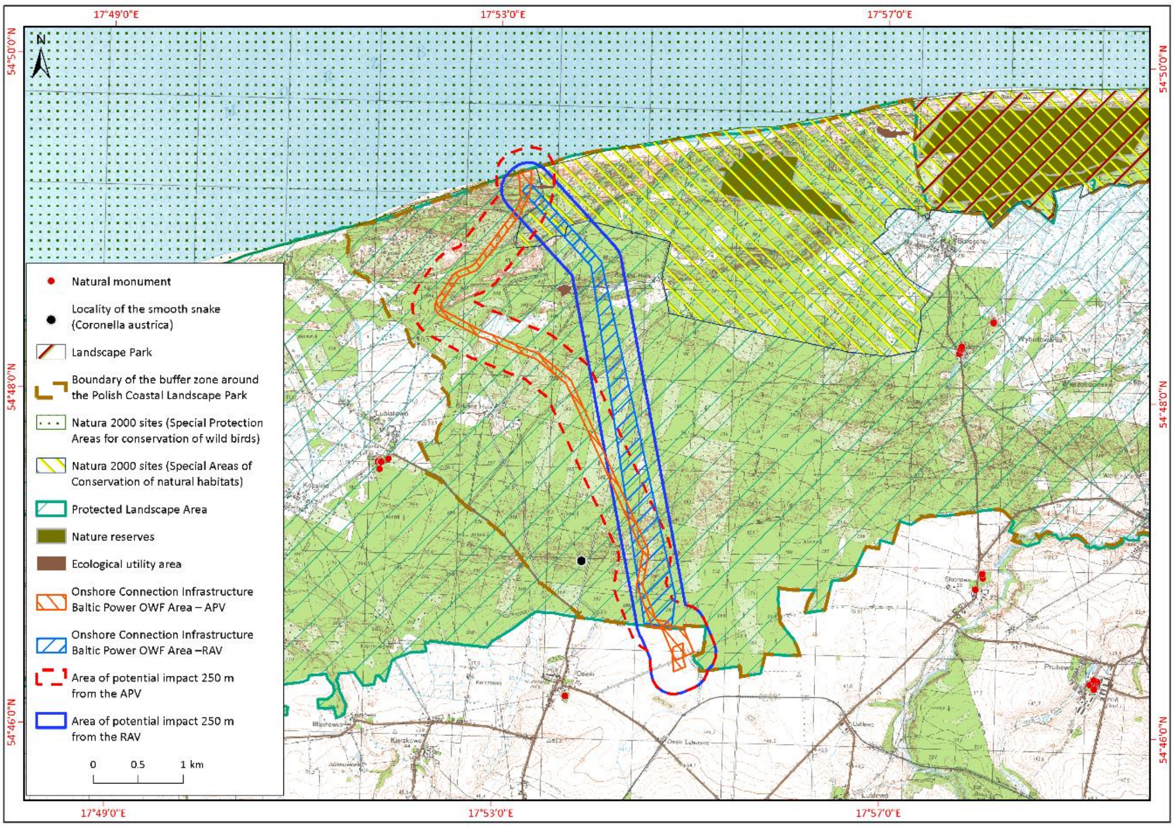


Figure 3.52. Position of the planned project in both variants against the forms of nature protection [Source: internal materials]

The **Coastal Protected Landscape Area** was established on 10 December 1994 under the Regulation No. 5/94 of 8 November 1994 on establishing protected landscape areas, specifying landscape park borders and delineating buffer zones around them with the introduction of bans and restrictions applicable therein (Official Journal of the Gdańsk Voivodeship of 1994, No. 27, item 139). It includes the seashore, forested and forest free strip of dunes running along the coast, and in the eastern part, the Błota Przymorskie Plain and northern fragments of the neighbouring Żarnowiecka Upland. Its main value is the preserved natural arrangement of landscape zones. The most important threats include intensive and unorganised development of tourist infrastructure, excessive pressure of tourist traffic and disturbance of water relations within the Bielawskie Błota protected area (land drainage system).

The legal act applicable for the Coastal Protected Landscape Area is the Resolution No. 458/XXII/12 of the Pomeranian Voivodeship Regional Assembly of 25 July 2016 on the protected landscape areas in the Pomeranian Voivodeship.

3.19.2.1 Areas in the NATURA 2000 network

The **Natura 2000 site Przybrzeżne Wody Bałtyku (PLB990002)** was established by the Regulation of the Minister of Environment of 21 July 2004 on the Natura 2000 special protection areas for birds. The area includes the Baltic Sea coastal waters of the depth from 0 to 20 m. Its boundaries stretch for 200 km beginning with the base of the Hel Peninsula and ending in the Pomeranian Bay. The seabed is uneven, the height differences reach 3 m. Small crustaceans dominate in the benthic fauna. Two bird species from the list included in Annex I to the Birds Directive, i.e. the black-throated diver and the red-throated diver winter in this area. In winter, more than 1% of the long-tailed duck migratory route population and at least 1% of the black guillemot and velvet scoter migratory route population are present there. This area is a bird sanctuary of European importance. A significant number of two bird species from the ones listed in the Appendix 1 of the Council Directive 79/409/EEC, namely black-throated loon and red-throated loon winter in this area. During the winter there is over 1% of the migratory species of long-tailed duck and at least 1% of black guillemot and velvet scoter. In benthic fauna, small crustaceans prevail. Large marine mammalssuch as grey seal (*Halichoerus grypus*), ringed seal (*Pusa hispida*) and harbour porpoise (*Phocaena phocaena*) are rarely observed. No plan of protective tasks was established for the Natura 2000 site.

The **Białogóra (PLH220003)** site was established on 5 February 2008 by the Commission Decision of 13 November 2007 adopting, pursuant to Council Directive 92/43/EEC, a first updated list of sites of Community importance for the Continental biogeographical region [notified under document C(2007)5043)(2008/25/EC)]. The area covers a part of the Słowińska Spit, composed of various aeolian formations, with the preponderance of parabolic dunes and large dune slacks with varying levels of peat content. A parabolic dune with deflation depressions covered with marshy coniferous forest and bog birch forest constitutes the main part of the refuge. The dune arms are covered by crowberry coniferous forests. White and grey dunes are present within the area. At the back of the dune embankment, there is a humid, dune slack with shallow peat layer surrounded by marshy coniferous forest. It is one of two places on the Gdańsk Pomerania coast, where the processes of paludification of the mineral substrate take place at present.

A Protective Task Plan for the Natura 2000 site Białogóra (PLH220003) has been established under the Regulation of the Regional Director for Environmental Protection in Gdańsk of 30 April 2014 on establishing the protective task plan for the Natura 2000 site Białogóra (PLH220003) (Journal of Laws of 2014, item 1916) amended by the Regulation of the Regional Director for Environmental Protection in Gdańsk of 17 February 2016 (Journal of Laws of 2016, item.1082).

The **ecological area "Torfowisko" [Peat bog] in Szklana Huta** is a poor fen, with a surface area of 0.86 ha located in the Choczewo Forest District, Choczewo precinct, Biała Góra forestry, section 42c, 43b.

The ecological area was established on 31 December 2000 by the regulation No. 183/2000 of the Pomeranian Voivodeship Governor of 28 November 2000 (Official Journal of the Pomeranian Voivodeship No. 115, item 738) on establishing some areas as ecological areas.

The planned project in both variants is located within the boundaries of the Polish Coastal Landscape Park buffer zone.

The following forms of nature protection occur in the surrounding area (up to 10 km) of the planned project in both variants:

- Natura 2000 site Lake Choczewskie (PLH220096);
- Choczewsko-Saliński Protected Landscape Area;
- Polish Coastal Landscape Park;
- nature reserves: Babnica, Białogóra;
- 5 ecological areas: Gajówka, Osoczne Oczko, Źródliska Bezimiennej, Torfowisko in Szklana Huta, Białogórskie Torfowisko;
- natural monuments.

The ecological area "Źródliska Bezimiennej" [Bezimienna Springs] is located between the APV and the RAV, in the vicinity of the RAV potential impact area. It includes a natural habitat and a site of rare or protected species with a surface area of 1.3 ha. It constitutes a spring community.

It was established by the Regulation No. 183/2000 of the Pomeranian Voivodeship Governor of 28 November 2000 (Official Journal of the Pomeranian Voivodeship No. 115, item 738) on establishing some areas as ecological areas.

3.19.3 Wildlife corridors

Pursuant to the Nature Conservation Act of 16 April 2004 (Journal of Laws of 2004, No. 92, item 880, as amended), a wildlife corridor is an area enabling the migration of animals, plants or fungi. Corridors facilitate the existence and exchange of genetic pools, abundances and above all the migration of species and individuals, conditioning the maintenance of environmental biodiversity. Their boundaries include mainly forest areas, surface waters, habitats of high nature value, as well as agricultural land, where a small share of communication and developed areas is visible. Depending on the impact area and the significance of impacts, terrestrial corridors can be divided into: supra-regional, regional, sub-regional and local.

The project does not run across any wildlife corridors [178] [Figure 3.53]. The system of wildlife corridors is an official system available on the websites of GDEP (https://www.gdos.gov.pl/dane-i-metadane).

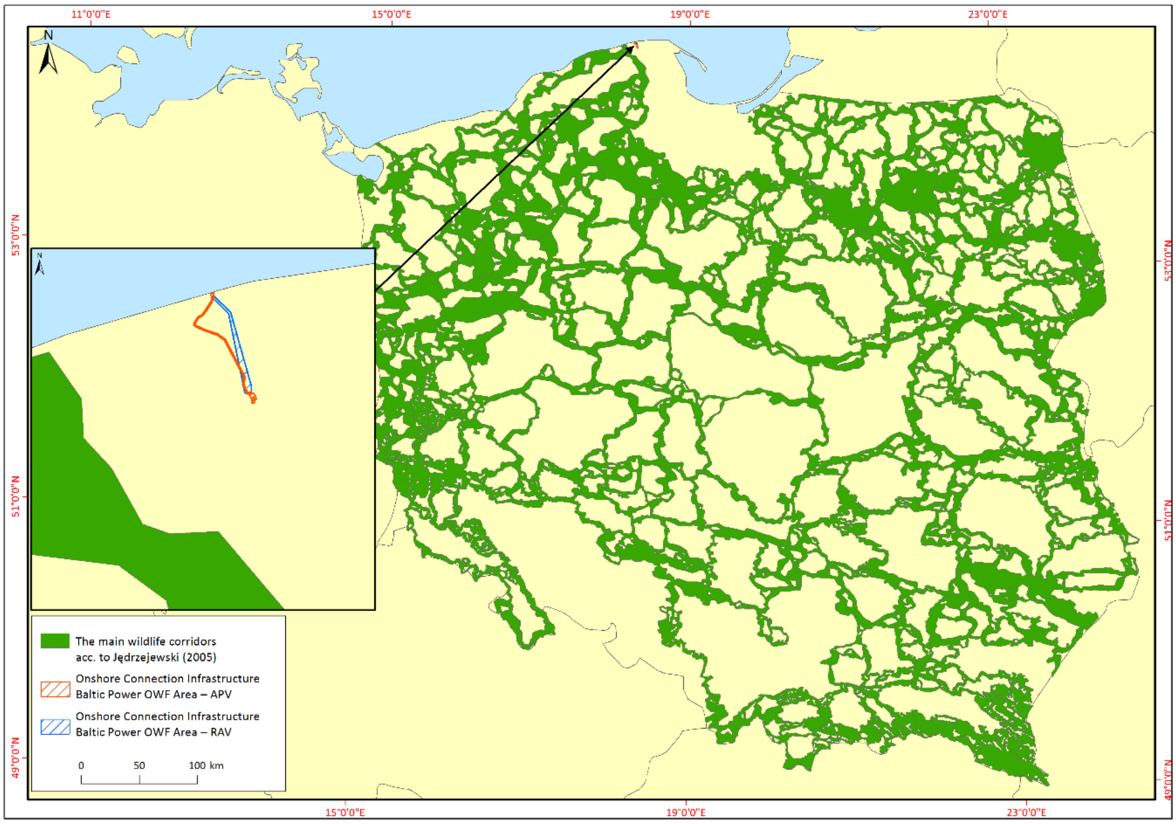


Figure 3.53. Main wildlife corridors, 2005 concept [Source: internal materials on the basis of [178]]

However, on a national scale, this picture has changed with the 2011 publication [177], when new areas were added to the existing wildlife corridors. Compliant with the publication, the planned project is located within the impact area of the Kashubian Coast wildlife corridor (code KPn-20C) [Figure 3.54].

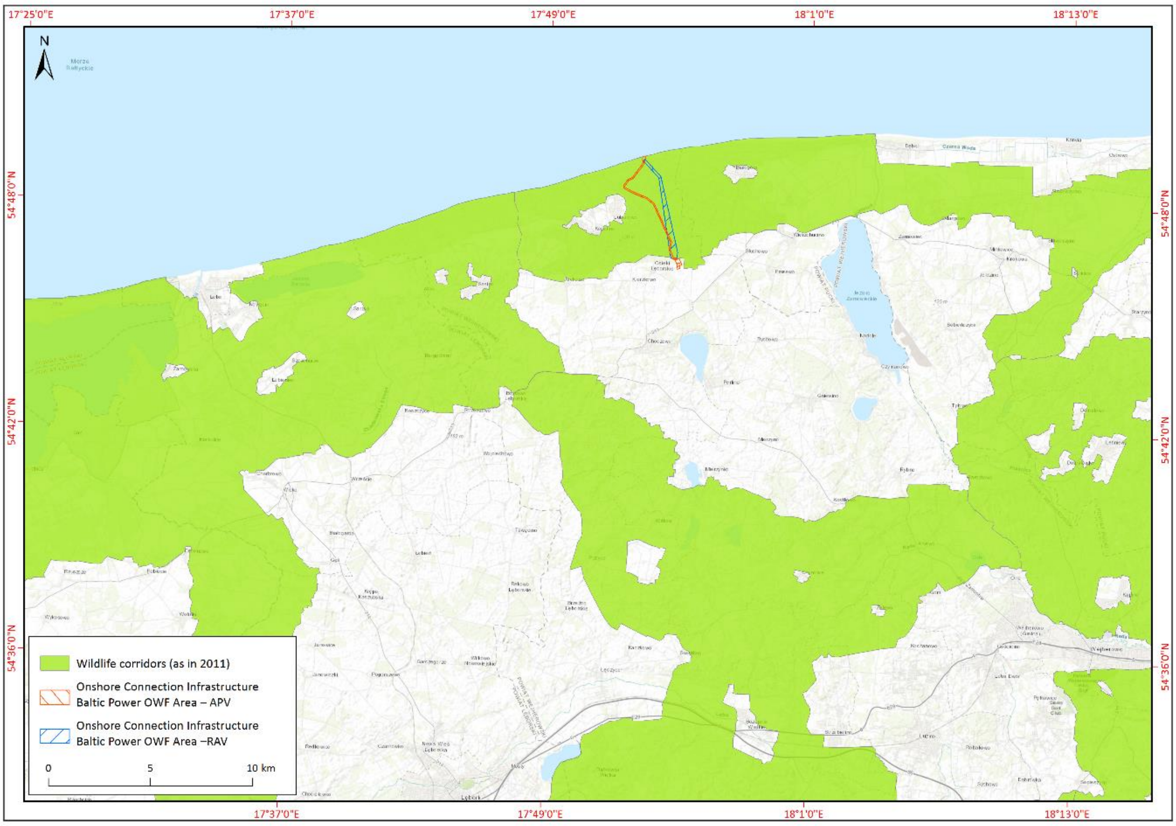


Figure 3.54. Wildlife corridors, 2011 concept [Source: internal materials on the basis of Jędrzejewski et al. 2011 [177]]

In accordance with the Concept of the Ecological Network of Pomeranian Voivodeship [203] the planned project is located within the Coastal Corridor area of a supra-regional importance.

The **Coastal Corridor** constitutes a forest-water-meadow-peat strip along the Baltic Sea coastline. This corridor is diversified in terms of structure and includes a strip of dunes, which runs also within the boundaries of the Słowiński National Park, on the Hel Peninsula, coastal forests and meadows, marshlands, swamps and two coastal lakes: Łebsko and Gardno. In the western part, outside the area adjacent to the shoreline, the corridor also includes a strip of forests located below, to the north and paralel to the Moszczeniczka Stream. Forests, including the tree-covered and shrubby areas, cover more than 50% of the corridor surface area, and water more than 15%. The proportion of grassland area is large, estimated to be around 25% of the corridor area. Some of the forests and grassland communities are located in wetlands, the total share of which in the corridor is over 6%. The share of developed land in the corridor is small (approx. 0.6% of the corridor surface area), since larger concentrations of developments are located within the settlement and recreational centres [Figure 3.55].

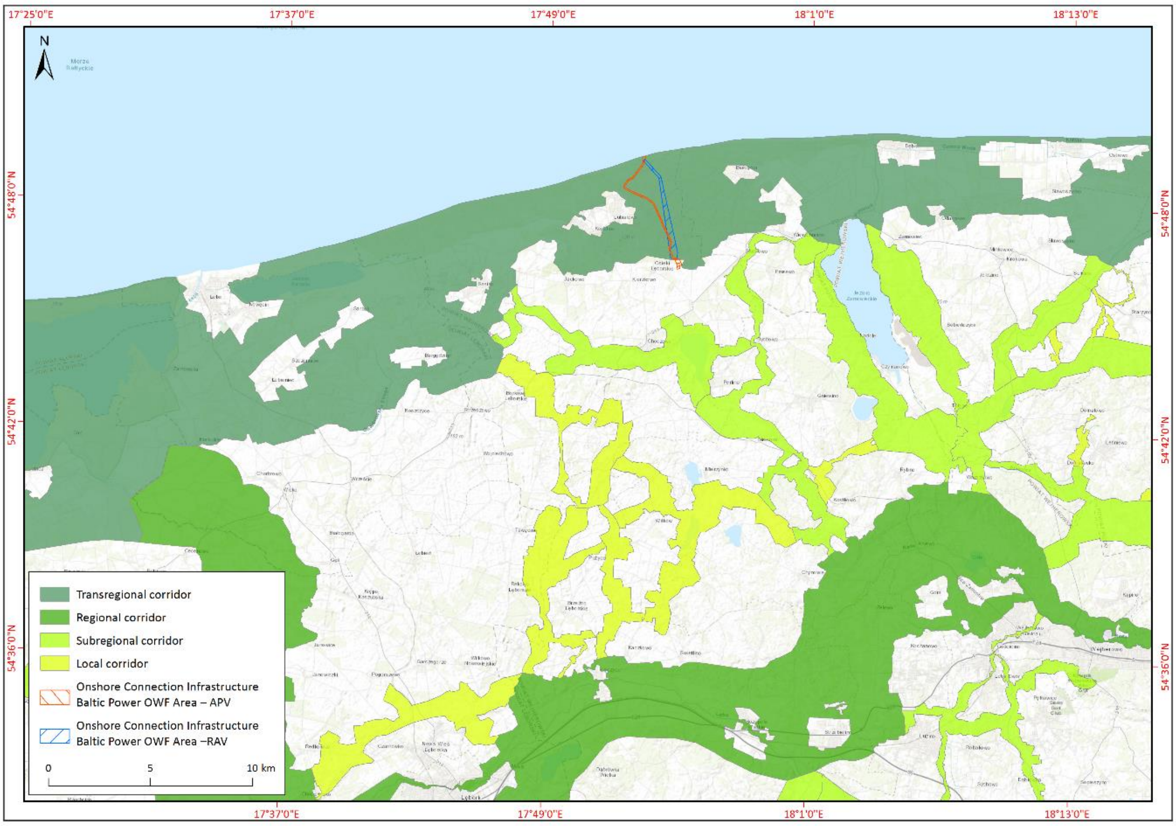


Figure 3.55. Location of the planned project against wildlife corridors [Source: internal materials on the basis of [203]]

The Coastal Corridor maintains direct connectivity with a corridor of a supra-regional importance of the Słupia and Wda Rivers as well as the regional corridors of the Łupawa Valley and the Ice-marginal Valley of Reda and Łeba (near-estuary sections of Słupia, Łupawa and Łeba river valleys are already contained within the coastal corridor). Moreover, the direct connectivity of the coastal corridor with the above-mentioned supra-regional and regional corridors is guaranteed thanks to several sub-regional corridors that fulfil the connective function.

The extensive, structurally diversified coastal corridor includes the Lubichowski piece of land, which comprises a dense complex of coastal forests in a strip west of the town of Łeba and east of the town of Dębki.

However, the above-mentioned concepts, completely fail to take into account the needs of birds, their places of concentration and migration routes. In accordance with the publications of Berthold [24] and Newton [259], along the south coast of the Baltic Sea, runs one of the branches of the East Atlantic Flyway, which connects the breeding grounds in northern Europe the wintering grounds located in southern and western Europe, Africa, and also in Asia, for a small number of species. A schematic representation of this route including the location of the survey area is shown in Figure 3.56.

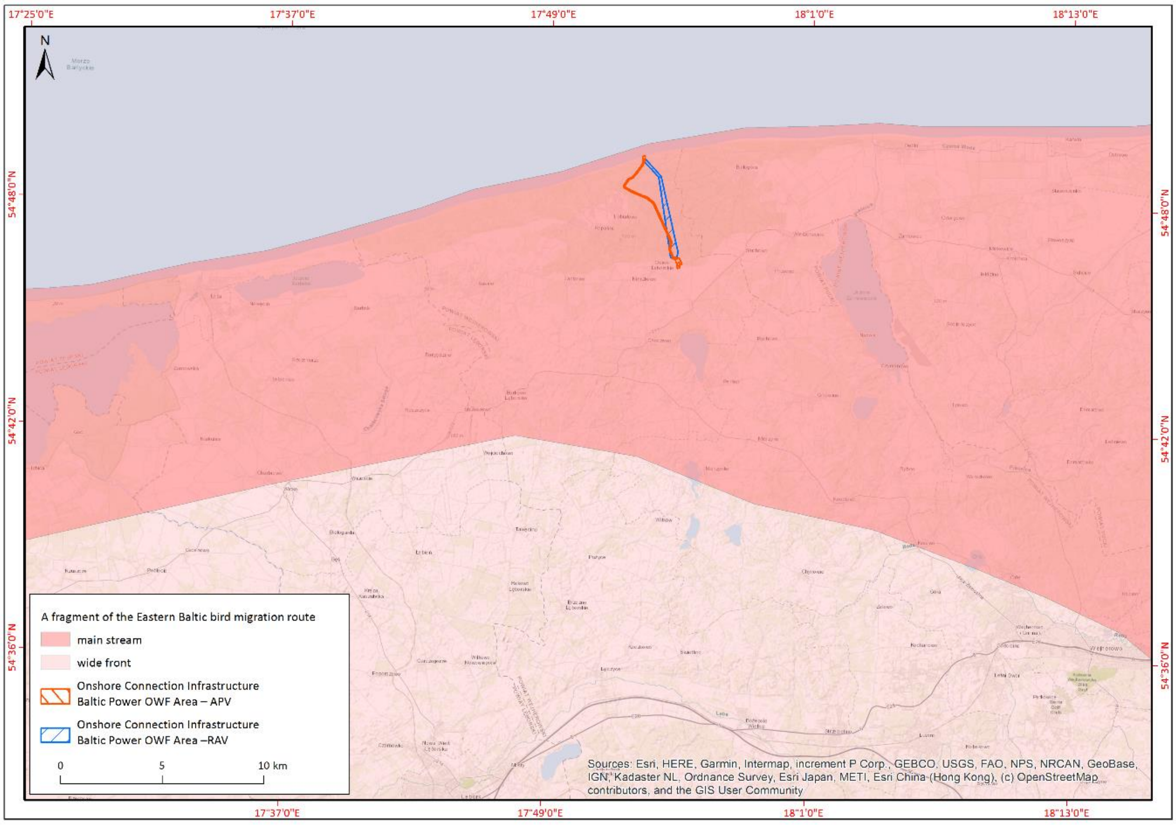


Figure 3.56. Location of the planned project against the East Atlantic Flyway [Source: internal materials on the basis of [24] and [259]]

3.19.4 Biodiversity

One of the most severe European environmental issues is the loss of biodiversity. The studies in this area identify five main factors affecting biodiversity: habitat loss and fragmentation, overexploitation and misuse of natural resources, pollution, invasive alien species and climate change. In accordance with Article 2 of the Convention on biodiversity, biodiversity should be understood as a diversification of all living organism froms, for example, terrestrial, marine and other aquatic ecosystems and the ecological complexes, which they are a part of. It refers to diversity within species (genetic diversity), between species and between ecosystems.

The biodiversity of a site is not uniform and is connected to the number and mosaicism of habitats. Variability of biodiversity also depends on the season of the year, the interrelationship between the abundance of the organisms concerned and the study group. An area exhibiting high plant biodiversity may not be particularly attractive to mammal or reptile species and, conversely, areas favourable to birds need not be rich in vascular plant species (e.g. dunes).

3.19.5 Environmental valorisation of the area

A detailed characteristics of the biotic elements was developed on the basis of annual inventory surveys on abiotic and biotic resources of the BP OWF CI survey area (Appendix 1. Report on inventory surveys) and those areas that fell within the areas of the potential impact of both variants were listed.

On the basis of the inventory surveys conducted, the following areas were considered most valuable in terms of macroscopic fungi biota:

- a strip of dune embankments overgrown with coastal coniferous forest north of Lubiatowo;
- grey dune habitats within the Wydmy Lubiatowskie dunes;
- the vicinity of the Bezimienna Stream, especially in its upper part.

The diversity of plant habitats and communities in these areas preserves, to a large extent, the high degree of naturalness and their condition in terms of the presence of macroscopic fungi can be described as adequate, determining the species diversity of the biota. Leaving larger fragments of fallen trunks (thick parts) is conducive to the maintenance of the population of rare saprophytic taxa, while the presence of well-preserved stands determines the proper mycorrhiza occurrence.

The valorisation of species carried out as part of the inventory surveys was taken into account when assessing the sites of lichen species of high nature value. Hence, the most valuable were the plots with the species considered to be of exceptionally high and high nature value. As a result of the analyses, the following areas were considered most valuable for lichens in the survey area: the old beech forests north-west of the village of Szklana Huta and the old beech forests north-east of the village of Szklana Huta.

The diversity of plant habitats and communities in these areas preserves, to a large extent, the high degree of naturalness and their condition in terms of the presence of lichens can be described as adequate, determining the species diversity of the biota. Leaving well-preserved old-growth of deciduous forests both in forest communities and along forest and municipal roads is favourable for the preservation of the population of rare epiphytic taxa. The presence of well-preserved forest stands determines the proper diversity of species biodiversity in lichens.

The valorisation of species carried out as part of the inventory surveys was taken into account when assessing the sites of vascular plant species of high nature value. Hence, the most valuable are the sites of species considered to be of very high and – to a lesser extent – of moderate nature value. As a result of the analysis, the most valuable plots of vascular plant flora in the survey area were the following areas:

- the coniferous forest habitats of the coastal *Empetro nigri-Pinetum* running along the beach north of Spacerowa street;
- areas around the middle section of Spacerowa street, mainly due to the presence of such species as: *Erica tetralix* and *Epipactis helleborine*.

The diversity of plant habitats and communities in these areas preserves, to a large extent, the high degree of naturalness, therefore their condition in terms of the presence of plant species can be described as adequate, determining the species diversity of the flora. Numerous peat bogs and the relief of dune embankments also helps the preservation of species diversity. The presence of well-preserved patches of coastal coniferous forest habitat determines the proper biodiversity of the species of flora, some of which are under partial protection.

The following habitats/ microhabitats were indicated as the most valuable sites of terrestrial invertebrates:

- patches of older dune pine forests, especially communities of dry forests, due to, among others, the ecological requirements of the forest *Stanagostus rufus*;

- communities of coastal crowberry coniferous forest, especially on loamy and sandy soils, due to the ecological requirements of *Typhaeus typhoeus*;
- mid-forest wetlands;
- dry and humid heathlands;
- herbal plant patches along roadsides, on areas of clearcutting and in the ecotone of forests with agricultural biocenoses;
- deadwood – various species, various types (trunks, stumps, boughs, branches, snags, stubs of snags, etc.), among others, due to the ecological requirements of a series of species from the Coccinellidae family;
- grey dunes, especially the parts next to the beach, among others, due to the ecological needs of the halophilic species, for example, *Aegialia arenaria*, *Melanimon tibialis* and *Phyllan gibbus*;
- the presence of mammals, especially roe deer, red deer, and wild boars due to the role of excrement in the ecology of many valuable invertebrate species, especially from the Histeridae family;
- the remains of drift-line vegetation, serving among others as a "rescue" biotope for flooded insects and other invertebrates that were previously blown from the land into the sea.

The most important sites for reptiles and amphibians were the forest margins, clearings, sapling stands, departmental roads and other sunny places. A very important place of reptiles occurrence was the sequence of the Wydmy Lubiatowskie dunes, where the sand lizard was found in great numbers. Undoubtedly, one of the most valuable sites is the place of the smooth snake (*Coronella austrica*), occurrence, which was recorded in 2016 (data from the RDEP in Gdańsk). This site is outside the boundaries of the planned project potential impact area in both variants [Figure 3.52].

The materials collected during the year-long avifauna surveys indicate that in the area covered by the planned project potential impact in both variants includes areas of high significance for several species of breeding birds. A particularly valuable species in the study area was the common redpoll (*Acanthis flammea*) whose breeding sites were located within the Wydmy Lubiatowskie dunes, which is one of the few breeding sites of the species in northern Poland. Other highly valuable species included the European nightjar (*Caprimulgus europaeus*) and the woodlark (*Lullula arborea*), as well as the black woodpecker (*Dryocopus martius*), which is a keystone species whose occurrence determines or facilitates the occurrence of several other bird species. Key habitats for breeding birds were the Wydmy Lubiatowskie dunes and older forest stands, especially those over 110 years old, as well as tree stands with an admixture of the common beech. A section of one of the major bird migratory routes in Central Europe stretches over the survey area, namely the East Atlantic Flyway, which connects the breeding grounds in northern Europe with the wintering grounds located in southern and western Europe, Africa, and also in Asia, for a small number of species. A massive flux of migrating birds was observed over the northern part of the survey area, heading west during the autumn migration and east during the spring migration. No major groupings/concentrations of birds were identified in the survey area – neither during the dispersal nor during the wintering period.

Summing up, the results of the inventory survey conducted show relatively high biodiversity in the area of the planned project in both variants. The greatest biodiversity occurs in the area of the Wydmy Lubiatowskie dunes and in the Bezimienna Stream valley.

3.20 Cultural values, monuments and archaeological sites and objects

The area analysed has been a settlement location for thousands of years, with the first nomadic peoples appearing at the end of the Palaeolithic Age and documented traces of human activity dating back to the Neolithic period. The archaeological finds in the area of the Choczewo commune confirm the local settlement agglomeration of the so-called Lusatian culture, autonomous in relation to rather distant centres of the so-called Oksywie and Wielbark cultures. In the early Middle Ages, the gord centres dominating in the region were the gords in Żarnowiec, Białogard and Będargów, whereas, in Ciekocin and Kopalino, relics of open settlements connected to the system of gords have been preserved.

In accordance with the Commune Monument Conservation Program [127], the following objects constitute cultural values in the Choczewo commune:

- rural arrangement of Pomeranian villages: Choczewo and Osieki Lęborskie;
- sacral architecture buildings in Osieki Leborskie, Ciekocinek and Zwartowo;
- manor-park complexes with granges;
- monuments of regional culture;
- monuments of technology;
- public utility buildings;
- Evangelical cemeteries and burial chapels;
- archaeological sites.

According to the register of immovable monuments of the Pomeranian Voivodeship (as of 27 July 2021), there are 17 objects under legal protection in the Choczewo commune.

Moreover, the immovable monuments in the Choczewo commune are under legal protection through entry in the Communal Register of Monuments, according to which there are 151 objects in the commune (www.ochronazabytkow.gda.pl). In the direct vicinity of the planned project, there are the following objects: manor park, residential buildings, grange in Osieki Lęborskie and filial church of Saint Mary's Star of the Sea in Osieki Lęborskie with a graveyard. The list of monuments located in the vicinity of the planned project is included in Table 3.31.

Table 3.31. List of immovable monuments in the vicinity of the planned project [Source: https://www.ochronazabytkow.gda.pl/wojewodzka-ewidencja-zabytkow/]

No.	Village	Object	Plot no.	Pomeranian Voivodeship reg. no.	Date of entry into the Register of Monuments	Distance from the planned project
1.	Choczewo	Manor house in a manor-park complex (ul. Kusocińskiego)	Plot 271	1056	-	3.9 km
2.	Choczewo	Manor outbuilding in a manor-park complex (ul. Wojska Polskiego)	Plot 270/21	1056	-	3.9 km
3.	Choczewo	Manor outbuilding in a manor-park complex (ul. Kusocińskiego/ Szkolna)	Plot 270, 271, 272, 273, 274	1056	-	4.2 km

No.	Village	Object	Plot no.	Pomeranian Voivodeship reg. no.	Date of entry into the Register of Monuments	Distance from the planned project
4.	Choczewo	Residential building (ul. Kościuszki)	Plot 523/7, 523/9	-	-	4.1 km
5.	Choczewo	Residential building (ul. Kościuszki)	Plot 295, 296	-	-	4.1 km
6.	Choczewo	Residential building (ul. Kościuszki)	Plot 523/7, 523/9	-	-	4.1 km
7.	Choczewo	Residential building in the Forest Inspectorate complex (ul. Kościuszki)	Plot 523/11	-	-	4.1 km
8.	Choczewo	Residential building (ul. Pierwszych Osadników)	Plot 246/4, 246/8	-	-	3.6 km
9.	Choczewo	Building – police station (ul. Pierwszych Osadników)	Plot 256	-	-	3.8 km
10.	Choczewo	Building – restaurant (ul. Pierwszych Osadników)	Plot 522	-	-	3.7 km
11.	Choczewo	Residential building (ul. Pierwszych Osadników)	Plot 259/3	-	-	3.8 km
12.	Choczewo	Residential building (ul. Pierwszych Osadników)	Plot 304/3	-	-	4.0 km
13.	Choczewo	Residential building near a former dairy (ul. Pierwszych Osadników)	Plot 301/1	-	-	4.1 km
14.	Choczewo	Residential building (ul. Pierwszych Osadników)	Plot 317/4	-	-	4.2 km
15.	Choczewo	Residential building (ul. Pierwszych Osadników)	Plot 316	-	-	4.0 km
16.	Choczewo	A former Evangelical, then Catholic graveyard by the church of Our Lady Queen of Poland (ul. Pierwszych Osadników)	Plot 188/4, 189/1, 189/2	-	-	4.2
17.	Choczewo	Residential building, near post office (ul. Pucka)	Plot 244/1	-	-	3.5 km
18.	Choczewo	Residential building, former railway building (ul. Pucka)	Plot 241/2	-	-	3.4 km
19.	Choczewo	Building, currently a preschool (ul. Szkolna)	Plot 266/1	-	-	3.9 km
20.	Osieki Lęborskie	Filial church of Saint Mary's Star of the Sea with a graveyard	-	1235	20.07.1988	1.3 km
21.	Osieki Lęborskie	Church graveyard, Catholic, former Evangelic	Plot 22	1235	-	1.3 km
22.	Osieki Lęborskie	Manor park	Plot 15/43-46	-	-	1.0 km
23.	Osieki Lęborskie	Grange	Plot 15/35	-	-	1.2 km

No.	Village	Object	Plot no.	Pomeranian Voivodeship reg. no.	Date of entry into the Register of Monuments	Distance from the planned project
24.	Osieki Lęborskie	Residential building, former inn	Plot 33/9	-	-	1.2 km
25.	Osieki Lęborskie	Residential building	Plot 17/50	-	-	1.1 km
26.	Osieki Lęborskie	Outbuilding (stone)	Plot 33/54	-	-	1.1 km
27.	Osieki Lęborskie	Residential building	Plot 15	-	-	1.3 km
28.	Osieki Lęborskie	Residential building	Plot 15/15	-	-	1.3 km

In the area of the Choczewo commune, as part of the undertaking in progress since 1978, which involves searching, recording and plotting archaeological sites on maps, so-called Archaeological Picture of Poland, the presence of 246 archaeological sites has been identified. According to the Commune Monument Conservation Program in Choczewo for the years 2017–2020 [127], the register of archaeological sites is not a finished set, further traces of settlements may be identified as a result of further verification or earthworks.

Within the planned project potential impact area, in none of the variants analysed, monuments, sites or archaeological objects were identified. The following archaeological sites are located in the vicinity [Figure 3.57]:

- Osieki Lęborskie site 1 – barrow-type cemetery (approx. 150 m west of the APV potential impact area and approx. 1.1 km of the RAV potential impact area);
- Osieki Lęborskie site 2 – box(shaped) graves (approx. 85 m west of the APV potential impact area and approx. 700 m of the RAV potential impact area).

In addition, ongoing preparatory works have identified 6 archaeological sites – barrows, located approx. 85 m south-west of the APV and approx. 810 m west of the RAV.

The objects mentioned above are barrows, a type of grave in the form of a conical or semi-circular mound with wooden, wooden-stone or stone elements containing a burial chamber involving a skeletal or corpse burial.

3.21 Use and management of land and tangible property

Main types of land use with reference to both variants are:

- forests along the prevailing sections of the underground and overhead cable line;
- waterlogged meadows in the Bezimienna Stream valley;
- arable lands within the area of the customer substation and 400 kV overhead line;
- local road (Spacerowa street) and fire break lanes;
- surface waters (watercourses and small water reservoirs).

In summer, these areas are visited by a great number of tourists. A street runs there (Spacerowa) which leads along the Wydmy Lubiatowskie dunes in the eastern direction. It is a part of the blue tourist trail. The areas across which the project will run belong to the 46th Missile Air Defence Battalion, formed in 1971 and dissolved on 28 December 2001. At present, a Rehabilitation and

Holiday Centre for disabled people is located there (ul. Spacerowa 38, Lubiatowo), constructed on the premises of a former military unit. Moreover, in the vicinity of the planned project, a fire observation tower is located. It belongs to the State Forests and is used for the observation of fire hazards in the area of the Choczewo Forest District.

3.22 Landscape, including the cultural landscape

Considering the typological classification [329], the planned project in the onshore part is located within the landscape with lowlands and depressions. The northern part of the planned project is located within an aeolian lowland landscape of a hill-like type. The central part lies within a deltaic-accumulative landscape of valleys and depressions and a fluvioglacial lowland landscape of a plain and undulating type. On the other hand, the southern part of the planned project lies within the area of a glacial lowland landscape of a hill-like type [Table 3.32].

Table 3.32. Landscape units located along the route of the planned project in its onshore part [Source: internal materials on the basis of [329]]

Class	Type	Species	Location
Lowlands	Glacial	Hill-like	39.5–40.5 km
	Fluvioglacial	Plain and undulating	37.3–39.5 km
	Aeolian	Hill-like	Shoreline – 35.5 km
Valleys and depressions	Deltaic-accumulative	-	35.5–37.3 km

The lowland glacial landscape is characterised by significant height differences, changeable terrain slopes and varied relief as well as a strongly developed hydrographic network with numerous wetlands, marshes, smaller watercourses and lakes. In the case of the hill-like type, lessive, brunic and brown soils prevail, which determinate the presence of mixed coniferous forests and oak-hornbeam forests. In the case of the planned project, this landscape is mainly determined by significant surface areas of arable land of diversified relief.

The landscape of the fluvioglacial lowland occurs in patches in the glacial and periglacial landscape. These are mainly outwash fans of poor soils, in large part covered with coniferous forests. In the case of the planned project, this landscape is mainly determined by the River Chełst with a network of channels and smaller watercourses within their vicinity as well as extensive pine forests.

The lowland aeolian landscape is characterised by the presence of aeolian hills in the form of parabolic and embankment-like sandy dunes. In the case of the planned project, this landscape is determined mainly by extensive areas of pine forests on dunes. The most valuable element determining the aeolian landscape of the planned project area is the Wydma Lubiatowska dune.

The landscape of valleys and deltaic-accumulative depressions occurs in the area of large river estuaries, where the material transported by the river sediments and blocks the free outflow of water, which results in smaller, lateral troughs in the overlying material. These areas are overgrown mainly with riparian forests. Due to the presence of very fertile soils (alluvial soils), the deltaic landscapes are dominated by intensive agriculture. In the case of the planned project, this landscape is determined mainly by the Biebrowski Cannal and the Lubiatówka Stream with a network of channels and smaller watercourses with visible agricultural fields in the area as well as extensive pine forests and waterlogged land.

Considering the physical and geographical regionalisation of Poland [204], the planned project is located in the Słowińskie Coast (northern part from the shoreline to 36 km) and Choczewo Upland (southern part from 36 km to 40.5 km).

3.22.1 Słowińskie Coast

The Słowińskie Coast is a narrow strip of land along the Baltic Sea coast, and its main landscape elements include beaches, coastal dunes, coastal swamps and lakes as well as elements of post-glacial relief. The landscape visible here is determined mainly by the reciprocal interaction of the sea and land (for example, abrasive processes, shoreline evolution as a result of wave movement and wind activity, or accumulation of sediments), as well as intensive human activity (for example, tourist traffic, coastal reinforcement works, erection of harbour facilities) [204].

3.22.2 Choczewo Upland

The Choczewo Upland is a region, in which 100 MASL are locally exceeded. This area is covered by many upland mounds divided by depressions and post-glacial valleys. There are numerous lakes and a relatively extensive network of smaller watercourses and channels in the depressions between upland mounds. The entire Choczewo Upland area is characterised by a mosaic of arable fields and woodlands. The anthropogenic elements which significantly influence the landscape of the Choczewo Upland include the remains of an unfinished nuclear power plant in the area of Lake Żarnowieckie (north-eastern part of the Upland) and the Żarnowiec Hydroelectric Power Plant constructed in the vicinity.

In accordance with Corine Land Cover 2018, the planned project runs mainly across forest areas and semi-natural ecosystems, and to a small degree across agricultural areas. The arable lands are visible in the area of the designed customer substation – the landscape of these lands should be considered culturally disharmonious, where the human activity relatively strongly transforms the landscape of the surrounding area. Forest areas are located along the entire route of the underground cable line – the landscape of these areas should be considered as naturally and culturally harmonious.

The Act of 23 July 2003 on the protection and the care of monuments (Journal of Laws of 2003, No. 162, item 1568 as amended), determines the cultural landscape as a space, which contains natural elements and artefacts of civilisation, historically shaped under the influence of natural factors and human activity. Historical elements important from the point of view of the cultural landscape in the surroundings of the planned project are archaeological sites in the form of cemeteries (Osieki Lęborskie 1 and Osieki Lęborskie 2) in the vicinity of the forester's lodge Szklana Huta [Figure 3.57], between the 36 and 37 km of the planned project. During excavation works carried out in the 1970s several box(shaped) graves were found there from the Iron Age (650–125 BC). Moreover, in the town of Osieki Lęborskie, an object entered into the Voivodeship Register of Monuments is located – a Roman Catholic Church of the Saint Mary's Star of the Sea (former Evangelic Church) with a church graveyard.

The planned project will be located within the area of the Coastal Protected Landscape. The applicable legal act is the Resolution No. 458/XXII/12 of the Pomeranian Voivodeship Regional Assembly of 25 July 2016 on the protected landscape areas in the Pomeranian Voivodeship, which includes the provisions resulting from the landscape protection needs. The Coastal Protected Landscape Area encompasses, first of all, the coastal zone represented by the dune spits and organogenic accumulation plains. This area is characterised by very high landscape values due to the strip-like arrangement of moraine uplands, extensive coastal plains, dunes and beaches and the seashore. The significant problems of this area include increased tourist traffic, which overloads the natural environment, mainly in places of intensive recreational and tourist investments, i.e. in the area of Karwie, Białogóra or Ostrowa [318].

In accordance with the Study of conditions and directions for the Choczewo commune spatial development (Resolution No. XXVIII/220/2021 of the Choczewo Commune Council adopted on 26 January 2021), the planned project does not run across natural and cultural landscape exposure protection zones, viewing axes, exposition fields or in the vicinity of viewing points. In the area of the shoreline, the planned project runs in direct vicinity of a viewing axis.

3.23 Population and living conditions of people

The planned project in both variants discussed is located in forest areas, the location of the customer substation is planned on arable lands of class 5, and the 400 kV power line on arable lands class 4a.

In the planned project impact area in the APV, the area of the Rehabilitation and Holiday Centre for disabled people is situated (ul. Spacerowa 38, Lubiatowo), where occupational therapy workshops for disabled people are held [Figure 3.57].

In the RAV, within the area of the planned project impact, there are no developed areas. At a distance of approx. 430 m in the eastern direction, there is a scout hall in Szklana Huta.

The buildings nearest to the planned customer substation and 400 kV overhead line are located at the following distances:

- approx. 900 m in the western direction – the village of Osieki Lęborskie;
- approx. 3 km in the north-western direction – the village of Lubiatowo.

Single residential homestead housing in Szklana Huta is located at a distance of 630 m from the APV and 1 km from the RAV.

The village of Lubiatowo is a former agricultural settlement, which nowadays serves as a summer resort. The main sectors of the commune economy are focused on: tourism, agriculture and services of various types. Agriculture is the dominant business activity. Agricultural holdings and entities operating around agriculture, including tourism, constitute the economic potential of the commune.

The village of Osieki Lęborskie is a former Kashubian settlement, under the Kierzkowo village council office. It is located near the suspended route of the Wejherowo-Choczewo-Lebork railway line.

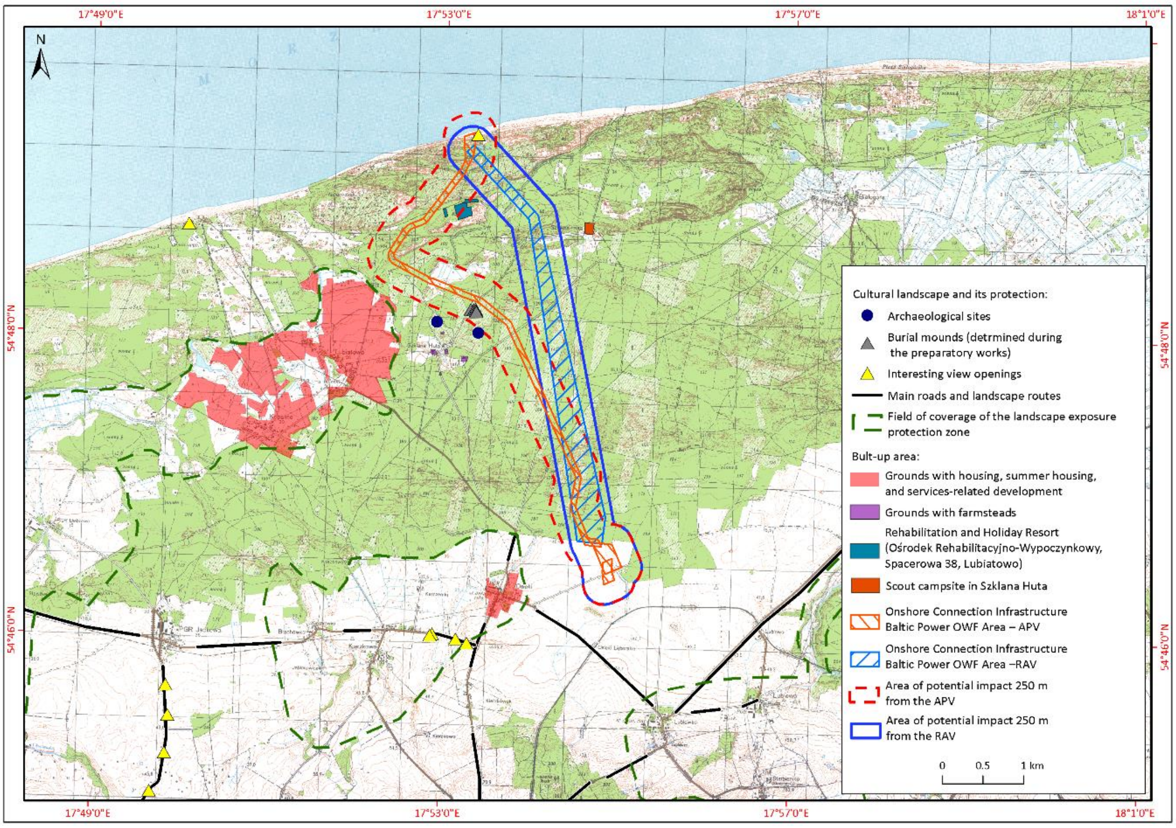


Figure 3.57. Location of the planned project against archaeological sites and site use and development [Source: internal materials]

4 Modelling performed for the purposes of the project impact assessment

4.1 Modelling of underwater noise propagation

This subsection presents the expected noise levels resulting from the construction and operation of subsea cables, determines the potential effects on marine mammals and fish that may result from noise emission, and estimates the range from the source at which the impact may be expected.

The references were reviewed to determine the characteristics (frequency and volume) of underwater noise sources that may occur during the construction and operation of submarine cables. The frequency of these noise sources was compared with the data published on hearing thresholds in fish and marine mammals to determine potential impacts.

4.1.1 Ambient noise components

The planned project is located in the area of ambient noise dominated by anthropogenic acoustic sources: vessels and fisheries (along with the associated fishing vessels). Due to the importance of areas in the vicinity of the planned project, for activities related to the implementation of OWFs and commercial fishing, the levels of underwater noise in the environment are likely to increase when compared to areas characterised by lower industrial activity.

4.1.2 Noise characteristics

The screw propeller is the most important source of underwater noise generated by vessels. The operation of the screw propeller is mostly the predominant part of underwater disturbances in the low frequency band at high vessel speeds, especially when cavitation occurs [189]. Cavitation consists in formation and sudden disappearance of gas bubbles in the liquid, accompanied by rapid pressure changes. It is an important source of noise and causes damage to drive elements. Cavitation often occurs in thrusters on small specialist vessels using the DP system.

In the case of DP systems maintaining the vessel in a preset position, higher levels of noise emitted by the vessel will occur during adverse weather conditions.

The vessel's propulsion engine is the main source of underwater noise, which increases strongly along with the speed of the vessel (values for transit speed were analysed). Generally, the level of underwater components of the vessel noise spectrum is unstable due to the changes in the load of the screw propeller under different sea conditions.

Noise generated by the works related to cable burial is continuous; the following values were assumed for individual vessels:

- large DP cable-laying vessels: 30 Hz – 3 kHz; from 100 to 197 dB re 1 µPa at a distance of 1 m from the source;
- smaller vessels without DP: 50 Hz – 2 kHz; 170 to 180 dB re 1 µPa;
- underwater vehicles for mechanical trenching applications: 172 – 185 dB re 1 µPa.

The relatively high density of water means that underwater noise is easily transmitted in the marine environment. This means that it is probable that the impact of underwater noise emissions resulting from the construction and operation of subsea cables may extend over long distances. However, the phenomena occurring in shallow waters, i.e. reflection from the seabed and water surface, dispersion, damping and absorption of the sound wave by the seabed make the noise propagation visible only up to a certain distance from the source, which depends on the seabed type [206]. The sound intensity also decreases with the increase in the area in which it propagates. In seawater, absorption depends on the frequency; higher frequencies are absorbed more easily than lower ones, but as the salinity decreases, this dependence also decreases. Therefore, in the internal parts of the Baltic Sea, higher frequencies do not dissipate as quickly as, for example, in the Danish Straits [5]. Higher frequencies dissipate the closest to the source over the seabed with fine-grained sand and the furthest over the seabed with medium silt content. The components of the lowest frequencies disappear at a very small distance from the vessel in the case of a fine-grained seabed. Frequency components below 100 Hz are practically no longer present at a distance of 200 m from the vessel. Subsequent low frequency components disappear gradually as the distance increases. At a distance of 10 000 m from the source, the sound received is the sum of components with frequencies higher than 400 Hz [206].

In Danish waters, the impact of the components of noise generated by vessels from medium to high frequency was analysed. Noise from vessels significantly increases the noise levels in the environment in the entire band recorded from 0.025 to 160 kHz at a distance of 60 m and 1000 m from the vessels passing-by. Vessels passing by at a distance of 1190 m reduce the audibility limit by more than 20 dB (at 1 and 10 kHz) while vessels passing by at a distance of 490 m or less reduce it by more than 30 dB (at 125 kHz). Therefore, although masking effects may occur due to high frequencies, the range of these impacts is low [20].

The intensity of different frequencies, also referred to as the Power Spectral Density (PSD), is a very important parameter in describing different noise sources. The comparison of the noise PSD with the hearing sensitivity and sound generation frequencies of different species helps to identify animals at risk of negative noise impact. The sound PSD can be presented in frequency bands of 1 Hz or 1/3 octave. The diagram below shows the PSD for continuous sound from vessels of different sizes [Figure 4.1].

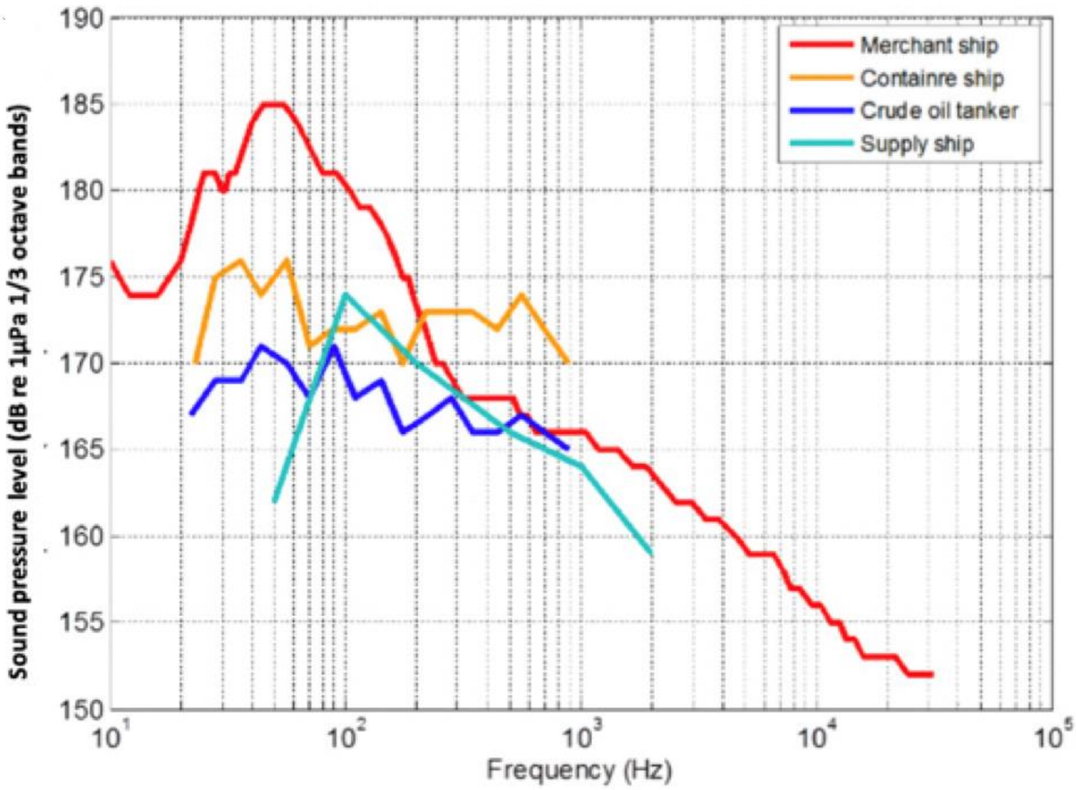


Figure 4.1. Power Spectral Density (PSD) of four types of vessels [Source: modified from NorthConnect [267]]

Figure 4.2 presents the change of the broadband root mean square sound pressure level (RMS SPL – average sound pressure level for/from all frequencies) in the area of the planned project in the case of occurrence of additional noise sources related to cable laying.

The maximum value of ambient noise pressure recorded by the SM4M devices during the monitoring period (RMS SPL = 147.8 dB re 1 µPa) was adopted as the starting point. Then, an increase in the noise level was presented for various types and numbers of vessels as well as equipment for cable burial in the seabed. As the reference values (1 m from the source) the following values were adopted: 197 dB re 1 µPa for large DP vessels, 180 dB re 1 µPa for smaller vessels without DP and 188.5 dB re 1 µPa for works related to cable burial in the seabed (mechanical trenching) [206, 16]. The red line represents their total share, i.e. for point 1 on the x-axis: one large vessel with DP, one smaller vessel without DP and one device for cable burial in the seabed, for point 2: two large vessels with DP, two smaller vessels without DP and two devices for cable burial in the seabed. It is evident that given the share of the large DP vessel, the impact of other vessels on the RMS SPL value is unnoticeable. However, it is worth remembering that the broadband root mean square sound pressure level is not a real representation of individual frequencies in the noise spectrum, which is crucial for assessing the impact on marine animals.

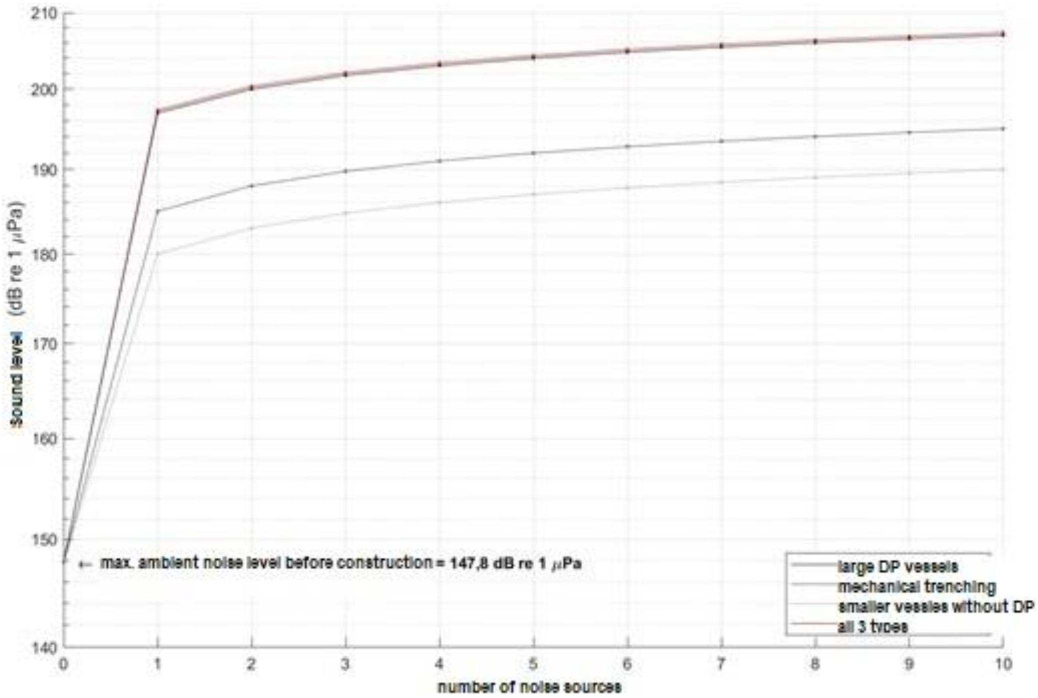


Figure 4.2. Increase in sound level in the survey area after addition of various noise sources, related to the project implementation [Source: internal materials]

Underwater noise monitoring was carried out during the construction of Nordstream 2. During the cable laying, the increase in the SPL measured was up to 19.6 dB at the time of cable burial (trenching). The average noise level estimated in the place closest to the pipeline during trenching was 126.0 dB in re 1 µPa. The spectral analysis showed that the largest share in the sound level was that of 1/3 octave band between 31.5 Hz and 2 kHz. Most of the spectra during pipeline laying reached the highest levels of approx. 125 Hz. Underwater noise emitted by the pipe laying vessel and support vessels was, as expected, comparable in terms of level and frequency to the noise emitted by commercial cargo vessels in the survey area. Underwater noise from trenching was also lower or comparable to vessel noise, with a comparable frequency spectrum [264].

4.1.3 Identification of receptors

The receptors sensitive to noise, which may be present in the vicinity of the planned project, include marine mammals and fish. A wide spectrum of anthropogenic sounds that may occur during the implementation of the planned project is not equally audible by animals [Figure 4.3]. Marine organisms are affected by lower sound energy than the total sound energy introduced into water, since the range of frequencies heard by individual organisms varies depending on the species [263].

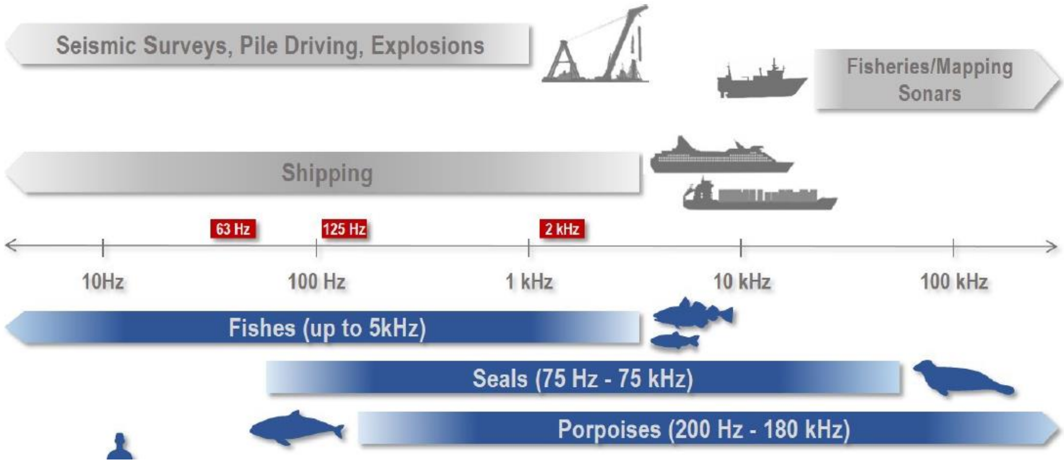


Figure 4.3. Hearing ranges of marine species present in the Baltic Sea and frequency range of noise generated by anthropogenic sound sources. Red fields are frequencies monitored as part of the BIAS monitoring [Source: BIAS [384]]

4.1.4 Analysis results

Where a noise source was identified as detectable for marine mammals or fish, the volume and the estimated range of the noise source were compared with the data published on hearing injuries and disturbance criteria for marine mammals and fish in order to determine the magnitude of the impact it may cause.

The noise sources will be mobile, so propagation conditions will change over time depending on many factors, i.a., topography and type of the seabed, wave motion, depth, water temperature, direction of vessel traffic and many others; therefore, it is impossible to determine precise impact ranges, and the values provided are estimates based on the knowledge available from surveys conducted under similar projects [380, 267, 20, 264, 133].

It is expected that none of the noise sources related to the installation or operation of the BP OWF CI will exceed the exposure limits determined on the basis of the injury criteria for marine mammals or fish. The underwater noise emissions predicted for the construction and operation of subsea cables do not pose a risk of injuries to marine mammals or fish but may cause disturbances in their behaviour.

The maximum ranges of disturbances for marine mammals will be between several hundred metres for large DP vessels and several dozen metres for the noise generated by smaller vessels and installation works. In the case of fish, disturbances will have a greater range due to higher sensitivity of the organisms and may reach up to approx. 1.4 km for large DP vessels and several hundred metres for smaller vessels and cable burial [150]. It should be noted that the disturbance exposure limit for fish of 150 dB re 1 µPa is considered to be overestimated [338], therefore such disturbance ranges are likely to be overestimated.

The ranges of disturbances resulting from installation works and the noise emitted by vessels related to the planned project are limited to a small area and will be short-term, thus, they are unlikely to have a significant impact on marine mammals or fish.

Vessels similar to those likely to be used for cable installation will be regularly used to service the transmission infrastructure in the OWF area. The source of noise generated by increased vessel traffic may significantly change the ambient noise level in relation to the initial conditions.

This information was used for the detailed assessments of impacts on marine mammals and fish.

4.2 Modelling of noise propagation in the atmosphere

4.2.1 Overhead line

The characteristic features of the corona discharge acoustic signal (CDAS) spectrum make the existing sound propagation models of this phenomenon refer to the A-weighted sound level, most often to bad weather conditions, i.e. when the noise of the corona discharge is the most intense, which seems obvious from the point of view of environmental protection problems.

The general sound propagation model of the high voltage overhead line as a source of noise is represented by the equation:

$$L_A = k_1 f_1 \left({}^{E}/_{E_0}\right) + k_2 f_2 \left({}^{n}/_{n_0}\right) + k_3 f_3 \left({}^{d}/_{d_0}\right) + k_4 f_4 \left({}^{l}/_{l_0}\right) + L_0$$

where:

L_A – *A*-weighted sound level forecast at the distance *l* from the line [dB];
E – maximum electric field intensity on the conductor surface [kV·cm^{-1}];
E_0 – critical (initial) intensity above which the corona discharge begins [kV];
n – number of conductors in a bundle;
d – diameter of the conductor in a bundle [cm];
l – distance between the observation point and the conductor [m];
n_0, d_0, l_0 – reference values, adopted (maintaining the units) as equal to 1;
L_0 – *A*-weighted sound level [dB].

The above form was adopted in almost all the known sound propagation models of overhead lines, although they differ in the values of the factors: k_1, k_2, k_3 and k_4, and sometimes in the forms of individual functions: f_1, f_2, f_3 and f_4 occurring in the above equation.

For the calculation of the unit sound power of the designed 220 and/or 275 kV overhead line, the sound propagation model developed and presented in the paper by Wszołek [433], used and calibrated in the calculations of the noise generated by the 220 and 400 kV lines operating in Poland in the systems with two- and three-conductor bundles in various geometric configurations, may be applied. In this model, the sound power calculations are performed for both the lines under rain conditions and with dry conductors.

The general form of this model is shown below, for rain conditions (L_{bw} – bad weather) and for dry conditions (L_{gw} – good weather) respectively.

$$L_{bw} = 10log\left[E^{8,5}\left(1 - exp\left(-k_r \delta_r (E - E_0)^{\frac{4}{3}}\right)\right)^{\propto_r}\right] - L_b$$

$$L_{gw} = 10log\left[E^{8,5}\left(1 - exp\left(-k_{nr} \tau (E - E_0)^{\frac{4}{3}}\right)\right)^{\propto_{nr}}\right] - L_g$$

where:

k_r, k_{nr} – factors scaling the rainfall (δ_r) respectively to the value expressed in mm·h^{-1} and the condition of the conductor surface (droplet lifetime τ) to the values specified in the Peek formula.

In order to separate the component taking into account the impact of rainfall from the component taking into account the impact of the conductor surface condition, additional scaling factors $\propto_r$ and

$\propto_{nr}$ are introduced, for which the best matching to the measurement results is obtained in the vicinity of the EHV lines operating in Poland [433]. The values of these factors are $\propto_r$= 1.8 and $\propto_{nr}$= 3.7, respectively.

In order to take into account the actual conditions of the conductor surfaces, the value range of the factor m_s in the range of 0.4–1.0 (m_s = 1.0 – smooth conductor without dirt and without damage, m_s = 0.4 – dirty and/or damaged conductor, e.g. with a scratched surface), which corresponds to the value τ = 1.4 – m_s, adopted in the formula L_{gw}. The levels $L_{Aeq(b)}$ and $L_{Aeq(g)}$ are the reference levels resulting from the logarithmic scale assumption.

In order to determine the total unit sound power, which is also a function of the number and diameter of the phase bundle conductors, the above formulas should be extended to include the following components:

the number of bundle conductors:

$$\Delta L_{ns} = 10log\left({}^{n}/_{n_0}\right)$$

the conductor diameter as for the linear source:

$$\Delta L_g = 45log\left({}^{d}/_{d_0}\right)$$

where:

- n_0 – reference number of conductors in a bundle, n_0 = 1;
- d_0 – diameter of the conductor in a bundle, d_0 = 1 cm;
- n – number of conductors in a bundle;
- d – diameter of the conductor in a bundle [cm].

In the sound propagation model adopted, the main parameter characterising a given conductor in terms of sound power generated as a result of corona discharge phenomena is its diameter as well as the surface type and condition.

For the sound propagation model, the diameters and surface type of typical steel and aluminium conductors of AFL-8 525 mm^2, AFL-8350 mm^2 or 408-AL1F/34-UHST type are adopted. It should be noted that in model calculations, conductors of very similar diameters are treated as identical sound sources, despite the fact that the external surface of each conductor may be slightly different. The unit sound power (at a given voltage, conductor bundle geometry and weather conditions) depends on the parameters of the phase position geometry, including mainly the height of their suspension above the ground.

Taking into account the computational model described above, the estimations of the sound level distribution in the surroundings of the designed three-circuit 220 and/or 275 kV overhead line will include:

- forecast distribution of $L_{Aeq(b)}$ sound levels (bad weather conditions) and $L_{Aeq(g)}$ sound levels (good weather conditions) as well as other noise levels (L_T – long-term level, L_{DEN} – day-evening-night level) generated by the conductors of the line planned for construction in cross-sections determined in the centre of representative spans (the same ones for which the distribution of electric and magnetic field intensity will be calculated), at the smallest distance between the phase conductors and the ground equal to h = h_{min}, for good weather conditions (dry conductors – good weather) and average intensity of rainfall (wet conductors – bad weather) of 1.2 mm·h^{-1};

- determination of the distribution of the L_{DEN} levels expected (day-evening-night level), using the methodology described in the Regulation of the Minister of Climate of 30 May 2020 on the method of determining the L_{DEN} noise level (Journal of Laws of 2020, item 1018) including the estimation of the uncertainty of calculations;
- determination of the distribution of L_T levels (long-term level), using the methodology described in the PN-N-01339 standard – Noise – Methods for the measurement and evaluation of audible noise from overhead transmission lines.

The forecast distributions of all the $L_{Aeq(b)}$ sound levels (bad weather conditions) and $L_{Aeq(g)}$ sound levels (good weather conditions) analysed, as well as other noise levels (L_T – long-term level, L_{DEN} – day-evening-night level) were determined by analytical methods, using the sound propagation model of transmission lines described in the papers of Wszołek [433, 434], will be presented both in tabular and in graphical form.

Different periods of good and bad weather conditions will be assumed for each of the levels determined. It should also be assumed for the calculations that during good weather the conductors are clean, whereas bad weather conditions are characterised by rainfall with the intensity of 1.2 mm·h^{-1}. The generally assumed average rainfall intensity ranges from 1 to 2 mm·h^{-1} (model calculations presented, i.a., in the studies of BPA or UHV Project). Experience shows that the adoption of such rainfall intensity for the calculations results in the matching most similar to the results of measurements performed on the domestic EHV overhead lines. It is unreasonable to assume a higher rainfall intensity, in particular exceeding 2 mm·h^{-1}, because the results of the measurements carried out in such conditions indicate that in such a situation the primary noise source is the rainfall itself and not the noise caused by the line.

For the calculations of the $L_{Aeq(b)}$ sound levels (bad weather conditions) and $L_{Aeq(g)}$ sound levels (good weather conditions), the procedures included in the paper by Wszołek [434] will be used, according to which:

$$L_{Aeq\,(z)} = 10\ \log \sum 10^{0.1 L_{Aeqi}}$$

$L_{Aeq(b)}$ – sound level generated by the i^{th} phase conductor determined at the observation point during bad weather.

$$L_{Aeq\,(d)} = 10\ \log \sum 10^{0.1 L_{Aeqi}}$$

$L_{Aeq(g)}$ – sound level generated by the i^{th} phase conductor determined at the observation point during good weather.

In the case of calculations of the L_T long-term level, the procedures included in the PN-N-01339 standard – Noise – Methods for the measurement and evaluation of audible noise from overhead transmission lines will be applied, according to which:

$$L_T = 10\ \log(t_f 10^{0.1 L_f} + t_b 10^{0.1 L_b})$$

where:

t_b – average duration of bad weather, expressed as a percentage of the annual period; t_b = 10% is assumed for Poland;

L_b – long-term average A-weighted sound level during bad weather [dB];

t_f – average duration of fine weather, expressed as a percentage of the annual period; t_f = 90% is assumed for Poland;

L_f – long-term average A-weighted sound level during fine weather [dB].

The maximum value of electric field intensity E_{max} on the surfaces of conductors will be calculated using an algorithm based on the simulated charge method implemented in the software developed as part of the paper by Wszołek [435].

The highest value of electric field intensity on the surface of the N bundle conductor is:

$$E_{\max} = \frac{1}{KN}\left[1 + \frac{d}{D}(N-1)\right]\sum_N \sum_K E_{sk}$$

where:

K – number of points selected on the conductor surface;

N – number of conductors in a bundle;

d – conductor diameter;

D – bundle diameter;

E_{ef} – effective value of electric field intensity on conductor surface.

On the basis of the above algorithms, calculations of the forecast noise will be performed:

- under bad weather conditions (rainfall intensity of 1.2 mm·h^{-1});
- under good weather conditions, for average good technical condition of the conductor surface (δ = 0.4).

The calculations of the forecast noise will include, among others, the following index levels:

- long-term level L_T, according to the formula [435];
- level L_{DEN}, in accordance with the provisions included in the Environmental Protection Law of 27 April 2001 (Journal of Laws of 2001, No. 62, item 627, as amended), according to the formula L_{DEN}.

The day-evening-night L_{DEN} level, according to the Regulation of the Minister of Climate of 30 May 2020 on the method of determining the L_{DEN} noise level (Journal of Laws of 2020, item 1018) and the Environmental Protection Law of 27 April 2001 (Journal of Laws of 2001, item 627, as amended) is defined as:

$$L_{DWN} = 10 \log \left[\frac{1}{24}(12 \cdot 10^{0.1 L_D} + 4 \cdot 10^{0.1(L_W + 5)} + 8 \cdot 10^{0.1(L_N + 10)})\right]$$

where:

L_D, L_E and L_N – long-term average A-weighted sound levels during all day (L_D), evening (L_E) and night (L_N) times respectively during a year, understood as the ranges determined at: (D) from 6:00 to 18:00, (E) from 18:00 to 22:00 and (N) from 22:00 to 6:00.

None of the computation software available, including the application most frequently used for the calculation of predicted noise levels, i.e. HPZ'2001 Windows (Acoustics Laboratory of the Building Research Institute) allows predictive noise calculations for high-voltage overhead lines where the source of noise is the corona discharge. In consequence, the noise level calculations will be carried out using a proprietary program, the algorithm of which is based on the sound propagation model of the overhead line, based on the model described in the paper by Wszołek [433] and adapted to domestic conditions. This model is an extension of the model provided in the standard PN-N-01339:2000 – Noise – Methods for the measurement and evaluation of audible noise from overhead transmission lines. The extended form of this model can be found in the paper by Wszołek [435]. When implementing the said computational model into a specific calculation algorithm, it is necessary to provide the following input data:

- line phase voltage (220 and/or 275 kV);
- diameter of the phase conductor designed for use (information from the Client);
- geometry of conductors in the design cross-section (information from the Client in the form of dimensioned tower silhouettes);
- distance between the calculation point and each line conductor;
- calculation factor depending on the conductor surface conditions (factor determined experimentally);
- calculation factor depending on weather condition (factor determined experimentally for different rainfall intensity);
- calculation factor depending on the geometry of the conductor system (factor determined experimentally).

As already mentioned, the results of the calculations of sound level distribution in the vicinity of the designed line, which were carried out using the implemented computational model described above, were presented in the tabular and graphical forms (diagrams) and commented. For all calculations, the extended uncertainty of calculations equal to UC = 2.4 dB will be assumed.

It should be clearly emphasised that to assess the noise impact of the overhead line designed, i.e. to compare the predicted sound levels with the admissible values specified in table 2 of the Regulation of the Minister of Climate of 30 May 2020 on the method of determining the L_{DEN} noise level (Journal of Laws of 2020, item 1018) only the $L_{Aeq(b)}$ and $L_{Aeq(g)}$ levels apply. Other levels for which the appropriate distributions were determined as a function of distance from the designed line were presented primarily for reference.

4.2.2 Customer substation

4.2.2.1 Substation acoustic model

In order to carry out the calculations, a three-dimensional acoustic model of the substation and its surroundings was created, including such elements as topography and development features, as well as significant sources of noise emission, including primarily transformers and reactors to be installed in the substation area [Figure 4.4].

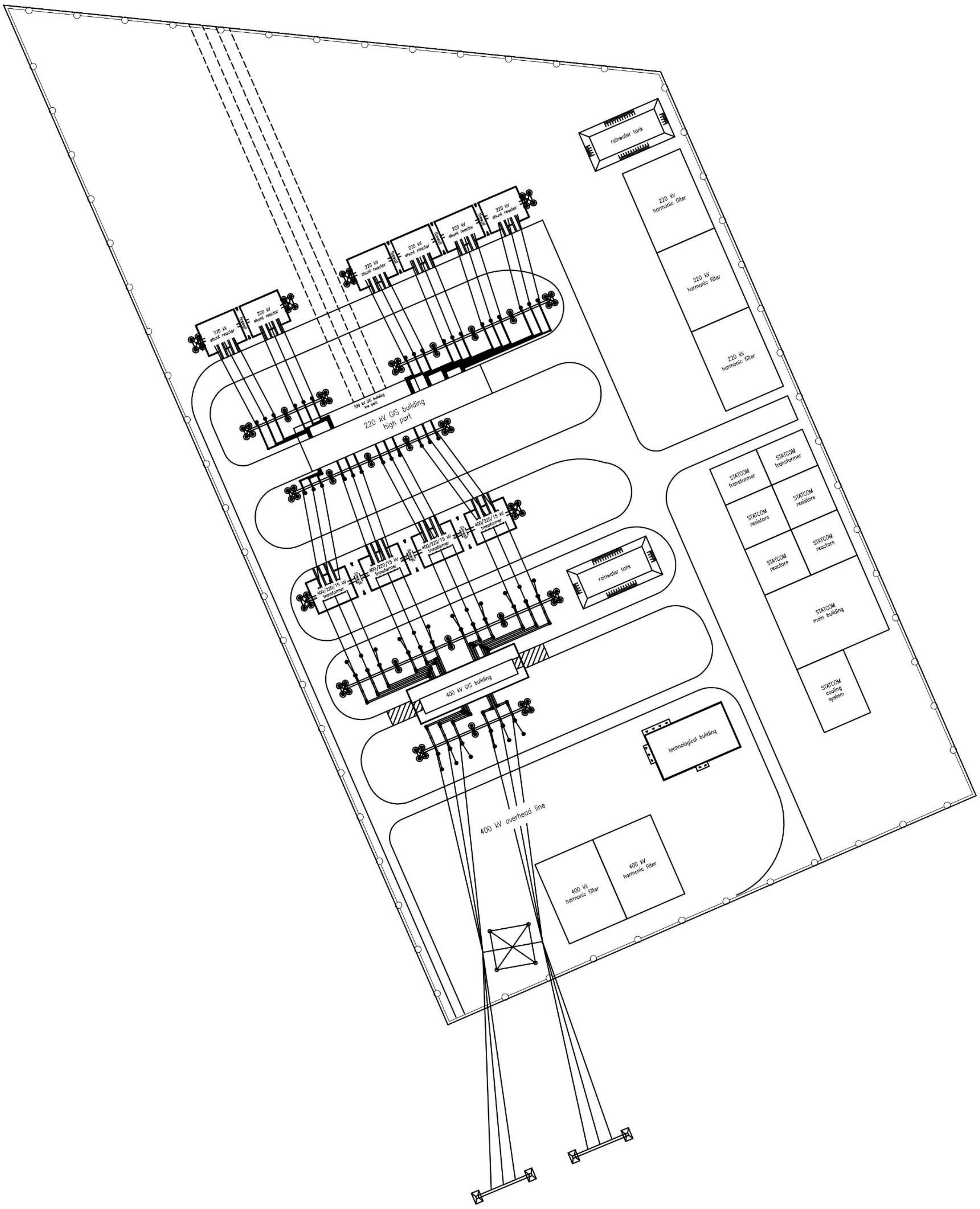


Figure 4.4. PKN Orlen substation design [Source: Applicant data]

The conditions related to the noise generated by the substation busbars, i.e. short sections of 400 kV connections extending from the substation area towards the PSE substation planned (Choczewo substation) were also characterised. Special attention was paid to the different nature of this noise (as compared to the noise generated by transformers and chokes) and its strong dependence on weather conditions.

An operating high-voltage substation, considered as a source of noise, is usually characterised by quite high noise levels. The main sources of this noise are the (auto)transformers and high-power reactors and, to a much lesser extent, the corona discharge related to busbars and incoming line sections, if they are overhead power lines. The level and propagation conditions of the noise generated are influenced by the state of the environment, and in the case of the noise originating from the corona discharge (busbar system or possibly incoming high voltage overhead lines) – by the atmospheric conditions.

As already mentioned, the sources of continuous noise emitted by a substation are mainly (auto)transformers and reactors, and above all the equipment used to cool them (fans). The noise levels of (auto)transformers and reactors are also affected by core vibration related to magnetostriction, and the intensity of this phenomenon depends both on the magnetic induction changing with the load and on many other physical and structural parameters of metal sheets forming the core (of transformers and reactors). For a supply frequency of 50 Hz, the fundamental frequency of the core vibration is 100 Hz, whereas the noise spectrum also contains higher frequencies. These are multiples of the fundamental frequency, particularly when the fundamental frequency (or its multiple) is close to the natural frequency of the core. The sound level of (auto)transformers and reactors depends on their power rating and design, especially with regard to fan cooling systems. The possibilities of reducing the level of noise generated by (auto)transformers and reactors are fairly limited and consist in the use of appropriate metal sheets and design solutions reducing the amplitude of vibration, as well as the elimination of fan-based oil cooling systems in favour of natural cooling.

The source of noise (acoustic noise) generated by busbar elements and short sections of outgoing lines are corona discharges and surface discharges on the elements of the electrical insulation system. The level of noise generated by these two elements depends on their design, in particular on the type of conductors used and the type of busbar system (flexible or rigid), and above all on the weather conditions. The level of noise increases in bad weather, whereas in good weather both the substation busbar systems and the outgoing 400 kV line sections are practically inaudible.

It should be clearly emphasised that the noise emitted by the busbar system and the incoming high-voltage conductors differs significantly from the noise originating from other sources, primarily those industrially operated, but also from the noise generated by (auto)transformers and reactors. This is because the noise of both these elements of the substation is determined by corona-related phenomena, the intensity of which – given their specific technical parameters – depends practically exclusively on atmospheric conditions, the consideration of which is extremely difficult, even with the measurement-based identification of noise levels. It is generally known that the noise generated by some extra-high voltage lines (220 and 400 kV) increases during drizzle or not particularly heavy rainfall, which is possible to observe while taking noise measurements in the vicinity of the line, but in the case of more intense precipitation, the primary source of the noise measured near the line is the precipitation itself. As there is practically no possibility of deenergizing the line (and the substation busbar system) during the noise measurements, it is practically impossible to separate the noise of incoming line sections and the substation busbar system from the noise generated by precipitation.

In domestic design practice, correlations have been developed on the basis of long-term studies, which help estimate, already at the design stage, the level of noise generated by the corona discharge from overhead lines or substation busbar systems. Experience has shown that the conductors and their layouts used in national transmission lines and extra-high voltage switchyards in substations are characterised by such dimensions that in good weather conditions the electric field intensity at their surface is lower than the intensity at which the corona discharge occurs, which is the main cause of noise. In a properly designed alternating current overhead line or substation busbar system operating in good atmospheric conditions (when the conductors, flexible or rigid busbar elements are dry), the corona discharge, which is the cause of line noise, does not occur because the maximum electric field intensity on the surface of these elements, particularly at 400 kV, does not exceed the critical intensity (at which the corona discharge originates), which is approximately 19–20 $kV{\cdot}cm^{-1}$. During bad weather, however, the critical intensity may decrease to a level of approximately 10–12 $kV{\cdot}cm^{-1}$, which means that in the case of 220 kV lines or switching stations (maximum field intensity on the surface of conductors: approximately 12–15 $kV{\cdot}cm^{-1}$) and 400 kV (maximum field intensity on the surface of conductors: 15–17 $kV{\cdot}cm^{-1}$), the occurrence of the noise-producing corona discharge is inevitable. In the case of 110 kV facilities (power lines and substations, in particular 110 kV overhead line switchyards at substations), the corona discharge is practically non-existent, irrespective of weather conditions, as the maximum electric field intensity on live conductive surfaces (irrespective of the type of conductors or busbar systems) does not exceed the level of approximately 7–10 $kV{\cdot}cm^{-1}$. Consequently, facilities with a rated voltage of 110 kV generally are not the sources of noise exceeding the ambient noise levels (regardless of weather conditions).

It should be noted that in the case of overhead lines or switchyard busbar systems rated at 220 and 400 kV, the corona discharge occurs only in bad weather conditions. Consequently, 220 and 400 kV power facilities are relatively rarely the sources of noise significantly exceeding the ambient noise levels. However, in adverse weather conditions (drizzle, light rain, rime ice), 400 kV facilities in particular can be sources of noise at fairly significant levels.

While it is possible to analytically estimate the noise levels caused by the corona discharge occurring under unfavourable weather conditions on 400 kV overhead lines, there are no sufficiently accurate computation tools for the analytical determination of noise levels generated by substation busbar systems or incoming line sections.

Another problem is the measurement assessment of the noise levels of overhead lines and extra-high voltage switchyard busbars. The frequently observed considerable discrepancy in measurement results is not only due to different weather conditions at the time of measurement, but also due to the acoustic environment in the area, the influence of which cannot be unambiguously accounted for. In particular, it is difficult to eliminate the rustling of trees, which occurs even in light wind conditions, and which sounds similar to the corona discharge noise.

In practice, it is impossible to lower the sound level of the existing and newly designed elements of the substation busbar elements and incoming line sections, except for the improvement of the quality of insulating equipment, which is a source of noise under unfavourable pollution (deposition of particulate matter and other chemical compounds on insulators) and weather conditions.

The above detailed discussion regarding the methods of estimating noise levels in the vicinity of high-voltage overhead lines, busbar systems and incoming line sections allows concluding that the noise level generated by the conductors (incoming line sections) as well as busbars of the 400 kV and 220 kV switchyard will be lower than the most stringent permissible value (in the case of noise originating from the corona discharge – 45 dB) specified in the Regulation of the Minister of the Environment of 1 October 2012 amending the Regulation on permissible noise levels in the environment (Journal of Laws 2012, item 1109).

4.2.2.2 Audible noise sources in the area of the planned substation

In order to determine the impact of noise emitted to the environment by a substation it is necessary to determine the level of noise emissions in the vicinity of the facility. This analysis should acknowledge that it will be a facility where the following significant noise sources will operate, shaping the acoustic climate in the immediate surroundings:

- transformers with a sound power level of 90 dB each – up to 6 units;
- shunt reactors with a sound power level of 90 dB each – up to 6 units;
- air conditioners on the infrastructure building, with a sound power level of 60 dB each – up to 10 units;
- fans on the infrastructure building, with a sound power level of 72 dB each – up to 5 units;
- structure-borne sound source – STATCOM main building with a sound power level of 73.2 dB inside;
- cooling system – equipment with a sound power level of 98 dB each – up to 1 unit;
- outgoing 400 kV line sections – replaced by a number of substitute point sources with a sound power level of 75 dB each – up to 78 substitute sources;
- elements of busbar systems and outgoing line sections of the PSE substation (for the calculation of cumulative impact – up to 32 substitute sources of noise with a sound power level of 64.1 dB each.

4.2.2.3 Modelling of the sound power of substitute noise sources for outgoing 400 kV lines

In order to account for the cumulative impact of such diverse noise sources as transformers, reactors and other sources where noise is not caused by the corona discharge, as well as the sources of the corona discharge noise (outgoing line sections), appropriate calculations were made to model the sound power of short sections of 400 kV overhead lines (outgoing lines) from the area of the planned customer substation to the PSE substation (PSE Choczewo substation). The data for the calculations were prepared on the basis of the results of the noise impact measurements for the outgoing line sections operating at two system substations with 400 kV overhead lines (Rogowiec and Trębaczew substations). These measurements were conducted in the vicinity of the outgoing line sections located 17 m above ground level (at the Rogowiec substation) and 22 m above ground level (at the Trębaczew substation), and their results, combined with the analytical estimation of the sound power level of both outgoing line sections, were presented in the environmental impact assessment report prepared for each of the above-mentioned projects.

The results of the calculations of noise levels generated by the above-mentioned 400 kV outgoing line sections, with the spatial configuration similar to the one predicted to be applied in the outgoing line sections designed for the customer substation in question, were used as a basis for estimating the sound power level of substitute point sources reflecting the noise generated by the designed outgoing line sections.

For the purpose of these estimates it was assumed that substitute emitters (individual sections of the 400 kV outgoing line) are situated every 10 m at the height of h = 21 m along a representative section with a length of 150 m. Observation points were set at a height of h = 4 m in the middle of the sections modelled this way (substitute emitter – outgoing line section) at distances from the axis of the outgoing line equal to 27 m and 83 m, corresponding to the noise range of 45 dB and 40 dB, respectively, determined under adverse weather conditions. With such assumptions, a number of calculations were carried out for various sound power levels of the substitute emitter, searching for its value at which the noise level at the observation points was the closest to the values of 45 dB and 40 dB.

As a result of the analyses, a 75 dB sound power level of a substitute omnidirectional noise source (a 400 kV outgoing line section) with a length of 10 m was adopted for further model calculations.

The following figure [Figure 4.5] and input data [Table 4.1] are presented for the purpose of estimating the sound power level of the 400 kV outgoing line.

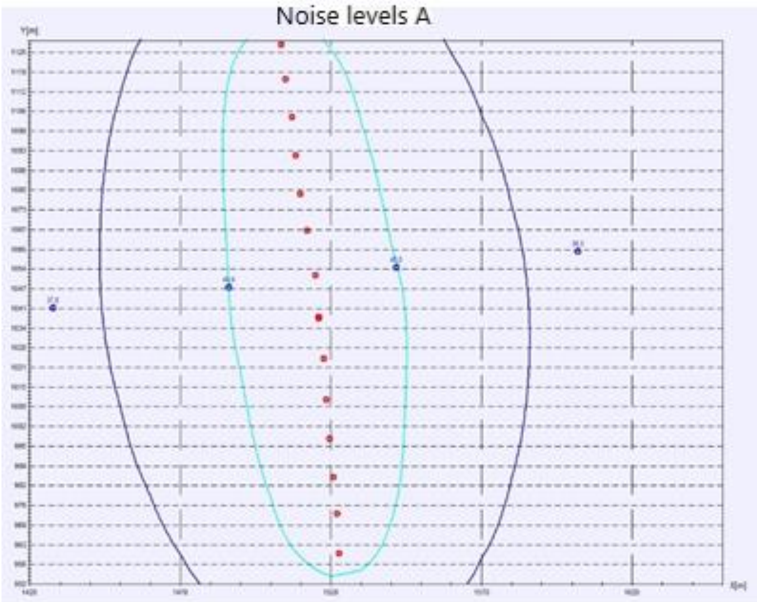


Figure 4.5. Modelling of the sound power of outgoing 400 kV lines [Source: internal materials]

Table 4.1. Equivalent sound levels LAeqT emitted to the environment and input data – Modelling of the sound power level of outgoing 400 kV lines [Source: internal materials]

<u>Outdoor Industrial Noise</u> HPZ’2001 Windows software: Version: March 2012 + GRUNT License of the Acoustics Laboratory of the Building Research Institute: HPZ-0217 ARS VITAE Wrocław	
Project description:	Simulation of the sound power level for outgoing lines
	Allowance was made for the ground impact in accordance with PN-ISO 9613-2 (simplified method)
Air temperature = 10°C	Relative humidity (RH) = 70%

A-weighted equivalent sound level at specified observation points

No.	Symbol	x [m]	y [m]	z [m]	L_A [dB]
1.	P1	1541.7	1054.5	4.0	45.0
2.	P2	1486.1	1048.0	4.0	44.9
3.	P3	1602.0	1059.8	4.0	38.3
4.	P4	1427.7	1041.1	0.0	37.9

<u>Outdoor Industrial Noise</u> HPZ’2001 Windows software: Version: March 2012 + GRUNT License of the Acoustics Laboratory of the Building Research Institute: HPZ-0217 ARS VITAE Wrocław	
Project description:	Simulation of the sound power level for outgoing lines

Item specification

No.	Item no.	Symbol	Description
Omnidirectional sources			
1.	1	W1	Outgoing 400 kV line section
2.	2	W2	Outgoing 400 kV line section
3.	3	W3	Outgoing 400 kV line section
4.	4	W4	Outgoing 400 kV line section
5.	5	W5	Outgoing 400 kV line section
6.	6	W6	Outgoing 400 kV line section
7.	7	W7	Outgoing 400 kV line section
8.	8	W8	Outgoing 400 kV line section
9.	9	W9	Outgoing 400 kV line section
10.	10	W10	Outgoing 400 kV line section
11.	11	W11	Outgoing 400 kV line section
12.	12	W12	Outgoing 400 kV line section
13.	13	W13	Outgoing 400 kV line section
14.	14	W14	Outgoing 400 kV line section
15.	15	W15	Outgoing 400 kV line section
Observation points			
16.	1	P1	27 m
17.	2	P2	27 m
18.	3	P3	83 m
19.	4	P4	83 m

Outdoor Industrial Noise HPZ’2001 Windows software: Version: March 2012 + GRUNT License of the Acoustics Laboratory of the Building Research Institute: HPZ-0217 ARS VITAE Wrocław	
Project description:	Simulation of the sound power level for outgoing lines
Air temperature = 10°C	Relative humidity (RH) = 70%

Omnidirectional sources, number = 15

No.	Symbol	x [m]	y [m]	z [m]	L_{WA} [dB]	K_0
1.	W1	1503.4	1128.1	21.0	75.0	3
2.	W2	1505.0	1116.7	21.0	75.0	3
3.	W3	1507.0	1104.1	21.0	75.0	3
4.	W4	1508.2	1091.5	21.0	75.0	3
5.	W5	1509.7	1078.9	21.0	75.0	3
6.	W6	1512.1	1066.7	21.0	75.0	3
7.	W7	1514.9	1052.0	21.0	75.0	3
8.	W8	1516.0	1037.8	21.0	75.0	3
9.	W9	1516.0	1038.2	21.0	75.0	3
10.	W10	1517.6	1024.4	21.0	75.0	3
11.	W11	1518.4	1011.0	21.0	75.0	3
12.	W12	1519.6	998.0	21.0	75.0	3
13.	W13	1520.8	985.4	21.0	75.0	3
14.	W14	1522.0	973.2	21.0	75.0	3
15.	W15	1522.7	960.2	21.0	75.0	3

Observation points, number = 4

No.	Symbol	x [m]	y [m]	z [m]	L_a [dB]
1.	P1	1541.7	1054.5	4.0	0.0
2.	P2	1486.1	1048.0	4.0	0.0
3.	P3	1602.0	1059.8	4.0	0.0
4.	P4	1427.7	1041.1	0.0	0.0

Grid of observation points

X_{min} [m]	X_{max} [m]	Y_{min} [m]	Y_{max} [m]	dx [m]	dy [m]	z [m]	L_a [dB]
1420.0	1650.0	950.0	1130.0	10.0	1.3	4.0	0.00

4.2.2.4 Calculation of predicted sound level

Having the sound power levels of the designed equipment available, the predicted sound levels in the vicinity of the facility were calculated. The distribution of noise levels emitted by all noise sources was determined according to the Instruction 338 ITB – Method of determining the emission and immission of industrial noise in the environment [448] and the Polish Standard PN-ISO 9613-2:2002. Acoustics – Attenuation of sound during propagation outdoors – General method of calculation [303]. For the purpose of numerical computations (predicted noise levels were computed by Anna Dorota Władyczka M.Sc., ARS-VITAE, Wrocław), the HPZ'2001 Windows software was used, version: March 2012 [315].

The range of impact of the predicted noise level was determined in the x, y, z coordinate system, defining with them the location of the planned noise sources to be operated within the substation area as well as attenuating elements (buildings and structures planned within the substation area). Also, the locations of noise monitoring points (P1–P5) which were situated at the boundaries of the nearest planned and existing residential developments were specified. Moreover, noise levels were computed at the façade of the residential building located at Osieki Lęborskie 26 (E1), i.e. the nearest to the planned customer substation.

The data characterising the noise sources presented in subchapter 4.2.2.2 were adopted for the computation, and their distribution within the area of the designed substation was presented in Figure 4.6.

For sources such as transformers and reactors, the height of their geometric centre of gravity was assumed as the noise emission point. The computations accounted for the elevation differentiation of the area by labelling terrain features as screens, and the actual height of buildings and noise sources was corrected for the differences in terrain elevation. As for the reference level "0", the lowest terrain located in the north-western part of the computation area with the elevation of 37 MASL was adopted.

The figure shows a schematic diagram of the spatial model adopted for noise modelling [Figure 4.6].

Figure 4.6. Modelling of the sound power of outgoing 400 kV lines [Source: internal materials]

It was also assumed that all the equipment at the substation will operate simultaneously and without interruption (around the clock), i.e. at the maximum sound power level, which means the most unfavourable conditions in terms of environmental impact. Moreover, it was assumed that the most unfavourable situation is adverse atmospheric conditions, in which the corona discharge of 400 kV outgoing lines is a significant source of noise; therefore, this phenomenon was also included in the computations.

Noise sources and screening elements are listed in Appendices 3.1 and 3.2. Buildings designed in the area of the project and terrain features were taken into account as screening elements. The attenuation caused by the presence of land surface was taken into account in the computational model by making an allowance for ground impact in accordance with PN-ISO 9613-2 (simplified method).

The outgoing line routes were replaced by a series of point sources of sound at designated distances so that the following condition is maintained:

$$r \geq 2\,l$$

where:

l – 10 m – the largest linear dimension of the source,

r – distance from the geometric centre of the source to the observation point at the nearest residential development.

For the purpose of noise calculations using a uniform methodology for industrial sources, including linear sources, the mean load (constant sound power) is assumed for the 8 consecutive least favourable hours of daytime and 1 least favourable hour of night time.

Observation points (P1–P5) and the computation point on the building façade (E1) were selected in accordance with Appendix 7 to the Regulation of the Minister of Environment of 30 October 2014 on the requirements for conducting measurements of emission volumes and measurements of the amount of water consumed [333]. The elevations of the observation points were assumed in accordance with the reference methodology, with their elevations corrected for the elevations of the screening elements of the terrain on which they are situated.

The figure illustrates the computational model for the PSE station [Figure 4.7].

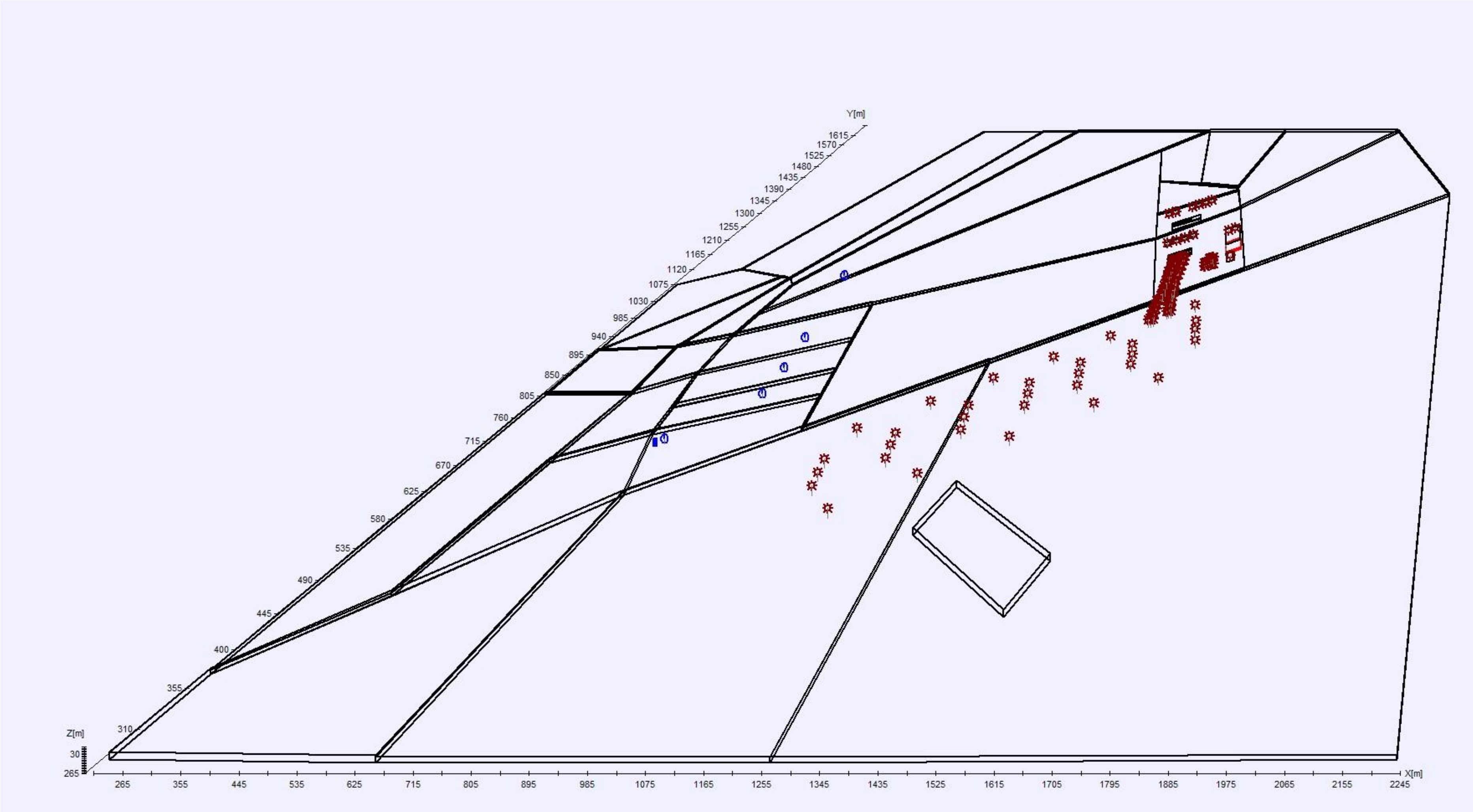


Figure 4.7. Computational model – spatial scheme – cumulative impact with the PSE substation [Source: internal materials]

Computation results are presented in a graphical form – as ranges of noise impact of levels at 40 and 50 dB – in subsection 6.1.5.5 for the customer substation and in sections 7 for the cumulative impact.

4.3 Modelling of the distribution of electric and magnetic components of the electromagnetic field

In the case of the lines designed, the distribution of the intensity of electric field *E* and magnetic field *H*, including the maximum value of each field component, is determined by computational methods. In the same way, it is also possible to determine the width of the area under the line in which the electric field intensity may exceed the admissible value for the areas intended for residential development. For modelling of the distribution of electric and magnetic components of the EMF generated by the 3-circuit 220 kV and/or 275 kV overhead line, the proprietary PolE-M v.1.0.2.0 software will be used, which serves to determine the distribution of both field components for the overhead lines designed with different configurations of phase conductors. The algorithm used in the software is based on the method of mirror images and superposition method, according to which the electric field (or magnetic field) at any point of the space surrounding overhead line conductors is the sum of fields from all line conductors. In order to determine the electric field generated by charged bodies which are in a heterogeneous environment, e.g. near the ground, the mirror images method is used. In this method, a heterogeneous environment with different electric permittivity in which charged bodies are placed can be replaced by a heterogeneous environment by introducing appropriate fictitious charges [Figure 4.8].

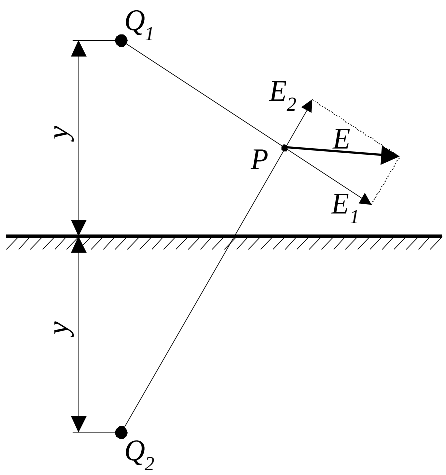


Figure 4.8. Line conductor and its specular reflection; Q1 – charge collected on the actual conductor, Q2 – charge collected on the introduced fictitious conductor, P – point where the electric field intensity is calculated, E1 – electric field intensity from the actual conductor, E2 – electric field intensity from the reflected conductor, E – resultant electric field intensity, y – conductor suspension height [Source: internal materials]

When introducing fictitious charges, the condition of equal tangential components of the electric field intensity vector and normal components of the electric induction vector at the boundary of two environments needs to be met. The analysed software also uses the simplifying assumption that each line conductor spanning between the towers is modelled with a straight, infinitely long conductor with a diameter characteristic for a specific type of actual conductor.

Calculation algorithms used to analyse the distribution of electric and magnetic fields generated by overhead lines are very complex and can be found in the papers by Junghans *et al.* [182, 183] and Szuba [372].

The PolE-M software enables calculations and distributions of electric and magnetic field intensity in a cross-section perpendicular to the axis of the line in which any number of circuits is operated, and in each of them – treated as a bundled conductor – maximum 4 conductors may operate.

In order to model a specific overhead line, it is required to provide the following technical data:

- coordinates of conductor suspension in the design cross-section, compliant with the series and type of towers in a given span;
- the minimum (smallest permissible) distance between the phase conductors and the ground;
- the maximum line working voltage;
- the maximum line load (maximum long-term phase load current);
- the type of phase conductors and bundle structure (if there is more than 1 conductor per phase),
- phase system in individual circuits.

The results of the model calculations performed are presented in the form of tables (maximum *E* and *H* values in the design cross-section and the width of the area in which E > 1 $kV \cdot m^{-1}$), and in graphical form illustrating the changes of *E* and *H* values when moving away from the line axis in both directions.

The calculations of the electric field distribution (similarly to the magnetic field) were carried out for a representative span of the analysed 4-circuit power line routed on towers, the dimensioned silhouette of which together with the circuit and phase system is presented in Figure 4.9. Such span is representative in the respect that it illustrates a case (of a location near the power line) in which the electric (and magnetic) field intensity may reach the maximum values near the entire line. As a result, the intensity of both field components at any other power line span will certainly not exceed those determined in the representative span.

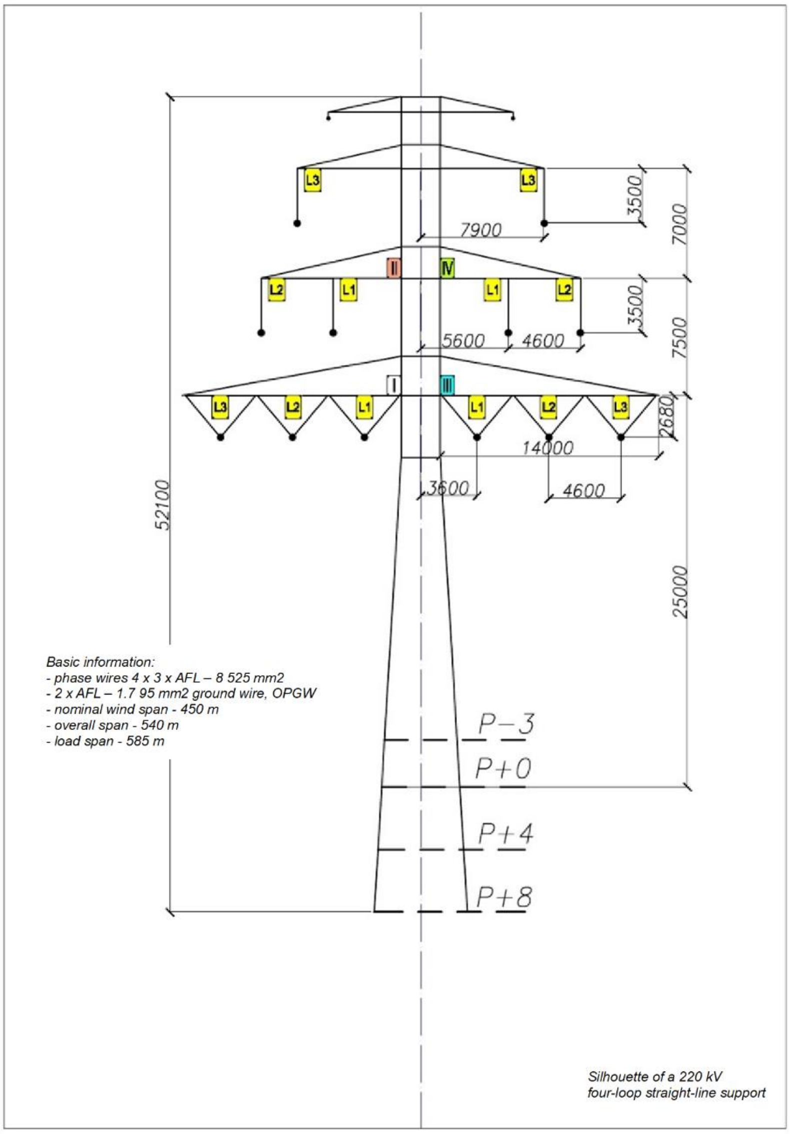


Figure 4.9. Dimensioned model of the lattice tower of the 4-circuit line, which is to be a method of electricity transmission from the cable chambers to the Applicant's substation, alternative to a cable route [Source: internal materials]

At this point, it should be stated that the authors of the document are responsible for checking whether, under the technical assumptions adopted in the documentation, the environmental quality standards may be exceeded, also under the most unfavourable operating conditions of the line (the smallest distance designed between the phase conductors and the ground and the maximum phase voltage and line load). In such a situation, it is neither purposeful nor necessary to perform detailed calculations of the distribution of both field components in all spans of the line, if it has been demonstrated that in the span with the smallest distance (in accordance with the design assumptions: h_{min} = 6.7 m for the line operating at 220 kV and h_{min} = 7.1 m for the line operating at 275 kV), the permissible levels of individual field components (environmental quality standards) will not be exceeded.

As already mentioned, due to the fact that the maximum value of the electric field intensity E_{max} and magnetic field intensity H_{max} under the line should be expected in the situation in which the distance between the ground and the lowest suspended conductor is the smallest ($h = h_{min}$). The calculations were carried out for the smallest (depending on many factors, the most important of which are: the height of towers, span length, tension of conductors, topography and the presence of facilities under the line) of the designed distance between the phase conductor and the ground of h_{min} = 6.7 m for the line operating at the voltage of 220 kV and h_{min} = 7.1 m for the line operating at the voltage of 275 kV.

4.4 Modelling of thermal impact of HV cable lines

The computational model was developed on the basis of the so-called image method and Kennelly formula assuming the existence of two linear heat sources, i.e. the actual source representing the power loss due to phase conductor resistance and dielectric losses in the primary insulation of a power line, and its symmetrical representation with regard to the Earth's surface, with identical power value as the actual source adopted with a negative sign. The soil temperature increase, originating from a single cable line at any point, is described by the following equation:

$$\theta_M(x,y) = -\int_{\infty}^{r''} \frac{\rho_t \cdot (P + W_d)}{2 \cdot \pi} \cdot \frac{dr}{r} + \int_{\infty}^{r'} \frac{\rho_t \cdot (P + W_d)}{2 \cdot \pi} \cdot \frac{dr}{r} = \frac{\rho_t \cdot (P + W_d)}{2 \cdot \pi} \cdot ln\frac{r'}{r''}$$

where:

ρ_t – thermal resistivity of soil;
r'' – distance between the point and the actual source;
r' – distance from the mapping source;
$P + W_d$ – source power resulting from thermal losses in the phase wire and dielectric losses in the insulation.

It is assumed that for a homogeneous centre, the thermal resistance of soil is constant in the entire semi-infinite environment and does not depend on the distribution of the temperature field in the ground. The superposition principle was applied to temperature fields coming from individual cable lines of the system in question in order to map thermal interaction and estimate the cumulative impact coming from all cable lines of the system in question.

$$T_M(x,y) = \sum_{i=1}^{n=12} \theta_M\,(x,y) + T_a$$

where:

$T_M(x,y)$ – temperature value at any point;
T_a – assumed ambient temperature value.

Thermal losses in the phase wires and dielectric losses in the main insulation were determined on the basis of the international standard IEC 60287-1-1.

Thermal calculations were made on the basis of the following alternative diagram consisting of a system of thermal resistances connected in series [Figure 4.10].

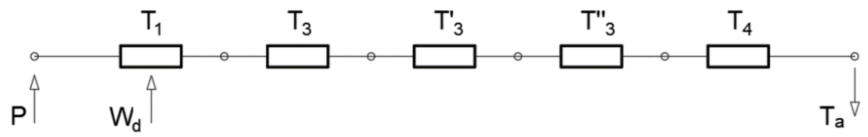


Figure 4.10. Alternative thermal diagram of a single cable line, where: T_1 – thermal resistance of primary insulation, T_3 – thermal resistance of the outer sheath, T'_3 – thermal resistance of pipe casing filling, T''_3 – thermal resistance of pipe casing, T_4 – external thermal resistance of soil [Source: internal materials]

Basic calculation assumptions:

- number of cable circuits – 4 pcs.;
- laying method – flat;
- axial distances between individual cable circuits – 5 m;
- axial distance between phases in each circuit – 0.3 m;
- laying depth – 2 m;
- soil temperature – 20°C;
- average soil resistivity value – 1 m × K/W;
- cable line load factor – LF = 1;
- both-ends bonding of return wires with cross-bonding;
- symmetrical loading of all circuits;
- frequency – 50 Hz.

Design assumptions for soil conditions in accordance with the IEC 60287-3-1 standard for Poland.

4.5 Modelling of suspended solids propagation

The analysis of the spatial distribution and intensity of the propagation of suspended solids released into the water depth during the underwater works related to the laying of the BP OWF CI cable lines was carried out using the MIKE 21 Coupled Model FM 2020 software created and developed by DHI.

For the purposes of conducting calculations connected to the transfer of suspended sediments, the following modules were used:

- Hydrodynamic module (HD);
- Spectral Wave module (SW);
- Mud Transport module (MT).

The hydrodynamic module (HD) allows simulating the changeability of a current field and the water table level depending on various functions of forcings in marine areas. This module allows the following hydraulic effects to be taken into account in the calculations [57] (MIKE 21/3 HD Coupled Model FM, 2020):

- friction at the water-seabed boundary (seabed roughness) and water-atmosphere boundary (wind impact);
- discontinuities in the form of sources and spillways;
- geometric variation of the submerged area, caused by the changing of the water table level;
- radiation stress caused by waves.

Spectral wave module (SW) calculates the parameters of the wave field (height and periods of waves and their directions) generated by wind with direction and speed changing over time. In the initial phase of the calculations, the direct influence of the wave motion on the dispersion of suspended solids resulting from the works carried out in the marine environment was tested (the result included in the study). From the available experiences connected to the laying and burial of power cables for the OWFs existing in the Baltic Sea, it results that such works can be carried out only at moderate wave motion, limited to a height of HS ≈1.5 m. Therefore, when evaluating the impact of wave motion on the dispersion of suspended solids, the maximum height of significant wave HS = 1.5 m was adopted for numerical calculations.

The mud transport (MT) module describes the erosion of seabed, transport of sediments (suspended solids) and sedimentation of the finest soil fractions, caused by the sea currents and wave motion impact. The MT module can be used for both silty and clayey sediments, as well as for a mixture of these sediments with sand, in which, however, fine fractions prevail, and the important feature characterising such a mixture is its coherence [140] (MIKE 21/3 MT Coupled Model FM, 2020).

When conducting the simulations, the following was taken into account:

- sea currents as the main factor forcing the suspended solids movement in the water depth;
- sediment sinking process due to their physical structure– single particles sinking and flocculent particles sinking.

Mild to moderate weather conditions were assumed in the simulations, since in reality only in such conditions it is possible to carry out works related to power cable laying and burial. This assumption does not restrict the timing of the works to a specific time of year, but the preference is for periods when weather windows are sufficiently long to allow the works to be carried out. Two methods of cable laying in the seabed were studied in the modelling. Among the methods possible to the applied in the project discussed, these two methods are characterised by the greatest impact on the environment. The first method – jetting – employs the energy of multiple water jets. The other technology analysed involves the use of high-performance submersible pumps (MFE, mass flow excavation). The jetting technology is one of the technologies taken into consideration for the phase of cable laying in the seabed, whereas the use of the MFE technology is envisaged for the operation phase, when recovering the cable from the seabed for the purposes of its repair becomes necessary. The MFE technology is considered to be the most intrusive to the marine environment and therefore meets the criterion of the worst-case calculation scenario.

The calculations carried out for the two cable route variants (APV and RAV), taking into consideration the different types of soils deposited on the seabed identified during geological examination. Such an approach enables reliable estimations not only of the unfavourable scenario, but also of the impact of the more environmental-friendly methods, the application of which in the project implementation is highly probable.

The results of numerical calculations enabled the analysis of the maximum ranges of the impact of the suspended solids of specific concentrations (formed during the burial of power cables in the seabed) as well as the thickness and spatial distributions on the seabed of the sediments generated in the process of the suspended solids sedimentation.

The methodology of processing the results enabled an unambiguous comparison of different methods of constructing cable lines in the offshore area. The arrangement of cable lines where the seabed sediment structure is disturbed covers all sections. Such an approach is in line with the assumptions of the worst-case scenario analysis. With the above assumption, the analysis results will always be slightly overestimated (conservative) relative to every possible cable route variant.

Environmental forcings applied in modelling were the impacts of winds blowing over the entire sea area surveyed, time-varying levels of the water table and sea currents, which are a natural factor generating water movement, and thus, the movement of suspended solids in the water depth.

4.5.1 Calculations

4.5.1.1 Cable route – APV

4.5.1.1.1 Jetting at 2 km/day

Below, the results for the cable burial technology of jetting with significant soil displacement are presented, with the cable laying vessel moving along the APV route at a speed of 2 km/day. The calculation results presented correspond to the moments of simulation time: *t1, t2* [Figure 4.11, Figure 4.12].

At moment *t1* (work in sandy sediments), the cloud of suspended solids with concentrations exceeding 30 $mg \cdot l^{-1}$, spreads to a distance of approx. 0.2 km, while at concentrations exceeding 4 $mg \cdot l^{-1}$ – to a distance of approx. 1.5 km.

At moment *t2* (work in cohesive sediments), the cloud of suspended solids with concentrations exceeding 30 $mg \cdot l^{-1}$, spreads to a distance of approx. 0.4 km, while at concentrations exceeding 4 $mg \cdot l^{-1}$ – to a distance of approx. 5 km.

Figure 4.13 presents a map of thickness distribution of the sediments generated in the process of sedimentation after the completion of a simulation of power cable burial in the seabed. The maximum thickness of a new layer of sediments at the cable corridor boundary does not exceed 4.3 mm, while the maximum range of the sediment with a thickness of >1 mm to the cable corridor boundary is 1.4 km.

Figure 4.14 presents a map of maximum sediment concentration levels at every point of the calculation area adopted during the entire simulation. Locally, at the cable corridor boundary, momentary concentrations reach the value of 120 $mg \cdot l^{-1}$ for cohesive soils. However, in most of the area where the disturbance occurs, the concentration range is 5–50 $mg \cdot l^{-1}$.

The maximum values of suspended solids concentration were analysed taking into consideration the duration of such disturbances. The result of the calculations presented in Figure 4.15, which presents the map of duration distribution of the concentration values exceeding the threshold of 30 $mg \cdot l^{-1}$, is used for the analysis. The maximum duration of such a concentration value in the scenario discussed is 16 hours.

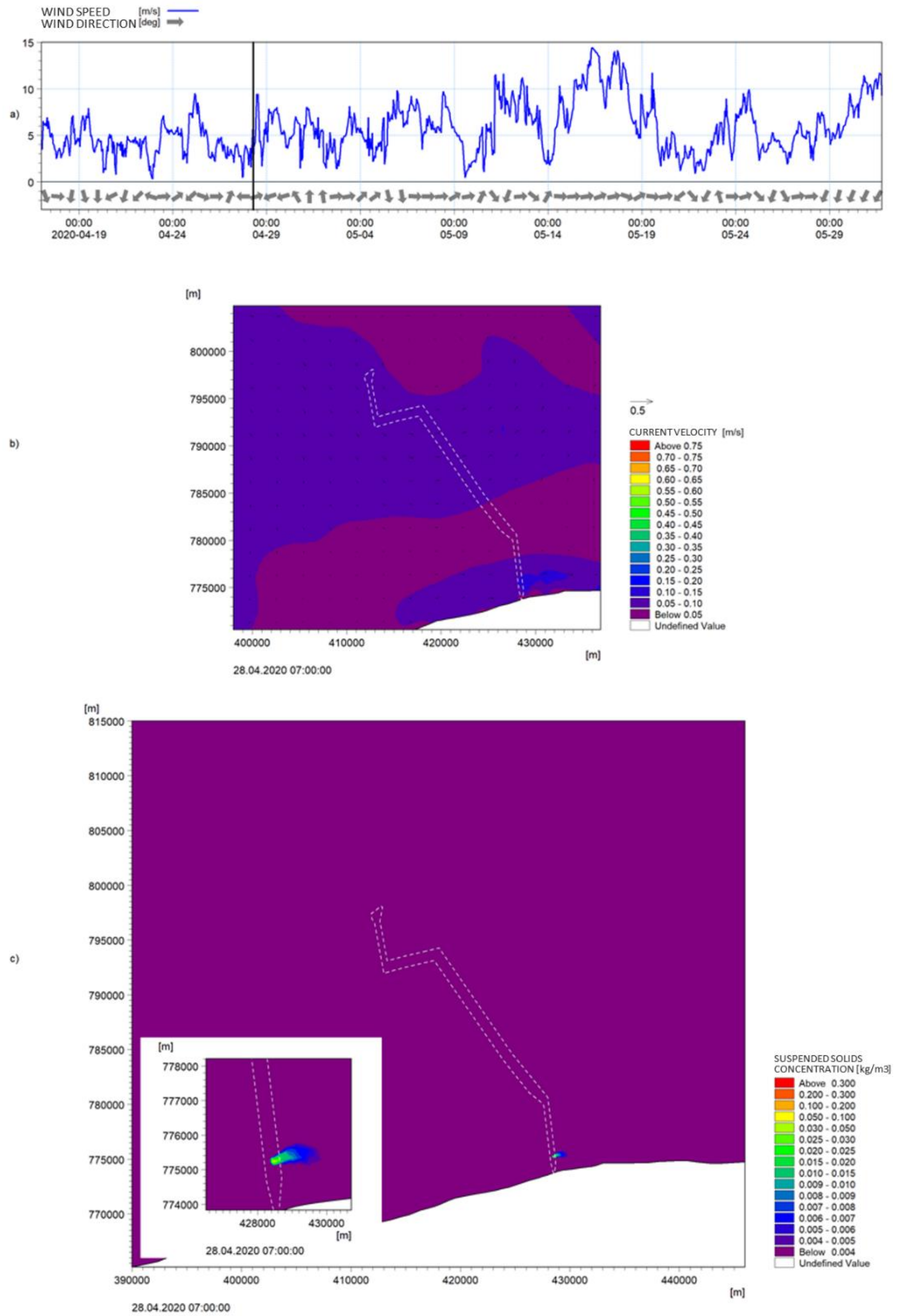


Figure 4.11. Results of the simulation of power cable burial under real hydrodynamic conditions in the time step t1 (sandy sediments) [Source: internal materials]

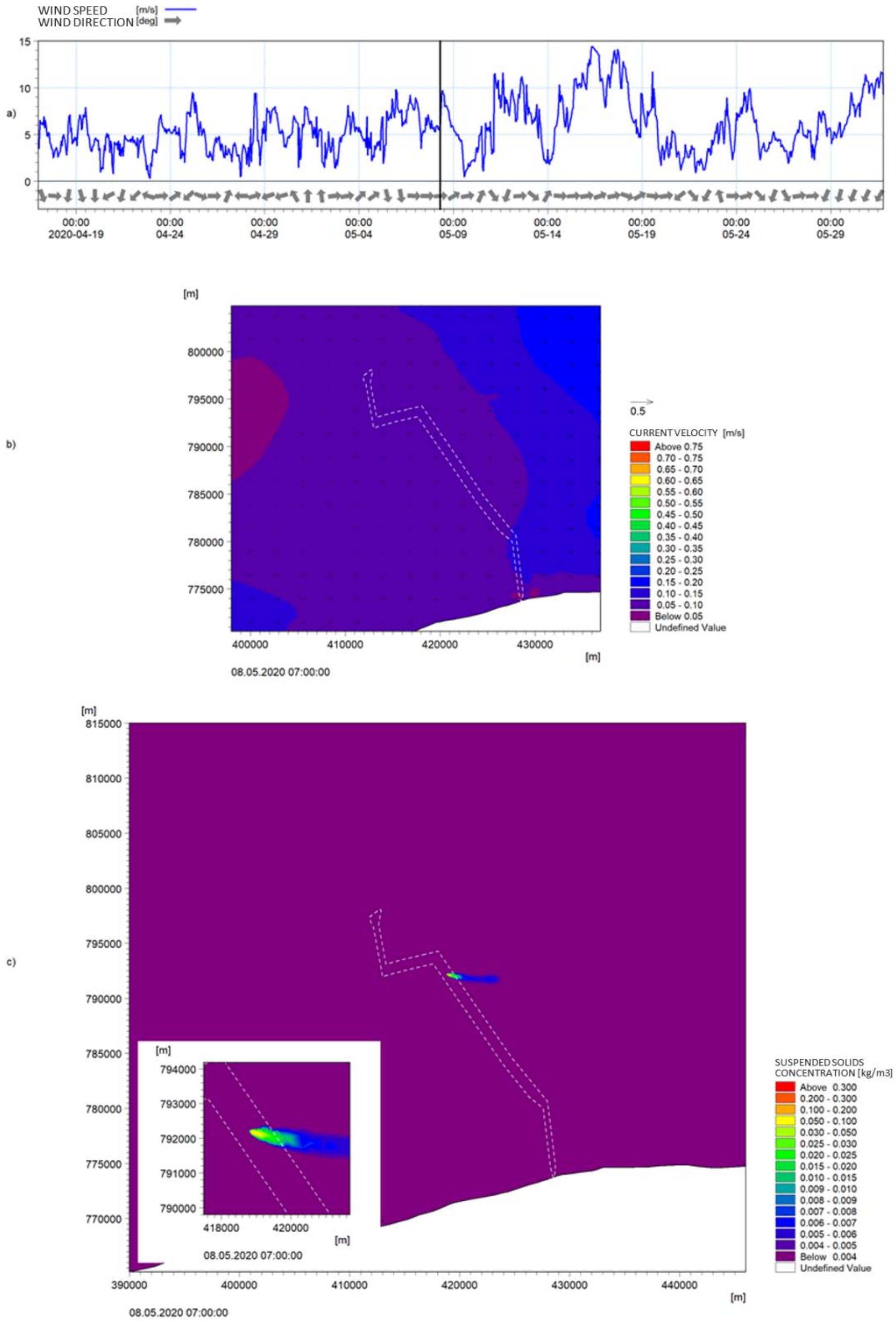


Figure 4.12. Results of the simulation of power cable burial under real hydrodynamic conditions in the time step t2 (cohesive sediments) [Source: internal materials]

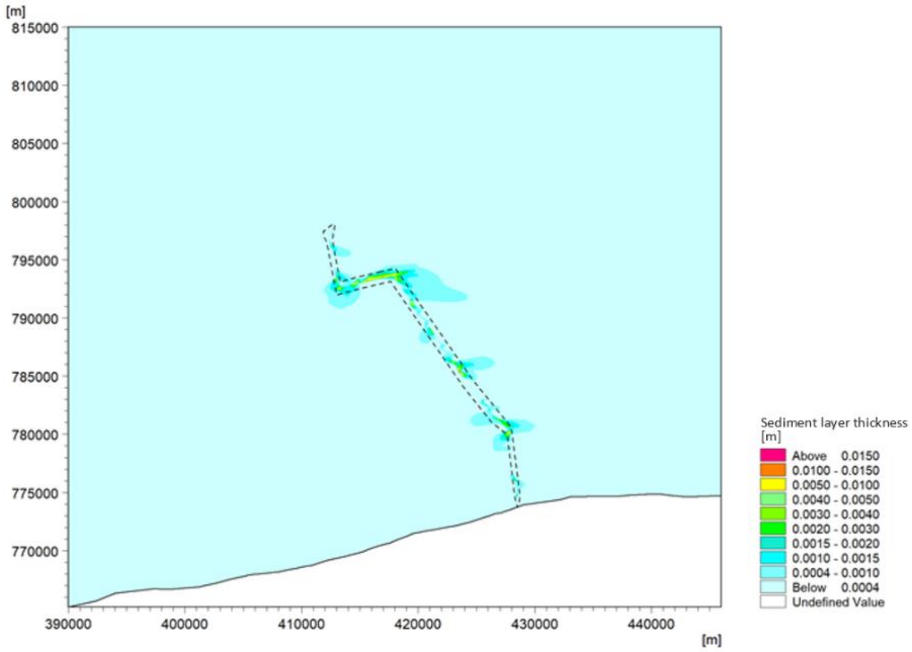


Figure 4.13. Results of the simulation of power cable burial – distribution of the seabed layer thickness after the completion of works along the entire route [Source: internal materials]

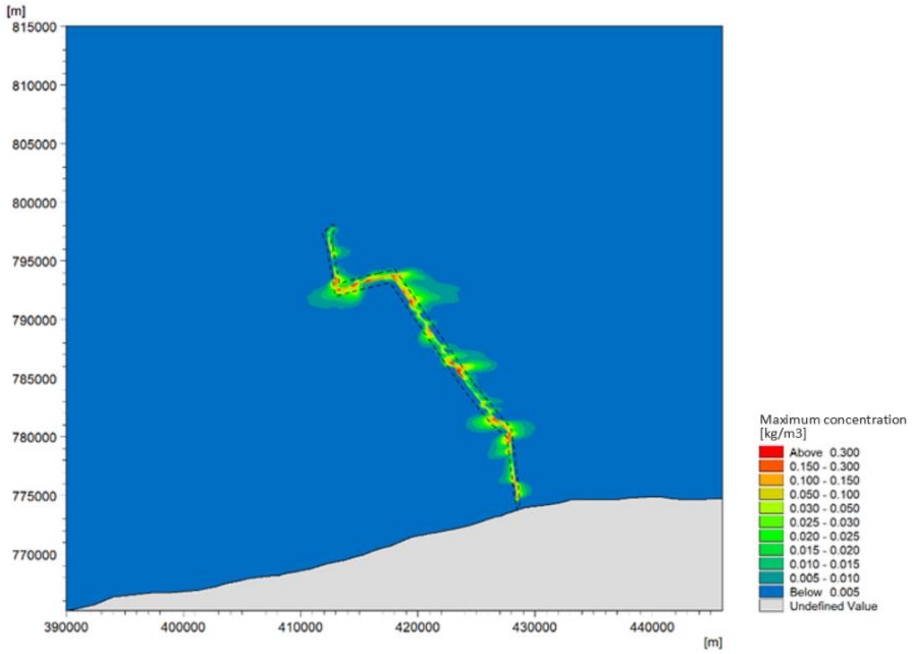


Figure 4.14. Results of the simulation of power cable burial – the maximum, temporary level of suspended solids concentration during works along the entire route [Source: internal materials]

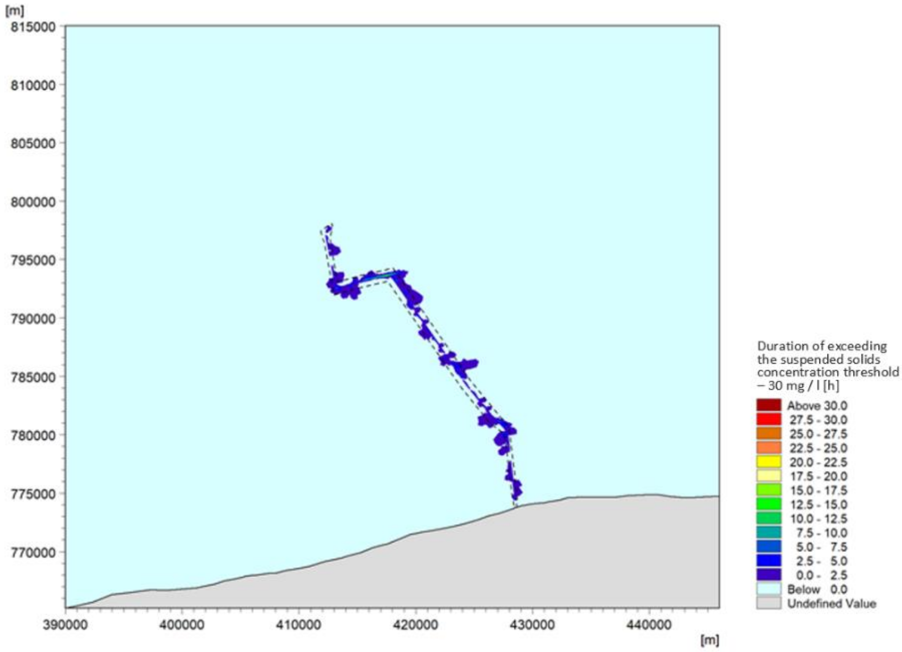


Figure 4.15. Duration of the exceedance of the suspended solids concentration threshold – 30 mg·l^{-1}– along the cable route [Source: internal materials]

4.5.1.1.2 Jetting at 5 km/day

Below, the results for the cable burial technology of jetting with significant soil displacement are presented, with the cable laying vessel moving along the APV route at a speed of 5 km/day. The calculation results presented correspond to the moments of simulation time: *t1, t2* [Figure 4.16, Figure 4.17].

At moment *t1* (work in sandy sediments), the cloud of suspended solids with concentrations exceeding 30 mg·l^{-1}, spreads to a distance of approx. 0.2 km, while at concentrations exceeding 4 mg·l^{-1} – to a distance of approx. 2.2 km.

At moment *t2* (work in cohesive sediments), the cloud of suspended solids with concentrations exceeding 100 mg·l^{-1} spreads to a distance of approx. 0.3 km, with concentrations exceeding 30 mg·l^{-1} – to a distance of approx. 1.2 km, and with concentrations exceeding 4 mg·l^{-1} – to approx. 11.5 km.

Figure 4.18 presents a map of the thickness distribution of the sediments generated in the process of sedimentation after the completion of a simulation of power cable burial in the seabed. The maximum thickness of a new layer of sediments at the cable corridor boundary does not exceed 3.7 mm, while the maximum range of the sediment with a thickness of >1 mm to the cable corridor boundary is 2.8 km.

Figure 4.19 presents a map of maximum sediment concentration levels at every point of the calculation area adopted during the entire simulation. Locally, at the cable corridor boundary, the momentary concentrations reach a value of 150 mg·l^{-1} for cohesive soils. However, in most of the area where the disturbance occurs, the concentration range is 5–50 mg·l^{-1}.

The maximum values of suspended solids concentration were analysed taking into consideration the duration of such disturbances. The result of the calculations presented in Figure 4.20, which presents the map of duration distribution of the concentration values exceeding the threshold of 30 mg·l^{-1}, is used for the analysis. The maximum duration of such a concentration value in the scenario discussed is 9 hours.

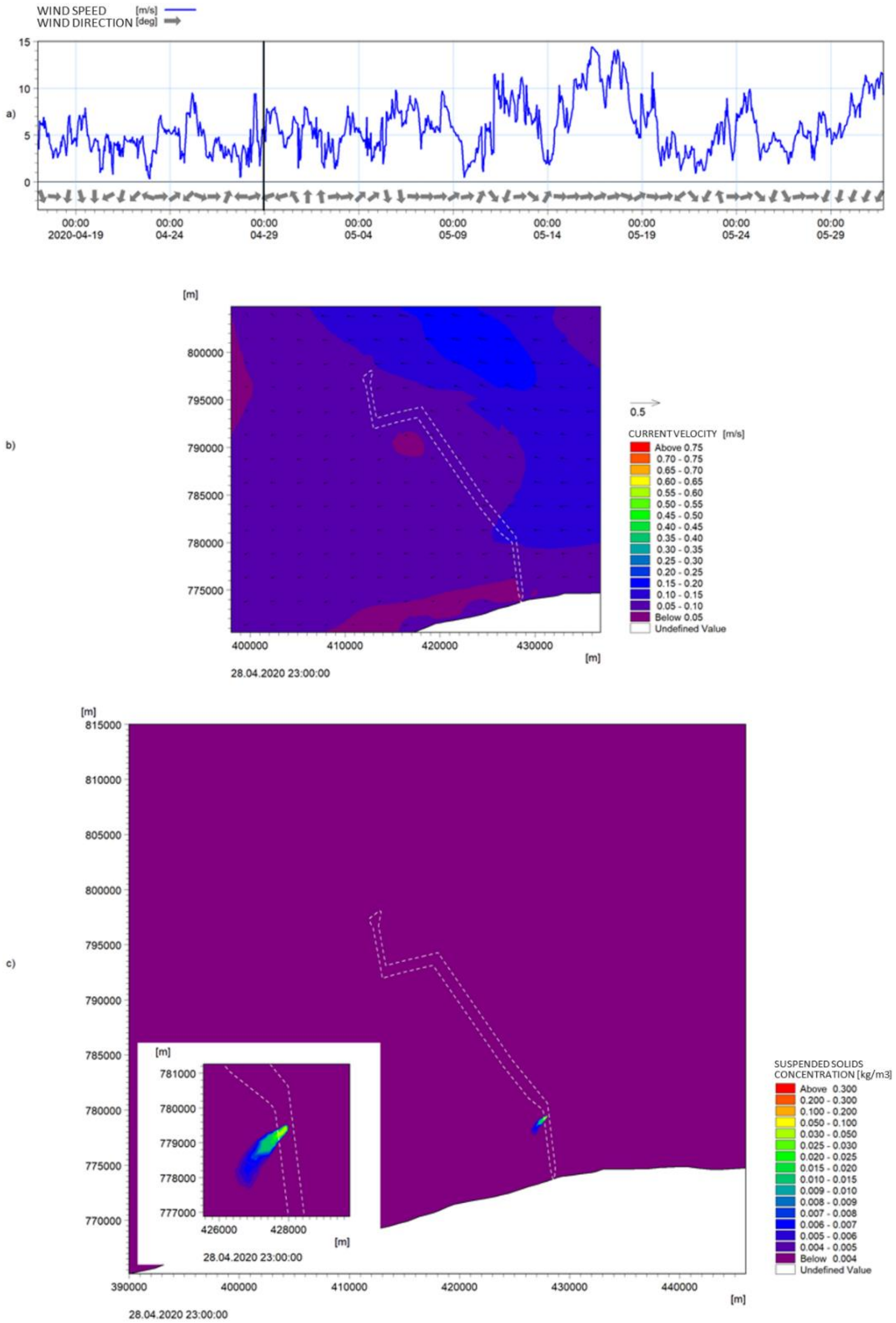


Figure 4.16. Results of the simulation of power cable burial under real hydrodynamic conditions in the time step t1 (sandy sediments) [Source: internal materials]

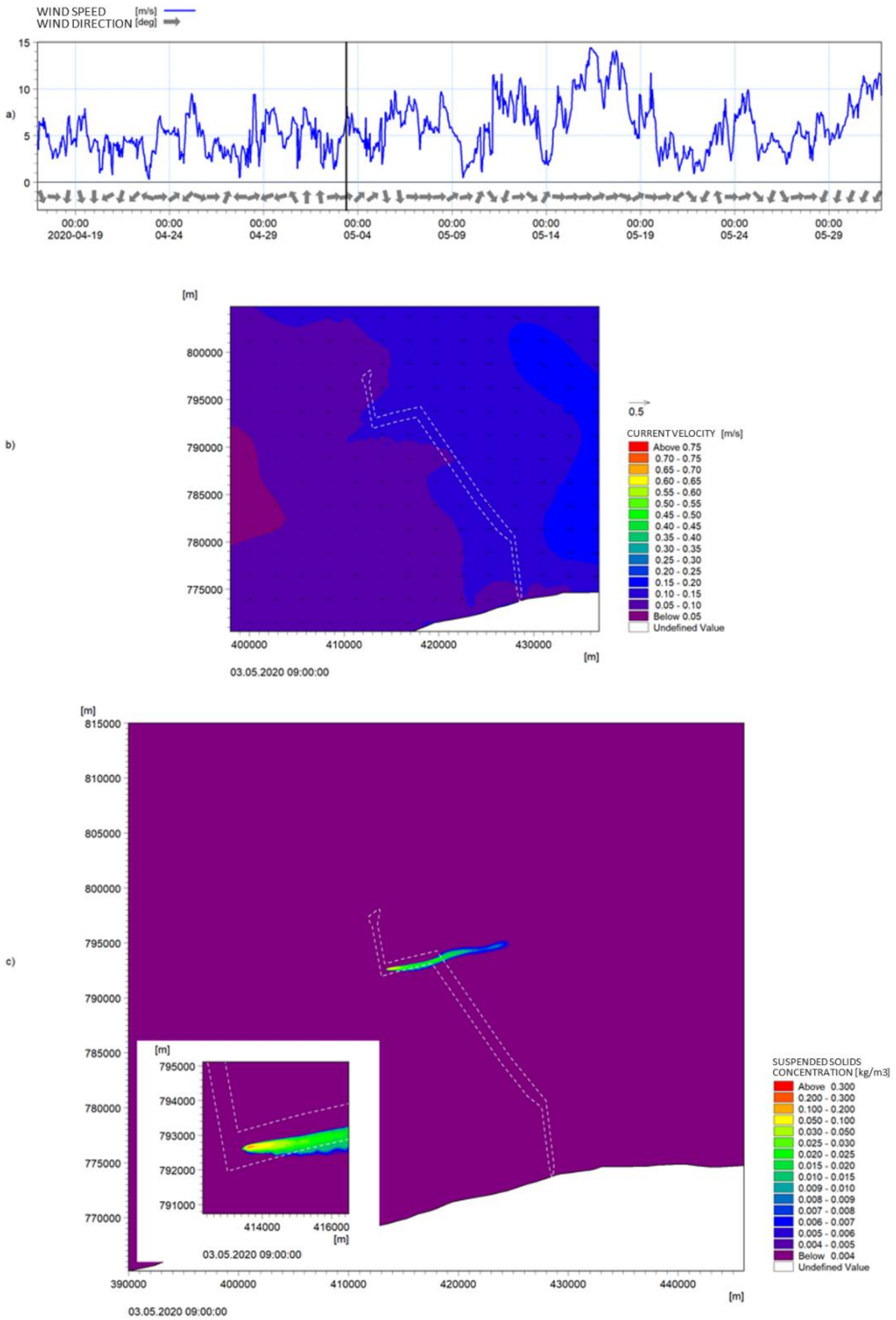


Figure 4.17. Results of the simulation of power cable burial under real hydrodynamic conditions in the time step t2 (cohesive sediments) [Source: internal materials]

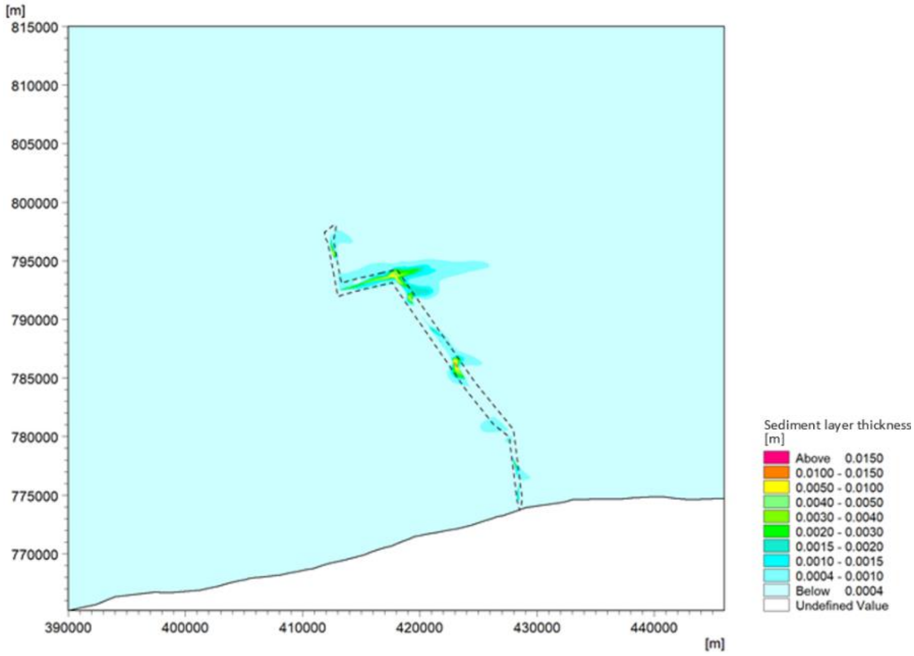


Figure 4.18. Results of the simulation of power cable burial – distribution of the seabed layer thickness after the completion of works along the entire route [Source: internal materials]

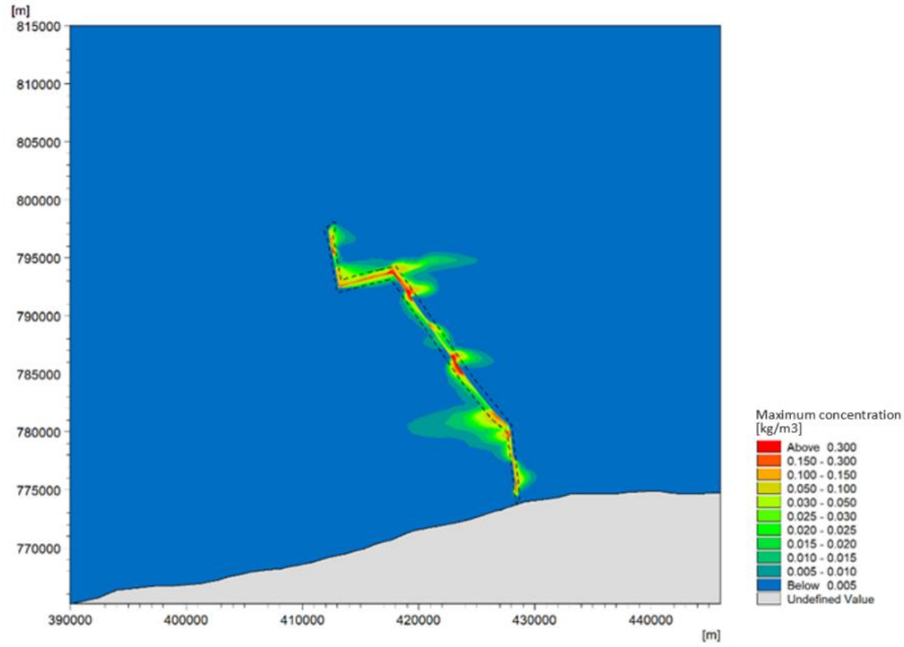


Figure 4.19. Results of the simulation of power cable burial – the maximum, temporary level of suspended solids concentration during works along the entire route [Source: internal materials]

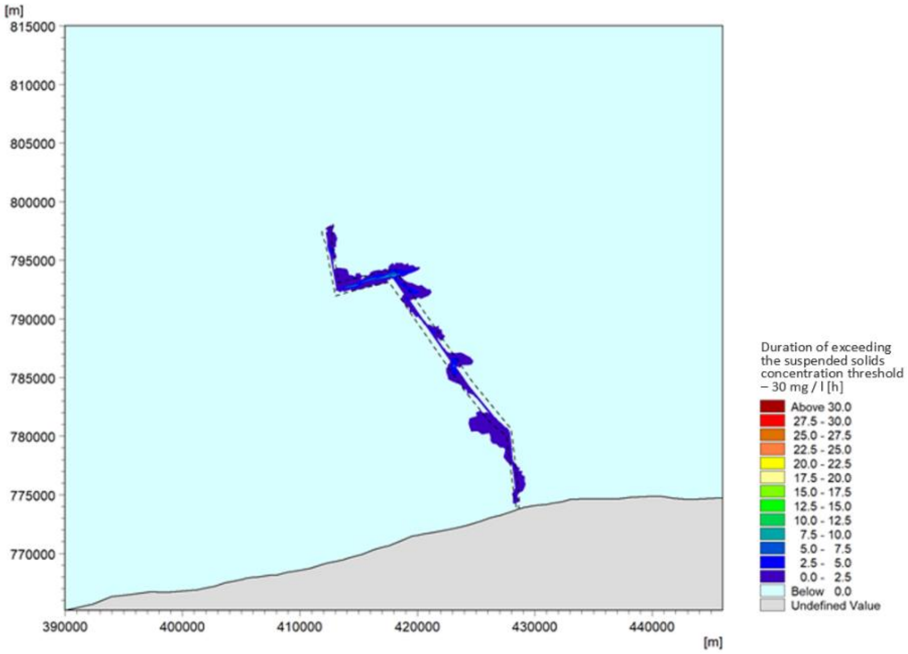


Figure 4.20. Duration of the exceedance of the suspended solids concentration threshold – 30 mg·l^{-1}– along the cable route [Source: internal materials]

4.5.1.1.3 Mass flow excavation at 2 km/day

Below, the results for the cable burial technology of mass flow excavation are presented, with the cable laying vessel moving along the APV route at a speed of 2 km/day. The calculation results presented correspond to the moments of simulation time: *t1, t2* [Figure 4.21, Figure 4.22].

At moment *t1* (work in sandy sediments), the cloud of suspended solids with concentrations exceeding 30 mg·l^{-1}, spreads to a distance of approx. 0.4 km, while at concentrations exceeding 4 mg·l^{-1} – to a distance of approx. 5.1 km.

At moment *t2* (work in cohesive sediments), the cloud of suspended solids with concentrations exceeding 100 mg·l^{-1} spreads to a distance of approx. 0.8 km, with concentrations exceeding 30 mg·l^{-1} – to a distance of approx. 2.5 km, and with concentrations exceeding 4 mg·l^{-1} – to approx. 12.5 km.

Figure 4.23 presents a map of the thickness distribution of the sediments generated in the process of sedimentation after the completion of a simulation of power cable burial in the seabed. The maximum thickness of a new layer of sediments at the cable corridor boundary does not exceed 26 mm, while the maximum range of the sediment with a thickness of >1 mm to the cable corridor boundary is 5.8 km.

Figure 4.24 presents a map of maximum sediment concentration levels at every point of the calculation area adopted during the entire simulation. Locally, at the cable corridor boundary, the momentary concentrations reach a value of 500 mg·l^{-1} for cohesive soils. However, in most of the area where the disturbance occurs, the concentration range is 5–100 mg·l^{-1}.

The maximum values of suspended solids concentration were analysed taking into consideration the duration of such disturbances. The analysis is informed by the result of the calculations presented in Figure 4.25, which illustrates the map of duration distribution of the concentrations exceeding the threshold of 30 mg·l^{-1}. The maximum duration of such a concentration value in the scenario discussed is 24 hours.

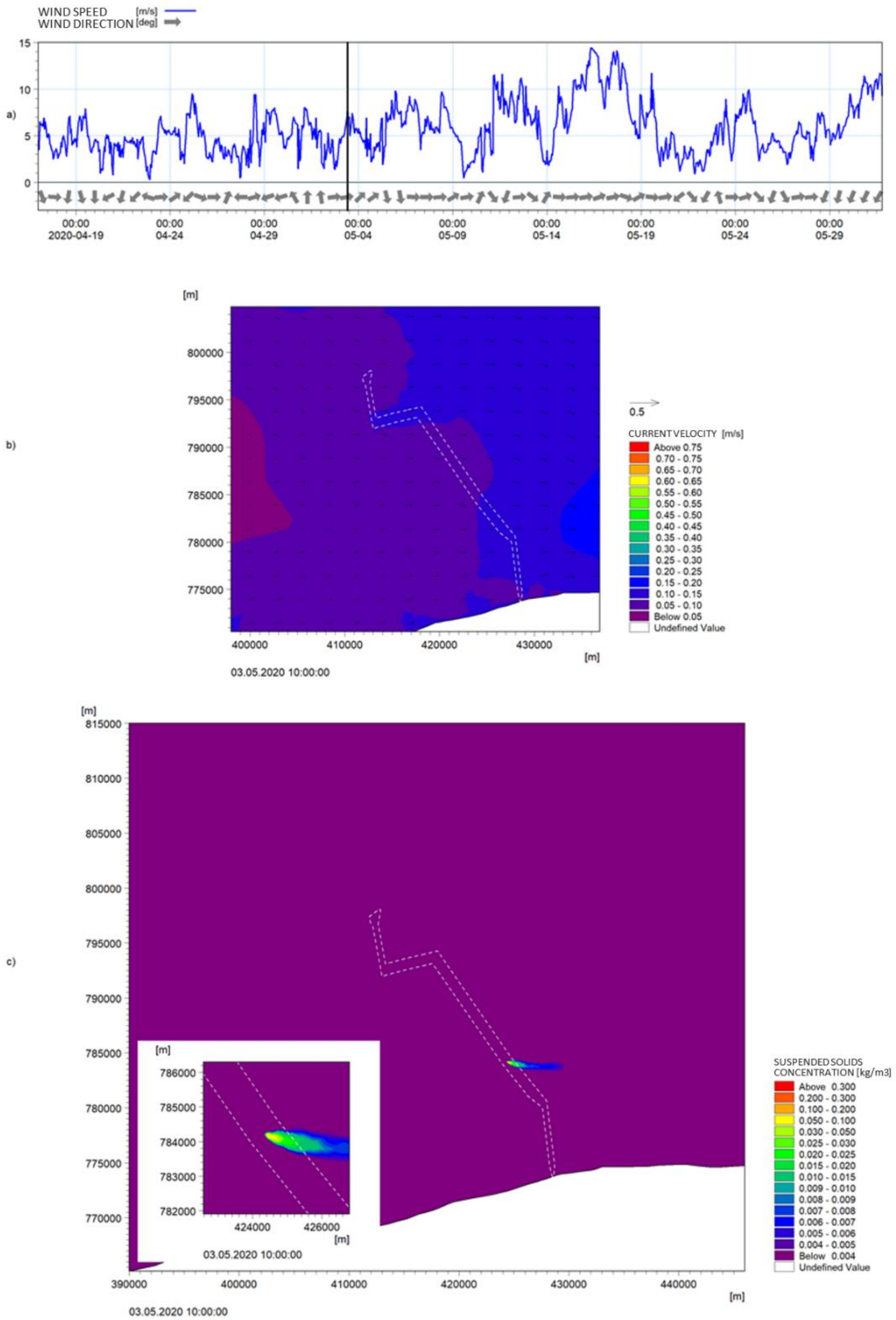


Figure 4.21. Results of the simulation of power cable burial under real hydrodynamic conditions in the time step t1 (sandy sediments) [Source: internal materials]

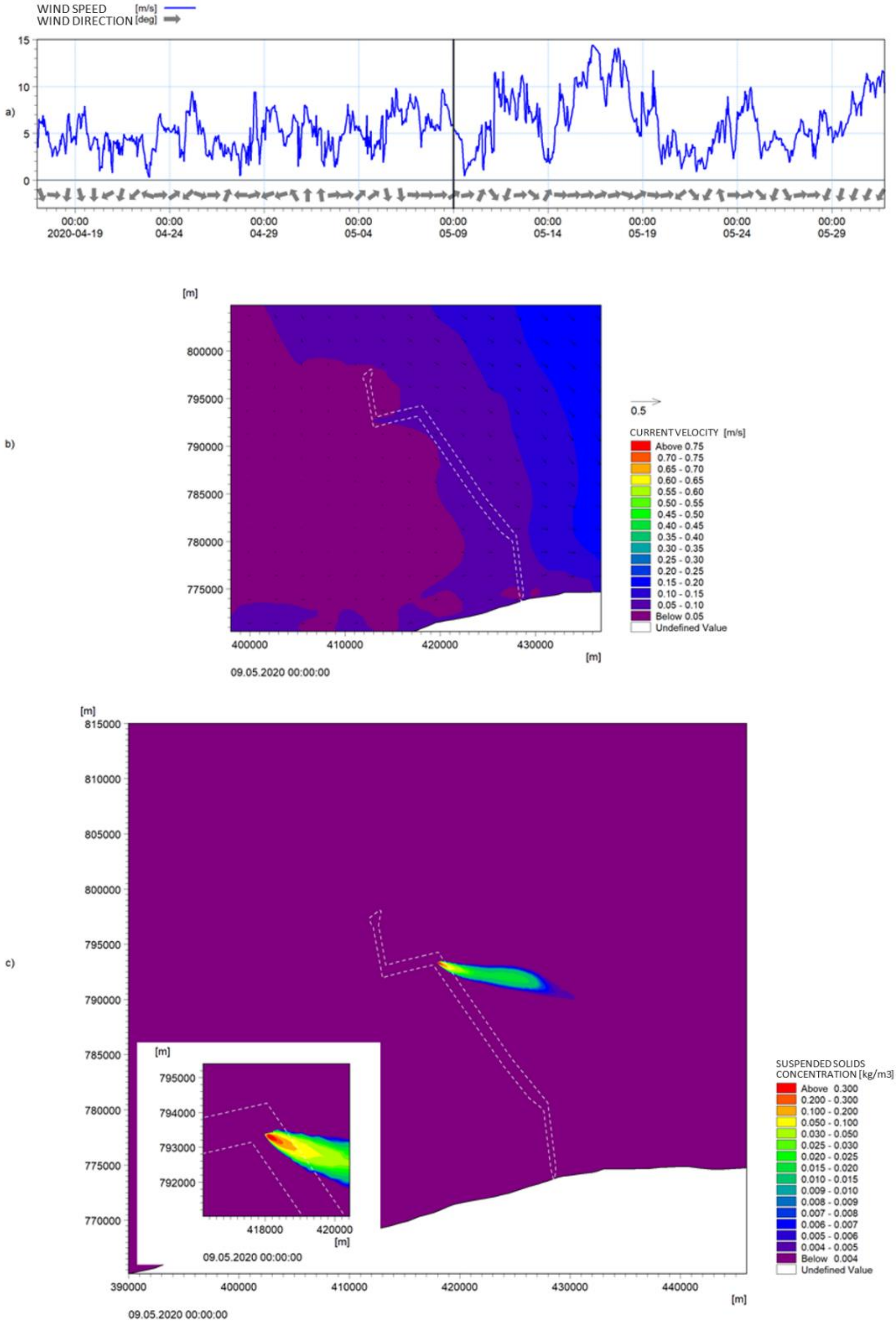


Figure 4.22. Results of the simulation of power cable burial under real hydrodynamic conditions in the time step t2 (cohesive sediments) [Source: internal materials]

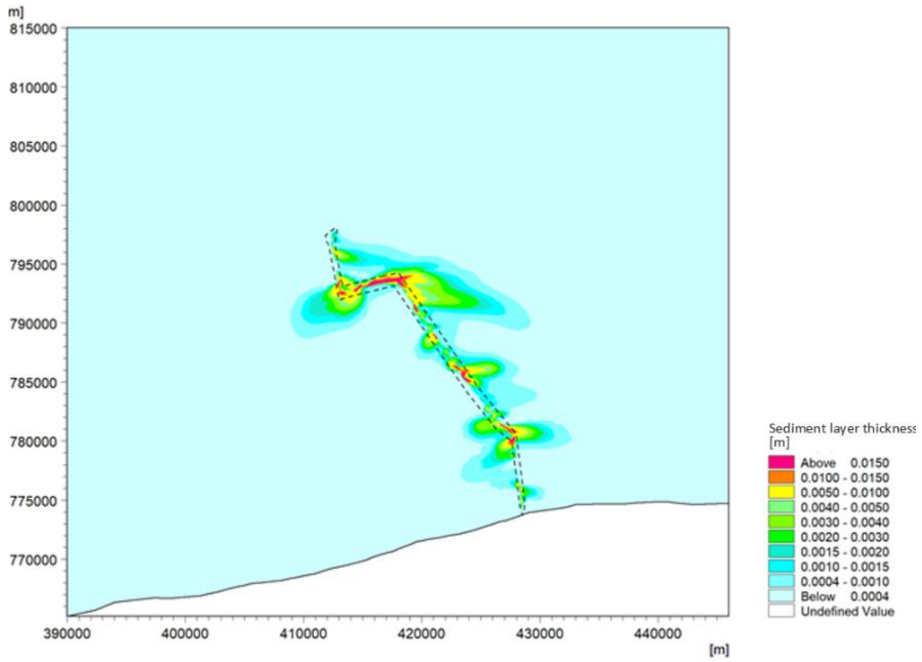


Figure 4.23. Results of the simulation of power cable burial – distribution of the seabed layer thickness after the completion of works along the entire route [Source: internal materials]

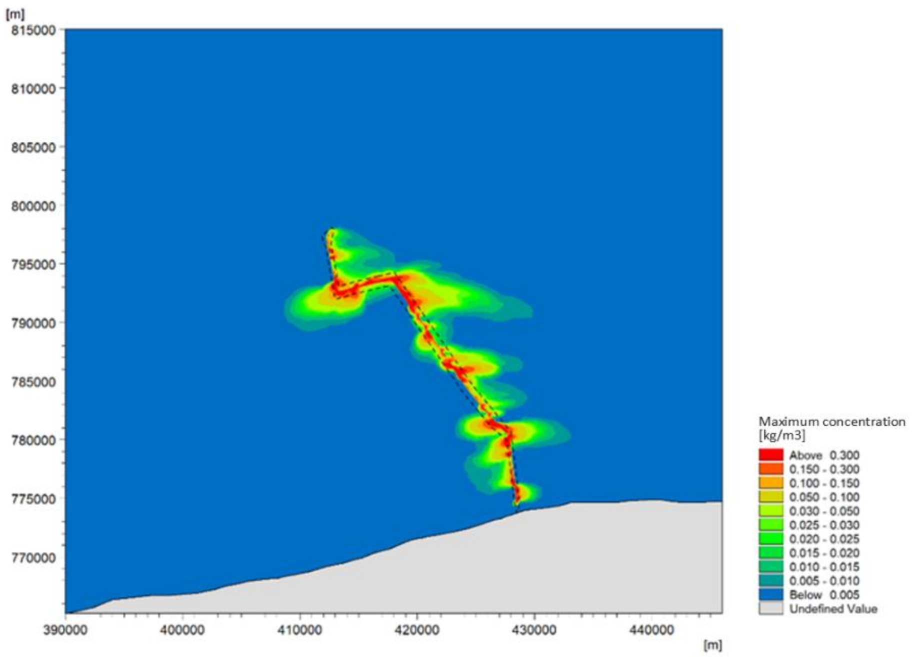


Figure 4.24. Results of the simulation of power cable burial – the maximum, temporary level of suspended solids concentration during works along the entire route [Source: internal materials]

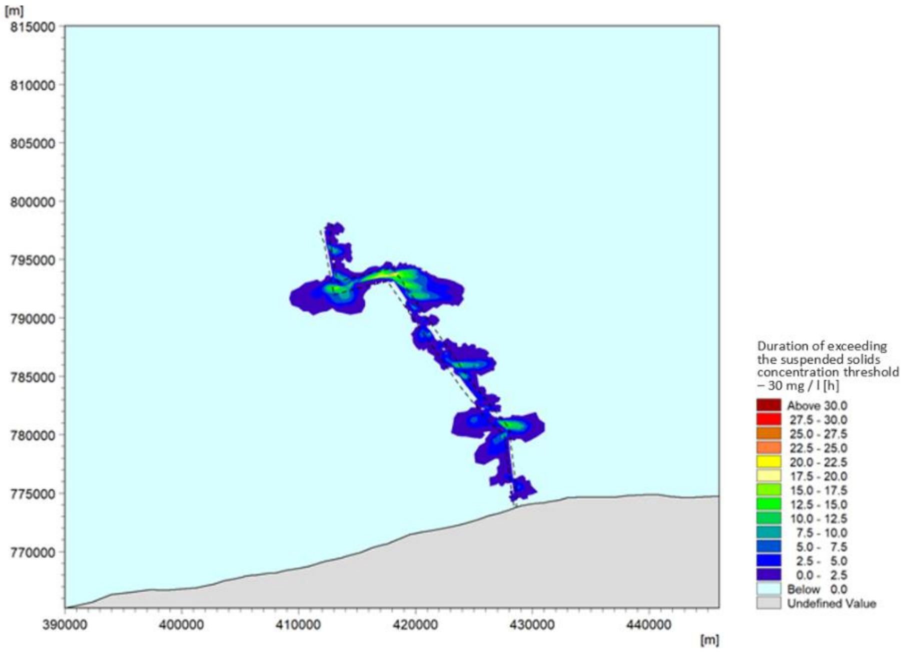


Figure 4.25. Duration of the exceedance of the suspended solids concentration threshold – 30 mg·l^{-1}– along the cable route [Source: internal materials]

4.5.1.1.4 Mass flow excavation at 5 km/day

Below, the results for the cable burial technology of mass flow excavation are presented, with the cable laying vessel moving along the APV route at a speed of 5 km/day. The calculation results presented correspond to the moments of simulation time: *t1, t2* [Figure 4.26, Figure 4.27].

At moment *t1* (work in cohesive sediments), the cloud of suspended solids with concentrations exceeding 100 mg·l^{-1} spreads to a distance of approx. 0.8 km, with concentrations exceeding 30 mg·l^{-1} – to a distance of approx. 2.0 km, and with concentrations exceeding 4 mg·l^{-1} – to approx. 7.2 km.

At moment *t2* (work in cohesive sediments), the cloud of suspended solids with concentrations exceeding 100 mg·l^{-1} spreads to a distance of approx. 0.2 km, with concentrations exceeding 30 mg·l^{-1} – to a distance of approx. 8.5 km, and with concentrations exceeding 4 mg·l^{-1} – to approx. 18.5 km.

Figure 4.28 presents a map of thickness distribution of the sediments generated in the process of sedimentation after the completion of a simulation of power cable burial in the seabed. The maximum thickness of a new layer of sediments at the cable corridor boundary does not exceed 22 mm, while the maximum range of the sediment with a thickness of >1 mm to the cable corridor boundary is 8 km.

Figure 4.29 presents a map of maximum sediment concentration levels at every point of the calculation area adopted during the entire simulation. Locally, at the cable corridor boundary, the momentary concentrations reach a value of 500 mg·l^{-1} for cohesive soils. However, in most of the area where the disturbance occurs, the concentration range is 5–120 mg·l^{-1}.

The maximum values of suspended solids concentration were analysed taking into consideration the duration of such disturbances. The analysis is informed by the result of the calculations presented in Figure 4.30, which illustrates the map of duration distribution of the concentrations exceeding the threshold of 30 mg·l^{-1}. The maximum duration of such a concentration value in the scenario discussed is 29 hours.

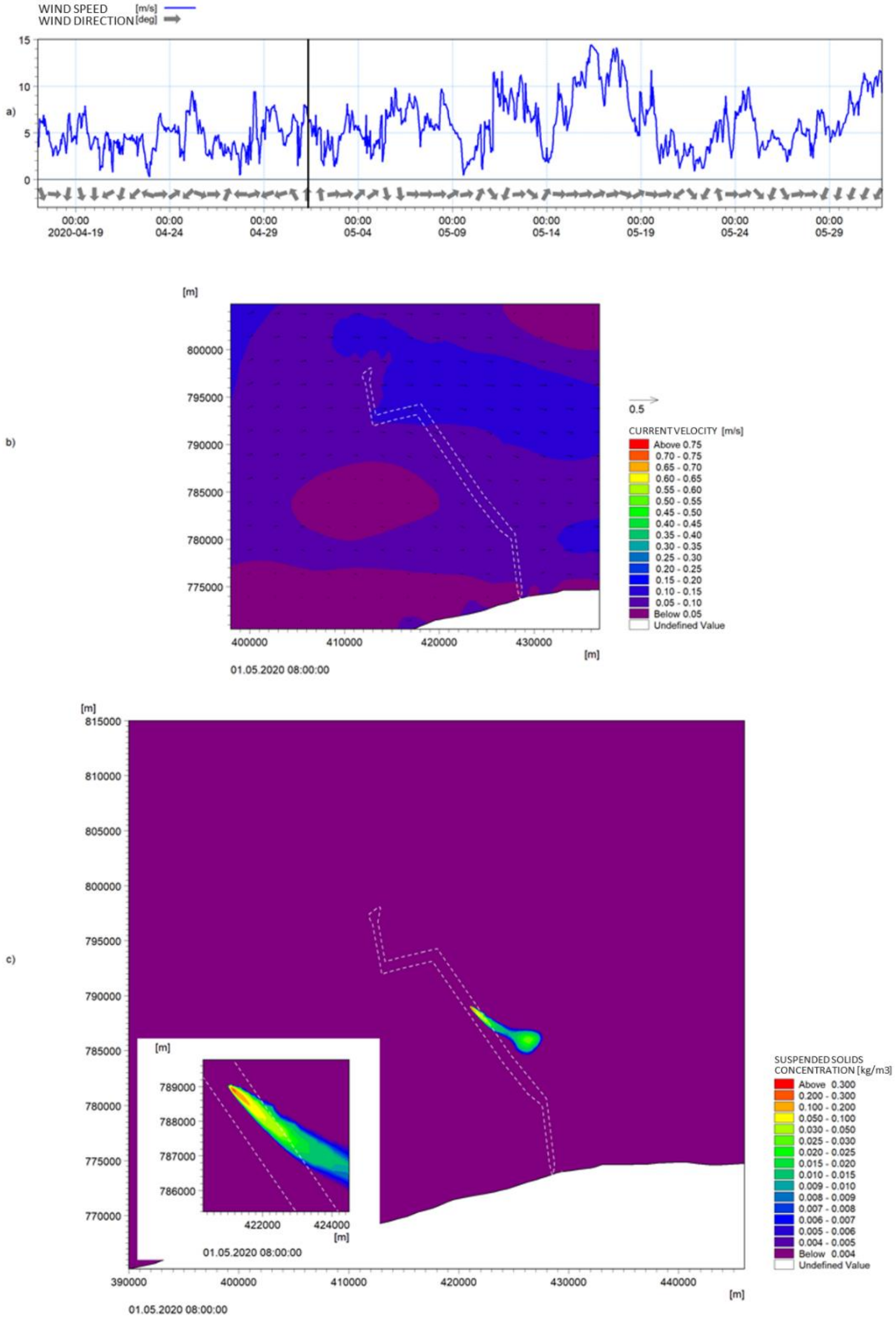


Figure 4.26. Results of the simulation of power cable burial under real hydrodynamic conditions in the time step t1 (sandy sediments) [Source: internal materials]

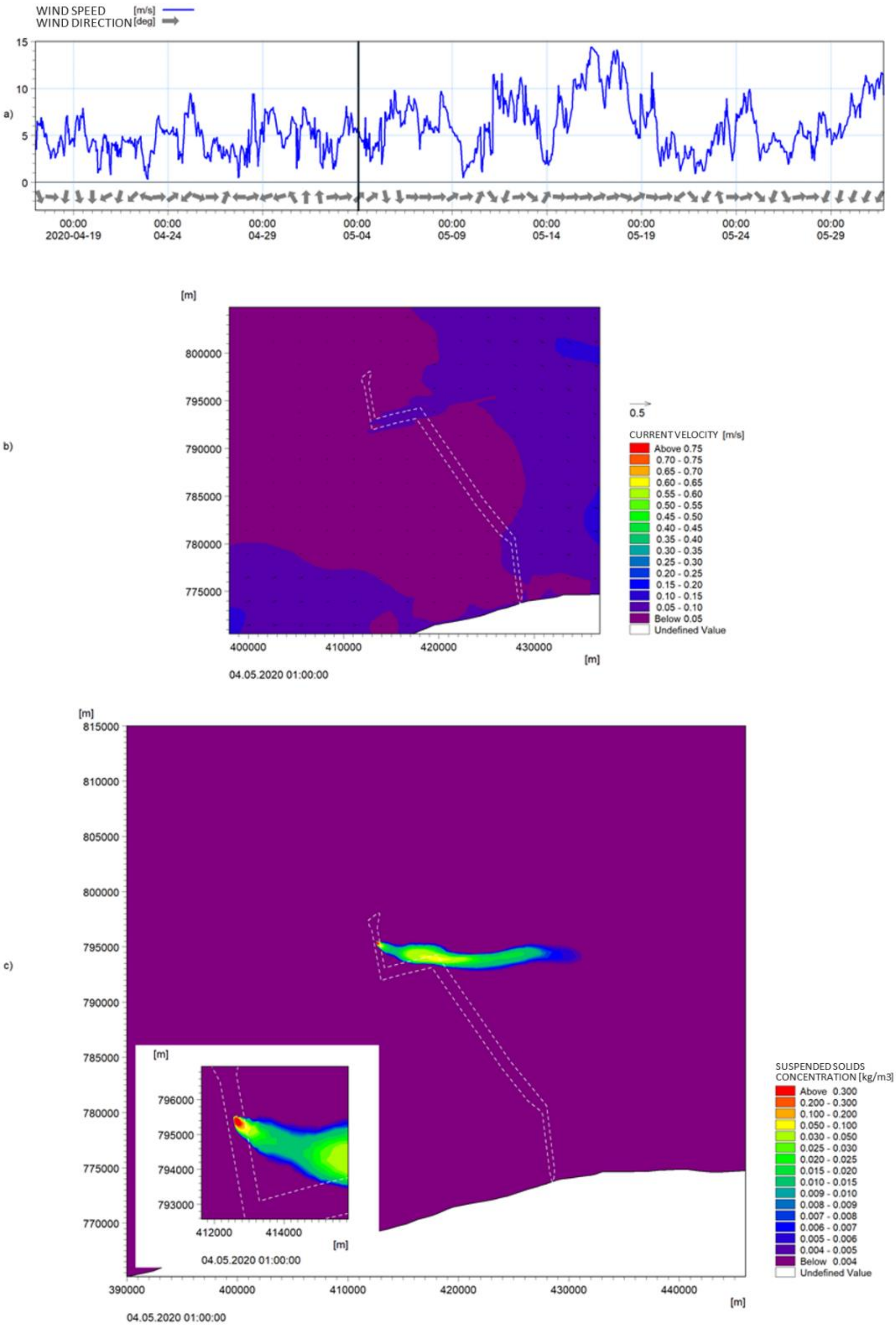


Figure 4.27. Results of the simulation of power cable burial under real hydrodynamic conditions in the time step t2 (cohesive sediments) [Source: internal materials]

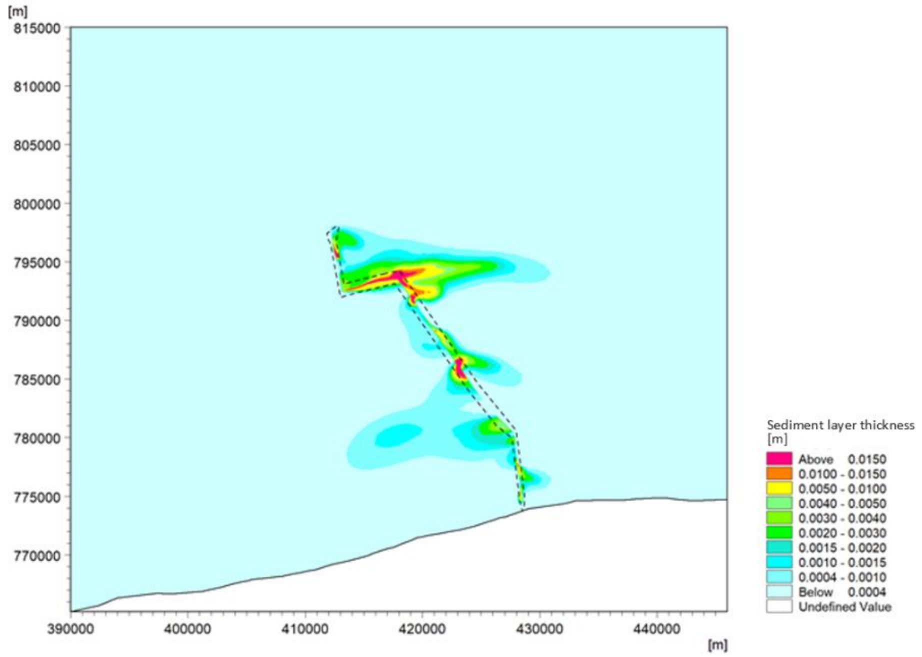


Figure 4.28. Results of the simulation of power cable burial – distribution of the seabed layer thickness after the completion of works along the entire route [Source: internal materials]

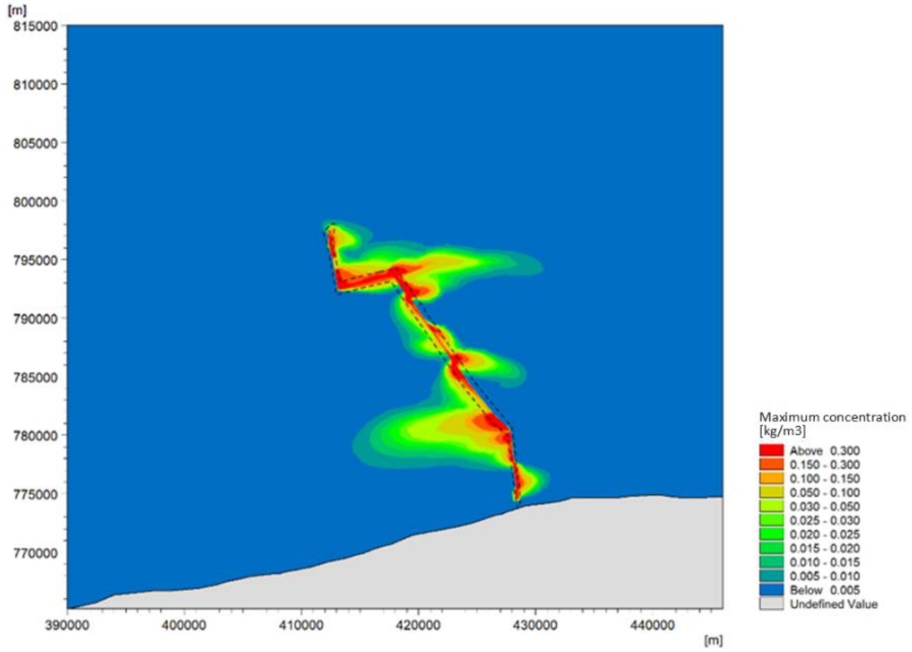


Figure 4.29. Results of the simulation of power cable burial – the maximum, temporary level of suspended solids concentration during works along the entire route [Source: internal materials]

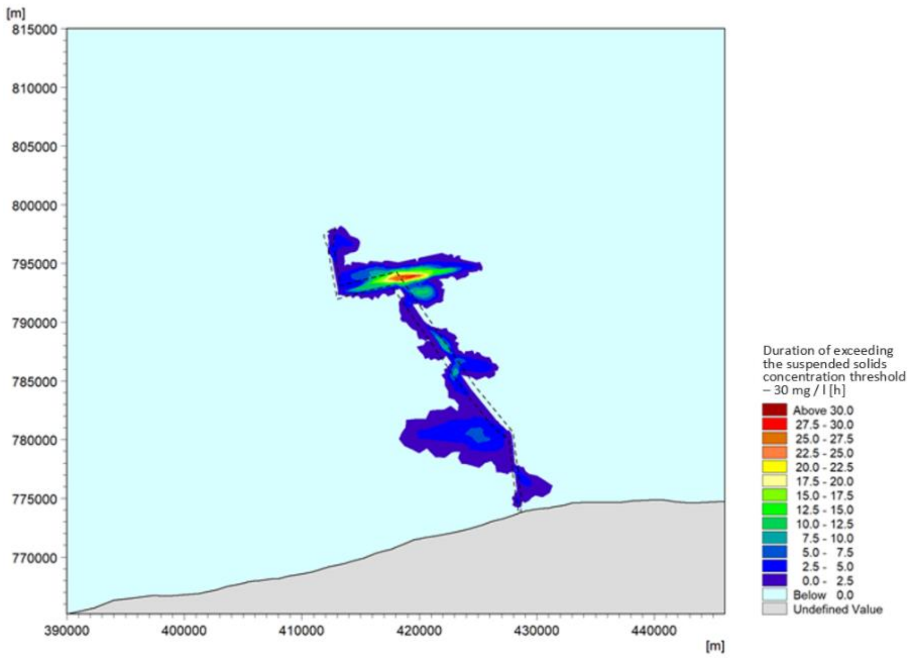


Figure 4.30. Duration of the exceedance of the suspended solids concentration threshold – 30 mg·l^{-1}– along the cable route [Source: internal materials]

4.5.1.2 Cable route – RAV

4.5.1.2.1 Jetting at 2 km/day

Below, the results for the cable burial technology of jetting with significant soil displacement are presented, with the cable laying vessel moving along the RAV route at a speed of 2 km/day. The calculation results presented correspond to the moments of simulation time: *t1, t2* [Figure 4.31, Figure 4.32].

At moment *t1* (work in sandy sediments), the cloud of suspended solids with concentrations exceeding 30 mg·l^{-1}, spreads to a distance of approx. 0.1 km, while at concentrations exceeding 4 mg·l^{-1} – to a distance of approx. 2.2 km.

At moment *t2* (work in cohesive sediments), the cloud of suspended solids with concentrations exceeding 30 mg·l^{-1}, spreads to a distance of approx. 0.3 km, while at concentrations exceeding 4 mg·l^{-1} – to a distance of approx. 6 km.

Figure 4.33 presents a map of thickness distribution of the sediments generated in the process of sedimentation after the completion of a simulation of power cable burial in the seabed. The maximum thickness of a new layer of sediments at the cable corridor boundary (500 m from the cable axis) does not exceed 2.5 mm, while the maximum range of the sediment with a thickness of >1 mm to the cable corridor boundary is 1.1 km.

Figure 4.34 presents a map of maximum sediment concentration levels at every point of the calculation area adopted during the entire simulation. Locally, the momentary concentrations at the cable corridor boundary (500 m from the cable axis) reach a value of 30 mg·l^{-1} for cohesive soils. However, in most of the area where the disturbance occurs, the concentration range is 5–30 mg·l^{-1}.

The maximum values of suspended solids concentration were analysed taking into consideration the duration of such disturbances. The analysis is informed by the result of the calculations presented in Figure 4.35 which illustrates the map of duration distribution of the concentrations exceeding the threshold of 30 mg·l^{-1}. The maximum duration of such a concentration value in the scenario discussed is 11 hours.

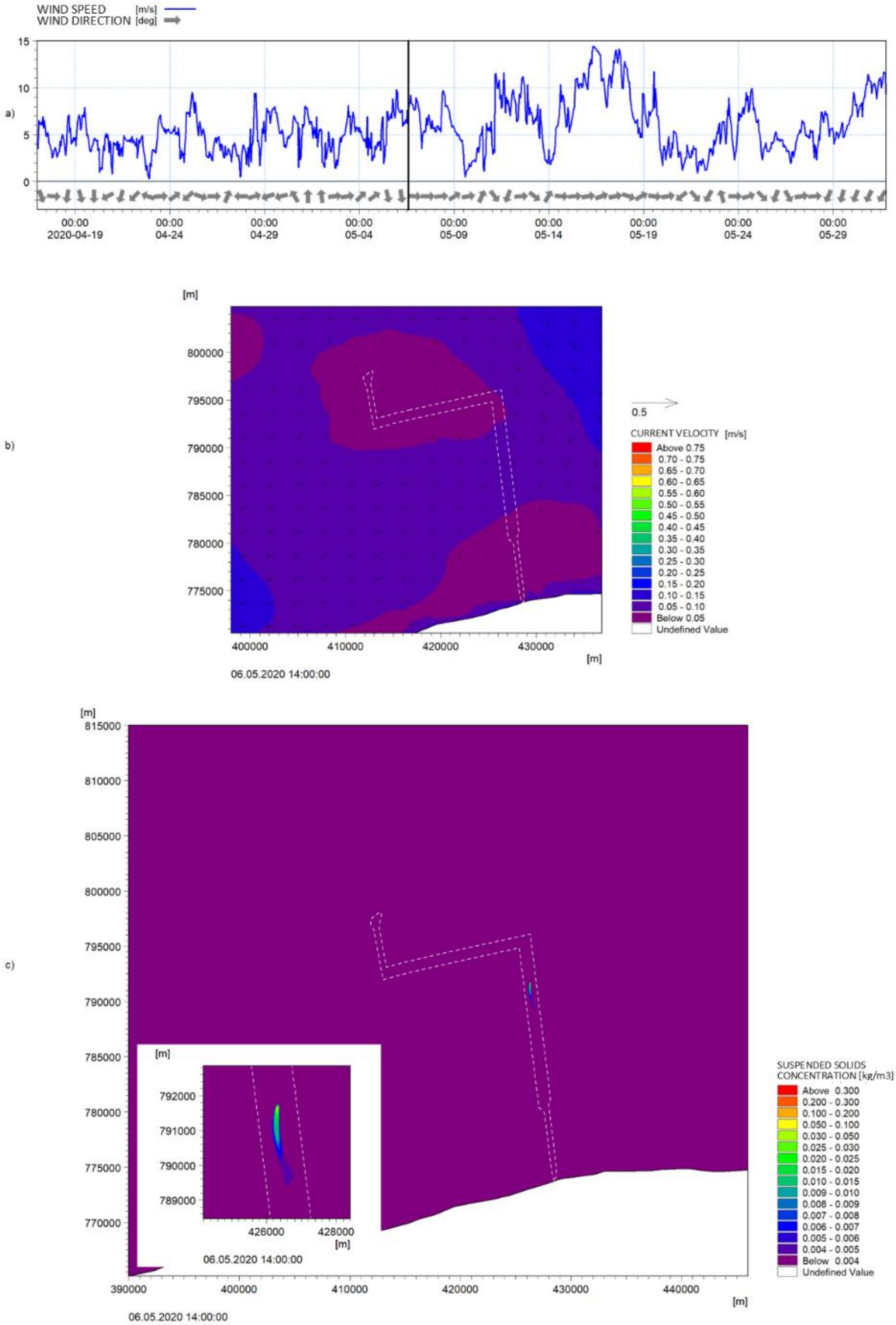


Figure 4.31. Results of the modelling of a power cable burial under real hydrodynamic conditions in the time step t1 (sandy sediments) [Source: internal materials]

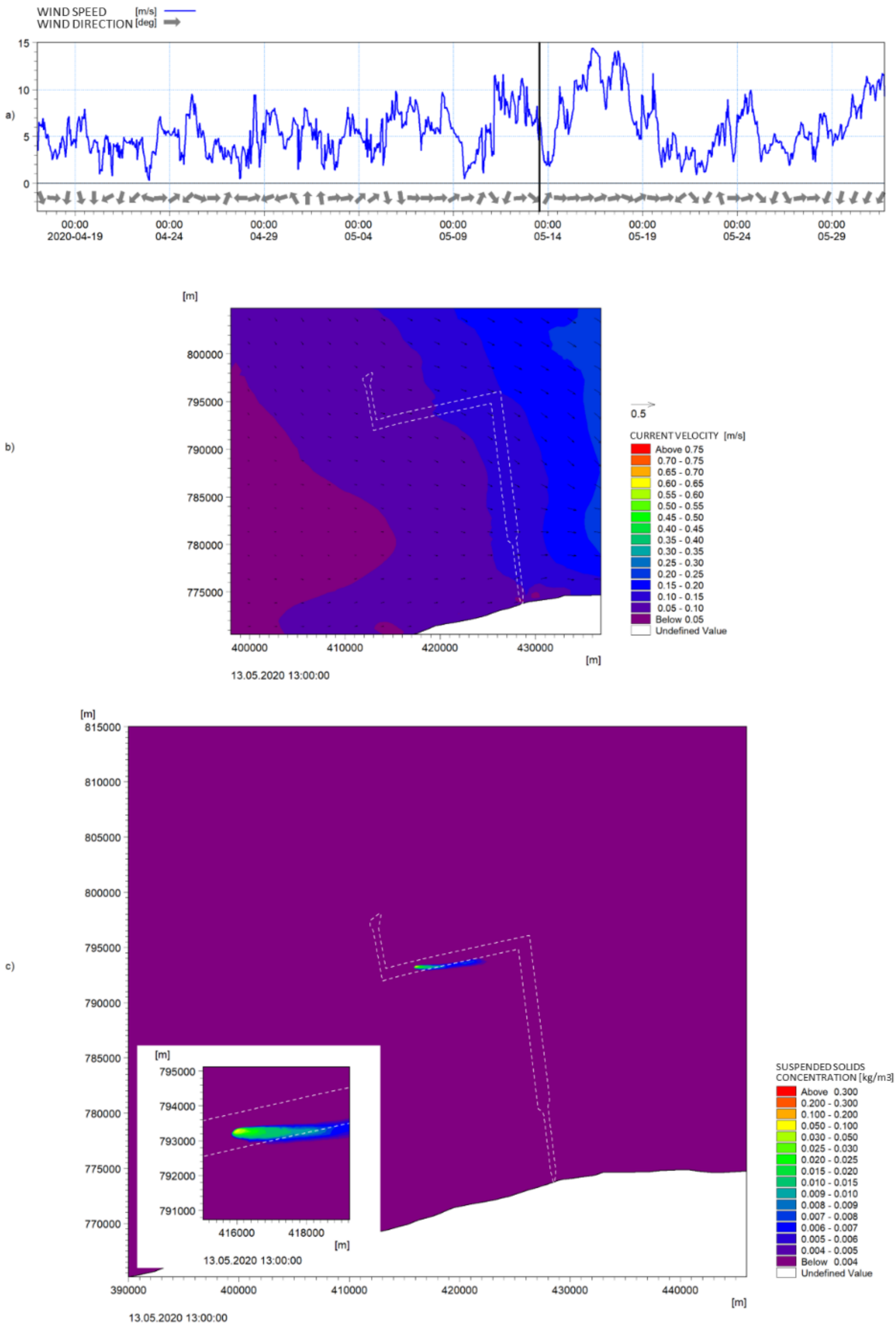


Figure 4.32. Results of the simulation of power cable burial under real hydrodynamic conditions in the time step t2 (cohesive sediments) [Source: internal materials]

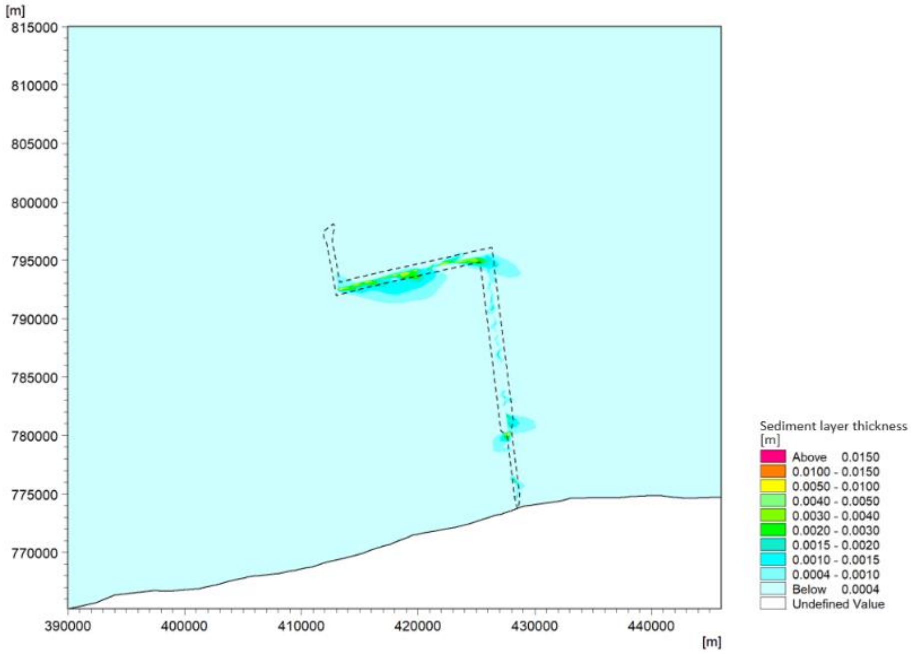


Figure 4.33. Results of the simulation of power cable burial – distribution of the seabed layer thickness after the completion of works along the entire route [Source: internal materials]

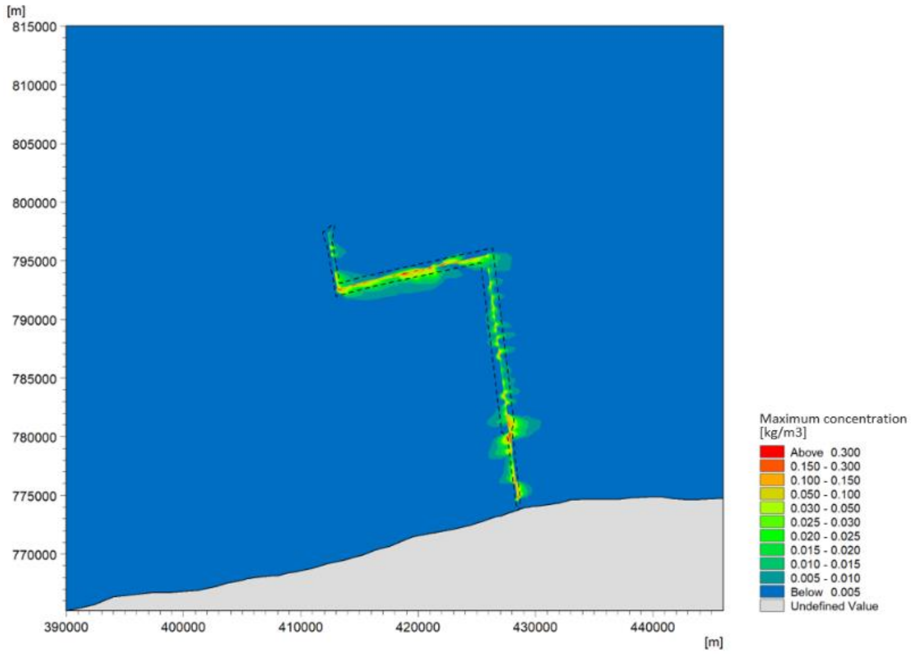


Figure 4.34. Results of the simulation of power cable burial – the maximum, temporary level of suspended solids concentration during works along the entire route [Source: internal materials]

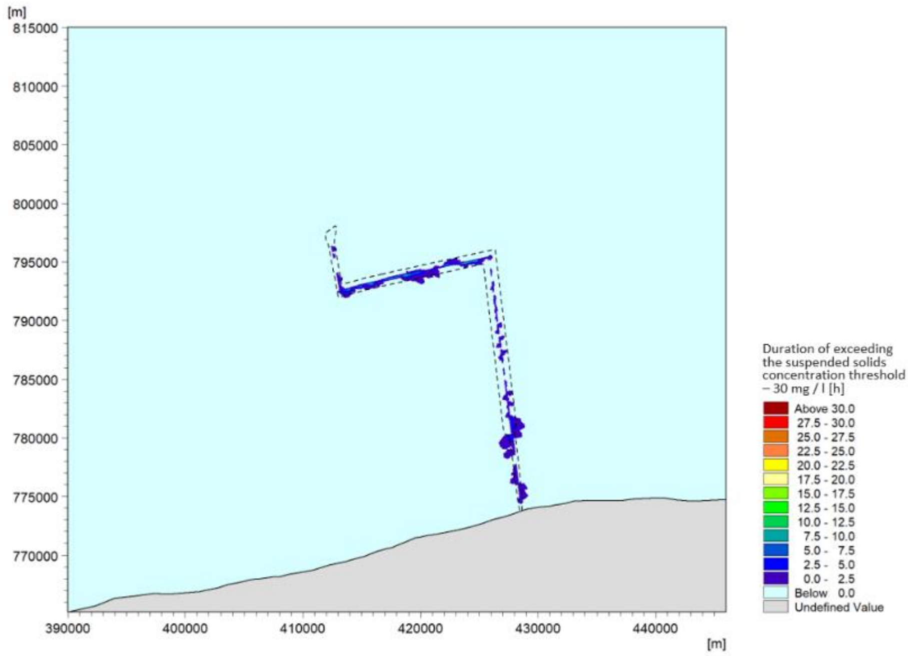


Figure 4.35. Duration of the exceedance of the suspended solids concentration threshold – 30 mg·l⁻¹– along the cable route [Source: internal materials]

4.5.1.2.2 Jetting at 5 km/day

Below, the results for the cable burial technology of jetting with significant soil displacement are presented, with the cable laying vessel moving along the RAV route at a speed of 5 km/day. The calculation results presented correspond to the moments of simulation time: *t1, t2* [Figure 4.36, Figure 4.37].

At moment *t1* (work in sandy sediments), the cloud of suspended solids with concentrations exceeding 30 mg·l^{-1}, spreads to a distance of approx. 0.5 km, while at concentrations exceeding 4 mg·l^{-1} – to approx. 6 km.

At moment *t2* (work in cohesive sediments), the cloud of suspended solids with concentrations exceeding 100 mg·l^{-1}, spreads to a distance of approx. 0.3 km, with concentrations of 30 mg·l^{-1} – to a distance of approx. 1.3 km, and with concentrations exceeding 4 mg·l^{-1} – to approx. 9 km.

Figure 4.38 presents a map of thickness distribution of the sediments generated in the process of sedimentation after the completion of a simulation of power cable burial in the seabed. The maximum thickness of a new layer of sediments at the cable corridor boundary does not exceed 3 mm, while the maximum range of the sediment with a thickness of >1 mm to the cable corridor boundary is 1 km.

Figure 4.39 presents a map of maximum sediment concentration levels at every point of the calculation area adopted during the entire simulation. Locally, at the cable corridor boundary, the momentary concentrations reach a value of 80 mg·l^{-1} for cohesive soils. However, in most of the area where the disturbance occurs, the concentration range is 5–50 mg·l^{-1}.

The maximum values of suspended solids concentration were analysed taking into consideration the duration of such disturbances. The analysis is informed by the result of the calculations presented in Figure 4.40, which illustrates the map of duration distribution of the concentrations exceeding the threshold of 30 mg·l^{-1}. The maximum duration of such a concentration value in the scenario discussed is 11 hours.

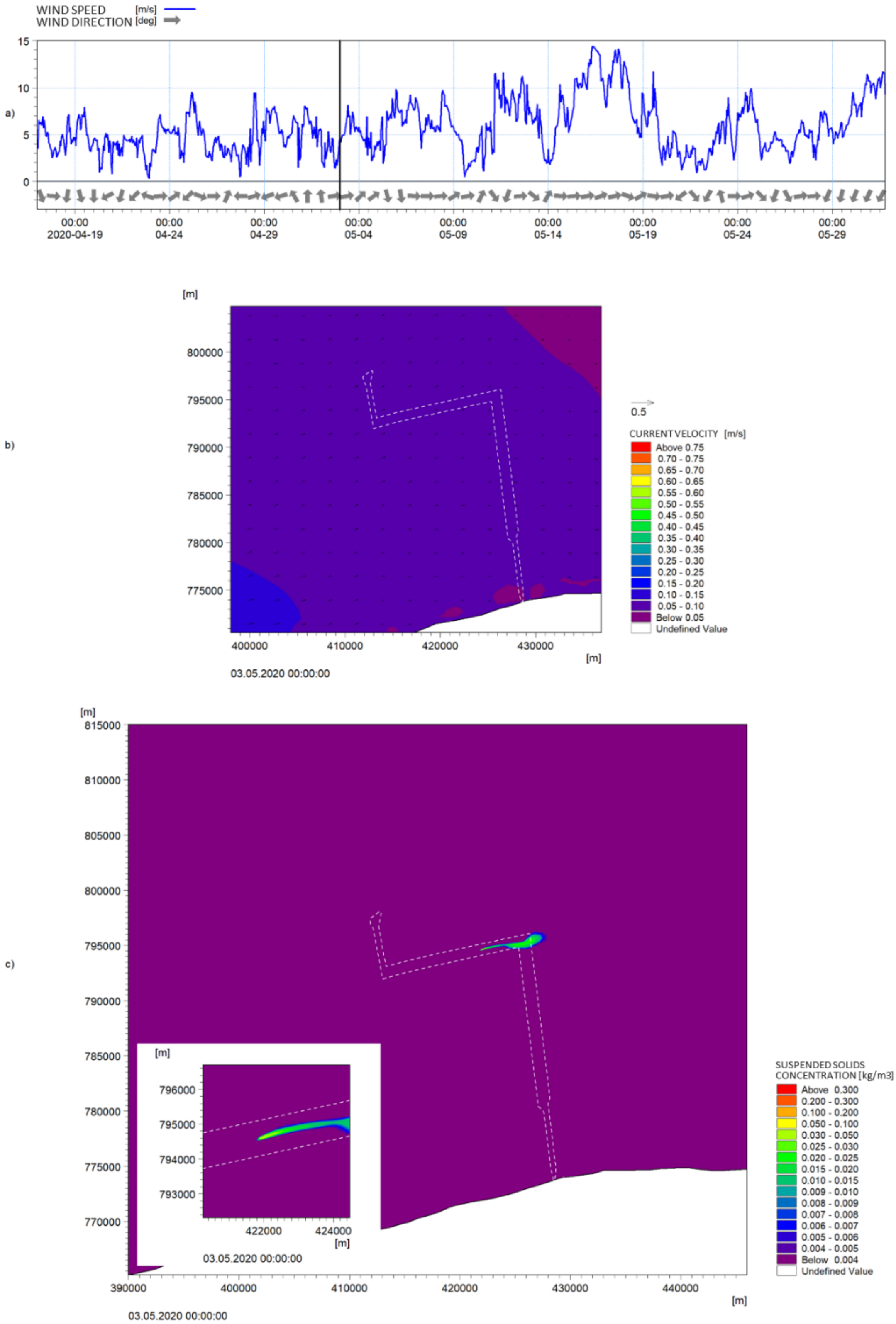


Figure 4.36. Results of the simulation of power cable burial under real hydrodynamic conditions in the time step t1 (sandy sediments) [Source: internal materials]

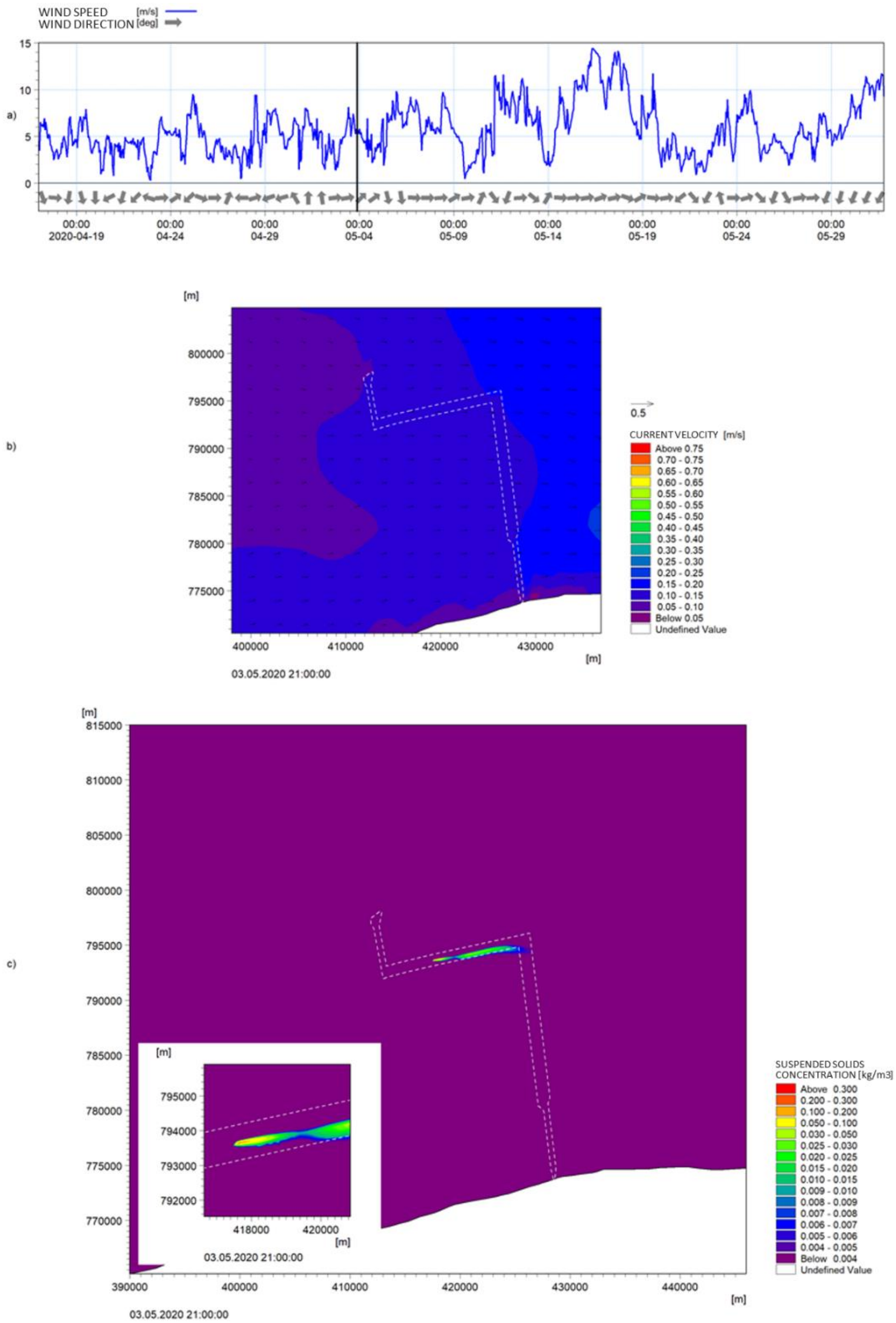


Figure 4.37. Results of the modelling of a power cable burial under real hydrodynamic conditions in the time step t2 (cohesive sediments) [Source: internal materials]

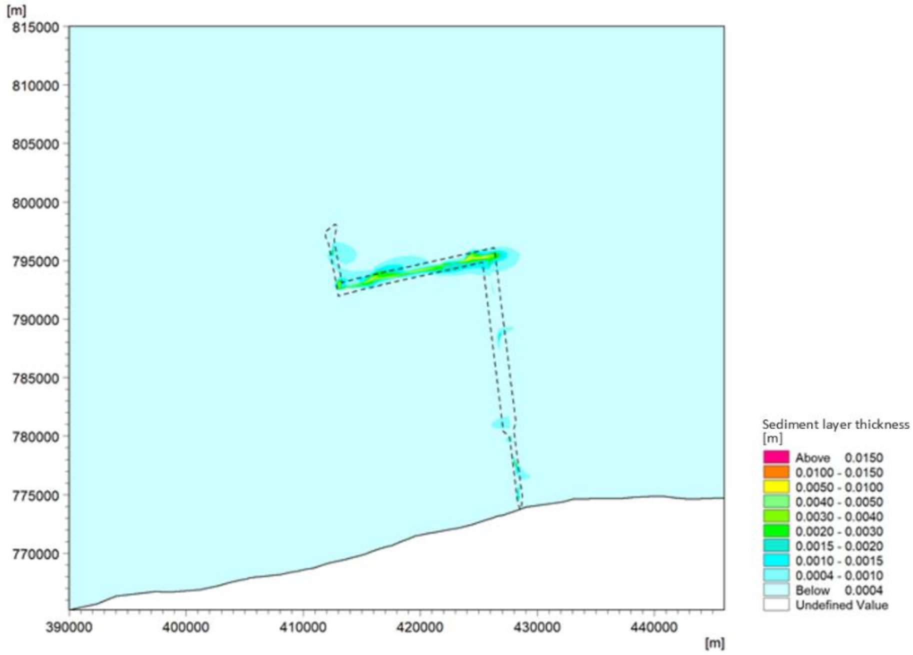


Figure 4.38. Results of the modelling of a power cable burial – distribution of the seabed layer thickness after the completion of works along the entire route [Source: internal materials]

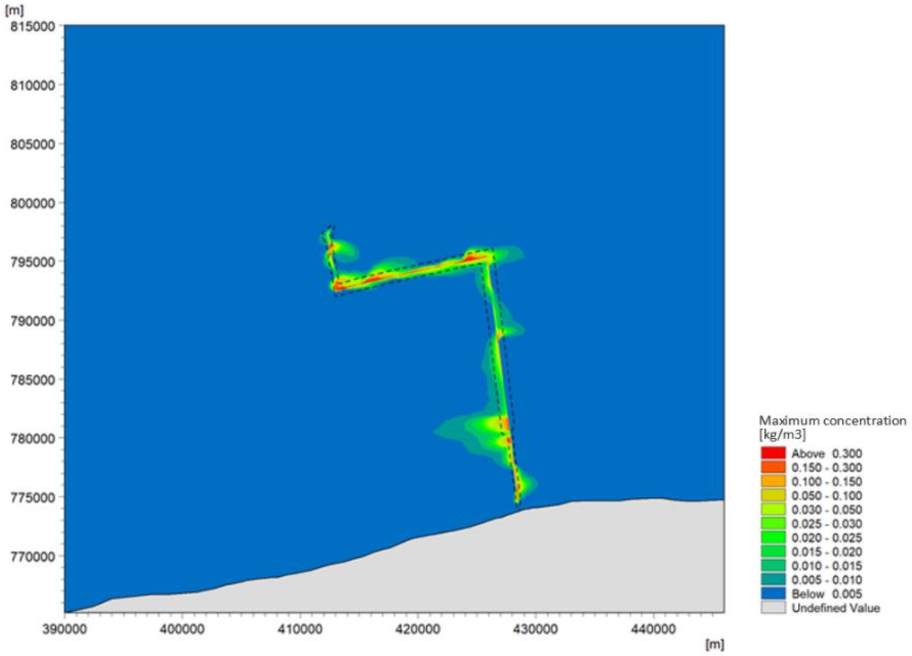


Figure 4.39. Results of the modelling of a power cable burial – the maximum, temporary level of suspended solids concentration during works along the entire route [Source: internal materials]

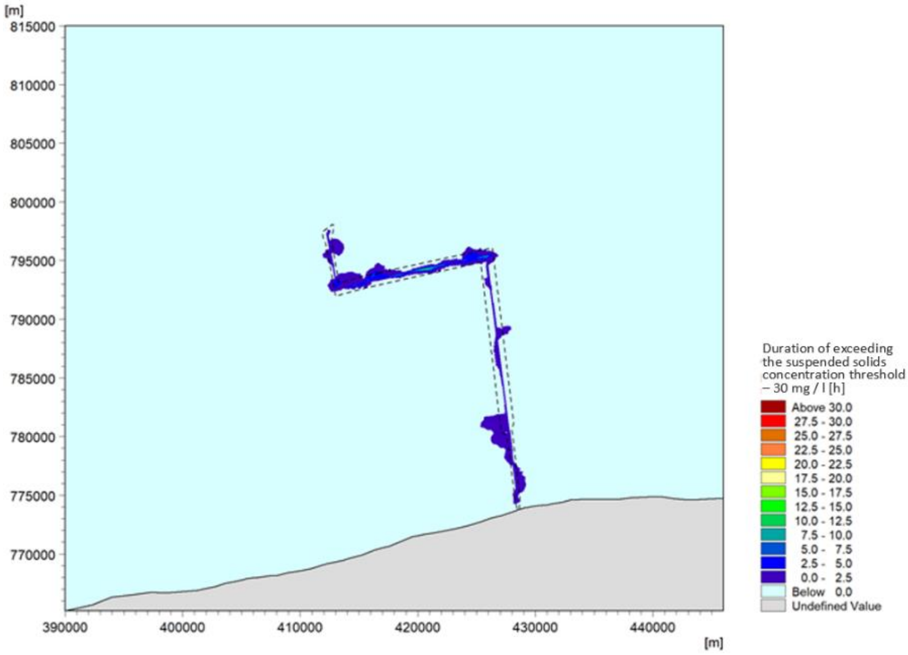


Figure 4.40. Duration of the exceedance of the suspended solids concentration threshold – 30 mg·l^{-1}– along the cable route [Source: internal materials]

4.5.1.2.3 Mass flow excavation at 2 km/day

Below, the results for the cable burial technology of mass flow excavation are presented, with the cable laying vessel moving along the RAV route at a speed of 2 km/day. The calculation results presented correspond to the moments of simulation time: *t1, t2* [Figure 4.41, Figure 4.42].

At moment *t1* (work in sandy sediments), the cloud of suspended solids with concentrations exceeding 100 mg·l^{-1} spreads to a distance of approx. 0.3 km, with concentrations exceeding 30 mg·l^{-1} – to a distance of approx. 0.9 km, and with concentrations exceeding 4 mg·l^{-1} – to approx. 3.3 km.

At moment *t2* (work in cohesive sediments), the cloud of suspended solids with concentrations exceeding 100 mg·l^{-1} spreads to a distance of approx. 0.8 km, with concentrations exceeding 30 mg·l^{-1} – to a distance of approx. 5.5 km, and with concentrations exceeding 4 mg·l^{-1} – to approx. 14.5 km.

Figure 4.43 presents a map of the thickness distribution of the sediments generated in the process of sedimentation after the completion of a simulation of power cable burial in the seabed. The maximum thickness of a new layer of sediments at the cable corridor boundary does not exceed 20 mm, while the maximum range of the sediment with a thickness of >1 mm to the cable corridor boundary is 4.1 km.

Figure 4.44 presents a map of maximum sediment concentration levels at every point of the calculation area adopted during the entire simulation. Locally, at the cable corridor boundary, the momentary concentrations reach a value of 220 mg·l^{-1} for cohesive soils. However, in most of the area where the disturbance occurs, the concentration range is 5–80 mg·l^{-1}.

The maximum values of suspended solids concentration were analysed taking into consideration the duration of such disturbances. The analysis is informed by the result of the calculations presented in Figure 4.45, which illustrates the map of duration distribution of the concentrations exceeding the threshold of 30 mg·l^{-1}. The maximum duration of such a concentration value in the scenario discussed is 30 hours.

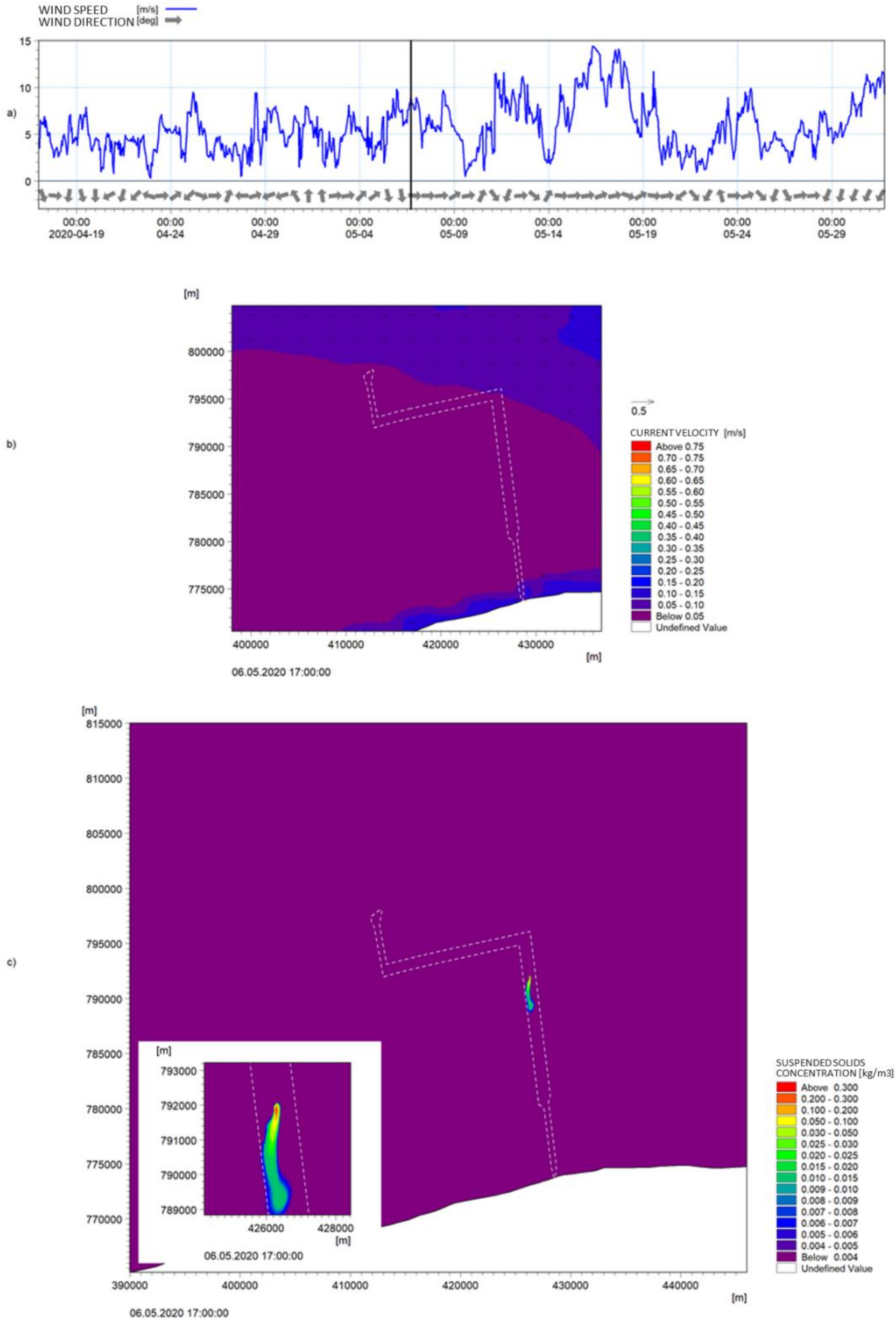
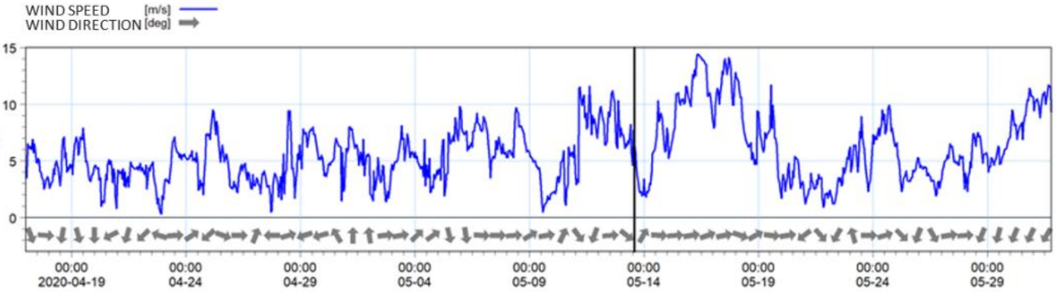
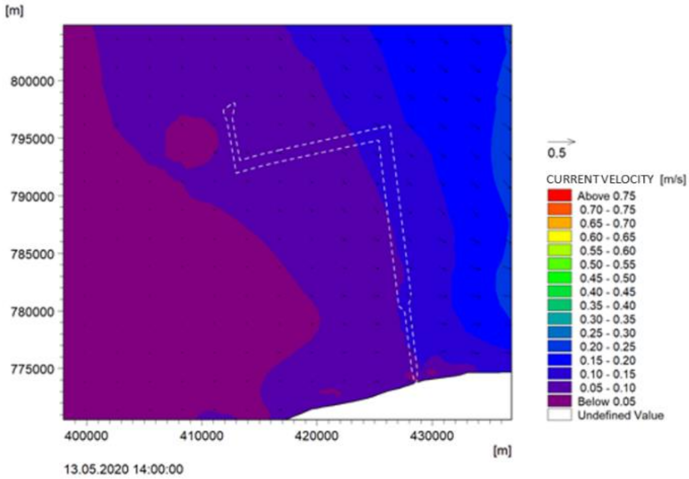


Figure 4.41. Results of the simulation of power cable burial under real hydrodynamic conditions in the time step t1 (sandy sediments) [Source: internal materials]

a)



b)



c)

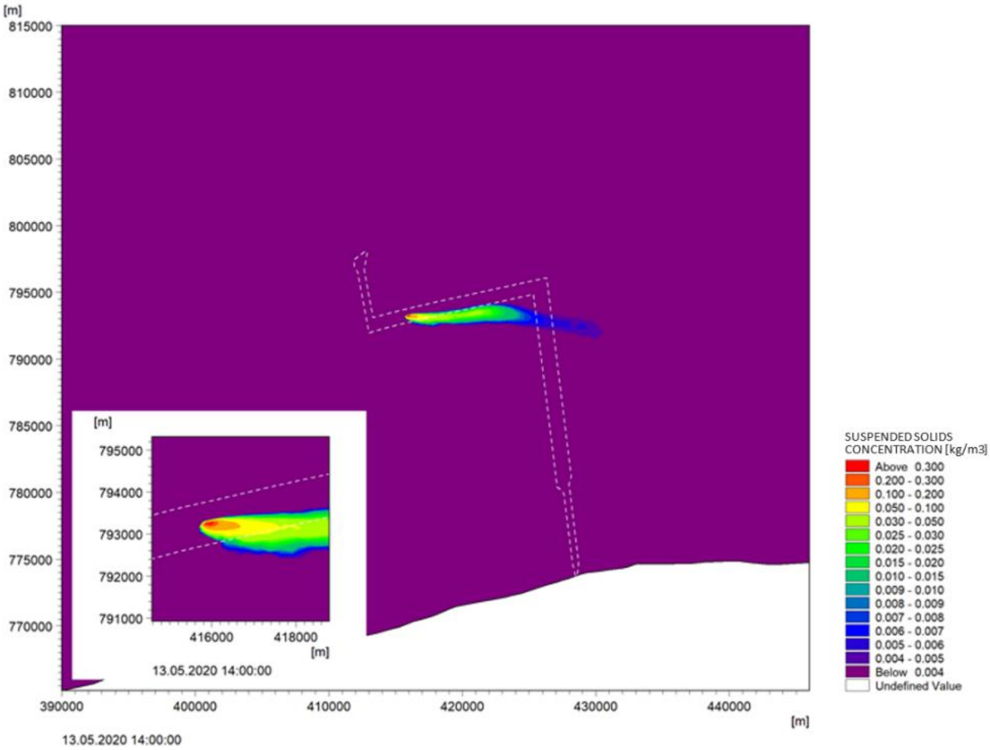


Figure 4.42. Results of the simulation of power cable burial under real hydrodynamic conditions in the time step t2 (cohesive sediments) [Source: internal materials]

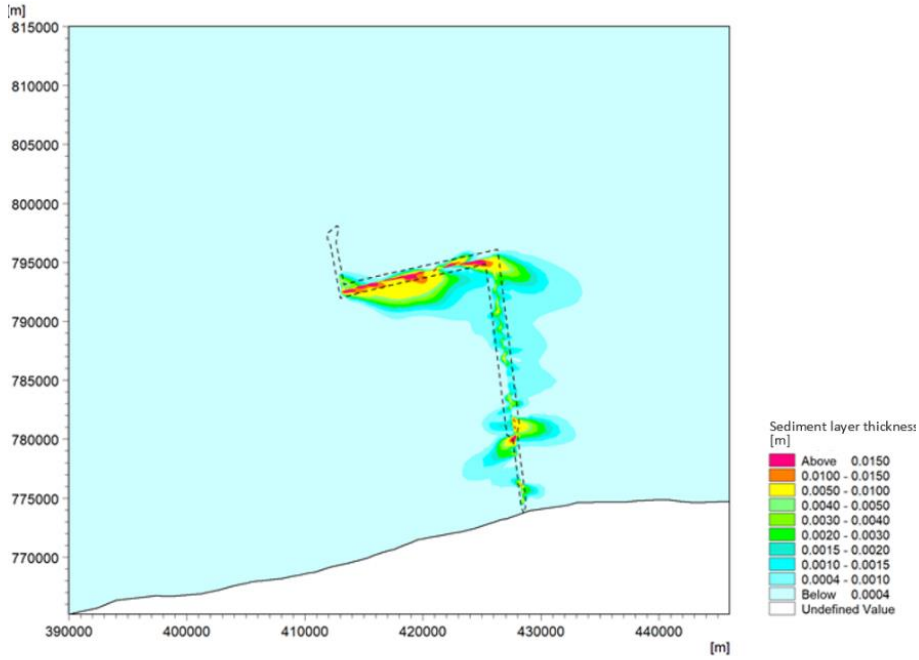


Figure 4.43. Results of the simulation of power cable burial – distribution of the seabed layer thickness after the completion of works along the entire route [Source: internal materials]

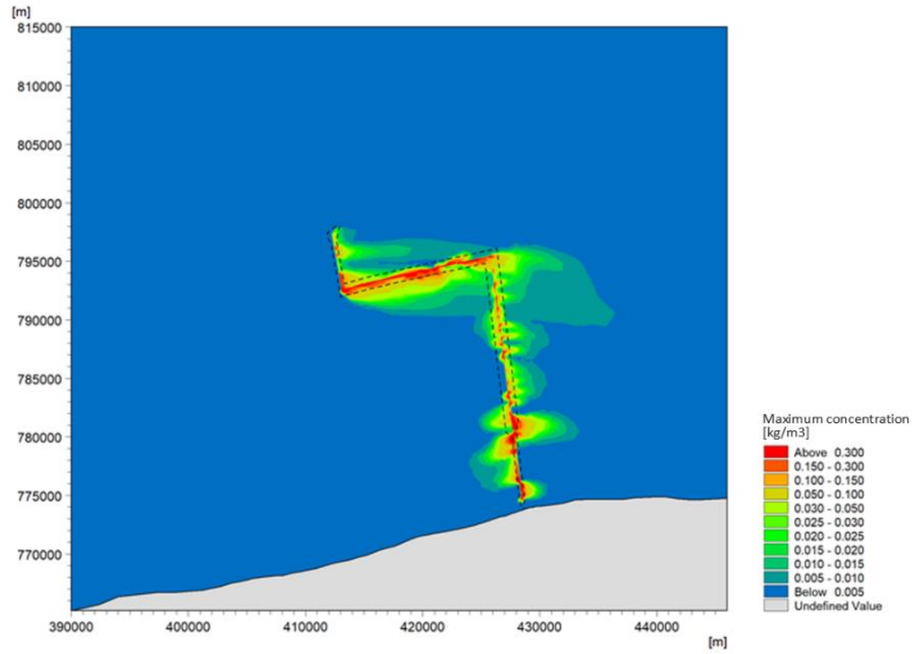


Figure 4.44. Results of the simulation of power cable burial – the maximum, temporary level of suspended solids concentration during works along the entire route [Source: internal materials]

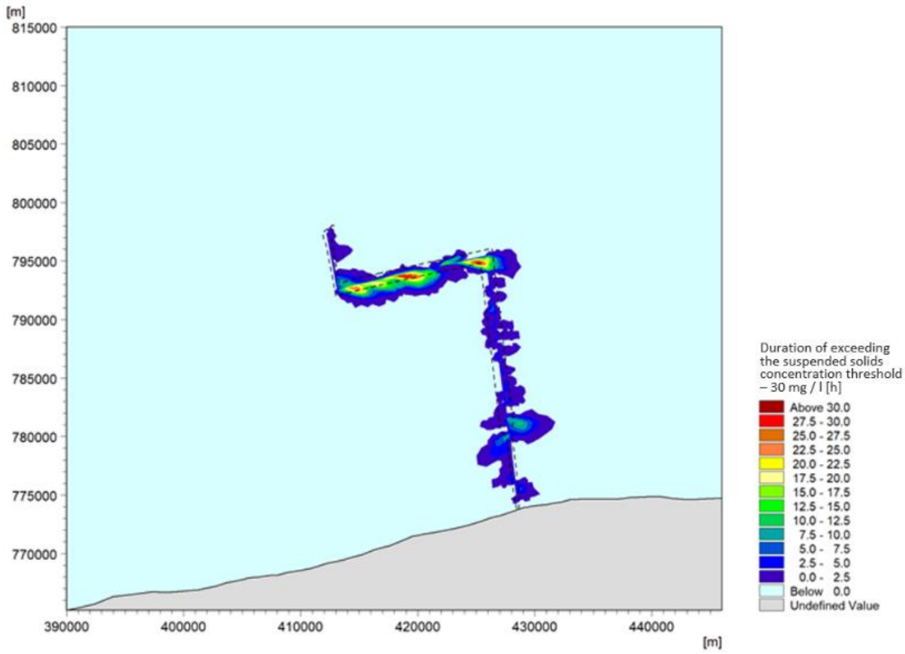


Figure 4.45. Duration of the exceedance of the suspended solids concentration threshold – 30 mg·l^{-1}– along the cable route [Source: internal materials]

4.5.1.2.4 Mass flow excavation at 5 km/day

Below, the results for the cable burial technology of mass flow excavation are presented, with the cable laying vessel moving along the RAV route at a speed of 5 km/day. The calculation results presented correspond to the moments of simulation time: *t1, t2* [Figure 4.46, Figure 4.47].

At moment *t1* (work in sandy sediments), the cloud of suspended solids with concentrations exceeding 100 mg·l^{-1} spreads to a distance of approx. 0.1 km, with concentrations exceeding 30 mg·l^{-1} – to a distance of approx. 1.2 km, and with concentrations exceeding 4 mg·l^{-1} – to approx. 7.5 km.

At moment *t2* (work in cohesive sediments), the cloud of suspended solids with concentrations exceeding 100 mg·l^{-1} spreads to a distance of approx. 2.3 km, with concentrations exceeding 30 mg·l^{-1} – to a distance of approx. 9.5 km, and with concentrations exceeding 4 mg·l^{-1} – to approx. 15 km.

Figure 4.48 presents a map of the thickness distribution of the sediments generated in the process of sedimentation after the completion of a simulation of power cable burial in the seabed. The maximum thickness of a new layer of sediments at the cable corridor boundary does not exceed 17 mm, and a maximum range of the sediment with a thickness of >1 mm to the cable corridor boundary is 4.5 km.

Figure 4.49 presents a map of maximum sediment concentration levels at every point of the calculation area adopted during the entire simulation. Locally, at the cable corridor boundary, momentary concentrations reach a value of 460 mg·l^{-1} for cohesive soils. However, in most of the area where the disturbance occurs, the concentration range is 5–100 mg·l^{-1}.

The maximum values of suspended solids concentration were analysed taking into consideration the duration of such disturbances. The analysis is informed by the result of the calculations presented in Figure 4.50, which illustrates the map of duration distribution of the concentrations exceeding the threshold of 30 mg·l^{-1}. The maximum duration of such a concentration value in the scenario discussed is 23 hours.

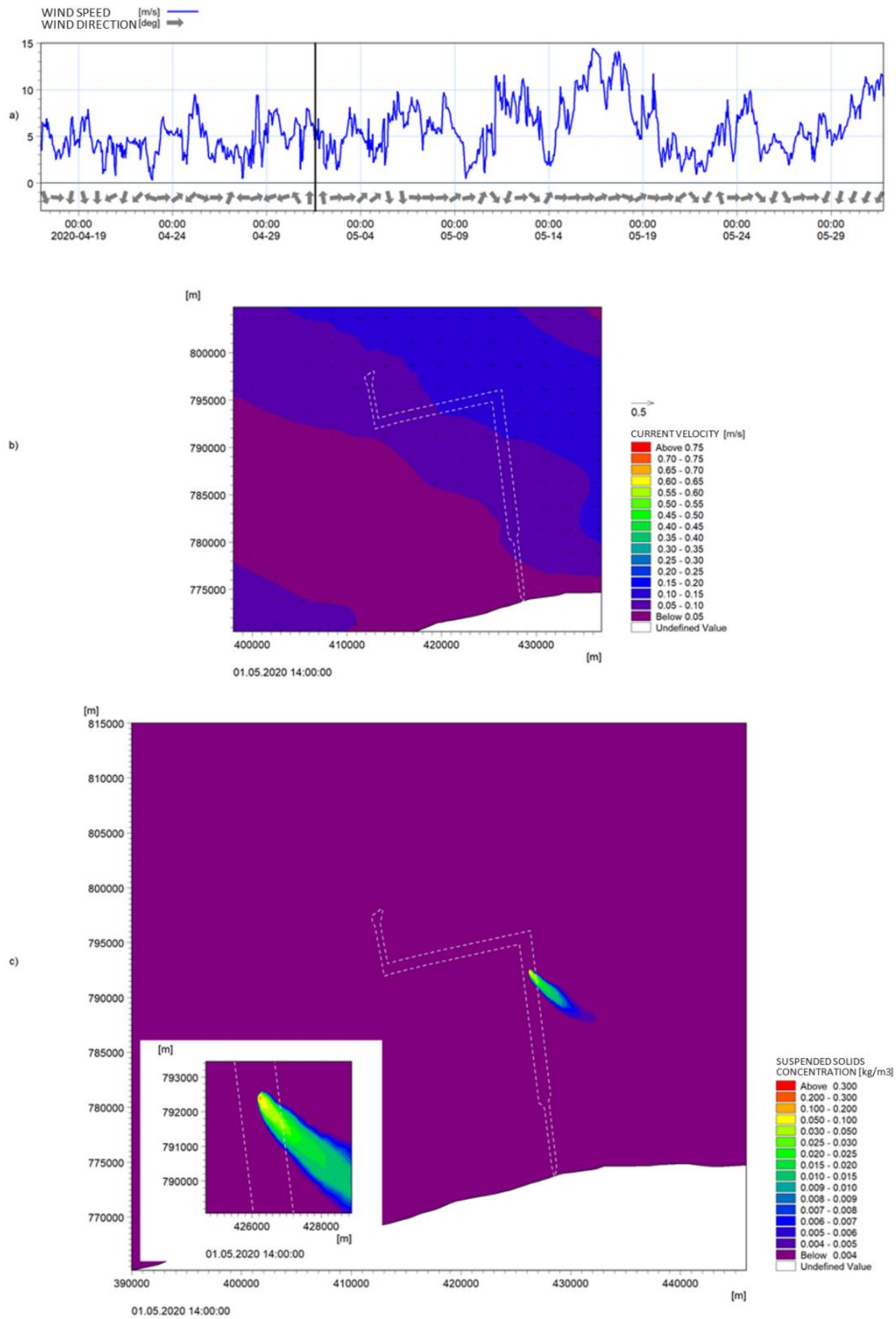


Figure 4.46. Results of the simulation of power cable burial under real hydrodynamic conditions in the time step t1 (sandy sediments) [Source: internal materials]

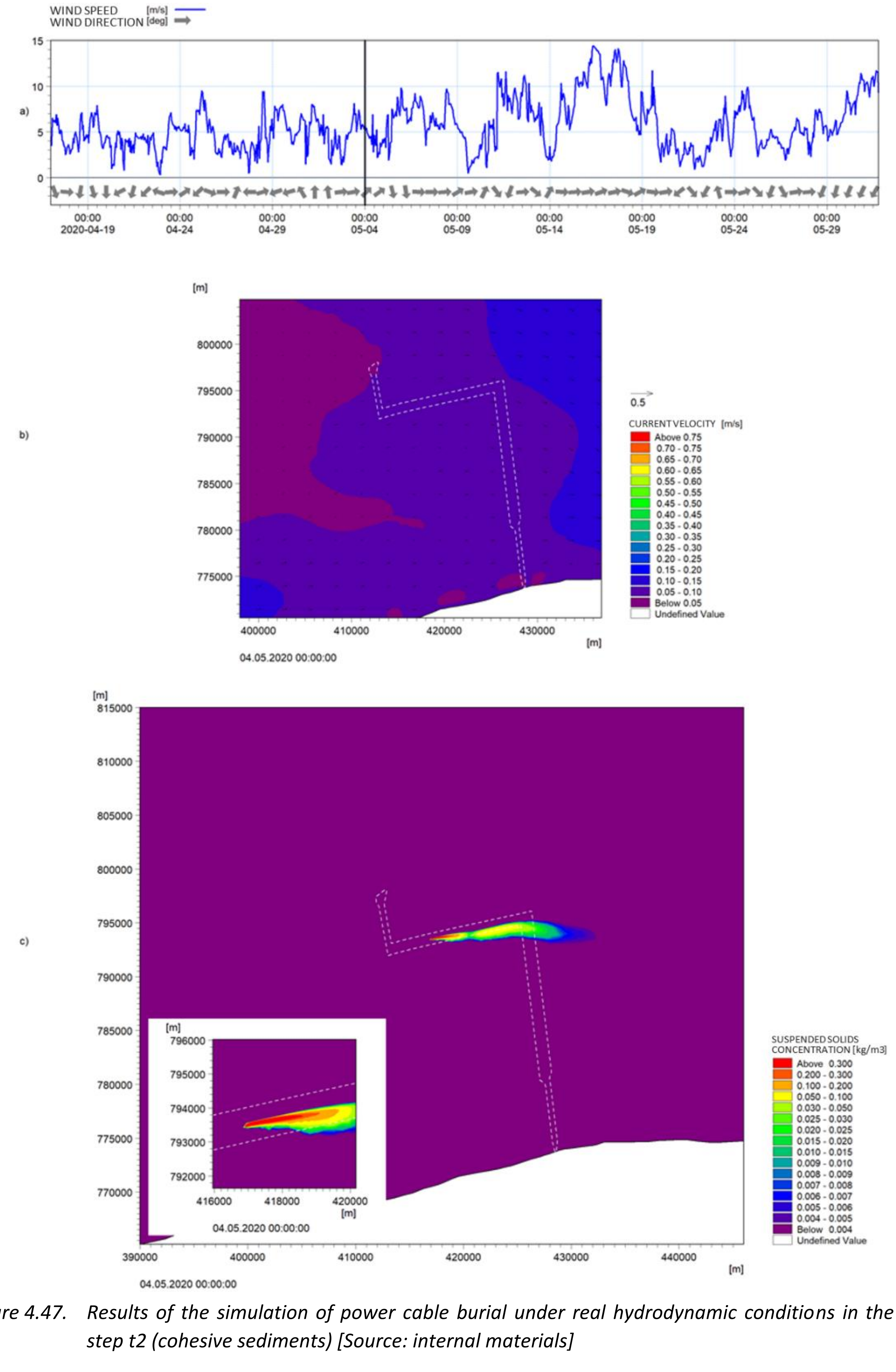


Figure 4.47. Results of the simulation of power cable burial under real hydrodynamic conditions in the time step t2 (cohesive sediments) [Source: internal materials]

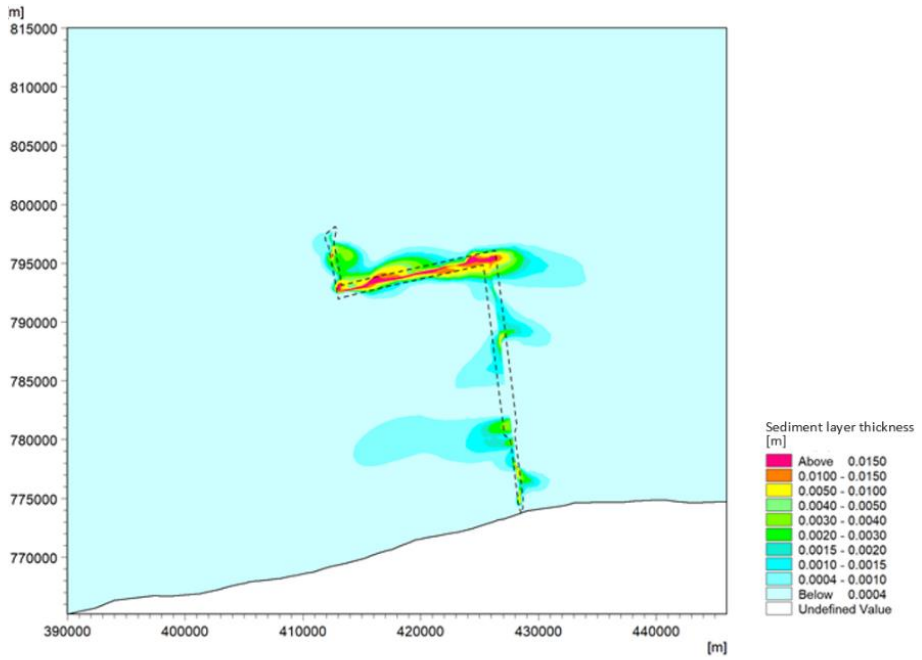


Figure 4.48. Results of the simulation of power cable burial – distribution of the seabed layer thickness after the completion of works along the entire route [Source: internal materials]

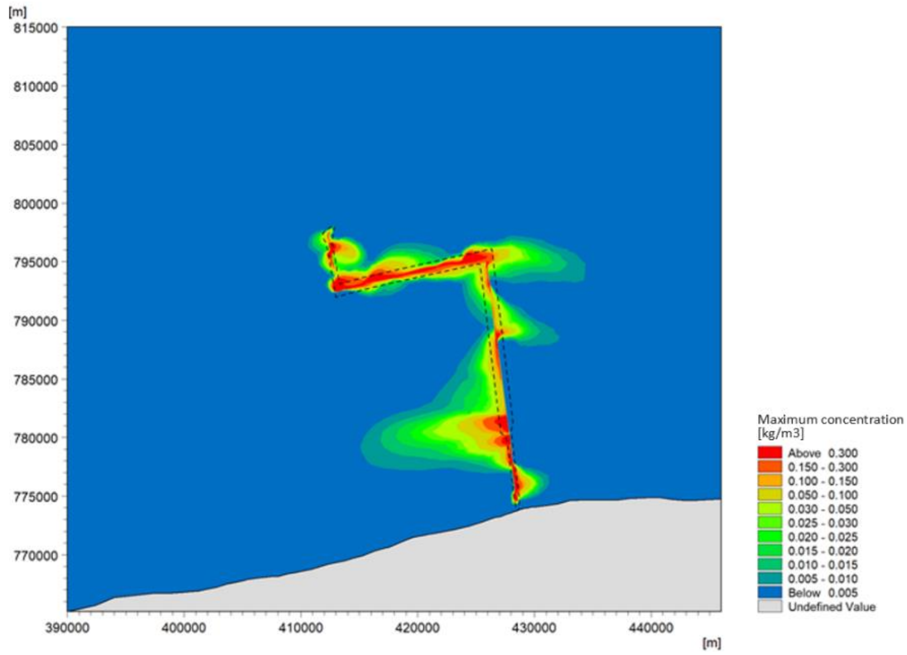


Figure 4.49. Results of the simulation of power cable burial – the maximum, temporary level of suspended solids concentration during works along the entire route [Source: internal materials]

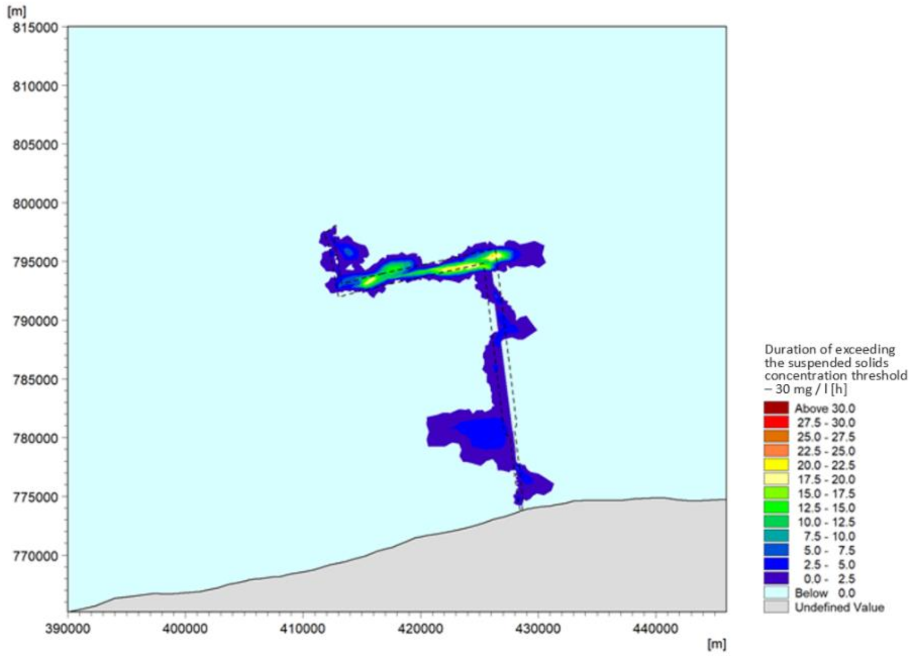


Figure 4.50. Duration of the exceedance of the suspended solids concentration threshold – 30 mg·l^{-1}– along the cable route [Source: internal materials]

4.5.1.3 Cable route – RAV/APV, summer period

4.5.1.3.1 Mass flow excavation at 5 km/day (summer period, RAV route)

Below, the results for the cable burial technology of mass flow excavation are presented, with the cable laying vessel moving along the RAV route at a speed of 5 km/day. The calculation results presented correspond to the moments of simulation time: *t1, t2* [Figure 4.51, Figure 4.52].

At time *t1* (work in sandy sediments), the cloud of suspended solids with concentrations exceeding 100 mg·l^{-1}, spreads to a distance of approx. 0.1 km, and with concentrations exceeding 30 mg·l^{-1} to a distance of approx. 0.5 km, and with concentrations exceeding 4 mg·l^{-1} – approx. 7.5 km.

At moment *t2* (work in cohesive sediments), the cloud of suspended solids with concentrations exceeding 100 mg·l^{-1} spreads to a distance of approx. 3 km, with concentrations exceeding 30 mg·l^{-1} – to a distance of approx. 3.5 km, and with concentrations exceeding 4 mg·l^{-1} – to approx. 9.5 km.

Figure 4.53 presents a map of the thickness distribution of the sediments generated in the process of sedimentation after the completion of a simulation of power cable burial in the seabed. The maximum thickness of a new layer of sediments at the cable corridor boundary does not exceed 15 mm, while the maximum range of the sediment with a thickness of >1 mm to the cable corridor boundary is 4 km.

Figure 4.54 presents a map of maximum sediment concentration levels at every point of the calculation area adopted during the entire simulation. Locally, at the cable corridor boundary, the momentary concentrations reach a value of 500 mg·l^{-1} for cohesive soils. However, in most of the area where the disturbance occurs, the concentration range is 5–150 mg·l^{-1}.

The maximum values of suspended solids concentration were analysed taking into consideration the duration of such disturbances. The analysis is informed by the result of the calculations presented in Figure 4.55, which illustrates the map of duration distribution of the concentrations exceeding the threshold of 30 mg·l^{-1}. The maximum duration of such a concentration value in the scenario discussed is 17 hours.

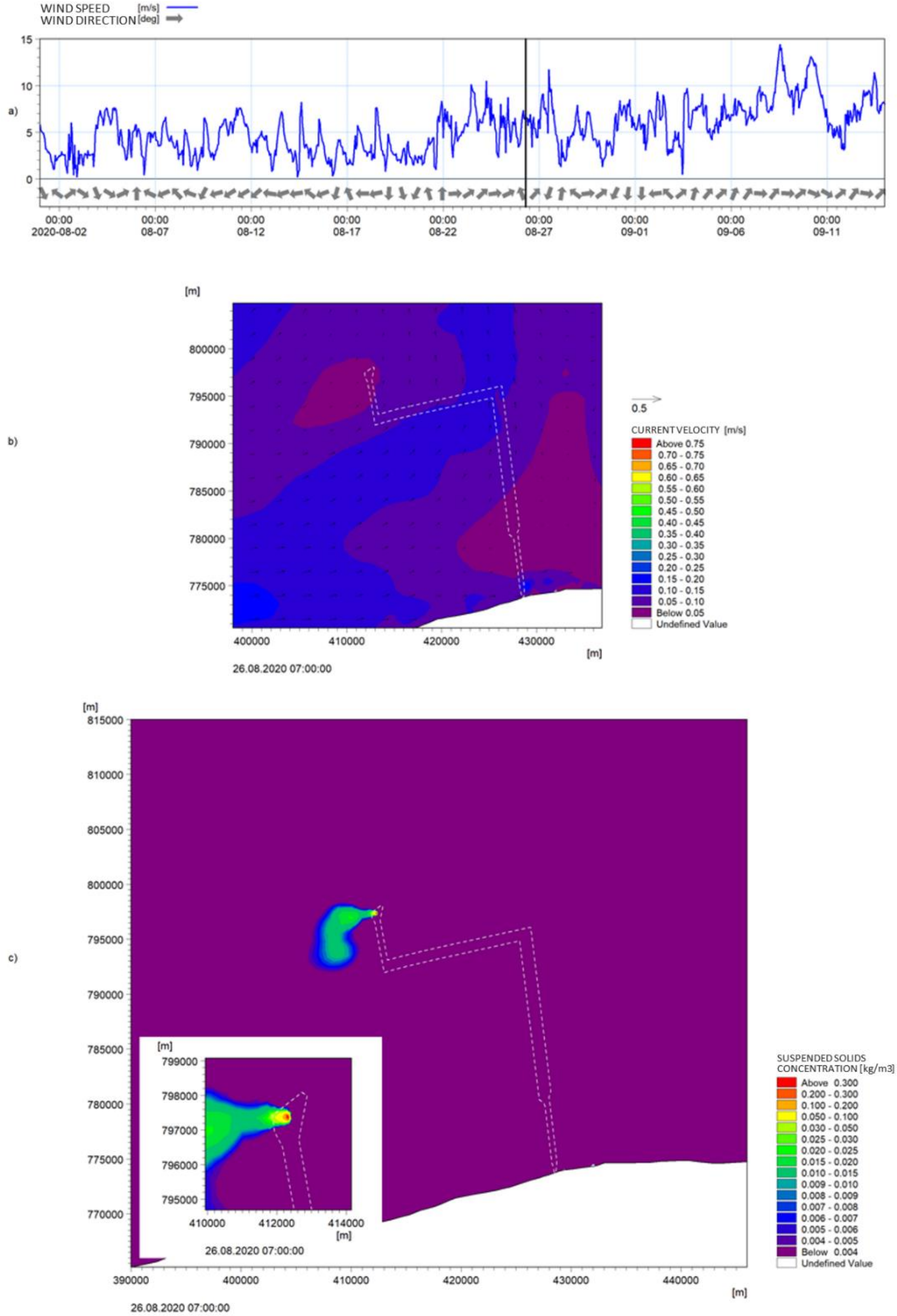


Figure 4.51. Results of the simulation of power cable burial under real hydrodynamic conditions in the time step t1 (sandy sediments) [Source: internal materials]

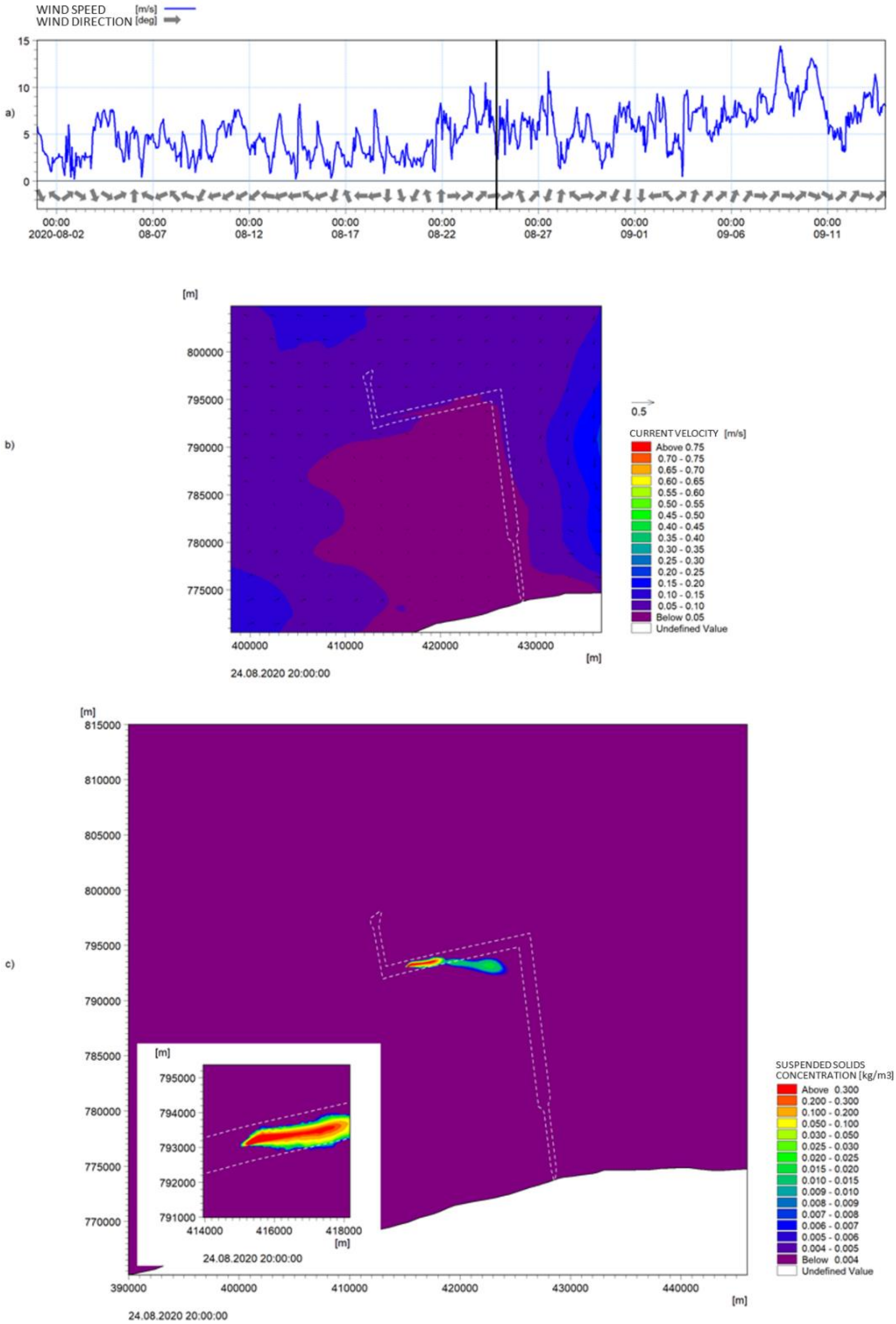


Figure 4.52. Results of the simulation of power cable burial under real hydrodynamic conditions in the time step t2 (cohesive sediments) [Source: internal materials]

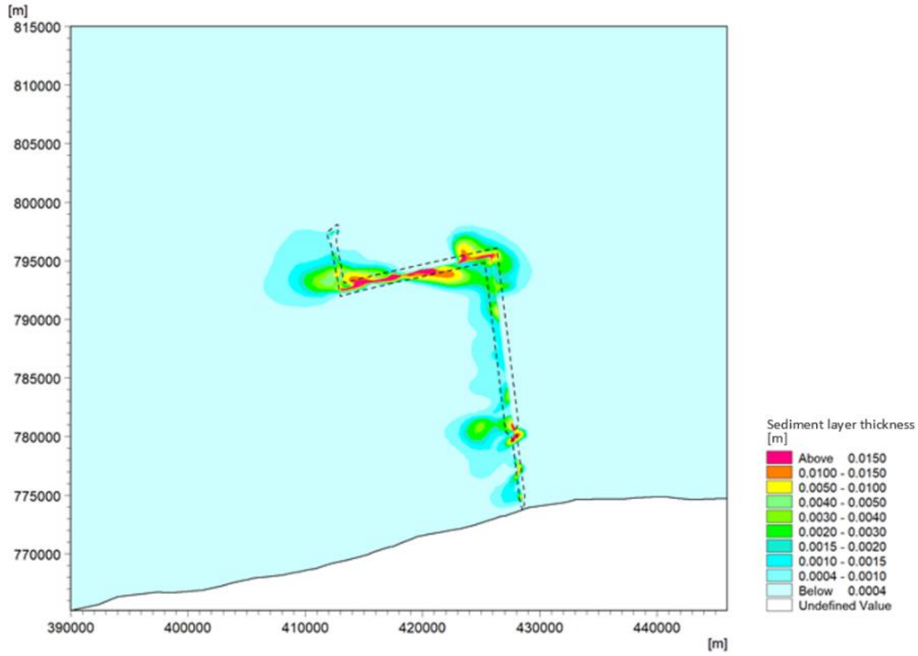


Figure 4.53. Results of the simulation of power cable burial – distribution of the seabed layer thickness after the completion of works along the entire route [Source: internal materials]

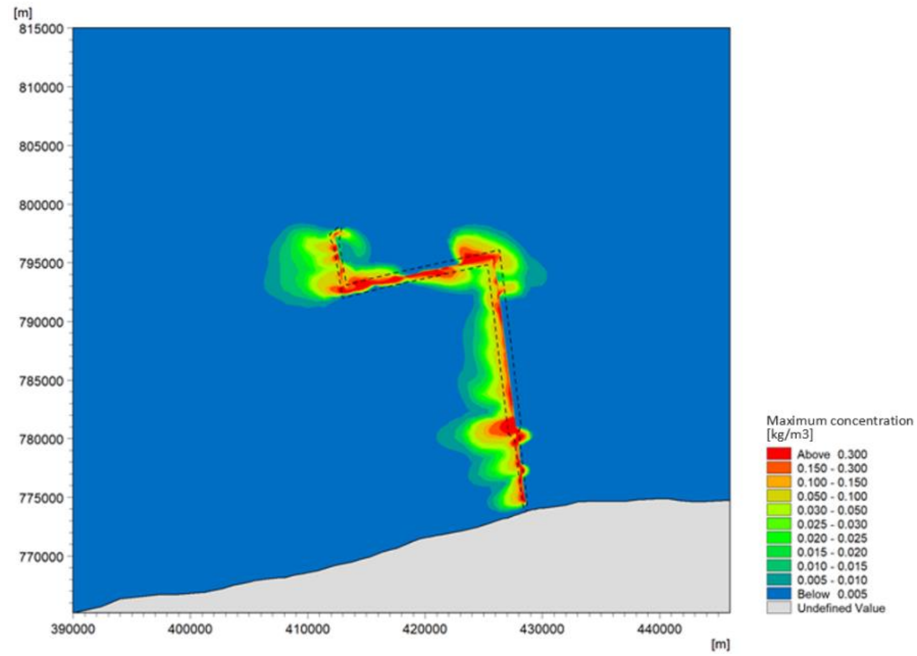


Figure 4.54. Results of the simulation of power cable burial – the maximum, temporary level of suspended solids concentration during works along the entire route [Source: internal materials]

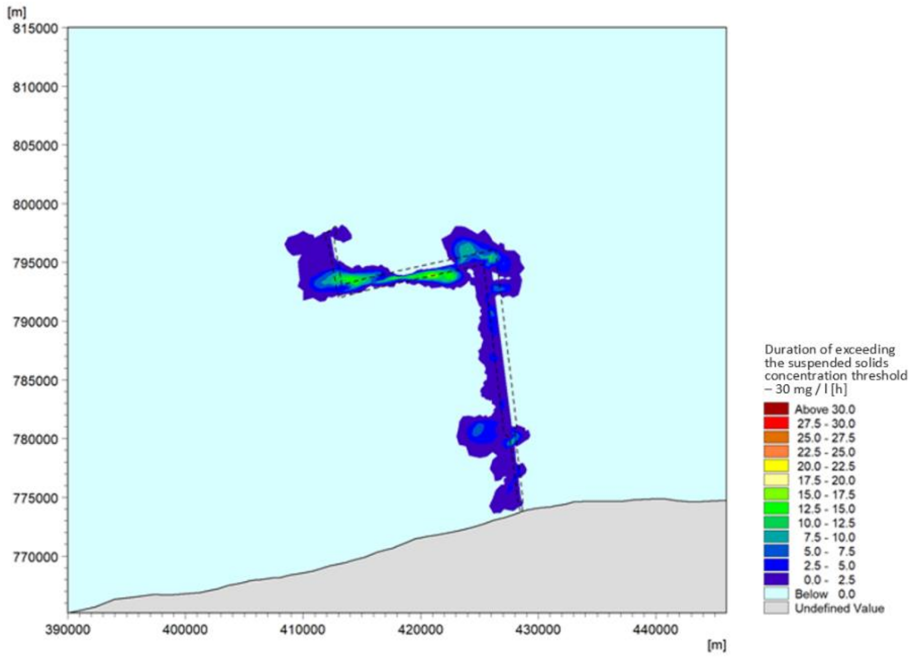


Figure 4.55. Duration of the exceedance of the suspended solids concentration threshold – 30 mg·l^{-1}– along the cable route [Source: internal materials]

4.5.1.3.2 Mass flow excavation at 5 km/day (summer period, APV route)

Below, the results for the cable burial technology of mass flow excavation are presented, with the cable laying vessel moving along the APV route at a speed of 5 km/day. The calculation results presented correspond to the moments of simulation time: *t1, t2* [Figure 4.56, Figure 4.57].

At moment *t1* (work in sandy sediments), the cloud of suspended solids with concentrations exceeding 100 mg·l^{-1} spreads to a distance of approx. 0.3 km, with concentrations exceeding 30 mg·/l^{-1} – to a distance of approx. 1.5 km, and with concentrations exceeding 4 mg·l^{-1} – to approx. 6.5 km.

At moment *t2* (work in cohesive sediments), the cloud of suspended solids with concentrations exceeding 100 mg·l^{-1} spreads to a distance of approx. 3 km, with concentrations exceeding 30 mg·l^{-1} – to a distance of approx. 4 km, and with concentrations exceeding 4 mg·l^{-1} – to approx. 10.5 km.

Figure 4.58 presents a map of the thickness distribution of the sediments generated in the process of sedimentation after the completion of a simulation of power cable burial in the seabed. The maximum thickness of a new layer of sediments at the cable corridor boundary does not exceed 23 mm, while the maximum range of the sediment with a thickness of >1 mm to the cable corridor boundary is 3.7 km.

Figure 4.59 presents a map of maximum sediment concentration levels at every point of the calculation area adopted during the entire simulation. Locally, at the cable corridor boundary, the momentary concentrations reach a value of 500 mg·l^{-1} for cohesive soils. However, in most of the area where the disturbance occurs, the concentration range is 5–150 mg·l^{-1}.

The maximum values of suspended solids concentration were analysed taking into consideration the duration of such disturbances. The analysis is informed by the result of calculations presented in Figure 4.60, which illustrates the map of duration distribution of the concentrations exceeding the threshold of 30 mg·l^{-1}. The maximum duration of such a concentration value in the scenario discussed is 30 hours.

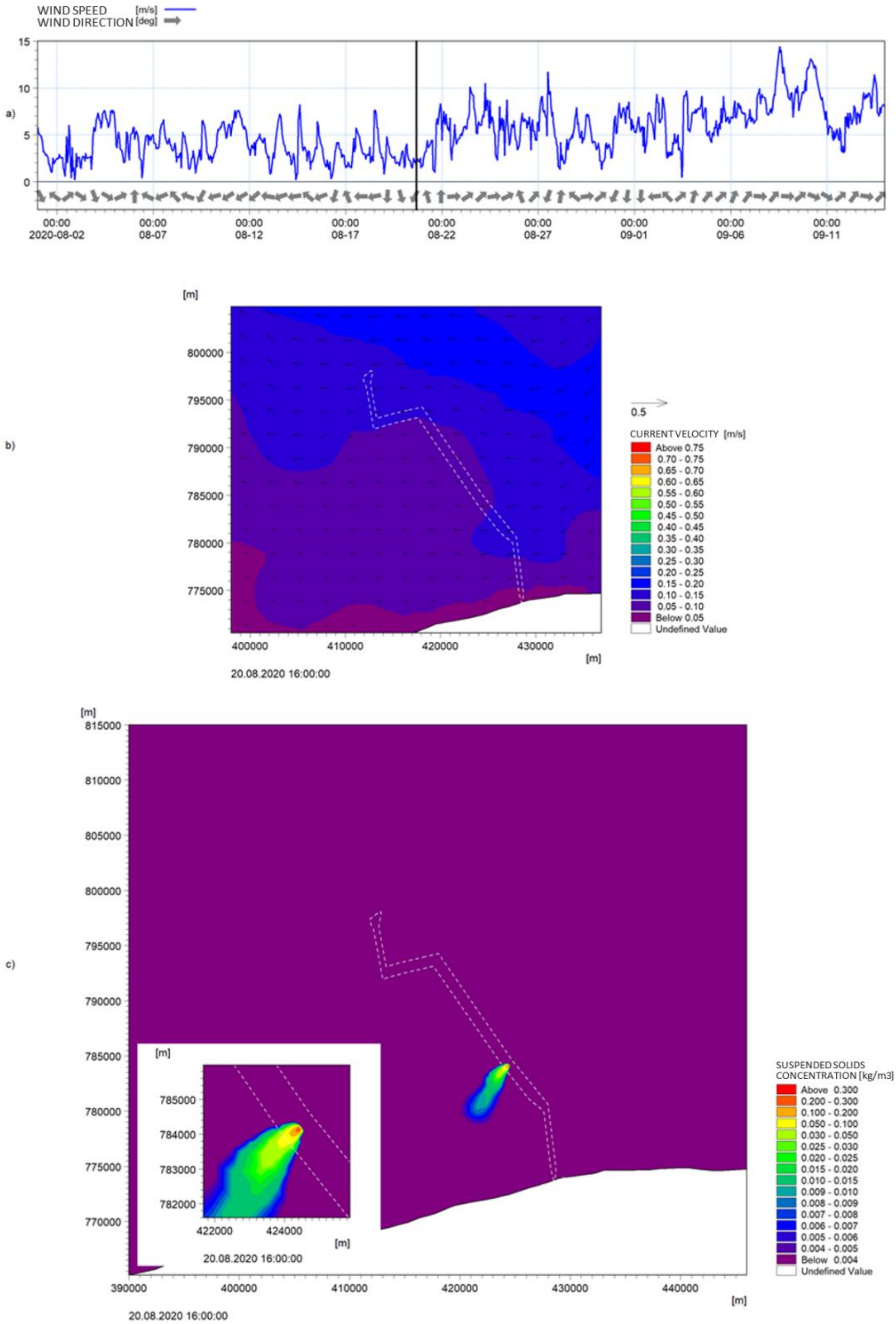


Figure 4.56. Results of the simulation of power cable burial under real hydrodynamic conditions in the time step t1 (sandy sediments) [Source: internal materials]

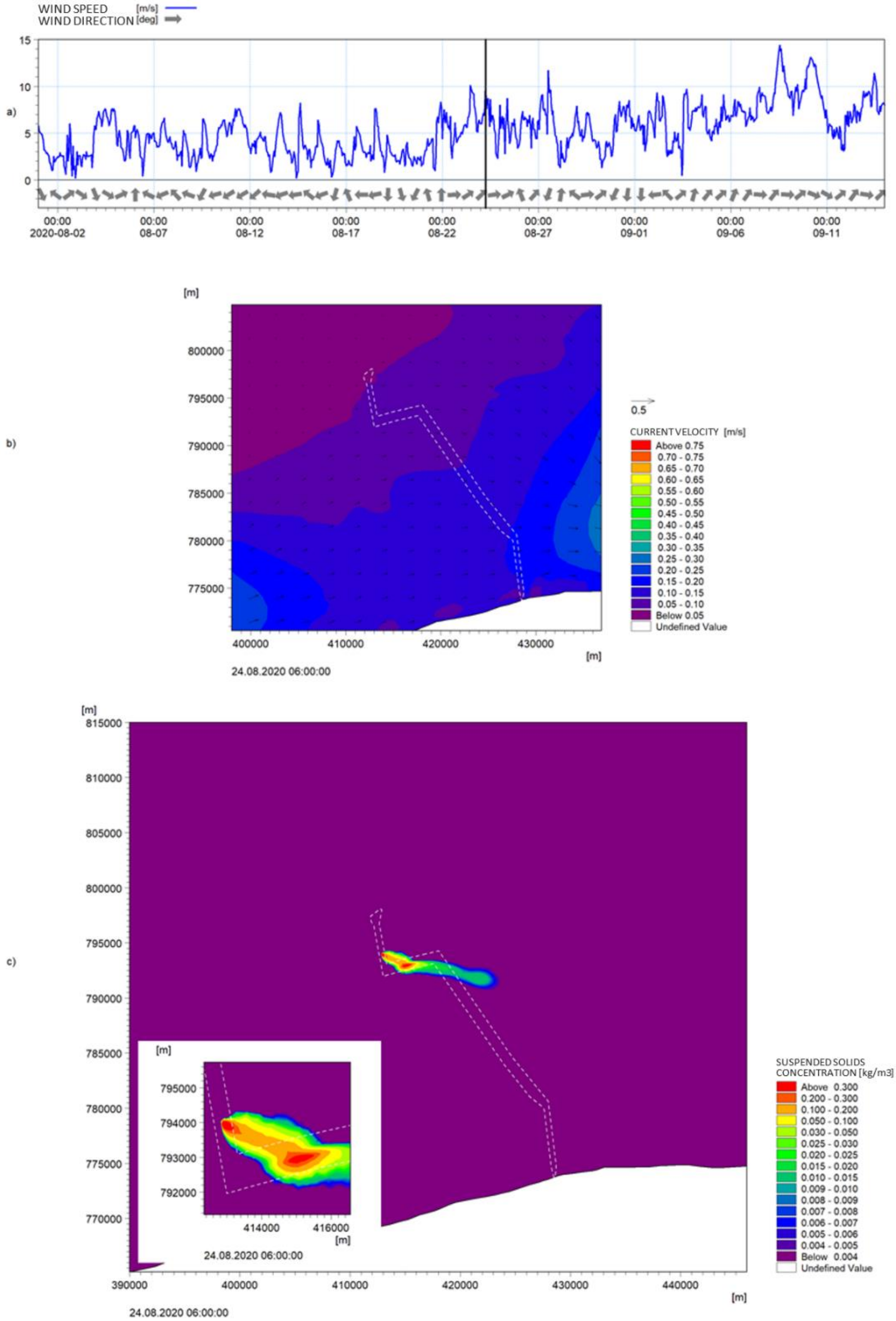


Figure 4.57. Results of the simulation of power cable burial under real hydrodynamic conditions in the time step t2 (cohesive sediments) [Source: internal materials]

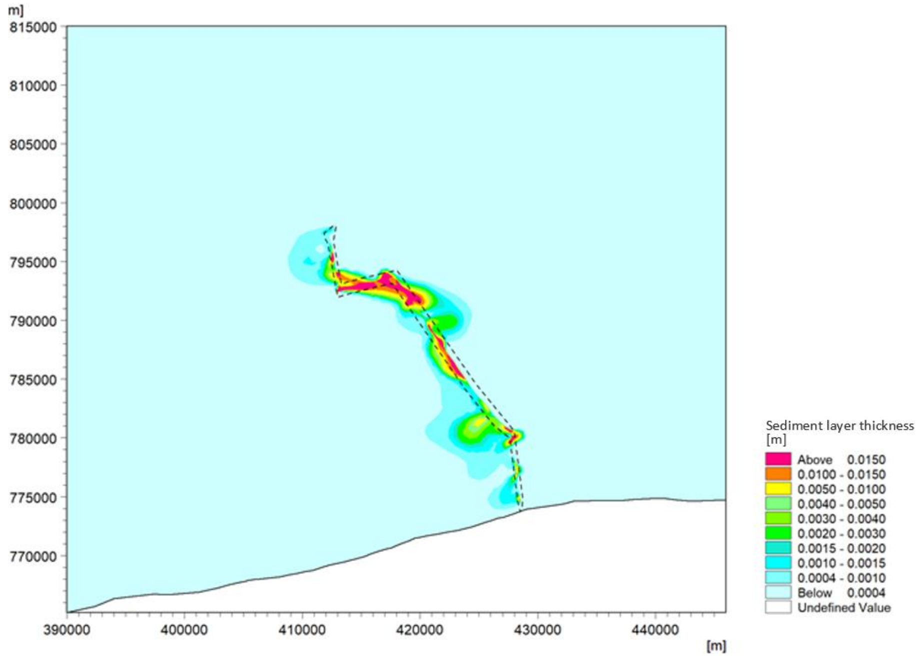


Figure 4.58. Results of the simulation of power cable burial – distribution of the seabed layer thickness after the completion of works along the entire route [Source: internal materials]

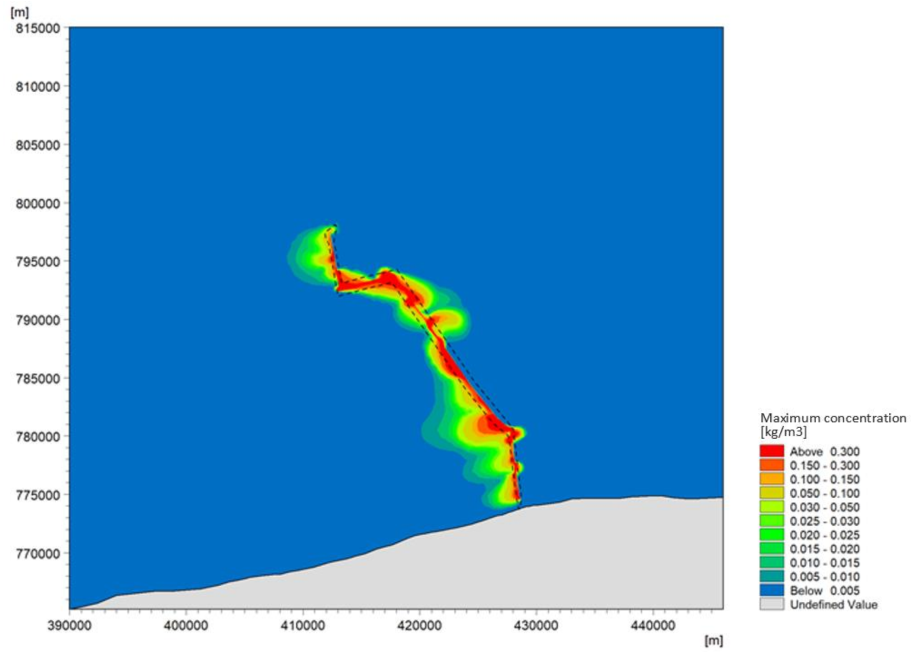


Figure 4.59. Results of the simulation of power cable burial – the maximum, temporary level of suspended solids concentration during works along the entire route [Source: internal materials]

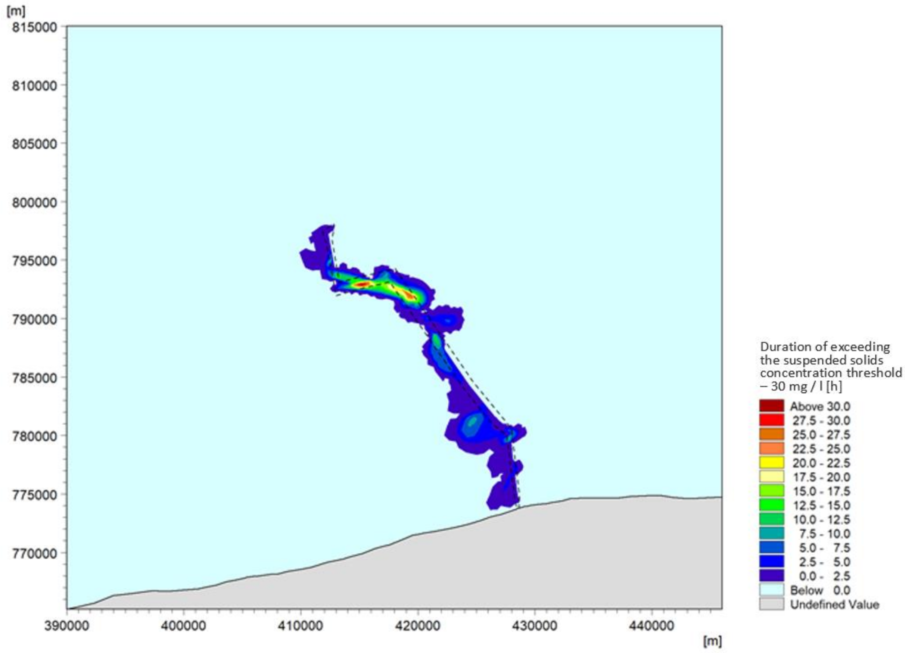


Figure 4.60. Duration of the exceedance of the suspended solids concentration threshold – 30 mg·l^{-1}– along the cable route [Source: internal materials]

4.5.2 Summary and conclusions

To conduct the calculations of suspended solids generation and the mode of their propagation during power cable laying and burial in the seabed, numerical models were created using the MIKE21 software package. The model enabled conducting calculation simulations according to the following scenarios:

- based on the BP OWF CI cable route adopted:
  - Applicant Proposed Variant (APV),
  - Rational Alternative Variant (RAV);
- based on the technology of subsea cable burial in the seabed:
  - construction phase: jetting method with soil displacement, two speeds of the cable laying vessel: 2 km/day and 5 km/day (~85 m·h^{-1} and ~210 m·h^{-1}, respectively), forcings: sea currents, wind,
  - operation phase: mass flow excavation method, two speeds of the cable laying vessel: 2 km/day and 5 km/day (~85 m·h^{-1} and ~210 m·h^{-1}, respectively), forcings: sea currents, wind;
- based on the environmental conditions:
  - spring period – predominance of winds from the W–N sector,
  - summer period – varied wind directions.

Various soil conditions along the cable route were considered as part of the analysis of both technologies, which could have been implemented to the model thanks to the preliminary geophysical identification of the designed BP OWF CI routes. Such an identification enabled the identification of route sections with non-cohesive and cohesive soils.

Performing all the planned simulations produced the following results:

- for the APV route, the scope of disturbance for the jetting method assumes the following values:
  - in non-cohesive (sandy) soils: the largest size of the suspended solids cloud with a concentration of 30 $mg \cdot l^{-1}$ → approx. 0.2 km from the cable route; the largest distance at which the suspended solids concentration drops below 4 $mg \cdot l^{-1}$ → approx. 2.2 km from the cable route,
  - in cohesive soils: the largest size of the suspended solids cloud with a concentration exceeding 100 $mg \cdot l^{-1}$ → approx. 0.3 km from the cable route, more than 30 $mg \cdot l^{-1}$ → approx. 1.2 km from the cable route; the largest distance at which the suspended solids concentration drops below 4 $mg \cdot l^{-1}$ → approx. 11.5 km from the cable route,
  - the thickness of sediments generated from the suspended solids sedimentation in the prevailing area of disturbance does not exceed 1 mm, only locally in the close vicinity of the cable, in the conditions of the current stagnation it can reach up to 4.3 mm,
  - the prevailing part of the sea area with suspended solids, outside the route corridor, is characterised by a suspended solids concentration of 5–50 $mg \cdot l^{-1}$,
  - suspended solids concentration exceeding 30 $mg \cdot l^{-1}$ lasts shorter than 16 hours;
- for the RAV route, the scope of disturbance for the jetting method assumes the following values:
  - in non-cohesive (sandy) soils: the largest size of the suspended solids cloud with a concentration exceeding 30 $mg \cdot l^{-1}$ → approx. 0.5 km from the cable route; the largest distance at which the suspended solids concentration drops below 4 $mg \cdot l^{-1}$ → approx. 6 km from the cable route,
  - in cohesive soils: the largest size of the suspended solids cloud with a concentration exceeding 100 $mg \cdot l^{-1}$ → approx. 0.3 km from the cable route, more than 30 $mg \cdot l^{-1}$ → approx. 1.3 km from the cable route; the largest distance at which the suspended solids concentration drops below 4 $mg \cdot l^{-1}$ → approx. 9 km from the cable route,
  - the thickness of sediments generated from the suspended solids sedimentation in the prevailing area of disturbance does not exceed 1 mm, only locally in the close vicinity of the cable, in the conditions of the current stagnation it reaches up to 3 mm,
  - the prevailing part of the sea area with suspended solids, outside the route corridor, is characterised by a concentration of 5–50 $mg \cdot l^{-1}$,
  - suspended solids concentration exceeding 30 $mg \cdot l^{-1}$ lasts shorter than 11 hours;
- for the APV route, the scope of disturbance for the mass flow excavation method assumes the following values:
  - in non-cohesive (sandy) soils: the largest size of the suspended solids cloud with a concentration exceeding 100 $mg \cdot l^{-1}$ → approx. 0.3 km from the cable route, more than 30 $mg \cdot l^{-1}$ → approx. 1.5 km from the cable route; the largest distance at which the suspended solids concentration drops below 4 $mg \cdot l^{-1}$ → approx. 7.5 km from the cable route,
  - in cohesive soils: the largest size of the suspended solids cloud with a concentration exceeding 100 $mg \cdot l^{-1}$ → approx. 3 km from the cable route, more than 30 $mg \cdot l^{-1}$ → approx. 8.5 km from the cable route; the largest distance at which the suspended solids concentration drops below 4 $mg \cdot l^{-1}$ → approx. 18.5 km from the cable route,

   - the thickness of sediments generated from the suspended solids sedimentation in the prevailing area of disturbance does not exceed 5 mm, only locally in the close vicinity of the cable, in the conditions of the current stagnation it can reach up to 26 mm,
   - the prevailing part of the sea area with suspended solids, outside the route corridor, is characterised by a concentration of 5–150 mg·l^{-1},
   - suspended solids concentration exceeding 30 mg·l^{-1} lasts shorter than 30 hours;

- for the RAV route, the scope of disturbance for the mass flow excavation method assumes the following values:

   - in non-cohesive (sandy) soils: the largest size of the suspended solids cloud with a concentration exceeding 100 mg·l^{-1} → approx. 0.1 km from the cable route, more than 30 mg·l^{-1} → approx. 1.2 km from the cable route; the largest distance at which the suspended solids concentration drops below 4 mg·l^{-1} → approx. 7.5 km from the cable route,
   - in cohesive: soils: the largest size of the suspended solids cloud with a concentration exceeding 100 mg·l^{-1} → approx. 3 km from the cable route, more than 30 mg·l^{-1} → approx. 9.5 km from the cable route; the largest distance at which the suspended solids concentration drops below 4 mg·l^{-1} → approx. 15 km from the cable route,
   - the thickness of sediments generated from the suspended solids sedimentation in the prevailing area of disturbance does not exceed 5 mm, only locally in the close vicinity of the cable, in the conditions of the current stagnation it can reach up to 20 mm,
   - the prevailing part of the sea area with suspended solids, outside the route corridor, is characterised by a suspended solids concentration of 5–150 mg·l^{-1},
   - suspended solids concentration exceeding 30 mg·l^{-1} lasts shorter than 30 hours.

The parameters of the environment disturbance calculated for the numerical simulations conducted are presented in tabular compilations. Table 4.2 presents the ranges of suspended solids concentrations during underwater works carried out in non-cohesive (sandy) soils, whereas Table 4.3 contains the same type of information but for cohesive soils. The tables contain all analysed scenarios from the spring period as well as those from the summer period in which the disturbance parameter value was higher than in the summer.

In Poland, there are no standards nor recommendations concerning the interpretation of the suspended solids concentration in the marine environment, therefore, several concentration thresholds were selected according to the following pattern:

- 4 mg·l^{-1} – is the suspended solids background recorded under normal environmental conditions;
- 10 mg·l^{-1} – concentration insignificant to the environment;
- 30 mg·l^{-1} – the suspended solids concentration most commonly presented in the Danish, German recommendations, treated as permissible both for commercial and recreational areas;
- 100 mg·l^{-1} – the level of visible water turbidity (however, higher concentrations may occur in the storm and post-storm periods).

Table 4.2. Concentration ranges for all the methods of cable burial in non-cohesive soils [Source: internal materials]

Method **Non-cohesive soil**	**Concentration range above 4 mg·l^{-1} [km]**	**Concentration range above 10 mg·l^{-1} [km]**	**Concentration range above 30 mg·l^{-1} [km]**	**Concentration range above 100 mg·l^{-1} [km]**
Jetting technology – 2 km/day (RAV)	2.2	0.9	0.1	-
Jetting technology – 5 km/day (RAV)	6.0	5.5	0.5	-
MFE technology – 2 km/day (RAV)	3.3	3.0	0.9	0.3
MFE technology – 5 km/day (RAV)	7.5	4.0	1.2	0.1
Jetting technology – 2 km/day (APV)	1.5	0.5	0.2	-
Jetting technology – 5 km/day (APV)	2.2	0.9	0.2	-
MFE technology – 2 km/day (APV)	5.1	1.5	0.4	-
MFE technology – 5 km/day (APV)	7.2	6.8	2.0	0.7
MFE technology – 5 km/day (RAV) – summer period	7.5	6.0	0.5	0.1
MFE technology – 5 km/day (APV) – summer period	6.5	4.0	1.5	0.3

Table 4.3. Concentration ranges for all the methods of cable burial in cohesive soils [Source: internal materials]

Method **Cohesive soil**	**Concentration range above 4 mg·l^{-1} [km]**	**Concentration range above 10 mg·l^{-1} [km]**	**Concentration range above 30 mg·l^{-1} [km]**	**Concentration range above 100 mg·l^{-1} [km]**
Jetting technology – 2 km/day (RAV)	6.0	1.5	0.3	-
Jetting technology – 5 km/day (RAV)	9.0	7.0	1.3	0.3
MFE technology – 2 km/day (RAV)	14.5	8.0	5.5	0.8
MFE technology – 5 km/day (RAV)	15.0	11.5	9.5	2.3
Jetting technology – 2 km/day (APV)	5.0	1.1	0.4	-
Jetting technology – 5 km/day (APV)	11.5	7.3	1.2	0.3
MFE technology – 2 km/day (APV)	12.5	9.0	2.5	0.8
MFE technology – 5 km/day (APV)	18.5	14.5	8.5	0.2
MFE technology – 5 km/day (RAV) – summer period	9.5	8.5	3.5	3.0
MFE technology – 5 km/day (APV) – summer period	10.5	9.5	4.0	3.0

Table 4.4. Sediment thickness, maximum concentrations and durations of disturbances during cable lying [Source: internal materials]

Method	**Maximum distance of the 1 mm sediment layer from the BP OWF CI corridor boundary [km]**	**Maximum thickness at the BP OWF CI corridor boundary [mm]**	**Highest, momentary concentration at the BP OWF CI corridor boundary [mg·l^{-1}]**	**Concentration range in the prevailing area with disturbances [mg·l^{-1}]**	**Maximum duration of disturbances >30 mg·l^{-1} [h]**
Jetting technology – 2 km/day (RAV)	1.1	2.5	30	5–30	11
Jetting technology – 5 km/day (RAV)	1.0	3.0	80	5–50	11
MFE technology – 2 km/day (RAV)	4.1	20	220	5–80	30
MFE technology – 5 km/day (RAV)	4.5	17	460	5–100	23
Jetting technology – 2 km/day (APV)	1.4	4.3	110	5–50	16
Jetting technology – 5 km/day (APV)	2.8	3.7	150	5–50	9
MFE technology – 2 km/day (APV)	5.8	26	>500	5–100	24
MFE technology – 5 km/day (APV)	8.0	22	>500	5–120	29
MFE technology – 5 km/day (RAV) – summer period	4.0	15	>500	5–150	17
MFE technology – 5 km/day (APV) – summer period	3.7	23	>500	5–150	30

Table 4.4 presents the remaining parameters of the marine environment disturbance caused by cable burial in the seabed. They include the thickness of the newly-formed sediment as a result of the suspended solids sedimentation process. The maximum distances up to which the sediment layer with a thickness exceeding 1 mm can reach from the location of works as well as the highest thickness calculated at the BP OWF CI boundary are presented. Moreover, the table contains information on the suspended solids concentration – the maximum momentary concentrations at the boundary of the BP OWF CI area as well as the ranges of concentrations in the prevailing part of the sea area with disturbances. The last column presents the maximum duration of a disturbance, defined as the exceedance of a 30 mg·l^{-1} concentration. All the values presented in the table refer to the burial of a single cable. Based on the residence time of the suspended solids in the water column, it can be concluded that the suspended solids disturbed by the burial process of a single cable will undergo sedimentation on the seabed by the time the burial of the next cable is commenced. On the other hand, the thickness of the sediment on the seabed will accumulate, but with interruptions between the deposition of successive layers.

The main objective of the calculations was to conduct numerical simulations for these methods of cable laying and burial, which cause the greatest disturbance in the marine environment, i.e. the jetting method and the mass flow excavation method. The analysis of the calculation results leads to the following conclusions:

- the momentary maximum concentrations of suspended solids, which locally reach up to 200 $mg \cdot l^{-1}$ for the jetting method with soil displacement and exceed 500 $mg \cdot l^{-1}$ for the mass flow excavation method, are definitely higher than the natural concentrations occurring in the survey area. The duration of concentrations higher than 100 $mg \cdot l^{-1}$ is short-term, not exceeding 16 hours for the former method and 30 hours for the latter method. Moreover, such high concentration values are limited spatially to the direct vicinity of the cable route;
- the increase in the speed of cable laying vessels increases the concentration and the suspended solids scope of impact. Speed is a factor that enables controlling, to a certain extent, the disturbing effects of suspended solids on the environment;
- the calculated duration of the deteriorated environmental conditions caused by cable burial (exceedance of the defined suspended solids concentrations) are short-term, and such impacts should also be considered short-term;
- the thickness of the newly-formed sediment layers for the jetting method in the area adjacent to the BP OWF CI area may reach up to 4.5 mm, and the range in which thickness exceeds 1 mm may reach up to 3 km. These parameters are lower compared to the mass flow excavation method;
- with the mass flow excavation method used to bury the cable, the area of the sediment structure disturbed with a high-performance intense water jet is significantly larger than in the case of any other possible method. The water jet disrupts the sediment bonding structure, allowing much of the finest soil to become suspended. In practice, this method is most commonly used only along limited sections, for example, in the location of the crossing of two linear installations, in order to limit the level of sinking of the previously buried installation;
- cable burial to the depth of 3 m below the seabed is practically the maximum level of burial used. For every project, this level is adopted depending on the present soil conditions and the intensity of the sea area use. Adoption of various (shallower) levels of power cable burial in the offshore part of the BP OWF CI is possible in the project analysed;
- during the actual engineering of individual cables of the BP OWF CI offshore part, the results of geotechnical surveys may slightly affect the cable route corrections.

After identification, the soil conditions may enable the application of the ploughing technology, in which the area of soil structure disturbance is smaller, and the amount of sediments becoming suspended is significantly smaller than for the methods analysed in this report.

5 Description of the environmental impacts predicted in the case the project is not implemented, taking into account the available information on the environment and scientific knowledge

Failure to implement the project consisting in the construction and operation of the BP OWF CI may take place in two cases, i.e.:

- complete abandonment of offshore wind energy in the PMA, which in consequence means the necessity to generate energy from the existing or other sources;
- abandonment of the Baltic Power OWF project with a power output of 1200 MW with the simultaneous implementation of other OWFs within the Polish EEZ.

The aforementioned options are fundamentally different. The first one would mean in the long term the abandonment of the use of an alternative source of electricity with a significant power output (e.g. the Baltic Power OWF itself would cover approximately 3% of national electric power demand), which would require a compensation through exploitation of conventional sources with a similar power output, along with the emissions of gaseous and particulate pollutants from combustion of fuels (hard coal or lignite), the generation of approx. 20% of waste from combustion in relation to the amount of the fuel combusted, and indirectly with the effects of environmental changes in the areas where fossil fuels are extracted.

An important premise for the implementation of the project is the potential avoidance of emissions of hazardous substances to the atmosphere. Assuming the use of 45% of its power output and 25 years of operation, a 1200 MW OWF can generate 134.03 TWh/482.51 PJ of electricity, which would help avoid the emission of over 48 million Mg CO_2, over 650 thousand Mg SO_2, approximately 88 thousand Mg of nitrogen oxides and more than 1.5 million Mg of particulate matter from lignite-fired power plants [97].

The above option will lead to local benefits related to abandoning the development of offshore areas. Failure to invest in offshore wind energy (wind turbines, power cables, substations) will in practice mean that complex impacts related to the construction, operation and decommissioning of these elements of the OWF will not occur over a period of several dozen years. This also results in the absence of restrictions on the availability of these areas to the existing and potentially new users [navigation, fisheries, tourism and possible production of hydrocarbons (crude oil and natural gas extracted below the seabed)].

The second option will mean the implementation of other OWFs in other sea areas, with a range of impacts on the marine environment and on human activities occurring there (navigation, production of hydrocarbons, fisheries, maritime tourism) that is difficult to estimate. However, this option has the advantage of reducing the effects of domestic fossil fuel extraction and combustion in conventional power plants. At the same time, while limiting the share of conventional energy in electricity generation, it will be possible, in accordance with the trends in the European power sector, to deepen the integration of the Polish EHV transmission systems with Germany, Denmark and Sweden.

For each of the two situations indicated above, the expected impacts on abiotic and biotic elements of a varied degree and extent will not occur. These elements will be subject to the existing impacts resulting from the existing pressures in the marine environment.

6 Project impact identification and assessment

6.1 Applicant Proposed Variant (APV)

OFFSHORE PART

6.1.1 Construction phase

6.1.1.1 Impact on the geological structure, seabed sediment structure, access to raw materials and deposits

A significant aspect of the assessment of the project impact on the processes taking place on the seabed and the seabed itself is to determine the scale of impact intensity and impact range. The impact is considered significant if the change to the character of the surface and the structure of the seabed is greater than the size of geomorphological forms potentially occurring at the seabed. The impact range determined as local, in geological and geomorphological terms, refers to spot changes or linear changes (cable laying) to the topography and structure of the seabed and does not extend beyond the dimensions of the forms possibly created in a given area.

The sensitivity, i.e. the response of the seabed topography and structure, is assessed on a five-step scale in accordance with the data from Table 6.1.

Table 6.1. Sensitivity of seabed topography to impacts resulting from the activities related to the BP OWF CI construction [Source: internal materials]

Sensitivity	Description
Irrelevant	No changes to the topography and structure of the seabed or changes similar to the ones caused by natural processes
Low	Changes noticeable, but not altering the character of the topography and structure of the seabed; local range
Moderate	Changes noticeable, altering the character of the topography and structure of the seabed to a degree not affecting the general character of the area; local range
High	Changes affecting the topography and structure of the seabed, altering its character and affecting processes taking place on the seabed; local range, limited to the project area, possible small impact on the character of the topography of adjacent areas
Very high	Changes significantly affecting the topography and structure of the seabed in the area analysed, which may significantly affect geological and geomorphological processes of the project area and adjacent areas

Depending on its structure, the seabed may exhibit different sensitivity to the impact of the project during the construction phase. The seabed made of till and till with a stony cover is difficult to wash out and withstands morphological changes. A sandy, sandy and silty, and silty seabed is more susceptible to washout and material being moved over it, e.g. in the form of sandy waves. Thus, the elements of the connection infrastructure may be uncovered or buried, both as a result of natural processes involving the movement of rock material along the seabed and as a result of this movement being disrupted by the connection infrastructure components.

Activities connected with the project construction may cause the following types of impact on the seabed:

- local spot changes in the seabed structure when it is necessary to replace/reinforce the ground under the cable route; these actions cause a change in the subtractive composition of seabed sediments;
- changes in the shape of the seabed due to the seabed preparation for cable laying, levelling of seabed unevenness along the cable route; changes in the seabed morphology will also occur as a result of the possible storage of rock material excavated during the seabed preparation for cable laying;
- seabed level changes due to the deposition of rock material raised and moved during preparatory and construction works (from suspended solids);
- pits forming in the seabed at the anchoring locations of vessels installing the elements of connection infrastructure;
- the disturbance and sedimentation of suspended solids − during construction works, suspended solids will be disturbed locally, which will result in water turbidity. Suspended solids generated as a result of sediment disturbance during dredging works are deposited on the seabed depending on the water movement in the area. The disturbed sediment will move mainly within the BP OWF CI area and no further than a dozen kilometres from its boundaries (in trace amounts), and during the deposition, it will cover the seabed with an average thickness of no more than 0.2 mm, which is comparable to the amount of suspended solids deposited as part of natural processes during the year.

The overall impact of the project during its construction phase was assessed as negligible for the general character of the seabed and its structure – the changes will be minor, distributed over a small surface of the seabed and linear (along the cable route).

In geological terms, taking into account the nature of deposits forming the seabed surface of the BP OWF CI area, no significant changes in the nature of deposits are expected. Possible changes may occur only in points, if it is necessary to replace weak soil with soil of appropriate parameters, but this will mainly depend on the technology selected. The impact on surface sediments will be **negligible**.

6.1.1.2 Impact on the quality of seawater and seabed sediments

Water and seabed sediments constitute very important elements of the water ecosystem of the Baltic Sea, which is shallow and small with limited water exchange through the narrow and shallow Danish Straits. The surface of the sea is approximately 4 times smaller than that of its catchment area. Approximately 85 million people live in this area. Such conditions make every interference in the marine environment – fisheries, shipping, discharge of municipal and industrial wastewater, surface water runoff from industrial and agricultural areas, but also the activity related to the exploitation and management of the seabed – affect the delicate ecological balance of the marine ecosystem [394]. Water and sediments in bodies of water are strictly connected with each other. A form of balance exists between the various components of the marine environment and, in particular, between water and seabed sediment. A change in one component (e.g. sediments) causes changes in the other (water) and vice versa.

Most pollutants (heavy metals and toxic organic compounds of low solubility and slow degradation) which are released into the environment as a result of human economic activity and reach surface waters are retained in sediments [34]. Sediments, however, are not only a place of deposition of persistent and toxic pollutants reaching the environment but also a place of existence, source of nourishment, place of reproduction and growth of numerous aquatic organisms. Contaminated sediments pose high risks to the biosphere, because some of the harmful substances contained in sediments may pass into the water as a result of chemical and biochemical processes and be accessible to living organisms [111; 39].

This subsection identifies, characterises and evaluates the impact of the BP OWF CI on the quality of sea water and seabed sediments. It was found that during the construction phase the BP OWF CI may cause various types of impacts on the receptors discussed (water and seabed sediments). These include: the release of pollutants and nutrients from sediments to water, contamination of water and seabed sediments with petroleum products, contamination of water and seabed sediments with anti-fouling agents, contamination of water and seabed sediments with accidentally released municipal waste or domestic sewage, contamination of water and seabed sediments with accidentally released chemicals and waste from the construction of the BP OWF CI.

6.1.1.2.1 Release of pollutants and nutrients from sediments into water

The disturbance of the seabed sediments connected with cable burial or vessel anchoring is a process which contributes to pollutants passing from sediments into water [394, 39, 111, 80]. During construction works, substances including labile metal forms, POPs, i.e. PAHs and PCBs, nutrients (nitrogen and phosphorus compounds) will pass into the water.

The most important parameters influencing the impact level are the length of cable sections as well as the width and depth of the cable trench, the types and amount of pollutants accumulated in seabed sediments, as well as the type of rock material forming the seabed.

The transfer of contaminants from the sediment into the water (and thus, the change of water quality), and the formation of suspended solids that remain suspended in the water for a long time, depends on the type of sediment. The largest amount of pollutants and nutrients will be transferred to water from the sediments with an increased organic matter content (e.g. silty, clayey sediments with a higher concentration of metals and POPs). These deposits will also contribute to the formation of a greater amount of suspended solids, which will remain in the water for a long time (reduced transparency). Intense resuspension may cause the release of nutrients immobilised in the sediment and contribute to eutrophication. In the case of sandy deposits with low organic matter content (e.g. coarse sandy sediments), the processes described will be less intense. These sediments are generally characterised by a small number of fine fractions and low concentrations of metals and persistent organic pollutants. Therefore, it is estimated that the processes related to the release of nutrients and POPs will occur at low intensity in the entire BP OWF CI area.

It should be emphasised that the substances released from the sediment will pass into water. However, within approx. 1 year from the completion of the construction activities, these substances will transfer back into sediments after reaching an equilibrium.

The power cable can be buried in the seabed using two main technologies:

- SLB – simultaneous laying and burial of the cable in the seabed sediment;
- PLB – post-lay burial of the cable.

The most far-reaching scenario is the application of the PLB technology in both the RAV and the APV, and the use of self-propelled remotely operated water jetting and mechanical trenching equipment in construction activities. In the case of this technology, the volume of sediment disturbed will be larger than in the case of the SLB technology.

Seabed sediment will be disturbed during cable laying. The maximum width of the seabed strip covered by the construction works for a single cable line will be 20 m, average depth – up to 4 m, and the length of approximately 46.8 km (assuming that the export cables will exit from each of no more than three substations of the BP OWF CI). The maximum volume of the sediment disturbed during the cable laying, assuming the trench depth of 4 m and slope inclination of maximum 1:3, will be 36 m^3 of sediment per 1 running meter of the cable.

Moreover, during cable laying, the seabed sediment will be disturbed due to anchoring of vessels. The anchoring process itself is short-term, affecting a small area (local) to a depth of approximately 3 m, so the volume of the sediment disturbed will be small.

Based on the above assumptions and concentrations of pollutants and nutrients found in the BP OWF CI area, an estimation of their release into water in the APV and RAV was made.

The calculations assume an average sediment volumetric density of 1.52 $g \cdot cm^{-3}$ (1520 $kg \cdot m^{-3}$) and an average sediment moisture content of 16.2%. For the purpose of calculations, the volume of sediment disturbed as a result of the cable laying process was assumed to be 36 000 m^3 for both the APV and the RAV.

The average concentrations of the parameters tested were analysed for the three cable laying routes considered, for the APV and the RAV. It was found that for each of them the average concentrations of the parameters in question have similar values, therefore for the purpose of further calculations the average concentration of each parameter was adopted for all three solutions. The only parameter that has a significant influence on the masses of contaminants and nutrients released is the length of the cable laying route.

The estimated amount of heavy metals, pollutants and nutrients that may be released in the APV and RAV during their implementation as part of the BP OWF CI project is presented in Table 6.2. The calculations were made for a single cable. If 4 cable lines are laid, the values will be four times higher.

However, they will not be significant in comparison with the loads entering the Baltic Sea each year through rivers from Poland and through rain [394], which are also presented in Table 6.2.

Table 6.2. Comparison of the mass of pollutants and nutrients that may be released into water during the construction of the Baltic Power OWF Connection Infrastructure (construction phase, APV, RAV) with the load entering the Baltic Sea through rivers and rain [Source: internal materials]

Parameter	1 km of a single cable	Cable route A (33.4 km (APV); 40.1 km (RAV))	Cable route B (32.8 km (APV); 39.5 km (RAV))	Cable route C (31.0 km (APV); 37.7 km (RAV))	Annual load entering the Baltic Sea through rivers	Annual load entering the Baltic Sea through rain
Volume of the sediment disturbed	36 000 m³ (APV) 36 000 m³ (RAV)	1 202 400 m³ (APV) 1 443 600 m³ (RAV)	1 252 800 m³ (APV) 1 494 000 m³ (RAV)	1 260 000 m³ (APV) 1 501 200 m³ (RAV)	No data available	No data available
Weight of the sediment disturbed	54 720 Mg (APV) 54 720 Mg (RAV)	1 827 648 Mg (APV) 2 194 272 Mg (RAV)	1 904 256 Mg (APV) 2 270 880 Mg (RAV)	1 915 200 Mg (APV) 2 281 824 Mg (RAV)	No data available	No data available
Dry weight of the sediment disturbed	45 855 Mg (APV) 45 855 Mg (RAV)	1 531 569 Mg (APV) 1 838 800 Mg (RAV)	1 595 767 Mg (APV) 1 902 997 Mg (RAV)	1 604 938 Mg (APV) 1 912 169 Mg (RAV)	No data available	No data available
Lead (Pb)	97 kg (APV) 77 kg (RAV)	3240 kg (APV) 3088 kg (RAV)	3182 kg (APV) 3042 kg (RAV)	3007 kg (APV) 2903 kg (RAV)	24 000 kg	200 000 kg
Copper (Cu)	28 kg (APV) 25 kg (RAV)	935 kg (APV) 1003 kg (RAV)	918 kg (APV) 988 kg (RAV)	868 kg (APV) 942 kg (RAV)	100 000 kg	No data available
Chromium (Cr)	40 kg (APV) 33 kg (RAV)	1336 kg (APV) 1323 kg (RAV)	1312 kg (APV) 1304 kg (RAV)	1240 kg (APV) 1244 kg (RAV)	No data available	No data available
Zinc (Zn)	257 kg (APV) 210 kg (RAV)	8584 kg (APV) 8421 kg (RAV)	8430 kg (APV) 8295 kg (RAV)	7967 kg (APV) 7917 kg (RAV)	No data available	No data available
Nickel (Ni)	29 kg (APV) 21 kg (RAV)	969 kg (APV) 842 kg (RAV)	951 kg (APV) 830 kg (RAV)	899 kg (APV) 792 kg (RAV)	700 000 kg	No data available
Cadmium (Cd)	Concentration in the BP OWF CI sediments below the limit of quantification				2300 kg	7100 kg
Mercury (Hg)	Concentration in the BP OWF CI sediments below the limit of quantification				2100 kg	3400 kg
Arsenic	Concentration in the BP OWF CI sediments below the limit of quantification				No data available	No data available
PCB congeners	<0.0229 g (APV) 0.0688 g (RAV)	<0.765 g (APV) 2.76 g (RAV)	<0.751 g (APV) 2.72 g (RAV)	<0.710 g (APV) 2.59 g (RAV)	715 000 g	260 000 g
PAH analytes (PAH group)	0.076 kg (APV) 0.041 kg (RAV)	2.54 kg (APV) 1.66 kg (RAV)	2.49 kg (APV) 1.63 kg (RAV)	2.36 kg (APV) 1.56 kg (RAV)	No data available	No data available
Available phosphorus (P)	2751 kg (APV) 2816 kg (RAV)	91 883 kg (APV) 112 922 kg (RAV)	90 233 kg (APV) 111 232 kg (RAV)	85 281 kg (APV) 106 163 kg (RAV)	9 500 000 kg (P tot.)	163 000 000 kg
Nitrogen (N)	<917 kg (APV) <917 kg (RAV)	<30 628 kg (APV) <36 772 kg (RAV)	<30 078 kg (APV) <36 222 kg (RAV)	<28 427 kg (APV) <34 571 kg (RAV)	190 000 000 kg (N tot.)	5 700 000 kg

The seabed sediment which will be disturbed during the underwater works, will be used only for cable burial and will not be transported to other places of the sea area or transported to the land. If a different decision is made and the sediment removed is transported to shore, the level of heavy metals, pollutants and nutrients released will be lower. Similarly, if the SLB technology is used, in which the seabed area disturbed including the sediments on it is significantly smaller, the impact will be smaller.

At the same time, disturbing seabed sediments may slightly improve their quality (increase in oxygenation and decrease in the amount of pollutants and nitrogen compounds in the sediment due to their transfer to water). The improved oxygenation of the sediments may, however, reduce (limit) the passage of phosphorus from the sediment since this process occurs under anaerobic (reducing) conditions [4].

The sensitivity of sea waters was assessed as moderate.

The release of pollutants and nutrients from seabed sediments during the construction phase is a direct negative impact of a regional range, short-term, reversible or irreversible, repeating during the construction period, characterised by low intensity.

The significance of this impact during the construction phase in the APV was assessed as insignificant (low) for sea waters and as negligible (irrelevant) for seabed sediments.

6.1.1.2.2 Contamination of water and seabed sediments with petroleum products during normal operation of vessels in the course of construction and at the time of their breakdown or collision

Pollutants entering water during normal operation of vessels form the second largest source of oil pollution at sea. This is the source of approx. 33% of oil released into the environment (mainly due to increased maritime traffic in the Baltic Sea region) [186]. In comparison, approximately 37% of oil entering the sea is a run-off from land brought by rivers, while the tanker disasters only rank third (12%).

During the construction phase, vessels (ships, barges, etc.) will be used, from which small amounts of petroleum products (lubricating oil, fuel oil, petrol, etc.) may leak into the water during normal operation. To a minor extent, they may contribute to the deterioration of water quality.

It should be assumed that these will be small spills (I degree), up to 20 m^3. Visible traces of such contaminants may disappear spontaneously in favourable conditions, as a result of evaporation and dissipation in water. In practice, the size of these spills will be limited to the BP OWF CI area. Additionally, the BP OWF CI area is crossed by a shipping route, within which permanent and organised vessel traffic takes place.

The sensitivity of sea waters and seabed sediments to small spills of petroleum products occurring during the normal operation of vessels was assessed as insignificant.

The contamination of seawaters or seabed sediments with oil derivatives released during normal operation of vessels is a direct negative impact of a local range, momentary or short-term, reversible, repeatable, and of low intensity.

The significance of this impact during the construction phase in the APV was assessed as negligible (irrelevant) for sea waters and seabed sediments.

The spillage of petroleum products resulting in the contamination of water and seabed sediments may also occur in emergencies (as a result of a breakdown or a collision of vessels, a construction disaster of one of the BP OWF CI facilities, as well as during maintenance works). Such events may contribute to the deterioration of coastal water quality (if the spill reaches the shore). In the event of a collision of vessels, a III degree spill can be expected, i.e. one above 50 m^3 and up to approx. 200 m^3.

A visible effect of an oil spill is an oil slick which, under the influence of gravity and surface tension, spreads at a speed depending on the type of oil and ambient conditions. The size of the spill is determined by such factors as oil volume, density, viscosity, temperature, wind speed and time. The estimated speed of an oil slick movement in large water bodies is approx. 2−3% of the wind speed. It has been found that a spill of 1.6 t (1.8 m^3) of oil spreading over the surface of 1 km^2 for one day forms a dark film with a thickness of 2 µm. 40 kg of oil, on the other hand, causes a slick on the surface of 1 km^2 that has a film thickness of 0.05 µm [142].

Oil film formed on the water surface may cause:

- impeded exchange of gases, especially of oxygen, between the water and the atmosphere;
- 5–10% decrease in light intensity under the water surface (mainly due to the presence of heavy fractions of oil and sulphur) limiting photosynthesis;
- increase in the temperature of water during the day as a result of light absorption by the oil layer.

While an oil slick is spreading, other degradation processes are progressing which lower the concentration of hydrocarbons on the water surface (e.g. the release of low molecular weight hydrocarbons). Heavier oil fractions may undergo sorption on the surface of organic and mineral suspensions, which may increase their specific gravity and gradually make them sink to the seabed. Thus, heavier oil fractions may be bound by seabed sediments, contaminating them. The susceptibility of seabed sediments to contamination depends on the grain size of the sediment and its packing. Loose sandy sediments are more susceptible to contaminant absorption. Compact till sediments inhibit the penetration of contaminants into the sediment. However, due to the type of sediments in the BP OWF CI area (small amount of organic matter and low content of fine fractions), oil spills will not cause a noticeable deterioration of their quality.

The probability of a breakdown or a collision of vessels in the Baltic Sea is low. Approximately 2 thousand vessels sail the Baltic Sea every day (including 200 tankers transporting oil and other liquids), and the number of collisions and failures in recent years has remained more or less constant (with a slight increase), i.e. approx. 120−190 accidents at sea every year. The majority of accidents in the Baltic Sea cause no contamination. The number of accidents involving contaminant release into water is up to 21 per year (according to 2017 data). However, it must be kept in mind that even one large-scale accident may seriously threaten the marine environment.

Increased ship traffic creates additional risks of collisions and oil spills. These risks were identified under the BRISK project (Sub-regional risk of spill of oil and hazardous substances in the Baltic Sea). According to BRISK project estimates, an oil spill of 300 to 5000 tonnes will occur every 4 years in Baltic waters, while an exceptionally large spill (5000 tonnes or more) will occur once every 26 years [71, 45]. In the south-eastern Baltic Sea area, where the BP OWF CI area analysed is located, the risk of a collision with a spill of over 5000 tons was estimated to be 1 incident in 1060 years, whereas the areas under the greatest threat are found around the Wolin and Rüggen islands as well as the Hel Peninsula.

During construction works, vessels sail at low speeds, therefore the risk of damage to the fuel tank is very low. A vessel generally holds fuel in several tanks, which reduces the risk of a major leak in case of a collision. Vessels used in the construction of wind farms may have fuel tanks with the total capacity of approx. 1200 m^3. Assuming a breakdown or a collision of the largest vessels used at the construction phase of the BP OWF CI (during inspections, maintenance and emergency repairs) and the destruction of the largest tanks of one vessel, no more than 200 m^3 of fuel oil, 15 m^3 of machine oil and approx. 2.5 m^3 of hydraulic oil may be released from one vessel (in the worst-case scenario) [402].

The most important parameters affecting the level of impact are the type and amount of petroleum products released, the weather conditions and the type of rock material forming the seabed.

The sensitivity of both receptors may be high in case of emergency or collision.

Moreover, a plan will be prepared for the BP OWF CI to prevent risks and contamination during the construction, operation and decommissioning of the BP OWF CI. This plan should specify the potential area under threat for various breakdown and disaster scenarios, as well as the methods of preventing and eliminating oil spills.

Contamination of water or seabed sediments with oil derivatives released in an accident is a direct negative impact of regional range, which is short-term, reversible, repeatable and of high intensity.

The significance of this impact during the construction phase in the APV, due to the random and sporadic nature of breakdowns and collisions was assessed as low for sea waters and seabed sediments.

6.1.1.2.3 Accidental contamination of water and seabed sediments with anti-fouling agents containing organotin compounds (e.g. TBT)

Hulls of vessels are protected against fouling with biocides, which may contain e.g. copper, mercury and organotin compounds (e.g. TBT). These substances may pass into the water and eventually be contained in the sediment. It should be assumed that the releases of those compounds will be limited due to their dilution in the water. Among the substances listed, organotin compounds are the most harmful (toxic) to aquatic organisms. The use of TBT (the most harmful substance) in anti-fouling paints is now prohibited, but the presence of those compounds in older vessels cannot be ruled out. The sensitivity of sea waters and seabed sediments to biocides released from hulls was assessed as medium.

Vessels (ships, barges, etc.) will be used at each phase of the project and their hulls may release certain amounts of anti-fouling substances into the water during normal operation. Consequently, they can contaminate sediments. To avoid this, at every stage of the project it is recommended to use vessels the hulls of which have not been coated with anti-fouling paint containing TBT. This will eliminate this most harmful impact on aquatic organisms.

The most important parameters influencing the level of impact are the type and amount of anti-fouling substances released as well as the type of rock material forming the seabed.

The sensitivity of both receptors is moderate.

Contamination of water and/or seabed sediments with antifouling substances during the construction phase forms a direct, negative impact of a local or regional range, short-term, reversible, repeatable during the construction period, of low intensity.

The significance of this impact during the construction phase in the APV was assessed as negligible for sea waters and seabed sediments.

6.1.1.2.4 Contamination of water and seabed sediments by accidental release of municipal waste or domestic sewage

At each project stage, waste will be generated on vessels and at the onshore site facilities (located in the port supporting the project implementation) – mainly municipal and other waste, not related to the construction process directly, as well as domestic sewage. Waste and sewage may be accidentally released into the sea while being received from vessels by another vessel and during a breakdown, resulting in a local increase in nutrient concentrations and the deterioration of water and sediment quality. However, the pollutants are expected to disperse quickly, and thus will not contribute to a permanent deterioration of the environment in the project area. The sensitivity of sea waters and seabed sediments to this type of impact is assessed as low.

The most important parameters affecting the level of this impact are the type and quantity of the waste or sewage released, the weather conditions as well as the type of rock material forming the seabed.

The sensitivity of both receptors is irrelevant.

The contamination of seawater or seabed sediments with municipal waste or domestic sewage is a direct negative impact of a local range, short-term or momentary, reversible, repeatable during the construction period, of low intensity.

The significance of this impact during the construction phase in the APV was assessed as negligible for sea waters and seabed sediments.

6.1.1.2.5 Contamination of water and seabed sediments by accidentally released chemicals and waste from the construction of the BP OWF CI

During the construction of the BP OWF CI, waste directly related to the construction process will be generated on vessels, at onshore site facilities (located in the port handling the implementation of the project) and at the project site. These may include, among others, damaged parts of the BP OWF CI components, cement, machine fluids and other chemical substances used or replaced during construction works. These may be accidentally released into the sea.

This waste is mainly generated during the construction and decommissioning phases [most often the waste from group 17 of the Annex to the Regulation of the Minister of Climate of 2 January 2020 on the waste catalogue (Journal of Laws of 2020, item 10)]. Waste produced during the construction phase will include e.g. cable scrap, sanitary waste from ships, flammable waste, oil and chemical waste, as well as construction waste. Waste should be neutralised in accordance with the applicable regulations concerning industrial waste.

The most important parameters affecting the level of this impact are the type and quantity of waste or sewage released, the weather conditions and the type of rock material forming the seabed.

Generally, for projects such as the BP OWF CI, a detailed plan is prepared to prevent the risks and contamination generated during the construction, operation and decommissioning of the BP OWF CI, which contains mitigating measures and a procedure to be followed in case of such events.

The sensitivity of both receptors in the case of this impact is moderate.

Contamination of seawater and/or seabed sediments connected with the BP OWF CI construction process is a direct, negative impact of a local range, short-term or momentary, irreversible, repeatable during the construction period, of medium intensity.

The significance of this impact in the construction phase in the APV was assessed as negligible for sea waters and as low for seabed sediments.

6.1.1.3 Impact on climate, including greenhouse gas emissions and impacts relevant for adaptation to climate change, impact on atmospheric air (air quality)

During the construction phase of the BP OWF CI, an increased emission of pollutants into the atmosphere can be expected (including greenhouse gases), due to the increased traffic of vessels involved in the project construction. However, the magnitude of these atmospheric emissions cannot be assessed at this stage, as the number, type and duration of use of specialist vessels will only be determined in the detailed design. It should be assumed that only the vessels which comply with national standards and standards resulting from international agreements on pollution emissions would be used.

During the construction phase, the significance of the planned project impact on climate and greenhouse gases will be negligible, as there will be no factors that could have any noticeable impact on their change.

The impact of the planned project on the air quality in the construction phase will be temporary and will cease after the works are completed. Furthermore, since the area is open and unobstructed, pollutant concentrations will be quickly diluted. Therefore, the significance of the impact will be **low**.

6.1.1.4 Impact on ambient noise

The ambient noise level in the area of the planned project, compared with the current level, will increase due to the rise in the number of vessels related to the construction and the equipment used for cable laying. It will be a continuous sound in the low frequency range.

Higher sound intensities increase both the sound detectability and the potential risk of negative sound impacts on receptors. However, the extent of this impact is restricted in time, to the period of the cable laying works, and in space, as a result of noise attenuation by water – from a few hundred metres for high frequencies to several kilometres from the sound source for low frequencies. Passing ships mostly generate low-frequency sounds. The direct negative impact on ambient noise levels will be local and short-term. The impact on ambient noise level was assessed as **insignificant**.

6.1.1.5 Impact on nature and protected areas

6.1.1.5.1 Impact on biotic elements in the offshore area

6.1.1.5.1.1 Phytobenthos

Macroalgae are present in the BP OWF CI area in the APV in negligible amounts (<1% macroalgal cover of the seabed). In addition, the hard bottom (boulders) which could potentially be overgrown by macroalgae constitutes less than 1% of the surface of the APV area. Given the negligible amount of macroalgae, they do not perform a habitat-forming function for fish and phytophilous fauna, and do not constitute a food base for fish and birds. The phytobenthos comprises species that are common in Polish maritime areas and are not protected. Therefore, the importance of phytobenthos in the APV area should be considered low.

The sensitivity of macroalgae was defined as the ability of the population to adapt to changes occurring in the environment as a result of the implementation of the project and their ability to return to the original state after the impact factor ceases.

The following potential impacts on phytobenthos were identified for the phase of construction of the BP OWF CI:

- disturbance of the hard substrate;
- increase in the concentration of suspended solids leading to increased turbidity of the water depth and increased sedimentation;
- redistribution of nutrients and contaminants from sediments to the water depth.

6.1.1.5.1.1.1 Disturbance of the hard substrate

During construction works on the seabed, local, direct damage to macroalgae growing on boulders in the area of the works may occur. These will be negative, direct and short-term impacts. After the impact ceases, it will be possible for the bottom to become overgrown with phytobenthos again within a year (brown algae) or several years (red algae). Therefore, the sensitivity of macroalgae to the impact was assessed as moderate. Considering the negligible amount of macroalgae in the area and their potential total destruction, the impact level should be assessed as high. According to Table 1.4, the significance of the impact on phytobenthos is assessed as moderate. The significance of macroalgae in the area is irrelevant, which means that their loss is not important for the ecosystem.

6.1.1.5.1.1.2 Increase in the concentration of suspended solids leading to increased turbidity of the water depth and increased sedimentation

As a result of sediment disturbance during construction works, water turbidity will increase and so will the deposit of sediments on the seabed. This will result in reduced availability of light in the near-seabed layer – shading of macroalgae on the seabed – which may disrupt photosynthesis for a short time. Such situations also occur naturally in the environment. As a result of storms, strong near-seabed currents, macroalgae are covered by sandy sediments, which are predominant in the APV. The sensitivity of macroalgae is, therefore, insignificant in this case. The impact will be negative, indirect, local and momentary, while its scale will be moderate. According to Table 1.4, the impact significance is assessed as negligible.

6.1.1.5.1.1.3 Redistribution of nutrients and contaminants from sediments to the water depth

During works conducted on the seabed, nutrients and contaminants (e.g. heavy metals) will be released into the water. Phytobenthos communities will be temporarily exposed to an increased concentration of nutrients (which may cause an increase in plant mass) and contaminants in the water (which may cause physiological disruption). The impact will be negative, indirect, local and momentary, while its scale will be moderate. The results of sediment chemical analyses, performed for the preparation of this EIA Report, indicate that the concentrations of nutrients (total nitrogen and total phosphorus) in the APV do not exceed values typical for the Southern Baltic sediments. Moreover, the concentrations of persistent organic pollutants (i.e. PAHs, PCBs and TBT) and toxic substances such as metals or mineral oils are low and do not deviate substantially from the data from literature regarding sandy sediments of the Southern Baltic. Consequently, the sensitivity of macroalgae to this impact was assessed as irrelevant and the significance of the impact as negligible [Table 1.4].

The assessment of the project impact on phytobenthos in the construction phase is summarised in Table 6.3.

Table 6.3. Assessment of the project impact on phytobenthos in the Baltic Power OWF Connection Infrastructure area in the construction phase [Source: internal materials]

Impact	Effect	Impact characteristics	Impact scale	Receptor sensitivity	Receptor significance	Impact significance
Disturbance of the hard substrate	Phytobenthos destruction	Negative, direct, local, momentary	High	Moderate	Irrelevant	Moderate*
Increase in the concentration of suspended solids leading to increased turbidity of the water depth and increased sedimentation	Photosynthesis disruption	Negative, indirect, local, momentary	Moderate	Irrelevant	Irrelevant	Negligible
Redistribution of nutrients and contaminants from sediments to the water depth	Biomass growth, physiological disturbance	Negative, indirect, local, momentary	Moderate	Irrelevant	Irrelevant	Negligible

**It should be remembered that the significance of macroalgae in the area is irrelevant, which means that their loss is not significant for the ecosystem*

6.1.1.5.1.2 Macrozoobenthos

Works carried out on the seabed during the BP OWF CI construction phase will cause the following impacts, affecting the condition of the macrozoobenthos inhabiting the area:

- disturbance of the seabed sediment structure;
- increased concentration of suspended solids in the water;
- sedimentation of suspended solids on the seabed;
- redistribution of pollutants from sediments into water.

The most important technical parameters of the BP OWF CI, which are important from the point of view of the assessment of the project impact on macrozoobenthos during the construction phase, are presented in Table 6.4.

Table 6.4. List of key parameters of the Baltic Power OWF Connection Infrastructure in the Applicant Proposed Variant (APV) for the assessment of impact on macrozoobenthos during the construction phase [Source: internal materials]

Parameter	Unit	Value/description
BP OWF CI corridor surface area (including corridors A, B, C)	km^2	34.6
Length of the BP OWF CI corridor (including corridors A, B, C) – assuming that the export cables are led from each of a maximum of three BP OWF substations, at which the benthic habitats can be possibly destroyed (excluding the approx. 1 km of cable length with the	km	45.8

Parameter	Unit	Value/description
borehole drilled under the seabed, i.e. trenchless installation of power cables in the HDD technology from the offshore area to the land)		
Cable type	-	Alternating current (AC) extra-high voltage (EHV) three-core cable
Maximum number of cables in the offshore area	-	4
Spacing between cables	m	100–200 (100 for the 11–13 m depth zone and 200 for the approx. 22 m)
Depth of the cable trench	m	4
Width of the technical belt within which the cable trench will be made	m	20
Method of power cable laying in the offshore area	-	Buried in the seabed or laid on the seabed surface, secured by, for example, concrete mattresses, rip-rap, concrete protections. No anti-fouling substances used
Technology of cable burial in the seabed	-	SLB (Simultaneous Lay and Burial) or PLB (Post Lay Burial) – cable ploughing or laying by a cable laying vessel or cable barge and subsequent cable burial using the devices operating in the jetting or mechanical trenching technologies along the entire route of a maximum of all 4 cable lines.
Volume of sediment disturbed during the cable-laying works	m^3	A maximum of 36 m^3 of sediment per 1 cable running metre with an assumed trench depth of 4 m and a maximum slope gradient of 1:3

For each of the up to 4 cable lines, the width of the construction belt will be up to 20 m, while the length of a single cable in the APV will be 45.8 km, because along the length of approximately 1 km between the shoreline and the sea area depth of 13 m the cables will be laid under the seabed. The cables will be brought ashore using the HDD or HDD Intersect technology, i.e. a separate borehole, which will be executed from the land side or, in an exceptional situation, from both the land and sea sides.

It is assumed that the construction phase (the laying of up to 4 cable lines and bringing the cables ashore) will be completed as quickly as possible and will be finalised within a maximum of four months from commencement. The start date of construction works will not depend on the time of year.

The assessment of the BP OWF CI impact during the construction phase was carried out separately for:

- soft-bottom macrozoobenthos;
- hard-bottom macrozoobenthos.

A separate assessment of the project impact on macrozoobenthos is the result of these two benthic fauna communities (from the soft and hard bottoms) differing in the taxonomic composition, abundance and biomass of their taxa. Consequently, they differ in significance and sensitivity regarding the various types of impact. The significance and sensitivity of the group of organisms assessed (the soft- and hard-bottom macrozoobenthos) together with the evaluation of the impact scale (nature of interactions, type of interactions, spatial extent, time scope) influence the assessment of a given impact significance.

The macrozoobenthos significance is primarily its ecological (functional) significance, such as the food supply or habitat-forming role, and the impact of these organisms on the condition of marine environment elements such as sediments and the near-seabed water layer [447, 414, 248, 213, 390]. Moreover the condition of macrozoobenthos as an environmental resource determines the ecological quality of marine areas, which can be assessed using appropriate indices [278].

The results of the inventory surveys carried out in the BP OWF CI showed that this community is not unique for the area, and does not stand out in terms of average abundance and biomass values nor specific natural values, having a “moderate” quality status in accordance with the Regulation of the Minister of Maritime Economy and Inland Navigation of 11 October 2019 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 2019, item 2149). The soft-bottom macrozoobenthos community inhabits the sandy and gravelly seabed, which constitutes as much as 99% of the surface of the planned project area. It comprises species that are common and characteristic for this type of the seabed in open waters of the Southern Baltic. The significance of the soft-bottom macrozoobenthos community in the area of the planned project for the functioning of the ecosystem was identified as low.

By contrast, a small fragment of the BP OWF CI area, which constitutes only less than 1% of the project area, is a cluster of stones located at the depth of 22.4–22.7 m. On their surface, the bay mussels *Mytilus trossulus* dominated in terms of abundance and biomass. The bay mussels may be a component of the diet of benthivorous birds. The quality status of the hard-bottom macrozoobenthos communities was assessed as very good, because among the 14 taxa found in this habitat there were all the species typical for this habitat and various fauna accompanying the sedentary bay mussels. The results regarding the occurrence of seabirds in the area of the described habitat, e.g. the velvet scoter and the long-tailed duck, which can feed on bivalves, indicate that this is not the area of their maximum density within the planned project [Appendix 1. Report on inventory surveys]. In addition, given the spot nature of this habitat, the significance of the hard bottom community of the BP OWF CI was assessed as medium.

The sensitivity of macrozoobenthos depends on the type of impact and preferences resulting from the very biology of the species concerned. On the one hand, it is the ability of the population to adapt to various changes occurring in the environment as a result of the project implementation and, on the other hand, the ability of a community of organisms to reconstruct the quantitative structure after the impact factor ceases to exist. The sensitivity of macrozoobenthos will differ in the subsequent phases of the project. Table 6.5 presents the definitions of macrozoobenthos sensitivity on a five-point scale.

Table 6.5. Macrozoobenthos sensitivity to the impacts of the Baltic Power OWF Connection Infrastructure [Source: internal materials based on literature [159, 28, 26]]

Sensitivity	Description
Irrelevant	The influence of the stressor has a very little impact on the changes in the structure and functioning of the organism community
Low	The survival of some benthic species may be limited; the ability to restore the benthic community and

Sensitivity	Description
	return to its original state after the impact factor has ceased to exist will happen within a year
Moderate	Some species in the benthic community will be destroyed and the survival of the remainder may be limited; after the impact factor ceases to exist, the ability to restore the quantitative structure of the longest-living species in this community may take up to several years
High	Most species in the benthic community will be destroyed and the survival of the remainder may be limited; the ability to restore the benthic community may be possible many years after the impact factor has ceased to exist, however, the community may have a different qualitative structure than before the period in which the environment changed as a result of the project implementation
Very high	The benthic community will be destroyed under the impact of the stressor, and it will not be possible to return it to its original state

The disturbance of the seabed sediment structure is a negative impact most strongly affecting macrozoobenthos species inhabiting the surface of sandy and gravelly sediments as well as the stony seabed, e.g. bivalves, as they are not able to actively move within the sediment, as well as organisms living in the sediment, mainly in its upper layer [43, 42]. The main factor leading to physical destruction of benthic fauna and its increased mortality when organisms are brought to the sediment surface is the burial of power cables in the seabed and the invasiveness of the method used [201, 446]. Many macrozoobenthic organisms inhabit the upper 4–5 cm sediment layer [42] but some can be buried up to 35 cm depth due to the biology of the individual species [43]. Therefore, when the cable is buried up to the depth of 4 m, most organisms will be eliminated from the project area over a strip with a maximum width of 20 m for a single cable. Destruction of macrozoobenthos organisms in the area of the BP OWF CI, until the restoration of their population, will contribute to a slight depletion of the food base for benthivorous fish and sea birds that feed mainly on mussels and the Baltic clam, as well as the destruction of polychaetes, which are dominant in the soft-bottom macrozoobenthos community described, playing an important role in bioturbation and bioirrigation, and thus transporting oxygen and organic matter deep into the sediment, which is important from the perspective of microbiological decomposition and mineralisation processes [42]. The inventory survey focused on the occurrence and density of seabirds in the area of the planned project showed that the BP OWF CI area serves as feeding sea for sea ducks, among others. However, it is not a place of their high concentrations. It was found that the destruction of benthic communities along the route of the planned transmission cable may lead to a reduction in the area of feeding grounds of benthivorous birds (the velvet scoter, the long-tailed duck, the common scoter) but it will be a minor impact.

In the APV, it should be assumed that the maximum physical destruction of macrozoobenthos along the route of a single power cable (extending from substation A) – given the degradation of a maximum of 20 m wide seabed strip and the cable length of 33.4 km – will occur on approx. 0.67 km^2 of seabed surface area, which will cover approx. 2.7 km^2 (approx. 7.8% of the BP OWF CI corridor surface area in the APV) for a maximum of 4 power cables within the entire BP OWF CI area. However, the surface area of the seabed degradation will not be a compact area, in which the structure and functions of benthic habitats will be irreversibly destroyed, because individual corridors will be located at 100 to 200 m intervals. Moreover, the seabed sediment that will be disturbed during underwater works will be used only for cable burial and will not be transported into a different location within the sea area. Therefore, the negative effects of this impact will be reversible for the soft-bottom benthic habitat in the medium-term (up to several years).

Only in a very small, limited seabed area (0.3 km^2 of a boulder area covering less than 1% of the corridor area in the APV), where this is impossible – in this case in boulder areas inhabited by the periphyton and phytophilous fauna at depths of 22.4–22.7 m – the cables may be laid directly on the seabed and protected against damage by means of, among others, concrete mattresses, rip-rap or concrete protection systems, thus also leading to the destruction of the hard-bottom macrozoobenthos community. On the other hand, the impact at this location will also be reversible, as in the case of the soft bottom, because a new artificial habitat, a so-called artificial reef, can be created on the concrete surface.

The sensitivity of the soft-bottom macrozoobenthos community in the BP OWF CI area to the impact described is moderate. Despite the fact that the abundance structure of the population of this organism community is dominated by *Pygospio elegans* and *Marenzelleria* sp. polychaetes, the ability to restore the entire community and return to its original state after the impact factor ceases to exist will take up to several years. This is due to the length of time it will take to restore the quantitative structure of the longest-living species in this group, such as the *Limecola balthica* bivalves, as well as the *Mya arenaria* bivalves predominant in the biomass [420, 447, 296], occurring along almost the entire route of the planned power cable.

By contrast, the sensitivity of the hard-bottom macrozoobenthos community, in which the *Mytilus trossulus* bivalves form a group of absolutely constant and dominant taxa in terms of abundance and biomass, will be moderate due to the fact that it will be possible for a similar community of organisms to colonise the surface of the concrete protections covering the cable at that location.

Impact assessment will be identical for the soft-bottom and the hard-bottom macrozoobenthos community. In both cases, given a moderate sensitivity of individual communities and a moderate scale of the impact, taking into account the medium-term duration of the seabed sediment structure disturbance (up to 4 months) of a local nature, the significance of the impact for the BP OWF CI area was assessed as low [Table 6.6, Table 6.7].

Increased concentration of suspended solids in the water is another type of impact on the macrozoobenthos in the BP OWF CI area during the construction phase. During the laying and burial of power cables in the seabed, due to the disturbance of the seabed sediment structure, the sediment from the seabed is lifted and dissipates in the water as suspended solids [223, 446]. The value of suspended solids concentration depends on the velocity of sea currents, their direction, turbulence processes, as well as the size of the seabed sediment fraction. Higher suspended solids concentration and longer exposure time of mineral and organic particles in the water cause adverse effects on the condition of benthic fauna [258, 158]. When there is an excessive concentration of suspended solids in the water, organisms that filter-feed or feed on suspended solids and organic matter deposited in sediments, e.g. bivalves, may feed less effectively. At a suspension concentrations above 250 mg·l^{-1}, the growth of macrozoobenthic organisms is limited [96], and it may even increase the mortality of bivalves, which is a result of the clogging effect [254, 251]. Despite the fact that macro-invertebrates are naturally adapted to high concentrations of suspended solids, such as the ones occurring during storms [26, 251], the Baltic Sea bivalves are physiologically less adapted to filtering suspended solids at high concentrations, because they are not prepared to living in conditions of strong currents or tides [96, 59].

For this factor, account must be taken of the volume of sediment removed in connection with cable burial, e.g. using water jetting and mechanical trenching technologies. Assuming that the volume of disturbed soil is 36 m^3/m of cable length, then for the maximum number of 4 cables running in parallel within the 45.8 km long BP OWF CI corridor, the volume of excavated sediment will be 6 595 000 m^3.

A model analysis of suspended solids dispersion in the offshore part of the Baltic Power OWF CI is presented in the report Offshore Connection Infrastructure – Baltic Power. Results of model calculations. Suspended solids dispersion in the Baltic Power MTI Area [236]. It demonstrates that the concentration of suspended solids in the water depth during construction activities, i.e. cable burial, depends on the method applied (preferred method – jetting) and on the type of seabed sediments in the construction area. The results of model calculations indicate the occurrence of considerable momentary concentrations of suspended solids above the natural background, primarily in the area of works and during their execution (max. over 200 $mg \cdot l^{-1}$ and avg. from 5 to 50 $mg \cdot l^{-1}$ for the jetting method) and demonstrate an extensive spatial range of suspended solids impact. However, the duration of the disturbance is relatively short (not exceeding 16 hours).

The sensitivity of the macrozoobenthos community inhabiting the soft bottom of the BP OWF CI area to this impact is negligible. Since the abundance structure of this community of organisms is dominated by organisms inhabiting the interior of the sediment, i.e. primarily polychaetes and oligochaetes rather than the representatives of the epifauna such as bivalves, the influence of the stressor, such as the increase in the concentration of suspended solids in the water, is not expected to cause significant changes in the structure and functioning of this community of organisms.

On the other hand, the hard-bottom macrozoobenthos community consisting primarily of filtrating organisms, i.e. the *Mytilus trossulus* bivalves, will be characterised by low sensitivity, since it cannot be excluded that with the increase in suspended solids concentration in water, the functioning of the filtering system and hence the survival of some of the most exposed individuals will be restricted.

Taking into account the sensitivity of individual macrozoobenthos communities, i.e. irrelevant for the soft-bottom macrozoobenthos and low for the hard-bottom macrozoobenthos and the scale of the impact described estimated as irrelevant for the soft-bottom macrozoobenthos and low for the hard-bottom macrozoobenthos, the significance of the increased suspended solids concentration for the macrozoobenthos in the BP OWF CI area was evaluated as negligible [Table 6.6, Table 6.7].

Sedimentation of suspended solids on the seabed is an impact causing increased mortality of benthic organisms due to covering them with an additional layer of sediment. Suspended solid particles that fall onto the seabed may be subject to erosion by being transported in the re-suspension process, which results from the hydrodynamic conditions in the sea area [446]. Given the mechanical capability of some of the macroinvertebrates to move in the sediment towards the oxygenated above-seabed layer, or the physiological resistance to hypoxic or even anoxic conditions [251, 157, 26], the sedimentation o suspended solids on the seabed will not lead to the mortality of all organisms. The species most sensitive to this impact are those representing the sedentary epifauna and macrozoobenthos larvae, since when covered by an additional layer of sediment, these organisms will have limited capacity to move and reach the sediment surface, which is an essential condition for respiration and feeding. The bivalves will extend their siphons above the sediment layer [239, 158, 251, 121]. Vagile infauna species (e.g. polychaetes and oligochaetes) are more tolerant to being covered with an additional sediment layer, as they are able to move through a layer with a thickness of up to 10 cm, although that depends on the sediment grain fraction and the duration of the negative impact. Typically, the macrozoobenthos is quite tolerant to being covered by an additional layer, up to 0.2–0.3 m thick, of suspended solids undergoing sedimentation, especially if this layer is composed of a fine sand fraction [96, 251, 121]. However, the long duration of negative impact contributes to increased mortality of all benthic species by covering them with an additional layer of suspended solids [158].

A model analysis providing data on the new thickness values of the sediments additionally deposited in the BP OWF CI is presented in the report Offshore Connection Infrastructure – Baltic Power. Results of model calculations. Suspended solids dispersion in the Baltic Power MTI Area [236]. It shows that after the application of the jetting method, the thickness of sediments generated from the suspended solids sedimentation in the prevailing area does not exceed 1 mm but locally, in the close vicinity of the cable under stagnant conditions, it can reach up to 4.3 mm. In the mass flow excavation method, the values can be higher: up to 5 mm in the predominant area and up to 26 mm in the close vicinity of the cable under stagnant conditions.

The sensitivity of the soft-bottom macrozoobenthos community from the BP OWF CI area to the sedimentation of suspended solids on the seabed was assessed as low, because the structure of this community – in addition to numerous representatives of the infauna (polychaetes), which may be exposed to anoxic conditions for a short period – also comprises epibenthos, including bivalves, mainly *Limecola balthica*, but also *Mya arenaria* and *Mytilus trossulus*. These are organisms which, when covered by an additional layer of sediment, may have an obstructed access to the oxygen dissolved in the water and may reduce their filtration process.

The hard-bottom macrozoobenthos community, represented primarily by the *Mytilus trossulus* bivalves, will also exhibit low sensitivity to suspended solids sedimentation on the seabed due to the negative impact associated with inhibited filtration.

Despite the fact that the sedimentation of suspended solids on the seabed may temporarily reduce the benthos resources and, therefore, reduce the food supply for the fish and seabirds in the affected area, the maximum sediment layer thickness, apart from the areas closest to the cables being laid, will not exceed the lethal values specified in the literature for all the macrozoobenthos taxa identified within the project area. Therefore, this impact will be short-term and reversible.

Taking into account the low sensitivity of both macrozoobenthos communities evaluated and the scale of the described impact assessed as low, the significance of the suspended solids sedimentation on the seabed of the BP OWF CI area was assessed as negligible for both the soft- and hard-bottom macrozoobenthos [Table 6.6, Table 6.7].

The last factor with a detrimental impact on the macrozoobenthos is the **redistribution of pollutants from the sediment to the water**. Due to the disturbance of seabed sediments during the burial of power cables, the benthic fauna is exposed to an increased concentration of pollutants, e.g. heavy metals, toxic organic compounds: PAHs and PCBs, TBT, entering the water depth from the sediments as a result of chemical and biochemical processes [39, 80, 394]. Among the substances listed, organotin compounds are the most harmful (toxic) to aquatic organisms. The use of TBT in antifouling paints is currently prohibited. Tributyltin is bioaccumulated by marine organisms, while the degree of harmfulness depends mainly on the final concentration in tissues. Bivalves are not able to degrade TBT via debutylation like e.g. fish and some sea snails. Accumulation of toxic substances leads to reproductive disorders, diseases and increased mortality of macrozoobenthos, resulting in the reduction of population numbers and biodiversity of the benthic fauna that will be dominated by opportunistic species. Filtering organisms, such as mussels, are highly susceptible to this impact as they develop cancer due to the accumulation of toxic substances in soft tissues [370, 113, 129, 161, 128, Appendix 1. Report on inventory surveys].

The impact on the macrozoobenthos was indirectly determined using surveys of the physico-chemical condition of benthic sediments in the BP OWF CI area with regard to their contamination, because during cable laying operations on the seabed some of the harmful components contained in the sediments may pass to the water as a result of chemical and biochemical processes and may be available and harmful to living organisms. As a result of the surveys conducted, it was concluded that the analysed surface seabed sediments from the survey area belong to inorganic deposits with the organic matter content (expressed as loss on ignition [LOI]) below 10%. They are characterised by a low nutrient content. Concentrations of persistent organic pollutants (i.e. PAHs, PCBs, TBTs) and harmful substances such as labile forms of heavy metals (arsenic, total chromium, zinc, copper, cadmium, lead, mercury, nickel), which under favourable conditions may pass from the sediment to the water depth and be responsible for their toxicity and bioavailability or quantities of mineral oils, in the BP OWF CI Area surveyed were low and did not deviate substantially from literature data for sandy sediments of the Southern Baltic. Concentrations of the labile forms of the elements tested were more or less even within the entire survey area. The sediments tested were also characterised by low concentrations of the radioactive element ^{137}Cs, typical for sandy sediments. Metals, phenols, cyanides, PAHs and PCBs did not exceed the limits for Class II set out in the Regulation of the Minister of Environment of 11 May 2015 on the recovery of waste outside installations and equipment (Journal of Laws of 2015, item 796) [80, 394, Appendix 1. Report on inventory surveys].

Due to the possibility of redistribution of pollutants from sediment into water, the sensitivity of both the soft- and hard-bottom macrozoobenthos community representatives to this impact will be irrelevant. Given the low values of pollutants surveyed, this impact is expected to have very little effect on any changes to the structure and function of the two macrozoobenthos communities.

Considering the negligible sensitivity of both macrozoobenthos communities assessed and the scale of the impact, described as insignificant, the significance of the negative impact on benthic organisms during the redistribution of pollutants from the sediment into the water in the BP OWF CI area will be negligible [Table 6.6, Table 6.7].

Table 6.6. Impact assessment of the project on soft-bottom macrozoobenthos in the Baltic Power OWF Connection Infrastructure area in the construction phase [Source: internal materials]

Impact	Characteristics of the soft-bottom macrozoobenthos community		Scale (size) of impact					Impact significance
	Significance	Sensitivity	Character	Type	Spatial range	Time span	Size	
Disturbance of the seabed sediment structure	Low	Moderate	Negative	Direct Reversible	Local	Medium-term	Moderate	Low
Increase in the content of suspended solids in the water	Low	Irrelevant	Negative	Direct	Local	Short-term Temporary	Irrelevant	Negligible
Sedimentation of suspended solids on the seabed	Low	Low	Negative	Direct	Local	Short-term Temporary	Low	Negligible
Redistribution of pollutants from the sediment into the water	Low	Irrelevant	Negative	Direct	Local	Short-term Temporary	Irrelevant	Negligible

Table 6.7. Impact assessment of the project on hard-bottom macrozoobenthos in the Baltic Power OWF Connection Infrastructure area [Source: internal materials]

Impact	**Characteristics of the hard-bottom macrozoobenthos community**		**Scale (size) of impact**					**Impact significance**
	Significance	**Sensitivity**	**Character**	**Type**	**Spatial range**	**Time span**	**Size**	
Disturbance of the seabed sediment structure	Medium	Moderate	Negative	Direct Reversible	Local	Medium-term	Moderate	Low
Increase in the content of suspended solids in the water	Medium	Low	Negative	Direct	Local	Short-term Temporary	Low	Negligible
Sedimentation of suspended solids on the seabed	Medium	Low	Negative	Direct	Local	Short-term Temporary	Low	Negligible
Redistribution of pollutants from the sediment into the water	Medium	Insignificant	Negative	Direct	Local	Short-term Momentary	Insignificant	Negligible

The analysis of the main pressure factors on the soft-bottom macrozoobenthos and hard-bottom macrozoobenthos during the BP OWF CI construction phase showed that the significance of these impacts was assessed at most as low (disturbance of the seabed sediment structure) and in the case of other factors – as negligible. The most negative impact will be the physical destruction of benthic organisms, especially in areas where the ecological quality of the communities was higher than medium, but which only occur in individual spots along the APV corridor, e.g. within the hard-bottom macrozoobenthos habitat as well as locally on the sandy seabed and in individual spots of corridor B. Nevertheless it should be emphasised that due to the very limited range of negative impacts on the more sensitive sites and their possible reversibility in the medium term, the overall impact of the construction phase on the macrozoobenthos is not significant.

6.1.1.5.1.3 Ichthyofauna

The main impacts on the ichthyofauna will be as follows:

- emission of noise and vibration;
- increased suspended solids concentration;
- emission of toxic substances;
- habitat change.

6.1.1.5.1.3.1 Noise and vibrations

Thanks to their hearing organs, fish are able to perceive acoustic stimuli. Ambient sound is used for orientation in the environment, registration of environmental conditions, communication, reproduction (mating), predator avoidance and prey location [6, 312]. For most fish, frequencies perceived range from less than 50 Hz to approx. 300–500 Hz, but some species can perceive sounds between 3 and 4000 Hz [219, 310].

Fish sensitivity to sound depends on the structure of their receptors. Fish without a swim bladder (e.g. adult flatfish) or fish in which the swim bladder is far away from the ear (e.g. salmon) are only able to perceive the movement of water particles. This is due to the narrow range of frequencies heard (usually up to approx. 500 Hz) and the higher hearing threshold. In the case of fish with a swim bladder located close to or directly connected to the ear (e.g. cod and herring), the hearing threshold is lower, and the range of frequencies perceived can reach 3000–4000 Hz [310].

On the one hand, the range of noise impact depends on the aforementioned structure of the hearing organ, and on the other hand – on sound intensity. Environmental factors affecting sound propagation, e.g. seabed morphology and salinity, also play an important role. Fish can perceive anthropogenic sounds from a distance of up to dozens of kilometres.

Depending on the noise intensity and the distance from its source, the impact can have various effects, ranging from behavioural changes to the death of fish [Table 6.8].

Table 6.8. Potential impact of noise on ichthyofauna [Source: internal materials based on Popper et al. [311]]

No.	Impact effect	Impact characteristics
1.	Death	Death due to the damage resulting from an exposure to sound
2.	Damage to tissue; disturbance of physiology	Example of damage: internal haemorrhage, damage to organs filled with gas, such as swim bladder and surrounding tissues

No.	Impact effect	Impact characteristics
3.	Hearing system damage (TTS, PTS)	Hair cell damage, temporary (TTS) or permanent threshold shift (PTS)
4.	Masking	Masking of important biological sound signals from the environment, including from other individuals
5.	Behavioural changes	Disturbance of normal activities, such as: feeding, spawning, creating shoals, migration, movement from preferred areas, effect of avoidance

The process of cable laying on the seabed will involve noise emissions. It will be generated both by the traffic of the vessels involved in the construction and by the operation of the underwater equipment used for the ploughing of the furrow in which the cable is laid. The noise generated by vessels reaches between 160 and 190 µPa^{2}s, depending on the size and speed of the vessel [282]. The sound generated by a vessel laying a cable should not differ from that of other vessels of similar size [431], while the low speed (0–3 knots) during operation should further reduce noise levels. According to Hammar *et al.* [145] the impact of this factor on cod in the area of an OWF located in the Danish Straits will be negligible.

Very little information is available in literature on the noise emitted by jetting equipment or devices flushing away the sediment from the furrow. According to Nedwell and Howell [257], the noise level generated during the ploughing of trenches for cables was 178 dB re 1 µPa^{2}s at a distance of 1 metre from the sound source. These authors assessed the potential impact of this noise level taking into account the hearing thresholds of different fish species: cod, salmon and common dab. For none of these taxa was the sound level emitted at a distance of 100 m from the noise source found to exceed the hearing threshold by more than 75 dB. This value, according to Nedwell and Howell [257], is the threshold above which a moderate behavioural response, such as avoidance, is to be expected. A higher noise level generated during such works, i.e. 187 dB re 1 µPa^{2}s, was reported by Taormina *et al.* [374]. Model simulations based on these values indicate that an increased noise level (120 dB re 1 µPa) will occur within an area of 400 km^2 from the sound source. A detailed analysis of the potential impact of noise generated during a high-voltage cable installation planned across the Strait of Georgia (Canada) showed that the predicted noise level during the works would not differ from the level existing in the area of the planned project [175].

Most sources [240, 327, 280, 281, 22, 374] assume that the impact of this factor on marine organisms will be relatively small. However, at the same time, many authors emphasise that a final assessment of the noise impact requires the acquisition of more data on noise levels generated during cable laying.

According to the project description (section 0), in the case of vessels, the noise will originate from engine operation, the sound of the propeller and the operation of the steering engines. Large vessels equipped with DP systems, e.g. cable laying vessels, generate noise with low frequencies ranging from 30 Hz to 3 kHz, and sound pressure from 100 to 197 dB re 1 µPa at a distance of 1 m from the source.

The operation of underwater devices involved in the construction of the cable lines also entails the generation of noise into the environment. The highest noise levels will be generated by single underwater vessels operating in the mechanical trenching technology, which emit sounds with a sound pressure from 172 to 185 dB re 1 µPa at a distance of 1 m from the source.

Therefore, the impact of noise and vibration on adult fish will be negative, direct, short-term and local.

The sensitivity of cod, herring and sprat to the impact was assessed as very high, while in the case of flounder, sand goby, common seasnail and straight-nosed pipefish − as high.

The significance of the impact was assessed as negligible for all the fish species examined. As far as the protected fish are concerned, during the surveys, only the larval stages occurred, for which the impact will be local.

6.1.1.5.1.3.2 Increase in suspended solids concentration

Cable burial in the sediment will lead to increased concentration of suspended solids in seawater. It will depend on a number of factors, related both to the technology of the process (furrow dimensions, tools used) and the environmental conditions (physical properties of the sediment, seabed morphology, water dynamics). According to Taormina *et al.* [374] concentrations of suspended solids during the construction of the BP OWF CI can reach several dozen $mg \cdot l^{-1}$.

The most commonly applied cable burial technologies are ploughing and the water jetting method based on sediment fluidisation. In the latter case, a strong water jet under the surface of the sediment causes spontaneous sinking of the cable into the hydrated sediment. According to OSPAR [281], water jetting is associated with higher sediment resuspension than ploughing, whereas information reported by Carter *et al.* [51] suggest that the former method causes less sediment disturbance. The range of impact and persistence of higher concentrations of suspended solids depends on the type of sediment as well as the strength and directions of currents present in the area. In the case of sandy sediments, especially those with coarser grain-size distribution, both the spatial range and the impact time will be much lower than in the case of silty sediments or silt and sand sediments. At the same time it can be assumed that the duration of the impact should not be long, considering the rate of cable installation varying from 100 to 2000 m/day, depending on the technology used [320].

According to Newcombe and MacDonald [258] the effects of resuspension of suspended solids on fish can be classified into three categories:

- lethal effect: death of individuals, may affect population size;
- sub-lethal effect: tissue injury, disruption of physiological processes, reduced growth rate, increased susceptibility to disease;
- behavioural effect: changes in behaviour and reproductive performance, avoidance response.

The intensity of the increased concentration on fish will depend on both physical factors such as sediment characteristics (grain size, mineral composition, adsorption and absorption capacity), salinity, temperature and oxygen concentration in the seawater [93], as well as biotic factors related to fish condition, their developmental stage, method of reproduction and lifestyle. The effect of the impact is also closely related to the concentration of suspended solids, the extent of increased levels of this factor and the duration of ichthyofauna exposure to the impact [258].

The basic factor shaping the intensity of impact of suspended solids is the developmental stage of the organism. The concentration causing lethal effect in early life stages (larvae and roe) is 100 to 1000 times lower than that needed to cause such effect in juvenile and adult fish [93].

The higher sensitivity at the earliest life stages is a result of high metabolism entailing high oxygen requirements [14, 291]. Therefore, the particles of suspended solids penetrating the gills of larvae may impede respiration and cause increased larval mortality [77, 145]. Experimental studies have shown slower growth of Atlantic herring larvae at suspension concentrations exceeding 540 mg·dm^{-3}, while suspension concentrations of 19 g·dm^{-3} resulted in 100% mortality [246]. Exposure of Pacific herring to concentrations up to 400 mg·dm^{-3} did not affect the condition or growth rate of larvae of this species [131]. In similar studies involving the Arctic grayling, Newcombe and MacDonald [258] indicated a slight increase in mortality (6%) at concentrations of 25 mg·dm^{-3}, whereas, a 4-day exposure of larvae to suspended solids concentration exceeding 230 mg·dm^{-3} increased mortality up to 50%. Experiments conducted on cod by Westerberg *et al.* [412] showed a very high sensitivity of the earliest developmental stages of this species (larvae with yolk sac). The avoidance response was observed at suspended solids concentration of 3 mg·dm^{-3}, and increased mortality at values of 10 mg·dm^{-3}.

High concentrations of sediment particles in water may also affect fish larvae indirectly by reducing visibility. This can result in a reduced ability of larvae to see and forage for food, as their visual range often does not exceed their body length [36]. According to Utne-Palm [401], high turbidity (80 JTU) negatively affects the ability of herring larvae to obtain food.

On the other hand, the limitation of visibility may indirectly positively affect the survival of larvae by reducing the predation pressure [130].

The increased sensitivity of larvae in comparison to adult fish results also from a significantly lower mobility of such developmental stages, and consequently a limited possibility to abandon the area subject to the impact.

A negative impact of increased suspended solids concentrations on fish roe was also observed. This involves mainly the limitation of gas and metabolite exchanges by the suspended solids particles adhering to the egg membrane [54, 9]. According to Rönnbäck and Westerberg [330], a significant increase in mortality of cod larvae at a suspended solids concentrations exceeding 100 mg·dm^{-3}. was observed.

The deposition of particles of suspended solids on the surface of pelagic roe may lead to a decrease in their buoyancy, causing them to sink to deeper water layers or to the seabed where they encounter less favourable oxygen conditions. These unfavourable conditions also increase predation pressure from benthic organisms as well as mechanical and physiological stress. This has been confirmed by studies by Rönnbäck and Westerberg [330], which show a loss of buoyancy of cod roe already at relatively low concentrations of suspended solids extending over a longer period (5 mg·dm^{-3} for 4 days).

The impact of increased concentrations of suspended solids on demersal roe is probably less intensive than in the case of pelagic roe. Information on the harmful impact of this factor concern mainly freshwater fish or fish having its spawning in freshwater, and a decrease in hatching success was observed only at relatively high concentrations (500–1000 mg·dm^{-3}) [14]. On the other hand, no distinct impact of an increased concentration of suspended solids in water was observed in relation to the hatching of herring roe, even at values up to 7000 mg·dm^{-3}[246]. Also, Kiørboe *et al.* [196] did not observe a negative effect of increased suspended solids concentrations (300–500 mg·dm^{-3}) on the development of roe of this species, although they note that the negative impact of this factor may be much stronger in the case of poor oxygen conditions. A different response of Pacific herring roe to increased concentration of suspended solids was found by Griffin *et al.* [132]. Their study showed that a two-hour exposure of eggs to suspension concentrations of 250 mg·dm^{-3} and 500 mg·dm^{-3} affected embryonic development and caused a decrease in larval survival and growth rates. Also, the harmfulness of suspended solid particles covering the roe deposited on the sediment surface cannot be excluded. According to Dushkin [86], the survival of herring roe depends on the amount of clayey material sedimenting from the water. A thin layer does not cause significant damage, sometimes only changing the rate of roe development. A thick layer of clay, especially if it is rich in organic particles, may lead to considerable mortality, particularly if the roe is deposited in multiple layers. In this case, only 40% of the larvae hatch from the two near-surface layers.

Due to the possibility of active avoidance of areas with high suspended solids concentration by adult developmental stages of fish, sublethal rather than lethal impacts should be expected [197]. The values of suspended solids concentrations triggering avoidance of contaminated areas differ depending on the species and the development stage. In general, it can be assumed that pelagic fish will be far less resistant to the impact of suspended solids than demersal fish. For juvenile herrings, the avoidance effect was observed at 12 mg·dm^{-3} [246], whereas for adult fish a similar response was observed at a slightly lower concentration (10 mg·dm^{-3}) [181].

According to Westerberg *et al*. [412] an avoidance response of adult herring and cod was already observed at concentrations above 3 mg·dm^{-3}, while studies by Hansson (cited by Sweden Offshore Wind AB [368]) indicate that such a response should only be expected at concentrations above 100 mg·dm^{-3}. The increase in suspended solids concentration may also indirectly affect the herring reproductive success. De Groot [77] indicates that as a result of problems in finding traditional spawning grounds, roe may be deposited at random locations that do not provide suitable conditions for development.

On the other hand, the studies conducted by Hammar *et al.* [143] during the construction of the Lillgrund OWF located in the Danish Straits did not confirm a significant impact of the suspended solids concentrations reaching up to 10 mg·dm^{-3} on the distribution of fish in the project area.

Studies by Moore [254] show that a 14-day exposure of plaice (representing demersal fish) to very high concentrations of suspended solids (4000 mg-dm^{-3}) did not increase mortality in this species. A reverse reaction to avoidance responses is also possible for species preferring an increased level of turbidity, which limits the pressure of predation [197].

In the report prepared for the environmental impact assessment of the Sæby OWF [320], based on the analysis of the available literature, concentration limits were proposed at which an avoidance response can be expected [Table 6.9].

Table 6.9. Limit values of suspended solids concentrations causing an avoidance response and lethal effect in adult fish [Source: internal materials based on: Ramboll [320]]

Species	Avoidance response	Lethal effect
Pelagic	10 mg·dm^{-3}	>500 mg·dm^{-3}
Demersal	50 mg·dm^{-3}	>3000 mg·dm^{-3}

In the analysis conducted using the Ecological Risk Assessment (ERA) method, the significance of suspended solids impact on different developmental stages of cod were assessed in the area of the project implemented on the spawning grounds of this species in the Danish straits [145]. The analysis indicated that only for the early developmental stages (roe, larvae and fry up to 3 months old) there is a low risk of the impact of this factor. However, no significant impact was identified at other developmental stages.

In a generalised assessment of the impact of OWFs on the Baltic Sea environment, Bergström *et al*. [22] classify the impact of suspended solids as low (Gulf of Bothnia) or moderate (Baltic Proper and the Danish Straits). Meissner *et al.* [240] state that with appropriate technology applied, concentrations of suspended solids during cable laying should not exceed those observed under natural conditions. Taormina *et al.* [374] assess the impact of suspended solids on fish as low.

It is assumed that the construction phase (laying up to 4 cable lines and bringing the cables ashore) will be completed as quickly as possible and will be finalised within a maximum of 6 months from commencement. The start date of construction work will not depend on the time of year.

Levelling of the seabed along the cable line routes is not expected to be necessary. The seabed sediment which will be disturbed during the underwater works will be used only for cable burial and will not be transferred to other locations of the sea area nor transported to the land. It is expected that part of the sediment disturbed will be subject to resuspension into the water depth and re-sedimentation at a certain distance from the location of the underwater works.

The comparison of the modelling results of suspended solids dispersion in the BP OWF CI area with information on the impact of different values of concentrations on fish indicates that in the case of adult stages of demersal fish only the avoidance response should be assumed. The level of concentrations temporarily exceeding 500 $mg \cdot dm^{-3}$, as predicted in the least favourable variant (cohesive soil, speed of 5 km/day, mass flow excavation method) may be harmful for pelagic fish. However, the areas affected will be very limited in terms of surface. Given the possibility of active avoidance of adverse conditions, this risk is not expected to be significant.

In the case of fish larvae, suspended matter concentrations exceeding 500 $mg \cdot dm^{-3}$ may inhibit the growth of herring larvae but the temporary and spatially limited nature of this impact is not expected to be significant. Moreover, the range of concentrations over most of the area affected by the disturbance predicted by the model (up to 150 $mg \cdot dm^{-3}$) is not expected to impact pelagic larvae and roe, according to the majority of literature on the subject.

At the same time, the results of the modelling of suspended solids dispersion in the BP OWF CI area indicate that the increase of their content in water will be short-term and local. Detailed results of the modelling of suspended solids dispersion are provided in the report entitled Offshore Connection Infrastructure – Baltic Power. Results of model calculations. Suspended solids dispersion in the Baltic Power MTI Area [236].

The impact related to the increase of suspended solids content will be negative, direct, local, and short-term.

Cod, European flounder, common seasnail, sand goby, sprat and straight-nosed pipefish sensitivity to the impact was assessed as moderate, whereas for herring it was assessed as high. The significance of the impact is assessed as negligible for all the fish species analysed.

6.1.1.5.1.3.3 Habitat change

The simultaneous occurrence of several factors associated with the construction of transmission infrastructure, such as noise and increased concentrations of suspended solids, may cause fish to avoid the work area. The significance of this effect will depend both on the size of the project area as well as on the duration and season of the year when the works take place. The scale of the impact depends both on the biology of individual species and their developmental stage [421]. The effect of fish avoiding even a small area that is an important spawning ground may be noticeable on a much larger sea area [21].

When furrows are dug for cable laying, the seabed structure is significantly disturbed. In case of using ploughs with skids, the width of the seabed strip subjected to the disturbance ranges from 2 to 8 m [51]. According to BERR [327], in the course of a properly conducted cable burial operation using a plough, the seabed disturbance should affect a small area while a major part of the furrow should be backfilled with the sediment running down from its slopes immediately after the passage of the equipment. According to Carter *et al*. [51], in the case of cable burial using the water jetting method (sediment fluidisation with a water jet injected under the surface of the sediment causes spontaneous sinking of the cable), the width of the disturbed seabed strip should not exceed 5 m.

Physical disturbance of the sediment and the seabed morphology may result in the disturbance of fish spawning [164, 165, 295, 314, 30]. The disruption of the primary sediment structure may result in periodical suspension of spawning or result in unfavourable development conditions for roe or fry [77, 295]. Such a reaction may concern herrings requiring a seabed covered with sediment allowing the attachment of eggs [196, 314].

During the works, some benthic organisms will be physically destroyed, especially the infauna, i.e. the organisms living below the sediment surface. This may lead to the reduction of food supply for benthivorous fish and cause the reduction of their number [66, 60, 350]. However, given the linear layout and the width of the area (defined on the scale of tens of metres) on which the disturbance will take place, it appears that it should not be a significant problem for fish as organisms actively seeking food.

During the works, roe deposited on the seabed or on vegetation attached to the seabed may be destroyed. This will affect such species as herring, ammodytids and protected species such as common seasnail and some species of gobies. In the case of gobies, spawning takes place in shallow water areas down to a depth of approximately 10 m. In situations where works are carried out in spawning or nursery areas, the significance of the area affected must be assessed. If its exclusion is likely to cause a significant effect on the ichthyofauna of the area, consideration should be given to carrying out works in periods outside spawning and nursery rearing [327]. Taormina *et al*. [374] assess the potential impact of habitat changes on fish as low.

In the OWF Area, the cable lines will run at a distance of approx. 1.45 km apart. Outside the OWF boundary, up to a depth of approx. 22 m measured from the water surface to the seabed, the cable lines will be laid at a distance of approx. 200 m apart. Next, following a route bend, the cables will converge to a distance of approx. 100 m, until approx. the 13 m isobath. Along the section from the substation to approximately the 13 m isobath, the cables are to be buried in the seabed sediment at a maximum depth of 4 m. The exceptions may be the areas of the seabed characterised by dense sediment structure or covered by numerous boulders, which would make it impossible to bury the cable in the sections crossing such areas. In such cases, the cables will be laid on the seabed surface, properly secured against damage. The cables will be brought ashore using trenchless HDD or HDD Intersect technology starting from the 13 m isobath. The drilling trajectory accounts for the need to protect the dune system and the environment of the near-shore zone (sandbanks zone)

The BP OWF CI area is neither a spawning ground of cod nor of the deep-water spawning European flounder, dominant in this area, nor sprat. Herring spawning may occur in the area surveyed, but it can be assumed that any disturbances in the reproductive process will not affect the recruitment of this species at the population level. The presence of a few larvae of ammodytids, shorthorn sculpin, long-spined bullhead, rock gunnel and turbot in the samples collected indicates that spawning of these taxa may occur in the near-shore area. This is confirmed by the data from literature pointing to shallow, near-shore areas with the seabed covered with sandy or gravelly sediment as a natural environment conducive to the reproduction of these fish. However, the trenchless landfall will help avoid adverse impacts in the zone up to the 13 m isobath, whereas the disturbance of spawning in the zone between 13 and 20 m will not affect the recruitment of these species at a population level due to the wide spawning areas along the entire coastline.

The impact related to the change of habitat will be negative, direct, temporary and local.

Cod, European flounder, common seasnail, sand goby, sprat, herring and straight-nosed pipefish sensitivity to the impact was assessed as high. The significance of the impact is assessed as negligible for all the fish species analysed.

6.1.1.5.1.3.4 Emission of toxic chemicals

During cable laying operations, harmful chemical substances may be released. They may originate from pollutants deposited in the sediments. During the ploughing of the furrows in which transmission infrastructure cables will be placed, resuspension of suspended solids will take place and the accumulated pollutants will be released into the water depth. A number of toxic substances may transfer into the water, e.g. heavy metals (cadmium, chromium, copper, lead, mercury, nickel, zinc, arsenic), chlorinated biphenyls, chloro- and phospho-organic pesticides, TBT and its decomposition products, the sum of hydrocarbons, polychlorinated dibenzodioxins, polychlorinated dibenzofurans and PCBs [151]. Therefore it is advisable to conduct surveys on the concentrations of toxic substances in sediments in the area of the planned route of the BP OWF CI before the commencement of works. This should allow to plan the cable route in such a way so as to avoid areas in which high concentrations of toxic substances occur in the sediments [391]. This applies particularly to areas near ports, areas connected with gas and oil extraction or areas that served as landfills in the past. Previous surveys of sediments in the Polish Maritime Areas had not indicated the presence of high concentrations of these substances. The detected concentrations of PCBs, organochlorine and organophosphorus pesticides and heavy metals (copper, zinc, cadmium, lead, mercury) in the sediments from different locations of the Polish Maritime Areas were too low to cause negative effects for organisms [75]. Also, the DDT, HCB, PCDD/F concentrations in the sandy sediments of this area remain at a level not causing a toxic effect in the marine organisms [371]. The low concentrations of heavy metals in the sediments of the Polish part of the Southern Baltic are indirectly confirmed by the results of the Polak-Juszczak study [305], during which no significant accumulation of harmful substances was found in the tissues of the flounder leading a benthic lifestyle. Also the results of the surveys conducted in the BP OWF CI area in 2019–2020 showed low concentrations of harmful substances in the sediment.

Additional sources of emissions may be the spills of petroleum products resulting from equipment and vessel failures. During a failure of equipment fitted with hydraulic cylinders, spillage of hydraulic fluids may occur. According to BERR [327], the most probable source of serious contamination with these substances is remotely operated underwater vehicles (ROVs), the leakage of which may range from 60 to 100 litres of hydraulic fluids. However, it can be assumed that compliance with the practices resulting from the International Convention for the Prevention of Pollution from Ships (MARPOL) by vessels involved in the construction should significantly reduce the risk of such accidents.

The sensitivity of fish to harmful substances depends on their developmental stage, sex and species. Maturing females, embryos and early larval stages are particularly sensitive. High concentrations of some harmful substances in the gonads of spawning fish may cause high mortality of their offspring [146, 413, 83].

The exposure of fish to toxic substances may cause morphological changes, such as abnormal development of reproductive organs, deformities of the lower jaw, eyes, spinal anomalies and a reduced larval size at hatching. Such effects were observed during surveys at the North Sea in such species as common dab, flounder, cod [83] and herring [229].

Physiological changes such as reduced heart rate and endocrine disruptions, including those that reduce spawning efficiency, may also take place. Some authors [171, 362, 409] provide also the information on the occurrence of behavioural disorders resulting in the reduced effectiveness of fish feeding.

Among the petroleum substances posing a potential risk as a result of shipwrecks/collisions, PAHs may be particularly dangerous. Their negative impact on the embryonic stages of fish have already been observed at low concentrations [61]. However, according to the U.S. National Oceans and Atmosphere Administration (NOAA), the impact of petroleum products on fish is largely limited to coastal and closed sea areas where active risk avoidance is hindered. Also, the studies of Koehler [200] and Vethaak and Wester [403] did not show a statistically significant link between the PAH concentrations and the occurrence of liver tumours in the flounder in Danish and German waters of the North Sea. However, the possibility of tumours being triggered by these substances has not been excluded.

Given the potential for fish to actively avoid contaminated areas, the relatively small extent of the impact and the likely rapid dilution of substances released from the sediment, it can be assumed that the risk to fish in the context of emissions of harmful substances released during the works is low, assuming that highly polluted areas are avoided [280]. Taormina *et al.* [374] assess the potential impact of toxic substance emissions on fish as low.

The concentrations of persistent organic pollutants (i.e. PAHs, PCBs and TBT) and hazardous substances, such as metals or mineral oils in the BP OWF CI area were low and did not deviate substantially from the data from literature regarding the sandy sediments of the Southern Baltic. The sediments tested were also characterised by low concentrations of the radioactive element ^{137}Cs typical for sandy sediments.

The impact related to releasing pollutants and nutrients from the sediments into water will be negative, direct, temporary and local.

Cod, European flounder, common seasnail, sand goby, sprat and herring sensitivity to the impact was assessed as moderate.

The significance of the impact is assessed as negligible for all the fish species analysed.

6.1.1.5.1.4 Marine mammals

The following impacts on marine mammals have been identified as a result of the project:

- change in acoustic conditions;
- appearance of suspended solids;
- appearance of pollutants;
- changes in the habitat;
- disturbance on the water surface.

Detailed characteristics of the individual impacts are presented below. Table 6.10 presents the relationship between the sources of each impact and the marine mammals; the significance of the impacts was determined in line with the assessment methodology (subsection 1.5). The assessment was carried out for both seal species together, as the project area is not situated close to areas of importance for these species; practically no seal species were observed during the monitoring [subsection 3.7.1.4], no significant or major impacts were identified, and the response to all impacts is likely to be very similar for all species, should they occur in the area [31, 190].

Considering the conservation status, abundance and distribution within the project area, the sensitivity of the grey seal and the harbour seal to all the impacts identified was assessed as low. The sensitivity of the harbour porpoise to noise was assessed as very high due to its conservation status and potential effects of this impact, while for the remaining impacts the sensitivity of this species is considered low [Table 6.10].

6.1.1.5.1.4.1 Noise

Additional noise will be generated during the project construction phase due to increased ship traffic, operation of underwater equipment and interference with the seabed (subsection 2.4.2).

Subsection 4.1 on underwater noise modelling presents a comparison of mammal audiograms to the frequency ranges generated by the operation of vessels and equipment at sea.

The comparison with marine mammal hearing thresholds shows that noise generated by large DP2 vessels, smaller vessels and submarine cable laying equipment is detectable by marine mammals. As the sound sources will be mobile, moving at different depths, and the propagation conditions of the generated sounds will change dynamically, the exact ranges of occurrence of the impact cannot be determined; however, it is known that the extent of the impact will be local, within a few hundred metres of the sound source.

Potential negative impacts in the immediate vicinity of the noise source that may result in temporary or permanent hearing threshold shift (TTS, PTS) or other injuries are highly unlikely, as harbour porpoises and seals temporarily avoid areas where noise generating activities are carried out [84]; in the case of surveys carried out in Germany during dredging works, avoidance by harbour porpoises occurred at a distance of 600 m. If the mammals do not spend too much time in the vicinity of the dredger, they will not be physically injured due to noise impacts. Impact on marine mammals is moderate in the case of the porpoise and insignificant for the seal.

Noise impact on marine mammals is moderate in the case of the harbour porpoise and insignificant for the seals.

6.1.1.5.1.4.2 Appearance of suspended solids

The impact on marine mammals due to increased concentrations of sediment in the form of suspended solids generated by construction activities may cause visual impairment and behavioural responses, such as the avoidance of suspended particulate matter plumes. All the three species of marine mammals are characterised by low sensitivity to the occurrence of suspended solids because the main senses used for environment exploration are hearing (the harbour porpoise) as well as hearing and sensing (seals).

The appearance of construction-related suspended solids has a local and short-term nature around the construction area; under the most unfavourable scenarios, suspended solids will be present in high concentrations at distances up to 1.3 km from the construction area and will remain suspended for up to 11 hours. The presence of marine mammals in the area of increased concentrations of suspended matter is highly unlikely, as they avoid areas where noise generating activities are carried out [84].

The impact of suspended solids on marine mammals during the construction phase is negligible.

6.1.1.5.1.4.3 Appearance of pollutants

Increased levels of pollution can be caused by increased vessel traffic or the release of pollutants from seabed sediments. However, based on the surveys conducted, it is assumed that the project will result in the release of small quantities of harmful chemicals from the seabed.

Increased vessel traffic during construction works may generate an increase in the discharge of pollutants into the water, and there is an increased risk of oil spills due to ship collisions, but the likelihood of such incidents is low, and ships are subject to legal requirements to prevent marine pollution.

Due to the small impact scale and low sensitivity of marine mammals, the significance of pollution occurrence during the construction phase will be negligible.

6.1.1.5.1.4.4 Changes in the habitat

The installation of power cables will change the seabed along the BP OWF CI route. Physical damage to the seabed may result in the loss of benthic fauna habitats (soft-bottom species) and temporary loss of benthic biomass, including the disturbance of spawning grounds. However, the trenchless landfall will help avoid adverse impacts in the zone up to the 13 m isobath, whereas the disturbance of spawning in the deeper zone will not affect individual fish species at a population level. The burial of the cable in the seabed only causes local damage, and recolonisation of the soft bottom takes place relatively quickly.

The temporary loss of benthic fauna biomass may have an indirect negative impact on marine mammals due to the destruction of spawning grounds of fish on which mammals feed, but this impact was assessed as negligible for all fish species surveyed, being local and short-term in nature.

The impact significance of changes in the habitat for marine mammals is negligible.

6.1.1.5.1.4.5 Disturbance on the water surface

Physical disturbance associated with construction works above water may be a potential negative impact for seals (but not for harbour porpoises), although these animals are not generally considered to be a disturbance sensitive species [31]. During breeding and moulting periods, seals are sensitive to physical disturbance on land near colonies, but as there are no known seal colonies in Polish waters and construction works will not be conducted in the vicinity of known colonies in water, the impacts on seal breeding and moulting are **negligible**.

Table 6.10. Impact on marine mammals in the construction phase of the Baltic Power OWF Connection Infrastructure [Source: internal materials]

Species	Impact	Nature of impact	Type of impact	Range	Time span	Impact scale	Receptor sensitivity	Impact significance
Harbour porpoise	Noise	Negative	Direct	Local	Short-term	Low	Very high	Moderate
	Appearance of suspended solids	Negative	Direct	Local	Momentary	Low	Low	Negligible
	Appearance of pollutants	Negative	Direct	Local	Long-term	Low	Low	Negligible
	Changes in the habitat	Negative	Indirect	Local	Long-term	Low	Low	Negligible
Seals (all the 3 species)	Noise	Negative	Direct	Local	Short-term	Low	Low	Low
	Appearance of suspended solids	Negative	Direct	Local	Momentary	Low	Low	Negligible
	Appearance of pollutants	Negative	Direct	Local	Long-term	Low	Low	Negligible
	Changes in the habitat	Negative	Indirect	Local	Long-term	Low	Low	Negligible
	Disturbance on the water surface	Negative	Direct	Local	Short-term	Low	Low	Negligible

6.1.1.5.1.5 Seabirds

6.1.1.5.1.5.1 Project impact on seabirds during the construction phase

Negative impacts will be related mainly to the construction phase. The main sources of impact on seabirds present in the project area will be:

- vessel traffic (installation and supply vessels) resulting in bird scaring;
- noise and vibration resulting in deterring fish that constitute food for piscivorous bird species (the razorbill, the common guillemot);
- resuspension of seabed sediments causing water turbidity and hampering the feeding of piscivorous bird species (the razorbill, the common guillemot);
- destruction of benthic communities along the transmission cable route. It may lead to the reduction of feeding areas of benthivorous birds (the velvet scoter, the long-tailed duck, the common scoter) as well as piscivorous birds (the razorbill, the common guillemot).

Installation of the transmission cable will result in bird scaring from the area of the works. This effect will, however, be local and short-term, as the impact will cease immediately after construction, and the noise generated by the project will not be different from that generated by numerous vessels sailing in the Baltic Sea. Furthermore, the European herring gull is a species accompanying vessels and its abundance in the survey area may temporarily increase during the project construction. Therefore, the significance of the impact for the long-tailed duck, the velvet scoter, the razorbill, the common guillemot and the common scoter may be regarded as **low**, and for the European herring gull – as negligible.

The noise generated by transmission cable laying will reduce fish densities in the works area. This will reduce the food supply for the razorbill and the common guillemot. The range of this impact will depend on the intensity of noise. However, the impact will be local, short-term, reversible and, due to the proximity of neighbouring sea areas that are rich in ichthyofauna, will have a **low significance**.

The impact on benthic communities will be short-term as it will cease upon completion of the works and its resources will return to their original state after some time. Recolonisation of the disturbed seabed area will be gradual and will result in the restoration of the food supply for benthivorous and piscivorous birds. This impact will be local, short-term and reversible and will have a **low significance**.

Water turbidity resulting from the re-suspension of seabed sediments due to cable laying will make it more difficult for piscivorous birds to locate food. This will reduce their food supply. The range of this impact will depend on a number of factors, including:

- current direction
- wave motion
- volume of the sediment disturbed.

The impact will be local, short-term, reversible and, due to the proximity of neighbouring sea areas that are rich in ichthyofauna, will have a **low significance**.

The impact significance on seabirds during the construction phase is assessed as **low** for the long-tailed duck, the velvet scoter, the common scoter, the razorbill and the common guillemot, and **negligible** for the European herring gull.

6.1.1.5.2 Impact on protected areas

6.1.1.5.2.1 Impact on protected areas other than Natura 2000 sites

In the offshore area of the planned project location and within the range of its potential impact there are no territorial forms of protection other than the areas of the Natura 2000 European ecological network. Therefore, no activities related to the construction of the BP OWF CI will cause any impact on such areas.

6.1.1.5.2.2 Impact on Natura 2000 sites

The identification and assessment of impacts on protected areas within the European Natura 2000 network is presented in subsection 6.3.

6.1.1.5.3 Impact on wildlife corridors

A wildlife corridor, pursuant to the Nature Conservation Act of 16 April 2004 (Journal of Laws of 2004, No. 92, item 880, as amended), is an area enabling the migration of plants, animals or fungi. The network of wildlife corridors connecting the European ecological network Natura 2000 in Poland was developed in 2011 [177]. No wildlife corridors were indicated in the PMA. In the spring and autumn periods, regular bird migrations take place in the Baltic area; however, the migration tactics and their routes are very poorly recognised.

Given the lack of information on the occurrence, functioning and significance of wildlife corridors in maritime areas, it was conservatively assumed that the value of this resource is medium. Considering the spatial scale of the planned project in relation to the size of the Baltic Sea area and its specificity resulting from the presence of installation vessels moving along with the progress of works, it was assessed that the impact of the Baltic Power OWF CI on potential migration routes of migratory species will be **negligible** during the construction phase.

6.1.1.5.4 Impact on biodiversity

6.1.1.5.4.1 Phytobenthos

Impacts on macroalgal species diversity in the APV are analogous to those found for phytobenthos (subsection 6.1.1.5.1.1), i.e.:

- disturbance of the substrate;
- increase in the concentration of suspended solids leading to increased turbidity of the water depth and increased sedimentation;
- redistribution of nutrients and contaminants from sediments to the water depth.

6.1.1.5.4.1.1 Disturbance of the substrate

The most significant impact is the disturbance of the substrate (destruction of macroalgae), which may cause a decrease in the number of species in the area. These will be a negative, direct and a short-term impact. After the impact ceases, it will be possible for the seabed to become overgrown again within a year (brown algae) or several years (red algae). Therefore, the sensitivity of macroalgae species to the impact was assessed as moderate. Considering the negligible amount of macroalgae in the area and their potential total destruction, the impact level should be assessed as high. According to Table 1.4, the significance of impact on species diversity is assessed as **moderate**. It should be remembered, however, that the significance of macroalgae in the area is irrelevant, which means that their loss is not significant for the ecosystem.

6.1.1.5.4.1.2 Increase in the concentration of suspended solids leading to increased turbidity of the water depth and increased sedimentation

As a result of sediment disturbance during construction works, water turbidity will increase and so will the deposit of sediments on the seabed. This will result in reduced availability of light in the near-seabed layer – shading of macroalgal species on the seabed – which may disrupt photosynthesis for a short time but will not affect the number of macroalgal species. Such situations also occur naturally in the environment. As a result of storms and strong near-seabed currents, macroalgae are covered by sandy sediments, which are predominant in the APV. The sensitivity of macroalgae is, therefore, insignificant in this case. The impact will be negative, indirect, local and momentary, while its scale will be moderate. According to Table 1.4, the impact significance is assessed as **negligible**. An increase in the concentration of suspended solids resulting in increased water turbidity and sedimentation will not affect the number of macroalgal species in the area.

6.1.1.5.4.1.3 Redistribution of nutrients and contaminants from sediments to the water depth

During the works conducted on the seabed, nutrients and contaminants (e.g. heavy metals) will be released into the water. Phytobenthos communities will be temporarily exposed to an increased concentration of nutrients (which may cause an increase in plant mass) and contaminants in the water (which may cause physiological disruption). The impact will be negative, indirect, local and momentary, while its scale will be moderate. The results of sediment chemical analyses, performed for the purpose of the preparation of this EIA Report, indicate that the concentrations of nutrients (total nitrogen and total phosphorus) in the APV do not exceed values typical for the Southern Baltic sediments. Moreover, the concentrations of persistent organic pollutants (i.e. PAHs, PCBs and TBT) and toxic substances such as metals or mineral oils are low and do not deviate substantially from the data from literature regarding the sandy sediments of the Southern Baltic. Consequently, the sensitivity of macroalgae to this impact was assessed as irrelevant and the significance of the impact as **negligible** [Table 1.4]. The redistribution of nutrients and pollutants from sediments to the water depth will not affect the number of macroalgal species in the area.

6.1.1.5.4.2 Macrozoobenthos

The impact of the project that has the most adverse character, possibly leading to a change in biodiversity of the macrozoobenthos in the BP OWF CI area is the disturbance of seabed sediment structure. It turns out that the physical destruction of macrozoobenthos communities along the route where up to 4 power cables (extended from substation A) will be laid will affect approx. 2.7 km^2 of the seabed inhabited by the soft-bottom macrozoobenthos and only 0.3 km^2 of the stony seabed covered by benthic fauna. This will not result in a significant change in the qualitative structure of the soft-bottom macrozoobenthos community, which consists of taxa typical and common on the shallow to medium-depth seabed (up to 35 MBSL) of the coastal and open waters of the Southern Baltic (eastern Gotland Basin), particularly as this will be a reversible phenomenon and the qualitative structure of the macrozoobenthos will recover within a few years after the impact ceases. The impact significance on macrozoobenthos biodiversity was assessed as **low**.

6.1.1.5.4.3 Ichthyofauna

During the construction phase, negative impact on the ichthyofauna biodiversity can be expected (reduction of the number of species present in the area). It can be assumed that it will mainly result from the avoidance of the area during cable laying works. The noise associated with the process (increased ship traffic, operation of cable laying equipment) may deter particularly the fish with a low reaction threshold such as the clupeids and cod. Area avoidance may also be associated with an increase in suspended solids concentration. However, for both of these factors, the negative impact will be local and short-term, directly related to the area at which the work front is focused at a given time.

Habitat change associated with the destruction of some benthic organisms may result in a reduction of the food base for benthivorous fish and consequently in the abandonment of the area by benthivorous fish. However, considering the width and surface area of the belt where the works will be conducted (80 m and 4 km^2, respectively), such effect seems unlikely. The significance of impact on ichthyofauna biodiversity was assessed as **low**.

6.1.1.5.4.4 Marine mammals

A potential negative impact of the project that may affect marine mammals is the temporary exclusion of the construction area from use as a result of deterrence by the noise generated by ships and equipment. However, given the local and short-term nature of this impact, the lack of evidence of significance of the area for particular marine mammal species and the sporadic occurrence of such species, the significance of this impact was assessed as **low**.

6.1.1.5.4.5 Seabirds

The analysis of the possible impacts resulting from the construction activities conducted during the BP OWF CI construction phase indicates that their effects will be mostly short-term and local. This applies to all types of emissions (noise, suspended solids and the release of nutrients from seabed sediments).

As a result of the construction works conducted, a temporary change in the species structure may occur in the project area and in the immediate surrounding area. In the case of seabirds from the BP OWF CI area, the most sensitive species will be displaced already in the construction phase, and the abundance of sea ducks will gradually decrease. An increase in the number of gulls and cormorants is expected, since they use the structures protruding from the water as their resting place. Therefore, it cannot be stated that the bird biodiversity will remain undisturbed. It should be emphasised that this change concerns the location where the construction activities will take place and the surrounding areas. After the completion of the construction phase, some of the birds representing the species more sensitive to the impacts (razorbills, sea ducks) may temporarily move to the neighbouring feeding grounds. The loss of zoobenthos in amounts insignificant from the point of view of the food resources for the seabirds will not result in the disturbance of food relations, which will not disrupt the existing balance and will not lead to a permanent elimination of species.

The marine habitat will not be fragmented in a manner that would enable the isolation of populations permanently or temporarily associated with the BP OWF CI area and adjacent sea areas.

To summarise, the significance of the project impact on biodiversity can be considered as **low**, given its local range.

6.1.1.6 Impact on cultural values, monuments and archaeological sites and objects

One shipwreck of historical significance was identified in the offshore part of the BP OWF CI area. It is the Danish S/S Elie, lying on the seabed at the distance of approx. 800 m from the shore (the area shared by the APV and the RAV). As no works involving interference with the surface seabed sediments will be conducted at the wreck site, the planned project will not affect its conservation status. The near-shore section of the cable lines will be brought ashore using the trenchless method, starting from a distance of 1200–1300 m from the shore, i.e. at the distance of at least 400–500 m from the position of the steamer wreck. Potential indirect impacts related to the re-sedimentation of the seabed sediments mobilised during construction activities will be insignificant. As indicated in the suspended solids dispersion analysis (see subsection 4.4), sedimentation outside the area of underwater works may cover the wrecks in the vicinity of the construction area with a very fine-grained sediment layer with a thickness of at most several millimetres, which will most probably be removed by hydrodynamic processes in a short time. The impact of the construction phase on the preservation of wrecks, regarded as historical artefacts, is considered **negligible**.

6.1.1.7 Impact on the use and management of the sea area and tangible property

During the BP OWF CI construction phase, the impact on the use and development of the sea area will result, almost exclusively, from the establishment by the Director of the Maritime Office in Gdynia of the protection zone for the cable lines, within which restrictions will apply to protect the subsea cables from damage or destruction. Out of the existing uses of the sea area, the protection zone will limit fishing activities in terms of the use of demersal fishing gear. The analysis of commercial fishing and fishing effort in the statistical rectangles N7, N8, O6, O7 and O8 (see subsection 3.9.2) showed that there are no significant commercial fisheries within their boundaries. It was assessed that the impacts of the BP OWF CI on fisheries during the construction phase will be **negligible**.

Restrictions to navigation in the area may result from the presence of vessels involved in the cable line installation works. The BP OWF CI area crosses the customary shipping route to and from the ports of Gdynia and Gdańsk (see subsection 3.9.1). Vessels sailing along this route will have to adjust their course in order to avoid the vessels involved in the construction works. Due to the minor impediments to navigation anticipated and the temporary nature of the impact, the impact significance was assessed as **negligible**.

The construction of the cable lines is not expected to generate impacts on other forms of sea area development during the BP OWF CI construction phase.

6.1.1.8 Impact on landscape, including cultural landscape

In the BP OWF CI construction phase, the potential impact of the project on the landscape, including cultural landscape, will result exclusively from the traffic of vessels involved in the construction works – cable line installation. The involvement of various types of vessels is expected, i.e. cable-laying vessels, cable barges, tugboats, service vessels or other multi-purpose vessels. The largest vessels expected to participate in the construction works are cable-laying vessels, which are up to 150 m long. The length of cable barges and service vessels is up to 100 m, while that of tugboats – up to 50 m. However, their presence will not interfere with the landscape of the sea area covered by the planned BP OWF CI construction, as it is already used for navigation to and from the ports in Gdynia and Gdańsk. It should be noted that the usual navigation route runs at a considerable distance from the shore, i.e. approx. 10 km, while in the case of the construction of the near-shore section of the cable lines large vessels such as cable-layers, will temporarily sail much closer to the shore and will be clearly visible to observers on the shore. However, this phenomenon will not be a significant deviation from the existing character of the sea area landscape.

The construction of the BP OWF CI will not involve the construction of elements extending above the water surface, so the impact on the landscape resulting from the presence of vessels participating in the cable line construction will cease immediately after the completion of the construction phase.

The subsea export cables will be brought ashore using the trenchless method along a section starting more than 100 m from the shoreline and ending in the offshore area behind the sandbank zone, i.e. at a distance of approximately 1200–1300 m from the shore. Thus, there will be no impacts on the coastal landscape, including beaches.

Considering the manner of implementation of the planned project and the current use of the sea area, the impact significance on the landscape, including cultural landscape, was assessed as **negligible**.

6.1.1.9 Impact on population, health and living conditions of people

During the construction phase, temporary impediments are expected for ships navigating along the usual route to and from the ports in Gdynia and Gdańsk, i.e. the necessity to modify the sailing course due to the presence of vessels involved in the cable line construction. However, this will be a minor impediment and will cease after the construction phase is completed.

Cable line construction will also result in a partial exclusion of the statistical rectangle areas from fishing activities – providing a safety zone for subsea cables. Within the entire PMA, the statistical rectangles N7, N8, O6, O7 and O8 do not constitute important fishing grounds for commercial species and are not intensively used by fishermen (see subsection 3.9.2).

During the BP OWF CI construction phase, no impacts on navigation and fisheries that could lead to negative impacts on the well-being and living conditions of people are expected. Therefore, the impact significance was assessed as **negligible**. No impacts on human health are expected to occur during the construction phase.

6.1.2 Operation phase

6.1.2.1 Impact on the geological structure, seabed sediment structure, access to raw materials and deposits

Changes within the seabed associated with the project impact will be local and, within the entire area occupied by the project, insignificant for the overall character of the seabed and its structure.

Depending on its structure, the seabed may exhibit different sensitivity to the impact of the project during its operation phase. The seabed made of till and till with a stony cover is difficult to wash out and withstands morphological changes. A sandy, sandy-silty, and silty seabed is more susceptible to washout and material being displaced over it, e.g. in the form of sandy waves. Thus, the elements of the connection infrastructure may be uncovered or buried, both as a result of natural processes involving the movement of rock material along the seabed and as a result of this movement being disrupted by the connection infrastructure components.

Activities related to the project operation may cause the following types of impact on the seabed:

- local changes in the seabed relief associated with the presence of the connection infrastructure components and their impact on the processes of sediment transport and deposition: seabed washouts upstream/downstream of the connection infrastructure components, formation of sediment accumulation upstream/downstream of infrastructure components (sandy drifts), cavities in the seabed created at the anchoring places of the maintenance vessels.

No changes in the seabed structure are expected during the project operation phase. The overall impact of the project during the operation phase can be assessed as **negligible**.

6.1.2.2 Impact on the seawater and seabed sediment quality

During the BP OWF CI operation, works affecting the quality of water and seabed sediments will be carried out in its area. These will mainly be service works and interventions in case of an emergency situation.

It was found that during its operation phase the BP OWF CI may cause two types of impacts on the receptors discussed (water and seabed sediments). Contamination of water and seabed sediments with petroleum products as well as change in the temperature of seabed sediments and water due to heat transfer from transmission cables.

6.1.2.2.1 Contamination of water and seabed sediments with petroleum products during normal operation of vessels in the course of routine maintenance activities and during breakdowns or collisions

During normal operation of vessels, when periodic inspections are conducted on the connection infrastructure, spillages of various petroleum products may occur (e.g. lubricating and diesel oils, petrol).

To a minor extent, they may contribute to the deterioration of water quality. Heavier oil fractions may undergo sorption on the surface of organic and mineral suspended solids, which will increase their specific gravity and make them gradually sink to the bottom. This is where they may be bound in seabed sediments.

Contamination of sea waters and/or seabed sediments with petroleum products released during normal operation of vessels during the BP OWF CI operation period is a direct negative impact which is local, momentary or short-term, reversible, repeatable and of low intensity.

The significance of this impact during the operation phase in the APV was assessed as **negligible** for sea waters and seabed sediments.

6.1.2.2.2 Change of water and sediment temperature through heat reception from transmission cables

Electric power will be transmitted from the BP OWF via up to 4 extra-high voltage submarine AC power cables with an operating voltage of 220 kV or 275 kV.

The electric current flowing through a power cable causes its heating related to power losses due to resistance, in accordance with Joule's law. As the temperature of the cable increases above the ambient temperature, the transfer of heat commences from the cable to the surrounding environment.

A precise quantification of the dissipated heat is difficult because of the phenomena such as conductivity, convection and heat radiation, subject to various physical laws [358].

Increasing the temperature of sediments in which the cable is buried and the interstitial waters (water filling the spaces between sand grains in the sediment) may cause:

- increased bacterial activity resulting in accelerated decomposition of organic matter;
- decrease of oxygen content in water;
- release of harmful substances, including metals, from sediment into water;
- adverse effects on benthic organisms.

The most important parameters affecting the impact level are the depth of cable burial and the type of seabed.

For example, in the operating Nysted Offshore Wind Farm, the temperature increase emitted by the transmission cable (132 kV) buried at a depth of 1 m did not exceed 1.4°C in a layer of 20 cm above the cable, whereas on the seabed surface the temperature changes were already imperceptible [245]. This cable was buried in gravel sediment, which favours much higher heat loss in interstitial spaces between sediment grains than in the case of fine-grained sediment [245]. Both these types of sediment are common in the area of the planned construction of the BP OWF CI, but the transmission cable planned in the investment will have an operating voltage between 220 and 275 kV.

Heating of the seabed sediment and interstitial waters may also favour the transfer of metals from sediment to the water depth and accelerate the processes of decomposition of organic pollutants in the seabed sediment. In fact, benthic fauna is naturally adapted to large, seasonal temperature changes and is insensitive or shows very low sensitivity to a temperature increase of 2°C [26]. According to the standards proposed by the German Federal Agency for Nature Conservation, the increase of temperature due to the heat emission by the OWF transmission cable in a layer 20 cm below the seabed, which is the main habitat of the infauna, must not exceed 2°C.

An increase in sediment temperature by 1°C may cause a 10-fold increase in bacterial activity, which may accelerate and increase organic matter decomposition processes. This situation may also favour the decomposition of organic nitrogen, which becomes more available due to increased and accelerated mineralisation to inorganic compounds (the amount of inorganic nitrogen forms – generally well soluble in water – increases). An increase in temperature may also cause a decrease in the oxygen content of the water [249, 440, 389] and promote the conversion of ammoniacal nitrogen compounds contained in water and sediments to the gaseous form, which is harmful to living organisms [99]. At a temperature of 5°C and pH 8.2, approximately 2% of ammonium compounds convert into the gas form, while at a temperature of 25°C approximately 8% of ammonium compounds convert into the gas form (approx. a 4-fold increase). The proportion of the different forms of ammonia is very important for fish and other marine organisms, for which the gaseous form (NH_3) is toxic, as opposed to the NH_4^+ ions [99]. According to Directive 76/464/EEC, the lethal concentration of ammonia for rainbow trout is 5 $mg \cdot dm^{-3}$, whereas for crustaceans it is 8 $mg \cdot dm^{-3}$.

Heating of the seabed sediment and interstitial waters may also favour (the intensity of processes of) transfer of metals from sediment to the water depth and accelerate the processes of decomposition (degradation) of organic pollutants in the seabed sediment. The increase in sediment temperature may also adversely affect the condition of benthic organisms [245]. Moreover, the nutrient and oxygen content may be changed as a result of disturbance in the temperature profile [431].

Heat emission by the cables is a direct, negative impact of local range, which is long-term, irreversible and constant during the operation period, but due to the lack of data it is difficult to determine its intensity. There is a limited number of field surveys and literature reports on operational submarine cables and the increase in temperature of the seabed sediment and the near-seabed water layer caused by them as well as the impact of this phenomenon on their quality.

6.1.2.3 Impact on climate, including greenhouse gas emissions and impacts relevant for adaptation to climate change, impact on atmospheric air (air quality)

During the operation phase, periodic inspections of the seabed power cables are foreseen along their entire length. These will take place at least once every 5 years and will be carried out by relatively small service vessels. Therefore, no significant impact of the activities on climate, greenhouse gas emissions and air quality is expected.

6.1.2.4 Impact on ambient noise

Cables used for energy transmission, buried in the seabed, will not generate noise. Periodic maintenance and repair of the cable, requiring activities similar to those described in detail for the construction phase, will be limited to a smaller area and will be temporary in nature. The impact of acoustic field in the operation phase will be **negligible**.

6.1.2.5 Impact on nature and protected areas

6.1.2.5.1 Impact on biotic elements in the offshore area

6.1.2.5.1.1 Phytobenthos

When a cable section is laid on the seabed surface and secured against damage or destruction by means of protective measures (e.g. concrete mattresses, rip-rap, concrete protections), macroalgae may grow on the surface of the protective elements, forming an artificial reef together with periphytic fauna [201, 331, 76]. The protective measures will be applied in seabed areas covered with boulders, which occur at depths exceeding 20 m in the APV. Therefore, it can be expected that the structures will be overgrown in negligible quantities mainly by red algae, which will be replaced by mussels and balanuses in the later phase of the artificial reef development [235, 331]. The course of succession of periphyton communities is not fully known and not always uniform, as it depends on the interaction of biotic factors (interspecific competition) and abiotic factors (hydrodynamic regime of waters, type of substrate introduced) [292]. The emergence of an artificial reef in the area is regarded as a negative impact (disturbance of the original conditions prevailing before the investment) or positive one (local increase of biodiversity) [72, 76].

Introduction of hard substrate into the environment, potentially to be overgrown by periphytic flora should be regarded as a negative/positive, indirect, local and long-term impact. The scale of this impact will be insignificant, as the boulder areas on which the protection systems may be constructed constitute less than 1% of the total surface of the APV, which means that the surface potentially overgrown by flora will be small. The sensitivity of macroalgae should be considered high as they have a high potential to develop in the presence of hard substrates to which they easily attach. The significance of the impact was assessed as negligible [Table 6.11].

Table 6.11. Assessment of impact on phytobenthos during the operation phase [Source: internal materials]

Impact	Effect	Impact nature	Impact scale	Receptor sensitivity	Receptor significance	Impact significance
Operation phase						
Introduction of hard substrate into the environment	Artificial reef formation (periphytic flora and fauna communities)	Negative/positive, indirect, local, long-term	Irrelevant	High	Irrelevant	Negligible

6.1.2.5.1.2 Macrozoobenthos

The operation of the BP OWF CI will result in the following impacts on the macrozoobenthos inhabiting this area:

- the loss of a fragment of macrozoobenthos habitat;
- EMF emission;
- heat emission;
- an artificial reef effect.

The most important technical parameters of the BP OWF CI [Table 6.12] which are significant from the point of view of the assessment of the project impact on macrozoobenthos during the operation phase are:

- power cables – their type, number, length and depth of burial in the seabed sediment (impact of heat and EMF).

Table 6.12. List of key parameters of the Baltic Power OWF Connection Infrastructure in the Applicant Proposed Variant (APV) for the assessment of the impact on macrozoobenthos during the operation phase [Source: internal materials]

Parameter	Unit	Value/description
BP OWF CI corridor surface area (including corridors A, B, C)	km^2	34.6
Length of the BP OWF CI corridor (including corridors A, B, C) – assuming that the export cables are extended from each of a maximum of 3 BP OWF substations, at which the benthic habitats can be possibly destroyed (excluding the approx. 1 km of cable length with the tunnel drilled under the seabed, i.e. trenchless installation of power cables in the HDD or HDD Intersect technology from the offshore area to the land)	-	45.8
Cable type	-	Alternating current (AC) extra-high voltage (EHV) three-core cable
Maximum number of cables in the offshore area	-	4
Spacing between cables	m	100–200 (100 for the 11–13 m depth zone and 200 for the approx. 22 m depth zone)
Depth of the cable trench	m	4
Method of power cable laying in the offshore area	-	Buried in the seabed or laid on the seabed surface, secured by, for example, concrete mattresses, rip-rap, concrete protections. No anti-fouling substances used.
Maximum cable operating temperature	°C	90
Electromagnetic field (EMF)	µT	Unknown

The assessment of the BP OWF CI impact during the operation phase was carried out separately for:

- the soft-bottom macrozoobenthos;
- the hard-bottom macrozoobenthos.

A separate assessment of the project impact on macrozoobenthos is the result of these two benthic fauna communities (from the soft and hard bottoms) differing in the taxonomic composition, abundance and biomass of their taxa. Consequently, they differ in significance and sensitivity regarding the various types of impact. The significance and sensitivity of the group of organisms assessed (the soft- and hard-bottom macrozoobenthos) together with the evaluation of the impact scale (nature of interactions, type of interactions, spatial extent, time scope) influence the assessment of a given impact significance.

The significance of the soft-bottom macrozoobenthos community is low while the significance of the hard-bottom macrozoobenthos community is high [subsection 6.1.1.5.1.2]. The definition of macrozoobenthos sensitivity is provided in Table 6.5.

In the case of cable installation in the seabed, followed by backfilling with the same excavated material, the **loss of a fragment of macrozoobenthos habitat** is only temporary and will not permanently eliminate biological life from the sediment surface previously colonised by the soft-bottom macrozoobenthos. Depending on the sensitivity of individual species, the colonisation of the seabed by benthos will take place. The structure of the recovering habitat may be the same as before the project implementation but a slight change in the qualitative and quantitative structure of the benthos may also occur, due to a change in the sediment structure on the seabed surface in the cable burial area [79]. Opportunistic species with a short lifespan, especially polychaetes [82], are the first to appear. However, a complete restoration of the habitat will take place when the longest-living benthic species reach their maximum size, biomass and sexual maturity. Under the conditions of the Southern Baltic, the succession of destroyed habitats may take up to several years, which is associated with the colonisation of the sandy seabed by bivalves [247, 271, 141]. Only in the case of the hard-bottom macrozoobenthos communities, if the hard substrate is removed or the cables are laid directly on the seabed (on the stones) and are secured against damage with e.g. concrete mattresses, rip-rap or concrete protection systems, the natural habitat will be permanently eliminated. On the other hand, the impact at this location will be reversible, as in the case of the soft bottom, because a new artificial habitat, a so-called artificial reef, can be created on the concrete surface. Thus, whether it concerns the loss of soft-bottom or hard-bottom macrozoobenthos communities, the destruction of benthic communities along the transmission cable line leads to a temporary reduction of the feeding area of benthivorous birds (ducks: the velvet scoter, the long-tailed duck, the common scoter) as well as fish for which bivalves are a key component of the diet. Nevertheless, the recolonisation of the disturbed seabed area will be gradual and will result in the restoration of the food supply for benthivorous birds.

In the APV, estimates of the scope of permanent loss of the hard-bottom macrozoobenthos resources in the BP OWF CI development area indicate that this will be only 0.3 km^2 of boulder areas covering less than 1% of the corridor area, located at a depth of 22.4–22.7 m.

Considering the loss of a fragment of the habitat, the sensitivity of the soft-bottom macrozoobenthos community will be moderate, while in the case of the hard-bottom macrozoobenthos it will be high, as part of the benthic community will be permanently destroyed due to the impact of stress factor acting throughout the entire operation phase.

The loss of a fragment of benthic habitat is a negative impact occurring during the operation phase. However, due to its local range and, above all, its reversibility in the case of sandy seabed macrozoobenthos, the significance of the impact was assessed as low. For a community comprising an aggregation of mussels (*Mytilus trossulus*) on a stony seabed together with associated fauna – mainly crustaceans, despite their loss due to the elimination of hard substrate or its covering by the cable protected with concrete covers – given the nature of the impact limited to only one location along the cable route with an area not exceeding 0.3 km^2, the significance of this habitat loss will also be low. Moreover, these mussels will be among the first species to quickly re-colonise such surfaces as concrete cable protection elements (artificial reef effect) or the seabed around the cable [Table 6.13, Table 6.14].

The operation of power cables will involve the generation of **EMF**, which is another impact that can adversely affect benthic organisms. The first commercial HVDC cable in the Baltic Sea was laid in 1954 between Sweden and Gotland [374], but since that time, although the literature on the potential effects of this impact on benthic fauna in the Baltic is better and better documented, knowledge on this subject is still inconclusive [241, 446, 72]. An important input information is the determination of cable laying depth, the magnitude of this radiation, time of exposure as well as cable type (AC or DC) and cable insulation method applied [7, 284, 374]. According to the characteristics of this project, it is known that these will be alternating current (AC) EHV cables, with a maximum number of 4 in a BP OWF CI corridor, and that they will be installed at a depth of up to 4 m in the sediment. At present, the magnitude of the EMF emitted is unknown.

It is known that the presence of cables in the marine environment modifies natural conditions for marine organisms. However, so far, no legal regulations have been created specifying what magnitude of EMF is harmful for marine animals. Experts are also convinced that conclusions formulated on the basis of laboratory experiments exploring negative effects on benthos may be inadequate (lower impact than in reality) to the *in situ* situation [62]. The impact of EMF on individual species of benthic fauna, including bivalves, crustaceans or polychaetes, has so far been examined only on the basis of laboratory tests [33, 172, 285, 356], and their results vary depending on the output characteristics of the EMF emitted and the organisms examined. However, many of the laboratory experiments conducted include invertebrate species that are commercially important resources for people (crabs, lobsters) [62, 162]. The results of an experiment conducted on the benthic fauna species which are representative and important in the PMA, i.e. *Limecola balthica* mussels and *Hediste diversicolor* polychaete suggest negative, cytotoxic and genotoxic impact of EMF with a frequency of 50Hz and magnetic induction of 1mT on these organisms, leading to cancer. The authors of this experiment [356] recommend considering the *L. balthica* mussels as a bioindicator species for the EMF impact on the benthic fauna. On the other hand, Jakubowska *et al.* [172] observed changes in motor skills as well as changes in bioturbation in polychaetes under the influence of EMF. Pursuant to the Marine Strategy Framework Directive (MSFD) [88], it is recommended to investigate the impact of EMF on aquatic organisms to determine the minimum value of harmful influence of this parameter on individual groups of animals.

In summary, EMF may not affect the structure and functioning of the benthos in the project area at all or may have a slight negative impact on benthic species at the level of biochemical and physiological changes [33, 22, 285]. As demonstrated in the analyses, in the case of AC EHV export cables, already at a distance of approx. 1.5 m from the cable, the EMF intensity levels are negligible in the context of the impact on the marine environment [265]. The burial of the cable at this depth or greater will neutralise the impact of EMF on benthic marine organisms sensitive to EMF. Nevertheless, it is still difficult to determine whether the magnitude of the EMF emitted by the AC cables in the BP OWF CI area will cause any adverse impact on macrozoobenthos.

Another impact – **heat emission** by the cable causing an increase in the sediment temperature during the operation phase – is caused by the electric current flowing in the cable as the cable heats up according to Joule's law. As the temperature of the cable rises, the heat is released to the environment. The heat emission is considerably higher for AC cables (this cable type will be used in the BP OWF CI area, with 220 or 275 kV voltage) than for DC cables [374]. The increase in sediment temperature may lead to adverse changes in the qualitative structure of macrozoobenthos living on and in the seabed in the immediate vicinity of the cables, as it modifies the chemical and physical properties of the seabed sediments and the availability of oxygen for benthic organisms, eliminating the most sensitive taxa [374]. For example, in the Nysted Offshore Wind Farm (Western Baltic, Danish waters), the increase in temperature emitted by the transmission cable (132 kV) buried at a depth of 1 m did not exceed 1.4 °C in a layer of 20 cm above the cable, whereas on the seabed surface the temperature changes were already imperceptible [245]. The cable was buried in gravel sediment, which favours much higher heat loss in interstitial spaces between sediment grains than in the case of fine-grained sediment. Both types of sediment are common in the intended area of the BP OWF CI. In fact, benthic fauna is naturally adapted to significant seasonal temperature changes and is insensitive or shows very low sensitivity to a temperature increase of 2°C [446, 26]. According to the standards proposed by OSPAR Convention for the Protection of the Marine Environment of the North-East Atlantic, the temperature increase due to the heat emission by transmission cables in a layer 20 cm below the seabed, which is the most biologically active habitat of the infauna, should not exceed 2°C.

As in the BP OWF CI area the AC cable type will be used, which is characterised by a high temperature of the phase conductor of up to 90°C, it is possible that this factor may have some influence on the macrozoobenthos communities above the buried cable, although according to the literature knowledge this impact will be insignificant [265, 374]. Nevertheless, if the cable is not installed immediately below the seabed surface, which is far more likely, no reduction of macrozoobenthos survival in the project area is expected at all during the operation phase. The actual effect of this impact, which is poorly documented in the literature, cannot be determined.

Table 6.13. Impact assessment of the project on the soft-bottom macrozoobenthos in the Baltic Power OWF Connection Infrastructure area in the operation phase [Source: internal materials]

Impact	**Characteristics of the soft-bottom macrozoobenthos community**		**Scale (size) of impact**					**Impact significance**
	Significance	**Sensitivity**	**Character**	**Type**	**Spatial range**	**Time span**	**Size**	
Loss of a fragment of the habitat	Low	Moderate	Negative	Direct Reversible	Local	Medium-term	Low	Low

Table 6.14. Impact assessment of the project on the hard-bottom macrozoobenthos in the Baltic Power OWF Connection Infrastructure area in the operation phase [Source: internal materials]

Impact	**Characteristics of the hard-bottom macrozoobenthos community**		**Scale (size) of impact**					**Impact significance**
	Significance	**Sensitivity**	**Character**	**Type**	**Spatial range**	**Time span**	**Size**	
Loss of a fragment of the habitat	Medium	High	Negative	Direct Permanent	Local	Long-term	Low	Low

The artificial reef effect is the colonisation of newly introduced artificial hard substrates by animal and plant periphyton communities and by mobile epifauna. Although this impact is widely documented in the literature (e.g. [27, 224, 26, 416, 193, 38, 331, 174, 22, 78, 232, 415]), so far it has been impossible to monitor the artificial reef phenomenon in the PMA of the Southern Baltic [21, 382, 383, 307]. Only experimental studies have been conducted on an artificial structure installed in the environment [91].

On the one hand, this is a positive phenomenon, since there will be an increase in local biodiversity [405, 416, 221, 22, 78], while on the other hand, the artificial reef effect can be considered a negative impact, as the original natural character of the seabed habitat fragment will be lost and it may be conducive to the propagation of invasive alien species that are not native to the PMA [48, 46, 72]. The invasive foreign species quickly displace indigenous species, leading to changes in the existing balance in the trophic network [173, 266, 215].

In case of the BP OWF CI area, the artificial reef may not be formed at all (if the cables are buried in the seabed along the entire corridor length) and if it does develop, it will only take place in a situation in which locally, along a very limited distance, cable burial proves impossible and the cables are laid on the seabed, secured with concrete material. This scenario may be considered if the cable is installed on the surface of a boulder area (hard-bottom macrozoobenthos community). Therefore, the artificial reef that may be formed on the concrete cable protections will compensate for the destruction of the natural habitat, and the biodiversity at the site will be maintained. Incidentally, such areas may also be formed on the seabed types that previously had a different character, where cable burial proves impossible. In general, based on experimental research [91] it is assumed that hard substrates will be firstly colonised by barnacles (*Amphibalanus improvisus*) and bay mussels (*Mytilus* sp.), followed by mobile crustaceans (such as *Gammarus* spp., *Corophium volutator* and *Monoporeia affinis*) as well as macroalgae. In the case of a single location, confined only to a structure fixed to the seabed (concrete cable protection), it is unlikely for alien species to occur at the site.

What is subject to assessment is no longer the original complex of benthic communities of the BP OWF CI but the impact of the artificial reef on the natural environment. It is possible to evaluate only the scale of this phenomenon. Although the artificial reef effect will be long-term and permanent, due to its localised range (very small surface, e.g. a single spot on the cable route) the impact significance will be low [Table 6.15].

Table 6.15. Impact assessment of the artificial reef on the ecosystem in the Baltic Power OWF Connection Infrastructure area in the operation phase [Source: internal materials]

Impact	Scale (size) of impact					Impact significance
	Character	Type	Spatial range	Time span	Size	
"Artificial reef" effect	Positive May also be negative	Direct	Local	Long-term Permanent	Low	Low

6.1.2.5.1.3 Ichthyofauna

6.1.2.5.1.3.1 Noise and vibrations

Cable vibration resulting from AC current flow is associated with sound emissions. Sound measured during a period of very low ambient noise levels at a distance of 100 m from a 138 kV AC transmission line passing through Trincomali Channel (Canada) did not exceed 80 dB re 1 μPa. Taking into account the cylindrical model of sound attenuation, it can be assumed that the noise level at a distance of 1 m from the cable will be approximately 100 dB re 1 μPa [175]. This value is definitely lower than the one that may occur during the BP OWF CI construction [280]. However, it should be remembered that in this case it is a continuous sound source. According to Meissner *et al.* [240], it can be assumed that the impact should not be significant. A similar assessment was made by Taormina *et al*. [374], with an emphasis that due to the lack of data on the long-term noise impacts on living organisms, this problem should be approached with special attention.

As the cable will be buried deeper than 1 m below the seabed surface or it will be secured, the noise level will be insignificant.

Emission of noise and vibrations generated during the BP OWF CI operation may directly and negatively affect the ichthyofauna. These impacts will be of negative, direct, local, long-term and permanent nature.

The sensitivity of cod, sprat and herring to the impact was assessed as high, while for European flounder, sand goby, common seasnail and straight-nosed pipefish – as moderate.

The significance of the impact is assessed as negligible for all the fish species analysed.

6.1.2.5.1.3.2 Habitat change

In locations where cable burial in the sediment is impossible, it may be necessary to apply various means of infrastructure protection against damage. These may include various types of concrete structures (concrete mats), boulder and stone embankments, plastic and metal covers [327]. Such objects, as well as the cable itself lying on the sediment surface, create a new habitat that can be colonised by organisms [374]. In this case, the so-called artificial reef effect occurs, the scale of which depends both on the size of the area where these structures are placed, on their surface area and complexity as well as the environmental conditions in which it was created and the composition of the fauna in its area [220, 144]. The formation of an artificial reef on a seabed lacking hard substrate will have a much more significant impact than in an environment where such substrate is present [374].

At the first stage, the reef becomes inhabited by periphyton organisms, macrophytes and invertebrates [103]. As soon as several months later, numerous populations of fish [387, 359] appear in the reef area, both those returning after the cessation of the disturbances related to the construction [323] as well as those absent in the area before (increase in biodiversity). According to Kerckhof *et al*. [194], after 6 years, we can speak about a fully developed community of organisms inhibiting the artificial reef (climax community).

After being inhabited by periphyton, macrophytes and invertebrates, artificial reef becomes an attractive habitat for ichtyofauna. The information on this issue is based on studies conducted in the OWF area. However, there have been no studies on the artificial reef effect caused by the presence of elements protecting the transmission infrastructure on the seabed. It may be assumed, however, that despite its smaller scale the nature of this impact will be similar to the one identified for the OWF. Artificial reefs formed by cable protection structures, as well as the cable itself lying on the seabed, can offer rich food resources and shelter, also creating favourable conditions for the reproduction of many fish species, for adult stages as well as roe, larvae and juvenile individuals. Such a situation was observed in the case of structural elements of wind turbines and anti-erosion protection solutions, where they constituted attractive shelters for young (2–3 year old) cod (*Gadus morhua*) [326]. The studies by Reubens *et al.* [325], which compared the fish catch efficiency of cod and bib (*Trisopterus luscus*) on a sandy seabed and in regions where hard artificial substrates were present (wrecks, OWFs), indicated distinct groupings of these species in the project area, particularly in the periods of intense feeding (summer, autumn). Artificial reefs may also provide favourable breeding conditions for numerous fish species such as herring (*Clupea harengus*), hooknose (*Agonus cataphractus*), garfish (*Belone belone*), lumpfish (*Cyclopterus lumpus*) and the rock gunnel (*Pholis gunnellus*) [446]. According to Spanggaard [176], the artificial reef area also provides preferable spawning conditions for gobies, which include species protected in Poland.

Studies conducted by Bergström *et al*. [23] in the area of the Lillgrund OWF located in the Sound strait showed visible aggregations of such fish species as cod, shorthorn sculpin, black goby, viviparous eelpout and eel in the project area. The results of surveys on the long-term impact of the Horns Rev 1 OWF on the abundance and taxonomic composition of fish have shown that the artificial reef effect was significant enough to cause an increase in the number of fish that prefer a hard substrate and, at the same time, too small to cause a decrease in the number of fish that prefer sandy substrates [357]. However, it should be remembered that the above information refers to the artificial reef effect related to OWF structural elements, the scale of which will be larger than that of transmission infrastructure protection systems.

Artificial reefs offering environmental conditions significantly different from those previously prevailing in a given area may constitute an environment facilitating invasion of alien species [220]. Most of the information about the appearance of alien species on artificial reefs concerns the periphyton and crustaceans, but it cannot be excluded that such areas may create a favourable environment also for alien fish species.

The newly created habitat, with its hard substrate and relatively rich food supply for benthivorous fish, may constitute a favourable environment for the colonisation by the invasive round goby *(Neogobius melanostomus)*. However, artificial reefs created as a result of the construction of transmission infrastructure are not an area where the reproduction of this species takes place. Round goby spawns at depths of 0.2 to 1.5 m, i.e. in areas where the construction of cable protection elements on the seabed surface is unlikely [406, 344].

Taormina *et al*. [374] identify the potential impact of the artificial reef effect created by subsea cables as small, while emphasising the need for further studies to collect more information on the subject. Meissner *et al*. [240] estimate that due to the small width of the strip of hard substrate created by the cable or its protective structures, the impact will be highly localised, although long-lasting.

If cable burial proves impossible, it will be laid on the seabed surface and secured against damage or destruction by standard protective measures such as concrete mattresses, sandbags, rip-rap, PVC pipe covers or concrete covers.

The impact related to the change of habitat will be positive, direct, local, permanent and long-term.

The sensitivity to the impact for cod, European flounder, herring, common seasnail and sand goby was assessed as high, while for sprat and straight-nosed pipefish – as moderate. The significance of the impact is assessed as negligible for all the fish species analysed.

6.1.2.5.1.3.3 Emission of toxic chemicals

Some of the cables used are filled with insulating fluids belonging to mineral oils and linear alkylbenzene fluids. These fluids are kept under constant pressure by pump stations located at the end of the transmission line. Such a cable structure carries the risk of leakage of insulating fluids into the environment if the cable is damaged or completely severed. The scale of such leakage will depend on the response time to the damage, the extent of the damage and the time required for its removal, as well as the location of the failure [280]. According to the analysis conducted during the design phase of the NorNedcable transmission infrastructure connecting the power systems of Norway and the Netherlands, the oil emission rate from a ruptured cable could reach 50 $dm^3 \cdot h^{-1}$, and the total spill volume in the worst case scenario would reach 2000 litres. The risk of such a failure was assessed as low. However, according to BERR [327], cables filled with mineral oils should not be used due to the risk of emissions, especially in the near-shore zone. The impact of petroleum emissions on fish is discussed in the subsection devoted to the construction phase.

The scale of linear alkylbenzene spills resulting from cable damage or severing will depend on similar factors as for mineral oils. A potential spill analysis carried out for these substances, for a transmission system crossing the Strait of Georgia (British Columbia, Canada) reports emissions of up to 3400 litres in the event of cable damage and 40 000 litres in the event of cable severing [170]. Decomposition of linear alkylbenzene fluids in the water depth is relatively quick, with complete degradation of 99% of the substances by microorganisms under aerobic conditions within 21 days. A failure of a cable buried in a near-shore zone can lead to accumulation of alkylbenzenes in the sediment. If anaerobic conditions occur in the sediment, these substances can remain in the sediment for up to 10–20 years. However, according to Jacques Whitford Limited [170] the toxicity of linear alkylbenzene fluids to fish, marine mammals and people is low.

When applying solutions involving external electrodes, toxic electrolysis products such as chlorine and halogenated organic compounds are released. These compounds can be toxic to living organisms. An assessment of the impact of these substances was carried out for two transmission systems using external electrodes: Basslink – a cable connecting Australia and Tasmania, and Labrador Island Link – a cable connecting Labrador and Newfoundland. For both transmission systems, a value of 10 ug·l was assumed as the concentration likely to cause adverse effects. Additionally, in the latter case it was assumed that a concentration of 1 $\mu g \cdot dm^{-3}$ could cause an avoidance response in fish. Calculations showed that for the Bass Strait (Basslink) system, concentrations regarded as toxic occurred within 2 m of the electrodes [269], while the Newfoundland solution demonstrated concentrations characterised by 1–2 orders of magnitude lower than the hazardous threshold assumed [256]. It was, therefore, concluded that in the case of the Basslink system, harmful impacts on fish could be expected only in the immediate vicinity of the electrodes, while harmful emissions from the Labrador Island Link transmission infrastructure electrodes would be too low to cause a fish avoidance response.

According to Sutton *et al*. [366], past experience related to the construction and operation of transmission systems involving external electrodes does not indicate the occurrence of significant negative environmental impacts.

The assessment of the impact of pollutant emissions during the operation phase, carried out by Taormina *et al*. [374] on the basis of a literature review, determines the level of this impact as negligible.

The impact related to releasing pollutants and nutrients from the sediments into water will be negative, direct, temporary and local.

The significance of the impact is assessed as negligible for all the fish species analysed.

6.1.2.5.1.3.4 Electromagnetic field impact

An electric current flowing through a conductor induces a magnetic field, the intensity of which depends on the current intensity. The field intensity decreases, both horizontally and vertically, with the distance from the current conductor. In the case of alternating current, the direction of flow changes, which entails changes in the magnetic field over time. As a result, the changing magnetic field induces an alternating electric field in seawater [123]. The use of three-phase AC cables practically allows to eliminate the emission of the magnetic field outside the cable due to current phase shifts in individual conductors of the cable [281].

Unlike alternating current, the magnetic field induced by direct current is static (there is no change in the field flux over time), so no alternating electric field is generated. However, in this situation an electric field may be induced in a moving medium, e.g. as a result of movement in a static magnetic field of electrolytes such as seawater (tides) or other conductors, e.g. moving marine organisms. This induced electric field creates a potential difference and can lead to current flow in moving matter or organisms.

The electric field, being dependent on the magnetic field, will similarly diminish with distance from the cable.

Based on calculations for various AC transmission system designs, Tricas and Gill [265] determined the average value of the magnetic field to be expected at different depths, depending on the distance from a cable buried in the seabed at the depth of 1 [Table 6.16].

Table 6.16. Magnetic field strength [μT] in relation to vertical distance from the seabed and horizontal distance from the cable (alternating current, cable burial depth 1 m) [Source: internal materials based on Tricas and Gill [265]]

Vertical distance from the seabed [m]	**Magnetic field strength [μT] at horizontal distance from the cable [m]**		
	0	**4**	**10**
0	7.85	1.47	0.22
5	0.35	0.29	0.14
10	0.13	0.12	0.08

The magnetic field strength generated in the case of high voltage DC technology (mean value from various projects) is presented in Table 6.17.

Table 6.17. Magnetic field strength [μT] in relation to vertical distance from the seabed and horizontal distance from the cable (direct current, cable burial depth 1 m) [Source: internal materials based on Tricas and Gill [265]]

Vertical distance from the seabed [m]	**Magnetic field strength [μT] at horizontal distance from the cable [m]**		
	0	**4**	**10**
0	78.27	5.97	1.02
5	2.73	1.92	0.75
10	0.83	0.74	0.46

Estimates prepared by the Centre for Marine and Coastal Studies Ltd [53] for high voltage DC solutions indicate that the strength of the field generated by the cable falls below the level of the natural terrestrial magnetic field at distances from 0 to just over 10 m from the cable (depending on cable type, current voltage and cable burial depth).

With the exception of solutions employing external electrodes, it can be assumed that cables that are properly insulated and embedded in the sediment should not be a direct source of electric field. When employing direct current technology with an electrode, the field strength expected may range from approx. 3 $V \cdot m^{-1}$ above the electrode to below 0.5 $V \cdot m^{-1}$ at a distance of 40 m (400 kV voltage, 1330 A current) [284]. A similar order of magnitude, although slightly lower values (1 $V \cdot m^{-1}$ over the electrode), are provided by Koops [205].

The spatial range of the induced electric field usually reaches up to several metres from its source [277, 92].

The sensitivity of ichthyofauna to the EMF impact depends on:

- the species-specific detection threshold;
- the type of sensor in the fish (magnetic, electrical);
- lifestyle (demersal, pelagic – seabed dwellers are exposed to a higher intensity of EMF) [92].

Magnetic fields can impact both the physiology and behaviour of fish as well as their spatial cognition. At physiological level, the impacts may include, for example, altered hormone values in brook trout [226]. Slower embryonic development has also been observed in sea trout and rainbow trout [110]. Laboratory studies conducted by Fey *et al.* [105] do not confirm a direct impact of magnetic field (10 mT) on the mortality and growth in the latter species. However, an experiment demonstrated a faster absorption of the yolk sac in larvae, which may negatively affect their condition. Krzemieniewski *et al.* [214] observed increased mortality of Wels catfish larvae exposed to a magnetic field of 0.4–0.6 T. On the other hand, no effect of long-term exposure to magnetic field (3.7 mT) was observed in juvenile flounder [33].

Disturbances in the natural field may cause problems with the orientation of migratory fish, such as European eel. However, the previous field surveys do not indicate a significant impact of cable-induced EMF on the migration capabilities of this species. In the surveys conducted in the Southern Baltic, no disturbances in the migration of eels swimming 500 m away from a wind turbine were observed [274]. Also, Westerbeg and Begout-Anras [411] did not find that high-voltage DC cables constituted a barrier to migration of this species. Only a reduction in swimming speed was observed in the zone near the cable; however, it was insignificant, causing an approx. 30-minute delay in the completion of the migration route [274]. Studies on the impact of the magnetic field generated by the submarine cable in the San Francisco Bay area on the migration of Chinook salmon (Oncorhynchus tshawytscha) did not indicate a significant impact of this potential source of interferences on the migration route, although its route was slightly changed [122].

Also, during the experimental surveys on the halibut's response to EMF, no significant changes in the behaviour of these fish were observed [430].

The extensive studies on the impact of cables running across the Nysted OWF area (the Danish straits) on ichthyofauna have indicated that although they constitute no barrier for fish, however, they can be an obstacle to their movement, especially the migration of eel. The authors of the EIA

Report conclude that although changes in the behaviour of fish along the cable route have been observed, their cause-and-effect relationship with EMF is unclear [73].

According to Poleo *et al*. [306], the Osteichthyes display a physiological response to an electric field of 7 $mV \cdot m^{-1}$ and a behavioural response in the range 0.5–7.5 $V \cdot m^{-1}$. Studies on the impact of electric field on salmonids and eels indicate the likelihood of such reactions as accelerated pulse (field strength of 0.007–0.07 $V \cdot m^{-1}$) as well as gill and fin vibration (field strength of 0.5–7.5 $V \cdot m^{-1}$) [237]. Harmful effects such as paralysis and temporary loss of consciousness were observed in fish exposed to an electric field with a strength above 15 $V \cdot m^{-1}$ [107], i.e. at values significantly exceeding the ones generated by subsea cables.

In the OWF environmental impact assessment carried out by Bergström *et al.* [22], the EMF impact was assessed as low. Also in the environmental impact assessment of the Horns Rev 2 OWF, the impact was classified as low or negligible [176]. According to Taormina *et al.* [374], the significance of this impact was classified as low for cables buried in the sediment and moderate for cables lying on the sediment surface.

As the analyses have shown, in the case of AC EHV export cables, already at a distance of approx. 1.5 m from the cable, the EMF intensity levels are negligible in the context of the impact on the marine environment. The burial of the cable at this depth or greater will neutralise the impact of EMF on the benthic and pelagic marine organisms sensitive to EMF.

The impact related to the emission of EMF will be negative, direct, local, long-term and permanent.

The sensitivity to the impact was assessed as moderate for all the fish species examined. The significance of the impact is assessed as **negligible** for all the fish species analysed.

6.1.2.5.1.4 Marine mammals

During the operation phase, marine mammals may be impacted by the noise generated from vessel traffic, operation of underwater equipment and interference in the seabed during periodic inspections or cable repair works. However, compared to the construction phase, these impacts will be significantly limited in time and space. The significance of this impact on the harbour porpoise was assessed as moderate, while on seals – as **low**.

6.1.2.5.1.5 Seabirds

In the operation phase, no significant impact of the BP OWF CI on seabirds is expected. After the installation of the transmission cable, the seabed will be repopulated by benthic communities, which will restore the original feeding areas of benthivorous and piscivorous birds. Thus, the number of birds in the project area during the operation phase is expected to be the same as before the project implementation. Moreover, there will be a positive impact during the operation phase, associated with the reduction of by-catches in the safety zone established over the offshore transmission cable.

Periodic inspections will be conducted by a single vessel equipped with a remotely operated underwater vehicle (ROV). The disturbance of birds will be incidental, temporary and reversible. The vessel traffic in the BP OWF CI area will not be more intense than in the surrounding areas.

Repair works, if any, are unlikely but nevertheless possible. The nature of the works and impacts on avifauna in such a case will be similar to the construction phase impacts.

The impact on all seabirds included in the assessment during the operation phase was assessed as **negligible**.

6.1.2.5.2 Impact on protected areas

6.1.2.5.2.1 Impact on protected areas other than Natura 2000 sites

In the offshore area of the planned project location and in the range of its potential impact there are no territorial forms of protection other than the areas of the Natura 2000 European ecological network. Therefore, in the operation phase, the BP OWF CI will not generate any impact on such areas.

6.1.2.5.2.2 Impact on Natura 2000 sites

The identification and assessment of impacts on protected areas within the European Natura 2000 network is presented in subsection 6.3.

6.1.2.5.3 Impact on wildlife corridors

A wildlife corridor, pursuant to the Nature Conservation Act of 16 April 2004 (Journal of Laws of 2004, No. 92, item 880, as amended), is an area enabling the migration of plants, animals or fungi. The network of wildlife corridors connecting the European ecological network Natura 2000 in Poland was developed in 2011 [177]. No wildlife corridors were indicated in the PMA. In the spring and autumn periods, regular bird migrations take place in the Baltic area; however, the migration tactics and their routes are very poorly recognised.

Given the lack of information on the occurrence, functioning and significance of wildlife corridors in maritime areas, it was conservatively assumed that the value of this resource is medium. Considering the specificity of the Baltic Power OWF CI resulting from the fact that it does not disturb – in terms of physical and emission-related aspects – the airspace as well as the water depth, it was assessed that during the operation phase the BP OWF CI will not generate any impacts on potential migration routes of migratory species.

6.1.2.5.4 Impact on biodiversity

6.1.2.5.4.1 Phytobenthos

When artificial reef (subsection 6.1.2.5.1.1) is formed on cable protection systems placed on the hard bottom, and macroalgae are part of it, species diversity in the area may increase. The cable protection elements may host not only species native to the area (subsection 3.7.1.1), but also new species whose spores have been brought in from other parts of the Baltic with the sea currents.

The impact of introduction of additional hard substrate in the area should be assessed as negative (disturbance of the original conditions existing before the commencement of the project) / positive (local increase in species diversity), indirect, local and long-term. The size of this impact will be insignificant, as the boulder areas on which the protection can be built constitute less than 1% of the total surface area of the APV, which means that the surface which could possibly be overgrown will be small. The sensitivity of macroalgal species was assessed as high because they have a high potential to thrive in the presence of hard substrates to which they easily attach. The significance of the impact is assessed as **negligible** (in accordance with Table 1.4).

6.1.2.5.4.2 Macrozoobenthos

In principle, there will be no significant changes at the stage of BP OWF CI operation, let alone an increase in biodiversity in terms of the structure of the benthic habitats because the cables are to be buried in the seabed (the soft-bottom macrozoobenthos habitats destroyed will recover in the project area and the qualitative structure of macrozoobenthos will be restored within several years after the impact cessation). On the other hand, if the cables are not buried in a limited area of the seabed but only laid and secured with concrete material, it may be an incidental case. The artificial reef will partially compensate for the hard-bottom macrozoobenthos community existing there before human interference in the environment which shall be destroyed. In this case it is also unlikely for the sites to support the spread of alien species. The impact significance on macrozoobenthos biodiversity was assessed as **negligible**.

6.1.2.5.4.3 Ichthyofauna

The assessment of impacts occurring during the operation phase (noise and vibration, electromagnetic field, release of harmful substances) indicates that they will not be significant. In the case of the first two impacts, the technical solutions described in section 0 should reduce their occurrence to a minimum. Therefore, no impact on biodiversity is expected. However, a possible impact on ichthyofauna biodiversity can be assumed given the presence of cable protection structures in places where, due to the seabed type, cable burial in the sediment will prove impossible. Structures such as rip-rap and concrete structures will provide a substrate for the formation of an artificial reef. This may result in a more abundant presence of certain fish species in their vicinity and a possible increase in certain biodiversity indicators. However, it should be emphasised that this phenomenon will have a very localised impact, given the probably small area on which the construction of such structures will be required. The significance of impacts on ichthyofauna biodiversity was assessed as **negligible**.

6.1.2.5.4.4 Seabirds

The analysis of the possible impacts resulting from the BP OWF CI operation indicates that their effects in terms of the changes in biodiversity of seabirds will be exclusively of local and short-term nature.

Destruction of benthic communities during the installation of transmission cables will result in a temporary reduction of feeding areas of benthivorous birds and later – piscivorous birds. Nevertheless, the recolonisation of the disturbed seabed area will be gradual during project operation and will result in the restoration of the food supply for seabirds. During the restoration of benthic habitats, both the recovery of their original species structure as well as changes caused by biological factors (invasive species) and/or physical factors (EMF, increased temperature of seabed sediments) may take place. Their nature is difficult to predict, but due to the scale of the impact it will not have a significant effect on avifauna biodiversity. In summary, the impacts on marine avifauna associated with the operation of the BP OWF CI are mainly associated with a temporary loss of habitats. The significance of impacts on seabird biodiversity was assessed as **negligible**.

6.1.2.5.4.5 Marine mammals

A potential negative impact of the project on marine mammals is the disturbance by the noise generated by ships and underwater equipment used during system maintenance or repair works. However, due to the localised and short-term nature of this impact, the lack of evidence as to the importance of this area for particular marine mammal species and the sporadic occurrence of such species, this impact was assessed as **moderate**.

6.1.2.6 Impact on cultural values, monuments and archaeological sites and objects

During the operation phase, no underwater works are anticipated that would result in seabed interference, except for *ad hoc* cable repairs in case of damage. Potential impacts on wrecks during the operation phase (see subsection 3.8) will result from the sedimentation of the sediments mobilised into the water column during the uncovering of a damaged subsea cable section. Mass flow excavation (MFE) of damaged sections of cable lines is associated with a more intense resuspension and sedimentation than the technologies planned to be used during the construction phase (see subsection 4.4). It should be noted, however, that the need for the application of MFE technology will only arise in emergency situations and that underwater works will cover only short cable line sections. For this reason, the impact of sedimentation on the surface of wrecks is expected to be smaller than during the construction phase and will not affect the conservation status of the wrecks. It should be assessed that the scale of impact of the BP OWF CI during the operation phase on the conservation status of the wrecks located within its boundaries and in the surrounding area will be insignificant and the impact will be **negligible**.

6.1.2.7 Impact on the use and management of the sea area and tangible property

During the BP OWF CI operation phase, the impact on the use and development of the sea area will result almost exclusively from the establishment by the Director of the Maritime Office in Gdynia of the safety zone for the cable lines, within which prohibitions and restrictions will apply in order to protect the subsea cables from damage or destruction. Out of the existing uses of the sea area, the safety zone will impose the strongest restrictions on fishing activities because the use of demersal fishing gear will most likely be prohibited within the zone. The analysis of commercial fishing and fishing effort in the statistical rectangles N7, N8, O6, O7 and O8 (see subsection 3.9.2) showed that there are no significant commercial fisheries within their boundaries. It was assessed that the impacts of the BP OWF CI on fisheries in this sea area will be **negligible**.

During the operation phase, the cable lines will be inspected periodically, at least once every 5 years. This type of work is usually performed by one vessel. Therefore, no impacts on navigation and other uses of the sea area are anticipated.

6.1.2.8 Impact on landscape, including the cultural landscape

Considering the low intensity of works in the operation phase – i.e. cable line inspections at least once every 5 years and a low probability of cable repair works – it was assumed that the BP OWF CI will generate no impacts on the landscape, including the cultural landscape, during the operation phase.

6.1.2.9 Impact on population, health and living conditions of people

Restrictions on the use of the sea area resulting from establishing a safety zone for the cable lines by the Director of the Maritime Office in Gdynia will most probably result in the exclusion of this part of the sea area from demersal fishing for ichthyofauna. Given the low significance of this part of the Baltic Sea in terms of commercial fishing and the small surface of the sea area predicted to be covered by the restrictions, it is expected that the impacts of the BP OWF CI on the population and living conditions of people due to the restrictions on fisheries are considered **negligible**. No impacts on human health are anticipated.

6.1.3 Decommissioning phase

6.1.3.1 Impact on the geological structure, seabed sediments, access to raw materials and deposits

During the decommissioning phase of the BP OWF CI, no dismantling of the subsea cable lines is anticipated. Therefore, no impacts on the geological structure, seabed sediment structure and access to raw materials and deposits are expected.

6.1.3.2 Impact on the seawater and seabed sediment quality

During the decommissioning phase of the BP OWF CI, no dismantling of the subsea cable lines is anticipated. Therefore, no impacts on the quality of seawater and seabed sediments are expected.

6.1.3.3 Impact on climate, including greenhouse gas emissions and impacts relevant for adaptation to climate change, impact on atmospheric air (air quality)

There are no plans to dismantle the power cable lines after their operation is discontinued. Therefore, there will be no negative impacts on the climate and air quality.

6.1.3.4 Impact on ambient noise

There are no plans to dismantle the subsea cable lines after their operation is discontinued. The reduction of vessel traffic in the area of the planned project in comparison to the construction and operation phases will influence the noise level. There will be no negative impacts on ambient noise levels.

6.1.3.5 Impact of the electromagnetic field

After the power transmission is discontinued, the cables left in the seabed will not generate electromagnetic field. Therefore, no impacts will occur.

6.1.3.6 Impact on nature and protected areas

6.1.3.6.1 Impact on biotic elements in the offshore area

6.1.3.6.1.1 Phytobenthos

Typical decommissioning activities will not be conducted after the operation is discontinued, as the export cables are not to be excavated from the seabed. Therefore, no impacts on phytobenthos will occur. It is assumed that the artificial reef formed during the operation period will comprise mainly animal organisms in the decommissioning phase. During reef formation (operation phase), mussels and barnacles will most likely displace macroalgae from the habitat (see subsection 6.1.2.5.1.1).

6.1.3.6.1.2 Macrozoobenthos

According to the technical characteristics of the planned project, there are no plans to remove the subsea cable lines after the BP OWF CI operation is discontinued – the power cables will remain buried in the seabed sediment. Therefore, there will be no impacts on macrozoobenthos. Only if incidentally hard substrates are introduced to the environment in a very limited area within the project area, the artificial reef will be preserved on a micro scale.

6.1.3.6.1.3 Ichthyofauna

According to the technical characteristics of the planned project, there are no plans to remove the subsea cable lines after the BP OWF CI operation is discontinued – the power cables will remain buried in the seabed sediment. Therefore, there will be no impacts on ichthyofauna. Also, the change in impact consisting in the cessation of EMF emissions related to current flow in cables after the infrastructure operation is discontinued will not affect ichthyofauna. According to the technical solutions presented in section 0, the assumed level of EMF emissions during operation will be very low. Therefore, the impact on ichthyofauna was assessed as insignificant. It can therefore be assumed that also its cessation will have no impact on ichthyofauna.

6.1.3.6.1.4 Marine mammals

According to the technical characteristics of the planned project, there are no plans to remove the subsea cable lines after the BP OWF CI operation is discontinued – the power cables will remain buried in the seabed sediment. Therefore, there will be no impacts on marine mammals.

6.1.3.6.1.5 Seabirds

According to the technical characteristics of the planned project, there are no plans to remove the subsea cable lines after the BP OWF CI operation is discontinued – the power cables will remain buried in the seabed sediment. Therefore, there will be no impacts on seabirds.

6.1.3.6.2 Impact on protected areas

6.1.3.6.2.1 Impact on protected areas other than Natura 2000 sites

In the offshore area of the planned project location and in the range of its potential impact there are no territorial forms of protection other than the areas of the Natura 2000 European ecological network. Additionally, according to the technical characteristics of the planned project, there are no plans to remove the subsea cable lines after the BP OWF CI operation is discontinued– the power cables will remain buried in the seabed sediment. In view of the above, in the decommissioning phase there will be no impacts on protected areas of this type.

6.1.3.6.2.2 Impact on Natura 2000 sites

According to the technical characteristics of the planned project, there are no plans to remove the subsea cable lines after the BP OWF CI operation is discontinued – the power cables will remain buried in the seabed sediment. Therefore, there will be no impacts on Natura 2000 sites.

6.1.3.6.3 Impact on wildlife corridors

According to the technical characteristics of the planned project, there are no plans to remove the subsea cable lines after the BP OWF CI operation is discontinued – the power cables will remain buried in the seabed sediment. Therefore, there will be no impacts on wildlife corridors.

6.1.3.6.4 Impact on biodiversity

According to the technical characteristics of the planned project, there are no plans to remove the subsea cable lines after the BP OWF CI operation is discontinued – the power cables will remain buried in the seabed sediment. Therefore, there will be no impacts on biodiversity.

6.1.3.6.4.1 Phytobenthos

Typical decommissioning activities will not be conducted after the operation is discontinued, as the export cables are not to be excavated from the seabed. Therefore, there will be no impacts on phytobenthos species diversity. It is assumed that the artificial reef formed during the operation period will comprise mainly animal organisms in the decommissioning phase. During reef formation (operation phase), mussels and barnacles will most likely displace macroalgae from the habitat (see subsection 6.1.2.5.1.1).

6.1.3.6.4.2 Macrozoobenthos

After the BP OWF CI operation is discontinued, there are no plans to remove the subsea cable lines – the power cables will remain buried in the seabed sediment. Therefore, there will be no impacts on macrozoobenthos species diversity. Only if hard substrates are incidentally introduced to the environment in a very limited area within the project area, the artificial reef – formed during the operation phase, consisting mainly of periphyton – will be preserved on a micro scale.

6.1.3.6.4.3 Ichthyofauna

As the cable lines are not expected to be dismantled upon decommissioning of the project and thus no significant impacts will occur at this stage, no changes to ichthyofauna biodiversity are anticipated.

6.1.3.6.4.4 Marine mammals

After the BP OWF CI operation is discontinued, there are no plans to remove the subsea cable lines, and the reduction of traffic of service vessels will contribute to the elimination of the disturbance to marine mammals Therefore, there will be no impacts on marine mammals.

6.1.3.6.4.5 Seabirds

After the BP OWF CI operation is discontinued, there are no plans to disassemble the transmission cables. Therefore, there will be no change in seabird biodiversity in the project area.

6.1.3.7 Impact on cultural values, monuments and archaeological sites and objects

According to the technical characteristics of the planned project, there are no plans to remove the subsea cable lines after the BP OWF CI operation is discontinued – the power cables will remain buried in the seabed sediment. Therefore, there will be no impacts on monuments as well as archaeological sites and objects.

6.1.3.8 Impact on the use and management of the sea area and tangible property

According to the technical characteristics of the planned project, there are no plans to remove the subsea cable lines after the BP OWF CI operation is discontinued – the power cables will remain buried in the seabed sediment. Therefore, there will be no impacts on the use and management of the sea area and tangible property.

6.1.3.9 Impact on landscape, including the cultural landscape

According to the technical characteristics of the planned project, there are no plans to remove the subsea cable lines after the BP OWF CI operation is discontinued – the power cables will remain buried in the seabed sediment. Therefore, there will be no impacts on landscape, including the cultural landscape.

6.1.3.10 Impact on population, health and living conditions of people

According to the technical characteristics of the planned project, there are no plans to remove the subsea cable lines after the BP OWF CI operation is discontinued – the power cables will remain buried in the seabed sediment. Therefore, there will be no impacts on population, health and living conditions of people.

ONSHORE AREA

For the purposes of the planned project implementation in the APV the following technical belts have been designated:

- **permanent** with a width of 25 m (up to 80 m near chambers) – an area directly connected to the construction works, covering the places where the surface layer of the ground and groundcover will be destroyed, and the trees and shrubs will be removed. The removal of trees and shrubs will be permanent;
- **temporary** with a width of 20 m from the external cable lines – constituting the so-called auxiliary belt, in which environmental impact is possible at the construction stage, as a result of construction works, the location of storage places for excavated soil, vehicle parking areas and access roads;
- **additional**, 250 m wide from the external cable lines – an area through which access roads may run [Figure 6.1].

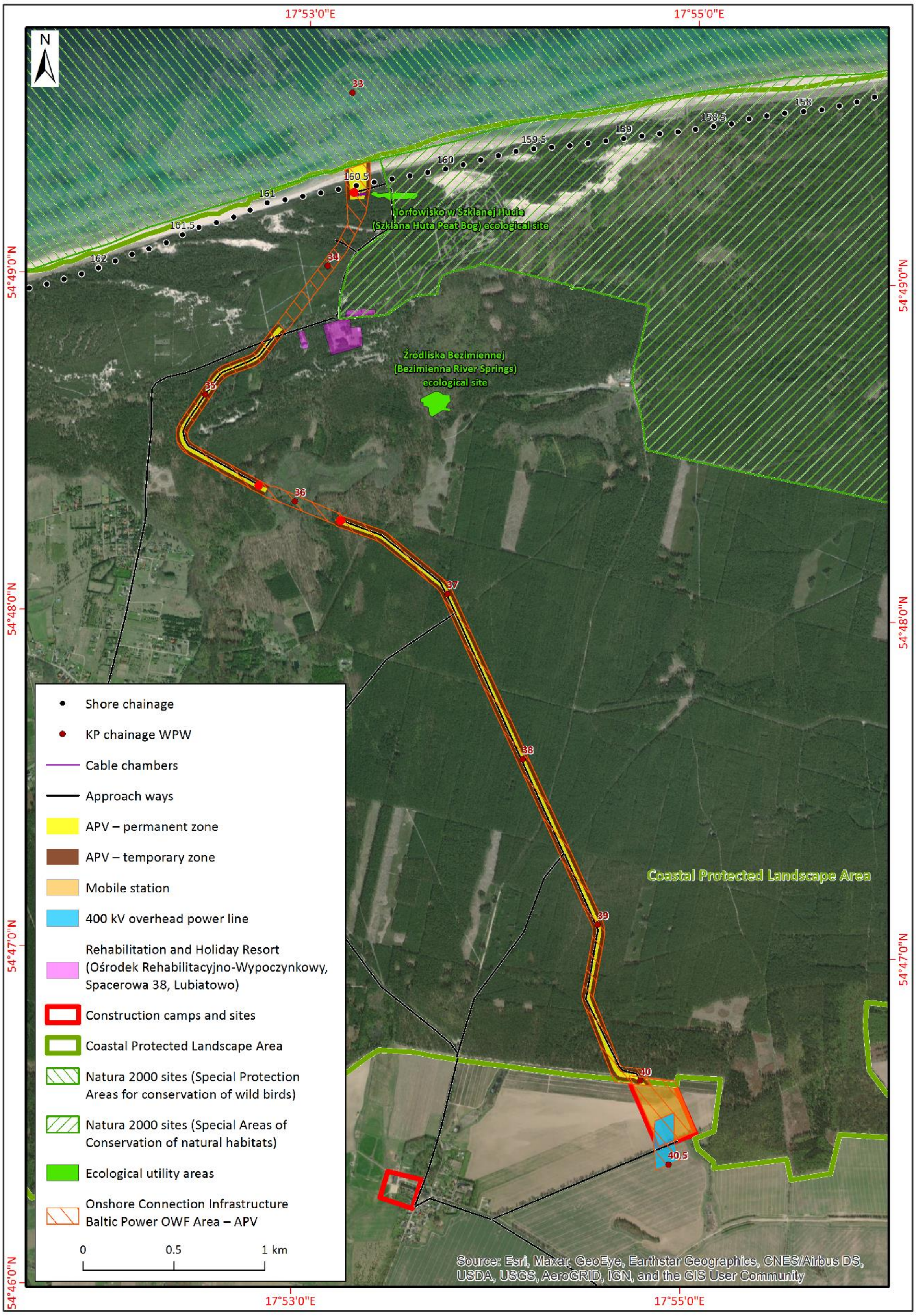


Figure 6.1. Planned project in the Applicant Proposed Variant (APV) [Source: internal materials]

6.1.4 Construction phase

6.1.4.1 Impact on geological structure, coastal zone, soils, and access to raw materials and deposits

The assessment of impact on geology and surface formations was based mainly on a detailed geological map of Poland at a scale of 1:50 000, digital geological data of the Polish Geological Institute – National Research Institute (PGI NRI), data from MIDAS service managed by PGI NRI and on deposit data sheets generated from the service.

The assessment of impact on soils was based on digital data obtained from the Institute of Soil Science and Plant Cultivation State Research Institute in Puławy (SSPC SRI) and from the State Forests, as well as on the literature materials listed on the list of literature references.

6.1.4.1.1 Impact on geological structure

Due to the planned project implementation, the following is planned:

- construction of an excavation for 4 cable chambers with a depth of approx. 2 m;
- construction of an open trench with a total length of 5 km a depth of 2 m and a width of 18 m in which 12 cables altogether will be laid;
- construction of 3 HDD or HDD Intersect passages with a width of around 1.5 km, 800 and 400 m; respectively
- levelling the ground for a customer substation and cable chambers;
- construction of access roads for the project (temporary and permanent ones);
- carrying out excavations for 2 towers for the implementation of a 270 m long section of a 400 kV overhead line.

The main construction phase impacts on geology and surface formations will be connected to:

- the construction of open trenches for cable laying, cable chambers and inlet and outlet chambers at the sections planned for trenchless passages;
- levelling works related to the ground levelling for the erection of a customer substation and cable chambers.

Moreover, the impacts will be connected to wind erosion and possible contamination of the open trenches with greases, oils, etc. as well as carrying out excavations for the foundations of two towers of the 400 kV overhead line.

Since the maximum depth of excavations will not exceed 2 m, the construction of the planned project will not affect deeper geological layers. The dimensions of the excavations for the two 400 kV line towers will be 8 x 10 m with the maximum depth of 4 m.

The cable chambers (4 chambers with a depth of 2 m and a side length of several meters at maximum) are to be placed in excavations with a depth of approx. 2 m, which will be backfilled later. The surplus earth will be managed within the technical belt.

The cable will be laid in trench sections of approx. 1 km length, and the duration of the trench staying open at that section will be approx. 1 week.

It is planned to lay 12 cables in total, divided into 4 cable tracks and to construct one trench approximately 2 m deep and 18 m wide. In the direct vicinity of the cables, bentonite (a mixture of sand and cement) will be used which is a non-toxic material that will not have a negative impact on the soil. The bentonite layer will be covered with concrete slabs above which perforated foil or plastic mesh will be placed. The remaining part of the trench will be filled with compacted virgin soil cleared of debris and stones [Figure 2.11], and the surplus earth will be managed within the permanent and temporary technical belts and handed over to specialist companies in accordance with the applicable regulations. The compacting of soil is carried out to prevent its sinking. Cable laying will mean a temporary occupation of the area for permanent and temporary technical belt.

In areas of particularly high natural value, at the crossing of watercourses and other obstacles that cannot be crossed by open trenches, trenchless technologies such as horizontal directional drilling or jacking under roads will be used. The sections planned to be crossed using horizontal directional drilling method are:

- the HDD or HDD Intersect borehole through the coastal zone – with the maximum length of 1.5 km;
- the HDD or HDD Intersect borehole under the Wydma Lubiatowska dune – with a length of approx. 800 m;
- the HDD or HDD Intersect borehole through the waterlogged area – with a length of approx. 420 m;
- jacking under dirt roads.

At further stages of the works, a detailed design of the crossings will be prepared, geotechnical investigations will be carried out, a detailed work schedule will be prepared and the Investor's supervision will be carried out.

Construction site facilities and yards will be located outside protected areas and outside wetlands. The main location of the material and equipment stockyard is planned at the customer substation area, while the back-up yards are planned in the village of Osieki Lęborskie. A temporary construction site facilities are permitted in the vicinity of cable chambers. The construction site back-up facilities and material-equipment bases will be equipped with portable sanitary facilities with airtight containers, systematically emptied by specialist companies, and possible spills will be neutralised with petroleum product neutralising agents; the staff will be instructed on how to use such agents.

The implementation of the planned project will require levelling in the area of the customer substation. The soil will be managed within the substation area and its surplus will be handed over to specialist companies to be managed in accordance with the applicable regulations. The area of the customer substation will be approx. 8 ha, while the area of the structures permanently fixed to the ground (under the point structures) will be up to 1 ha.

Due to the necessity to access the project area and the storage site for materials and equipment, it is planned to use the existing roads and construct new ones. It is planned to build about 5 km of new roads with a hardened surface along the axis of the planned cable tracks. In addition, the Investor plans to use the existing road infrastructure.

The degree of the impacts described above depends on the sensitivity of land conditioned by the type of surface formations. The areas most vulnerable to the construction phase impacts of the planned project are dune areas as well as areas with high level of groundwater deposition.

The most valuable dune area, at which the aeolian sands susceptible to wind erosion and infiltration of possible pollutants such as oil spills are present is the Wydma Lubiatowska dune. A horizontal directional drilling is planned at this section, which excludes the risk of damaging the surface formations and minimises the risk of contamination infiltration. An area vulnerable in geological terms to the infiltration of pollutants, which is due to a high level of groundwater deposition, are alluvial mud and humus sand formations of endorheic depressions and valley bottoms at km 35+800 to 36+100, which is also planned to be crossed using horizontal directional drilling technology.

The remaining part of the planned cable route leads through the areas of alluvial sands and glacial tills, characterised by greater resistance than aeolian sands on dunes and the formations with high level of groundwater occurrence. The planned customer substation and the 400 kV overhead line are located on sandy-silty eluvia of glacial tills and on glacial tills.

The main material and equipment stockyard is located in the area of the planned customer substation on the ground consisting of glacial tills, similarly to the back-up yard in Osieki Lęborskie. The back-up yard in Osieki Lęborskie is located in half on glacial tills and in half on humus sands and alluvial muds. No landslides were identified in the area analysed.

Table 6.18 and Table 6.19 contain the assessment of surface formations resistance and the evaluation of the impact on surface formations. The planned project will not affect deeper geological layers.

Table 6.18. Assessment of the surface formations resistance to the construction phase impacts for the Applicant Proposed Variant (APV) [Source: internal materials]

No.	Impacts	Types of surface formations	Resistance
1.	Disturbance of surface formations (trench)	Aeolian sands	High
		Alluvial sands	High
		Glacial tills and eluvial deposits	High
		Alluvial mud and humus sands	Low
2.	Area occupancy and levelling works for the erection of the customer substation	Glacial tills	High
		Sandy-silty eluvial deposits of glacial till	High
3.	Wind erosion	Aeolian sands	Low
		Alluvial sands	Moderate
		Glacial tills and eluvial deposits	High
		Alluvial mud and humus sands	High
4.	Oil and grease contamination (roads, storage yards, back-up facilities)	Aeolian sands	Low
		Alluvial sands	Moderate
		Glacial tills and eluvial deposits	High
		Alluvial mud and humus sands	Low

Table 6.19. Characteristics of the construction phase impacts on the surface formations for the Applicant Proposed Variant (APV) [Source: internal materials]

No.	Impacts	Types of surface formations	Nature of impact	Type of impact	Impact range	Temporal scope of impact	Impact scale	Impact sensitivity	Impact significance
1.	Disturbance of surface formations (excavation)	Aeolian sands	Negative	Direct, primary, reversible	Local	Momentary	Irrelevant (HDD or HDD Intersect section)	Low	Negligible
							Moderate		Low
		Alluvial sands					Moderate	Low	Low
		Glacial tills and eluvial deposits					Moderate	Low	Low
		Alluvial mud and humus sands					Irrelevant (HDD or HDD Intersect)	High	Negligible
2.	Levelling works for the erection of the customer substation and cable chambers	Aeolian sands	Negative	Direct, primary, permanent	Local	Momentary	Moderate	Low	Low
		Glacial tills					High	Low	Low
		Sandy-silty eluvial deposits of glacial till					Low	Low	Negligible
3.	Wind erosion	Aeolian sands	Negative	Indirect, primary, reversible	Local	Momentary	Irrelevant (HDD or HDD Intersect section)	No impact	Negligible
							Moderate	High	Moderate
		Alluvial sands					Low	Low	Negligible
		Glacial tills and eluvial deposits					Low	Low	Negligible
		Alluvial mud and humus sands					Low (HDD or HDD Intersect and construction site)	Low	Negligible
4.	Oil and grease contamination (roads, storage yards, back-up	Aeolian sands	Negative	Direct, primary, reversible	Local	Momentary	Irrelevant (HDD or HDD Intersect section)	No impact	Negligible
							Low	High	Low

No.	Impacts	Types of surface formations	Nature of impact	Type of impact	Impact range	Temporal scope of impact	Impact scale	Impact sensitivity	Impact significance
	facilities)	Alluvial sands					Low	Low	Negligible
		Glacial tills and eluvial deposits					High	Low	Low
		Alluvial mud and humus sands					Moderate	Moderate	Moderate

Alluvial mud and humus sands are characterised by the lowest resistance to excavations, which is related to the disturbance of the soil and soil-water relations.

Aeolian sands have the lowest resistance to wind erosion, which is related to their loose structure and small grain diameter.

The lowest resistance to contamination with greases and oils is shown by aeolian sands (due to the loose structure facilitating infiltration) as well as alluvial mud and humus sands (due to the high level of groundwater transporting contaminants).

The route of the planned project crosses through aeolian sands a total length of about 2 km, most of which are the aeolian dune sands forming the Wydma Lubiatowska dune, under which the planned project runs through an HDD borehole. The significance of the impact resulting from excavation works along the sections planned to be crossed using the HDD or HDD Intersect method was considered negligible. Only at the sections of aeolian sands, located outside the Wydma Lubiatowska dune, planned to be crossed by an open trench (a total of about 300 m of aeolian dune sands), the impact significance was assessed as moderate. Due to the construction of cable chambers, it will be necessary to carry out levelling works within the aeolian sands area. The significance of this impact was assessed as low. The risk of contamination with grease and oil spills along the sections planned to be crossed by a horizontal directional drilling was assessed to be negligible, whereas along the sections of aeolian sands planned to be crossed by an open trench, to be moderate. The significance of the impact was assessed to be low. The impact on aeolian sands resulting from wind erosion along the sections planned to be crossed by the horizontal directional drilling method was assessed similarly; its significance was assessed to be negligible, while along the sections of aeolian sands planned to be crossed by an open trench, the significance of the impact was assessed to be moderate.

Alluvial sands are planned to be crossed by an open trench. These are common soils, more resistant to wind erosion and contamination than aeolian sands. The significance of the impact of wind erosion on such formations was assessed as negligible. The significance of the impact of trench implementation was considered to be low. The significance of the impact related to the risk of contamination with grease and oils was assessed as negligible.

Due to their compact structure, tills show even greater resistance to wind erosion and pollution than alluvial sands. Tills and till residues occur in the central and southern part of the planned cable route and in the area planned for the location of the customer substation and the 400 kV overhead line. These formations are planned to be crossed by an open trench method and the area for the substation is to be levelled. The impact on the tills related to the excavation of the trench was considered to be low. Material-equipment bases as well as a customer substation will be located on these formations, therefore it will be necessary to carry out levelling works. This impact was assessed to be low. The significance of the impacts resulting from the risk of contamination with grease and oils was assessed to be low. The impact related to the occurrence of wind erosion was assessed to be irrelevant.

Along the section from km 35+800 to 36+100 there are humus and alluvial sands in a waterlogged valley bottom. Due to the high level of groundwater deposition, these soils are susceptible to infiltration of pollutants. The entire section is planned to be crossed by a horizontal directional drilling, therefore the significance of the impact resulting from the implementation of the excavation and wind erosion was assessed to be negligible. The back-up site for the storage of materials and equipment in Osieki Lęborskie is partially located on this type of formations, which poses a risk of oil contaminants entering the ground, infiltrating and being transported in groundwater. Therefore, the significance of the impact was considered to be moderate.

As a result of the assessment, the impact on geological and surface formations was found to be moderate at most. The most valuable sections, i.e. the Wydma Lubiatowska dune and the waterlogged valley, are planned to be crossed by a horizontal directional drilling, which minimises the risk of impact occurrence. Among sensitive surface formations there are the aeolian dune sands which occur outside the Wydma Lubiatowska dune along a section with a total length of about 300 m and within which moderate impacts resulting from the implementation of an open trench and the risk of wind erosion have been established. Also sensitive to impacts are the alluvial and humus sands which, along the route of the planned project, are planned to be crossed entirely by a horizontal directional drilling. Only the location of the back-up storage site in Osieki Lęborskie is planned partially on this type of formations. In this place, it is recommended to put emphasis on protecting the ground against possible spills and leaks.

The impacts related to the disturbance of surface formations will be **negative, indirect, primary, reversible, local and short-term. The scale of impact is irrelevant**/**low**.

The impacts related to the levelling works for the construction of a customer substation and cable chambers will be **negative, direct, primary, permanent, local and temporary**. **The scale of impact is irrelevant/low**.

The impacts related to the wind erosion will be **negative, indirect, primary, reversible, local, and short-term. The scale of impact is irrelevant and moderate in relation to aeolian sands.**

The impacts connected to contamination with grease and oils will be **negative, direct, primary, reversible, local and short-term. The scale of impact is irrelevant/low and moderate in relation to alluvial mud and humus sands.**

6.1.4.1.2 Impact on the topography and dynamics of the coastal zone

The main impacts on the topography and dynamics of the coastal zone will be related to:

- levelling works related to the ground levelling for the construction of cable chambers;
- construction of inlet and outlet chambers at the sections planned for trenchless crossing.

As part of the planned project, 4 cable chambers are to be located at a distance of approximately 75 m (the most extreme western chamber) to 90 m (the most extreme eastern chamber) from the dune baseline (as at March 2021), between 160.4 km and 160.6 km according to the shoreline chainage of the Maritime Office in Gdynia. Construction works will be preceded by tree and shrub felling and will include their cutting and grubbing up, removing the stumps, transporting the resulting spoil outside the construction site and filling the pits left by the removed stumps. At the places in which cable chambers are to be located, ground levelling over the maximum area of 0.25 ha will be carried out. Then, on the coarse sand bedding, the chambers in the form of prefabricated elements will be erected, cables will be installed, the chambers will be secured, backfilled and the area will be restored to the condition prior to the construction. The surplus earth will be managed within the permanent technical belt.

The impact on the coastal zone development during the construction phase will be minimal and limited to a small area. The erection of cable chambers as concrete cuboid-shaped objects with a side length of up to a few meters, at a depth of about 2 m, will not affect the dynamics of the coastal zone, but it may have a minimal/negligible impact on the aeolian processes that may be launched in the area of the planned cable chambers. The important issue during the restoration of the area to its original condition is to ensure the appropriate condition of the vegetation growing on the dune surface. In the case it was neglected, aeolian processes may be initiated, and consequently, a burial or exposure of the elements of the planned project could take place.

Trenchless technologies in the form of horizontal directional drilling will be used to run cable lines in the area of the coastal zone and the Wydma Lubiatowska dune. Each of the maximum four offshore cable lines shall be routed on land with a separate drilling made from land in the direction of the sea. The boreholes on land will be located from approximately 75 m (the most extreme western chamber) to 90 m (the most extreme eastern chamber) from the dune baseline (as at March 2021). With an average beach width in this area of 30–40 m (as at 2021), the distance from the waterline will be 105–115 m (the most extreme western chamber) to 120–130 m (the most extreme eastern chamber), respectively. The trajectory of the boreholes, their length and depth, take into account the need to protect the dune system and the environment of the dynamic nearshore zone. The detailed borehole parameters shall be known after the planned geotechnical surveys have been conducted [Table 6.20, Table 6.21].

The structure of the shore as a result of the borehole execution will not be disturbed to the extent that it will have a negative impact on the change of its function and stability, thus it will not affect the actions taken by the competent administrative authorities as part of the protective tasks. In addition, it will not cause changes in the flora and fauna of the beach and dune area.

Table 6.20. Assessment of the coastal zone resistance to the construction phase impacts for the Applicant Proposed Variant (APV) [Source: internal materials]

No.	Impacts	Elements of the coastal zone	Resistance
1.	Levelling works	Beach	High
		Wydma Lubiatowska dune	Moderate
2.	Trenchless technologies	Beach	High
		Wydma Lubiatowska dune	High

Table 6.21. Characteristics of the construction phase impacts on the coastal zone for the Applicant Proposed Variant (APV) [Source: internal materials]

No.	Impacts	Elements of the coastal zone	Nature of impact	Type of impact	Impact range	Temporal scope of impact	Impact scale	Impact sensitivity	Impact significance
1.	Levelling works	Beach	None	-	-	-	Irrelevant (HDD or HDD Intersect)	No impact	Negligible
		Wydma Lubiatowska dune	Negative	Direct/indirect, secondary/primary, reversible	Local	Momentary	Irrelevant (HDD or HDD Intersect)	Moderate	Low
2.	Trenchless technologies	Beach	None	-	-	-	Irrelevant (HDD or HDD Intersect)	No impact	Negligible
		Wydma Lubiatowska dune	Positive	Direct, primary, permanent	Local	Momentary	Irrelevant	Low	Negligible
3.	Deforestation	Beach	None	-	-	-	Irrelevant (HDD or HDD Intersect)	No impact	Negligible
		Wydma Lubiatowska dune	None	-	-	-	Irrelevant (HDD or HDD Intersect)	No impact	Negligible

The planned project in the APV does not pass through areas at which intense aeolian processes occur (see subsection 3.13.2). With due diligence during construction works and proper protection of the dune surfaces for the duration of operation, such processes should not be initiated.

The Applicant Proposed Variant will have a minimal effect on the character change of the geomorphology of the area during the construction phase. The project will not disturb significantly the contemporary geomorphological processes in this area.

The impacts related to the levelling works will be **negative, direct/indirect, primary/secondary, reversible, local and short-term. The scale of impact is irrelevant/low**.

The impacts related to the trenchless technologies will be **positive, indirect, primary, permanent, local and short-term. The scale of impact is irrelevant.**

6.1.4.1.3 Impact on soils

Over 90% of the length of the planned project route is located in forest area. Only the customer substation and the 400 kV overhead line are located in non-forest areas.

In the area of the planned project impact, the dominant types of soil are arenosols as well as podzolic and brunic soils.

In the impact assessment, particular attention was paid to hydrogenic soils, i.e. peats, muck soils, gley-podzols and umbric gleysols, since they are the most sensitive to the potential impacts of the planned project (trench opening, excavation drainage). This type of soil is particularly sensitive to changes in water relations. Special attention was also paid to arenosols.

The construction of the planned project will involve temporary occupation of the land for a permanent technical belt with a width of 25 m (up to 80 m in the area of cable chambers) and a temporary belt (20 m from the external cables) as well as the digging and maintenance of a cable trench, about 2 m deep and 18 m wide.

The cable and its protective elements are non-toxic and chemically neutral and do not pose a threat to the ground-water environment, including soils.

The planned project is located mainly in the soils of forest complexes, where no separate storage of the humic layer is planned in order to maintain the productive properties of the soil. After the excavation is completed, the 25 m wide permanent technical belt area will remain permanently deforested.

As a result of the project implementation within the boundaries of the permanent and temporary technical belts, as well as access roads and storage yards, the soil will be exposed to temporary quality deterioration as a result of the disturbance of the soil profile at the excavation site and compaction as a result of heavy equipment movement. The degree of the impact on soils depends on their sensitivity to:

- compaction;
- changes in water relations;
- aeolian erosion;
- contamination.

The main construction phase impacts on the soils will be connected to:

- carrying out open excavations and levelling works (disturbance of the soil profile);
- movement of heavy construction and assembly equipment (soil compaction);

- drainage of excavations (disturbance of water relations);
- preparation of inlet and outlet chambers for the needs of trenchless crossings (disturbance of the soil profile, disturbance of water relations);
- the occupation of land for the construction of a customer substation, a 400 kV overhead line, access roads and storage yards.

Moreover, the impacts will be connected to aeolian erosion and possible contamination of soils with greases, oils, etc.

A change in soil structure through compaction may occur within the strip of a road along which heavy construction equipment will move. Soil compaction can also be expected in the locations of material and equipment bases. As a result of soil compaction, water and gas conditions change. The volume of the pores decreases, the roots receive less oxygen, and the penetration by the organisms is also more difficult. The ability to infiltrate rainwater also decreases, and an increase in surface runoff increases the risk of erosion. Depending on the type of soil, its structure can be regenerated. Sandy, low-porosity soils are less sensitive to compaction than loamy soils. In the case of complete saturation with water, the sensitivity to compaction increases. Due to the above, hydrogenic soils are particularly at risk of this type of impact. Both the storage yards and access roads will be located outside hydrogenic soils. The main material and equipment stockyard is located in the area of the planned customer substation on brown soils, similarly to the back-up yard in Osieki Lęborskie.

Soil-water relations are an environmental factor influencing other components. The main reasons for the possible disturbance of water relations include excavations, trench draining and construction of inlet and outlet chambers for trenchless methods. If the elevation of the trench bottom is lower than the groundwater elevation, it may cause the trench to function as a drain and the need to drain the trench. Groundwater drainage caused by excavation may cause local drying of the top layer of soil, as a result of which the soil is threatened with aeolian erosion, soil is blown away and its most valuable elements are lost. The trenches will need to be drained in places, in which the level of groundwater is above the trench bottom elevation. It is planned to carry out excavations with a depth of approx. 2 m. Along the route of the planned project there is one waterlogged area (approx. km 35+750 to 36+100), planned to be crossed using a trenchless method. When constructing inlet and outlet chambers, it will be necessary to perform a point excavation at which the necessity to drain it is likely to occur.

The sections to be drained will be selected at further stages of design works. The time of opening the trench at one section will not exceed a week. On the other hand, the stabilisation of the groundwater table at the previous level is likely to take place 1–2 days after the completion of pumping. The type of drainage planned to be applied will be determined after analysing the results of the ground surveys. In order to reduce the risk of disturbance of water relations, it is recommended to apply mitigation measures in the form of, for example, sheet piling, e.g. at the site of point excavation for HDD or HDD Intersect drilling through a waterlogged valley.

Sensitivity to wind erosion depends on the degree of soil formation and structure, as well as on the bedrock and organic matter content. The most sensitive are the early development stage soils, with a loose structure, composed of single, unbound particles, i.e. arenosols. Arenosols occur in the area of the Wydma Lubiatowska dune, which will be crossed using a horizontal directional drilling, thus the soil structure will not be disturbed. A patch of this type of soil is also present in the area from km 33+550 to 35+000 and from km 35+250 to 35+350. The section of km 35+250 to 35+350 is planned to be crossed with an open trench. The podzolic soils which are quite common (km 34+600 to 35+250, km 36+300 to 37+000 and km 37+900 to 39+120) are also sensitive to wind erosion.

Especially sensitive to contamination by grease and oil spills are sandy soils, which do not have the capacity to absorb hydrocarbons due to their low organic matter content. Soils from waterlogged areas are similarly sensitive due to the possibility of the contamination migration with water. Along the route of the planned project, hydrogenic soils are planned to be crossed by horizontal directional drilling and no access roads or storage yards are planned on them, thus they are not at risk of this type of impact. The largest complex of arenosols (sandy soils), occurring on the Wydma Lubiatowska dune, is also planned to be crossed by a horizontal directional drilling.

In relation to the construction of a customer substation, the top soil layer will be removed. It will be necessary to conduct levelling works and construct small scale excavations. As part of the 400 kV overhead line construction, excavations will be made for two towers of the 400 kV line with dimensions of 8 x 10 m and the maximum depth of up to 4 m. The surplus soil will be distributed within the substation area.

Table 6.22 and Table 6.23 contain the assessment of soil resistance and the evaluation of the impact on soils for the APV.

Table 6.22. Assessment of the soil resistance to the construction phase impacts for the Applicant Proposed Variant (APV) [Source: internal materials]

No.	Impacts	Soil type	Resistance
1.	Disturbance of the soil profile (excavations)	Arenosols	High
		Podzolic	High
		Brunic	High
		Hydrogenic	Low
		Brown soils	High
2.	Change of the soil-water relations (dewatering)	Arenosols	High
		Podzolic	High
		Brunic	High
		Hydrogenic	Low
		Brown soils	High
3.	Compacting of soil	Arenosols	High
		Podzolic	High
		Brunic	High
		Hydrogenic	Low
		Brown soils	High
4.	Wind erosion	Arenosols	Low
		Podzolic	Moderate
		Brunic	High
		Hydrogenic	High
		Brown soils	High
5.	Contamination with greases and oils	Arenosols	Low
		Podzolic	Moderate
		Brunic	High
		Hydrogenic	Low
		Brown soils	High

Table 6.23. Characteristics of the construction phase impacts on the soils in the Applicant Proposed Variant (APV) [Source: internal materials]

No.	Impacts	Soil type	Nature of impact	Type of impact	Impact range	Temporal scope of impact	Impact scale	Impact sensitivity	Impact significance
1.	Disturbance of the soil profile (excavations)	Arenosols	Negative	Direct, primary, reversible	Local	Long-term	Irrelevant (HDD or HDD Intersect section)	No impact	Negligible
							Moderate	Low	Low
		Podzolic					Low	Low	Negligible
		Brunic					Low	Low	Negligible
		Hydrogenic					Irrelevant (HDD or HDD Intersect)	No impact	Negligible
		Brown soils					Low	Low	Negligible
2.	Change of the soil-water relations (dewatering)	Arenosols	Negative	Direct, primary, reversible	Local	Short-term	Irrelevant (HDD or HDD Intersect)	No impact	Negligible
		Podzolic					Low	Low	Negligible
		Brunic					Low	Low	Negligible
		Hydrogenic					Low (inlet and outlet chambers)	High	Low
		Brown soils					Low	Low	Negligible
3.	Compacting of soil	Arenosols	Negative	Direct, primary, reversible	Local	Momentary	Irrelevant (using existing roads)	Low	Negligible
							Low	Low	Negligible
		Podzolic					Low	Low	Negligible
		Brunic					Low	Low	Negligible
		Hydrogenic					Irrelevant (HDD or HDD Intersect, no roads)	No impact	Negligible

No.	Impacts	Soil type	Nature of impact	Type of impact	Impact range	Temporal scope of impact	Impact scale	Impact sensitivity	Impact significance
		Brown soils					High	Low	Low
4.	Wind erosion	Arenosols	Negative	Indirect, primary, reversible	Local	Momentary	Irrelevant (HDD or HDD Intersect section)	No impact	Negligible
							Moderate	High	Moderate
		Podzolic					Moderate	Moderate	Low
		Brunic					Moderate	Low	Low
		Hydrogenic					Irrelevant (HDD or HDD Intersect)	Low	Negligible
		Brown soils					Moderate	Low	Low
5.	Contamination with greases and oils	Arenosols	Negative	Direct, primary, reversible	Local	Momentary	Low	High	Low
							Moderate	High	Moderate
		Podzolic					Low	Moderate	Low
		Brunic					Low	Low	Negligible
		Hydrogenic					Irrelevant (lack of access roads)	High	Negligible
		Brown soils					High	Low	Low

Hydrogenic soils exhibit low resistance to the disturbance of the soil profile as a result of excavation works and the disturbance of the of soil-water relation balance. They are also sensitive to compaction and susceptible to contamination with oils and greases. Arenosols are also the soils with low resistance to contamination with greases and oil spills due to their loose structure. Additionally, arenosols are sensitive to wind erosion.

The scale of impact connected to the disturbance of the soil profile was assessed to be low. The scale of impact on arenosols was assessed to be moderate, due to the construction of cable chambers planned within their area. Due to the scale of impact, its significance was assessed as low. On the remaining sections of the route, the significance of the impact related to the construction of trenches was assessed as negligible.

Hydrogenic soils are the most sensitive to draining and the related change in soil-water relations. The soils of this type are planned to be crossed by horizontal directional drilling, but it is likely that one or two inlet/outlet chambers will be required in connection with the implementation of the directional drilling. Therefore, the significance of the impact was assessed as low. In the remaining section of the planned project route, the need for draining will occur locally, in places with an elevated groundwater table. Due to the technology of the planned project implementation, the trench will be made in sections with a length of 1 km, and the time of the trench staying open will not exceed 1 week. The significance of impact on the remaining types of soil was assessed to be negligible.

The impact of compaction will result from the location of storage bases (brown soils) and the movement of heavy equipment on access roads. The access roads will be located mainly on brunic soils, podzols and brown soils, and locally on arenosols. The access road is not planned to be located in the area of hydrogenic soils (negligible impact). In the area of arenosols, it is planned to use the existing access roads, except for the complexes in the area of km 35+250 to 35+350. The significance of impact on podzolic and brunic soils was assessed to be negligible. The impact on brown soils was assessed to be low.

The impact of wind erosion in the areas of arenosol occurrence, along the sections which are planned to be crossed by an open trench, was assessed to be moderate. On podzolic, brunic and brown soils, the impact was assessed to be low as they are less sensitive to this type of impact than arenosols. The impact on the hydrogenic soils and arenosols of the Wydma Lubiatowska dune was assessed to be irrelevant, since these sections are planned to be crossed by a horizontal directional drilling.

Hydrogenic soils and soils with loose structure are the most sensitive to the contamination with greases and oils. No access roads are planned on hydrogenic soils; therefore, the impact was assessed to be irrelevant. The impact on arenosols (the soils with the loosest structure) was assessed to be low. Along the sections of the arenosols located outside the Wydma Lubiatowska dune, within which short sections of new access roads are planned, the impact was assessed to be moderate. The significance of impact on podzolic soils was assessed to be low. The main and back-up storage yards are to be located on brown soils. With the implementation of measures protecting against contaminants penetrating into the ground and a proper organisation of back-up facilities, compliant with the legal regulations and good practice, the impact was assessed as low.

The largest complex of arenosols occurring on the Wydma Lubiatowska dune will be crossed by a horizontal directional drilling; therefore, their structure will not be disturbed. Hydrogenic soils along the route of the planned project will also be crossed by horizontal directional drilling. In both cases, the significance of the impact related to the disturbance of the structure was considered negligible.

As a result of the assessment, only moderate impacts related to wind erosion as well as the contamination with greases and oils along the sections of arenosols located outside the Wydma Lubiatowska dune were found. In the event of oil leaks and spills, potentially the most at risk are the sections of arenosols at which the new access roads are planned.

The impacts related to the disturbance of soil profile will be **negative, indirect, reversible, local and long-term. The scale of impact is irrelevant/low**.

The impacts connected to the change in the soil-water relations will be **negative, direct, primary, reversible, local and short-term. The scale of impact is irrelevant/low.**

The impacts connected to the compacting of soil will be **negative, direct, primary, reversible, local, and short-term. The scale of impact is irrelevant.**

The impacts related to the wind erosion will be **negative, indirect, primary, reversible, local and short-term. The scale of impact is irrelevant/low and moderate in relation to arenosols.**

6.1.4.1.4 Impact on the access to raw materials and deposits

The planned project is located entirely within the area of Żarnowiec concession No. 5/2019/Ł for the prospection, exploration and production of hydrocarbons of 13 June 2019, owned by ShaleTech Energy Sp. z o.o. It is recommended to communicate with the concession owner in order to coordinate the work schedules. The potential ground works related to the horizontal directional drilling, may have an impact on the seismic survey results, if such surveys were to be carried out nearby at the same time by the concession owner.

Since the planned project is located at a distance of more than 4 km from the nearest deposit, no construction phase impacts on the deposit and the access to mineral deposits are expected.

There will be no impact on access to raw materials and deposits.

6.1.4.2 Impact on the quality of surface waters

The assessment of the impact on the quality of surface waters was carried out with reference to the SWB data sheets developed as part of the Vistula River Basin Management Plan (Journal of Laws of 2016, item 1911), and also the monitoring results published by CIEP as part of the State Environmental Monitoring of surface waters and published in the Environmental Status Reports for the Pomeranian Voivodeship.

On the basis of the above data, the impact of the planned project implementation on the possibility to achieve the environmental objectives of the Water Framework Directive established in the Regulation of the Council of Ministers of 18 October 2016 on the Vistula River Basin Management Plan (Journal of Laws of 2016, item 1911) was presented.

The construction of the planned project will involve temporary occupation of the land for a permanent technical belt with a width of 25 m (up to 80 m in the area of cable chambers) and a temporary belt (20 m from the external cables) as well as the digging and maintenance of a cable trench, about 2 m deep and 18 m wide, the construction of paved roads with a maximum length of about 5 km, a customer substation, a 400 kV overhead line and the related foundation of towers.

As a result of the project implementation within the permanent and temporary technical belts as well as access roads, storage yards, customer substation and a 400 kV overhead line, surface waters may be exposed to a deterioration of their quality. This regards especially:

- the waterlogged areas in the vicinity of Spacerowa street at km 34+400 to 34+800;
- the waterlogged valley with a system of watercourses constituting tributaries of the Bezimienna Stream at km 35+750 to 36+100;
- a drainage ditch in the area of the customer substation at km 39+500 to 39+900;
- a drainage ditch in the area of the 400 kV overhead line at km 40+400.

The planned project within the permanent and temporary technical belts crosses watercourses and ditches at the following shoreline chainage sections:

- km 35+900 along an approx. 80 m;
- km 36+050 along an approx. 70 m;
- km 39+500 along an approx. 170 m;
- km 40+400 along an approx. 125 m.

The first two watercourses belong to the waterlogged valley of the Bezimienna Stream, in this area at km 35+830 to 36+250 a horizontal directional drilling with a length of about 420 m will be used. Running cable lines below the ground level eliminates the interference in this ecosystem, and consequently, the possibility of negative impacts occurrence. Also, no access roads will be constructed there.

The scale of the impact on the waterlogged valley of the Bezimienna Stream was assessed as irrelevant and the significance of the impact as negligible.

In front of the customer substation, there is a small drainage ditch. This ditch does not belong to the biotope complexes of high ecological value, mainly due to the immediate vicinity of agricultural lands. Its low significance in the surrounding environment is confirmed by the results of inventory surveys on abiotic and biotic resources of the BP OWF CI survey area (Appendix 1. Report on inventory surveys). It will be crossed with an open trench or using trenchless method. Crossing by a possible open trench will interrupt the ditch continuity along a section of approximately 170 m. All details related to the possible open trench method will be agreed with the trench administrator at the stage of water and legal permits.

The scale of impact on this water course was assessed to be moderate and the significance of the impact also to be moderate.

A small drainage ditch runs in the area of the planned 400 kV overhead line. It has no great significance in the surrounding space, which is confirmed by the results of the inventory surveys on abiotic and biotic resources of the BP OWF CI survey area (Appendix 1. Report on inventory surveys). The construction of the EHV overhead line associated with the need to set the towers will not interfere with this ditch.

The scale of the impact on this watercourse was assessed to be irrelevant and the significance of the impact to be negligible.

In the assessment of impact on the quality of surface waters, particular attention was paid to two ponds within the boundaries of the ecological area “Torfowisko” [Peat bog] in Szklana Huta. These reservoirs are located approximately 20 m from the outer (eastern) cable chamber (km 33+550). A dirt track that will serve the function of an access road to cable chambers during the construction phase runs across them. The Investor faced the choice of using the existing road or building a new one, the construction of which would involve additional tree felling. The use of the road leading through the ecological area “Torfowisko” [Peat bog] in Szklana Huta during the construction phase as an access road to the construction site in the area of cable chambers creates a potential risk of water pollution in the area of the ponds occurring there, due to the possibility of the penetration of petroleum products from vehicles and construction machinery. The ecological area is a poor fen, which is a sensitive ecosystem important for the preservation of biodiversity.

The scale of impact on the ponds was assessed as high, and the significance of impact as important. However, the contamination of soil and water is unlikely and concerns only the short-term construction phase of the underground cable lines. The amount of contamination will be minimised through the maintenance of construction and transport equipment in good technical condition and adequate planning of works within the building site. With this approach, the use of the existing road is a more advantageous solution than the construction of a new access road, which would be associated with additional tree felling.

In the waterlogged area at km 34+400 to 34+800, an open trench is planned, and the crossing under Spacerowa street will be done by means of horizontal jacking. In places, where the level of groundwater is above the trench bottom elevation, it will have to be drained. The type of drainage planned to be applied will be determined after analysing the results of the ground surveys.

The scale of impact on waterlogged areas was assessed to be moderate as well as the significance of the impact.

The implementation of underground cable lines is related to minor ground levelling in the area of cable chambers of 0.25 ha and the customer substation with an area of approx. 8 ha. Additionally as part of the project it is planned to build about 5 km of new roads with a hardened surface along the axis of the planned cable tracks. The planned levelling will be local and will not contribute to changes in the infiltration of rainwater and meltwater. Slight changes will take place as a result of the introduction of hardening of the terrain in the previously forest areas, which will limit the gravitational movement of surface and rainwater in this strip.

As part of the work conducted, the trees will be felled including the grabbing of roots in the preparation of space for cable lines. This leads to changes in the lighting conditions of the watercourses, and thus, the temperature and oxygenation of the water. It also limits the supply of bedload. Moreover, the grabbing of trunks may lead to the disturbance of the bank and bottom structure as well as the liquidation of the natural bank reinforcements [317].

No wastewater or materials that could negatively affect the quality of water are to be accumulated during the project implementation. During the construction phase, the waste and wastewater will be handled in accordance with the applicable regulations and standards. As a result, wastewater and waste will not pose any threat to the quality of surface water.

Summarising, the implementation of the project may have a local and short-term negative impact on the elements of water quality, which is primarily related to:

- a possible runoff of slurry from the construction site adjacent to the waterlogged areas and watercourses – temporary impact related to torrential rainfall;
- possible pollution as a result of accidental spills from machines and vehicles – impact in emergency situations which will not take place during the proper conduct of construction works;

- the removal of trees and shrubs within a 25 m wide strip – a local decrease of watercourse shading.

Taking into account the above conditions, there is no possibility of any significant impact on the water relations of the project area and its immediate vicinity. There will also be no significant negative impact on water ecosystems (ponds) with proper supervision of the construction works.

The planned project will be implemented within the boundaries of the RWBs (River Water Bodies) listed in Table 6.24. A detailed characteristics of the RWBs including the assessment of their status is presented in subsection 3.14.

Table 6.24. Compilation of River Water Body catchment areas intersected by the planned project in the Applicant Proposed Variant (APV) [Source: internal materials based on http://www.gios.gov.pl/pl/stan-srodowiska/monitoring-wod]

No.	Code	Name	Status	General status	Beginning of intersection	End of intersection	Estimated length of the RWB catchment area intersection [km]
Lower Vistula water region							
1	CWDW1801	Immediate catchment area of the sea	-	-	33+400	38+850	5.45
2	RW200017476925	Chełst to its outlet into Lake Sarbsko	HMWB	BAD	38+850	40+500	1.65

HMWB – Highly Modified Water Body

6.1.4.2.1 Immediate catchment area of the sea CWDW1801

Due to the fact that no safety data sheet has been prepared for the immediate catchment area of the sea CWDW1801, the environmental objectives were adopted as for the adjacent SWBs, in line with the position of the "Polish Waters". According to this principle, the environmental objective for the immediate catchment area of the sea CWDW1801 is a good ecological status and a good chemical status.

Groundworks related to the implementation of trenches and the use of construction machinery and vehicles may affect the quality of surface waters. Potential temporary deterioration of water quality will not affect the water quality indicators and classes in relation to the entire immediate catchment area of the sea CWDW1801. The implementation of the project in the construction phase according to the planned scope and using the adopted technologies will not result in negative impact on hydromorphological, physico-chemical, biological and chemical properties of surface waters, and thus, will not threaten the achievement of environmental objectives specified in the Vistula River Basin Management Plan (2016) for the above-mentioned SWBs.

6.1.4.2.2 The Chełst River to its outlet into Lake Sarbsko RW200017476925

For the RWB Chełst to where it flows into Lake Sarbsko RW200017476925, goals were set for, among others, the Coastal Protected Landscape Area, within which the planned project is located (subsection 3.14). The planned project in places of high nature value, which include watercourses and waterlogged areas, will be implemented with the use of trenchless methods. The mid-forest watercourses, waterlogged areas and peat bogs will be preserved in unchanged form. The planned project in the APV will not affect the water relations; therefore, it does not threaten the achievement of the objectives adopted for the Coastal Protected Landscape Area. The implementation of the planned project may have a local and short-term negative impact on the elements of water quality, which is primarily related to the possible runoff of the slurry from the construction site adjacent to waterlogged areas and watercourses, their possible pollution as a result of accidental spills from machines and vehicles, and the removal of trees and shrubs in the 25 m wide strip, which will reduce their shading locally.

The impact of the planned project on the RWB Chełst to its outlet into Lake Sarbsko RW200017476925 will concern a small part of the catchment area. This impact will be mostly short-term and reversible. The watercourses crossed by the planned project do not belong to the biotope complexes of high ecological value, due to the immediate vicinity of agricultural lands [Table 6.25, Table 6.26, Table 6.27].

Table 6.25. Assessment of the surface waters resistance to the construction phase impacts for the Applicant Proposed Variant (APV) [Source: internal materials]

No.	Impacts	Hydrographic features	Resistance
1.	Runoff of the slurry from the construction site adjacent to waterlogged areas, watercourses and ditches	Small ponds	Low
		Waterlogged areas	Moderate
		Waterlogged valley with a system of watercourses constituting tributaries of the Bezimienna Stream	Low
		Drainage ditch in the area of the customer substation	Moderate
		Drainage ditch in the area of the 400 kV overhead line	Moderate
2.	Contamination as a result of accidental spills from machinery and vehicles	Small ponds	Low
		Waterlogged areas	Moderate
		Waterlogged valley with a system of watercourses constituting tributaries of the Bezimienna Stream	Low
		Drainage ditch in the area of the customer substation	Moderate
		Drainage ditch in the area of the 400 kV overhead line	Moderate
3.	Removal of trees and shrubs within a 25 m wide strip – change of the insolation conditions of watercourses	Small ponds	Moderate
		Waterlogged areas	Moderate
		Waterlogged valley with a system of watercourses constituting tributaries of the Bezimienna Stream	Low
		Drainage ditch in the area of the customer substation	Moderate
		Drainage ditch in the area of the 400 kV overhead line	Moderate

Table 6.26. Characteristics of the construction phase impacts on surface waters quality in the Applicant Proposed Variant (APV) [Source: internal materials]

No.	Impacts	Hydrographic features	Nature of impact	Type of impact	Impact range	Temporal scope of impact	Impact scale	Impact sensitivity	Impact significance
1.	Runoff of slurry from the construction site adjacent to the waterlogged areas and watercourses	Small ponds	Negative	Direct, primary, irreversible	Local	Permanent	High	High	Important
		Waterlogged areas		Direct, primary, reversible		Momentary	Moderate	High	Moderate
		Waterlogged valley with a system of watercourses constituting tributaries of the Bezimienna Stream					Irrelevant (HDD or HDD Intersect section)	Low	Negligible
		Drainage ditch in the area of the customer substation					Moderate	High	Moderate
2.	Contamination as a result of accidental spills from machinery and vehicles	Small ponds	Negative	Direct, primary, irreversible	Local	Permanent	High	High	Important
		Waterlogged areas		Direct, primary, reversible		Momentary	Moderate	High	Moderate
		Waterlogged valley with a system of watercourses constituting tributaries of the Bezimienna Stream					Irrelevant (HDD or HDD Intersect section)	Low	Negligible
		Drainage ditch in the area of the customer substation					Moderate	High	Moderate
3.	Removal of trees and shrubs –	Small ponds	Negative	Indirect, primary, irreversible	Local	Permanent	Moderate	High	Moderate
							Low	Low	Low

No.	Impacts	Hydrographic features	Nature of impact	Type of impact	Impact range	Temporal scope of impact	Impact scale	Impact sensitivity	Impact significance
	change of the insolation conditions of watercourses	Waterlogged areas					Low	Low	Low
		Waterlogged valley with a system of watercourses constituting tributaries of the Bezimienna Stream					Moderate	Moderate	Low
		Drainage ditch in the area of the customer substation					Moderate	Moderate	Low

Table 6.27. Summary of the impact of the construction of the Baltic Power OWF Connection Infrastructure on SWBs in the Applicant Proposed Variant [(APV) [Source: internal materials]

SWB code	SWB name	Length of the SWB catchment area intersection [km]	Collisions with watercourses significant within an SWB	Protected areas	Nature value	Method of intersection	Types of impacts on water quality elements	Are the environmental objectives of the SWB threatened by the implementation of work?
CWDW1801	Immediate catchment area of the sea	5.45	Yes	Yes	High	Horizontal directional drilling/open trench	Direct, primary, reversible	No
RW200017476925	Chełst to its outlet into Lake Sarbsko	1.65	No	Yes	Moderate	Open trench	Direct, primary, reversible	No

The impacts connected to the runoff of slurry from a construction site will be **negative, direct, primary, reversible, local and short-term. The scale of impact is moderate. With regard to the ponds in the ecological area "Torfowisko" [Peat bog] in Szklana Huta, the impacts will be irreversible, permanent, large-scale and of important significance.**

The impacts connected to the contamination as a result of accidental spills from machinery and vehicles will be **negative, direct, primary, reversible, local and short-term. The scale of the impact is moderate and negligible for the HDD or HDD Intersect section.**

If the lighting conditions for watercourses change, the impacts will be **negative, indirect, primary, irreversible, local and permanent. The scale of impact is low and moderate**.

6.1.4.3 Impact on hydrogeological conditions and groundwater

The hydrogeological conditions during the construction phase will be affected by groundworks in the form of open trenches and trenchless methods (horizontal directional drilling, jacking). Cable lines will be laid in a dry trench, therefore, in places where the groundwater level is above the trench bottom elevation, it will be necessary to drain them. A detailed analysis of the hydrogeological conditions and groundwater is presented in the subsection 3.15 based on the Hydrogeological Map of Poland, Choczewo Sheet (1:50 000) [228]. According to the characteristics prepared, the first aquifer in the area of the planned project occurs at a depth of about 5–20 m in the area of the cable chambers (km 33+550) to about 20–50 m in the vicinity of the customer substation and 400 kV overhead line (km 40+500).

The places of the lowest deposition of groundwater are situated at:

- km 34+500 to 35+400: 2–5 m;
- km 35+400 to 35+650: 1–2 m;
- km 35+650 to 36+100: 2–5 m.

In the area of the waterlogged valley, trenchless methods will be used, which partially overlap with the place at which the water occurs at a depth of 2–5 m (km 34+500 to km 35+400). When constructing inlet and outlet chambers, it will be necessary to perform a point excavation which may need to be drained. It is planned to drain the excavations with the use of pumps, wellpoints and additional drainage trenches. The type of drainage will be thoroughly reviewed only after the analysis of the results of ground surveys at a later stage of design works, when such sections will be selected on the basis of the information on groundwater levels, their nature and in reference to the design data. Draining will be carried out locally, within small areas.

In order to reduce the risk of disturbance of water relations, it is recommended to apply mitigation measures in the form of sheet piling at the sites of point excavations for HDD or HDD Intersect drilling through a waterlogged valley.

The wellpoint method consists in creating a depression curve by pumping water with special wellpoints located outside the trench. Figure 6.2 presents the diagram of draining excavations using the wellpoint method.

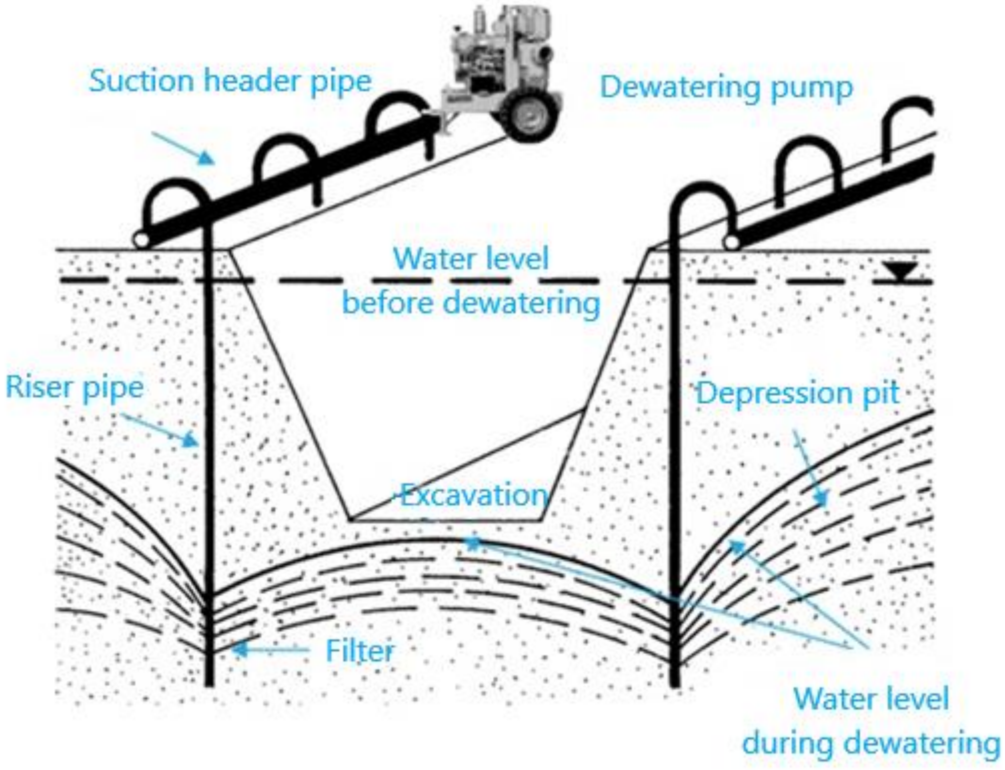


Figure 6.2. Diagram of excavations draining by wellpoint method [Source: http://iglofiltry.com.pl/Iglofiltry/iglofiltry-jako-metoda-odwadeniem]

Draining of the interior of a trench involves installing pumps which pump out the water from the open trench and discharge it into a receiver. The use of additional drainage trenches enables the water outflow from the main trench and its further flow to the receivers.

Regardless of the choice of the excavation drainage technology, the pumped out water will be discharged outside the construction site to the existing watercourses running in the vicinity of the planned project compliant with the applicable legal regulations. Drainage works will be carried out in advance until the cable lines are laid and buried.

During the construction phase, there is a risk of groundwater contamination, especially with petroleum products related to the use of construction vehicles and machinery. However, the contamination of groundwater is unlikely and concerns only the short-term phase of the construction of cable lines and only their small sections. Maintaining the construction and transport equipment in good technical condition as well as appropriate organisation of work will reduce the probability of contaminants penetrating into groundwater.

Due to the planned laying of the transmission infrastructure at a depth of about 2 m and the depth of groundwater deposition mostly at a depth of 10–20 MBGL, no significant impacts on groundwater are expected. The foundation of the customer substation and towers for the 400 kV line also will not affect the groundwater due to the depth of its deposition in this area (approx. 20–50 MBGL). In the case of shallow deposition of surface soil water and groundwater, it is expected that the performance of deep drainage of the excavations may have a local (several meters radius from the excavation) and temporary (up to one month) impact on the water table. The impact scale will depend directly on the depth of the excavation and the local hydrological conditions. It is expected that the impact caused by the drainage of the excavations will be only short-term, limited to the duration of the drainage works. A consequence of excavation drainage may be temporary fluctuations in the level of surface soil water in the project area and its immediate vicinity (several meters). The water from the drainage of the excavations will be trickled over the surrounding area, away from the excavations, therefore the water relations within the work area will not change. Upon the completion of construction works, the groundwater level at the excavation sites should level out within a few days. Moreover, a relatively short period of work during the construction of foundations guarantees that there will be no long-term changes in the aquatic environment due to possible de-watering, including the creation of a depression cone. These will be **negative, indirect, primary, momentary and short-term, reversible and local. The scale of impact is negligible**.

The special significance of the construction phase impact on the hydrological conditions and groundwater is connected to the presence of ecological area “Torfowisko” [Peat bog] in Szklana Huta. For the purposes of this Report, in places at which the cable chambers are planned, drillings were made with a core drill to a depth of 2.5 m (i.e. 0.5 m below the chamber foundation). No groundwater was found within the 2.5 m boreholes drilled. At the implementation stage of the project consisting in embedding both the cable chambers and the cables themselves in the ground within the ecological area, drainage should be abandoned, since the depression cone created may cause dewatering of peats. Moreover, excessive drawing of groundwater in coastal areas as a result of construction drainage may lead to the disturbance of water relations and saltwater ingress, and consequently, affect the quality of groundwater. Although the holes made up to a depth of 2.5 m did not reach water, yet if the chambers were to be embedded deeper than 2.5 m and additionally, taking into account the water fluctuations of about 1.5 m, then the water table may occur in the area of the chamber foundation. Moreover, during the implementation of the project, the condition of mechanical equipment should be checked, since any spills of fuels or other harmful substances will easily migrate into the groundwater and may adversely affect, in particular, the unique vegetation of ecological area. It should also be noted that the main supply of the ecological area “Torfowisko” [Peat bog] in Szklana Huta is precipitation and meltwater, while the waters of the first aquifer supply it indirectly. Peats are saturated with water mainly during periods of increased rainfall and thaw.

In the case of dewatering in the area of cable chambers, the emergence of a depression cone and the drainage of the ecological area, **the scale of impact will be high and the impact significance will be important**.

The characteristics of GWBs was developed on the basis of the GWB data sheets prepared by the Polish Geological Institute – National Research Institute constituting an appendix to the Regulation of the Council of Ministers of 18 October 2016 on the Vistula River Basin Management Plan (Journal of Laws of 2016, item 1911). These data were supplemented with the publications of the State Environmental Monitoring.

The planned project will be implemented within the boundaries of the GWBs listed in Table 6.28. The detailed characteristics of GWBs including the assessment of their status is presented in subsection 3.15.

Table 6.28. Compilation of the catchment areas of Groundwater Bodies (GWBs) intersected by the planned project in the Applicant Proposed Variant (APV) [Source: internal materials based on http://www.gios.gov.pl/pl/stan-srodowiska/monitoring-wod]

GWB	General status	Beginning of intersection	End of intersection	Estimated length of the GWB catchment area intersection [km]
Lower Vistula water region				
13	Good	33+400	38+850	5.45
11	Good	38+850	40+500	1.65

Within the boundaries of GWBs, at the sections potentially requiring draining, the impact will cease with the completion of the construction phase, and the water will be discharged to the receiver, while the construction drainage does not pose a threat to the Quaternary aquifer and to the lower layers. This impact will be mostly short-term and reversible. During the project implementation, the impacts will involve the occupation of the area for the project as well as the risk of groundwater contamination with oils and greases from machinery and equipment used during construction.

Pursuant to Art. 59 of the Water Law Act of 20 July 2017 (Journal of Laws of 2017, item 1566, as amended) the environmental objective for the Ground Water Bodies (GWBs) is to:

- prevent or limit the amount of contaminants entering the water;
- prevent deterioration and enhance their status;
- protection and undertaking remedial actions, as well as ensuring appropriate balance between the demand and supply for such water, to achieve their good status.

Analysing the above legal conditions, the groundwater, status, as well as taking into account the nature of the project and the associated impacts, it should be stated that the project in question will not contribute to the failure to achieve the environmental objectives contained in the Vistula River Basin Water Management Plan (2016).

The impacts connected to the fluctuations in groundwater level as a result of drainage will be **negative, indirect, primary, reversible, local and short-term. The scale of impact is moderate. In the general assessment the impact significance will be low. With regard to the ecological area "Torfowisko" [Peat bog] in Szklana Huta, the impacts will be irreversible, permanent, large-scale and of important significance.**

The impacts connected to the contamination as a result of accidental spills from machinery and vehicles will be **negative, direct, primary, reversible, local and short-term. The scale of impact is moderate. With regard to the ecological area "Torfowisko" [Peat bog] in Szklana Huta, the impacts will be irreversible, permanent, large-scale and of important significance** [Table 6.29, Table 6.30].

Table 6.29. Characteristics of the construction phase impacts of the planned project in the Applicant Proposed Variant (APV) on groundwater [Source: internal materials]

No.	Impacts	Nature of impacts	Type of impacts	Range of impact	Temporal scope of impact	Scale of impacts	Sensitivity of impacts	Impact significance
1	Fluctuations of the groundwater level due to dewatering	Negative	Indirect, primary, reversible	Local	Short-term	Moderate	Moderate	Low
2	Contamination as a result of accidental spills from machinery and vehicles	Negative	Direct, primary, reversible	Local	Short-term	Moderate	Moderate	Low

Table 6.30. Summary of the impact of the construction of the Baltic Power OWF Connection Infrastructure on GWBs in the Applicant Proposed Variant [(APV) [Source: internal materials]

GWB code	Length of the SWB catchment area intersection [km]	Collisions with watercourses significant within a GWB	Protected areas	Nature value	Method of intersection	Types of impacts on water quality elements	Are the environmental objectives of the GWB threatened by the work conduct?
13	5.45	Yes	Yes	High	Horizontal directional drilling/open trench	Direct, primary, reversible	No
11	1.65	No	Yes	Moderate	Open trench	Direct, primary, reversible	No

6.1.4.4 Impact on climate, including greenhouse gas emissions and impacts relevant for adaptation to climate change, impact on atmospheric air (air quality)

The implementation of the planned project will be related to:

- periodic, local increase in greenhouse gas emissions during the project construction phase (movement of vehicles and machinery on site, deforestation, waste generation);
- periodic increase in energy demand for construction purposes, leading to an indirect increase in greenhouse gas emissions;
- emission of greenhouse gases indirectly related to the energy intensity of the project, e.g. in connection with the use of energy for the production of materials, transport, etc.

During the project construction phase, there will be a fugitive emission of dust and gaseous pollutants related to typical earthworks, construction and assembly works and transport. Vehicle traffic, excavation works, and ground storage may cause periodic emission of dust into the atmosphere, limited mainly to the construction site. Performing construction and assembly works results in periodic emission of pollutants into the air caused by the operation of assembly equipment and means of transport (CO_2, NO_x, SO_x). The amount of dust emission will depend on weather conditions, e.g. the ground humidity significantly reduces the emission of dust resulting from the movement of vehicles on dirt tracks. Due to the fact that most of the works will be carried out in a trench and will be limited in time (up to 36 months), the impact on the atmosphere will be limited to the immediate vicinity of the cable lines. Construction works related to the construction of the customer substation and the 400 kV overhead line will be carried out in agricultural areas, away from the residential buildings of Osieki Lęborskie and will have a negligible impact on the climate. They will be associated with the transport of materials for the construction and the welding of reinforcement elements for the power line foundations and towers.

The emission figures of individual pollution types caused by combustion of fuel in combustion engines of machines are provided in the "EMEP/EEA air pollutant emission inventory guidebook" (2007) published by the European Environment Agency [Table 6.31]. The highest figures were adopted in the calculations for the two groups of machines referred to as industrial and forestry machines. These figures reflect the quantity of pollution caused as a result of the combustion of 1 kg of fuel (diesel oil density of 0.820 $g \cdot l^{-1}$ was adopted in the calculations).

Table 6.31. Figures of air pollutant emission resulting from the combustion of 1 kg of diesel oil in utility machinery engines [Source: EMEP/EEA air pollutant emission inventory guidebook (2007)]

Diesel engine [$g \cdot kg^{-1}$ fuel]	**NO_x**	**NM-VOC**	**CH_4**	**CO**	**NH_3**	**N_2O**	**PM**	**$PM_{2.5}$**
Forestry	50.3	6.50	0.17	14.5	0.007	1.32	2.42	2.27
Industry	48.8	7.08	0.17	15.8	0.007	1.30	2.29	2.15

In accordance with the EMEP/EEA air pollutant emission inventory guidebook (2007) published by the European Environment Agency, it was adopted that the share of NO_2/NO_x is 55%. It was also adopted that the mean daily fuel consumption by all the machines used will be 100 $l \cdot h^{-1}$ (82 kg). Moreover, it was adopted that all machines will work for a maximum of 8 hours per day (non-stop) for 252 business days per year [Table 6.32].

Table 6.32. Levels of air pollutant emission [Source: EMEP/EEA air pollutant emission inventory guidebook (2007)]

Substance emitted	**Hourly emission [kg·h^{-1}]**	**Annual emission [Mg·year^{-1}]**
NO_2	2.270	4.574
LZO VOC	0.581	1.170
CH_4	0.014	0.028
CO	1.296	2.612
NH_3	0.0006	0.001
N_2O	0.108	0.218
PM10	0.195	0.400
PM2.5	0.176	0.355

The highest concentrations of pollutants in reference to the permissible concentrations will apply to NO_2 emissions, which is a natural consequence of diesel fuel combustion. The emission of pollutants during the project implementation will take place as a result of the work of relatively small groups of equipment at various stages of the planned project (the stages of work will only partially overlap). As a consequence, the emission of pollutants from all the above-mentioned devices will be distributed both in time and space. Thus, it is estimated that the implementation of the project will not cause emissions at a level which may exceed the permissible concentrations of substances in the air.

The emission of the remaining substances will be of a trace amount and will not result in exceeding the permissible values of pollutants in the air.

The impacts on climate will be **negative, direct and indirect, primary, reversible and irreversible and local. The scale of impact is low and moderate** [Table 6.33].

Table 6.33. Characteristics of the construction phase impacts on climate including greenhouse gas emission in the Applicant Proposed Variant (APV) [Source: internal materials]

No.	Impacts	Nature of impacts	Type of impacts	Range of impact	Temporal scope of impact	Scale of impacts	Sensitivity of impacts	Impact significance
1	Increase in greenhouse gas emissions (movement of vehicles and machinery on site, deforestation, waste generation)	Negative	Direct, primary, reversible	Local	Momentary	Moderate	Moderate	Low
2	Increase in energy demand for construction purposes	Negative	Indirect, primary, reversible	Local	Short-term	Low	Low	Negligible
3	Emission of greenhouse gases related to the energy intensity of the project	Negative	Indirect, primary, irreversible	Local	Constant	Low	Low	Negligible

Mitigation is understood as activities aimed at preventing or reducing greenhouse gas emissions. These activities focus mainly on improving energy efficiency, increasing the share of energy from renewable sources in gross final energy consumption, sequestration (capturing and safe storage of CO_2), as well as reducing the energy consumption of sectors of the economy. The implementation of the planned project leads to:

- direct greenhouse gas emissions by the project during the preparatory works and the construction phase;
- direct greenhouse gas emissions caused by activities accompanying the project (waste generation, deforestation aimed at habitat loss resulting in CO_2 sequestration);
- direct greenhouse gas emissions from transport accompanying the construction phase of the project;
- indirect greenhouse gas emissions related to energy demand.

Table 6.34 presents standard measures to minimise the impact of the planned project on climate changes during the construction phase, in relation to direct and indirect greenhouse gas emissions.

Table 6.34. Analysis of the project impacts related to climate change in the Applicant Proposed Variant (APV) [Source: internal materials based on "Poradnik przygotowania inwestycji z uwzględnieniem zmian klimatu, ich łagodzenia i przystosowania do tych zmian oraz odporności na klęski żywiołowe" [literally: Guide to investment preparation taking into account climate change, its mitigation and adaptation to these changes as well as the resistance to natural disasters] [313]]

Type of greenhouse gas	Nature of emission	Mitigation measures
CO_2, NO_2 and suspended dust	Fugitive and short-term emissions, limited to the immediate area of the works carried out	• The use of modern and efficient equipment • Work performed during the day in daylight • The project located in places that ensure the optimal method of transport in terms of pollution and its proper organisation • Limiting the operation of vehicle engines to the necessary minimum

Activities aimed at preventing or limiting greenhouse gas emissions, i.e. mitigating climate changes by the planned project, focuses mainly on the limited time and nature of emissions, the use of modern and efficient equipment, work performed during the day in daylight, the location of the project in a place ensuring the optimal method of transport in terms of pollution and its proper organisation.

Due to the scale and location of the planned project and the incidental, in terms of climate change rate, duration of the project it will not have an impact on climate change, and the climate and its changes will not have a significant impact on the project. The construction process of the BP OWF CI will last a maximum of 36 months, after which the area within the temporary technical belt will be re-grassed, while the climate changes take place in a longer time horizon than the planned duration of the project implementation. In the 25 m wide, permanently deforested, permanent technical belt, there will be an increase in insolation and air temperature, a decrease in air humidity and an increase in ventilation. Minor thermal and humidity changes related to the transformation of the active surface will occur within the range of the customer substation and the tower structures erected.

The European Green Deal aims to make Europe climate neutral by 2050. To make this target legally binding, the Commission proposed a European Climate Law which, inter alia, sets a new, more ambitious net greenhouse gas emissions target – a reduction of at least 55% by 2030 compared to 1990 levels [388].

A framework strategy for a resilient energy union based on a forward-looking climate policy [360] is a document focused on climate change issues, guaranteeing energy security; identifying the global challenges faced by the EU's energy system, requiring the EU countries solidarity and cooperation to provide consumers with safe, affordable and sustainable energy. The strategy sets environmental goals and priorities, including:

- reducing emissions by promoting investments in new technologies and new infrastructure and creating an integrated internal energy market by: creating more interconnections between EU countries, which will facilitate the fast and free transfer of energy; intensification of the construction and maintenance of necessary infrastructure elements;
- ensuring security of supply through: diversification of energy sources, close cooperation between neighbouring countries in the event of energy shortages or energy crises.

The EU strategy on adaptation to climate change sets out the overall goal of the Strategy, which is to contribute to making Europe more resilient to climate change, which is related to increasing preparedness and capacity to respond to the effects of climate change at the local, regional, national and EU level.

In 2013, the Council of Ministers adopted the Polish National Strategy for Adaptation to Climate Change by 2020 with the perspective by 2030. The main directions listed include ensuring energy security and good environmental status. The implementation of the planned project is in line with the environmental objective 1.3 – adaptation of the energy sector to climate change – adaptation activities: Designing transmission networks, such as underground and overhead ones, taking into account extreme weather situations, in order to reduce the risk of, among others, the deposition of ice and snow on them, flooding and damage in the events of strong wind. The provisions and the resulting conditions have been included in this Report.

6.1.4.5 Impact on ambient noise

The construction phase of the underground cable lines, customer substation and 400 kV overhead line will generate temporary noise, the source of which will be:

- preparatory works, organisation of construction facilities, equipment base and material supplies;
- performing tree felling including root grabbing for the cable line and access roads construction;
- earthworks carried out by diggers consisting in digging a trench for cable lines;
- execution of horizontal directional drillings in places crossed using trenchless method;
- drainage of excavations with the use of wellpoints;
- earthworks carried out with bulldozers consisting in backfilling the trench and levelling the area.

The duration of the construction will last 36 months at maximum.

Each of the phases will be characterised by a certain emission of noise to the environment, the loudest phase being the phase of earthworks during the trench digging using a digger. It should be noted that at each stage the construction will be progressive, which means that the front of the works will move, i.e. the source of noise (e.g. a digger) will be present in one place for some time, and then it will move to another place, carrying out further work.

As part of the planned project implementation, trenchless methods will be applied, which will constitute a significant source of noise. The main difference increasing the impact of trenchless methods on the acoustic climate is the need for continuous work (around the clock). There are more machines at the construction site, than in the case of the open trench method. Additionally, the machinery involves pumps with an acoustic power of approx. 93 dB, slurry recycling and recovery device with an acoustic power of approximately 99 dB, slurry preparatory mixer with an acoustic power of 89 dB and a drilling rig with an acoustic power of approximately 108 dB. Noise levels differ depending on the place of inlet and outlet, due to different assembly sites and different machinery park. At the inlet chamber there is a machine park with the above-mentioned machines, thus making it louder.

The construction works will be carried out during the day with the use of equipment ensuring the most effective protection against noise. The sound power level of the devices used in construction is subject to restrictions depending on the type of device and the installed net power in accordance with the guidelines contained in the Regulation of the Minister of Economy of 21 December 2005 on the essential requirements for equipment for use outdoors regarding noise emission to the environment (Journal of Laws of 2005, No. 263, item 2202 as amended).

In the immediate vicinity of the planned project in the APV there are acoustically protected areas in the form of the buildings of the Rehabilitation and Holiday Centre for disabled people (ul. Spacerowa 38, Lubiatowo). Pursuant to Art. 114, section 1 of the Act of 27 April 2001 – Environmental Protection Law (Journal of Laws of 2001, No. 62, item 627, as amended), the basis for categorisation of areas subject to protection against noise are the provisions of local spatial development plans.

Pursuant to Resolution No. IX/76/2007 of the Choczewo Commune Council of 13 September 2007, the local spatial development plan for Lubiatowo region, Kierzkowo precinct, and Choczewo commune is in force there (Official Journal of the Pomeranian Province No. 3 of 17.01.2008, item 92). According to the provisions of the plan, the basic function is single family housing areas, it is allowed to locate collective housing facilities, social welfare services, health, culture, sports, recreation, relaxation, gastronomy, tourism, trade up to 200 m^2 of usable space and apartments integral to the activity conducted. With regard to noise levels, the permissible noise level in the environment adopted in the local plan was as for the areas intended for housing development. The permissible A-weighted noise level for road and installation noise, expressed in A-weighted sound level in dB, is [in accordance with point 2 of the table "The issues concerning the permissible noise levels in the environment – the Regulation of the Minister of the Environment of 14 June 2007 on permissible noise levels in the environment" (Journal of Laws of 2007, No. 120, item 826, as amended); Table 3.27, subsection 3.17]:

- installation noise:
  - LAeqD = 50 dB for the daytime,
  - LAeqD = 40 dB for the night-time;
- road noise:
  - LAeqD = 61 dB for the daytime,
  - LAeqD = 56 dB for the night-time.

Due to the existing forest complexes between the work site and the Centre, it is estimated that the acoustic impact will not be significantly burdensome for the people staying there.

Since noise emissions during the construction phase cannot be avoided, the possible nuisance should be maximally limited, i.e.:

- the construction works generating the highest noise level should be carried out, if possible, only during daylight hours, excluding Sundays and holidays (except for the works that must be performed 24 h·d.$^{-1}$, such as drilling and building the customer substation), and the work schedule will be provided to the management of the Centre;
- when planning construction works, noise generating devices should be placed as far away from the facilities of the Centre as possible.

In the remaining course of the BP OWF CI, construction works will be carried out in principle within high forest vegetation insulating noise emission and away from acoustically protected areas.

The noise generated during the construction phase will be limited in time, with a local impact range and with the application of minimising measures the impact on the Rehabilitation and Holiday Centre for disabled people in Lubiatowo, will not have a significant negative influence on people's living conditions.

The impacts of the planned project will be **negative, direct, primary, reversible, local and short-term** [Table 6.35].

Table 6.35. Matrix defining the significance of the construction phase impact on ambient noise in the Rational Alternative Variant (RAV) [Source: internal materials]

Impact significance		**Receptor sensitivity**				
		Irrelevant	**Low**	**Moderate**	**High**	**Very high**
Scale (size) of impact	Irrelevant	Negligible	Negligible	Negligible	Negligible	Low
	Low	Negligible	Negligible	Low	Low	Moderate
	Moderate	Negligible	Low	Low	Moderate	Moderate
	High	Negligible	Low	Moderate	Important	Significant
	Very high	Low	Moderate	Moderate	Significant	Significant

6.1.4.6 Impact on nature and protected areas

6.1.4.6.1 Impact on biotic elements in the onshore area

6.1.4.6.1.1 Fungi

The main construction phase impacts on the biota of macroscopic fungi will be connected to:

- the construction of open trenches for cable laying, cable chambers and inlet and outlet chambers at the sections planned for trenchless passages;
- the levelling works related to the levelling of the area for the customer substation, 400 kV overhead line towers and the cable chambers.

In such cases, the mycelium will be destroyed, and consequently, the plot of species will be eliminated.

In addition to the above-mentioned factors, the impact will be negligible and limited to the possible destruction of individual fruiting bodies. The mycelium present in the soil and under the bark of trees will remain intact.

Table 6.36 and Table 6.37 present a compilation of macroscopic fungi species occurring within the technical belts designated for the purposes of the planned project implementation including an Environmental Impact Assessment.

The impact of the planned project on the biota of fungi will be **negative, direct, primary, reversible/permanent, local and long-term. The significance of impact is low.**

Table 6.36. List of macroscopic fungi species by technical belts in the Applicant Proposed Variant (APV) [Source: internal materials]

No.	Species		Conservation status	Threat category[1]	Permanent technical belt	Temporary technical belt	Additional technical belt	Comments
	Species name	Binomial nomenclature						
1.	Red ring rot	*Phellinus pini*	None	R	Not found	Plot destruction within the tree felling area	Impact on mycelia insignificant	Arboreal species
2.	Yellow knight	*Tricholoma equestre*	None	R	Not found	Not found	Impact on mycelia insignificant	-
3.	Woolly tooth	*Phellodon tomentosus*	None	E	Not found	In the trench zone or in the area of other direct actions the plots shall be destroyed	Impact on mycelia insignificant	-
4.	Dune brittlestem	*Psathyrella ammophila*	None	E	Not found	Not found	Impact on mycelia insignificant	-

[1]*Red list status: R – rare, potentially endangered with extinction, E – dying out, critically endangered*

Table 6.37. Characteristics of the construction phase impacts on the macroscopic fungi in the Applicant Proposed Variant (APV) [Source: internal materials]

No.	Impacts	Nature of impact	Type of impact	Impact range	Temporal scope of impact
1.	Disturbance of surface formations (excavation)	Negative	Direct, primary, reversible	Local	Long-term
2.	Levelling works for the erection of the customer substation and cable chambers	Negative	Direct, primary, permanent	Local	Long-term
3.	Wind erosion	Negative	Indirect, primary, reversible	Local	Long-term
4.	Oil and grease contamination (roads, storage yards, back-up facilities)	Negative	Direct, primary, reversible	Local	Long-term

6.1.4.6.1.2 Lichens

The main construction phase impacts on the biota of lichen will be connected to:

- the construction of open trenches for cable laying, cable chambers and inlet and outlet chambers at the sections planned for trenchless passages;
- the levelling works related to the levelling of the area for the customer substation, 400 kV overhead line towers and the cable chambers.

In such cases, the thalli will be destroyed, and consequently, the plot of species will be eliminated. Sulphur oxides and nitrogen oxides will be emitted as a result of construction machinery operation during the construction phase. The epiphytic lichen species are especially vulnerable to air pollution.

The main construction phase impacts on the biota of epiphytic lichens will be connected to the planned felling of trees and shrubs within the technical belt over a total surface area not exceeding 40 ha. In such cases, the thalli will be destroyed, and consequently the plot of species will be eliminated.

Leaving well-preserved old-growth of deciduous forests both in forest communities and along forest and municipal roads is favourable for the preservation of the population of epiphytic lichens. The presence of well-preserved forest stands determines the proper diversity of species biodiversity in lichens. During the implementation of the project, priority should be given to the preservation of the plots of epiphytic lichens by protecting the tree trunks on which they occur, by surrounding old-growth forests with a net or tape, which will ensure that the project will not enter the old-growth habitats. For the protection of terricolous lichen, the construction site must be limited to the smallest possible area, and the soil from the excavation should be placed on a protective foil spread over the surface.

Table 6.38 and Table 6.39 present a compilation of lichen species occurring within the technical belts designated for the purposes of the planned project implementation including an Environmental Impact Assessment.

The impact of the planned project on the biota of lichen will be **negative, direct, primary, reversible/permanent, local and long-term. Impact significance: important.**

Table 6.38. List of lichen species by technical belts in the Applicant Proposed Variant (APV) [Source: internal materials]

No.	**Species**		**Conservation status[1]**	**Threat category[2]**	**Permanent technical belt**	**Temporary technical belt**	**Additional technical belt**	**Comments**
	Species name	**Binomial nomenclature**						
1.	Silver-lined wrinkle	*Tuckermanopsis chlorophylla*	PP	VU	Not found	Not found	Impact on thalli insignificant	Epiphytic species
2.	Bristlybeard lichen	*Usnea hirta*	PP	VU	Destruction of plots due to excavation	In the tree felling zone or in the area of other direct actions the plots shall be destroyed	Impact on thalli insignificant	Epiphytic species
3.	-	*Zwackhia viridis*	None	VU	Not found	Not found	Impact on thalli insignificant	Epiphytic species
4.	Tree reindeer lichen	*Cladonia arbuscula*	PP	None	Destruction of plots due to excavation	In the trench zone or in the area of other direct actions the plots shall be destroyed	Impact on thalli insignificant	Terrestrial
5.	Reindeer lichen	*Cladonia portentosa*	PP	None	Destruction of plots due to excavation	In the trench zone or in the area of other direct actions the plots shall be destroyed	Impact on thalli insignificant	Terrestrial
6.	Grey reindeer lichen	*Cladonia rangiferina*	PP	None	Destruction of plots due to excavation	Not found	Impact on thalli insignificant	Terrestrial
7.	Griffith's cliostomum lichen	*Cliostomum griffithii*	None	VU	Not found	Not found	Impact on thalli insignificant	Epiphytic species
8.	Sulphured crimson dot lichen	*Pyrrhospora quernea*	None	CR	Not found	Not found	Impact on thalli insignificant	Epiphytic species
9.	Rim lichen	*Lecanora intumescens*	None	EN	Not found	Not found	Not found	Epiphytic species
10.	Eagle’s claws lichen	*Anaptychia ciliaris*	SP	EN	Not found	Not found	Impact on thalli insignificant	Epiphytic species
11.	Cartilage lichen	*Ramalina fraxinea*	SP	EN	Destruction of plots due to deforestation in the area planned for the location of the 400 kV overhead	Not found	Impact on thalli insignificant	Epiphytic species

No.	Species		Conservation status[1]	Threat category[2]	Permanent technical belt	Temporary technical belt	Additional technical belt	Comments
	Species name	Binomial nomenclature						
					line and near the southern boundary of the customer substation			
12.	Dotted ribbon lichen	*Ramalina fastigiata*	SP	EN	Near the southern boundary of the customer substation, the plots may be destroyed as a result of tree felling	Not found	Impact on thalli insignificant	Epiphytic species
13.	Farinose cartilage lichen	*Ramalina farinacea*	PP	VU	Not found	In the tree felling zone or in the area of other direct actions the plots shall be destroyed	Impact on thalli insignificant	Epiphytic species
14.	Flapjack ribbon	*Ramalina pollinaria*	PP	VU	Not found	Not found	Impact on thalli insignificant	Epiphytic species
15.	-	*Varicellaria hemisphaerica*	None	VU	Not found	Not found	Impact on thalli insignificant	Epiphytic species
16.	-	*Pyrenula nitida*	None	VU	Not found	Not found	Impact on thalli insignificant	Epiphytic species
17.	Pierced lichen	*Pertusaria pertusa*	None	VU	Destruction of plots due to deforestation	In the tree felling zone or in the area of other direct actions the plots shall be destroyed	Impact on thalli insignificant	Epiphytic species
18.	Covered lichen	*Pertusaria hymenea*	None	CR	Destruction of plots due to deforestation	Not found	Impact on thalli insignificant	Epiphytic species
19.	-	*Pertusaria coronata*	None	VU	Not found	Not found	Impact on thalli insignificant	Epiphytic species
20.	-	*Pertusaria flavida*	None	EN	Not found	Not found	Impact on thalli insignificant	Epiphytic species
21.	Scribble lichen	*Opegrapha niveoatra*	None	VU	Not found	Not found	Impact on thalli insignificant	Epiphytic species

No.	Species		Conservation status[1]	Threat category[2]	Permanent technical belt	Temporary technical belt	Additional technical belt	Comments
	Species name	Binomial nomenclature						
22.	-	*Opegrapha vermicellifera*	None	EN	Not found	Not found	Impact on thalli insignificant	Epiphytic species
23.	-	*Arthonia didyma*	None	EN	Not found	Not found	Impact on thalli insignificant	Epiphytic species
24.	Iceland moss	*Cetraria islandica*	PP	VU	Not found	Not found	Impact on thalli insignificant	Epiphytic species
25.	Salted starburst lichen	*Imshaugia aleurites*	PP	None	Destruction of plots due to deforestation	In the tree felling zone or in the area of other direct actions the plots shall be destroyed	Impact on thalli insignificant	Epiphytic species
26.	Elegant camouflage lichen	*Melanohalea elegantula*	SP	VU	Not found	Not found	Impact on thalli insignificant	Epiphytic species
27.	Whiskered camouflage	*Melanelixia subargentifera*	None	VU	Not found	Not found	Impact on thalli insignificant	Epiphytic species
28.	Abraded camouflage lichen	*Melanelixia subaurifera*	PP	VU	Not found	Not found	Impact on thalli insignificant	Epiphytic species
29.	Bark barnacle lichen	*Thelotrema lepadinum*	VU	EN	Not found	Not found	Impact on thalli insignificant	Epiphytic species
30.	Tube lichen	*Hypogymnia tubulosa*	PP	NT	Destruction of plots due to deforestation	In the tree felling zone or in the area of other direct actions the plots shall be destroyed	Impact on thalli insignificant	Epiphytic species
31.	Green powdery stellated lichen	*Physconia distorta*	None	EN	Not found	Not found	Impact on thalli insignificant	Epiphytic species
32.	-	*Pleurosticta acetabulum*	PP	EN	Destruction of plots due to deforestation in the area of the location of the 400 kV overhead line and near the southern boundary of the	Not found	Impact on thalli insignificant	Epiphytic species

No.	Species		Conservation status[1]	Threat category[2]	Permanent technical belt	Temporary technical belt	Additional technical belt	Comments
	Species name	**Binomial nomenclature**						
					customer substation			
33.	-	*Gyalecta carneola*	None	None	Not found	Not found	Impact on thalli insignificant	Epiphytic species
34.	Speckled horsehair lichen	*Bryoria fuscescens*	PP	VU	Not found	Not found	Impact on thalli insignificant	Epiphytic species
35.	Common greenshield lichen	*Flavoparmelia caperata*	PP	EN	Not found	Not found	Impact on thalli insignificant	Epiphytic species

[1]Pursuant to the Regulation of the Minister of the Environment of 9 October 2014 on the protection of plant species (Journal of Laws of 2014, item 1409): SP – species under strict protection, PP – species under partial protection

[2]Threat categories (according to Cieśliński et al. [58]; Fałtynowicz and Kukwa [100]): CR – critically endangered/on the verge of extinction, EN – endangered, VU – vulnerable, NT – near threatened

Table 6.39. Characteristics of the construction phase impacts on lichens in the Applicant Proposed Variant (APV) [Source: internal materials]

No.	Impacts	Nature of impact	Type of impact	Impact range	Temporal scope of impact
1.	Disturbance of surface formations (excavations)	Negative	Direct, primary, reversible	Local	Long-term
2.	Levelling works for the erection of the customer substation and cable chambers	Negative	Direct, primary, permanent	Local	Long-term
3.	Wind erosion	Negative	Indirect, primary, reversible	Local	Long-term
4.	Oil and grease contamination (roads, storage yards, back-up facilities)	Negative	Direct, primary, reversible	Local	Long-term

6.1.4.6.1.3 Mosses and liverworts

The main construction phase impacts on the biota of mosses and liverworts will be connected to:

- the construction of open trenches for cable laying, cable chambers and inlet and outlet chambers at the sections planned for trenchless passages;
- the levelling works related to the levelling of the area for the customer substation, 400 kV overhead line towers and the cable chambers.

In such cases, the plot of species will be eliminated.

Table 6.40 and Table 6.41 present a compilation of moss and liverwort species occurring within the technical belts designated for the purposes of the planned project implementation including an Environmental Impact Assessment.

The impact of the planned project on the biota of mosses and liverworts will be **negative, direct, primary, reversible/permanent, local and long-term. The significance of the impact is negligible.**

Table 6.40. List of moss and liverwort species by technical belts in the Applicant Proposed Variant (APV) [Source: internal materials]

No.	Species		Conservation status[1]	Permanent technical belt	Temporary technical belt	Additional technical belt
	Species name	Binomial nomenclature				
1.	White pincushion moss	*Leucobryum glaucum*	PP	Not found	Not found	Impact on specimens insignificant
2.	Mountain fern moss	*Hylocomium splendens*	PP	Not found	Not found	Impact on specimens insignificant
3.	Pointed spear-moss	*Calliergonella cuspidata*	PP	Not found	Not found	Impact on specimens insignificant
4.	Neat feather-moss	*Pseudoscleropodium purum*	PP	Not found	Not found	Impact on specimens insignificant
5.	Red-stemmed feathermoss	*Pleurozium schreberi*	PP	Not found	Not found	Impact on specimens insignificant
6.	Wavy broom moss	*Dicranum polysetum*	PP	Not found	Not found	Impact on specimens insignificant
7.	Broom forkmoss	*Dicranum scoparium*	PP	Not found	Not found	Impact on thalli insignificant
8.	Bog groove-moss	*Aulacomnium palustre*	PP	Destruction of plots due to excavation	Not found	Impact on specimens insignificant
9.	Crisped pincushion moss	*Ulota crispa*	PP	Destruction of plots due to excavation	Not found	Impact on thalli insignificant
10.	Common hair-cap moss	*Polytrichum commune*	PP	Not found	Not found	Impact on specimens insignificant
11.	Red bog-moss	*Sphagnum rubellum*	PP	Not found	Not found	Impact on specimens insignificant
12.	Knight's plume moss	*Ptilium crista-castrensis*	PP	Not found	Not found	Impact on specimens insignificant
13.	Wood-rust	*Nowellia curvifolia*	PP	Not found	Not found	Impact on specimens insignificant
14.	Bruch’s pincushion	*Ulota bruchii*	PP	Not found	Not found	Impact on specimens insignificant

[1]Pursuant to the Regulation of the Minister of the Environment of 9 October 2014 on the protection of plant species (Journal of Laws of 2014, item 1409): PP – species under partial protection

Table 6.41. Characteristics of the construction phase impacts on mosses and liverworts in the Applicant Proposed Variant (APV) [Source: internal materials]

No.	Impacts	Nature of impact	Type of impact	Impact range	Temporal scope of impact
1.	Disturbance of surface formations (excavations)	Negative	Direct, primary, reversible	Local	Long-term
2.	Levelling works for the erection of the customer substation and cable chambers	Negative	Direct, primary, permanent	Local	Long-term
3.	Wind erosion	Negative	Indirect, primary, reversible	Local	Long-term
4.	Oil and grease contamination (roads, storage yards, back-up facilities)	Negative	Direct, primary, reversible	Local	Long-term

6.1.4.6.1.4 Vascular plants and natural habitats

The main construction phase impacts on vascular plants and natural habitats will be connected to:

- the construction of open trenches for cable laying, cable chambers and inlet and outlet chambers at the sections planned for trenchless passages;
- the levelling works related to the levelling of the area for the customer substation, 400 kV overhead line towers and the cable chambers.

In such cases, the plot of species will be eliminated and the habitat patch reduced in size.

Table 6.42, Table 6.43 and Table 6.44 present vascular plan species and a compilation of natural habitats in technical belts delineated for the purposes of the planned project implementation in the Applicant Proposed Variant.

The impact of the planned project on plants and habitats will be **negative, direct, primary, reversible/permanent, local and long-term. Impact significance: important.**

Table 6.42. List of vascular plant species by technical belts in the Applicant Proposed Variant (APV) [Source: internal materials]

No.	**Species**		**Conservation status[1]**	**Permanent technical belt**	**Temporary technical belt**	**Additional technical belt**	**Comments**
	Species name	**Binomial nomenclature**					
1.	Marsh Labrador tea	*Ledum palustre*	PP	Not found	Not found	Not found	Impact on specimens insignificant
2.	Black crowberry	*Empetrum nigrum* L.	PP	Destruction of plots due to excavation	Not found	In the trench zone or in the area of other direct actions the plots shall be destroyed	Impact important
3.	One-flowered wintergreen	*Moneses uniflora* (L.) A. Gray	PP	Destruction of plots due to excavation	Not found	Not found	Impact important
4.	Broad-leaved helleborine	*Epipactis helleborine* (L.) Crantz	PP	Destruction of plots due to excavation	Destruction of plots due to excavation	In the trench zone or in the area of other direct actions the plots shall be destroyed	Impact important
5.	Creeping lady's-tresses	*Goodyera repens* (L.) R. Br	SP	Destruction of plots due to excavation	Not found	In the trench zone or in the area of other direct actions the plots shall be destroyed	Impact important
6.	Sand sedge	*Carex arenaria* L.	PP	Destruction of plots due to excavation	Destruction of plots due to excavation	In the trench zone or in the area of other direct actions the plots shall be destroyed	Impact important
7.	Stiff clubmoss	*Lycopodium annotinum* L.	PP	Not found	Not found	Not found	Impact on specimens insignificant
8.	Cross-leaved heath	*Erica tetralix* L.	SP	Not found	Not found	In the trench zone or in the area of other direct actions the plots shall be destroyed	Impact on specimens insignificant

[1]Pursuant to the Regulation of the Minister of the Environment of 9 October 2014 on the protection of plant species (Journal of Laws of 2014, item 1409): SP – species under strict protection, PP – species under partial protection

Table 6.43. List of natural habitats by technical belts in the Applicant Proposed Variant (APV) [Source: internal materials]

No.	Habitat no.	Name of habitat	Permanent technical belt	Temporary technical belt	Additional technical belt
1.	2120	Shifting dunes along the shoreline with *Ammophila arenaria* (“white dunes”)	-	-	Impact on habitat negligible
2.	2130	Fixed coastal dunes with herbaceous vegetation ("grey dunes")	-	-	Impact on habitat negligible
3.	2180	Wooded dunes of the Atlantic, Continental and Boreal region	Destruction of a habitat patch connected to excavation	In the excavation zone or in the area of other direct activities habitat patches shall be destroyed	Impact on habitat important
4.	9110	*Luzulo-Fagetum* beech forests	Destruction of a habitat patch connected to excavation	In the excavation zone or in the area of other direct activities habitat patches shall be destroyed	Impact on habitat important

Table 6.44. Characteristics of the construction phase impacts on plants and habitats in the Applicant Proposed Variant (APV) [Source: internal materials]

No.	Impacts	Nature of impact	Type of impact	Impact range	Temporal scope of impact
1.	Disturbance of surface formations (excavations)	Negative	Direct, primary, reversible	Local	Long-term
2.	Levelling works for the erection of the power substation and cable chambers	Negative	Direct, primary, permanent	Local	Long-term
3.	Wind erosion	Negative	Indirect, primary, reversible	Local	Long-term
4.	Oil and grease contamination (roads, storage yards, back-up facilities)	Negative	Direct, primary, reversible	Local	Long-term

6.1.4.6.1.5 Forest complexes

The route of the BP OWF CI will require tree felling:

- in the 25 m wide and 5 km long permanent technical belt (no clearings are planned in the area of trenchless crossings) which covers a maximum area of 15 ha;
- in a temporary technical belt, with a width of 25 m from the external cable lines and an approx. length of 5 km, in connection with the conduct of construction works (except for the area of horizontal drillings) which covers a maximum area of 25 ha.

The trees growing in the area of construction site facilities and access roads (not intended for felling) will be appropriately secured against damage by the construction equipment.

The largest area of the permanent technical belt is occupied by fresh mixed coniferous forests (57%) and fresh coniferous forests (31%) with pine as a dominant species. More than 66% of the surface area of forests is occupied by commercial forests. The following categories of protective forests are also present there; soil-protective, water-protective and research forests.

A very similar structure is present within the temporary technical belt [Table 6.45].

A detailed compilation of the forest units including a complete list of forest addresses, surface areas, types of habitat, forest functions, conservation classes, vertical structure, age of species harvesting maturity and the surface area of individual units divided by individual technical belts are presented in Table 6.45. The table contains complete forest units along the APV route, without taking into account the forest areas planned to be crossed with horizontal directional drilling.

Table 6.45. The course of the Applicant Proposed Variant within the permanent and temporary technical belts including the taxonomic description data of the State Forests (as of 1 March 2021) [Source: internal materials based on https://www.bdl.lasy.gov.pl/portal/uslugi-mapowe-ogc]

No.	Forest address	Type of forest habitat[1]	Farm[2]	Forest function[3]	Conservation class[4]	Species name[5]	Share	Age	Permanent technical belt [m^2]	Temporary technical belt [m^2]
1.	15-01-1-02-43 -g -00	FCF	S	PROT	SOIL PROT	PI	8	91	3311.005	5085.074
2.	15-01-1-02-43 -i -00	FCF	S	PROT	SOIL PROT	PI	9	76	4599.011	6182.997
3.	15-00-1-02-43 -j -01	DCF	S	PROT	SOIL PROT	PI, M	10	71	8110.328	14,477.153
4.	15-01-1-02-43 -n -00	FCF	S	PROT	SOIL PROT	PI	8	116	1697.034	1795.088
5.	15-01-1-02-44 -l -00	MCF	S	PROT	SOIL PROT	PI	10	166	73.714	871.166
6.	15-00-1-02-96 -c -01	FMCF	S	PROT	SOIL PROT	PI	10	136	2659.697	3914.295
7.	15-01-1-02-112 -h -00	MSDF	CLF	COMM	-	BC	7	106	-	103.494
8.	15-01-1-02-113 -h -00	FMCF	S	PROT	SOIL PROT	PI	9	121	3315.386	3958.551
9.	15-01-1-02-114 -a -00	FMCF	S	PROT	SOIL PROT	PI	7	30	472.554	1284.203
10.	15-01-1-02-114 -b -00	FMCF	S	PROT	SOIL PROT	PI	10	18	1391.316	1613.85
11.	15-00-1-02-114 -c -01	FCF	S	PROT	SOIL PROT	PI	6	106	4308.505	6198.553
12.	15-01-1-02-114 -d -00	FMCF	S	PROT	SOIL PROT	PI	10	136	-	498.186
13.	15-01-1-02-114 -g -00	FCF	S	PROT	SOIL PROT	PI	10	146	-	6.214
14.	15-01-1-02-114 -h -00	FMCF	S	PROT	SOIL PROT	PI	10	51	238.66	1155.414
15.	15-01-1-02-114 -i -00	FMCF	S	PROT	SOIL PROT	PI	8	41	2677.076	4001.24
16.	15-00-1-02-114 -j -01	FMCF	S	PROT	SOIL PROT	PI	4	46	1754.044	2697.702
17.	15-01-1-02-114 -k -00	FMCF	S	PROT	SOIL PROT	PI	10	116	3333.268	4621.616
18.	15-01-1-02-115 -a -00	FCF	PF	PROT	SOIL PROT	PI	6	53	-	340.338
19.	15-01-1-02-115 -b -00	FMCF	PF	PROT	SOIL PROT	PI	10	40	2972.185	4279.24
20.	15-00-1-02-115 -c -01	FMCF	PF	PROT	SOIL PROT	PI	10	35	2203.637	3323.747
21.	15-01-1-02-115 -d -00	FMCF	PF	PROT	SOIL PROT	PI	7	166	2960.213	4406.843
22.	15-00-1-02-164 -j -01	FMCF	LF	COMM	-	PI	10	61	3543.528	5267.805

No.	Forest address	Type of forest habitat[1]	Farm[2]	Forest function[3]	Conservation class[4]	Species name[5]	Share	Age	Permanent technical belt [m^2]	Temporary technical belt [m^2]
23.	15-01-1-02-165 -b -00	FMCF	LF	COMM	-	PI	10	54	2319.965	3747.05
24.	15-00-1-02-165 -c -01	FMCF	LF	COMM	-	PI	10	48	2948.689	4328.201
25.	15-01-1-02-165 -d -00	FMCF	LF	COMM	-	PI	10	44	2293.81	3686.48
26.	15-01-1-02-165 -f -00	FMCF	LF	COMM	-	PI	10	61	5868.168	9124.912
27.	15-01-1-02-166 -a -00	FMCF	LF	COMM	-	PI	10	62	1913.44	2974.896
28.	15-01-1-02-166 -b -00	FMCF	PF	PROT	RES	PI	10	56	2759.607	5428.596
29.	15-00-1-02-166 -c -01	FMCF	PF	PROT	RES	PI	10	48	1384.399	2490.591
30.	15-01-1-02-166 -d -00	FMCF	LF	COMM	-	PI	10	71	2147.422	3336.794
31.	15-01-1-02-166 -f -00	FCF	LF	COMM	-	PI	10	56	2747.568	2796.41
32.	15-01-1-02-167 -a -00	MSDF	CLF	COMM	-	PI	9	111	4336.296	6856.468
33.	15-01-1-02-167 -f -00	AAF	S	PROT	WTR PROT	SP	6	38	-	233.861
34.	15-01-1-02-168 -b -00	MMCF	S	PROT	WTR PROT	PI	9	51	180.18	1455.312
35.	15-00-1-02-168 -c -01	MSDF	S	PROT	WTR PROT	PI	4	96	-	119.251
36.	15-00-1-02-185 -c -01	FMCF	LF	COMM	-	PI	10	63	2873.518	4410.403
37.	15-01-1-02-185 -d -00	FCF	LF	COMM	-	PI	10	53	2400.781	3732.806
38.	15-01-1-02-185 -f -00	FCF	LF	COMM	-	PI	10	66	224.638	836.989
39.	15-01-1-02-185 -g -00	FCF	LF	COMM	-	PI	10	43	-	41.229
40.	15-01-1-02-186 -b -00	FMCF	LF	COMM	-	PI	10	44	1072.578	1777.771
41.	15-00-1-02-186 -c -01	FMCF	LF	COMM	-	PI	10	57	2337.229	3634.593
42.	15-01-1-02-186 -d -00	FMCF	LF	COMM	-	PI	10	46	4906.151	7403.525
43.	15-01-1-02-186 -f -00	FMCF	LF	COMM	-	PI	10	61	972.155	1735.848
44.	15-01-1-02-200 -a -00	FCF	LF	COMM	-	PI	10	36	3764.959	5379.078
45.	15-01-1-02-200 -b -00	FCF	LF	COMM	-	PI	10	66	776.601	1248.438
46.	15-01-1-02-200 -f -00	FCF	LF	COMM	-	PI	7	59	631.294	1415.456
47.	15-00-1-02-199 -c -01	FCF	LF	COMM	-	PI	10	64	2168.032	2261.74

No.	Forest address	Type of forest habitat[1]	Farm[2]	Forest function[3]	Conservation class[4]	Species name[5]	Share	Age	Permanent technical belt [m²]	Temporary technical belt [m²]
48.	15-01-1-02-199 -d -00	FCF	LF	COMM	-	PI	10	51	8789.32	13,659.392
49.	15-01-1-02-210 -f -00	MSDF	CLF	COMM	-	PI	9	96	5683.965	9016.127
50.	15-01-1-02-211 -a -00	MSDF	CLF	COMM	-	PI	8	61	1900.282	2431.665
51.	15-01-1-02-211 -b -00	MSDF	CLF	COMM	-	PI	10	56	836.302	1842.449
52.	15-01-1-02-112 -g -00	AAF	S	PROT	WTR PROT	AL	9	16		400.427
53.	15-01-1-02-113 -g -00	AAF	S	PROT	WTR PROT	AL	10	18	1637.744	3837.321
54.	15-01-1-02-168 -a -00	AAF	S	PROT	WTR PROT	AL	9	18	3447.176	4258.688
55.	15-01-1-02-96 -a -00	MCF	S	PROT	SOIL PROT	PI	10	96	3090.103	4923.876
56.	15-01-1-02-115 -g -00	FCF	PF	PROT	SOIL PROT	PI	10	26	1009.215	1998.08
57.	15-01-1-02-115 -h -00	FMCF	PF	PROT	SOIL PROT	PI	8	37	1394.587	2043.159
58.	15-01-1-02-164 -k -00	FMCF	LF	COMM	-	PI	10	56	-	241.545
59.	15-01-1-02-167 -b -00	FMCF	CLF	COMM	-	PI	10	52	1794.132	2595.301
60.	15-00-1-02-167 -c -01	AAF	S	PROT	WTR PROT	AL	7	86	3502.89	4972.839
61.	15-01-1-02-185 -b -00	FCF	LF	COMM	-	PI	10	58	5081.084	7429.023
62.	15-01-1-02-186 -g -00	FCF	LF	COMM	-	PI	10	48	2702.635	4202.14
63.	15-01-1-02-186 -h -00	FCF	LF	COMM	-	PI	10	44	1972.445	2956.952
64.	15-01-1-02-43 -a -00	FMCF	S	PROT	SOIL PROT	PI	10	81	1283.815	652.849
65.	15-00-1-02-43 -c -01	FMCF	S	PROT	SOIL PROT	PI	10	106	7286.345	5688.259
66.	15-01-1-02-43 -d -00	-	-	-	-	PI	-	106	1126.778	1680.433
67.	15-01-1-02-43 -o -00	FMCF	S	PROT	SOIL PROT	PI	10	81	2227.857	1283.782
68.	15-01-1-02-199 -b -00	FCF	LF	COMM	-	PI	10	61	2421.729	3884.992
69.	15-01-1-02-199 -i -00	FCF	LF	COMM	-	PI	10	44	0.351	403.889
70.	15-01-1-02-199 -f -00	FCF	LF	COMM	-	PI	8	44	2928.462	5160.136
71.	15-01-1-02-211 -f -01	MSDF	CLF	COMM	-	PI	9	96	3055.664	4228.885
72.	15-01-1-02-211 -d -01	FMCF	CLF	COMM	-	PI	10	96	350.013	546.457

No.	Forest address	Type of forest habitat[1]	Farm[2]	Forest function[3]	Conservation class[4]	Species name[5]	Share	Age	Permanent technical belt [m^2]	Temporary technical belt [m^2]
73.	15-01-1-02-211 -c -01	FMCF	CLF	COMM	-	PI	10	111	1268.052	2473.096
Total									**165,439.587**	**249,351.229**

[1]FMCF – fresh mixed coniferous forest, MMCF – moist mixed coniferous forests, DCF – dry coniferous forest, FCF – fresh coniferous forest, MCF – moist coniferous forest, FSDF – fresh semi-deciduous forest, MSDF – moist semi-deciduous forest. AAF – ash-alder forest

[2]CLF – clearing and logging farm, LF – logging farm, PF – protection farm, S – special farm

[3]COMM – commercial forests, PROT – protective forests

[4]RES – research, SOIL PROT – soil-protecting, WTR PROT – water-protecting

[5]BC – beech, M – maple, AL – alder, PI – pine, SP – spruce

The **fresh mixed coniferous forest** habitat is present along the entire route of the planned project in considerable dispersion. In the area discussed, natural and close to natural habitats occupy about 65% of all fresh mixed coniferous forest habitats. These are mainly forests with an economic function, only in the area of cable chambers from km 33+550 to 33+730 and south of Spacerowa street, from km 34+600 to 35+850, there are soil-protective forests. The significance of impact was assessed to be important. Forests of a **fresh coniferous forests** type dominate in the southern part from km 37+900 to 39+400. Also, they occur in the northern part, where the crossing by horizontal drilling is planned, and there, the significance of the impact was considered negligible. The habitats of fresh coniferous forest develop on poor sands. These soils are quite susceptible to chemical and biological degradation Any interference in the soil causes an accelerated decomposition of organic matter deposited on the soil surface and in mineral horizons. Faster mineralisation of soil humus may result in a deficit of nutrients, especially nitrogen, at a later stage of the stand development. The significance of impact was assessed to be important. Patches of **fresh semi-deciduous forest** occur scattered at the edges of the area discussed and belong to a group of moderately fertile habitats. These are commercial forests. The significance of the impact was assessed to be moderate. The **dry coniferous forests** which are present in the northern part of the planned project within the area of the Wydmy Lubiatowskie dunes at km 34+000 to 34+400 are characterised by low resistance. The ease with which the stabilised coastal dune sands can be triggered supports the decision to refrain from any use. This area is planned to be crossed by horizontal directional drilling; therefore, the significance of the impact was considered negligible. The **moist coniferous forest** habitat covers a small area south of Spacerowa street from km 34+500 to 34+600 on poor sands with large fluctuations in the groundwater level. Any interference causes an accelerated decomposition of organic matter, affecting chemical and biological degradation. In order to reduce the risk of disturbance of water conditions in this area, it is recommended to apply minimising measures in the form of sheet piling. The significance of impact was assessed to be important. **Ash-alder forest** occurs in small areas in the vicinity of the Bezimienna Stream from km 35+850 to 36+200. When developing this type of habitats, particular attention should be paid to soil protection and no interference in water conditions should be allowed. In this aspect, it is planned to cross the area by a horizontal directional drilling. The significance of the impact was assessed as negligible. The negligible area in the area of the planned project of the **moist mixed coniferous forest** habitat in terms of fertility is at the same level in the trophic network as the fresh mixed coniferous forest. The significance of the impact was assessed to be low. The habitat of a **moist semi-deciduous forest** covers a small area within the area of a waterlogged valley which is planned to be crossed by horizontal directional drilling. The significance of the impact was assessed as negligible.

The impacts of the planned project connected to the felling of trees will be **negative, direct, primary, reversible in the temporary technical belt, irreversible in the permanent technical belt, local, and long-term within the permanent technical belt and medium-term in technical belt. Impact significance: important.**

The impacts related to logging and the resultant soil erosion will be **negative, indirect, simple, reversible in the temporary technical belt, irreversible in the permanent technical belt, local and medium-term (temporary technical belt) or permanent (permanent technical belt). Impact significance: important for fresh and moist coniferous forests.**

The habitats of fresh and moist coniferous forests and ash alder forests are the most susceptible to contamination with oils and greases. The impacts of the planned project related to the contamination will be **negative, direct, primary, reversible, local and short-term. Impact significance is mainly moderate** [Table 6.46, Table 6.47].

Table 6.46. Assessment of forest resistance to the construction phase impacts in the Applicant Proposed Variant (APV) [Source: internal materials]

No.	Impacts	Type of forest habitat	Resistance
1.	Deforestation	Fresh mixed coniferous forest	Moderate
		Fresh coniferous forest	Low
		Fresh semi-deciduous forest	Moderate
		Dry coniferous forest	Low
		Moist coniferous forest	Low
		Ash-alder forest	Low
		Moist mixed coniferous forest	Moderate
		Moist semi-deciduous forest	Moderate
2.	Soil erosion	Fresh mixed coniferous forest	Moderate
		Fresh coniferous forest	Low
		Fresh semi-deciduous forest	High
		Dry coniferous forest	Low
		Moist coniferous forest	Low
		Ash-alder forest	Low
		Moist mixed coniferous forest	Moderate
		Moist semi-deciduous forest	Moderate
3.	Contamination with greases and oils	Fresh mixed coniferous forest	Moderate
		Fresh coniferous forest	Low
		Fresh semi-deciduous forest	High
		Dry coniferous forest	Low
		Moist coniferous forest	Low
		Ash-alder forest	Low
		Moist mixed coniferous forest	Moderate
		Moist semi-deciduous forest	Moderate

Table 6.47. Characteristics of the construction phase impacts on forests in the Applicant Proposed Variant (APV) [Source: internal materials]

No.	Impacts	Type of forest habitat	Nature of impact	Type of impact	Impact range	Temporal scope of impact	Impact scale	Impact sensitivity	Impact significance
1.	Tree felling	Fresh mixed coniferous forest	Negative	Direct, primary, reversible (temporary technical belt)/ irreversible (permanent technical belt)	Local	Medium-term (temporary technical belt) and permanent (permanent technical belt)	High	High	Important
		Fresh coniferous forest					Irrelevant (HDD or HDD Intersect section)	No impact	Negligible
							High	High	Important
		Fresh semi-deciduous forest					Moderate	High	Moderate
		Dry coniferous forest					Irrelevant (HDD or HDD Intersect section)	No impact	Negligible
		Moist coniferous forest					High	High	Important
		Ash-alder forest					Irrelevant (HDD or HDD Intersect section)	No impact	Negligible
		Moist mixed coniferous forest					Low	High	Low
		Moist semi-deciduous forest					Irrelevant (HDD or HDD Intersect section)	No impact	Negligible
2.	Soil erosion	Fresh mixed coniferous forest	Negative	Indirect, primary, reversible (temporary technical belt)/ irreversible (permanent technical belt)	Local	Medium-term (temporary technical belt) and permanent (permanent	High	Moderate	Moderate
		Fresh coniferous forest					Irrelevant (HDD or HDD Intersect section)	No impact	Negligible

No.	Impacts	Type of forest habitat	Nature of impact	Type of impact	Impact range	Temporal scope of impact	Impact scale	Impact sensitivity	Impact significance
						technical belt)	High	High	Important
		Fresh semi-deciduous forest					Moderate	Moderate	Low
		Dry coniferous forest					Irrelevant (HDD or HDD Intersect section)	No impact	Negligible
		Moist coniferous forest					High	High	Important
		Ash-alder forest					Irrelevant (HDD or HDD Intersect section)	No impact	Negligible
		Moist mixed coniferous forest					Low	Moderate	Low
		Moist semi-deciduous forest					Irrelevant (HDD or HDD Intersect section)	No impact	Negligible
3.	Contamination with greases and oils	Fresh mixed coniferous forest	Negative	Direct, primary, reversible	Local	Momentary	Low	Very high	Moderate
		Fresh coniferous forest					Low	Very high	Moderate
		Fresh semi-deciduous forest					Low	Moderate	Low
		Dry coniferous forest					Low	High	Low
		Moist coniferous forest					Low	Very high	Moderate
		Ash-alder forest					Low	Very high	Moderate
		Moist mixed coniferous forest					Low	Very high	Moderate
		Moist semi-deciduous forest					Low	Very high	Moderate

6.1.4.6.1.6 Invertebrates

A detailed characteristics of invertebrates developed on the basis of one-year-long inventory surveys on abiotic and biotic resources of the BP OWF CI survey area (Appendix 1. Report on inventory surveys) and data from literature is presented in subsection 3.19.1.6. The impacts on biotic elements in the onshore area refer to the technical belts designated for the implementation of the planned project [Table 6.48].

Table 6.48. List of invertebrate species by technical belts in the Applicant Proposed Variant (APV) including assessment [Source: internal materials]

No.	Species		Conservation status[1]	Threat category[2]	Permanent technical belt	Temporary technical belt	Comments
	Species name	Binomial nomenclature					
1.	Violet ground beetle	*Carabus violaceus*	PP	None	Not found	Not found	Coleoptera
2.	Blue-winged grasshopper	*Oedipoda caerulescens*	None	NT	Impact on specimens insignificant	Impact on specimens insignificant	Orthoptera
3.	Minotaur beetle	*Typhaeus typhoeus*	None	NT	Not found	Not found	Coleoptera
4.	-	*Oberea oculata*	None	RR	Not found	Not found	Coleoptera
5.	European paper wasp	*Polistes dominulus*	None	CR	Impact on specimens insignificant	Impact on specimens insignificant	Hymenoptera
6.	Black-backed meadow ant	*Formica pratensis*	PP	None	Not found	Not found	Hymenoptera
7.	-	*Melanimon tibialis*	None	RR	Not found	Not found	Coleoptera
8.	Rock grayling	*Hipparchia semele*	None	RR	Not found	Not found	Lepidoptera
9.	-	*Sericomyia silentis*	None	RR	Not found	Not found	Diptera
10.	Common carder bee	*Bombus pascuorum*	PP	None	Not found	Not found	Hymenoptera
11.	Buff-tailed bumblebee	*Bombus terrestris*	PP	None	Not found	Not found	Hymenoptera
12.	Broad-bodied chaser	*Libellula depressa*	None	LC	Not found	Not found	Odonata

[1]Pursuant to the Regulation of the Minister of the Environment of 16 December 2016 on the protection of animal species (Journal of Laws of 2016, item 2183, as amended): PP – species under partial protection
[2]NT – near threatened, RR – rare in region, i.e. Eastern (Gdańsk) Pomerania, CR – critically endangered, LC – least concern

The main construction phase impacts on the invertebrate fauna will be connected to:

- the construction of open trenches for cable laying, cable chambers and inlet and outlet chambers at the sections planned for trenchless passages;

- the levelling works related to the levelling of the area for the customer substation, 400 kV overhead line towers and the cable chambers.

In such cases, the disturbance of invertebrates and a possible destruction of nests will take place.

These impacts due to the presence of common coastal species of insects in this area may be considered insignificant, and not leading to the elimination of the species site [Table 6.49].

Moreover, the impacts will be connected to aeolian erosion and possible contamination of open trenches with greases, oils, etc. – which may negatively affect the bumblebee nests.

Table 6.49. Matrix defining the significance of the construction phase impact on invertebrates in the Applicant Proposed Variant (APV) [Source: internal materials]

Impact significance		**Receptor sensitivity**				
		Irrelevant	**Low**	**Moderate**	**High**	**Very high**
Scale (size) of impact	Irrelevant	Negligible	Negligible	Negligible	Negligible	Low
	Low	Negligible	Negligible	Low	Low	Moderate
	Moderate	Negligible	Low	Low	Moderate	Moderate
	High	Negligible	Low	Moderate	Important	Significant
	Very high	Low	Moderate	Moderate	Significant	Significant

6.1.4.6.1.7 Ichthyofauna

A detailed characteristics of ichthyofauna developed on the basis of the one-year-long inventory surveys on abiotic and biotic resources of the BP OWF CI survey area (Appendix 1. Report on inventory surveys) and data from literature is presented in subsection 3.19.1.7. The impacts on biotic elements in the onshore area refer to the technical belts designated for the implementation of the planned project.

During the construction phase, no impact on ichthyofauna is expected [Table 6.50]. Due to the extremely low water levels, which have been observed for many years, despite the presence of potential hiding places, shading, stream bed diversity etc., the watercourses surveyed are characterised by a low ichthyological diversity (subsection 3.19.1.7).

Table 6.50. Matrix defining the significance of the construction phase impact on ichthyofauna in the Applicant Proposed Variant (APV) [Source: internal materials]

Impact significance		**Receptor sensitivity**				
		Irrelevant	**Low**	**Moderate**	**High**	**Very high**
Scale (size) of impact	Irrelevant	Negligible	Negligible	Negligible	Negligible	Low
	Low	Negligible	Negligible	Low	Low	Moderate
	Moderate	Negligible	Low	Low	Moderate	Moderate
	High	Negligible	Low	Moderate	Important	Significant
	Very high	Low	Moderate	Moderate	Significant	Significant

6.1.4.6.1.8 Herpetofauna

In the planned project area, two species of amphibians were found – the common toad and the common frog, as well as three species of reptiles – the sand lizard, the viviparous lizard and the slow worm. All of the herpetofauna species found in the area are protected as part of the Regulation of the Minister of the Environment of 16 December 2016 on the protection of animal species (Journal of Laws of 2016, item 2183, as amended) [Table 6.51].

Table 6.51. Species of amphibians and reptiles found in the project area in the Applicant Proposed Variant (APV) including their conservations status [Source: internal materials]

No.	Species/taxon	Conservation status[1]
1.	Common toad *Bufo bufo*	PP
2.	Common frog *Rana temporaria*	PP
3.	Slow worm *Anguis fragilis*	PP
4.	Sand lizard *Lacerta agilis*	PP
5.	Viviparous lizard *Zootoca vivipara*	PP

[1]Pursuant to the Regulation of the Minister of the Environment of 16 December 2016 on the protection of animal species (Journal of Laws of 2016, item 2183, as amended): PP – species under partial protection

The construction phase impacts will mainly involve the transformation of the environment which will be caused by a partial destruction of habitats, e.g. deforestation of the technical belt for excavations, construction of new access roads, occupation of land by the customer substation and the 400 kV line towers, as well as the slight fragmentation of habitats as a result of the creation of a 120 m wide treeless belt and new access roads running across the forest areas. This impact will be permanent and long-term. The habitats of amphibians and reptiles living in the area of the planned project will be the most vulnerable to the works related to the construction phase. These habitats will be destroyed during the project construction.

Table 6.52 characterises the impact of the construction phase on the herpetofauna occurring in the technical belts designated for the project implementation.

Most of the construction phase impacts on herpetofauna will be **of moderate scale, and the significance of impact will be low. The highest impact on herpetofauna will be connected to the felling of trees and traffic of vehicles. These will be the impacts of moderate scale and significance.**

Table 6.52. Construction phase impacts on the herpetofauna present in the planned project area and in its immediate vicinity – Applicant Proposed Variant (APV) [Source: internal materials]

No.	Impacts	Nature of impact	Type of impact	Impact range	Temporal scope of impact	Impact scale	Impact sensitivity	Impact significance	Comments
1.	Excavations and cable laying	Negative	Direct, reversible	Local	Momentary, short-term	Moderate	Low	Low	After the completion of work, not visible in the area
2.	Construction of the customer substation, cable chambers and a 400 kV line	Negative	Direct, permanent		Permanent, long-term	Moderate	Low	Low	Impact also in the project operation phase
3.	Tree felling	Negative	Direct, indirect, permanent		Permanent, long-term	Moderate	Moderate	Moderate	Impact also in the project operation phase
4.	Crossing with horizontal directional drilling	Neutral	Direct		Momentary, short-term	Irrelevant, low	Low	Low	Will not be visible in the area
5.	Technical belts, access roads, traffic of vehicles	Negative	Direct, indirect, permanent		Permanent, long-term	Moderate	Moderate	Low Moderate	Impact also in the project operation phase
6.	Noise, disturbance	Negative	Direct, indirect		Momentary, short-term	Low	Low	Low	Ceases after the construction phase
7.	Contamination	Negative	Direct, indirect		Momentary, short-term	Low	Low	Low	Ceases after the construction phase

6.1.4.6.1.9 Birds

The construction phase impacts will mainly involve the transformation of the environment which will be caused by a partial destruction of habitats, e.g. deforestation of the technical belt for excavations, temporary technical belt, construction of new access roads, occupation of land by the customer substation and the 400 kV overhead line, as well as the slight fragmentation of habitats as a result of the creation of a 120 m wide treeless belt and new access roads running across the forest areas. This impact will be permanent and long-term. The breeding bird species occupying various habitats that will be partially destroyed during construction works will be most vulnerable to the construction phase work. Except for the creation and deforestation of the permanent technical belt and the new access roads, the project, in principle, will not be visible in the area along the forest section.

Table 6.53 and Table 6.54 contain the characteristics of bird species found in the planned project area in the APV including their conservation status as well as the quality of resources, into which the species was assigned. Bird species which may be affected by the project were indicated. Moreover, the construction phase impacts on the birds present in the area and its immediate vicinity were assessed.

Most of the construction phase impacts on birds will be **of moderate or low scale, while the significance of impact will be low. The greatest impacts on birds will be connected to the felling of trees and the traffic of vehicles. These will be the impacts of moderate scale and significance.**

Table 6.53. Bird species found in the planned project area in the Applicant Proposed Variant (APV) including their conservation status as well as the quality of resources, into which the species was assigned. List of bird species that may be affected by the project [Source: internal materials]

No.	Species		Status[1]	Protection[2]	IUCN[3]	Annex 1 BD[4]	PRDB[5]	PRLB[6]	SPEC[7]	Resource type[8]	Permanent technical belt, temporary technical belt
	Species name	Binomial nomenclature									
1.	Stock dove	*Columba oenas*	LB, M	SP	LC	-	-	-	-	Low value	Present, sections of breeding areas >1 pair
2.	Common wood pigeon	*Columba palumbus*	CB, M	G	LC	-	-	-	-	Low value	Present, sections of breeding areas >1 pair
3.	European nightjar	*Caprimulgus europaeus*	LB, M	SP	LC	Yes	-	-	SPEC3	High value	Present, sections of breeding areas >1 pair
4.	Common cuckoo	*Cuculus canorus*	LB, M	SP	LC	-	-	-	-	Low value	Present, sections of breeding areas >1 pair
5.	Common crane	*Grus grus*	CB, M	SP	LC	Yes	-	-	SPEC2	Moderate value	Present, sections of breeding areas >1 pair
6.	Eurasian woodcock	*Scolopax rusticola*	LB, M	G	LC	-	-	-	-	Low value	Present, sections of breeding areas >1 pair
7.	Green sandpiper	*Tringa ochropus*	LB, M	Strict/active	LC	-	-	-	-	Moderate value	Present, sections of breeding areas >1 pair
8.	Long-eared owl	*Asio otus*	CB, M	SP	LC	-	-	-	-	Low value	Present, sections of breeding areas >1 pair
9.	Tawny owl	*Strix aluco*	CB, M	SP	LC	-	-	-	-	Low value	Present, sections of breeding areas >1 pair
10.	Eurasian sparrowhawk	*Accipiter nisus*	LB, M	SP	LC	-	-	-	-	Low value	Present, sections of breeding areas >1 pair
11.	Northern goshawk	*Accipiter gentilis*	LB, M	SP	LC	-	-	-	-	Low value	Present, sections of breeding areas >1 pair
12.	Common buzzard	*Buteo buteo*	CB, M	SP	LC	-	-	-	-	Low value	Present, sections of breeding areas >1 pair
13.	Eurasian wryneck	*Jynx torquilla*	LB, M	SP	LC	-	-	-	SPEC3	Low value	Present, sections of breeding areas >1 pair
14.	European green woodpecker	*Picus viridis*	LB, M	Strict/active	LC	-	-	-	-	Low value	Present, sections of breeding areas >1 pair
15.	Black	*Dryocopus martius*	CB, M	Strict/active	LC	Yes	-	-	-	High value	Present, sections of breeding areas >1 pair

No.	Species		Status[1]	Protection[2]	IUCN[3]	Annex 1 BD[4]	PRDB[5]	PRLB[6]	SPEC[7]	Resource type[8]	Permanent technical belt, temporary technical belt
	Species name	Binomial nomenclature									
	woodpecker										
16.	Great spotted woodpecker	*Dendrocopos major*	CB, M	SP	LC	-	-	-	-	Low value	Present, sections of breeding areas >1 pair
17.	Eurasian hobby	*Falco subbuteo*	LB, M	Strict/active	LC	-	-	-	-	Low value	Present, sections of breeding areas >1 pair
18.	Golden oriole	*Oriolus oriolus*	LB, M	SP	LC	-	-	-	-	Low value	Present, sections of breeding areas >1 pair
19.	Red-backed shrike	*Lanius collurio*	CB, M	SP	LC	Yes	-	-	SPEC2	High value	Present, sections of breeding areas >1 pair
20.	Eurasian jay	*Garrulus glandarius*	CB, M	SP	LC	-	-	-	-	Low value	Present, sections of breeding areas >1 pair
21.	Coal tit	*Periparus ater*	LB, M	SP	LC	-	-	-	-	Low value	Present, sections of breeding areas >1 pair
22.	European crested tit	*Lophophanes cristatus*	LB, M	SP	LC	-	-	-	SPEC2	Low value	Present, sections of breeding areas >1 pair
23.	Marsh tit	*Poecile palustris*	LB, M	SP	LC	-	-	-	-	Low value	Present, sections of breeding areas >1 pair
24.	Willow tit	*Poecile montanus*	LB, M	SP	LC	-	-	-	SPEC3	Low value	Present, sections of breeding areas >1 pair
25.	Eurasian blue tit	*Cyanistes caeruleus*	CB, M	SP	LC	-	-	-	-	Low value	Present, sections of breeding areas >1 pair
26.	Great tit	*Parus major*	CB, M	SP	LC	-	-	-	-	Low value	Present, sections of breeding areas >1 pair
27.	Woodlark	*Lullula arborea*	CB, M	SP	LC	Yes	-	-	SPEC2	High value	Present, sections of breeding areas >1 pair
28.	Icterine warbler	*Hippolais icterina*	LB, M	SP	LC	-	-	-	-	Low value	Present, sections of breeding areas >1 pair
29.	Wood warbler	*Phylloscopus sibilatrix*	LB, M	SP	LC	-	-	-	-	Low value	Present, sections of breeding areas >1 pair
30.	Willow warbler	*Phylloscopus trochilus*	LB, M	SP	LC	-	-	-	SPEC3	Low value	Present, sections of breeding areas >1 pair
31.	Common chiffchaff	*Phylloscopus collybita*	LB, M	SP	LC	-	-	-	-	Low value	Present, sections of breeding areas >1 pair
32.	Long-tailed tit	*Aegithalos caudatus*	LB, M	SP	LC	-	-	-	-	Low value	Present, sections of breeding areas >1 pair
33.	Eurasian blackcap	*Sylvia atricapilla*	CB, M	SP	LC	-	-	-	-	Low value	Present, sections of breeding areas >1 pair
34.	Garden warbler	*Sylvia borin*	LB, M	SP	LC	-	-	-	-	Low value	Present, sections of breeding areas >1 pair
35.	Lesser	*Sylvia curruca*	LB, M	SP	LC	-	-	-	-	Low value	Present, sections of breeding areas >1 pair

No.	Species		Status[1]	Protection[2]	IUCN[3]	Annex 1 BD[4]	PRDB[5]	PRLB[6]	SPEC[7]	Resource type[8]	Permanent technical belt, temporary technical belt
	Species name	Binomial nomenclature									
	whitethroat										
36.	Common whitethroat	*Sylvia communis*	LB, M	SP	LC	-	-	-	-	Low value	Present, sections of breeding areas >1 pair
37.	Eurasian treecreeper	*Certhia familiaris*	LB, M	SP	LC	-	-	-	-	Low value	Present, sections of breeding areas >1 pair
38.	Eurasian nuthatch	*Sitta europaea*	LB, M	SP	LC	-	-	-	-	Low value	Present, sections of breeding areas >1 pair
39.	Eurasian wren	*Troglodytes troglodytes*	CB, M	SP	LC	-	-	-	-	Low value	Present, sections of breeding areas >1 pair
40.	Common starling	*Sturnus vulgaris*	CB, M	SP	LC	-	-	-	SPEC3	Low value	Present, sections of breeding areas >1 pair
41.	Mistle thrush	*Turdus viscivorus*	CB, M	SP	LC	-	-	-	-	Low value	Present, sections of breeding areas >1 pair
42.	Song thrush	*Turdus philomelos*	CB, M	SP	LC	-	-	-	-	Low value	Present, sections of breeding areas >1 pair
43.	Common blackbird	*Turdus merula*	CB, M	SP	LC	-	-	-	-	Low value	Present, sections of breeding areas >1 pair
44.	Fieldfare	*Turdus pilaris*	LB, M	SP	LC	-	-	-	-	Low value	Present, sections of breeding areas >1 pair
45.	Spotted flycatcher	*Muscicapa striata*	LB, M	SP	LC	-	-	-	SPEC2	Low value	Present, sections of breeding areas >1 pair
46.	European robin	*Erithacus rubecula*	LB, M	SP	LC	-	-	-	-	Low value	Present, sections of breeding areas >1 pair
47.	Thrush nightingale	*Luscinia luscinia*	LB, M	SP	LC	-	-	NT	-	Low value	Present, sections of breeding areas >1 pair
48.	Red-breasted flycatcher	*Ficedula parva*	LB, M	SP	LC	Yes	-	-	-	High value	Present, sections of breeding areas >1 pair
49.	European pied flycatcher	*Ficedula hypoleuca*	LB, M	SP	LC	-	-	NT	-	Low value	Present, sections of breeding areas >1 pair
50.	Common redstart	*Phoenicurus phoenicurus*	LB, M	SP	LC	-	-	-	-	Low value	Present, sections of breeding areas >1 pair
51.	Goldcrest	*Regulus regulus*	LB, M	SP	LC	-	-	-	SPEC2	Low value	Present, sections of breeding areas >1 pair

No.	Species		Status[1]	Protection[2]	IUCN[3]	Annex 1 BD[4]	PRDB[5]	PRLB[6]	SPEC[7]	Resource type[8]	Permanent technical belt, temporary technical belt
	Species name	Binomial nomenclature									
52.	Common firecrest	*Regulus ignicapilla*	LB, M	SP	LC	-	-	-	-	Low value	Present, sections of breeding areas >1 pair
53.	Dunnock	*Prunella modularis*	LB, M	SP	LC	-	-	-	-	Low value	Present, sections of breeding areas >1 pair
54.	Tree pipit	*Anthus trivialis*	LB, M	SP	LC	-	-	-	SPEC3	Low value	Present, sections of breeding areas >1 pair
55.	Common chaffinch	*Fringilla coelebs*	CB, M	SP	LC	-	-	-	-	Low value	Present, sections of breeding areas >1 pair
56.	Hawfinch	*Coccothraustes coccothraustes*	LB, M	SP	LC	-	-	-	-	Low value	Present, sections of breeding areas >1 pair
57.	Eurasian bullfinch	*Pyrrhula pyrrhula*	LB, M	SP	LC	-	-	-	-	Low value	Present, sections of breeding areas >1 pair
58.	Greenfinch	*Chloris chloris*	LB, M	SP	LC	-	-	-	-	Low value	Present, sections of breeding areas >1 pair
59.	Common linnet	*Linaria cannabina*	LB, M	SP	LC	-	-	-	SPEC2	Low value	Present, sections of breeding areas >1 pair
60.	Common redpoll	*Acanthis flammea*	LB, M	SP	LC	-	-	-	-	High value	Present, sections of breeding areas >1 pair
61.	Red crossbill	*Loxia curvirostra*	LB, M	SP	LC	-	-	-	-	Low value	Present, sections of breeding areas >1 pair
62.	Eurasian siskin	*Spinus spinus*	LB, M	SP	LC	-	-	-	-	Low value	Present, sections of breeding areas >1 pair
63.	Yellowhammer	*Emberiza citrinella*	CB, M	SP	LC	-	-	-	SPEC2	Low value	Present, sections of breeding areas >1 pair

[1]LB – likely breeding, CB – confirmed breeding (Wilk [419]), M – migrant, visitor or recorded in the survey area

[2]Pursuant to the Regulation of the Minister of the Environment of 16 December 2016 on the protection of animal species (Journal of Laws of 2016, item 2183, as amended): SP – strictly protected species; Strict/active – strictly protected species, active protection permissible; pursuant to the Regulation of the Minister of the Environment of 11 March 2015 on the development of a list of game species (Plot of Laws of 2005, No. 45, item 433): G – game species

[3]IUCN – classification according to the International Union for the Conservation of Nature, the extinction risk of species: LC – least concern, NT – near-threatened (BirdLife 2020)

[4]Bird species listed in Annex I of the Birds Directive [89]

[5]Bird species listed in the Polish Red Data Book of Animals, concerns breeding birds: CR– species critically endangered, EN – species strongly endangered, EXP– extinct as a breeding species in Poland, LC – least-concern, NT – near-threatened, VU – vulnerable (Głowaciński [124])

[6]Polish Red List of Birds: CR – critically endangered; EN – endangered, NT – near-threatened, RE – regionally extinct, VU – vulnerable (Wilk et al. [418])

[7]The SPEC (Species of European Conservation Concern) categories of special concern assigned by the BirdLife International federation: SPEC1 – species of global conservation concern, SPEC 2 – endangered species, the European population of which exceeds 50% of the global population and their conservation status was assessed as unfavourable, SPEC 3 – endangered species, the European population of which does not exceed 50% of the global population and their conservation status was assessed as unfavourable (BirdLife 2020)

[8]Type of resources – compliant with the environmental inventory (Appendix 1. Report on inventory surveys)

Table 6.54. Construction phase impacts on the birds present in the planned project area and in its immediate vicinity – Applicant Proposed Variant (APV) [Source: internal materials]

No.	Impacts	Nature of impact	Type of impact	Impact range	Temporal scope of impact	Impact scale	Impact sensitivity	Impact significance	Comments
1.	Excavations and cable laying	Negative	Direct, reversible	Local, site-specific	Momentary, short-term	Moderate	Low	Low	After completion of work, not visible in the area
2.	Construction of the customer substation, cable chambers and a 400 kV line	Negative	Direct, permanent	Local, site-specific	Permanent, long-term	Moderate	Low	Low	-
3.	Tree felling	Negative	Direct, indirect, permanent	Local, site-specific	Permanent, long-term	Moderate	Moderate	Moderate	-
4.	Crossing with horizontal directional drilling	Neutral	Direct	Local, in points	Momentary, short-term	Irrelevant, low	Low	Low	Will not be visible in the area
5.	Technical belts, access roads, traffic of vehicles	Negative	Direct, indirect, permanent	Local, site-specific	Permanent, long-term	Moderate	Moderate	Low Moderate	Impact also in the project operation phase
6.	Noise, disturbance	Negative	Direct, indirect	Local, site-specific	Momentary, short-term	Low	Low	Low	Ceases after the construction phase
7.	Contamination	Negative	Direct, indirect	Local, site-specific	Momentary, short-term	Low	Low	Low	Ceases after the construction phase

6.1.4.6.1.10 Mammals

In the area analysed, within the technical belts designated for the project implementation, mammals are represented by species relatively common across Poland. Most of them adapt well to the changes in the environment. With the exception of small mammals connected to a particular habitat, the remaining animals inhabiting the area analysed use large areas of land and many habitats and are not assigned to any specific site.

The construction phase impacts will mainly involve the transformation of the environment which will be caused by a partial destruction of habitats, e.g. deforestation of the permanent technical belt for excavations, temporary belt, construction of new access roads, occupation of land by the customer substation and the 400 kV overhead line towers, as well as the slight fragmentation of habitats as a result of the creation of a 25 m wide treeless belt and new access roads running across the forest areas. This impact will be permanent and long-term. Mammals occupying various microhabitats that will be destroyed during the project construction will be the most vulnerable to the works connected to the construction phase. Except for the construction phase and the deforestation of the technical belt and the construction of new access roads, the project along the forest section, will not be visible in the area. After the construction phase is completed, the land will be subject to succession process, new habitats that will be used by animals will be formed which will mitigate the effects of the land transformation and fragmentation. In a long-term perspective, the project will not generate negative impacts on mammals.

Table 6.55 and Table 6.56 contain the characteristics of mammal species found in the planned project area including their conservation status. Moreover, the construction phase impacts on the mammals present in the area and its immediate vicinity were assessed.

Most of the construction phase impacts on mammals will be **of moderate or low scale, while the significance of impact will be low. The highest impact on mammals will be connected to the felling of trees and traffic of vehicles. These will be the impacts of moderate scale and significance.**

Table 6.55. Species of mammals in the area of the planned project in the Applicant Proposed Variant (APV) including their conservation status [Source: internal materials]

No.	Species		Conservation status[1]	Threat category[2]	Permanent technical belt	Temporary technical belt	Comments
	Species name	Binomial nomenclature					
1.	Grey wolf	*Canis lupus*	SP	NT	-	-	The species can potentially occur within the entire area connected to the project
2.	Eurasian otter	*Lutra lutra*	PP	LC	-	-	-
3.	Stoat	*Mustela erminea*	PP	LC	-	-	The species can potentially occur within the entire area connected to the project
4.	Northern white-breasted hedgehog	*Erinaceus roumanicus*	PP	LC	-	-	The species may occur in the areas connected to the project near the village of Osieki Lęborskie
5.	European beaver	*Castor fiber*	PP	LC	-	-	-
6.	European water vole	*Arvicola amphibius*	PP	LC	-	-	The species can potentially occur in the waterlogged parts of the area connected to the project
7.	Wood mouse	*Apodemus sylvaticus*	PP	LC	-	-	The species can potentially occur in the waterlogged or more heavily overgrown parts of the area connected to the project
8.	Red squirrel	*Sciurus vulgaris*	PP	LC	-	-	-
9.	Common shrew	*Sorex araneus*	PP	LC	-	Confirmed	The species can potentially occur in the waterlogged parts of the area connected to the project
10.	Eurasian pygmy shrew	*Sorex minutus*	PP	LC	-	-	The species can potentially occur in the waterlogged parts of the area connected to the project
11.	European mole	*Talpa europaea*	PP	LC	-	Confirmed	The species can potentially occur within the entire area connected to the project
12.	Bats	*Chiroptera*	SP	-	Confirmed	Confirmed	The species can potentially occur within the entire area connected to the project
13.	Other mammal species	-	Not under protection	LC	Confirmed	Confirmed	The species can potentially occur within the entire area connected to the project

[1]Pursuant to the Regulation of the Minister of the Environment of 16 December 2016 on the protection of animal species (Journal of Laws of 2016, item 2183, as amended): SP – species under strict protection, PP – species under partial protection

[2]Annex II of the EU Habitats Directive: LC – species of least-concern, NT – near-threatened species, SPZ – species for which protection zones are established, G – game species, NI – non-indigenous species

Table 6.56. Assessment of the construction phase impacts on mammals present in the planned project area and its immediate vicinity – Applicant Proposed Variant (APV) [Source: internal materials]

No.	Impacts	Nature of impact	Type of impact	Impact range	Temporal scope of impact	Impact scale	Impact sensitivity	Impact significance	Comments
1.	Excavations and cable laying	Negative	Direct, reversible	Local, site-specific	Momentary/short-term	Moderate	Low	Low	After the completion of work, not visible in the area
2.	Construction of the customer substation, cable chambers and a 400 kV line	Negative	Direct, permanent	Local, site-specific	Permanent/long-term	Moderate	Low	Low	Impact also in the project operation phase
3.	Tree felling	Negative	Direct, indirect, permanent	Local, site-specific	Permanent/long-term	Moderate	Moderate	Moderate	-
4.	Crossing with horizontal directional drilling	Positive	Direct	Local, in points	Momentary/short-term	Irrelevant/ low	Low	Low	Will not be visible in the area
5.	Technical belts, access roads, traffic of vehicles	Negative	Direct, indirect, permanent	Local, site-specific	Permanent/long-term	Moderate	Moderate	Low Moderate	Impact also in the project operation phase
6.	Noise, disturbance	Negative	Direct, indirect	Local, site-specific	Momentary/short-term	Low	Low	Low	Ceases after the construction phase
7.	Contamination	Negative	Direct, indirect	Local, site-specific	Momentary/short-term	Low	Low	Low	Ceases after the construction phase

6.1.4.6.2 Impact on protected areas

6.1.4.6.2.1 Impact on protected areas other than Natura 2000 sites

The **Coastal Protected Landscape Area** was established due to its distinctive landscape with a diverse ecosystem, valuable due to the possibility of fulfilling the needs of tourism and leisure industry, as well as functioning as wildlife corridor. The issue of the impact on the landscape is discussed in subsection 6.1.5.10, and on wildlife corridors in subsection 6.1.5.7.3. Within the Coastal Protected Landscape Area the following will occur:

- permanent transformation of the top layer of the lithosphere, without changes in the topography (except for a slight ground levelling in the area of cable chambers – 0.25 ha);
- in the case of shallow occurrence of the first aquifer, periodical drainage of excavations;
- permanent elimination of vegetation cover;
- impact on fauna, mainly its periodic scaring.

The impact on the Coastal Protected Landscape Area in the construction phase will be mainly connected to the felling of trees within:

- the 25 m wide and 5 km long permanent technical belt – covering no more than 15 ha (permanent deforestation);
- the temporary technical belt with a width of 20 m from the external cable lines – covering no more than 25 ha (temporary deforestation).

In total, as a result of the implementation of the BP OWF CI, a maximum area of 40 ha will be cleared with 25 ha being restored to its pre-construction condition after the completion of the construction phase.

As part of the planned project, trenchless methods are planned to be used. In these places, felling of trees will not be necessary:

- the HDD or HDD Intersect borehole through the coastal zone – with the maximum length of 1.5 km;
- the HDD or HDD Intersect borehole under the Wydma Lubiatowska dune – with a length of approx. 800 m;
- the HDD or HDD Intersect borehole through the waterlogged area – with a length of approx. 420 m.

The impacts will have a local range, and the construction works will not create a barrier within the Coastal Protected Landscape Area.

The construction phase impact on the Coastal Protected Landscape Area will be connected to construction works, the presence of construction machinery and equipment, and the construction of excavations and will cease after the construction works are completed, the cables are buried, and the reconstruction works in the temporary technical belt are finished. The Applicant is not planning to carry out levelling works along the route of underground cable lines. Only in places of cable chamber location such works are possible.

The construction phase of the planned project will have a moderate impact on the Coastal Protected Landscape Area due to the recreational function of this area. The impact during the construction phase is assessed as **negative, direct, primary, reversible, local and medium-term.**

The customer substation and the 400 kV overhead line planned as part of the project are located outside the Coastal Protected Landscape Area.

Ecological area "Torfowisko" [Peat bog] in Szklana Huta was established due to the need to protect the poor fen ecosystem, which is important for the preservation of biodiversity.

The impacts of the construction phase have been characterised in subsections 6.1.5.2 and 6.1.5.3 in relation to the quality of surface water as well as hydrological and groundwater conditions. The most important impacts will be related to the provision of access road to the cable chambers there. The traffic of vehicles and construction machinery on this road creates a potential risk of contamination with petroleum products, especially since any spills of fuels or other harmful substances will easily migrate into the groundwater and may adversely affect the unique vegetation of the ecological area. At the implementation stage of the project consisting in embedding both the cable chambers and the cables themselves in the ground within the ecological area, drainage should be abandoned, since the depression cone created may cause dewatering of peats. During the implementation of the project, the condition of mechanical equipment should be checked to prevent the release of contaminants in the form of oils, greases and fuels.

The impact of the planned project in the event of contamination of ecological area as a result of accidental spills from machines and vehicles will be **irreversible, permanent, of a high scale and important significance** [Table 6.57, Table 6.58].

Table 6.57. Assessment of the protected areas resistance to the construction phase impacts in the Applicant Proposed Variant (APV) [Source: internal materials]

No.	Impacts	Forms of environmental protection	Resistance
1.	Removal of trees and shrubs within the permanent and temporary belts	Coastal Protected Landscape Area	Moderate
		Ecological area "Torfowisko" [Peat bog] in Szklana Huta	Moderate
2.	Construction works, using heavy machinery	Coastal Protected Landscape Area	Moderate
		Ecological area "Torfowisko" [Peat bog] in Szklana Huta	Low

Table 6.58. Characteristics of the construction phase impacts on the protected areas other than Natura 2000 sites in the Applicant Proposed Variant (APV) [Source: internal materials]

No.	Impacts	Forms of environmental protection	Nature of impact	Type of impact	Impact range	Temporal scope of impact	Impact scale	Impact sensitivity	Impact significance
1.	Removal of trees and shrubs within the permanent and temporary belts	Coastal Protected Landscape Area	Negative	Direct, primary, irreversible	Local	Medium-term	Moderate	High	Moderate
		Ecological area “Torfowisko” [Peat bog] in Szklana Huta		Indirect, secondary, reversible			Low	Moderate	Low
2.	Contamination as a result of accidental spills from machinery and vehicles	Coastal Protected Landscape Area	Negative	Direct, primary, irreversible	Local	Medium-term	Moderate	High	Moderate
		Ecological area “Torfowisko” [Peat bog] in Szklana Huta				Permanent	High	High	Important

Although the ecological area "Źródliska Bezimiennej" [Bezimienna Springs] is not located in the area of the potential impact of the APV, due to its specificity and connection with the area, the impact of the project construction phase on the area was assessed. This area comprises the aggregation of the Bezimienna Stream springs with well-preserved reed rushes and fragments of moss beds. The purpose of protection is to maintain the unchanged status of the watercourse springs. Along the planned project route, in the area of the waterlogged valley, trenchless methods will be used. When constructing inlet and outlet chambers, it will be necessary to perform a point excavation which may need to be drained using pumps, wellpoints and additional drainage trenches. In order to reduce the risk of the disturbance of water conditions and to minimise the potential impact on the ecological area "Źródliska Bezimiennej" [Bezimienna Springs], it is recommended to use sheet piling at the point excavation sites. In this aspect, no impact on the ecological area "Źródliska Bezimiennej" [Bezimienna Springs] is expected.

6.1.4.6.2.2 Impact on Natura 2000 site Białogóra (PLH220003)

The identification and assessment of impacts on protected areas within the European Natura 2000 network is presented in subsection 6.3 [Table 6.59].

Table 6.59. Matrix defining the significance of the construction phase impact on Natura 2000 sites in the Applicant Proposed Variant (APV) [Source: internal materials]

Impact significance		**Receptor sensitivity**				
		Irrelevant	**Low**	**Moderate**	**High**	**Very high**
Scale (size) of impact	Irrelevant	Negligible	Negligible	Negligible	Negligible	Low
	Low	Negligible	Negligible	Low	Low	Moderate
	Moderate	Negligible	Low	Low	Moderate	Moderate
	High	Negligible	Low	Moderate	Important	Significant
	Very high	Low	Moderate	Moderate	Significant	Significant

6.1.4.6.3 Impact on wildlife corridors

The construction phase involving the felling of trees, construction of excavations and laying of cables, as well as the construction of a customer substation and a 400 kV overhead line will cause a temporary spatial discontinuity of the Coastal Wildlife Corridor of a supra-regional importance within the 25 m wide permanent belt and in the temporary belt. In the area of the Wydmy Lubiatowskie dunes and the waterlogged valley, trenchless methods are planned to be used. In these places, felling of trees will not be necessary. In total, the construction phase will affect a strip with the width not exceeding 70 m, along the section of approximately 6.5 km. The construction of the underground cable line will be performed in approximately 1 km long sections, and the construction site will be fenced. The implementation of the planned project related to the use of heavy machinery emitting noise will result in the migration of species found within the project boundaries to the neighbouring areas. Both on the routes of the movement of mammals and on the routes of bird migration, the construction works will be carried out only for a short period, along short sections, which will not significantly affect the conditions of animal migration. The construction works, including tree felling, may temporarily scare away migrating animals. Since the construction works will generally be carried out during daytime, the scaring will result in a slight and short-term limitation of the functionality of wildlife corridors. Breaking the spatial continuity within the belt up to 70 m wide is a negligible area in relation to the entire wildlife corridor, and the felling of trees carried out in appropriate phenological periods will minimise the potential impacts.

The construction works will not create a barrier effect within the supra-regional Coastal Wildlife Corridor or the East Atlantic Flyway.

The impacts of the planned project will be **negative, direct, primary, reversible, local and short-term** [Table 6.60].

Table 6.60. Matrix defining the significance of the construction phase impact on wildlife corridors in the Applicant Proposed Variant (APV) [Source: internal materials]

Impact significance		**Receptor sensitivity**				
		Irrelevant	**Low**	**Moderate**	**High**	**Very high**
Scale (size) of impact	Irrelevant	Negligible	Negligible	Negligible	Negligible	Low
	Low	Negligible	Negligible	Low	Low	Moderate
	Moderate	Negligible	Low	Low	Moderate	Moderate
	High	Negligible	Low	Moderate	Important	Significant
	Very high	Low	Moderate	Moderate	Significant	Significant

6.1.4.6.4 Impact on biodiversity

According to the definition of 'the impact on biodiversity' contained in Art. 5 point 16 of the Nature Conservation Act of 16 April 2004 (Journal of Laws of 2004, No. 92, item 880, as amended), biodiversity means the diversity of the living organisms occurring in ecosystems, within a species and between species, as well as the diversity of ecosystems. The term includes animals as well as plants and fungi.

As shown in the previous subsections, the planned project implementation will have important significance for the protected species of lichens, plants, habitats and forests. Most impacts on other species will be short-term, local and in most cases reversible. There will be no impacts which could cause a serious risk of a permanent loss of habitats and species. With the use of minimising measures the impact of the construction phase was assessed as moderate [Table 6.61].

Table 6.61. Matrix defining the significance of the construction phase impact on biodiversity in the Applicant Proposed Variant (APV) [Source: internal materials]

Impact significance		**Receptor sensitivity**				
		Irrelevant	**Low**	**Moderate**	**High**	**Very high**
Scale (size) of impact	Irrelevant	Negligible	Negligible	Negligible	Negligible	Low
	Low	Negligible	Negligible	Low	Low	Moderate
	Moderate	Negligible	Low	Low	Moderate	Moderate
	High	Negligible	Low	Moderate	Important	Significant
	Very high	Low	Moderate	Moderate	Significant	Significant

6.1.4.7 Impact on cultural amenities, monuments and archaeological objects and sites

Within the area of the technological belts designated for the purposes of the planned project, there are no monuments entered into the register of historical monuments of the Pomeranian Voivodeship, documentation sites nor archaeological objects.

The construction of the BP OWF CI will not affect the cultural values, monuments, archaeological sites nor objects [Table 6.62].

Table 6.62. Matrix defining the construction phase impact on cultural values, monuments, archaeological sites and objects in the Applicant Proposed Variant (APV) [Source: internal materials]

Impact significance		**Receptor sensitivity**				
		Irrelevant	**Low**	**Moderate**	**High**	**Very high**
Scale (size) of impact	Irrelevant	Negligible	Negligible	Negligible	Negligible	Low
	Low	Negligible	Negligible	Low	Low	Moderate
	Moderate	Negligible	Low	Low	Moderate	Moderate
	High	Negligible	Low	Moderate	Important	Significant
	Very high	Low	Moderate	Moderate	Significant	Significant

6.1.4.8 Impact on the use and development of the land area and tangible goods

The phase of underground cable lines construction will involve a temporary and local restriction of the tourism function of the forests in the area.

The route of the BP OWF CI will require tree felling:

- in the 25 m wide and 5 km long permanent technical belt (no clearings are planned in the area of trenchless crossings) which covers 56 forest units with a maximum area of 15 ha;
- in the temporary technical belt, with a width of 20 m from the external cable lines and an approx. length of 6.5 km, in connection with the tree felling related to the conduct of construction works (except for the area of the crossing of the Wydmy Lubiatowskie dunes by horizontal drilling) which covers 63 forest units with an area of approx. 25 ha.

The existing forest use will be supplemented with a new function of electricity transmission. Due to the technologies used and the laying of cable lines in the trench, they will not be visible in the field.

The area where the customer substation and the 400 kV line will be located is currently undeveloped and is used as agricultural land. After the construction of structures, it will become impossible to continue agricultural activities in that area. This fact will reduce the biologically active surface and the infiltration of rainwater into the groundwater. The vegetation cover in this area will be destroyed through the removal of the existing vegetation cover as well as indirectly through the change of the soil and water relations. The load on the access road to the substation and the line will increase, which will contribute to the negligible increase in the emission of dust (car traffic) and flue gases coming primarily from the car engines.

The impact on tangible goods in the construction phase will involve the use of the road infrastructure.

The construction phase impact on the use and development of land and on tangible goods was assessed as low [Table 6.63].

Table 6.63. Matrix defining the construction phase impact on the use and development of land and on tangible goods in the Applicant Proposed Variant (APV) [Source: internal materials]

Impact significance		**Receptor sensitivity**				
		Irrelevant	**Low**	**Moderate**	**High**	**Very high**
Scale (size) of	Irrelevant	Negligible	Negligible	Negligible	Negligible	Low

Impact significance		**Receptor sensitivity**				
		Irrelevant	**Low**	**Moderate**	**High**	**Very high**
impact	Low	Negligible	Negligible	Low	Low	Moderate
	Moderate	Negligible	Low	Low	Moderate	Moderate
	High	Negligible	Low	Moderate	Important	Significant
	Very high	Low	Moderate	Moderate	Significant	Significant

6.1.4.9 Impact on landscape, including the cultural landscape

During the construction phase of the project, the basic impact on the landscape will be the temporary appearance of the construction sites for underground cable lines, customer substation and towers for the 400 kV line. During the construction phase, tree felling and grubbing will take place, earthworks will be carried out (excavations, levelling) and vehicle traffic related to the transport of materials will occur. Storage yards for the storage of machinery and construction materials will appear. Waste from construction works and sanitary sewage will be generated.

After the completion of construction works, the areas along the excavations and on the temporary access roads to them will be restored to their previous use. Considering the fact that the works will progress in space as the cable lines are laid, the impact of the project is defined as local and short-term.

The construction phase impact on the landscape, including the cultural landscape was assessed as moderate. According to the Study of the conditions and directions of spatial development in the Choczewo commune (Resolution no. XXVIII/220/2021 of the Choczewo Commune Council of 26 January 2021), in the area of the shoreline and the access to the beach, the planned project is directly adjacent to the viewing axis. However, taking into account the direction of the axis and the nature of the planned project, it should be stated that any impact of the project on the perception of the landscape from the viewing axis can only take place during the construction phase. This impact will be short-term and local and will cease with the completion of construction works [Table 6.64].

Table 6.64. Matrix defining the construction phase impact on landscape including cultural landscape in the Applicant Proposed Variant (APV) [Source: internal materials]

Impact significance		**Receptor sensitivity**				
		Irrelevant	**Low**	**Moderate**	**High**	**Very high**
Scale (size) of impact	Irrelevant	Negligible	Negligible	Negligible	Negligible	Low
	Low	Negligible	Negligible	Low	Low	Moderate
	Moderate	Negligible	Low	Low	Moderate	Moderate
	High	Negligible	Low	Moderate	Important	Significant
	Very high	Low	Moderate	Moderate	Significant	Significant

6.1.4.10 Impact on population, health and living conditions of people

During the construction phase of the underground cable lines, customer substation and 400 kV overhead line, the potential impact on people may be related to temporary nuisance of construction works, causing the emission of air pollutants, noise and ground vibrations.

Due to the course of the planned project outside the settlement districts, mostly at considerable distances from the rural development areas, the above-mentioned nuisance will not occur. The only temporary nuisance during the construction phase may concern the people staying in the Rehabilitation and Holiday Centre for disabled people, which is located in the immediate vicinity of the planned project. In order to limit them, it has been proposed that the construction works generating the highest noise level should be carried out, if possible, only during daylight hours, excluding Sundays and holidays (except for the works that must be performed 24 $h{\cdot}d.^{-1}$, such as horizontal drilling and building a customer substation), and the work schedule will be provided to the management of the Centre. Moreover, when planning the construction works, noise generating devices, should be placed as far away from the facilities of the Centre as possible.

The nuisance related to the impact of the road transport of construction materials, equipment and people, i.e. air pollution (exhaust fumes and dust from roads), noise and ground vibrations will be limited spatially (road surroundings) and in time (the period of construction works).

Due to the moderate scope of the construction works and road transport, as well as their conduct usually during daytime, no negative impact on human health is expected.

The construction phase impact on population, health and living conditions of people was assessed as moderate [Table 6.65].

Table 6.65. Matrix defining the construction phase impact on population, health and living conditions of people in the Applicant Proposed Variant (APV) [Source: internal materials]

Impact significance		**Receptor sensitivity**				
		Irrelevant	**Low**	**Moderate**	**High**	**Very high**
Scale (size) of impact	Irrelevant	Negligible	Negligible	Negligible	Negligible	Low
	Low	Negligible	Negligible	Low	Low	Moderate
	Moderate	Negligible	Low	Low	Moderate	Moderate
	High	Negligible	Low	Moderate	Important	Significant
	Very high	Low	Moderate	Moderate	Significant	Significant

6.1.5 Operation phase

The planned project in the form of underground cable lines in the operation phase is a virtually maintenance-free undertaking due to the service works taking place once a year. The operation phase will entail the highest impact in relation to the customer substation and the 400 kV overhead line.

6.1.5.1 Impact on geological structure, coastal zone, soils, and access to raw materials and deposits

6.1.5.1.1 Impact on geological structure

With regard to the underground cable lines, the main impact in the operation phase will be the permanent occupation of land over an area of up to 15 ha for a permanent technical belt, which will involve permanent deforestation. This necessity is due to the risk of cables being damaged by the root systems and their possible failure. In this context, the access to cable chambers as well as joint stations shall be ensured. The width of the permanent technical belt will be about 25 m, reaching 80 m in the area of the cable chambers.

The permanent occupation of the land will also be related to the operation of 4 cable chambers. The chambers will be located within a permanently deforested permanent technical belt. Each cable chamber will be equipped with an inspection hatch used also for the maintenance purposes. Cable chambers will be designed to prevent the water from collecting and to provide safe access to the devices located inside.

During operation, maintenance works will be conducted on the cable line using the existing access roads. The maintenance works will be conducted once a year. It is planned to build about 5 km of new access roads of a dirt track type along the axis of the cable tracks. They will be used as service access roads during the operation phase of the planned project. The existing dirt tracks and asphalt roads will also be used.

It is also planned to occupy the area within the customer substation for structures permanently fixed to the ground and in the area of the 400 kV overhead line towers. Within the customer substation area, infrastructural and technological facilities which do not generate emissions into the ground will be present. The construction of a station area drainage system is planned which will be performed with adaptation to local and geotechnical conditions. As part of the dewatering of the area, perimeter drains will be constructed around the designed cubature facilities, under the ducts and cable chambers. The system will be equipped with pre-treatment devices, thus, no impact on the surface formations is expected. In the area of the operating station, a rainwater drainage system will be constructed to drain the rainwater from the drainage of autotransformer stands, road surfaces and other hardened surfaces. The drainage of rainwater from the autotransformer stands will be completed with a coalescing separator and a well with an automatic closure. These devices will be used to clean the small amounts of oil contamination in the drained rainwater and will prevent the outflow of petroleum substances beyond the autotransformer oil pan and the separator.

During the operation phase of the 400 kV overhead line, no impact on geological structure will occur. Only in the event of the necessity to perform maintenance works and works necessary to remove a breakdown, may the surface formations be contaminated with petroleum substances from damaged vehicles and machines. In such a case, small amounts of pollutants can get into the environment. These impacts were assessed as negligible. Threats of this type will be counteracted by the use of modern, efficient equipment as well as proper organisation and supervision of works.

In connection with the cable operation, heat will be emitted to the ground. To ensure the best conditions for cable heat dissipation into the environment, the cable line along its entire length will be laid surrounded by bentonite.

The thermal parameters of the soil, including its thermal resistivity, depend largely on the humidity, density and the type of fraction. Normal soil humidity, as well as its temperature, change periodically throughout the year. The cyclical changes in soil resistivity are mainly caused by the changeability of atmospheric conditions, in particular the amount of precipitation, exposure to direct sunlight, and the strength and direction of the wind. Under domestic conditions, typical value of the thermal resistivity of a very wet sand is 0.5 m × K/W, while for a very dry sand or till, the values are 1.2–1.5 m × K/W and for an extremely dry sand, it is 2.5 m × K/W.

Figures Figure 6.3, Figure 6.4, Figure 6.5 and Figure 6.6 show the simulation results for the temperature field distribution in the ground for the system of 4-circuit cable line and example results of the numerical analyses of the results obtained for the purpose of determining the boundary isotherms of the temperature field distribution around the cable system considered.

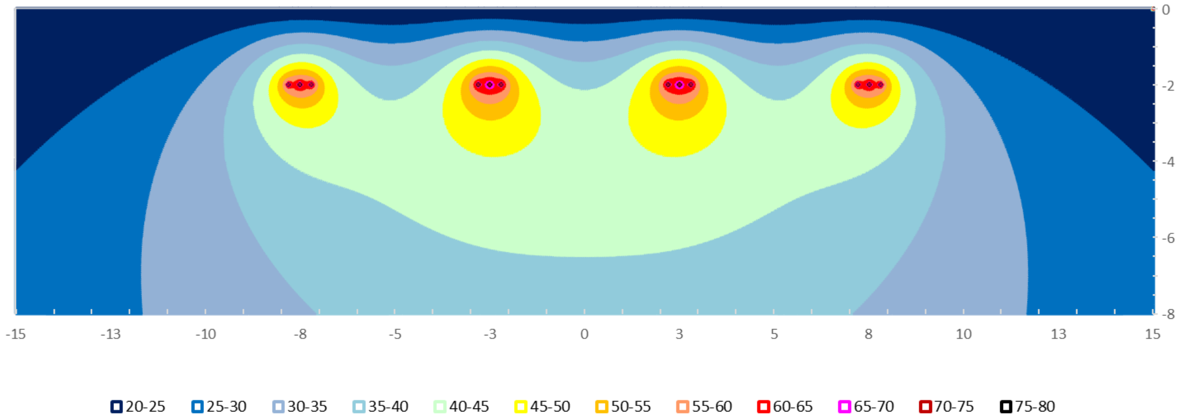


Figure 6.3. Results of the simulation of the temperature field distribution for 220 kV (1000 A) cable lines [Source: internal materials]

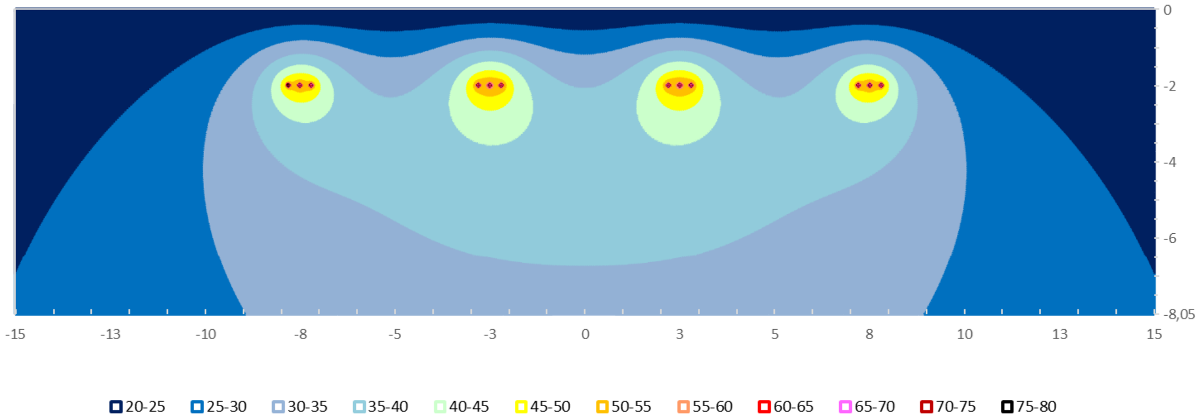


Figure 6.4. Numerical analysis of the thermal calculations for 275 kV (800 A) cable lines [Source: internal materials]

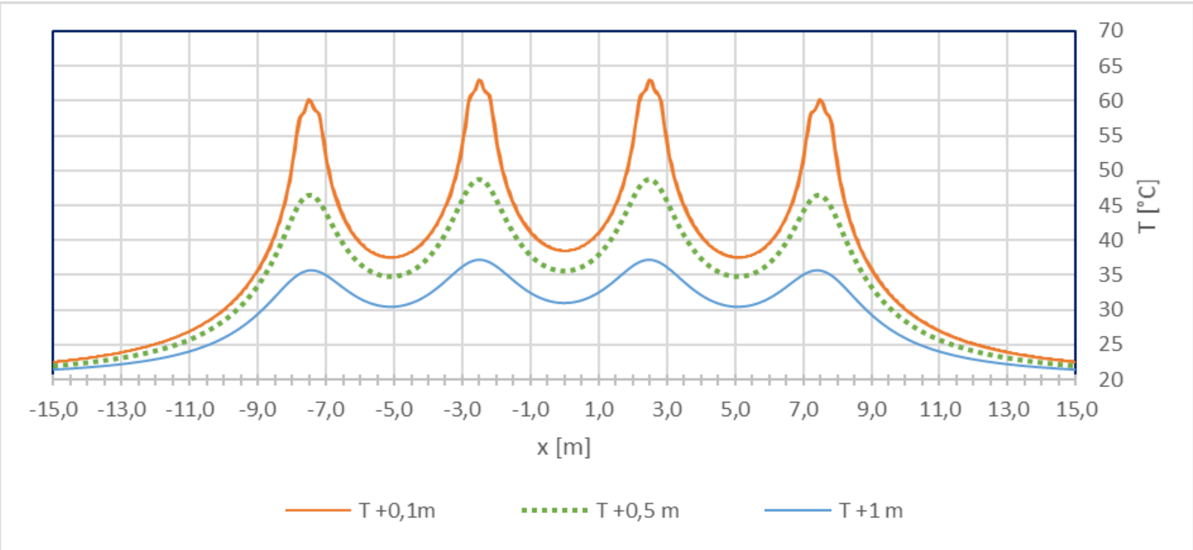


Figure 6.5. Earth temperature distribution for selected distances above the 220 kV (1000 A) cable system [Source: internal materials]

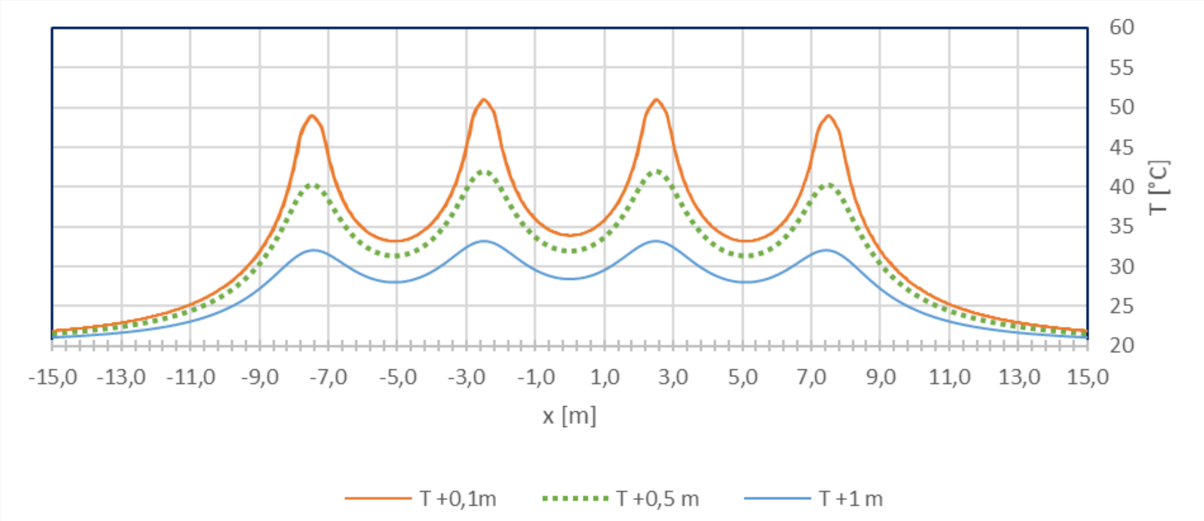


Figure 6.6. Earth temperature distribution for selected distances above the 275 kV (800 A) cable system [Source: internal materials]

According to the results of the analysis, it was assessed that a significant thermal impact will occur only to a limited extent. The boundary isotherms at a level of 50°C close in the area directly adjacent to the casing pipes of cable lines or at a distance of about 1 m from them [Table 6.66].

Table 6.66. Summary of the calculation results of the estimated temperature values inside cable lines and the expected values on the surface of casing pipes [Source: internal materials]

Technical assumptions behind the construction of cable lines	Representative cross-section of the phase wire [mm^2]	Estimated temperature value of the phase wire [°C]	Estimated temperature value of the casing pipe surface [°C]
220 kV, 1000 A, filled pipes	1000	~82	~62
275 kV, 800 A, filled pipes	800	~69	~51

The computational results of the analyses conducted allow for the conclusion that at a distance of more than 5 m from the extreme cable lines, the thermal impact will be at the level of several degrees above the assumed ground temperature. In the case of using cables with a wider cross-section, while maintaining other parameters constant (current intensity, voltage, pipe filling), the generated temperatures will be lower than those specified for phase wires with a cross-section of 1000 and 800 mm^2.

According to the results presented above of the analysis of the heat emission by the planned power cables, the impact on the surface formations resulting from the emission of heat to the ground was assessed as low.

The impact related to the permanent deforestation of the permanent technical belt was assessed to be low, with the exception of alluvial muds and humus sands, where, due to the fact that the vast majority of these formations are to be crossed by directional drilling, the impact was assessed as negligible. Most of the aeolian sands will be crossed by directional drilling, but due to the complexes of these formations planned to be crossed with a trench, the impact was assessed as low.

The impact related to the permanent land occupation for cable chambers concerns aeolian sands. The impact related to the permanent occupation of land as a result of the construction of a customer substation and a 400 kV line concerns tills. Since they show high resistance to this impact, it was assessed to be low [Table 6.67].

Table 6.67. Assessment of the planned project impact in the Applicant Proposed Variant (APV), during the operation phase, on geological structure [Source: internal materials]

Potential impact type (factor)	Impact description	Types of surface formations	Assessment of the impact on geological structure
Land occupation for a customer substation, 400 kV overhead line and cable chambers	Permanent land occupation within the customer substation for structures permanently fixed to the ground and in the area of the 400 kV overhead line towers as well as in the area of cable chambers	Aeolian sands	Low, local
		Alluvial sands	Negligible, local
		Glacial tills and eluvial deposits	Low, local
		Alluvial mud and humus sands	Negligible, local
Deforestation	In the 25 m wide and 5 km long permanent technical belt (no clearings are planned in the area of trenchless crossings) which covers a maximum area of 15 ha	Aeolian sands	Important, local
		Alluvial sands	Low, local
		Glacial tills and eluvial deposits	Low, local
		Alluvial mud and humus sands	Negligible, local
Thermal	Electricity transmission via high-voltage cable lines is naturally associated with the presence of thermal impact in their immediate vicinity. The thermal effect of typical power cable lines occurs as a result of power losses in the phase wire and dielectric losses in the main insulation	All	Low, local

6.1.5.1.2 Impact on the topography and dynamics of the coastal zone

During the operation phase, there will be no impact of the planned project in the APV on the topography and dynamics of the coastal zone. No significant aeolian activity was recorded within the Wydmy Lubiatowskie dunes. After clearing the forest along the cable route, care should be taken of the appropriate condition of the vegetation on the surface of the dunes. In the case it was neglected, aeolian processes may be initiated, and consequently, a burial or exposure of the elements of the planned project could take place. **This variant will not significantly change the character and landscape of the Wydmy Lubiatowskie dunes.**

6.1.5.1.3 Impact on soils

As a result of the planned project operation and its impact on soils, a permanent occupation of land for the following purposes will occur:

- deforested strip of land (permanent technical belt) with a maximum area of 15 ha;
- customer substation;
- cable chambers;
- 400 kV line tower sites;
- access roads.

The operation of the planned project will not be a source of significant negative impacts on soil. Due to untroubled operation, no impact on the soil-water relations in the neighbouring areas is expected. The natural, local drainage regime will be maintained. Within the customer substation area, infrastructural and technological facilities which do not generate emissions into the ground will be present. The construction of a station area drainage system described in subsection 6.1.5.1.1 is planned. The system will be equipped with pre-treatment devices, thus, no impact on soil is expected.

As a result of the construction of access roads, a customer substation, towers for the 400 kV overhead line and the maintenance of a permanently deforested strip of land, the nature of soils within this area will be changed and their productivity reduced.

The area of the permanently deforested strip of land will have 15 ha at maximum. The area occupied by the facilities permanently fixed to the ground within the boundaries of the customer substation will cover up to 1 ha. Moreover, the permanently occupied area will include point objects in the form of cable joints and cable chambers.

The main impact of the planned project on the soil will be the emission of heat into the ground, thus indirectly affecting the soils. As a result of the heating of the cables buried in the ground, a slight change in the thermal conditions of the soil may occur. The thermal properties of the soil are among the main habitat factors. According to the analysis conducted, at a distance of more than 5 m from the most extreme cable lines, the thermal impact will be at a level of several degrees above the assumed ground temperature, which may result in the overdrying of the soil in this area.

Table 6.68 presents the assessment of the impact on soil in the operation phase.

Table 6.68. Assessment of the planned project impact in the Applicant Proposed Variant (APV), during the operation phase, on soils [Source: internal materials]

Potential impact type (factor)	Impact description	Assessment of the impact on soils
Thermal	Electricity transmission via high-voltage cable lines is naturally associated with the presence of thermal impact in their immediate vicinity. The thermal effect of typical power cable lines occurs as a result of power losses in the phase wire and dielectric losses in the main insulation	Moderate, local
Land occupation for a customer substation, 400 kV overhead line and cable chambers	The permanent land occupation for technical belt covering 15 ha as well as a maximum of 1 ha within the area of substation occupied by the facilities permanently fixed to the ground	Low, local
Deforestation	Within the 25 m wide and 5 km long permanent technical belt (no clearings are planned in the area of trenchless crossings) which covers a maximum area of 15 ha	Moderate, local

According to the results of the analysis of the heat emission by the planned power cable, **the impact on soil resulting from the emission of heat to the ground was assessed as moderate and local. The soil resistance to this impact was assessed as medium. The emitted heat is not expected to change habitats nor species.**

The impact related to the permanent land occupation for cable chambers concerns arenosols. The impact related to the permanent occupation of land as a result of the construction of a customer

substation and a 400 kV overhead line concerns brown soils. Since they show high resistance to this impact, it was assessed to be low.

The impact related to the permanent deforestation of the technical belt will not occur on hydrogenic soils, on which, due to the planned crossing using the directional drilling method, no trees and shrubs are planned to be cut. The significance of impact on the remaining types of soil was assessed to be moderate.

6.1.5.1.4 Impact on the access to raw materials and deposits

Since the planned project is situated at a distance of more than 4 km from the nearest deposit, **no operation phase impacts are expected on deposits**.

No operation phase impacts of the planned project on the possibility to execute the Żarnowiec concession No. 5/2019/Ł for the prospection, exploration and production of hydrocarbons of 13 June 2019, owned by ShaleTech Energy Sp. z o.o., is expected.

6.1.5.2 Impact on the quality of surface waters

The impact of the planned project in the form of cable chambers, underground cable lines and 400 kV line on the quality of surface waters during the operation phase will be connected to a potential contamination as a result of accidental spills from machinery and vehicles related to maintenance works. It is assumed that the maintenance and servicing of installations and devices will be carried out with the use of the equipment in good working order and with the use of appropriate safeguards, in accordance with the law and internal instructions of the Applicant. Along the underground cable lines, over a distance of approx. 5 km, hardened access roads will be used which will provide access to cable chambers and cable joints.

In the assessment of impact on the quality of surface waters, particular attention was paid to two ponds within the boundaries of the ecological area “Torfowisko” [Peat bog] in Szklana Huta. The use of the road leading through the ecological area as an access road to the cable chambers for the purposes of maintenance works gives rise to a potential risk of contamination of waters within this area caused by the possibility of penetration by petroleum products from construction vehicles and machinery. The ecological area is a poor fen, which is a sensitive ecosystem important for the preservation of biological diversity. In this context, **the scale of impact on ponds was assessed as high, and the significance of impact as important.** However, it should be remembered that the contaminations of soil and water are unlikely and concern only the short-term maintenance works.

The operation of the customer substation may be associated with an accidental spill of electrical insulating oils, electrolytes, foam-extinguishing agents, and fuel for the power generator into the ground and its possible ingress into surface waters. In order to prevent potential failures, there are plans to apply leakproof bunds for transformers and reactors, connected to a rainwater pre-treatment system (oil separation) and an additional closure allowing the outflow to be shut off immediately to protect the sewerage system in the event of an oil spill or fire emergency. For batteries it is planned to use trays or pans to contain the electrolyte in the event of their unsealing. Moreover, the station will be equipped with a portable kit of sorbents and agents designed to handle the hazardous substances spilled and leaking – appropriate to the size of the facility and the number of devices containing such substances.

At the customer substation, only temporary stays of the operating service crews are assumed, during which a negligible consumption of water for everyday needs is assumed. The water will be supplied from the nearest water supply system or a local water intake within the station area. Sewage shall be disposed to an external sewage system or to a leakproof sewage tank.

Operation of the customer substation under normal operating conditions (failure-free operation) will not affect the quality of surface waters. Also, the operation of the 400 kV line will not affect the quality of surface waters.

The impacts connected to the contamination as a result of accidental leaks from machinery and vehicles was assessed as low and local. Only the scale of impacts on ponds in the vicinity of the ecological area "Torfowisko" [Peat bog] in Szklana Huta was assessed as high, and the significance of impact as important.

The impacts related to the accidental leaks at the customer substation were considered to have low significance and local scope [Table 6.69].

Table 6.69. Assessment of the planned project impact in the Applicant Proposed Variant (APV), during the operation phase, on the quality of surface waters [Source: internal materials]

Potential impact type (factor)	**Impact description**	**Assessment of the impact on the quality of surface waters**
Contamination as a result of accidental leaks from machinery and vehicles	In connection with the service works which will take place once a year and the use of vehicles and machines, the contamination of surface waters as a result of accidental leaks is possible	Low, local The scale of impact on small ponds – high, the significance – important
Accidental leaks at the customer substation	Accidental leaks of electrical insulating oils, electrolytes, foam extinguishing agents, power generator fuel	Low, local

The planned project will be implemented within the boundaries of the following SWBs: the immediate catchment area of the sea CWDW1801 along a 5.45 km long section and RW20001747692 along a 1.65 km. The detailed characteristics of SWBs including the assessment of their status is presented in subsection 3.14.

Due to the scale and nature of the planned project, its operation is not expected to affect the environmental objectives listed in the Water Framework Directive and the Vistula River Basin Water Management Plan if the preventive and minimising measures described in this report are applied by the Applicant.

6.1.5.3 Impact on hydrogeological conditions and groundwater

The potential impact on groundwater, particularly on unconfined groundwater and the first aquifer, may be related to the contamination of the useful aquifer due to an influx of pollutants (hydrocarbons, suspended solids) from equipment and machinery used for maintenance or installation of connection infrastructure components as well as from rainwater and snowmelt infiltrating both along the underground cable lines and from the surface area allocated for the customer substation. This impact will be reduced as a result of the planned provision of a drainage system at the substation. Moreover, the operation of the customer substation may be associated with an accidental leak of electrical insulating oils, electrolytes, foam extinguishing agents, and fuel for the power generator into the ground.

A particularly significant impact of the operation phase on groundwater is associated with the passage of vehicles along the road leading through the ecological area "Torfowisko" [Peat bog] in Szklana Huta. The use of that road creates a potential risk of groundwater contamination due to a possible leakage of petroleum substances from vehicles and construction equipment. Before service works, the functionality of mechanical equipment should be checked, since any spillage of fuels or other harmful substances will easily migrate into the groundwater and may adversely affect, in particular, the unique vegetation of ecological area. **The scale of impact on groundwater in this area was assessed as high, and the impact significance as important.**

It is assumed that the maintenance and servicing of installations and devices will be carried out with the use of equipment in good working order and with appropriate safeguards, compliant with the law and internal instructions of the Applicant. This will minimise the risk of contamination of the useful aquifer.

Located at the depth of approximately 2 m, the project in question will not cause any changes in the soil and water environment. No groundwater extraction activities will be carried out, which could lower the groundwater table, in particular the **useful aquifer level**.

The planned project will operate within the boundaries of GWB 13 along a distance of approximately 5.45 km and GWB 11 along a distance of approximately 1.65 km. The detailed characteristics of GWBs including the assessment of their status is presented in subsection 3.14.

Due to the scale and nature of the planned project, there will be no impact on GWBs in the operation phase. Also, the achievement of environmental objectives was not found to be threatened [Table 6.70].

Table 6.70. Assessment of the planned project impact on groundwater in the Applicant Proposed Variant (APV), during the operation phase [Source: internal materials]

Potential impact type (factor)	Impact description	Assessment of the impact on groundwater
Contamination of the useful aquifer	Inflow of contaminants from equipment and machines used for the maintenance of the connection infrastructure elements and the 400 kV overhead line as well as from rainwater and snowmelt infiltrating both along the underground cable lines and from the surface area allocated for the customer substation	Low, local The scale of impact on small ponds – high, the significance – important
Accidental leaks at the customer substation	Accidental leaks of electrical insulating oils, electrolytes, foam extinguishing agents, power generator fuel	Low, local

6.1.5.4 Impact on climate, including greenhouse gas emissions and impacts relevant for adaptation to climate change, impact on atmospheric air (air quality)

The operation of the planned project in the form of cable chambers and underground cable lines will not be a significant source of air emissions. During the operation phase, emissions will be associated with service and maintenance works, and their levels will be negligible.

The impact on climate in the operation phase may be related to the permanent deforestation of the area in the permanent technical belt of up to 15 ha. Deforestation is associated with the loss of habitats supporting natural CO_2 sequestration. The links between biodiversity and climate change are reciprocal – changing climate conditions are already affecting biodiversity and ecosystem functioning. In the future, climate change is expected to become the key driver of biodiversity loss alongside land use change. Climate change affects biodiversity because species evolve within a specific range of environmental conditions, such as temperature, humidity, etc. As these factors change together with climate change, species must migrate to stay in their optimal environment. Some species are adaptable but for others environmental changes pose a serious threat, leading to species extinction and reduced biodiversity [313].

The intensity of CO_2 uptake by forests depends, among other things, on the species and age of the trees, the type of soil and undergrowth as well as climatic conditions. Due to the complexity of the process, no universal model or CO_2 capture rates have been developed so far, and the available literature data on the subject are divergent [112]. Preliminary results show that 1 hectare of pine forest can annually absorb up to 30 Mg of CO_2 [9] [56]. This indicator refers to forest stands over 50 years old and may be burdened with inaccuracies related, among others, to CO_2 storage in the vegetation cover below the measuring system installed [317].

Within the range of the newly created forest clearing in the permanent technical belt the following phenomena will occur: increase in insolation, increase in air temperature, decrease in air humidity and increase of ventilation, particularly in the case of wind directions consistent with the alignment of the clearing. Due to the presence of a dense forest area in the surroundings, these changes will affect a small fragment of the forest. In this aspect, the impacts will be insignificant.

With regard to the customer substation, in the event of failure the following emissions may occur:

- SF6 insulation gases or refrigerant from the air-conditioning system;
- exhaust gases from power generators.

Prevention of SF6 emissions to the atmosphere from gas-insulated equipment and instruments will be achieved, among others, by automatic control of gas density indirectly through pressure measurement, the result of which takes into account the effect of temperature given ongoing correction. If the sensors detect a drop in the gas density below a permissible level, the control system of the switchgear is locked. The planned project will also involve regular periodic checks of the enclosure leak-tightness, along with gas leak tests using SF6 sensors, in case of a suspected leak. Mechanical ventilation will be used in rooms where gas-insulated equipment is installed to ensure operator safety. Such ventilation should protect personnel from the effects of an emergency gas leak. Each gas compartment must be provided with a two-stage alarm system in case of SF6 gas leakage. The gas-insulated switchgear (GIS) is a sealed unit with an earthing system and connections for the return current distribution ensuring low impact of EMF and possible interferences.

The planned 400 kV overhead line will not affect the climate. There will be negligible anemometric changes in the range of pole structures as well as negligible temperature and humidity changes in the range of pole foundations with transformed active surface.

In reference to the above provisions, no operation phase impacts of the planned project on climate are expected; there will also be no greenhouse gas emissions nor impacts relevant to the climate change adaptation.

6.1.5.5 Impact on ambient noise

Noise impact of the BP OWF CI in the operation phase will be associated with the functioning of the customer substation and the 400 kV overhead line connecting the customer substation with the PSE substation.

6.1.5.5.1 Noise levels permissible in the environment

According to the Regulation of the Minister of the Environment of 14 June 2007 on permissible noise levels in the environment (Journal of Laws of 2007, No. 120, item 826, as amended) in the areas of single-family and multi-family residential developments as well as farmstead and collective housing developments, the following acoustic climate standards apply with regard to the noise emitted by power lines:

- permissible A-weighted equivalent sound level – daytime, reference time interval equal to 16 hours: 50 dB(A);
- permissible A-weighted equivalent sound level – night-time, reference time interval equal to 8 hours: 45 dB(A).

When assessing the potential environmental nuisance of the transmission systems to be constructed, it is important to identify development areas with buildings related to permanent or temporary stay of children and adolescents [Table 6.71, No. 1] as well as residential development areas [Table 6.71, No. 2].

It should also be noted that the above-mentioned regulation determines the following indicators characterising the noise level generated by an overhead power line:

- L_{DEN} (long-term average sound level determined over all days of the year, including the daytime (6–18), evening (18–22) and night-time (22–6);
- LN (long-term average sound level determined over all night-time hours of the year).

These indicators, th method of determination of which is specified in the Regulation of the Minister of the Environment of 14 June 2007 on permissible noise levels in the environment (Journal of Laws 2014, item 112), are applicable for conducting a long-term policy on noise protection, while the permissible values of these indicators for overhead power lines as noise sources are listed in Table 6.71.

Table 6.71. Permissible levels of environmental noise generated by power lines, expressed in terms of L_{DEN} and L_N indicators, which are applicable to the long-term noise protection policy – appendix (Table 4) to the Regulation of the Minister of the Environment [Source: Regulation of the Minister of the Environment of 14 June 2007 on permissible noise levels in the environment (Journal of Laws of 2014, item 112)]

No.	**Type of area**	**Permissible long-term average A-weighted sound level [dB]**	
		L_{DEN} reference time interval equal to all days of the year	**L_N reference time interval equal to all night-time hours**
1	Health resort protection zone “A” Hospital and nursing home areas Development areas with buildings related to permanent or temporary stay of children and adolescents	45	40

No.	Type of area	Permissible long-term average A-weighted sound level [dB]	
		L_{DEN} reference time interval equal to all days of the year	L_N reference time interval equal to all night-time hours
2	Areas of single-family and multi-family residential developments as well as farmstead and collective housing developments Recreational and leisure areas Residential and commercial areas Inner city zones of cities with more than 100 000 inhabitants[1)]	50	45

1) The inner city zone in cities with more than 100 000 inhabitants is an area of compact residential development with a concentration of administrative, commercial and service facilities. In the case of cities with districts of more than 100 000 inhabitants, inner city zones may be delimited within such districts if they are characterised by compact residential development with a concentration of administrative, commercial and service facilities

Numerous results of the noise measurements conducted near substations, including 400 kV overhead systems, indicate that the level of the noise emitted from the substations is constant, whereas the noise of a definitely lower intensity, originating from busbar systems and incoming line sections, depends largely on the atmospheric conditions.

As already mentioned, permissible levels of noise emitted to the environment are defined for protected areas such as residential areas, leisure and recreation areas, hospitals, etc., whereas there are no permissible noise levels set for forest, industrial and agricultural areas. Permissible noise levels are, therefore, defined for a given area depending on the function of such area, as defined in the local spatial development plan or, if there is no local plan, on the actual manner of development of the area.

Partially, the area of the customer substation under analysis is included in the provisions of the local spatial development plan "Wiatraki w Lublewie" [Windmills in Lublewo] Choczewo commune (Resolution no. XIV/144/2008 of the Choczewo Commune Council of 19 March 2008, Journal of the Pomeranian Voivodeship no. 58 of 24 June 2008, item 1658). According to the plan, there are agricultural areas and areas for the location of electrical power equipment there for which there are no requirements with regard to the permissible noise level [Figure 6.7].

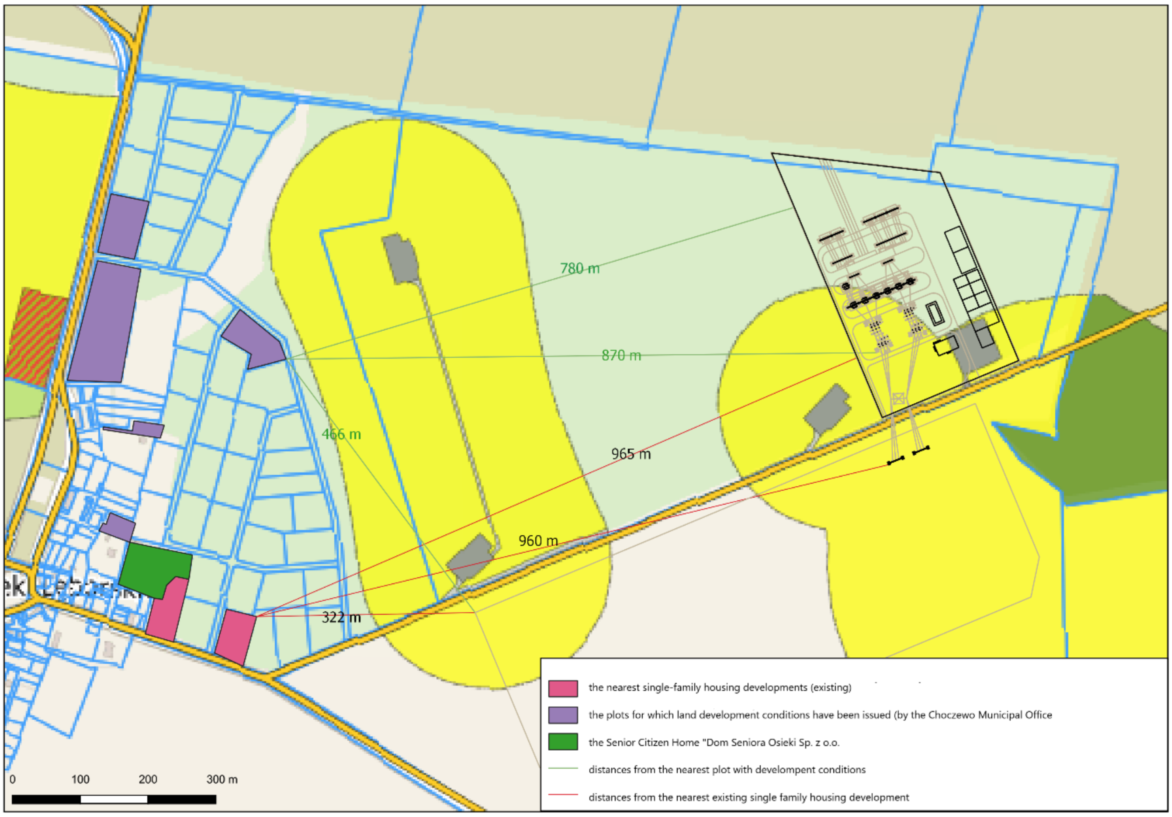


Figure 6.7. Location of the existing and planned residential development on the basemap of the LSDP "Wiatraki w Lublewie" [Windmills in Lublewo] Choczewo commune (Resolution no. XIV/144/2008 of the Choczewo Commune Council of 19 March 2008, Journal of the Pomeranian Voivodeship no. 58 of 24 June 2008, item 1658). [Source: internal materials]

It should be noted that for the majority of the areas surrounding the planned substation, including the areas of existing and planned residential developments, no local spatial development plan has been adopted specifying the use of land in the vicinity of the substation, and thus, indicating areas protected from noise. The nearest areas surrounding the station are:

- from the south and west – agricultural areas;
- from the east – agricultural and forest areas;
- from the north – forest areas;
- from the west, at a considerable distance from the planned substation (approximately 780 m away at the nearest) there are existing and planned single-family residential development areas of Osieki Lęborskie village (these areas are not covered by the LSDP).

Therefore, from the formal point of view, defined permissible noise levels are in force in the areas of existing and planned single-family residential developments, while in the remaining areas noise is not regulated.

In accordance with the Regulation of the Minister of the Environment of 1 October 2012 amending the regulation on permissible noise levels in the environment (Journal of Laws of 2012, item 1109) the following normative (permissible) noise levels are adopted for single-family residential development areas:

- 50 dB – during daytime (6:00–22:00);
- 40 dB – during night-time (22:00–6:00).

6.1.5.5.2 The forecast impact of the planned project on the acoustic climate of the environment

The source of noise generated by overhead power lines is the corona discharge from live conductors (mainly phase conductors) as well as surface discharges on the elements of the electrical insulation system (insulators and fittings). These phenomena do not pose a risk to human health and can only be observed at nighttime as a "glowing arc” on line conductors. The corona discharge is an electrical discharge into space (air) that occurs when the maximum value of the electric field strength on the surface of a conductor (or other conductive element of the line) exceeds a critical value. In a properly designed line, during good atmospheric conditions (i.e. when conductors and other live parts are dry), the phenomenon of corona discharge should not occur, because the maximum field strength on the surface of a conductor is usually between 15 and 17 $kV \cdot cm^{-1}$, while the critical intensity above which the corona discharge occurs is approximately 19–20 $kV \cdot cm^{-1}$. During adverse atmospheric conditions (high humidity, light precipitation, rime ice), the critical intensity falls even to 10–12 $kV \cdot cm^{-1}$, which results in an intense corona discharge. It may also occur on line conductors during good atmospheric conditions but only in the case of considerable irregularities occurring on the surface of phase conductors (the sharp edge phenomenon) or line fittings, caused by e.g. dirt, scratching or delamination of the conductor.

As mentioned earlier, weather conditions have a major impact on the occurrence of the corona discharge. Studies conducted to date indicate a strong correlation between the level of noise emitted by power lines and air humidity, although a quantitative approach to this problem has not been satisfactorily described yet. It is known, however, that a significant increase in the level of emitted noise is observed when the value called the dew point exceeds the so-called critical level, i.e. the conditions in which the water accumulated in the air begins to condense and form droplets, particularly on the line conductors.

Along the entire length of the overhead lines to be constructed, it is planned to use steel-aluminium phase conductors type 468/24-A1F/UHST-261 (equivalent to conductors marked AFL-8350 mm^2) in the 400 kV lines in the form of a three-core bundle for each phase. The use of three-core bundles in both sections of the transmission line results in a considerable decrease in the noise level generated by the overhead line compared to the noise generated by single wires or dual-core bundles [Table 6.72]. This method is commonly used by designers of EHV lines both at home and abroad.

Table 6.72. Averaged results of noise measurements in the vicinity of 400 kV lines operated in Poland in good and bad weather conditions [Source: internal materials]

Feature measured	Good weather			Bad weather					
	Distance from the line axis			All weather			Constant rain		
				Distance from the line axis					
	15 m	30 m	60 m	15 m	30 m	60 m	15 m	30 m	60 m
2 x 525 mm² core bundle, double-circuit power line (Z52 towers)									
Stand. dev.	4.0	3.7	3.6	4.1	4.1	4.2	2.0	1.8	1.7
$L_{Aeq, min}$	31.7	29.8	27.7	44.3	42.8	39.5	49.5	48.5	46.5
$L_{Aeq, max}$	44.1	42.6	38.9	55.8	53.9	50.8	55.8	53.9	50.8
$L_{Aeq, average}$	**38.8**	**36.0**	**33.2**	**51.1**	**49.2**	**46.7**	**52.9**	**51.1**	**48.6**
2 x 525 mm² core bundle, single-circuit power line (Y25 towers)									
Stand. dev.	3.4	3.1	2.8	3.8	3.9	3.8	1.9	2.3	2.7

Feature measured	Good weather			Bad weather					
	Distance from the line axis			All weather			Constant rain		
				Distance from the line axis					
	15 m	30 m	60 m	15 m	30 m	60 m	15 m	30 m	60 m
$L_{Aeq, min}$	32.1	29.8	27.7	42.7	39.8	37.2	47.7	43.6	39.5
$L_{Aeq, max}$	41.4	38.0	34.8	53.1	51.1	48.4	53.1	51.1	48.4
$L_{Aeq, average}$	**37.2**	**34.2**	**31.7**	**49.4**	**46.5**	**43.7**	**51.4**	**48.6**	**45.7**
3 x 350 mm² core bundle, double-circuit power line (Z33 towers)									
Stand. dev.	3.0	2.1	2.3	3.1	2.9	2.8	1.2	1.4	1.2
$L_{Aeq, min}$	28.4	27.4	25.5	36.4	35.0	32.2	42.8	39.9	37.3
$L_{Aeq, max}$	38.8	36.1	32.2	47.2	44.5	41.2	47.2	44.5	41.2
$L_{Aeq, average}$	**32.0**	**31.1**	**27.3**	**43.6**	**41.4**	**38.9**	**45.3**	**42.4**	**39.7**

As indicated by the above data, averaged from numerous measurements of noise levels recorded at a distance of 30 m from a 400 kV line made with the use of bundled conductors, even under the worst weather conditions, the noise usually does not exceed the value of 39.0–44.5 dB(A), depending on the type of bundle and geometrical configuration of the conductors.

It is characteristic that the noise level decreases as the distance from the line increases, which is confirmed by the results of noise measurements carried out on various domestic 400 kV overhead lines, in good and bad weather conditions [Table 6.72]. An analysis of the data in this table clearly demonstrates that in the vicinity of domestic 400 kV double-circuit overhead lines, in which three-core bundles of phase conductors are used, the noise level during bad weather exceeds the permissible value of 45 dB(A) only up to a distance of 15–30 m from the line axis.

It should be emphasised, however, that the literature data are characterised by a large discrepancy in the measurement results, caused not only by the weather conditions during the measurements, but also by the different impact of the ambient noise. This indicates considerable difficulties in modelling the noise level distribution at the stage of designing an overhead power line, with additional difficulty being caused by the fact that noise emission from power lines is quite strongly related to the local terrain conditions (topography).

6.1.5.5.3 Results of the noise level calculations for 400 kV line

The calculations of predicted sound level distribution in the vicinity of the planned overhead connection of the customer substation with the substation being an element of the NPS (PSE S.A. substation) were made for the characteristic (representative) cross-section of the system of two parallel single-circuit 400 kV lines, i.e. in the place where the distance from the ground to the line conductors is the smallest and is equal to $h = h_{min} = 12.0$ m. This means that the calculations of the sound level distribution in the surroundings of the operating system of two single-circuit 400 kV lines, the axes of which are 30.0 m apart, were carried out in the same computational cross-section as the electric and magnetic field intensity distributions, as well as under the same line operating conditions (maximum sag of the conductors, optimal phase arrangement given the electric field distribution).

The calculations were carried out at 1.5, 4 and 5 m above the ground level, assuming the simultaneous operation of both 400 kV lines equipped with 468/24-A1F/UHST-261 bundled conductors, in line with the project assumptions. The results of these calculations are presented in

Table 6.73 as well as in a graphic form (isolines) in figures: Figure 6.8–Figure 6.10. The results are presented in the form of sound level distribution graphs in the aforementioned cross-section, up to a distance of ±100 m from the axis of the overhead line.

The distributions determined are for good and bad weather conditions (L_{Aeq}), long-term levels (L_T) as well as day-evening-night levels (L_{DEN}).

Table 6.73. Calculation results for the forecast corona discharge noise distribution at heights of 1.5; 4.0 and 5.0 MAGL accompanying the operation of a set of two single-circuit lines running parallelly with 400 kV rated voltage erected using a three-core bundle made of 468/24-A1F/UHST-261 type cables [Source: internal materials]

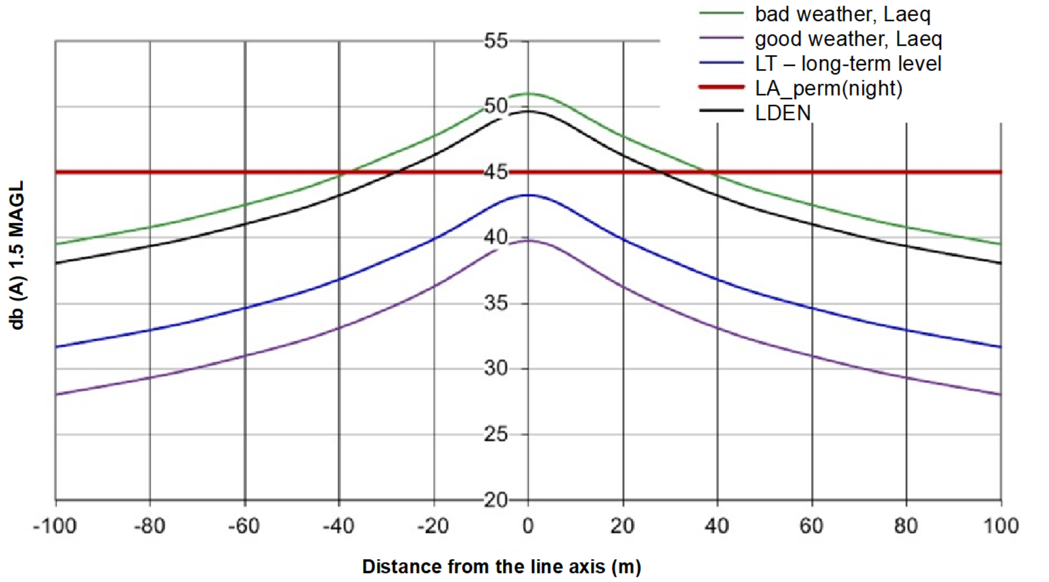
P towers						**400 kV phase conductors 3 x 468/24-A1F/UHST-261 Lower bundle suspension height: 12 m Phase arrangement: two parallel lines**							
No.	**Distance from the centre line [m]**	**Height of 1.5 MAGL**				**4.0 MAGL**				**5.0 MAGL**			
		$L_{Aeq,bw}$	$L_{Aeq,gw}$	L_T	L_{DEN}	$L_{Aeq,bw}$	$L_{Aeq,gw}$	L_T	L_{DEN}	$L_{Aeq,bw}$	$L_{Aeq,gw}$	L_T	L_{DEN}
1.	-100	39.5	28.0	31.7	38.1	39.5	28.0	31.7	38.1	39.5	28.1	31.7	38.1
2.	-82	40.7	29.2	32.8	39.2	40.7	29.2	32.8	39.2	40.7	29.2	32.8	39.2
3.	-70	41.6	30.1	33.7	40.1	41.6	30.1	33.8	40.2	41.6	30.1	33.8	40.2
4.	-50	43.5	31.9	35.6	42.0	43.5	32.0	35.7	42.1	43.6	32.0	35.7	52.1
5.	-40	44.7	33.1	36.8	43.2	44.8	33.2	36.9	43.3	44.9	33.2	37.0	43.4
6.	-35	45.4	33.8	37.5	43.9	45.6	33.9	37.7	44.1	45.7	34.0	37.8	44.2
7.	-30	46.2	34.6	38.3	44.7	45.6	34.7	38.5	44.9	46.6	34.8	38.6	45.0
8.	-24	47.1	35.5	39.2	45.6	47.4	35.8	39.5	45.9	47.6	35.9	39.6	46.0
9.	-18	48.1	36.7	40.3	46.7	48.4	37.0	40.6	47.0	48.6	37.1	40.7	47.1
10.	-12	49.3	38.0	41.5	47.9	49.8	38.5	42.1	48.5	50.0	38.8	42.3	48.7
11.	-8	50.1	38.8	42.3	48.7	50.9	39.7	43.2	49.6	51.3	40.1	43.5	49.9
12.	-4	50.7	39.5	43.0	49.4	51.8	40.7	44.1	50.5	52.4	41.2	44.6	51.0
13.	0	51.0	39.8	43.2	49.6	52.2	41.0	44.4	50.8	52.7	41.6	45.0	51.4
14.	4	50.7	39.5	43.0	49.4	51.8	40.7	44.1	50.5	52.4	41.2	44.6	51.0
15.	8	50.1	38.8	42.3	48.7	50.9	39.7	43.2	49.6	51.3	40.1	43.5	49.9
16.	12	49.3	38.0	41.5	47.9	49.8	38.5	42.1	48.5	50.0	38.8	42.3	48.7
17.	18	48.1	36.7	40.3	46.7	48.4	37.0	40.6	47.0	48.6	37.1	40.7	47.1
18.	24	47.1	35.5	39.2	45.6	47.4	35.8	39.5	45.9	47.6	35.9	39.6	46.0
19.	30	46.2	34.6	38.3	44.7	46.5	34.7	38.5	44.9	46.6	34.8	38.6	45.0
20.	35	45.4	33.8	37.5	43.9	45.6	33.9	37.7	44.1	45.7	34.0	37.8	44.2
21.	40	44.7	33.1	36.8	43.2	44.8	33.2	36.9	43.3	44.9	33.2	37.0	43.4
22.	50	43.5	31.9	35.6	42.0	43.5	32.0	35.7	42.1	43.6	32.0	35.7	42.1
23.	70	41.6	30.1	33.7	40.1	41.6	30.1	33.8	40.2	41.6	30.1	33.8	40.2
24.	82	40.7	29.2	32.8	39.2	40.7	29.2	32.8	39.2	40.7	39.2	32.8	39.2
25.	100	39.5	28.0	31.7	38.1	39.5	28.0	31.7	38.1	39.4	28.1	31.7	38.1

L_T – long-term level, L_{DEN} – day-evening-night level, $L_{Aeq,bw}$ – A-weighted equivalent sound level in bad weather, $L_{Aeq,gw}$ – A-weighted equivalent sound level in good weather

Forecast corona discharge noise distribution at a height of 1.5 MAGL
Two, 1-circuit 400 kV overhead lines run parallelly

Suspension height of the lower phase **h= 12,0 m** Span no. **xx**

Towers P Operating cables 3x468/24-A1F/UHST-261 **opposite** phase system Span



Isoline range [m]	height MAGL [m]	Side of the line	50 dB [m]	**45 dB** [m]	40 dB [m]
Bad weather (Laeq)	**1,5**	**L**	**8**	**38**	**92**
		P	**8**	**38**	**92**
Level L (DEN (z))	**1,5**	**L**	**b.z.**	**28**	**72**
		P	**b.z.**	**28**	**72**

[1]. An average value of the isoline range of a given value was determined. This range can change within the limits of the calculation uncertainty, which in the model adopted is +/- 2.4 dB

Bad weather – an average rainfall intensity of 1.2 mm/h was used for the calculations

n/r – no range. Level of noise in the entire cross-section does not exceed the criterion value (at a given height above ground level)

The permissible noise values were adopted according to the Regulation of the Minister of the Environment of 14 June 2007 on permissible noise levels in the environment (Journal of Laws of 2007, No. 120 item 826) tables 2 and 4

50 dB isoline
Determines the range of the permissible value acc. to the Reg. of the Min. of the Env., item 2a-c, daytime (LaeqD) and LDEN

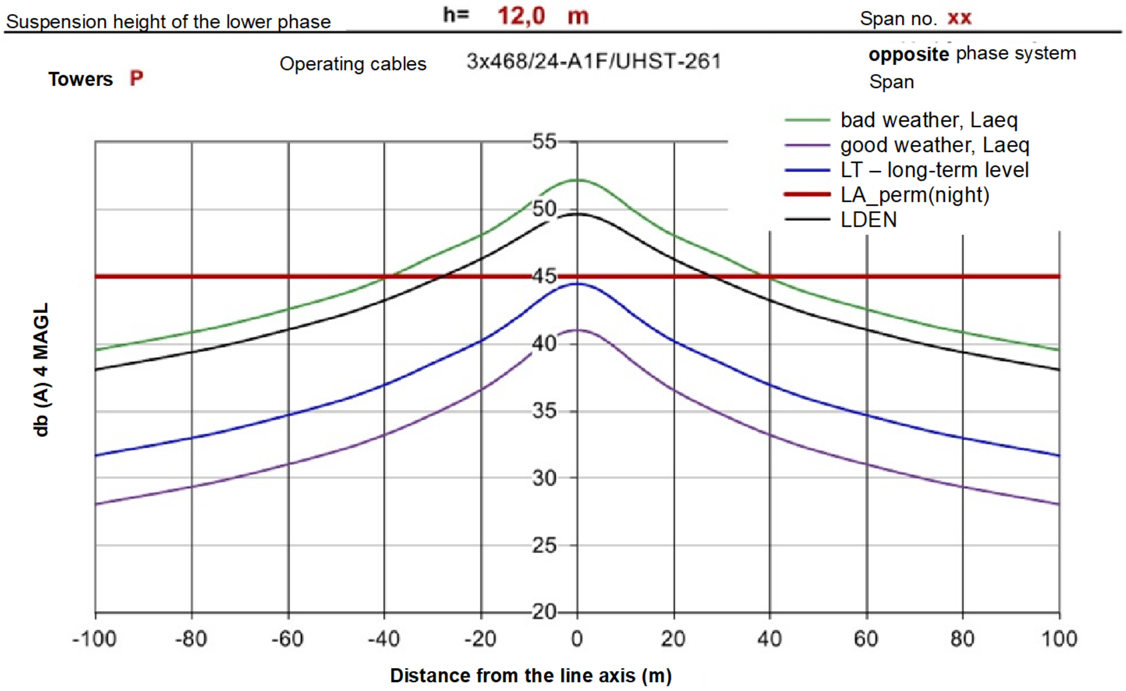
45 dB isoline
Determines the range of the permissible value acc. to the Reg. of the Min. of the Env., item 2a-c, night-time LN, and item 1a-c, daytime LaeqD as well as LDEN

40 dB isoline
Determines the range of the permissible value acc. to the Reg. of the Min. of the Env., item 1a-c, night-time LaeqN and LN

The typical dirt coefficient k = 0.6 at a scale 0.4–1 was adopted for the calculations.
For normal conductors (typical, slightly dirty surface) k = 0.6.
For clean conductors in good technical condition k = 0.4.

Figure 6.8. Calculation results for the forecast corona discharge noise distribution at a height of 1.5 MAGL accompanying the operation of a set of two single-circuit lines running parallelly with 400 kV rated voltage erected using a three-core bundle made of 468/24-A1F/UHST-261 type cables [Source: internal materials]

Forecast corona discharge noise distribution at a height of 4 MAGL
Two, 1-circuit 400 kV overhead lines run parallelly



Isoline range [m]	height MAGL [m]	Side of the line	50 dB [m]	45 dB [m]	40 dB [m]
Bad weather (Laeq)	4	L	11	39	92
		P	11	39	92
Level L (DEN (z))	4	L	5	30	72
		P	5	30	72

An average value of the isoline range of a given value was determined. This range can change within the limits of the calculation uncertainty, which in the model adopted is +/- 2.4 dB

Bad weather – an average rainfall intensity of 1.2 mm/h was used for the calculations

n/r – no range. Level of noise in the entire cross-section does not exceed the criterion value (at a given height above ground level)

The permissible noise values were adopted according to the Regulation of the Minister of the Environment of 14 June 2007 on permissible noise levels in the environment (Journal of Laws of 2007, No. 120 item 826) tables 2 and 4

50 dB isoline
Determines the range of the permissible value acc. to the Reg. of the Min. of the Env., item 2a-c, daytime (LaeqD) and LDEN

45 dB isoline
Determines the range of the permissible value acc. to the Reg. of the Min. of the Env., item 2a-c, night-time LN, and item 1a-c, daytime LaeqD as well as LDEN

40 dB isoline
Determines the range of the permissible value acc. to the Reg. of the Min. of the Env., item 1a-c, night-time LaeqN and LN

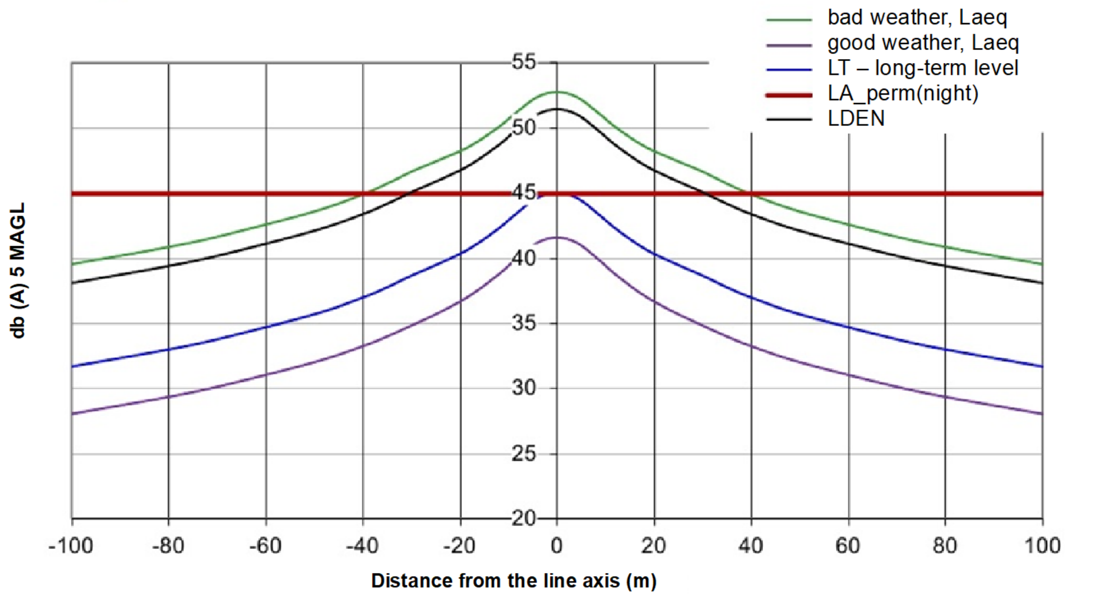
The typical dirt coefficient k = 0.6 at a scale 0.4–1 was adopted for the calculations.
For normal conductors (typical, slightly dirty surface) k = 0.6.
For clean conductors in good technical condition k = 0.4.

Figure 6.9. Calculation results for the forecast corona discharge noise distribution at a height of 4.0 MAGL accompanying the operation of a set of two single-circuit lines running parallelly with 400 kV rated voltage erected using a three-core bundle made of 468/24-A1F/UHST-261 type cables [Source: internal materials]

Forecast corona discharge noise distribution at a height of 5 MAGL
Two, 1-circuit 400 kV overhead lines run parallelly

Suspension height of the lower phase **h= 12,0 m** Span no. **xx**

Towers P Operating cables 3x468/24-A1F/UHST-261 **opposite** phase system Span



Isoline range [m]	height MAGL [m]	Side of the line	50 dB [m]	**45 dB** [m]	40 dB [m]
Bad weather (Laeq)	5	L	12	39	92
		P	12	39	92
Level L (DEN (z))	5	L	7	31	72
		P	7	31	72

[1] An average value of the isoline range of a given value was determined. This range can change within the limits of the calculation uncertainty, which in the model adopted is +/- 2.4 dB

Bad weather – an average rainfall intensity of 1.2 mm/h was used for the calculations

n/r – no range. Level of noise in the entire cross-section does not exceed the criterion value (at a given height above ground level)

The permissible noise values were adopted according to the Regulation of the Minister of the Environment of 14 June 2007 on permissible noise levels in the environment (Journal of Laws of 2007, No. 120 item 826) tables 2 and 4

50 dB isoline
Determines the range of the permissible value acc. to the Reg. of the Min. of the Env., item 2a-c, daytime (LaeqD) and LDEN

45 dB isoline
Determines the range of the permissible value acc. to the Reg. of the Min. of the Env., item 2a-c, night-time LN, and item 1a-c, daytime LaeqD as well as LDEN

40 dB isoline
Determines the range of the permissible value acc. to the Reg. of the Min. of the Env., item 1a-c, night-time LaeqN and LN

The typical dirt coefficient k = 0.6 at a scale 0.4–1 was adopted for the calculations.
For normal conductors (typical, slightly dirty surface) k = 0.6.
For clean conductors in good technical condition k = 0.4.

Figure 6.10. Calculation results for the forecast corona discharge noise distribution at a height of 5.0 MAGL accompanying the operation of a set of two single-circuit lines running parallelly with 400 kV rated voltage erected using a three-core bundle made of 468/24-A1F/UHST-261 type cables [Source: internal materials]

The results of the noise level distribution calculations in the vicinity of the two single-circuit 400 kV overhead lines to be built parallel at a distance of 30 m, indicate that:

- the maximum value of the sound level in the most unfavourable operating conditions of the line (bad weather) will not exceed at any point beneath the line (at the height of 4.0 MAGL) the value of 52.8 dB, which means an exceedance by 7.8 dB of the permissible value established in the Regulation of the Minister of the Environment of 14 June 2007 on permissible noise levels in the environment (Journal of Laws of 2007, No. 120, item 826, as amended) at 45 dB for residential development areas;

- the area of land under the above-mentioned system of 400 kV overhead lines running in parallel, where the calculation analyses indicate the exceedance of the permissible value of 45 dB (for residential development areas) extends (at the height of 4.0 MAGL) to the distance of 39 m from the line axis in both directions;
- given the possibility of the permissible value of noise level (45 dB) being exceeded, the construction of residential buildings is not possible in the belt with a width of 78 m (2 x 39 m) along the parallel 400 kV overhead line system.

The impacts on ambient noise were considered to be moderate and local.

6.1.5.5.4 Results of the calculations of the noise levels away from the customer substation

The calculations conducted for the noise levels show that at all observations points at the boundary of the planned residential development, the night-time (40 dB) and daytime (50 dB) noise limits for single-family development will not be exceeded. The calculations have been conducted in the calculation area on a rectangular plan with sides of 1800 m × 2100 m.

The calculation results for the projected noise level emitted to the environment at observation points and at the facade are presented for daytime and night-time in Table 6.74.

Table 6.74. Equivalent sound levels L_{AeqT} emitted to the environment by the designed customer substation (ORLEN)

Hałas Przemysłowy Zewnętrzny (Outdoor Industrial Noise) HPZ'2001 Windows software: Version: March '2012 + GRUNT License of the Acoustics Laboratory of the Building Research Institute: HPZ-0217 ARS VITAE Wrocław	
Project description:	Customer substation (Orlen) daytime and night-time
	Allowance was made for the ground impact in accordance with PN-ISO 9613-2 (simplified method)
Air temperature = 10°C	Relative humidity (RH) = 70%

A-weighted equivalent sound level at specified observation points

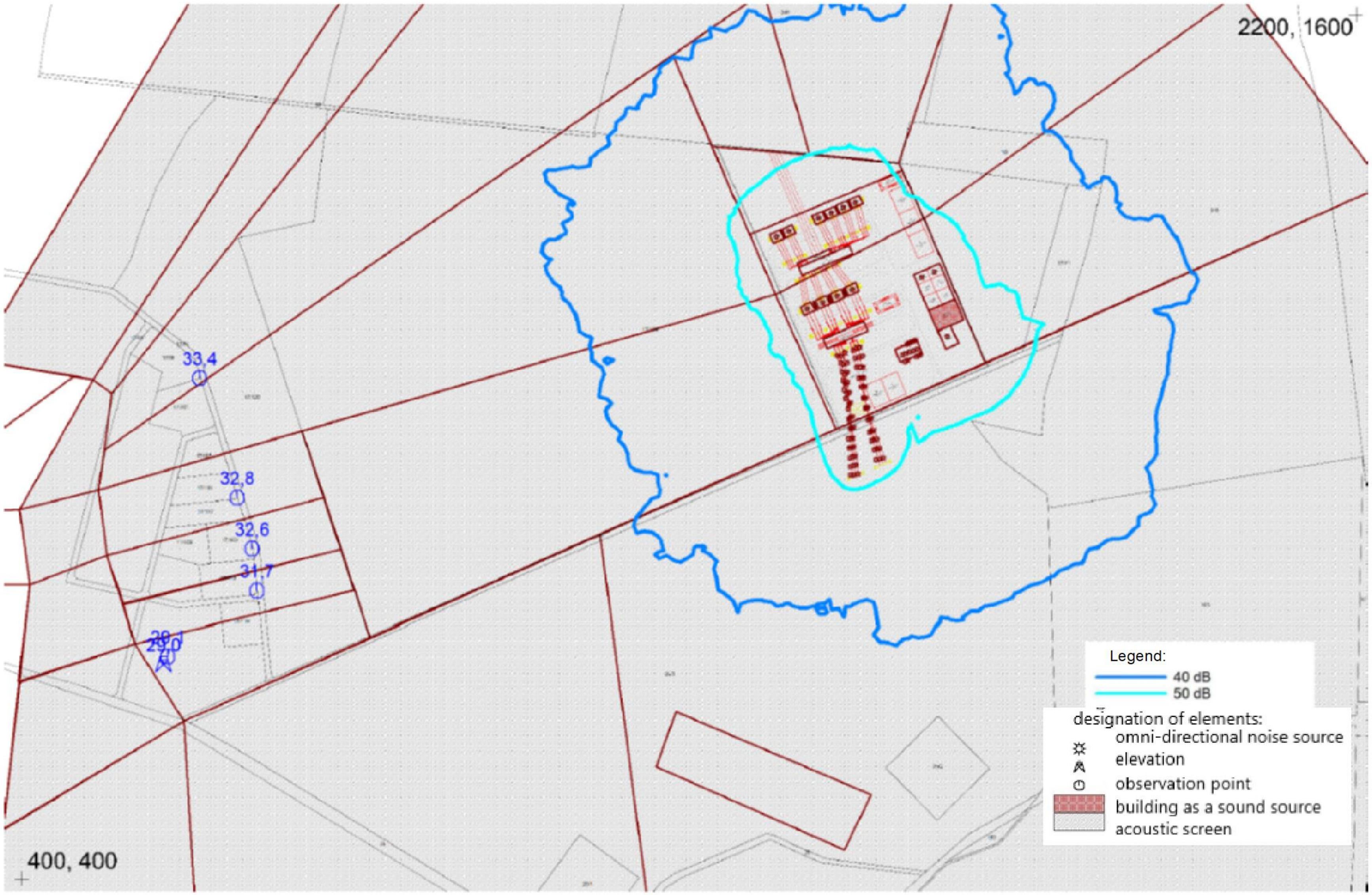
No.	Symbol	x [m]	y [m]	z [m]	L_A [dB]
1.	P1	640.0	1095.0	6.5	33.4
2.	P2	691.1	928.9	8.5	32.8
3.	P3	711.0	858.0	9.5	32.6
4.	P4	717.3	799.7	10.5	31.7
5.	P5	597.6	708.9	12.5	29.1

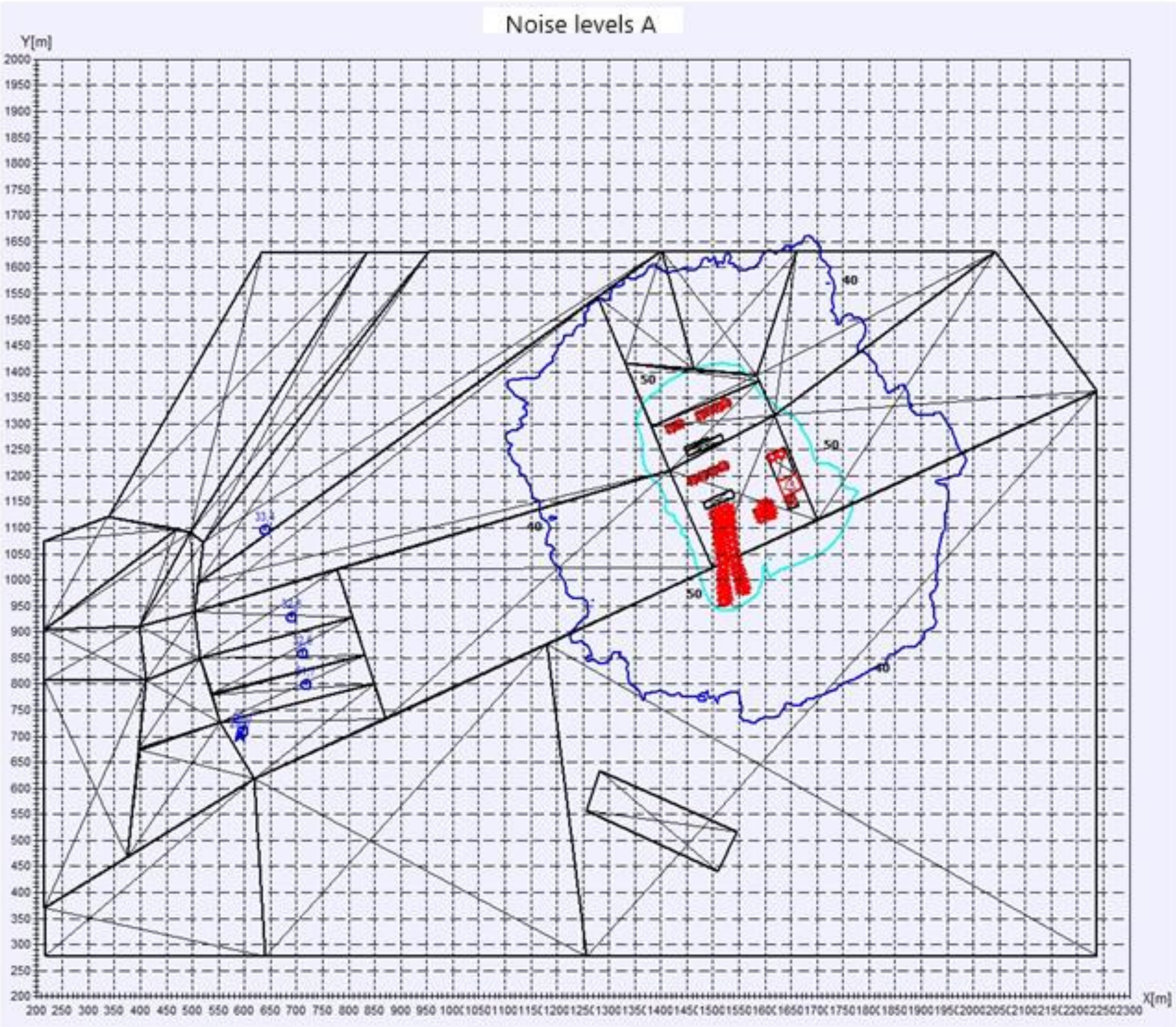
A-weighted equivalent sound level at facade points

No.	Symbol	x [m]	y [m]	z [m]	L_A [dB]
1	E1	591.2	698.4	12.0 16.0 20.0	29.0 28.8 28.9

The results of model calculations showed that an operating customer substation (PKN ORLEN), in which all devices generating noise operate continuously (24 h/d.) with a maximum acoustic power, will not cause an exceedance of the permissible sound level threshold determined for night (40 dB) and day (50 dB) in the area of the nearest protected developments, including planned and existing residential buildings [Figure 6.11].

The impact of noise from a customer substation in the operation phase will be low.


2200, 1600
33,4
32,8
32,6
31,7
400, 400
Legend:
40 dB
50 dB
designation of elements:
omni-directional noise source
elevation
observation point
building as a sound source
acoustic screen



Legend:
Lighty blue line – 50 dB isophone
Navy blue line – 40 dB isophone
Noise sources – maked in claret – transformers, glands, etc. and substitute emitters of 400 kV line leads
Punkty obserwacji hałasu (P1 – P5) i punkt obliczeniowy przy elewacji budynku (E1) – granatowe punkty
Dark gray contours – screening elements – buildings, structures, and landform features

Figure 6.11. Visualisation of calculation results of noise emission from PKN Orlen customer substation, for daytime and night-time [Source: internal materials]

6.1.5.6 Electromagnetic field impact

6.1.5.6.1 Underground cable lines

The components of power circuits in most types of power equipment generate EMF, which due to its low frequency (50 Hz – so-called quasi-stationary field) can be identified on the basis of its two separately measured components: electric (E – electric field strength) and magnetic (H – magnetic field strength).

Electric fields with significant intensities are mainly generated by high-voltage system elements, whereas the magnetic field component reaches relatively high values in the vicinity of high-current circuits.

High-voltage power cables, due to the presence of a cable operating wire screening sheaths, are not a source of magnetic field, since its normal (radial) component disappears completely as a result of the presence of a semiconductive screen surrounding the operating wire, copper or aluminium as well as the presence of a conductive screen surrounding the electrical insulating sheath. Therefore, estimating the levels of the electric field component outside the cable is unjustified.

By contrast, the electricity flowing through the phase wire is the source of electromagnetic field of relatively high values. The value of this field, which is usually determined over a cable line up to a height of 2.0 MAGL, in accordance with the requirements of the Regulation of the Minister of Climate of 17 February 2020 on methods of verifying compliance with permissible levels of electromagnetic fields in the environment (Journal of Laws of 2020, item 258), is determined by the depth of underground cable line installation and the distance between individual conductors (phases) forming an electrical circuit (power cable run).

The adverse effects of the magnetic component of EMF on living organisms have been reported in the scientific literature for a fairly long time and although the mechanism of the EMF impact on biological structures is not precisely explored, many countries, including Poland, have introduced regulations limiting exposure to this type of fields.

The legal act concerning protection against EMF in environmental exposure is the Regulation of the Minister of Health of 17 December 2019 on the permissible levels of electromagnetic fields in the environment (Journal of Laws of 2019, item 2448).

According to the provisions of this regulation (appendix to the aforementioned regulation), the permissible environmental level of EMF with a frequency of 50 Hz should not exceed, in places accessible to the public, the following threshold values:

- electric field intensity (E) – 10 $kV \cdot m^{-1}$;
- magnetic field intensity (H) – 60 $A \cdot m^{-1}$.

It is, therefore, recognised, as in the case of regulations in force in other countries, that fields characterised by the levels indicated above (and also by lower levels) do not have an adverse impact on any element of the environment (plants, animals, water and air), including people, without having any cumulative or synergic impacts.

However, the referenced legal act contains two important limitations regarding the above-mentioned permissible values. One of them relates directly to the electric field [electric component (E) of EMF] with a frequency of 50 Hz. It states that in areas designated for residential development, the 50 Hz electric component (E) of EMF may not exceed 1 $kV \cdot m^{-1}$. This limitation, which is significant in the case of high-voltage overhead lines, is of no significance in the case of cable lines, including high-voltage cable lines because, as already mentioned, power cables with conductor screens are not the source of electric field released into the environment (ground and air).

The results of calculations of the maximum values of the magnetic field strength (H) which can be expected over the power cable route for both distances between cable lines (5 and 17 m) are presented in Table 6.75, while the diagrams of the magnetic field strength (H) distribution in the cross-section transverse to the axis of the cable route are illustrated in figures: Figure 6.12–Figure 6.23.

Table 6.75. Results of calculations of the expected maximum values of the magnetic field strength (H) in the vicinity of the cable lines operating at 220 kV, each line under current load of $I_{(220\ kV)}$ = 830 A as well as 275 kV, each line under current load of $I_{(275\ kV)}$ = 890 A. Calculations were performed for two distances between individual lines, i.e. 5 and 17 m [Source: internal materials]

Line variant	**Cable circuit (maximum) load current $I_{(220\ kV)}$ = 830 A**			**Cable circuit (maximum) load current $I_{(275\ kV)}$ = 890 A**		
	Maximum value of magnetic field intensity H [A·m^{-1}] determined at a height of			**Maximum value of magnetic field intensity H [A·m^{-1}] determined at a height of**		
	0.2	**1.0**	**2.0**	**0.2**	**1.0**	**2.0**
Distance between cable circuits: 5 m	12.5	6.9	4.3	13.1	7.4	4.6
Distance between cable circuits: 17 m	13.5	7.3	4.0	14.6	7.8	4.3

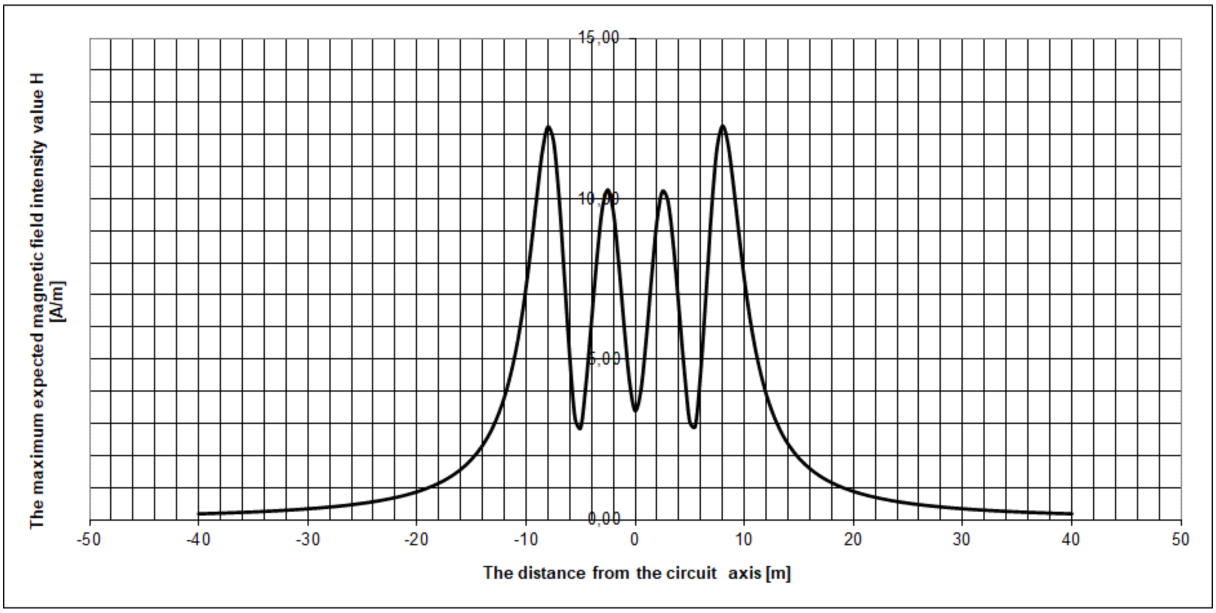


Figure 6.12. Maximum expected value of the magnetic field intensity (H) at a height of 0.2 MAGL as a function of the distance from the axis of the circuit, where the distance between adjacent circuits is 5.0 m. The calculations were carried out for circuits with the voltage U_{n1} = 220 kV and the circuit maximum load capacity (I220 kV) = 830 A [Source: internal materials]

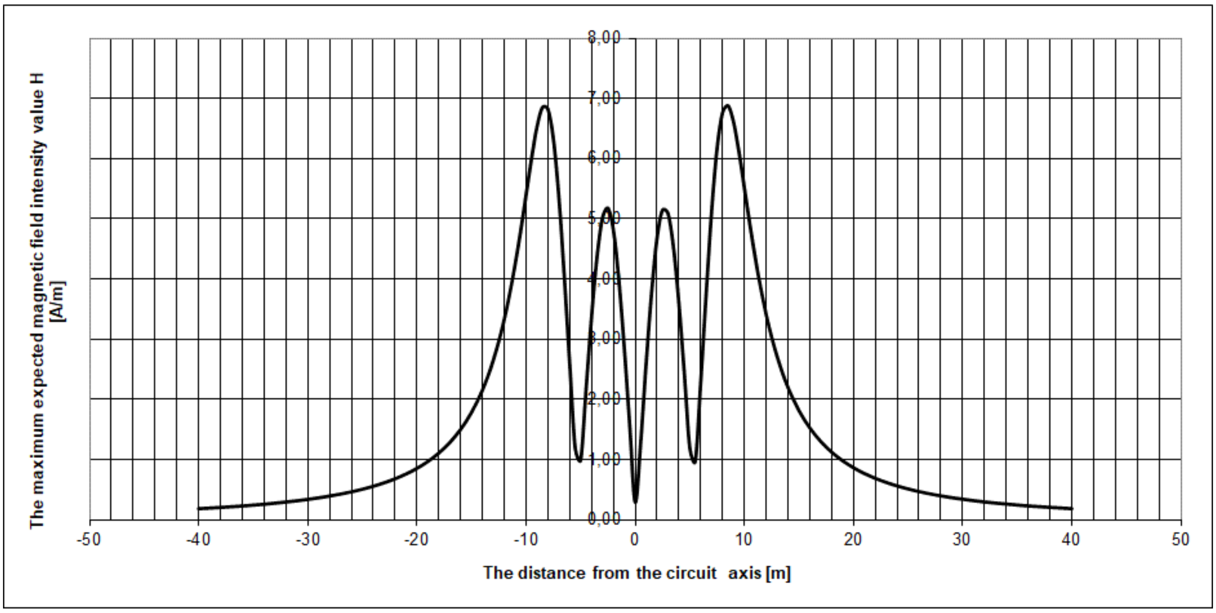


Figure 6.13. Maximum expected value of the magnetic field strength (H) at a height of 1.0 MAGL as a function of the distance from the axis of the circuit, where the distance between adjacent circuits is 5.0 m. The calculations were carried out for circuits with the voltage U_{n1} = 220 kV and the circuit maximum load capacity (I220 kV) = 830 A [Source: internal materials]

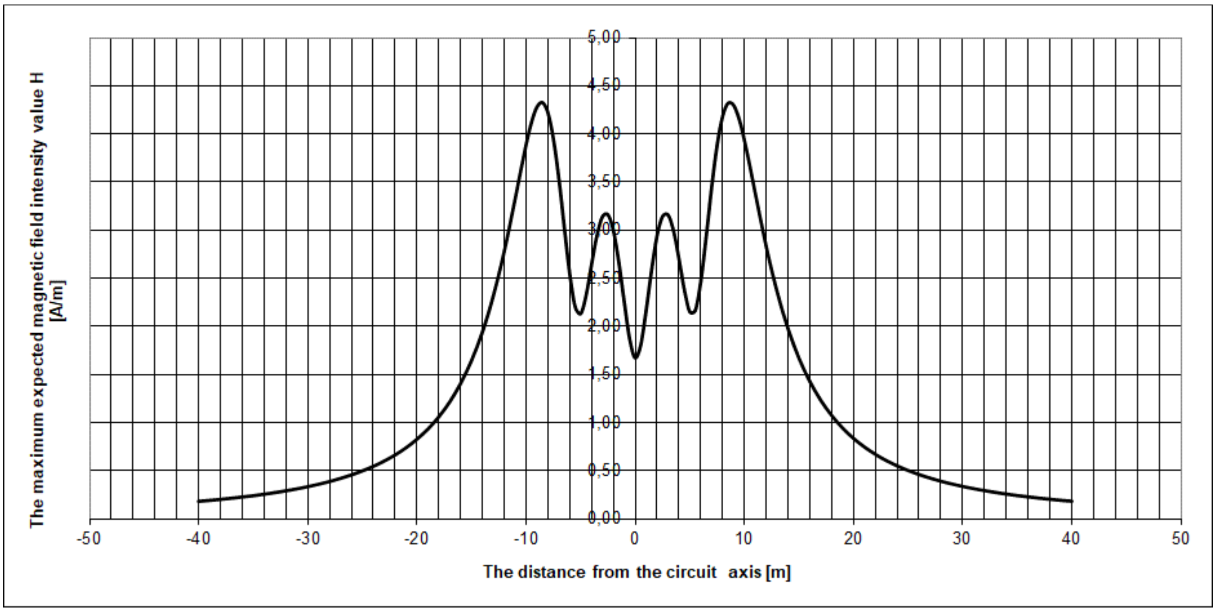


Figure 6.14. Maximum expected value of the magnetic field strength (H) at a height of 2.0 MAGL as a function of the distance from the axis of the circuit, where the distance between adjacent circuits is 5.0 m. The calculations were carried out for circuits with the voltage U_{n1} = 220 kV and the circuit maximum load capacity (I220 kV) = 830 A [Source: internal materials]

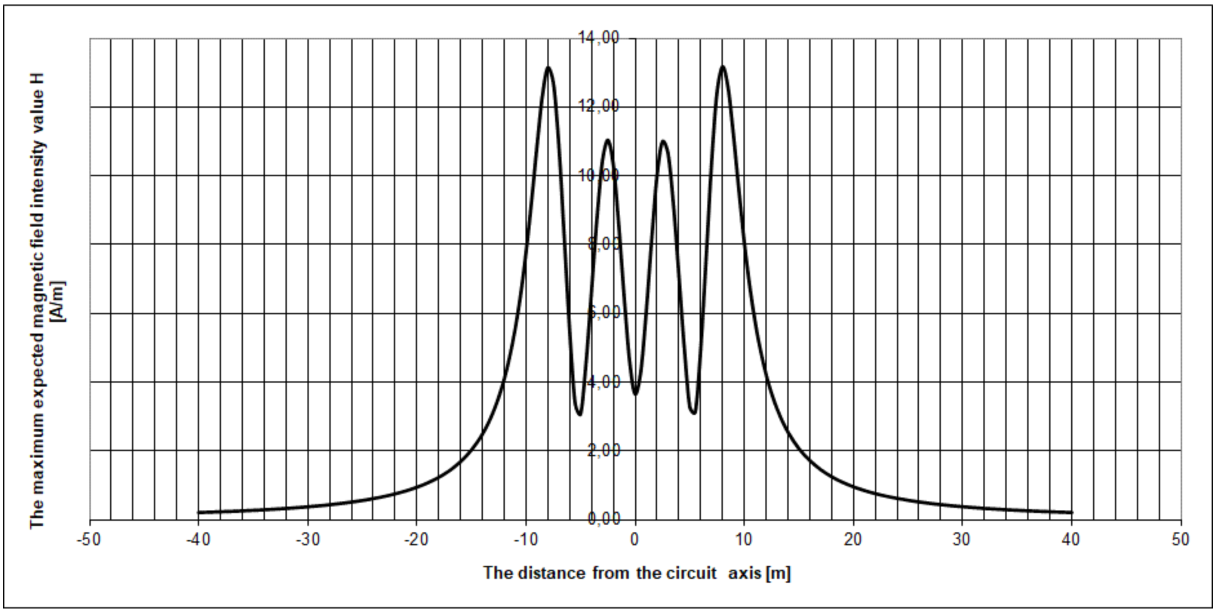


Figure 6.15. *Maximum expected value of the magnetic field strength (H) at a height of 0.2 MAGL as a function of the distance from the axis of the circuit, where the distance between adjacent circuits is 5.0 m. The calculations were carried out for circuits with the voltage U_{n2} = 275 kV and the circuit maximum load capacity (I275 kV) = 890 A [Source: internal materials]*

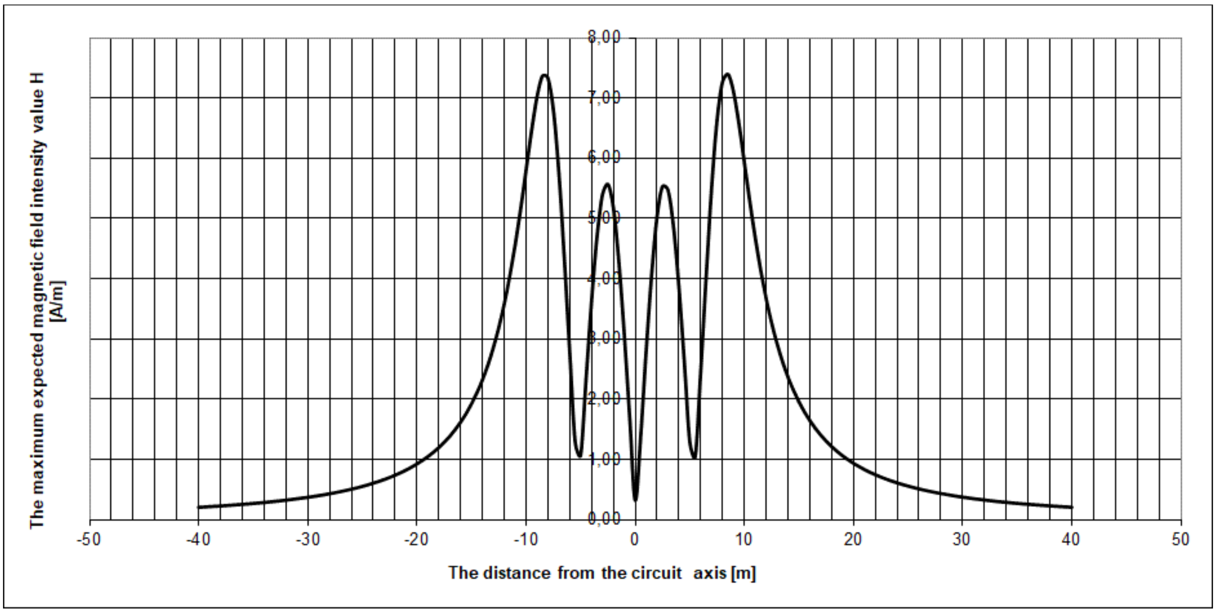


Figure 6.16. *Maximum expected value of the magnetic field strength (H) at a height of 1.0 MAGL as a function of the distance from the axis of the circuit, where the distance between adjacent circuits is 5.0 m. The calculations were carried out for circuits with the voltage U_{n2} = 275 kV and the circuit maximum load capacity (I275 kV) = 890 A [Source: internal materials]*

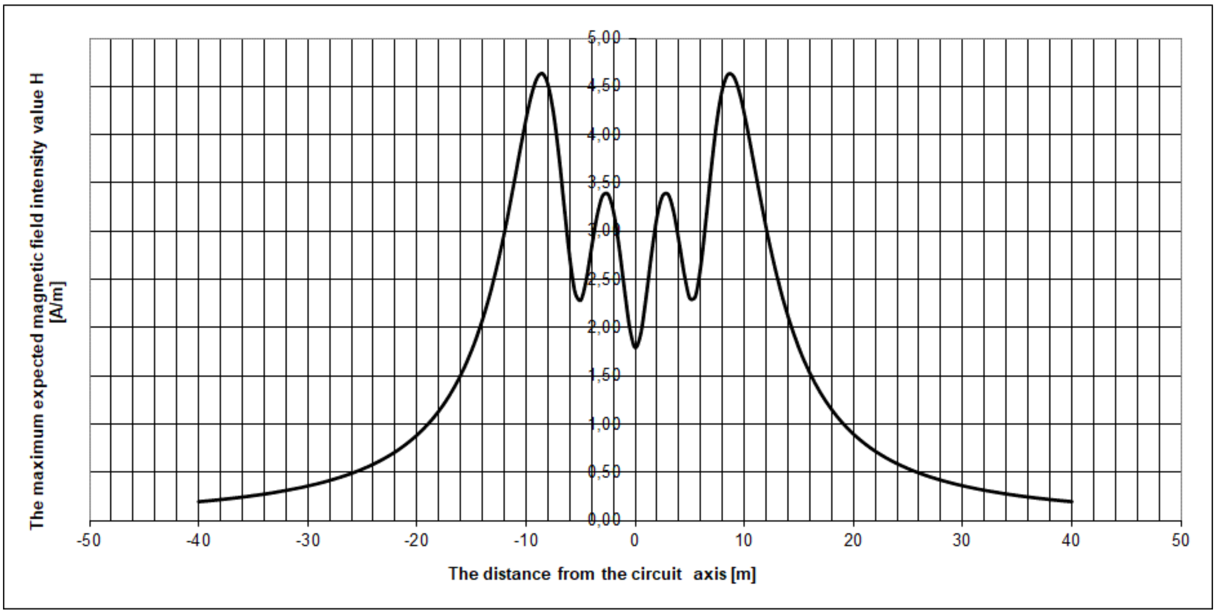


Figure 6.17. *Maximum expected value of the magnetic field strength (H) at a height of 2.0 MAGL as a function of the distance from the axis of the circuit, where the distance between adjacent circuits is 5.0 m. The calculations were carried out for circuits with the voltage U_{n2} = 275 kV and the circuit maximum load capacity (I275 kV) = 890 A [Source: internal materials]*

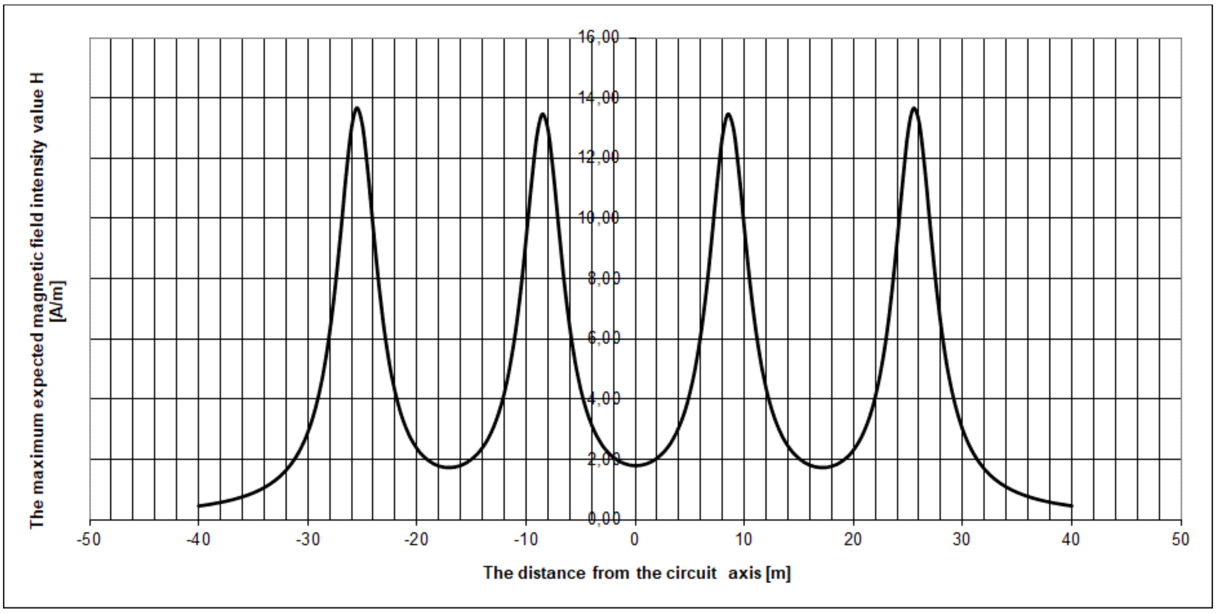


Figure 6.18. *Maximum expected value of the magnetic field strength (H) at a height of 0.2 MAGL as a function of the distance from the axis of the circuit, where the distance between adjacent circuits is 17.0 m. The calculations were carried out for circuits with the voltage U_{n1} = 220 kV and the circuit maximum load capacity (I220 kV) = 830 A [Source: internal materials]*

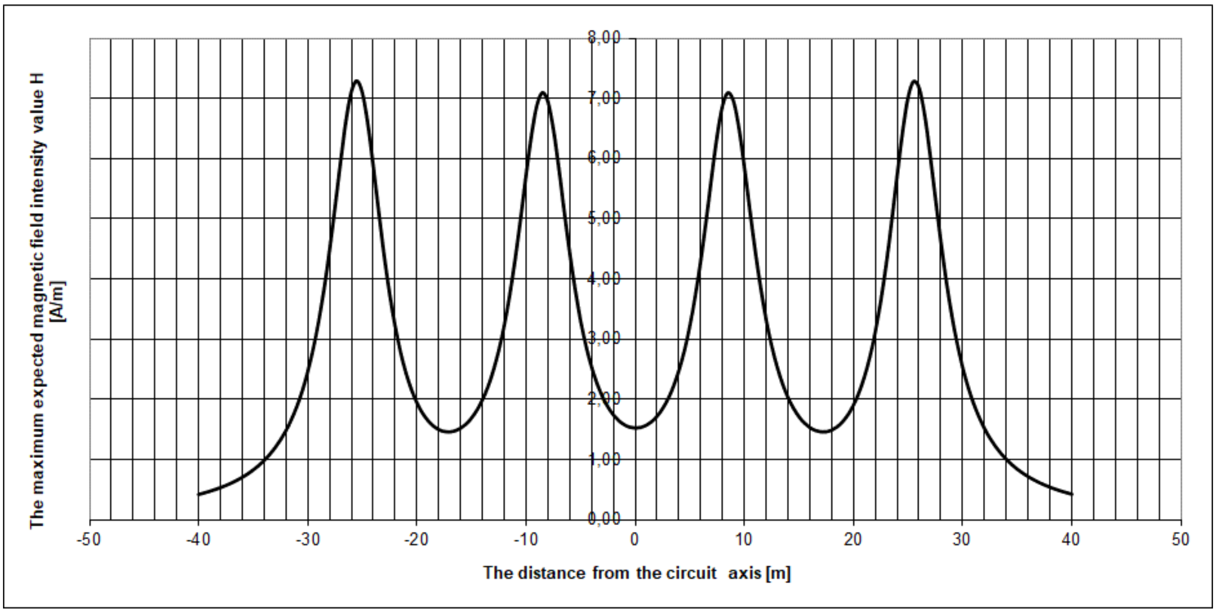


Figure 6.19. Maximum expected value of the magnetic field strength (H) at a height of 1.0 MAGL as a function of the distance from the axis of the circuit, where the distance between adjacent circuits is 17.0 m. The calculations were carried out for circuits with the voltage nU_{n1} = 220 kV and the circuit maximum load capacity (I220 kV) = 830 A [Source: internal materials]

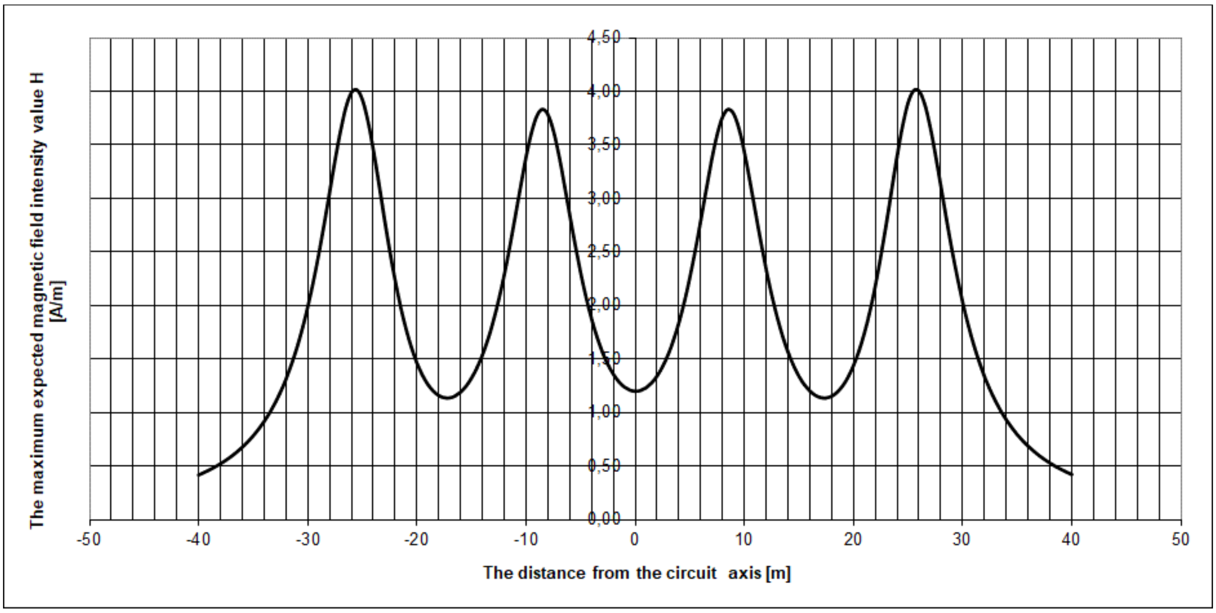


Figure 6.20. Maximum expected value of the magnetic field strength (H) at a height of 2.0 MAGL as a function of the distance from the axis of the circuit, where the distance between adjacent circuits is 17.0 m. The calculations were carried out for circuits with the voltage U_{n1} = 220 kV and the circuit maximum load capacity (I220 kV) = 830 A [Source: internal materials]

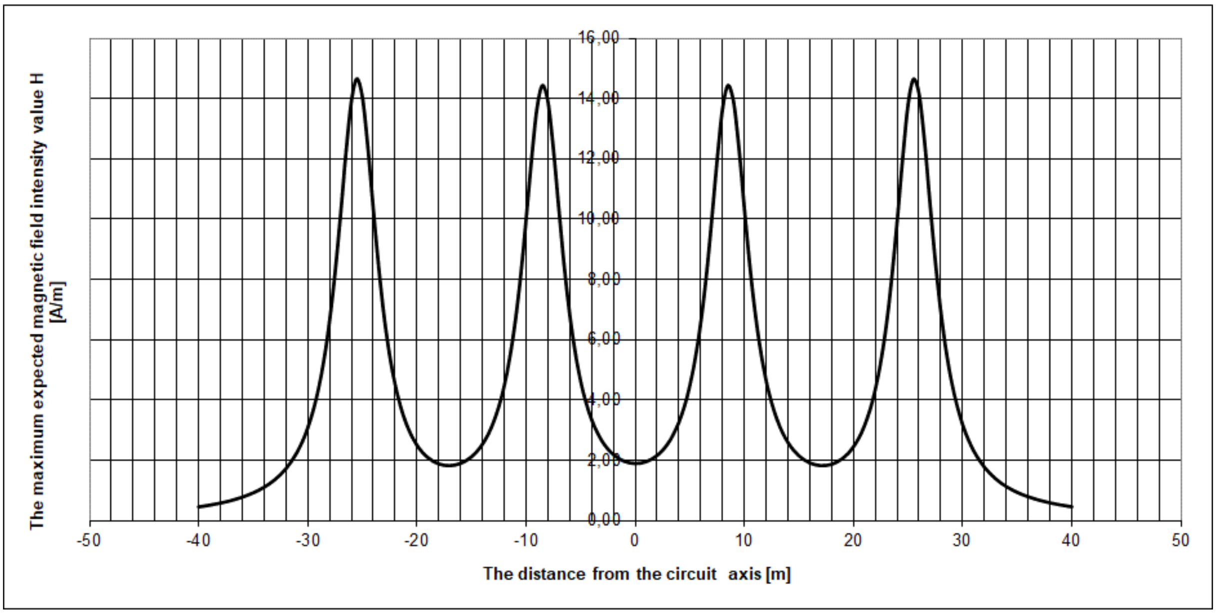


Figure 6.21. Maximum expected value of the magnetic field strength (H) at a height of 0.2 MAGL as a function of the distance from the axis of the circuit, at which the distance between adjacent circuits is 17.0 m. The calculations were carried out for circuits with the voltage U_{n2} = 275 kV and the circuit maximum load capacity (I275 kV) = 890 A [Source: internal materials]

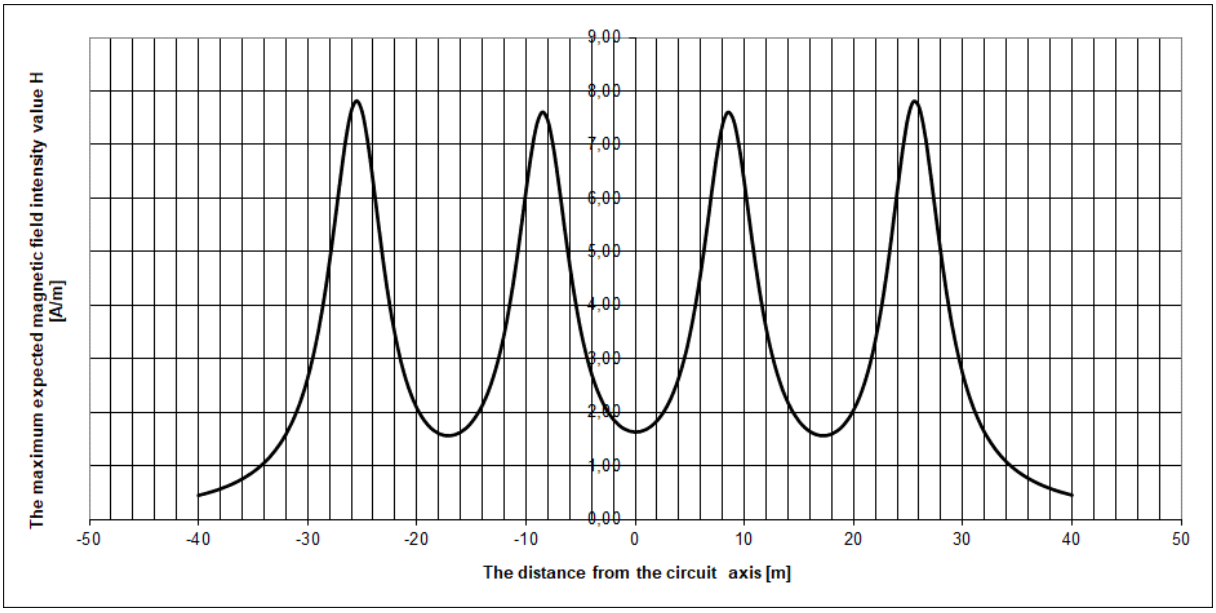


Figure 6.22. Maximum expected value of the magnetic field strength (H) at a height of 1.0 MAGL as a function of the distance from the axis of the circuit, at which the distance between adjacent circuits is 17.0 m. The calculations were carried out for circuits with the voltage U_{n2} = 275 kV and the circuit maximum load capacity (I275 kV) = 890 A [Source: internal materials]

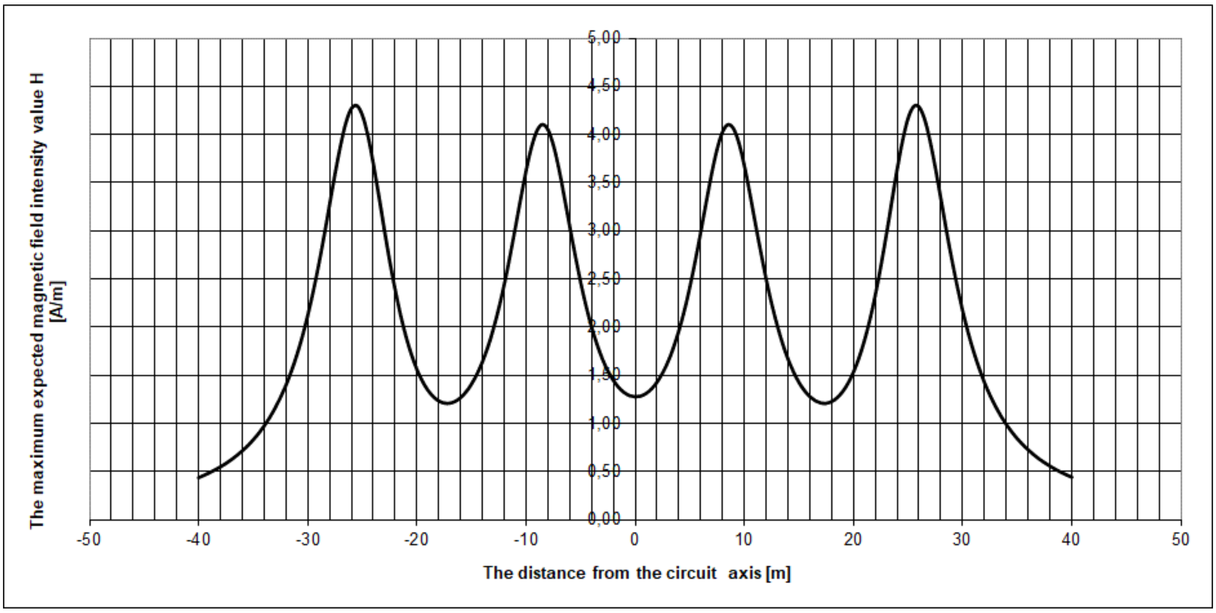


Figure 6.23. Maximum expected value of the magnetic field strength (H) at a height of 2.0 MAGL as a function of the distance from the axis of the circuit, at which the distance between adjacent circuits is 17.0 m. The calculations were carried out for circuits with the voltage U_{n2} = 275 kV and the circuit maximum load capacity (I275 kV) = 890 A [Source: internal materials]

The estimates conducted indicate unambiguously that even at maximum load of both direct current (DC) and alternating current (AC), the permissible value (2500 $A \cdot m^{-1}$ for the permanent magnetic field – DC, and 60 $A \cdot m^{-1}$ for the magnetic field with a 50 Hz frequency – AC), established under the regulation mentioned above is not exceeded in any case at an altitude of 2.0 MASL. This means that the presence of humans (environmental exposure) even directly above the cable line is permitted without time restrictions.

The impact of electromagnetic field in the operation phase shall be negligible.

6.1.5.6.2 Two single-circuit 400 kV lines

As has already been mentioned, the connection between the customer substation and the power substation planned by PSE S.A. which constitutes an element of the National Power System, is planned to be executed as two parallel single-circuit 400 kV overhead lines with a 30 m distance between the axes. To select the optimal electromagnetic field in terms of environmental impact, 4 most typical phase configurations (A, B, C and D) were analysed in individual circuits, illustrated in Figure 6.24.

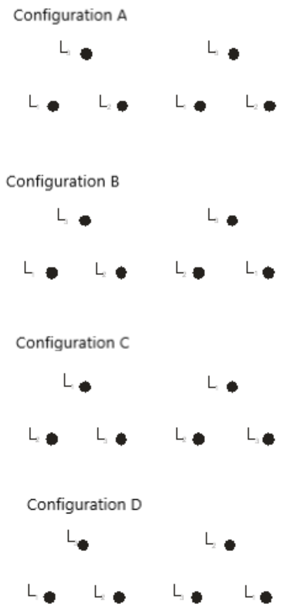


Figure 6.24. Analysed phase configurations in the transmission circuit consisting of two parallel single-circuit 400 kV overhead lines [Source: internal materials]

When analysing the distribution of the expected values of the individual components of electromagnetic field determined at an altitude of 2.0 MAGL with the most environmentally unfavourable line operating conditions adopted, i.e.:

- the maximum working voltage of the 420 kV line (at rated voltage of 400 kV);
- the maximum load of each line circuit (maximum current flowing in each phase) I = 950 A;
- the smallest distance of the phase conductors from the ground $h = h_{min} = 12$ m.

The results of the calculations of the expected maximum values of both field components (electric E and magnetic H) and the width of the area in which the intensity of the electric field may exceed 1 $kV \cdot m^{-1}$ (permissible value for the areas intended for residential development) in the vicinity of 2 parallel overhead lines are presented in Table 6.76.

Table 6.76. Results of calculations for the expected maximum values of the electric field (E) and magnetic field (H) intensities as well as the width of the area in which the residential developments are not allowed (E > 1 $kV \cdot m^{-1}$) in the vicinity of two single-circuit 400 kV overhead lines running parallel at a distance of 30 m, at each circuit loading with a current of I = 9500 A. The calculations were conducted at an altitude of 2.0 MAGL for 4 phase configurations (A, B, C and D [Figure 6.24]) in individual line circuits [Source: internal materials]

Configuration of phases in individual circuits [Figure 6.24]	**Maximum expected value of the electric field intensity E [$kV \cdot m^{-1}$]**	**Maximum expected value of the magnetic field intensity H [$A \cdot m^{-1}$]**	**Maximum width of the area under the line in which the electric field intensity may exceed the admissible value for the areas intended for residential development (1 $kV \cdot m^{-1}$) [m]**
A	6.4	13.0	-52 ÷ +52 m
B	9.5	21.7	-51 ÷ +51 m
C	6.4	13.0	-52 ÷ +52 m
D	6.2	15.3	-51 ÷ +51 m

The results of calculations of the expected maximum values of both field components in the vicinity of two 400 kV overhead lines running parallel, which were conducted in a cross-section perpendicular to the axis of both parallel lines, in the location in which the distance of the lines from the ground is the smallest ($h = h_{min} = 12$ m), are presented in Figure 6.25. However, the calculations were conducted for various phase configurations [Figure 6.24] in individual circuits of each line.

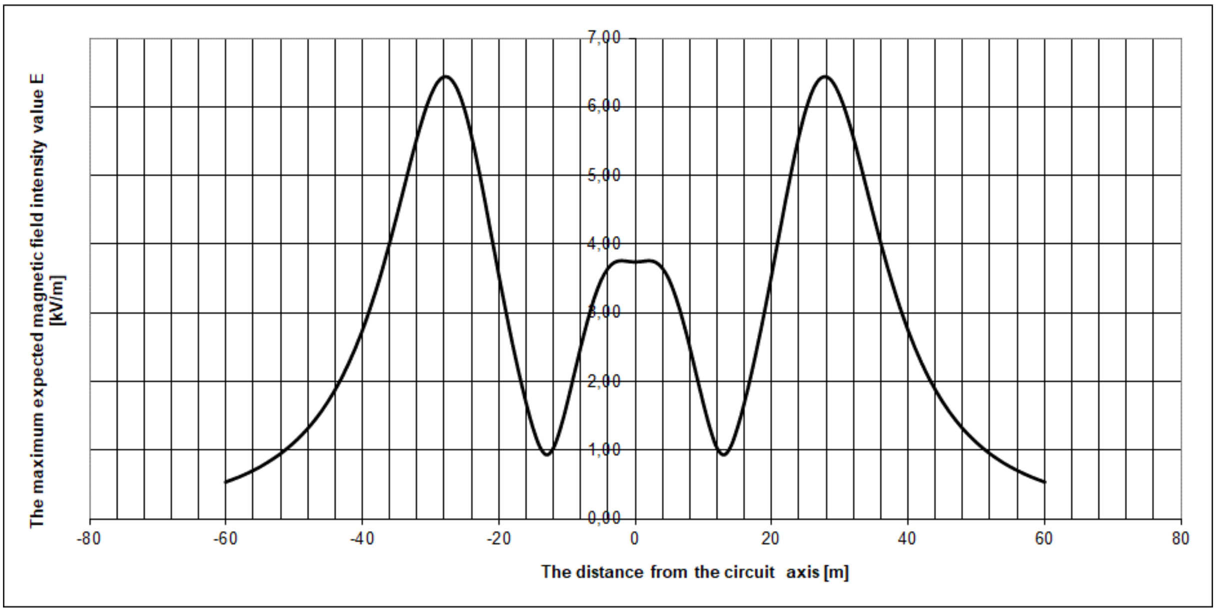


Figure 6.25. Maximum expected value of the electric field strength (H) at a height of 2.0 MAGL as a function of distance from the axis of two, 1-circuit 400 kV overhead lines that run parallel. The calculations were made for the phase configuration marked with the letter A [Figure 6.24] [Source: internal materials]

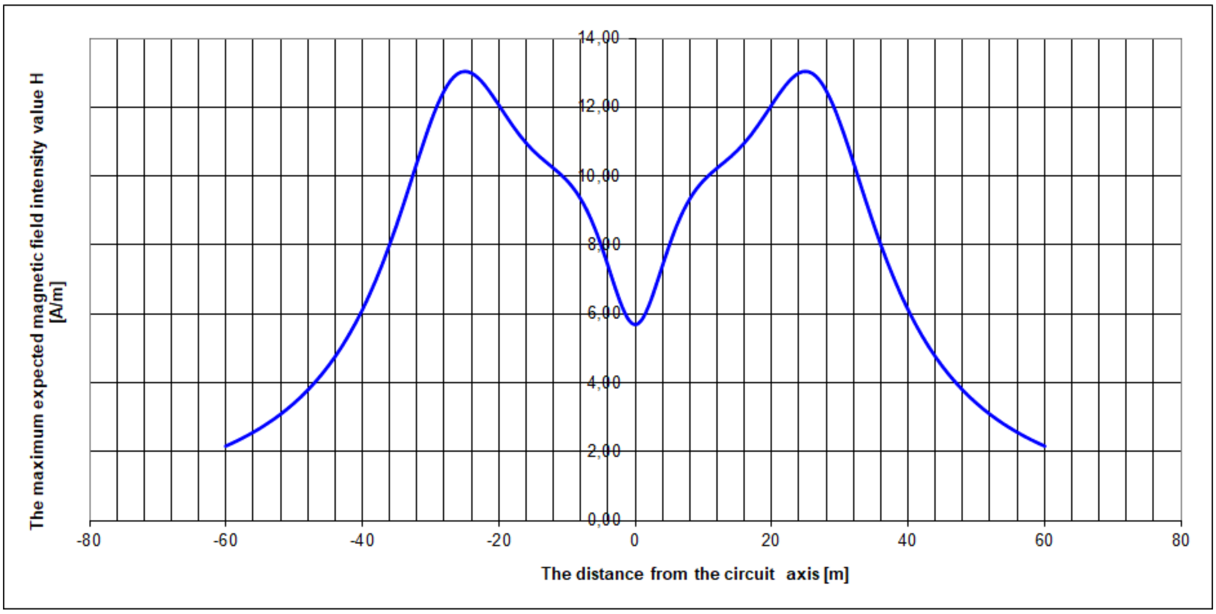


Figure 6.26. Maximum expected value of the magnetic field strength (H) at a height of 2.0 MAGL as a function of distance from the axis of two, 1-circuit 400 kV overhead lines that run parallel. The calculations were made for the phase configuration marked with the letter A [Figure 6.24] with the maximum load capacity for each circuit I = 950 A [Source: internal materials]

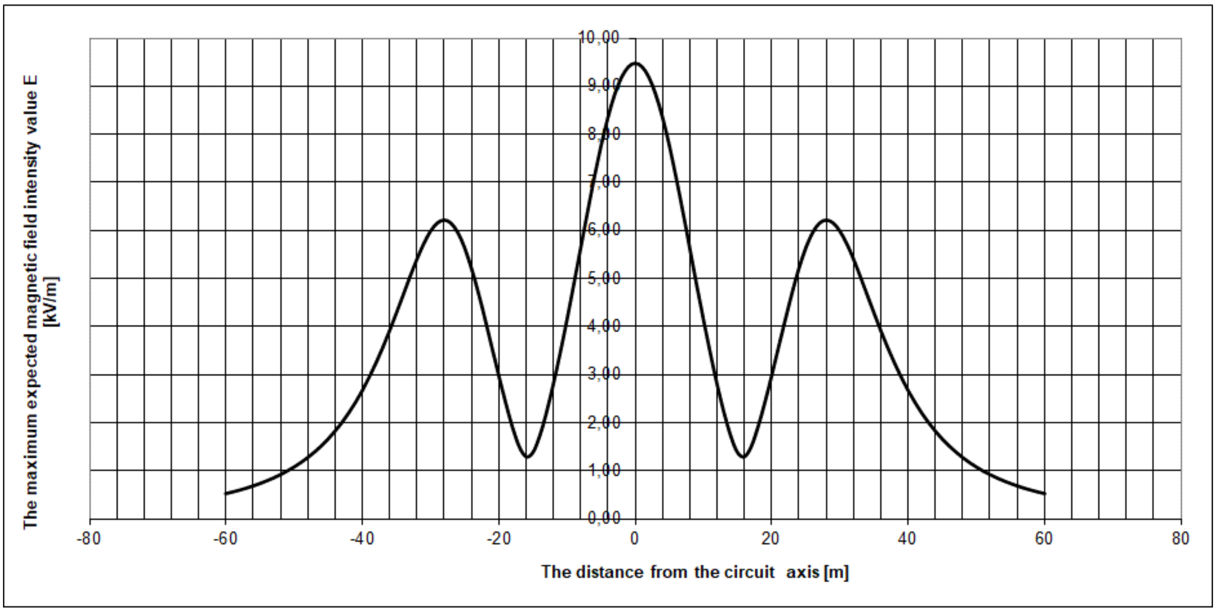


Figure 6.27. Maximum expected value of the electric field strength (H) at a height of 2.0 MAGL as a function of distance from the axis of two, 1-circuit 400 kV overhead lines that run parallel. The calculations were made for the phase configuration marked with the letter B [Figure 6.24] [Source: internal materials]

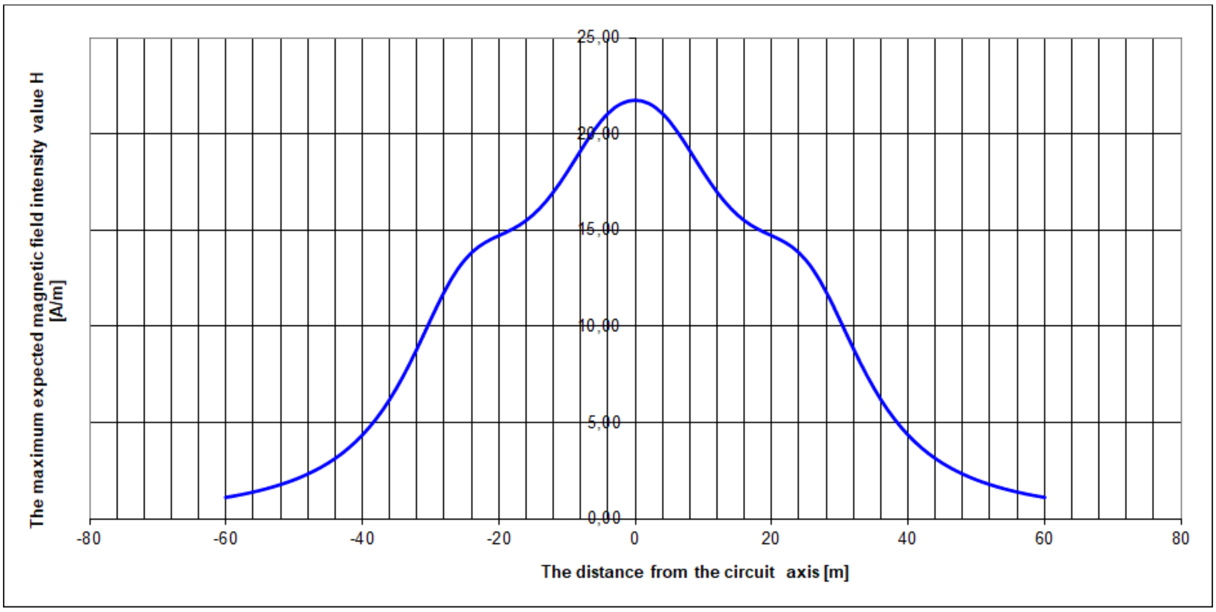


Figure 6.28. Maximum expected value of the magnetic field strength (H) at a height of 2.0 MAGL as a function of distance from the axis of two, 1-circuit 400 kV overhead lines that run parallel. The calculations were made for the phase configuration marked with the letter B [Figure 6.24] with the maximum load capacity for each circuit I = 950 A [Source: internal materials]

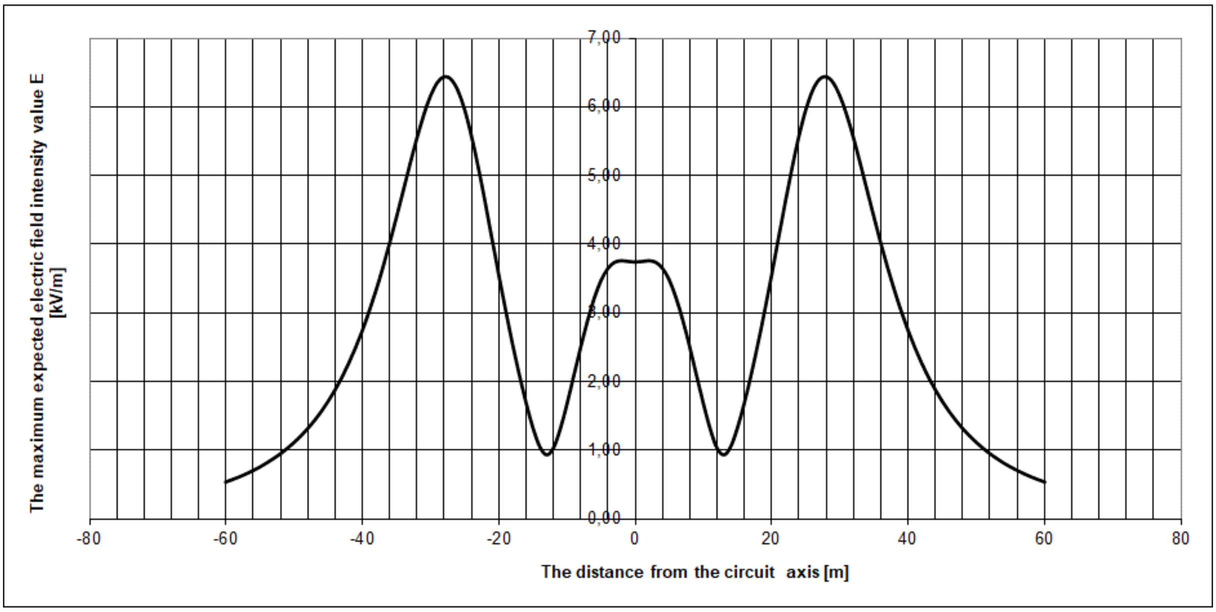


Figure 6.29. Maximum expected value of the electric field strength (H) at a height of 2.0 MAGL as a function of distance from the axis of two, 1-circuit 400 kV overhead lines that run parallel. The calculations were made for the phase configuration marked with the letter C [Figure 6.24] [Source: internal materials]

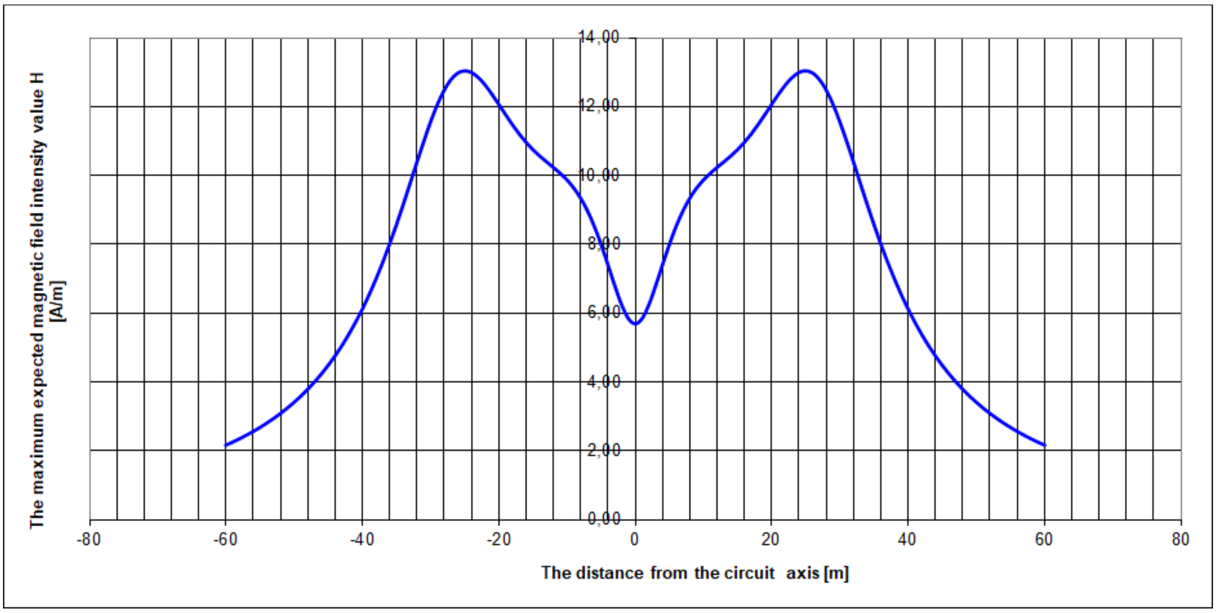


Figure 6.30. Maximum expected value of the magnetic field strength (H) at a height of 2.0 MAGL as a function of distance from the axis of two, 1-circuit 400 kV overhead lines that run parallel. The calculations were made for the phase configuration marked with the letter C [Figure 6.24] with the maximum load capacity for each circuit I = 950 A [Source: internal materials]

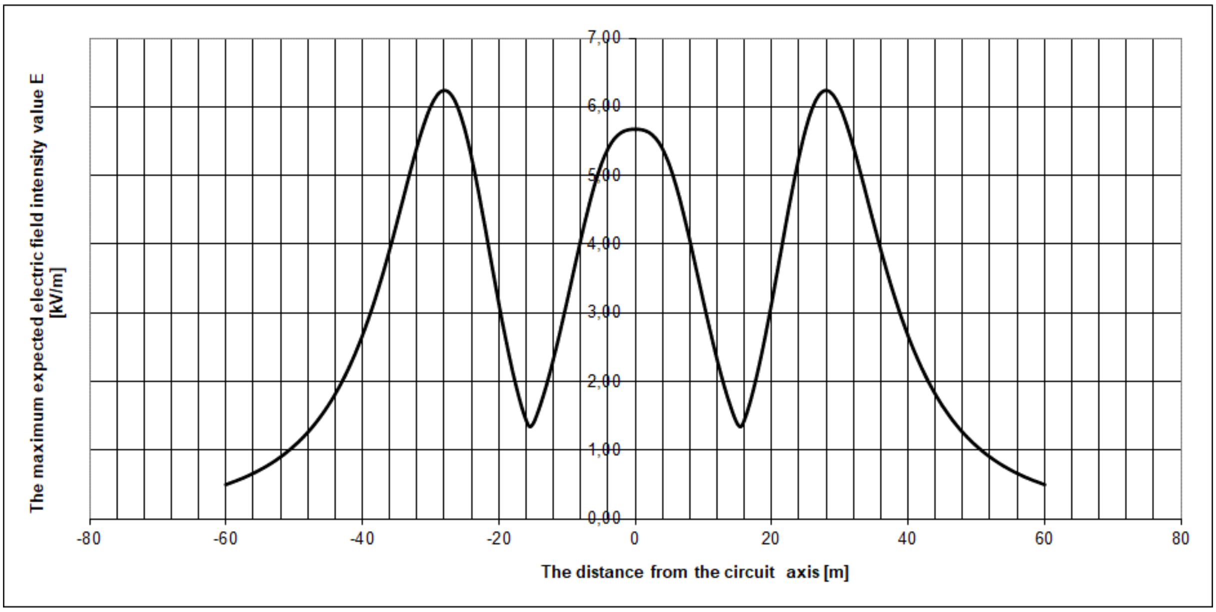


Figure 6.31. Maximum expected value of the electric field strength (H) at a height of 2.0 MAGL as a function of distance from the axis of two, 1-circuit 400 kV overhead lines that run parallel. The calculations were made for the phase configuration marked with the letter D [Figure 6.24] [Source: internal materials]

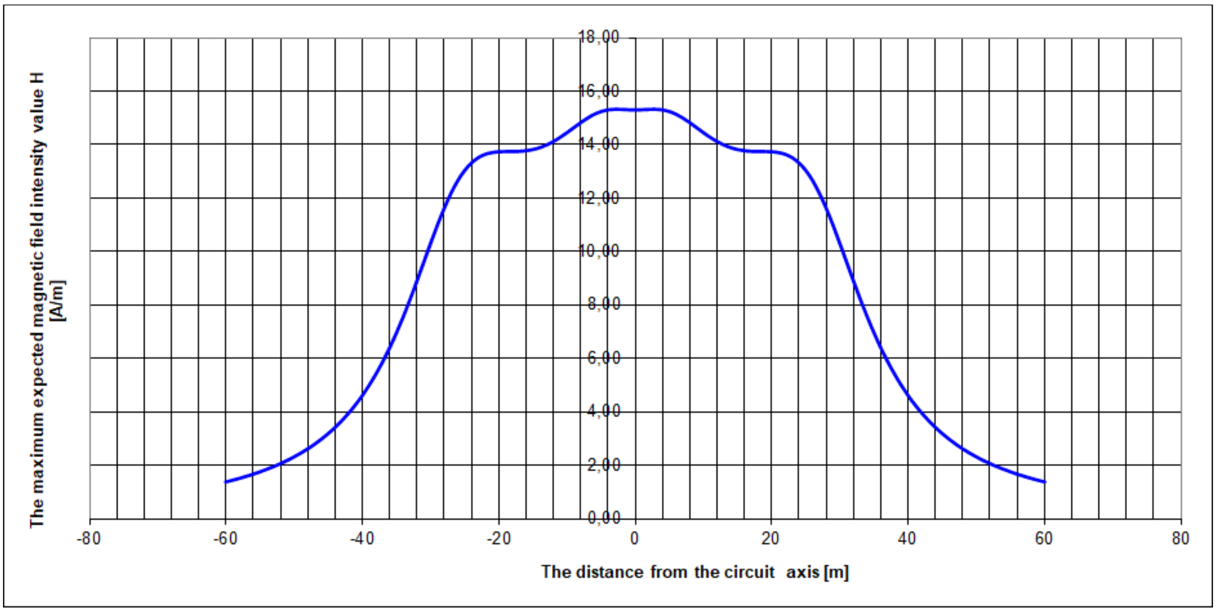


Figure 6.32. Maximum expected value of the magnetic field strength (H) at a height of 2.0 MAGL as a function of distance from the axis of two, 1-circuit 400 kV overhead lines that run parallel. The calculations were made for the phase configuration marked with the letter D [Figure 6.24] with the maximum load capacity for each circuit I = 950 A [Source: internal materials]

The calculations conducted for the smallest distance of phase circuits from the ground ($h = h_{min} = 12$ m), indicated that the intensity of the electric field (E) under the line (at any location at a height of 2.0 MAGL) will not exceed at any location under the line, regardless of the configuration of the phase circuits, the value of 9.5 $kV \cdot m^{-1}$. However, the lowest value of this parameter ($E = 6.2\ kV \cdot m^{-1}$) should be expected for the phase configurations marked with D.

The calculation results show clearly that, irrespective of the phase configuration in a transmission line consisting of two parallel 400 kV single-circuit overhead lines at a distance of 30 m from each other, the intensity of electric field (E) determined at an altitude of 2.0 MAGL at any location in the vicinity of the line shall not exceed the permissible value (10 kV·m^{-1}) set forth in the applicable regulations on the protection against electromagnetic fields.

In the strip with a width of approx. 102–104 m (depending on the selection of the phase configuration) under the transmission circuit analysed, areas may occur inside which the electric field intensity will exceed the value of 1 kV·m^{-1}, i.e. the admissible value for the areas intended for residential development.

The calculations of the expected maximum magnetic field intensity values conducted for the smallest distance of phase circuits from the ground ($h = h_{min} = 12$ m), indicated that the intensity of the magnetic field (H) under the line (at any location at a height of 2.0 MAGL) will not exceed at any location under the line, regardless of the configuration of the phase circuits, the value of 21.7 kV·m^{-1}, and the lowest value of this parameter (H = 13 A·m^{-1}) should be expected for the phase configurations marked with A and C.

The analysis conducted indicates that the most favourable variant in terms of the environment protection against EMF is the one marked with D, and only slightly less favourable variants are A and C. Variant B is the most unfavourable one.

The impact of the electromagnetic field in the operation phase due to the impossibility of exceeding the permissible individual electromagnetic field components shall be low – insignificant.

6.1.5.7 Impact on nature and protected areas

6.1.5.7.1 Impact on biotic elements in the onshore area

6.1.5.7.1.1 Fungi

In the project operation phase, potential impacts on the fungal biota may be related to:

- the change of habitat conditions due to the location of the cable connection and the surface area of land occupied;
- service works as well as local damage to the top layer of the soil and habitats.

These will be local impacts of low significance.

6.1.5.7.1.2 Lichens

In the project operation phase, potential impacts on the lichen biota are similar to those on the fungal biota and may be associated with the change of habitat conditions and performance of service works.

These will be local impacts of low significance.

6.1.5.7.1.3 Mosses and liverworts

In the project operation phase, potential impacts on mosses and liverworts may be associated with the change of habitat conditions and damage to the top layer of the soil and habitats during service works.

These will be local impacts of low significance.

6.1.5.7.1.4 Vascular plants and natural habitats

In the project operation phase, potential impacts on vascular plants and natural habitats may be associated with the change of habitat conditions as well as damage to the top layer of the soil and habitats during service works.

These will be local impacts of low significance.

6.1.5.7.1.5 Forest complexes

The route of the underground cable lines will involve permanent deforestation within a permanent technical belt with a width of approximately 25 m and a length of approximately 5 km (no clearings are planned in the area of trenchless crossings), covering a maximum area of 15 ha. The route of the underground cable lines within the permanent technical belt will run across 58 forest plots belonging to the RDSF in Gdańsk. Fresh mixed coniferous forests (57%) and fresh coniferous forests (31%) are predominant in this area, with pine as a dominant species. More than 66% of the surface area of forests is occupied by commercial forests.

In compliance with the Environmental Protection Plan for the years 2014–2023 of the Choczewo Forest District (RDSF in Gdańsk), the surface area of the Choczewo Forest District is 17 572 ha. Permanent deforestations will have a local scope. The loss of forest resources for the entire Choczewo Forest District will be only 0.08%.

The impacts of the planned project connected to the felling of trees will be negative, direct, primary, irreversible, local, and permanent.

6.1.5.7.1.6 Invertebrates

In the project operation phase, the potential impacts on the fauna of invertebrates may involve the destruction of habitats and microhabitats as a result of maintenance works.

These will be local impacts of low significance.

6.1.5.7.1.7 Ichthyofauna

In the operation phase, **no impacts on ichthyofauna are expected**. Due to the extremely low water levels, which have been observed for many years, despite the presence of potential hiding places, shading, stream bed diversity etc., the watercourses surveyed are characterised by a low ichthyological diversity (subsection 3.19.1.7).

6.1.5.7.1.8 Herpetofauna

In the project operation phase, the potential impacts on the herpetofauna may involve the destruction of habitats as a result of service works.

These will be local impacts of low significance.

6.1.5.7.1.9 Birds

In the project operation phase, potential impacts on birds may be related to:

- the location of the underground cable lines:
    - change of habitat conditions due to the location of the cable connection and the surface area of land occupied,
    - performance of service works and scaring of birds;

- the location of the 400 kV overhead line connecting the customer substation with the PSE substation:
  - risk of bird collisions with the wires,
  - impediments to migration.

After the construction phase is completed, the land will be subject to succession process, new habitats that will be used by birds will be formed, which will mitigate the effects of the land transformation and fragmentation in forest areas. For at least 3 bird species the deforestation of the project area will make the area attractive as a breeding site. The species are: the tree pipit (*Anthus trivialis*), the European nightjar (*Caprimulgus europaeus*) and the woodlark (*Lullula arborea*). It should be noted that the European nightjar and the woodlark are bird species regarded as belonging to the valuable resources.

In terms of long-term impacts, the project in the form of underground cable lines will not cause negative impacts on birds – breeding, wintering or migratory species.

These will be moderate impacts of a local scale.

In the operation phase of the 400 kV overhead line connecting the customer substation with the PSE station, significant negative impacts may occur, mainly during unfavourable atmospheric conditions and the associated lower altitudes of bird flights. According to the results of the annual inventory of abiotic and biotic resources in the BP OWF CI survey area (Appendix 1. Report on inventory survey), the arable farmland area was not a place of concentration for any bird species, also during harvesting and ploughing periods, when birds frequently use the readily available food resources exposed during fieldwork. However, during migration periods the flux of birds is concentrated along the coast of the Baltic Sea, forest areas and over farmland areas. High risk of bird collision with the planned HV line is forecast in this context. In the case of migratory birds, the impact will be significant on a continental scale as well.

6.1.5.7.1.10 Mammals

During the project operation phase, the potential impacts on mammals may involve animal disturbance as a result of maintenance works. After the construction phase is completed, the land will be subject to succession process, new habitats that will be used by animals will be formed, which will mitigate the effects of the land transformation and fragmentation. In a long-term perspective, the project will not generate negative impacts on mammals.

These will be local impacts of low significance.

6.1.5.7.2 Impact on protected areas

6.1.5.7.2.1 Impact on protected areas other than Natura 2000 sites

6.1.5.7.2.1.1 Coastal Protected Landscape Area

Given the nature of the planned project, including mainly the underground route, no negative impact is expected on the landscape being protected as the Coastal Protected Landscape Area. Four cable chambers will be visible in the forest landscape. These are cuboid facilities with small dimensions (with a side length of a few metres at most). The operation phase of the planned project is associated with permanent felling of trees along a distance of approximately 5 km, over an area of up to 15 ha. The main impacts will be related to the appearance of a deforested area with a width of 25 m along a distance of approximately 5 km. However, this space will not be occupied by man-made elements that will be visible in the area. Paved roads will be constructed along the infrastructure of the underground cable lines.

The remaining operation phase impacts will mainly concern vegetation (subsection 6.1.5.7.1.4) and birds (subsection 6.1.5.7.1.9).

The customer substation and the 400 kV overhead line are located outside the borders of the Coastal Protected Landscape Area.

The applicable legal act for the Coastal Protected Landscape Area is the Resolution No. 458/XXII/12 of the Pomeranian Voivodeship Regional Assembly of 25 July 2016 on the protected landscape areas in the Pomeranian Voivodeship, which includes the provisions on ecosystem protection and prohibitions arising from the protection needs.

Pursuant to Article 24 of the Act on Nature Conservation (Journal of Laws 2004 No. 92, item 880, as amended), the prohibitions listed in the Resolution do not apply to public purpose investments, such as the planned project.

The impact on the Coastal Protected Landscape Area in the APV operation phase will be moderate and of local range.

6.1.5.7.2.1.2 Ecological area "Torfowisko" [Peat bog] in Szklana Huta

In its operation phase, the planned project will be limited to service works once per year. For such purposes, the road running through the site will be used as an access road to the cable chambers. The use of this road poses a potential risk of surface water, groundwater and soil contamination due to possible leakage of petroleum substances from vehicles and construction machinery. The ecological area is a poor fen, which is a sensitive ecosystem important for the preservation of biological diversity. In this context, **the scale of impact on the ecological area was assessed as high, and the significance of impact as important.** However, it should be remembered that the contaminations of soil and water are unlikely and concern only the short-term maintenance works.

6.1.5.7.2.1.3 "Źródliska Bezimiennej" ecological area

In its operation phase, the planned project will be limited to service works once per year. Therefore, there will be no impact on the "Źródliska Bezimiennej" ecological area, which is located away from access roads.

6.1.5.7.2.2 Impact on Natura 2000 sites

As demonstrated in section 6.3, thanks to the application of measures minimising the negative impact on habitat 2180 Wooded dunes of the Atlantic, Continental and Boreal region, no significant negative impact on the integrity of the area is expected. The planned project, in the APV, will have no impact on Natura 2000 sites.

These will be local impacts of low significance.

6.1.5.7.3 Impact on wildlife corridors

The planned project crosses the Coastal Wildlife Corridor of supra-regional importance and is also located within the East Atlantic Flyway, which runs along the southern boundary of the Baltic Sea. After the construction phase is completed, the land will be subject to a succession process, new habitats used by birds and animals will be formed, which will mitigate the effects of the land transformation and fragmentation in forest areas. The planned underground cable line project will not cause impacts that could affect migration routes of birds or other plant and animal species. The planned project will not pose an obstacle to the movement of animals, so there will be no barrier effect.

These will be local impacts of low significance.

The 400 kV line and the customer substation are located outside the forest area and the Coastal Wildlife Corridor.

The operation of the planned 400 kV line along the section of 270 m connecting the customer substation with the PSE substation may negatively impact the East Atlantic Flyway due to the high risk of bird collision with the planned high voltage line.

These will be significant impacts.

6.1.5.7.4 Impact on biodiversit

The planned project does not pose a threat to biodiversity. The most valuable natural areas (characterised by the highest biodiversity) will be crossed by a trenchless method and no tree felling will be carried out there. Having analysed the project impact on particular forms of nature conservation and biotic elements, it can be concluded that there will be no impacts that could pose a significant risk of permanent loss of habitats and species. The only threats may occur in the vicinity of the ecological area “Torfowisko” [Peat Bog] in Szklana Huta due to service works and potential contamination of surface water, groundwater and soils caused by possible leakage of petroleum substances from construction vehicles and machinery along the road crossing the site. However, it should be remembered that soil and water contamination is unlikely and concerns only short-term maintenance works (once per year). Moreover, it was concluded that the operation of the project will have a significant impact on birds due to the construction of the 400 kV overhead line connecting the two substations. The planned project will involve permanent forest felling and in this case the significance of the impact was assessed as important.

With the application of mitigating measures, the impact of the operation phase of the connection infrastructure was assessed as moderate.

6.1.5.8 Impact on cultural values, monuments and archaeological sites and objects

In the operation phase, the planned project will have no impact on cultural values, monuments and archaeological sites and objects due to its location beyond their occurrence as well as at a significant distance from them.

6.1.5.9 Impact on the use and development of the land area and tangible goods

In the operation phase, the planned project in the permanent technical belt with a width of 25 m, will be subject to some limitations connected to the necessity to ensure power transmission safety. A red perforated cable warning tape will be stretched over the cables along the entire length of the 220 kV cable lines. On the surface of the terrain, the route of the lines will be marked with marker posts where possible.

Along the cable lines, paved roads will be constructed to provide access to the cable lines. The land use in the area of the customer substation and the 400 kV overhead line will change from agricultural to industrial.

These will be local impacts of low significance.

6.1.5.10 Impact on landscape, including the cultural landscape

Due to the nature of the planned project, including mainly the underground structures, no negative impact on the landscape, including the cultural landscape is expected, since the planned project is to have a mid-forest location.

These will be local impacts of low significance.

During the operation phase, a new facility will appear in the previously undeveloped area, namely a customer substation. The following facilities will be located within the substation boundaries: an infrastructure building, a 400 kV switchgear building, a 220 kV switchgear building, a 220 kV or 275 kV switchgear building and a building for fire tanks and pumps.

The substation will be built on agricultural land class 5, approximately 900 m west of the nearest buildings in Osieki Lęborskie and approximately 3 km away from the buildings in Lubiatowo. The area is not attractive in terms of landscape or tourism. There are no forms of nature conservation in place. The customer substation will be visible from the nearby Osieki Lęborskie – Lublewko municipal road and from the neighbouring buildings in Osieki Lęborskie and Lublewko. Therefore, it will have larger or smaller (depending on subjective assessment of the observer) impact on the landscape.

The customer substation will constitute a new anthropogenic element in the agricultural landscape, set against the background of forests, therefore its impact on the landscape will be smaller than in the case of location in the open space.

These will be significant, permanent impacts of a local scale.

The proposed 400 kV line set on class 4a agricultural land will be a new linear element of landscape anthropisation, surrounded by forests and farmland.

The assessment of the impact of the overhead line on the landscape depends on the following components [8]:

- a lattice tower of the EHV line is an alien element in the landscape, given its technical character and the impossibility of masking the tall structure;
- as the viewing distance from the lattice tower increases, the dissonance in the landscape clearly decreases, which is mainly due to the fact that the tower is an openwork structure, blurring into the landscape at a distance of 2–3 km (considering the two basic types of transmission towers – lattice and tubular – in general, lattice towers affect the landscape to a lesser extent because due to the openwork structure they are less visible against the background of the sky and offer a quicker blurring effect as the distance from the observer increases);
- an important characteristic of lattice towers, which affects their perception in the landscape, is the colour of their construction – grey towers offer an effect of blurring into the landscape, especially in cloudy weather, while green (olive-coloured) towers blur into the landscape when viewed against the background of a forest, etc.;
- an important determinant affecting the perception of the towers, which varies over time, are the weather conditions; in particular the cloud cover and the direction of illumination of the towers;
- the terrain in the surrounding area and its coverage by woody (forest) vegetation have a crucial impact on the perception of the towers;

- the exposure of the towers in the landscape and their negative perception is strongly influenced by their location on the axis of roads or along their course, when they are dominant in the landscape and remain within the range of visibility of observers driving towards them for a long time.

The main components of the planned 400 kV overhead line that will affect the landscape are:

- the use of lattice towers with a height of approximately 56 m;
- a 270 m long line that will connect the customer substation with the PSE substation;
- the use of bird scaring devices, e.g. FireFly;
- location against the background of a forest, in an agricultural area with flat terrain;
- location away from residential areas: approximately 900 m west of Osieki Lęborskie and approximately 3 km from Lubiatowo;
- location approximately 650 m from the Osieki Lęborskie – Lublewko road;
- course outside the forms of nature protection.

The planned 400 kV line will be visible from the nearby Osieki Lęborskie – Lublewko municipal road and the neighbouring buildings of Osieki Lęborskie and Lublewko. Due to the presence of forests in the surrounding landscape, it will not be visible from Lubiatowo.

The impact of the 400 kV line on landscape will be significant, permanent and of local range.

6.1.5.11 Impact on population, health and living conditions of people

The major nuisances related to the functioning of the project discussed involve the emission of heat, noise and electromagnetic radiation from the 220 or 275 underground lines, the 400 kV overhead line and the customer substation:

- 220 or 275 kV underground cable lines:
  - will not cause a significant thermal impact – at a distance of more than 5 m from the outermost cable lines the thermal impact will be at the level of several degrees above the assumed ground temperature,
  - will not cause the exceedance of the 50 Hz magnetic field threshold (60 $A \cdot m^{-1}$) for areas accessible to the public, and the anticipated impact of the electric field strength (over 1 $kV \cdot m^{-1}$) will be contained within the entire route of the designed line,
  - will not cause any impact on the surrounding landscape considering the mid-forest location,
  - will improve the operation of the power system in the region, including an increase in its reliability, which will improve the supply of electricity to people's living and working facilities, including ensuring continuity, and consequently, will improve people's living conditions;

- 400 kV overhead line:
  - the maximum value of the sound level in the most unfavourable operating conditions of the line (bad weather) will not exceed at any point beneath the line (at the height of 4.0 MAGL) the value of 52.8 dB, which means an exceedance by 7.8 dB of the permissible value established in the Regulation of the Minister of the Environment of 14 June 2007 on permissible noise levels in the environment (Journal of Laws of 2007, No. 120, item 826, as amended) [Table 3.27; subsection 3.17] for residential development areas at 45 dB,

  - the area of land under the above-mentioned system of 400 kV overhead lines running in parallel, where the calculation analyses indicate the exceedance of the permissible value of 45 dB (for residential development areas) extends (at the height of 4.0 MAGL) to the distance of 39 m from the line axis in both directions,
  - given the possibility of the permissible value of noise level (45 dB) being exceeded, the construction of residential buildings is not possible within the belt with a width of 78 m (2 x 39 m) along the parallel 400 kV overhead line system,
  - will improve the operation of the power system in the region, including an increase in its reliability, which will improve the supply of electricity to people's living and working facilities, including ensuring continuity, and consequently, will improve people's living conditions;
- the customer substation will not cause an exceedance of the permissible value of the sound level determined for the night-time (40 dB) and daytime (50 dB) in the area of the nearest protected buildings, including the planned and existing residential buildings.

In the APV, the planned project will not result in the deterioration of the environmental living conditions for humans, and its operation will improve the living conditions of the inhabitants in terms of power supply for the domestic and commercial needs.

These will be moderate impacts of a local scale.

6.1.6 Decommissioning phase

As the decommissioning phase of the BP OWF CI is not intended, no environmental impacts will occur. Cessation of the underground cable line usage will be associated with land reclamation in the direction of the forest. Impacts associated with the decommissioning of the customer substation and the 400 kV overhead line will be identical to those in the construction phase. As a result of the decommissioning of the facilities, the area will be reclaimed in the primary direction, namely agricultural use.

6.2 Rational Alternative Variant (RAV)

OFFSHORE AREA

In the offshore area of the BP OWF CI, the differences between the APV and the RAV will result from a different path and length of the planned cable line routes. The impact analysis has shown that the implementation of the RAV will entail the occurrence of impacts, the scale and significance of which will be analogous to those identified for the APV. It is also not anticipated that any other elements of the marine environment than those described in the APV will be impacted.

ONSHORE AREA

For the purposes of the planned project implementation in the RAV the following belts have been designated:

- **permanent belt,** 70 m wide – the area directly connected to construction works, includes spot locations of towers. Within the permanent belt, the surface layer of the ground and forest floor litter will be destroyed, the trees and shrubs will be removed due to the location of the overhead line. The removal of trees and shrubs is permanent;

- **technological belt,** 25 m wide from the external overhead lines – the area indispensable for the correct operation of the overhead line and the equipment related, involving permanent clearance;
- **additional belt**, 250 m wide from the external cable lines – an area through which access roads may run [Figure 6.33].

The RAV beginning point in the form of cable chambers and end point in the form of a customer substation and a 400 kV overhead line are the same as in the APV – their impacts are identified in subsection 6.1.

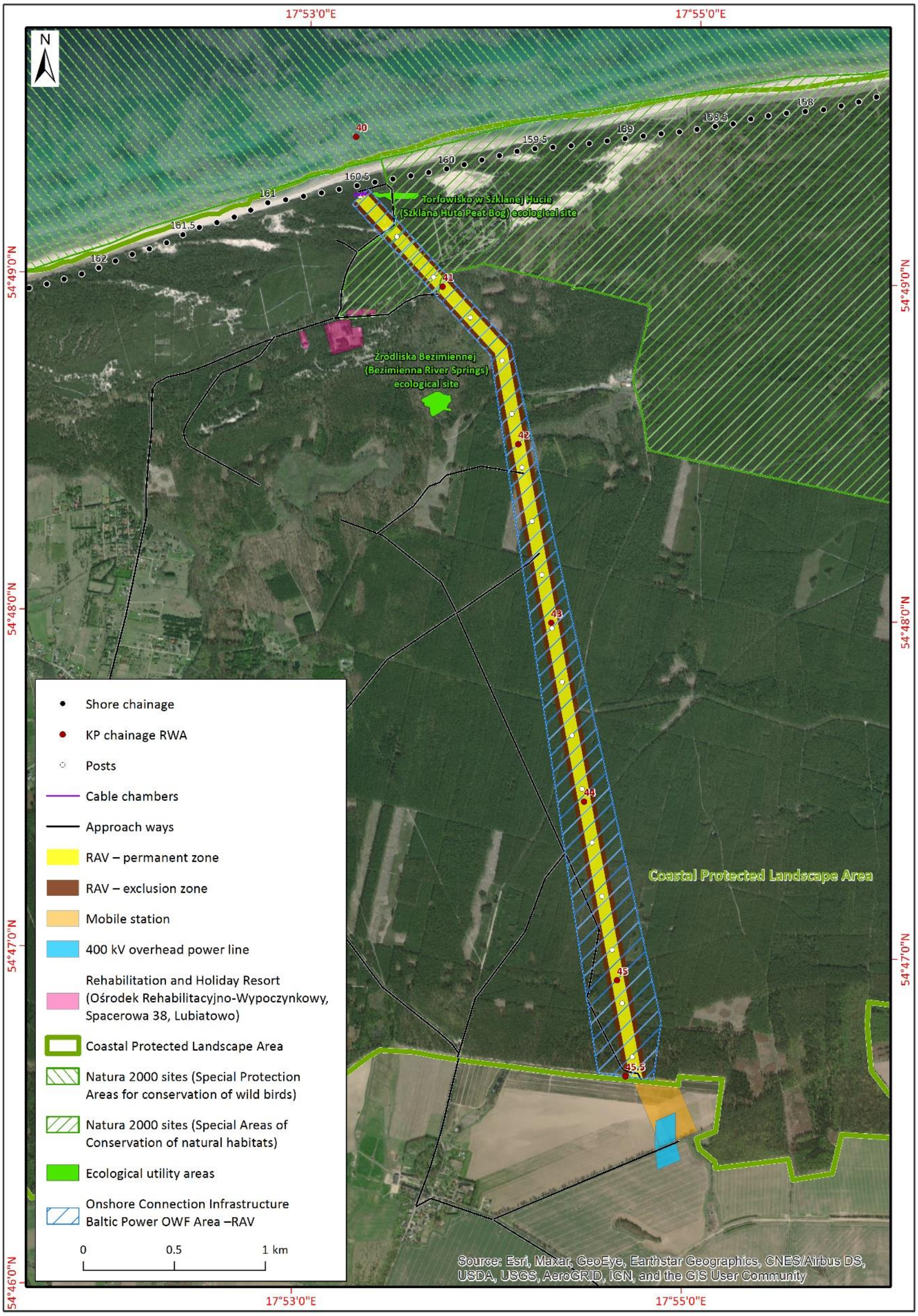


Figure 6.33. Planned project in the Rational Alternative Variant (RAV) [Source: internal materials]

6.2.1 Construction phase

6.2.1.1 Impact on geological structure, coastal zone, soils, and access to raw materials and deposits

The assessment of impact on geology and surface formations was based mainly on a detailed geological map of Poland at a scale of 1:50 000, digital geological data of the Polish Geological Institute – National Research Institute (PGI NRI), data from MIDAS service managed by PGI NRI and on deposit data sheets generated from the service.

The assessment of impact on soils was based on digital data obtained from the Institute of Soil Science and Plant Cultivation State Research Institute in Puławy (SSPC SRI) and from the State Forests, as well as on the literature materials listed in the list of literature references.

6.2.1.1.1 Impact on geological structure

Due to the planned project implementation, the following is planned:

- the construction of a borehole using the HDD or HDD Intersect method across the coastal zone with a length of approx. 1.5 km;
- the construction of an excavation for 4 cable chambers with a depth of approx. 2 m;
- the construction of point excavations for overhead line towers – 18 pcs. with dimensions 10 x 8 m and a depth of up to 4 m (for pile towers, pile driving up to a depth of 15 MBGL);
- permanent deforestation within the permanent belt with a width of 70 m and within the technological belt with a width of 25 m from the external power lines (in total, deforestation within a 120 m wide belt along 5.2 km);
- the levelling of the area for the erection of a customer substation and around cable chambers;
- the construction of access roads and material and equipment base within the area of the customer substation.

The main construction phase impacts on geology and surface formations will be connected to:

- the construction of 4 boreholes at a distance of approx. 210 m from the shoreline and a distance of approx. 20 m from one another;
- the construction of excavations for overhead line towers as well as for the purposes of cable chambers and boreholes;
- pile driving;
- levelling works related to levelling of the area for the erection of a customer substation and in the area of cable chambers.

Moreover, the impacts will be connected to aeolian erosion and possible contamination of open excavations with greases, oils, etc.

Apart from the tower sites designed, essentially, no other construction works will be carried out.

Since the maximum depth of excavations will not exceed 4 m and the pile towers will be driven up to a depth of 15 MBGL; the construction of the planned project will not affect the deeper geological layers.

The cable chambers (4 chambers with a depth of 2 m and a side length of several meters at maximum) are to be placed in excavations with a depth of approx. 2 m, which will be backfilled later. The surplus earth will be managed within the RAV permanent technical belt.

The excavation for the 18 prefabricated tower foundations will have 8 x 10 m in size and up to 4 m in depth at maximum. It is planned to drive pile-foundation towers to a depth of approx. 15 MBGL on weak soils (sands, peats).

For a single tower site, four excavations will be prepared for four foundations. The support structure foundations will be compliant with standards and requirements, and the types of foundations for all tower site locations will be selected considering the existing geotechnical conditions, specified on the basis of detailed surveys of soil geotechnical parameters, which will be carried out at the stage of advanced technical engineering. Changes to the ground surface and the subsurface soil layer will be limited to the tower sites and at a scale of the entire project will have a spot character. The soil removed from the excavations will be used for foundation backfilling. Proper soil compacting will eliminate the risk of soil settlement in the area of foundations.

An increased impact scale should be expected in the case pile foundations are used, which are applied for land areas characterised by unfavourable soil and water conditions (weak soils) or high level of groundwater. Then, the penetration of soil may reach an increased level compared to other foundations, as a result of the necessity to apply the pile driving process (piles are driven up to a depth of 15 MBGL).

Some of the excavations will require water draining, which will temporarily disturb the soil-water relations. After the backfilling of the excavations, the soil-water relations will return to equilibrium within a few days.

The construction site facilities and yards, as in the case of the APV, will be located outside protected and waterlogged areas. The main location of the material and equipment stockyard is planned at the customer substation area, back-up yards are planned in the village of Osieki Lęborskie. A temporary construction site facilities are permitted in the vicinity of cable chambers. The construction site back-up facilities and material-equipment bases will be equipped with portable sanitary facilities with airtight containers, systematically emptied by specialist companies, while the possible leakages will be neutralised with petroleum product neutralising agents; the staff will be instructed on how to use such agents.

The implementation of the planned project will require ground levelling in the area of the customer substation and the cable chambers. The soil will be managed within the customer substation area and the technical belt, its surplus will be handed over to specialist companies to be managed in accordance with the applicable regulations.

Due to the necessity to access the project area and storage bases, it is planned to use the existing roads and construct new ones.

The degree of the planned project impacts described above depends on the sensitivity of land conditioned by the type of surface formations. The areas the most vulnerable to the construction phase impacts are dune areas as well as areas with high level of groundwater deposition. The most valuable dune area, at which the aeolian sands susceptible to wind erosion and infiltration of possible pollutants such as oil spills are present is the Wydmy Lubiatowskie dunes. An area vulnerable in geological terms to the infiltration of pollutants, which is due to a high level of groundwater deposition, are alluvial mud and humus sand formations of endorheic depressions and valley bottoms at km 41+000 to 41+760.

The remaining part of the planned project route leads through areas of alluvial, aeolian sands and glacial tills, characterised by greater resistance to wind erosion and potential pollution with greases and oils than aeolian sands on dunes. The planned customer substation is located on sandy-silty eluvia of glacial tills and on glacial tills.

The main material and equipment stockyard is located in the area of the planned customer substation on the ground consisting of glacial tills. The back-up yard in Osieki Lęborskie is located in half on glacial tills and in half on humus sands and alluvial muds.

No landslides were identified in the area analysed.

The assessment of surface formation resistance to the construction phase impact for the RAV is identical to the APV and is included in subsection 6.1.4.1 [Table 6.18].

Table 6.77 presents the assessment of impacts on the surface formations.

Table 6.77. Characteristics of the construction phase impacts on the surface formations for the Rational Alternative Variant (RAV) [Source: internal materials]

No.	Impacts	Types of surface formations	Nature of impact	Type of impact	Impact range	Temporal scope of impact	Impact scale	Impact sensitivity	Impact significance
1.	Disturbance of surface formations (point-wise excavations and piles)	Aeolian sands	Negative	Direct, primary, reversible	Local	Momentary	Moderate	Low	Low
		Alluvial sands					Low	Low	Negligible
		Glacial tills and eluvial deposits					Low	Low	Negligible
		Alluvial muds and humus sands					Low	High	Low
2.	Levelling works for the erection of the power substation and in the area of cable chambers	Aeolian sands	Negative	Direct, primary, permanent	Local	Momentary	Moderate	Low	Low
		Glacial tills					High	Low	Low
		Sandy-silty eluvial deposits of glacial till					Low	Low	Negligible
3.	Wind erosion	Aeolian sands	Negative	Indirect, primary, reversible	Local	Momentary	Moderate	High	Moderate
		Alluvial sands					Low	Low	Negligible
		Glacial tills and eluvial deposits					Low	Low	Negligible
		Alluvial muds and humus sands					Low	Low	Negligible
4.	Oil and grease contamination (roads, storage yards, back-up facilities)	Aeolian sands	Negative	Direct, primary, reversible	Local	Momentary	Low	High	Low
		Alluvial sands					Low	Low	Negligible
		Glacial tills and eluvial deposits					High	Low	Low
		Alluvial muds and humus sands					Moderate	Moderate	Moderate

The characteristics of the construction phase impacts for the RAV is similar as for the APV and described in subsection 6.1.5.1.1.

Summing up, the impact of the planned 220 or 275 kV overhead line on the geological structure will be as insignificant as in the case of an underground cable line.

6.2.1.1.2 Impact on the topography and dynamics of the coastal zone

The impact on the topography and dynamics of the coastal zone connected to the levelling works in the area of cable chambers will be identical as in the APV (subsection 6.1.5.1.2). Similarly to the APV, the shore structure will not be disturbed as a result of drilling.

The overhead line construction phase involves the necessity of permanent deforestation of the area within the permanent belt and the technological belt, 70 and 25 m wide from the external power lines, respectively. As a result of the project implementation, the permanent deforestation within a 120 m wide and 5.2 km long strip of land would take place.

Although in the RAV no earthwork will be carried out at the same scale as in the APV, the deforestation of dunes in an approx. 120 m wide strip and the erection of power grid masts involves a high probability (higher than in the case of the APV) of triggering aeolian processes within the Wydmy Lubiatowskie dunes. As a result of triggering such processes, significant changes to the nature of the relief may occur both within the investment belt as well as in the neighbouring areas. As a result of the aeolian processes triggering, the elements of infrastructure can become exposed or buried by the sandy aeolian material transported. The dune processes may significantly affect the neighbouring habitats.

In this context, the scale of the construction phase impact on the Wydmy Lubiatowskie dunes was determined as high, and the significance of impacts related to the possibility of triggering aeolian processes within the Wydmy Lubiatowskie dunes was assessed to be significant.

The assessment of the coastal zone resistance to the construction phase impact for the RAV is identical to the APV and is included in subsection 6.1.4.1 [Table 6.20].

Summing up, the impact on the topography and dynamics of the coastal zone will be higher in the case of the RAV implementation, due to a definitely greater scale of the tree falling areas as well as higher probability of aeolian processes triggering within the Wydmy Lubiatowskie dunes [Table 6.78].

Table 6.78. Characteristics of the construction phase impacts on the coastal zone for the Rational Alternative Variant (RAV) [Source: internal materials]

No.	Impacts	Elements of the coastal zone	Nature of impact	Type of impact	Impact range	Temporal scope of impact	Impact scale	Impact sensitivity	Impact significance
1.	Levelling works	Beach	None	-	-	-	Irrelevant (HDD or HDD Intersect)	No impact	Negligible
		Wydmy Lubiatowskie dunes	Negative	Direct/indirect, secondary/primary, reversible	Local	Momentary	Irrelevant (HDD or HDD Intersect)	Moderate	Low
2.	Deforestation	Beach	None	-	-	-	Irrelevant (HDD or HDD Intersect)	No impact	Negligible
		Wydmy Lubiatowskie dunes	Negative	Direct, primary, permanent	Local	Constant	High	High	Important

6.2.1.1.3 Impact on soils

The construction of the planned project will involve a temporary, local occupation of the area connected to the construction of excavations for the tower foundations. The construction of 4 excavations for cable chambers is planned. It is planned to erect up to 18 towers. 4 excavations with dimensions of 8 x 10 m and a depth of 4 m for each are necessary. The surface area of the land occupied by the towers will be approx. 0.5 ha. The pile towers on weak soils (peat and sands) will be driven in up to a depth of 15 m.

The material, from which the tower foundations will be constructed, is non-toxic and chemically neutral, and does not pose a threat to the ground-water environment, including soils.

The planned project is located mainly in the soils of forest complexes, where no separate storage of the humic layer is planned in order to maintain the productive properties of the soil. After the excavation is completed, a belt with a maximum surface area of 60 ha will remain permanently deforested (permanent technical belt and technological belt).

The degree of impact on soils and the main impacts are described in subsection 6.1.4.1.3.

In places, where the level of groundwater is above the excavation bottom elevation, it will have to be drained. It is planned to construct point excavations up to a depth of 4 m. On weak soils, it is planned to erect towers on pile foundations, driven up to a depth of 15 m. In the area of the planned project, there are the following hydrogenic soils:

- fens: from km 40+950 to 41+000, in the western part of the impact area at approx. km 41+100 to 41+500;
- poor fens: from km 41+900 to 42+000;
- complex of gleyic podzols (umbric): from km 41+200 to 41+580, from km 41+750 to 41+800 and in the area of km 42+000.

Sensitivity to erosion depends on the degree of soil formation and structure, as well as on the bedrock and organic matter content. The most sensitive are the early development stage soils, with a loose structure, composed of single, unbound particles, i.e. arenosols. Arenosols occur at km 40+300 to 40+900. In the area of these soils, it will be necessary to erect 2 towers for the planned overhead line. These will be pile foundation towers. Podzolic soils, which occur quite commonly at approximately half of the length of the planned overhead line route, are also sensitive to erosion.

Soils are at risk of contamination with fuels, greases, and oils, used in vehicles and other equipment during construction. Sandy soils, which do not have the capacity to absorb hydrocarbons due to their low organic matter content, are especially sensitive to contamination. Soils from waterlogged areas are similarly sensitive due to the possibility of contamination migration with water. There are no plans to locate storage yards in the area of hydrogenic soils. It is planned to erect two towers on pile foundations on hydrogenic soils.

There are no plans of the construction of new access roads on arenosols, there are plans to use the existing roads.

In relation to the construction of a customer substation, the top soil layer will be removed. It will be necessary to conduct levelling works and construct small scale excavations. The excavated material will be distributed within the technical belt boundaries. As part of the 400 kV overhead line construction, excavations will be made for two towers of the 400 kV line with dimensions of 8 x 10 m and the maximum height of up to 4 m. The surplus soil will be distributed within the substation area.

The assessment of the soil resistance to the construction phase impacts is identical as in the APV (subsection 6.1.4.1.3, Table 6.22).

Table 6.79 presents the characteristics of impacts on soils in the construction phase for the RAV.

Table 6.79. Characteristics of the construction phase impacts on soils for the Rational Alternative Variant (RAV) [Source: internal materials]

No.	Impacts	Type of geological formations	Nature of impacts	Type of impacts	Range of impact	Temporal scope of impact	Impact scale	Impact sensitivity	Impact significance
1.	Disturbance of the soil profile (point excavations and piles)	Arenosols Podzols	Negative	Direct, primary, reversible	Local	Long-term	Moderate (cable chambers)	Low	Low
							Low	Low	Negligible
		Brunic					Low	Low	Negligible
		Hydrogenic					Low	Low	Negligible
		Brown soils					Low	Low	Negligible
		Arenosols					Low	Low	Negligible
2.	Change of the soil-water relations (dewatering)	Arenosols	Negative	Direct, primary, reversible	Local	Short-term	Low	Low	Negligible
		Podzols					Low	Low	
		Brunic					Low	Low	
		Hydrogenic					Low	High	Low
		Brown soils					Low	Low	Negligible
3.	Compacting of soil	Arenosols	Negative	Direct, primary, reversible	Local	Momentary	Low	Low	Negligible
		Podzols					Low	Low	Negligible
		Brunic					Low	Low	Negligible
		Hydrogenic					Low	High	Low
		Brown soils					High	Low	Low
4.	Wind erosion	Arenosols	Negative	Indirect, primary, reversible	Local	Momentary	Moderate (cable chambers)	High	Moderate
		Podzols					Low	Moderate	Low
		Brunic					Low	Low	Negligible
		Hydrogenic					Low	Low	Negligible

No.	Impacts	Type of geological formations	Nature of impacts	Type of impacts	Range of impact	Temporal scope of impact	Impact scale	Impact sensitivity	Impact significance
		Brown soils					Moderate	Low	Low
5.	Contamination with greases and oils	Arenosols	Negative	Direct, primary, reversible	Local	Momentary	Moderate	High	Moderate
		Podzols					Low	Moderate	Low
		Brunic					Low	Low	Negligible
		Hydrogenic					Low	High	Low
		Brown soils					High	Low	Low

Hydrogenic soils, characterised by low resistance to the disturbance of the soil profile, change in the water relations, compacting of soil as well as contamination with greases and oils, are most sensitive to the construction phase impacts. The second type of soils sensitive to the construction phase impacts are arenosols susceptible to wind erosion and contamination with greases and oils.

The scale of impact connected to the disturbance of the soil profile was assessed as small, since this will involve point excavations. The scale of impact on arenosols was assessed as moderate, since the construction of cable chambers is planned in their area. Due to the scale of impact, its significance was assessed as low. On the remaining sections of the route the significance of impact related to the construction of excavations was assessed as negligible.

Since the excavations are planned to be carried out in point locations, the impact scale of the changes in soil-water relations was assessed as small. The impact will have the greatest significance in the case of hydrogenic soils. For hydrogenic soils, the significance of impact was assessed as low, for the remaining types of soil as negligible.

The impact related to the compacting of soils will stem from the location of storage bases and the use of the existing access roads. The location of storage bases is planned on brown soils, therefore the scale of impact was assessed as large. The access roads will be located mainly on brunic soils, podzols and brown soils, and locally on arenosols. The access road in the area of hydrogenic soils will run along a relatively short section, therefore the scale of impact was assessed as small, and the significance of impact as low. There are plans to use the existing access roads in the area of arenosols. The significance of impact on arenosols, podzols and brunic soils was assessed as negligible.

Wind erosion is an impact occurring as a result of the construction of excavations. Since the location of point excavations/piles is possible in all types of soils, the scale of impact on all types of soils (with the exception of arenosols) was assessed as small. Since the trench for the cable chamber will be constructed in the area of arenosols, the scale of impact was assessed as moderate. The soils with the loosest structure, i.e. arenosols, are the most sensitive to wind erosion, while podzols are slightly less sensitive. The remaining types of soils are even less sensitive, thus, the significance of impact on these types was assessed as low. The significance of impact of wind erosion on podzols was assessed as low. The remaining types of soils are less sensitive to wind erosion, thus, the impact was assessed as negligible, with the exception of brown soils, in the case of which the significance was assessed as low, due to the small scale of impact.

Hydrogenic soils and soils with loose structure are the most sensitive to the contamination with greases and oils. The access road in the area of hydrogenic soils will run along a relatively short section, therefore the scale of impact was assessed as small (although this type of soil is sensitive to this type of impact). The significance of impact on hydrogenic soils was assessed as negligible. There are plans to use the existing roads with dirt tracks as access roads to the construction site in the area of arenosols (soils with the most loose structure), which creates the risk of oil contaminants penetrating into the ground. The impact was assessed as moderate. The construction of new access roads is planned in the area of podzols and brunic soils. The impact on podzols was assessed as low, because their structure is more compact than in the case of arenosols, which makes them more resistant to this type of impact. The impact on brunic soils was assessed as negligible. The storage yards, both main and back-up ones, are to be constructed on brown soils. With the implementation of measures protecting against contaminants penetrating into the ground and a proper organisation of back-up facilities, compliant with the legal regulations and good practice, the impact was assessed as low.

Summing up, the impact on soils related to the implementation of the planned project in the RAV was assessed as moderate at most, similarly as in the case of the APV. They are related to the impact of wind erosion and the risk of contamination of arenosols with oils and greases.

6.2.1.1.4 Impact on the access to raw materials and deposits

The planned project is located entirely within the area of Żarnowiec concession No. 5/2019/Ł for the prospection, exploration and production of hydrocarbons of 13 June 2019, owned by ShaleTech Energy Sp. z o.o. It is recommended to communicate with the concession owner in order to coordinate the work schedules. Due to the small scope and technology of earthworks, no impact on the seismic survey results in expected, if at the same time such surveys were to be carried out nearby by the concession owner.

Since the planned project is located at a distance of more than 4 km from the nearest deposit, no construction phase impacts on the deposit and the access to mineral deposits are expected.

No impact on access to raw materials and deposits.

6.2.1.2 Impact on the quality of surface waters

The assessment of the impact on the quality of surface waters in the RAV was carried out in a similar way as for the APV with reference to the SWB data sheets developed as part of the Vistula River Basin Management Plan (Journal of Laws of 2016, item 1911), and also to the monitoring results published by CIEP as part of the State Environmental Monitoring of surface waters published in the Environmental Status Reports for the Pomorskie Voivodeship.

On the basis of the above data, the impact of the RAV implementation on the possibility to achieve the environmental objectives of the Water Framework Directive established in the Regulation of the Council of Ministers of 18 October 2016 on the Vistula River Basin Management Plan (Journal of Laws of 2016, item 1911).

The 220 or 275 kV overhead line designed in the permanent technical belt runs across the following watercourses:

- a watercourse at km 40+620 along an approx. 150 m long section;
- the Bezimienna Stream at km 41+150 along an approx. 125 m long section;
- a watercourse at km 41+730 along an approx. 125 m long section;
- a drainage ditch in the area of the customer substation at km 45+150 to 45+500 along a section of approx. 460;
- a drainage ditch in the area of the 400 kV overhead line at km 46+000 along an approx. 125 m long section.

The planned project is situated in the direct vicinity of small ponds that constitute an ecological area "Torfowisko" [Peat bog] in Szklana Huta. A dirt track that will serve the function of an access road to cable chambers in the construction phase runs across them. A detailed description of the construction phase impacts on ponds is presented in subsection 6.1.4.2.

The scale of impact on ponds was assessed as high, and the significance of impact as significant.

The 220 or 275 kV overhead line will intersect the hydrographic objects without collision. Construction works related to the erection of the line towers (construction excavations for the tower foundations and access roads) will be carried out beyond the areas of hydrographic objects. The watercourse situated closest to the planned tower location is the watercourse at km 40+620. The planned location of the tower in this area may lead to the contamination of surface waters as a result of the potential leak of contaminants from the machinery and construction vehicles during the construction phase.

In this phase of the project, the nature of impacts on the quality of surface waters is connected first of all to the possible contaminations of surface waters with substances used at the construction site. The risk of contamination of water, especially with petroleum products, is connected to the use of various types of specialist machinery at the construction site. No wastewater or materials that could negatively affect the quality of water are to be collected during the project implementation. During the construction phase, the waste and wastewater will be handled in accordance with the applicable regulations and standards. As a result, wastewater and waste will not pose any threat to the quality of surface water.

Due to the fact that none of the support structures will be located in open surface waters, no impact of the project on the quality of surface water is expected.

The assessment of the surface water resistance to the construction phase impacts is identical as in the APV (subsection 6.1.4.2, Table 6.25).

The impacts connected to contamination will be **negative, direct, primary, reversible, local, and short-term. Impact significance: important**.

As part of the work conducted, trees will be felled including grabbing of roots for the construction of the 220 or 275 kV overhead line, which may lead to a change in the watercourse insolation conditions, and consequently in the temperature and oxygenation of water, as well as a limited wood debris supply. Such impacts will be **negative, indirect, primary, irreversible, local, and permanent. Impact significance: moderate.**

The planned project in the RAV will be implemented within the boundaries of the RWBs (River Water Bodies) listed in Table 6.80. A detailed characteristics of the RWBs including the assessment of their status is presented in subsection 3.3.

Table 6.80. Compilation of River Water Body catchment areas intersected by the planned project in the Rational Alternative Variant (RAV) [Source: internal materials http://www.gios.gov.pl/pl/stan-srodowiska/monitoring-wod]

No.	Code	Name	Status	General status	Beginning of intersection	End of intersection	Estimated length of the RWB catchment area intersection [km]
Lower Vistula water region							
1	CWDW1801	Immediate catchment area of the sea	-	-	40+300	44+950	4.65
2	RW200017476925	The Chełst River to its outlet into Lake Sarbsko	HMWB	Bad	44+950	46+000	1.05

HMWB – Highly Modified Water Body

The implementation of the project in the construction phase according to the planned scope and using the adopted technologies (application of methods ensuring local dewatering of excavations for the foundations of towers, no interference with the surface water) will not result in negative impact on hydromorphological, physico-chemical, biological and chemical properties of surface waters, and thus, will not threaten the achievement of environmental objectives specified in the Vistula River Basin Management Plan [334] for the above-mentioned RWBs [Table 6.81, Table 6.82].

Table 6.81. Characteristics of the construction phase impacts on the surface water quality in the Rational Alternative Variant (RAV) [Source: internal materials]

No.	Type of impact	Nature of impacts	Type of impacts	Range of impact	Temporal scope of impact	Impact scale	Significance of impact
1.	Runoff of slurry from the construction site in the vicinity of watercourses	Negative	Direct, primary, reversible	Local	Short-term	Low	Important
2.	Contamination as a result of accidental leaks from machinery and vehicles	Negative	Direct, primary, reversible	Local	Short-term	Low	Important
3.	Removal of trees and shrubs within a 120 m wide strip – change of the insolation conditions of watercourses	Negative	Direct, secondary, permanent	Local	Constant	Moderate	Moderate

Table 6.82. Summary of the impact of the construction of the Baltic Power OWF Connection Infrastructure on Surface Water Bodies (SWBs) in the Rational Alternative Variant (RAV) [Source: internal materials]

SWB code	SWB name	Length of the SWB catchment area intersection [km]	Collisions with watercourses significant within an SWB	Protected areas	Nature value	Method of intersection	Types of impacts on water quality elements	Are the environmental objectives for the SWB threatened by the implementation of work?
CWDW1801	Immediate catchment area of the sea	4.65	Yes	Yes	High	Open excavations for towers	Direct, primary, reversible	No
RW200017476925	The Chełst River to its outlet into Lake Sarbsko	1.05	No	Yes	Moderate	Open excavations for towers	Direct, primary, reversible	No

Summing up, as a result of the implementation of the planned project according to the RAV, the impact on the surface waters was concluded to be smaller than in the APV, due to the intersections over hydrographic objects conducted without any collisions. The possibility of water contamination as a result of accidental leaks from machinery and vehicles will be identical. In the case of the RAV, the insolation conditions will be changed within a strip of greater width, which may lead to the change in hydrological conditions.

6.2.1.3 Impact on hydrogeological conditions and groundwater

The impact on hydrogeological conditions during the construction phase may involve short-term disturbance of the first level of groundwaters in the excavations constructed for the foundations of some towers. According to the hydrological map of Poland (1:50 000), the first aquifer within the area of the planned project is located at a depth from approx. 5–20 m in the vicinity of the first tower to approx. 20–50 m in the vicinity of the customer substation (km 45+500) and the overhead line.

The places of the deepest deposition of groundwater are situated at:

- km 40+900 to 41+000: 2–5 m;
- km 41+000 to 41+760: 1−2 m;
- km 41+760 to 41+900: 2–5 m.

In these locations, approx. 4 towers will be erected along an approx. 1 km long section. Due to a shallow level of groundwaters, as well as the presence of weak soils, it may be necessary to conduct dewatering using pumps and wellpoints (subsection 6.1.4.2). Greater impacts on groundwaters will occur in the case of pile driving to a depth of up to 15 MBGL. Regardless of the dewatering method selected, this will be a short-term and local impact, which will not permanently disturb the water relations and the resources of groundwaters.

Due to a small size of the excavations and their removal (backfilling) after the completion of foundations, possible changes to the soil-water conditions in the vicinity of the excavations will be short-term, of limited scope and insignificant for the functioning of nature in the vicinity of the tower locations.

During the construction phase, there is a risk of groundwater contamination, especially with petroleum products connected to the use of construction vehicles and machinery. Maintaining the construction and transport equipment in good technical condition as well as appropriate organisation of work will reduce the probability of contaminants penetrating into groundwater.

These will be **negative, direct, momentary and short-term, reversible, and local. The scale of impact is negligible**.

The special significance of the construction phase impact on the hydrogeological conditions and groundwater is connected to the ecological area "Torfowisko" [Peat bog] in Szklana Huta. They are presented in subsection 6.1.4.3. In the case of dewatering in the area of cable chambers, leading to the emergence of a cone of depression and drainage of the ecological site, the impact will have a large scale and will be significant.

The planned project in the RAV will be situated within the GWBs listed in Table 6.83. The detailed characteristics of the GWBs including the assessment of their status is presented in subsection 3.15.

Table 6.83. Compilation of Ground Water Body catchment areas intersected by the planned project in the Rational Alternative Variant (RAV) [Source: internal materials http://www.gios.gov.pl/pl/stan-srodowiska/monitoring-wod]

GWB	General status	Beginning of intersection	End of intersection	Estimated length of the GWB catchment area intersection [km]
Lower Vistula water region				
13	Good	40+300	44+950	4.65
11	Good	44+950	46+000	1.05

The impacts of the GWB no. 13 in the RAV may involve dewatering connected to the erection of towers in the areas with high level of groundwater deposition, i.e. along an approx. 760 m section at km 41+000 to 41+760. In this area, the impacts will cease with the completion of the construction phase. This impact will be mostly short-term and reversible. During the project implementation, the impacts will involve the occupation of the area for the project as well as the risk of groundwater contamination with oils and greases from machinery and equipment used during construction.

Within the boundaries of GWB no. 11, the construction phase will involve the construction of excavations for the towers and, due to the depth of deposition of groundwater, will not affect GWB no. 11.

Pursuant to Art. 59 of the Water Law Act of 20 July 2017 (Journal of Laws of 2017, item 1566, as amended) the environmental objective for the GWBs is to:

- prevent or limit the amount of contaminants entering the water;
- prevent deterioration and enhance their status;
- protect and undertake remedial actions, as well as ensure appropriate balance between the demand and supply for such water, to achieve their good status.

This project will not threaten the achievement of environmental objectives included in the Vistula River Basin Management Plan [Table 6.84, Table 6.85], approved by the Prime Minister at the meeting of the Council of Ministers on 22 February 2011.

Table 6.84. Characteristics of the construction phase impacts of the planned project in the Rational Alternative Variant (RAV) on groundwater [Source: internal materials]

No.	Impacts	Nature of impacts	Type of impacts	Range of impact	Temporal scope of impact	Scale of impacts	Sensitivity of impacts	Impact significance
1.	Fluctuations of the groundwater level due to dewatering	Negative	Indirect, primary, reversible	Local	Short-term	Moderate	Moderate	Low
2.	Contamination as a result of accidental leaks from machinery and vehicles	Negative	Indirect, primary, reversible	Local	Short-term	Moderate	Moderate	Important

Table 6.85. Summary of the impact of the construction in the Rational Alternative Variant (RAV) on GWBs [Source: internal materials]

GWB code	Length of the GWB catchment area intersection [km]	Collisions with watercourses significant within a GWB	Protected areas	Nature value	Method of intersection	Types of impacts on water quality elements	Are the environmental objectives of the GWB threatened by the work conduct?
13	4.65	No	Yes	High	Point excavations for towers and non-collision overhead line	Direct, primary, reversible	No
11	1.05	No	Yes	High	Point excavations for towers and non-collision overhead line	Direct, primary, reversible	No

Summing up, the impact on hydrogeological conditions and groundwater in the RAV will be identical with reference to the ecological area “Torfowisko” [Peat bog] in Szklana Huta and the potential risk of dewatering in that area. It must be noted that the risk of the formation of a cone of depression or potential dewatering of the ecological area is minimal, due to the depth of the groundwater deposition in that area, which was confirmed by drilling. The impact on hydrogeological conditions and groundwater will the same in both variants (subsection 6.1.4.3), although the type of impacts will be different: the APV involves open excavations and use of trenchless methods, while the RAV will involve point excavations for the construction of towers.

6.2.1.4 Impact on climate, including greenhouse gas emissions and impacts relevant for adaptation to climate change, impact on atmospheric air (air quality)

The significance of impact on climate and air quality for the RAV is similar as in the case of the APV. The differentiating factor is the duration of the construction phase, which in the case of a 220 or 275 kV overhead line will last up to 18 months, and in the case of an underground cable line (APV) will last 36 months at maximum.

Summing up, it can be expected that the impact on climate, including greenhouse gas emissions, in the case of the RAV will be lower due to the short duration of the construction phase as well as the smaller quantity of equipment necessary for the implementation of the project.

6.2.1.5 Impact on ambient noise

Similarly to the APV, the main sources of noise in the construction phase of the 220 or 275 kV overhead line, will be:

- construction equipment (excavator, crane, power generator, etc.);
- motor vehicles (transport of equipment, construction materials and people).

The emission of pollutants will have a point-like occurrence, in the locations of tower construction as well as linearly along the access roads. The construction site facilities will be the same as in the APV, while the access will be provided using the existing roads. The duration of the construction will be shorter and it will last 18 months at maximum.

The factors differentiating those two variants are the duration of the construction phase as well as the scope of the work.

Summing up, in the case of the overhead line construction, the acoustic impact of the noise sources in the construction phase will be irregular, varying daily due to the movement of the equipment, which makes it impossible to present the distribution of the sound field representative for a longer period of time. The line construction will be carried out away from the acoustically protected areas in the mid-forest environment. It can be expected that the impact on the ambient noise in the case of the RAV will be lower, due to a shorter duration of the construction and a different type of technology used.

6.2.1.6 Impact on nature

6.2.1.6.1 Impact on biotic elements in the onshore area

The construction of a 220 or 275 kV overhead line will involve a permanent occupation of a 70 m wide strip of land and a technical belt with a width of 25 m away from the external lines along an approx. 5.2 km section. In total, tree felling will be conducted within a 120 m wide strip along a 5.2 km long section. Compared to the APV, the main impacts on flora and its habitats will be the same. The differentiating factor will be a far greater surface of land affected by the felling of trees.

The main construction phase impacts on the abiotic elements will be connected to the felling of trees and shrubs within the permanent technical and technological belts with a total surface area of approx. 60 ha. This entails a permanent deforestation.

A detailed characteristics of the biotic elements developed on the basis of annual inventory surveys on abiotic and biotic resources of the BP OWF CI survey area (Appendix 1. Report on inventory surveys) and the data from literature is presented in subsection 3.19.1. The impacts on biotic elements in the onshore area refer to the technical belts designated for the implementation of the planned project.

6.2.1.6.1.1 Fungi

The main construction phase impacts on the biota of fungi will be connected to:

- construction of excavations for the overhead line towers and cable chambers;
- pile driving;
- levelling works related to the levelling of the area for the erection of a customer substation, 400 kV overhead line towers and in the area of cable chambers.

Moreover, the impacts will be connected to aeolian erosion and possible contamination of open excavations with greases, oils, etc.

Table 6.86 and Table 6.87 present a compilation of macroscopic fungi and lichen species occurring within the technical belts designated for the purposes of the planned project implementation according to the RAV.

As a result of multi-surface felling, the thallus will be destroyed, and consequently – the plot of species will be eliminated.

The impact of the planned project in the RAV on the biota of fungi will be **negative, direct, primary, reversible/permanent, local, and long-term. The significance of impact is low.**

Table 6.86. List of macroscopic fungi species by technical belts in the Rational Alternative Variant (RAV) [Source: internal materials]

No.	Species		Conservation status[1]	Threat category[2]	Permanent technical belt	Technological belt	Additional technical belt	Comments
	Species name	Binomial nomenclature						
1.	Chaga	*Inonotus obliquus*	PP	R	Not found	Not found	Impact on mycelia insignificant	Arboreal species
2.	–	*Postia guttulata*	None	E	Not found	Not found	Impact on mycelia insignificant	Arboreal species
3.	Crimped gill	*Plicaturopsis crispa*	None	R	Not found	Not found	Impact on mycelia insignificant	Arboreal species
4.	Woolly tooth	*Phellodon tomentosus*	None	E	Not found	Not found	Impact on mycelia insignificant	Terrestrial or arboreal species
5.	White birch bolete	*Leccinum niveum*	None	V	Not found	Not found	Impact on mycelia insignificant	-
6.	Dune brittlestem	*Psathyrella ammophila*	None	E	Not found	Not found	Impact on mycelia insignificant	-
7.	Jellied bolete	*Suillus flavidus*	PP	E	Not found	Not found	Impact on mycelia insignificant	-
8.	European destroying angel	*Amanita virosa*	None	V	In the excavation zone or in the area of other direct actions the plots shall be destroyed	Not found	Impact on mycelia insignificant	-
9.	Cornflower bolete	*Gyroporus cyanescens*	None	R	Not found	Not found	Impact on mycelia insignificant	-

[1]Pursuant to the Regulation of the Minister of the Environment of 9 October 2014 on the protection of plant species (Journal of Laws 2014, item 1409): PP – species under partial protection
[2]Red List status: V – vulnerable, R – rare, potentially endangered with extinction, E – dying out, critically endangered

Table 6.87. Characteristics of the construction phase impacts on macroscopic fungi in the Rational Alternative Variant (RAV) [Source: internal materials]

No.	Impacts	Nature of impact	Type of impact	Impact range	Temporal scope of impact
1.	Disturbance of surface formations (excavations)	Negative	Direct, primary, reversible	Local	Long-term
2.	Levelling works for the erection of the customer substation and cable chambers	Negative	Direct, primary, permanent	Local	Long-term
3.	Wind erosion	Negative	Indirect, primary, reversible	Local	Long-term
4.	Oil and grease contamination (roads, storage yards, back-up facilities)	Negative	Direct, primary, reversible	Local	Long-term

6.2.1.6.1.2 Lichens

The main construction phase impacts on the biota of lichen will be connected to:

- construction of excavations for overhead line towers and cable chambers;
- pile driving;
- levelling works related to the levelling of the area for the erection of a customer substation, 400 kV overhead line towers and in the area of cable chambers.

In such cases, the thalli will be destroyed, and consequently the plot of species will be eliminated. Sulphur oxides and nitrogen oxides will be emitted as a result of construction machinery operation during the construction phase. The epiphytic lichen species are especially vulnerable to air pollution.

The main construction phase impacts on the biota of epiphytic lichens will be connected to the planned felling of trees and shrubs within the technical belt over a total surface area not exceeding 60 ha. In such cases, the thalli will be destroyed, and consequently the plot of species will be eliminated.

Table 6.88 and Table 6.89 present a compilation of lichen species occurring within the technical belts designated for the purposes of the planned project implementation including an Environmental Impact Assessment.

The impact of the planned project on the biota of lichen will be **negative, direct, primary, reversible/permanent, local, and long-term. Impact significance: important.**

Table 6.88. List of lichen species by technical belts in the Rational Alternative Variant (RAV) [Source: internal materials]

No.	Species		Conservation status[1]	Threat category[2]	Permanent technical belt	Technological belt	Additional technical belt	Comments
	Species name	Binomial nomenclature						
1.	Silver-lined wrinkle	*Tuckermanopsis chlorophylla*	PP	VU	Not found	Not found	Impact on thalli insignificant	Epiphytic species
2.	Bristlybeard lichen	*Usnea hirta*	PP	VU	Destruction of plots as a result of deforestation	In the tree felling zone or in the area of other direct actions the plots shall be destroyed	Impact on thalli insignificant	Epiphytic species
3.	-	*Zwackhia viridis*	None	VU	Not found	Not found	Impact on thalli insignificant	Epiphytic species
4.	Tree reindeer lichen	*Cladonia arbuscula*	PP	None	Destruction of plots as a result of deforestation	In the tree felling zone or in the area of other direct actions the plots shall be destroyed	Impact on thalli insignificant	Terrestrial
5.	Reindeer lichen	*Cladonia portentosa*	PP	None	Destruction of plots as a result of deforestation	In the tree felling zone or in the area of other direct actions the plots shall be destroyed	Impact on thalli insignificant	Terrestrial
6.	Grey reindeer lichen	*Cladonia rangiferina*	PP	None	Not found	In the tree felling zone or in the area of other direct actions the plots shall be destroyed	Impact on thalli insignificant	Terrestrial
7.	Farinose cartilage lichen	*Ramalina farinacea*	PP	VU	Not found	In the tree felling zone or in the area of other direct actions the plots shall be destroyed	Impact on thalli insignificant	Epiphytic species
8.	Pierced lichen	*Pertusaria pertusa*	None	VU	Not found	Not found	Impact on thalli insignificant	Epiphytic species
9.	Covered lichen	*Pertusaria hymenea*	None	CR	Not found	Not found	Impact on thalli insignificant	Epiphytic species
10.	Iceland moss	*Cetraria islandica*	PP	VU	Not found	Not found	Impact on thalli insignificant	Epiphytic species
11.	Salted starburst lichen	*Imshaugia aleurites*	PP	None	Destruction of plots as a result of deforestation	In the tree felling zone or in the area of other direct actions the plots shall be destroyed	Impact on thalli insignificant	Epiphytic species

No.	Species		Conservation status[1]	Threat category[2]	Permanent technical belt	Technological belt	Additional technical belt	Comments
	Species name	Binomial nomenclature						
12.	Abraded camouflage lichen	*Melanelixia subaurifera*	PP	VU	Not found	In the tree felling zone or in the area of other direct actions the plots shall be destroyed	Impact on thalli insignificant	Epiphytic species
13.	Powder-headed tube lichen	*Hypogymnia tubulosa*	PP	NT	Destruction of plots as a result of deforestation	In the tree felling zone or in the area of other direct actions the plots shall be destroyed	Impact on thalli insignificant	Epiphytic species
14.	-	*Gyalecta carneola*	None	None	Not present	Not present	Impact on thalli insignificant	Epiphytic species

[1]Pursuant to the Regulation of the Minister of the Environment of 9 October 2014 on the protection of plant species (Journal of Laws 2014, item 1409): SP – species under strict protection, PP – species under partial protection

[2]Threat categories (according to Cieśliński et al. [58]; Fałtynowicz and Kukwa [100]): CR – critically endangered/on the verge of extinction, EN – endangered, VU – vulnerable, NT – near threatened

Table 6.89. Characteristics of the construction phase impacts on lichens in the Rational Alternative Variant (RAV) [Source: internal materials]

No.	Impacts	Nature of impact	Type of impact	Impact range	Temporal scope of impact
1.	Disturbance of surface formations (excavations)	Negative	Direct, primary, reversible	Local	Long-term
2.	Levelling works for the erection of the power substation and cable chambers	Negative	Direct, primary, permanent	Local	Long-term
3.	Wind erosion	Negative	Indirect, primary, reversible	Local	Long-term
4.	Oil and grease contamination (roads, storage yards, back-up facilities)	Negative	Direct, primary, reversible	Local	Long-term

6.2.1.6.1.3 Mosses and liverworts

The main construction phase impacts on the biota of mosses and liverworts will be connected to:

- construction of excavations for the overhead line towers and cable chambers;
- pile driving;
- levelling works related to the levelling of the area for the erection of a customer substation, 400 kV overhead line towers and in the area of cable chambers.

In such cases, the plot of species will be eliminated.

Table 6.90 and Table 6.91 present a compilation of moss and liverwort species occurring within the technical belts designated for the purposes of the planned project implementation including an Environmental Impact Assessment.

The impact of the planned project on the biota of mosses and liverworts will be **negative, direct, primary, reversible/permanent, local, and long-term. Impact significance: important.**

Table 6.90. List of moss and liverwort species by technical belts in the Rational Alternative Variant (RAV) [Source: internal materials]

No.	Species		Conservation status[1]	Permanent technical belt	Technological belt	Additional technical belt
	Species name	Binomial nomenclature				
1.	White pincushion moss	*Leucobryum glaucum*	PP	Not found	Not found	Impact on specimens insignificant
2.	–	*Eurhynchium angustirete*	PP	Not found	Not found	Impact on specimens insignificant
3.	Mountain fern moss	*Hylocomium splendens*	PP	Destruction of plots as a result of deforestation	In the excavation zone or in the area of other direct actions the plots shall be destroyed	Impact on specimens insignificant
4.	Dilated scalewort	*Frullania dilatata*	PP	Not found	Not found	Impact on specimens insignificant
5.	Pointed spear-moss	*Calliergonella cuspidata*	PP	Destruction of plots as a result of deforestation	In the excavation zone or in the area of other direct actions the plots shall be destroyed	Impact on specimens insignificant
6.	Bruch’s pincushion	*Ulota bruchii*	PP	Not found	Not found	Impact on specimens insignificant
7.	Crisped pincushion moss	*Ulota crispa*	PP	Destruction of plots as a result of deforestation	In the excavation zone or in the area of other direct actions the plots shall be destroyed	Impact on thalli insignificant
8.	Neat feather-moss	*Pseudoscleropodium purum*	PP	Destruction of plots as a result of deforestation	In the excavation zone or in the area of other direct actions the plots shall be destroyed	Impact on specimens insignificant
9.	Wood-rust	*Nowellia curvifolia*	PP	Not found	Not found	Impact on specimens insignificant
10.	Common hair-cap moss	*Polytrichum commune*	PP	Not found	Not found	Impact on specimens insignificant
11.	Bog groove-moss	*Aulacomnium palustre*	PP	Not found	Not found	Impact on specimens insignificant
12.	Red-stemmed feathermoss	*Pleurozium schreberi*	PP	Destruction of plots as a result of deforestation	In the excavation zone or in the area of other direct actions the plots shall be	Impact on specimens insignificant

No.	Species		Conservation status[1]	Permanent technical belt	Technological belt	Additional technical belt
	Species name	Binomial nomenclature				
					destroyed	
13.	Ciliated fringewort	*Ptilidium ciliare*	PP	Not found	Not found	Impact on specimens insignificant
14.	Lyell's bristle moss	*Orthotrichum lyellii*	PP	Not found	Not found	Impact on specimens insignificant
15.	Red bog-moss	*Sphagnum rubellum*	PP	Not found	Not found	Impact on specimens insignificant
16.	Wavy broom moss	*Dicranum polysetum*	PP	Destruction of plots as a result of deforestation	In the excavation zone or in the area of other direct actions the plots shall be destroyed	Impact on specimens insignificant
17.	Broom forkmoss	*Dicranum scoparium*	PP	Destruction of plots as a result of deforestation	In the excavation zone or in the area of other direct actions the plots shall be destroyed	Impact on thalli insignificant

[1]*Pursuant to the Regulation of the Minister of the Environment of 9 October 2014 on the protection of plant species (Journal of Laws 2014, item 1409): PP – species under partial protection*

Table 6.91. Characteristics of the construction phase impacts on mosses and liverworts in the Rational Alternative Variant (RAV) [Source: internal materials]

No.	Impacts	Nature of impact	Type of impact	Impact range	Temporal scope of impact
1.	Disturbance of surface formations (excavation)	Negative	Direct, primary, reversible	Local	Long-term
2.	Levelling works for the erection of the customer substation and cable chambers	Negative	Direct, primary, permanent	Local	Long-term
3.	Wind erosion	Negative	Indirect, primary, reversible	Local	Long-term
4.	Oil and grease contamination (roads, storage yards, back-up facilities)	Negative	Direct, primary, reversible	Local	Long-term

6.2.1.6.1.4 Vascular plants and natural habitats

Table 6.92 and Table 6.94 present vascular plan species and a compilation of natural habitats in belts delineated for the purposes of the planned project implementation in the RAV.

As a result of the construction works in the permanent technical and technological belts, plots of species will be eliminated and the habitat patch surface area will be reduced. **Impact significance: important.**

Table 6.92. List of vascular plant species by technical belts in the Rational Alternative Variant (RAV) [Source: internal materials]

No.	Species		Conservation status[1]	Technological belt	Additional technical belt	Comments
	Species name	Binomial nomenclature				
1.	Marsh Labrador tea	*Ledum palustre*	PP	Not found	Not found	Impact on specimens insignificant
2.	Black crowberry	*Empetrum nigrum* L.	PP	Destruction of plots as a result of deforestation	In the tree felling zone or in the area of other direct actions the plots shall be destroyed	Impact on specimens significant
3.	One-flowered wintergreen	*Moneses uniflora* (L.) A. Gray	PP	Not found	Not found	Impact on specimens insignificant
4.	Broad-leaved helleborine	*Epipactis helleborine* (L.) Crantz	PP	Destruction of plots as a result of deforestation	In the tree felling zone or in the area of other direct actions the plots shall be destroyed	Impact on specimens significant
5.	Creeping lady's-tresses	*Goodyera repens* (L.) R. Br	SP	Not found	Not found	Impact on specimens insignificant
6.	Sand sedge	*Carex arenaria* L.	PP	Not found	In the tree felling zone or in the area of other direct actions the plots shall be destroyed	Impact on specimens moderate
7.	Stag's-horn clubmoss	*Lycopodium clavatum* L.	PP	Not found	Not found	Impact on specimens insignificant
8.	Cross-leaved heath	*Erica tetralix* L.	SP	Not found	Not found	Impact on specimens insignificant

[1]Pursuant to the Regulation of the Minister of the Environment of 9 October 2014 on the protection of plant species (Journal of Laws 2014, item 1409): SP – species under strict protection, PP – species under partial protection

Table 6.93. List of natural habitats by technical belts in the Rational Alternative Variant (RAV) [Source: internal materials]

No.	Habitat no.	Name of habitat	Permanent technical belt	Technological belt	Additional technical belt
1.	2130	Fixed coastal dunes with herbaceous vegetation ("grey dunes")	-	-	Impact on habitat negligible
3.	2180	Wooded dunes of the Atlantic, Continental and Boreal region	Destruction of a habitat patch connected to deforestation	In the tree felling zone or in the area of other direct actions, habitat patches shall be destroyed	Impact on habitat important
4.	91D0	Bog woodland	Destruction of a habitat patch connected to deforestation	In the tree felling zone or in the area of other direct actions, habitat patches shall be destroyed	Impact on habitat important

Table 6.94. Characteristics of the construction phase impacts on plants and habitats in the Rational Alternative Variant (RAV) [Source: internal materials]

No.	Impacts	Nature of impact	Type of impact	Impact range	Temporal scope of impact
1.	Disturbance of surface formations (excavations)	Negative	Direct, primary, reversible	Local	Long-term
2.	Levelling works for the erection of the power substation and cable chambers	Negative	Direct, primary, permanent	Local	Long-term
3.	Wind erosion	Negative	Indirect, primary, reversible	Local	Long-term
4.	Oil and grease contamination (roads, storage yards, back-up facilities)	Negative	Direct, primary, reversible	Local	Long-term

6.2.1.6.1.5 Forest complexes

The route of the 220 or 275 kV overhead line will involve permanent felling of trees:

- within the permanent technical belt with a width of approx. 70 m and a length of 5.2 km – it covers a surface area of approx. 35 ha;
- within the technological belt with a width of 25 m from the external overhead lines and a length of approx. 5.2 km – it covers a surface area of approx. 25 ha.

In total, the maximum surface area of tree felling will cover approx. 60 ha.

The trees growing in the area of construction site facilities and access roads (not intended for felling) will be appropriately protected against damage by the construction equipment.

The largest area of the permanent technical belt is occupied by fresh coniferous forests (62%) and fresh mixed coniferous forests (13%) with pine as a dominant species. More than 66% of the surface area of forests is occupied by commercial forests. The following categories of protective forests are also present here; soil-protective and water-protective forests.

A very similar structure is present within the technological belt [Table 6.95].

A detailed compilation of the forest units including a complete list of forest addresses, surface areas, types of habitat, forest functions, conservation classes, vertical structure, age of species harvesting maturity and the surface area of individual units divided by individual technical/technological belts are presented in Table 6.95.

Table 6.95. Rational Alternative Variant (RAV) layout within the permanent technical and technological belts including the taxonomic description data of the State Forests (as of 1 March 2021) [Source: internal materials based on https://www.bdl.lasy.gov.pl/portal/uslugi-mapowe-ogc]

No.	Forest address	Type of forest habitat[1]	Farm[2]	Forest function[3]	Conservation class[4]	Species name[5]	Percentage	Age	Permanent technical belt [m^2]	Technological belt [m^2]
1.	15-01-1-02-42 -f -00	FCF	S	PROT	SOIL PROT	PI	7	86	1173.99	2313.3
2.	15-01-1-02-42 -g -00	FCF	S	PROT	SOIL PROT	PI	10	81	3025.71	3583.23
3.	15-01-1-02-93 -a -00	MMCF	S	PROT	SOIL PROT	PI	9	116	9898.77	17 269.7
4.	15-01-1-02-93 -d -00	FCF	S	PROT	SOIL PROT	PI	10	116	12740.7	16 165.8
5.	15-01-1-02-93 -f -00	MMCF	S	PROT	SOIL PROT	BI	8	61	4398.98	3238.59
6.	15-01-1-02-93 -g -00	MMCF	S	PROT	SOIL PROT	BI	5	46	2506.84	4723.64
7.	15-01-1-02-94 -a -00	MBF	S	PROT	SOIL PROT	BI	6	51	196.24	-
8.	15-01-1-02-94 -b -00	MBF	S	PROT	SOIL PROT	PI	10	131	2691.09	3932.22
9.	15-01-1-02-94 -f -00	MMCF	S	PROT	SOIL PROT	PI	6	106	8.25097	-
10.	15-01-1-02-94 -g -00	FCF	S	PROT	SOIL PROT	PI	10	116	324.405	758.73
11.	15-01-1-02-109 -a -00	MBF	S	PROT	WTR PROT	AL	6	51	1260.58	151.518
12.	15-01-1-02-109 -h -00	FCF	LF	COMM	-	PI	10	41	1159.99	19.7319
13.	15-01-1-02-109 -i -00	FCF	LF	COMM	-	PI	10	34	15100.7	22 745.1
14.	15-00-1-02-110 -c -01	FCF	LF	COMM	-	PI	10	41	3177.45	1261.14
15.	15-01-1-02-110 -f -00	FCF	LF	COMM	-	PI	10	31	886.776	659.747
16.	15-00-1-02-163 -c -01	FCF	LF	COMM	-	PI	9	51	411.487	-
17.	15-01-1-02-163 -d -00	FCF	LF	COMM	-	PI	10	66	10 294.6	14 988.8
18.	15-01-1-02-164 -a -00	FCF	LF	COMM	-	PI	10	55	2841.08	855.263
19.	15-00-1-02-164 -c -01	FCF	LF	COMM	-	PI	10	51	782.407	27.1311
20.	15-01-1-02-164 -d -00	FMCF	LF	COMM	-	PI	10	64	332.68	0.181366
21.	15-01-1-02-164 -f -00	FMCF	LF	COMM	-	PI	10	55	15 709	25 123
22.	15-00-1-02-185 -c -01	FMCF	LF	COMM	-	PI	10	63	5366.44	9383.07
23.	15-01-1-02-185 -d -00	FCF	LF	COMM	-	PI	10	53	1172.32	29.1798

No.	Forest address	Type of forest habitat[1]	Farm[2]	Forest function[3]	Conservation class[4]	Species name[5]	Percentage	Age	Permanent technical belt [m²]	Technological belt [m²]
24.	15-01-1-02-185 -f -00	FCF	LF	COMM	-	PI	10	66	7675.35	10 839.1
25.	15-01-1-02-185 -g -00	FCF	LF	COMM	-	PI	10	43	2891.3	4565.36
26.	15-01-1-02-200 -a -00	FCF	LF	COMM	-	PI	10	36	434.115	-
27.	15-01-1-02-184 -f -00	FCF	LF	COMM	-	PI	10	63	50.536	-
28.	15-01-1-02-198 -d -00	FCF	LF	COMM	-	PI	10	30	90.837	-
29.	15-01-1-02-198 -i -00	FMF	CLF	COMM	-	PI	8	35	5.30366	-
30.	15-00-1-02-198 -j -01	FMCF	LF	COMM	-	PI	10	71	4372.23	4026.8
31.	15-01-1-02-199 -a -00	FCF	LF	COMM	-	PI	10	81	712.948	-
32.	15-00-1-02-199 -c -01	FCF	LF	COMM	-	PI	10	64	8001.21	12 488.6
33.	15-01-1-02-199 -d -00	FCF	LF	COMM	-	PI	10	51	15 530.8	24 953.8
34.	15-00-1-02-210 -c -01	FMF	CLF	COMM	-	PI	8	26	3806.25	48 56.02
35.	15-01-1-02-210 -d -00	FMCF	LF	COMM	-	PI	10	71	680.308	3633.87
36.	15-01-1-02-210 -f -00	FMF	CLF	COMM	-	PI	9	96	14 341.3	20 074.6
37.	15-01-1-02-211 -a -00	FMF	CLF	COMM	-	PI	8	61	1748.74	284.151
38.	15-01-1-02-43 -b -00	-	-	-	-	WL	-	26	109.781	-
39.	15-01-1-02-109 -d -00	FMCF	LF	COMM	-	PI	10	10	3972.65	6037.08
40.	15-01-1-02-110 -a -00	MBF	S	PROT	WTR PROT	AL	8	81	2491.53	6699.82
41.	15-01-1-02-110 -b -00	FMCF	CLF	COMM	-	BI	7	41	3489.75	5442.69
42.	15-01-1-02-164 -b -00	FCF	LF	COMM	-	PI	10	63	10 822.5	16 677.3
43.	15-01-1-02-185 -b -00	FCF	LF	COMM	-	PI	10	58	18 512.3	25 658.9
44.	15-01-1-02-43 -a -00	FMCF	S	PROT	SOIL PROT	PI	10	81	263.164	146.025
45.	15-00-1-02-43 -c -01	FMCF	S	PROT	SOIL PROT	PI	10	106	4703.28	8599.63
46.	15-01-1-02-43 -d -00	-	-	-	-	PI	-	106	1254.94	3292.25
47.	15-01-1-02-43 -o -00	FMCF	S	PROT	SOIL PROT	PI	10	81	5431.99	5158.94
48.	15-01-1-02-42 -b -00	FCF	S	PROT	SOIL PROT	PI	8	76	4342	6293.97

No.	Forest address	Type of forest habitat[1]	Farm[2]	Forest function[3]	Conservation class[4]	Species name[5]	Percentage	Age	Permanent technical belt [m²]	Technological belt [m²]
49.	15-01-1-02-184 -d -00	FCF	LF	COMM	-	PI	10	52	5965.09	7808.96
50.	15-01-1-02-199 -b -00	FCF	LF	COMM	-	PI	10	61	7397.26	12 496.4
51.	15-01-1-02-199 -i -00	FCF	LF	COMM	-	PI	10	44	2991.17	3475.86
52.	15-01-1-02-199 -f -00	FCF	LF	COMM	-	PI	8	44	1667.22	244.891
53.	15-01-1-02-42 -d -00	DCF	S	PROT	SOIL PROT	PI, M	10	76	12 261.9	16 161.3
54.	15-00-1-02-94 -c -01	MBF	S	PROT	SOIL PROT	BI	6	51	11 593.9	16 412.7
55.	15-99-1-02-109 -j -01	FCF	LF	COMM	-	PI	10	146	270.714	19.2921
56.	15-01-1-02-109 -j -01	FCF	LF	COMM	-	PI	9	3	6759.63	10 961.3
57.	15-01-1-02-211 -c -01	FMCF	CLF	COMM	-	PI	10	111	31.9622	-
Total									**240 083.4448**	**339 415.6813**

[1]FMCF – fresh mixed coniferous forest, MMCF – moist mixed coniferous forests, DCF – dry coniferous forest, FCF – fresh coniferous forest, MCF – moist coniferous forest, FSDF – fresh semi-deciduous forest, MSDF – moist semi-deciduous forest. AAF – ash-alder forest, MBF – mixed bog forest

[2]CLF – clearing and logging farm, LF – logging farm, PF – protection farm, S – special farm

[3]COMM – commercial forests, PROT – protective forests

[4]RES – research, SOIL PROT – soil-protecting, WTR PROT – water-protecting

[5]BC – beech, M – maple, AL – alder, PI – pine, SP – spruce, BI – birch, WL – willow

Along the planned route of the 220 or 275 kV overhead line, the **fresh coniferous forest** habitats are dominant in the central and southern part of the planned route. These are mainly commercial forests. Soil-protective forest are present in the northern part. They are formed mainly on impoverished sands. Deforestation within the area of dunes is connected to a high probability (higher than in the case of the APV) of triggering aeolian processes within the area of Wydmy Lubiatowskie dunes. As a result of triggering such processes, significant changes to the nature of the relief may occur both within the investment belt as well as in the neighbouring areas. As a result of the aeolian processes triggering, the elements of infrastructure can become exposed or buried by the sandy aeolian material transported. The dune processes may significantly affect the neighbouring habitats. As a result, the scale of construction phase impact was determined as high, and the significance of impacts related to the possibility of triggering aeolian processes, connected to the felling of fresh coniferous forests within the area of Wydmy Lubiatowskie dunes was assessed as significant. The **fresh mixed coniferous forests** are scattered throughout the route of the planned line. These are mainly commercial forests. Soil-protective forest are present in the northern part. The significance of impact related to deforestation within the area of dunes was assessed as significant. The **fresh mixed deciduous forest** habitat occupies the southern part of the planned route and it belongs to the group of moderately fertile habitats. These are commercial forests. The significance of the impact was assessed as moderate. The **dry coniferous forests** which are present in the northern part of the planned project within the area of the Wydmy Lubiatowskie dunes at km 40+700 to 40+900 are characterised by low resistance. The ease with which the stabilised coastal dune sands can be triggered supports the decision to refrain from any use. As a result, the scale of construction phase impacts was determined as high, and the significance as important. The **moist mixed coniferous forest** habitat is present at km 41+300 to 41+600 and in terms of fertility, they are at the same level in the trophic network as the fresh mixed coniferous forest. These are soil-protective forests. The significance of impact was assessed as important.

The assessment of the forest resistance to the construction phase impacts for the RAV is identical as for the APV and is presented in subsection 6.1.4.6.1.5 [Table 6.46].

The impacts of the planned project connected to the felling of trees will be **negative, direct, primary, reversible, local and permanent.**

The impacts of the planned project connected to the felling of trees will be **negative, direct, primary, reversible/irreversible, local, and medium-term (additional technical belt) and permanent within the permanent belt.**

The impacts connected to the felling of trees and the resultant erosion of soil will be: **negative, indirect, primary, irreversible, local and permanent.**

The impacts connected to contamination will be **negative, direct, primary, reversible, local and momentary** [Table 6.96].

Table 6.96. Characteristics of the construction phase impacts on forests in the Rational Alternative Variant (RAV) [Source: internal materials]

No.	Impacts	Type of forest habitat	Nature of impact	Type of impact	Impact range	Temporal scope of impact	Impact scale	Impact sensitivity	Impact significance
1.	Tree felling	Fresh mixed coniferous forest	Negative	Direct, primary, irreversible	Local	Constant	High	High	Important
		Fresh coniferous forest					High	High	Important
		Fresh mixed forest					Moderate	High	Moderate
		Dry coniferous forest					High	High	Important
		Moist mixed coniferous forest					High	High	Important
2.	Soil erosion	Fresh mixed coniferous forest	Negative	Indirect, primary, irreversible	Local	Constant	High	High	Important
		Fresh coniferous forest					High	High	Important
		Fresh mixed forest					Moderate	High	Moderate
		Dry coniferous forest					High	High	Important
		Moist mixed coniferous forest					High	High	Important
3.	Contamination with greases and oils	Fresh mixed coniferous forest	Negative	Direct, primary, reversible	Local	Momentary	High	High	Important
		Fresh coniferous forest					High	High	Important
		Fresh mixed forest					Moderate	High	Moderate
		Dry coniferous forest					Moderate	High	Important
		Moist mixed coniferous forest					High	High	Important

6.2.1.6.1.6 Invertebrates

A detailed characteristics of invertebrates developed on the basis of one-year-long inventory surveys on abiotic and biotic resources of the BP OWF CI survey area (Appendix 1. Report on inventory surveys) and data from literature is presented in subsection 3.19.1.6. The impacts on biotic elements in the terrestrial area refer to the permanent technical and technological belts designated for the implementation of the planned project [Table 6.97].

Table 6.97. List of invertebrate species by technical belts in the Rational Alternative Variant (RAV) including assessment [Source: internal materials]

No.	Species		Conservation status[1]	Threat category[2]	Permanent technical belt	Technological belt	Comments
	Species name	Binomial nomenclature					
1.	Blue-winged grasshopper	*Oedipoda caerulescens*	None	NT	Impact on specimens insignificant	Impact on specimens insignificant	Orthoptera
2.	Minotaur beetle	*Typhaeus typhoeus*	None	NT	Not found	Not found	Coleoptera
3.	European paper wasp	*Polistes dominulus*	None	CR	Impact on specimens insignificant	Impact on specimens insignificant	Hymenoptera
4.	Black-backed meadow ant	*Formica pratensis*	PP	None	Not found	Not found	Hymenoptera
5.	-	*Melanimon tibialis*	None	RR	Not found	Not found	Coleoptera
6.	Camberwell beauty	*Nymphalis antiopa*	None	RR	Not found	Not found	Lepidoptera
7.	Rock grayling	*Hipparchia semele*	None	RR	Not found	Not found	Lepidoptera
8.	Early bumblebee	*Bombus pratorum*	PP	-	Impact on specimens insignificant	Impact on specimens insignificant	Hymenoptera
9.	Common carder bee	*Bombus pascuorum*	PP	None	Impact on specimens insignificant	Impact on specimens insignificant	Hymenoptera
10.	Buff-tailed bumblebee	*Bombus terrestris*	PP	None	Impact on specimens insignificant	Impact on specimens insignificant	Hymenoptera

[1]Pursuant to the Regulation of the Minister of the Environment of 16 December 2016 on the protection of animal species (Journal of Laws of 2016, item 2183, as amended): PP – species under partial protection
[2]NT – near threatened, RR – rare in region, i.e. Eastern (Gdańsk) Pomerania, CR – critically endangered, LC – least concern

The main construction phase impacts on the invertebrate fauna will be connected to:

- construction of excavations for the overhead line towers and cable chambers;
- pile driving;
- levelling works related to the levelling of the area for the erection of a customer substation, 400 kV overhead line towers and in the area of cable chambers.

In such cases, the disturbance of invertebrates and a possible destruction of nests will take place.

Such impacts due to the presence of common coastal species of insects in this area may be considered insignificant, and not leading to the elimination of the species site.

Moreover, the impacts will be connected to aeolian erosion and possible contamination of open excavations with greases, oils, etc. which may negatively affect the bumblebee nests [Table 6.98].

Table 6.98. Matrix defining the significance of the construction phase impact on invertebrates in the Rational Alternative Variant (RAV) [Source: internal materials]

Impact significance		**Receptor sensitivity**				
		Irrelevant	**Low**	**Moderate**	**High**	**Very high**
Scale (size) of impact	Irrelevant	Negligible	Negligible	Negligible	Negligible	Low
	Low	Negligible	Negligible	Low	Low	Moderate
	Moderate	Negligible	Low	Low	Moderate	Moderate
	High	Negligible	Low	Moderate	Important	Significant
	Very high	Low	Moderate	Moderate	Significant	Significant

6.2.1.6.1.7 Ichthyofauna

During the construction phase, no impact on ichthyofauna is expected. Due to the extremely low water levels, which have been observed for many years, despite the presence of potential hiding places, shading, stream bed diversity etc., the watercourses surveyed are characterised by a low ichthyological diversity (subsection 3.19.1.7) [Table 6.99].

Table 6.99. Matrix defining the significance of the construction phase impact on ichthyofauna in the Rational Alternative Variant (RAV) [Source: internal materials]

Impact significance		**Receptor sensitivity**				
		Irrelevant	**Low**	**Moderate**	**High**	**Very high**
Scale (size) of impact	Irrelevant	Negligible	Negligible	Negligible	Negligible	Low
	Low	Negligible	Negligible	Low	Low	Moderate
	Moderate	Negligible	Low	Low	Moderate	Moderate
	High	Negligible	Low	Moderate	Important	Significant
	Very high	Low	Moderate	Moderate	Significant	Significant

6.2.1.6.1.8 Herpetofauna

The impact of the RAV will not differ significantly from the impact of the APV. Similarly to the APV, herpetofauna in the area of the RAV is represented by species relatively common across Poland. Most of them adapt well to the changes in the environment. 4 species of amphibians were found in the area of the planned project. All of the herpetofauna species found in the area are protected as part of the Regulation of the Minister of the Environment of 16 December 2016 on the protection of animal species (Journal of Laws of 2016, item 2183, as amended) [Table 6.100].

Table 6.100. Amphibian species found in the project area with their conservations status in the Rational Alternative Variant (RAV) [Source: internal materials]

No.	**Species/taxon**	**Conservation status**
1.	Common toad *Bufo bufo*	PP
2.	Common frog *Rana temporaria*	PP

No.	Species/taxon	Conservation status
1.	Slow worm *Anguis fragilis*	PP
2.	Sand lizard *Lacerta agilis*	PP
3.	Viviparous lizard *Zootoca vivipara*	PP

[1]Pursuant to the Regulation of the Minister of the Environment of 16 December 2016 on the protection of animal species (Journal of Laws of 2016, item 2183, as amended): PP – species under partial protection

The construction phase impacts will mainly involve the transformation of the environment which will be caused by partial destruction of habitats, e.g. deforestation of the permanent technical and technological belts, excavations, occupation of land by the customer substation, high-voltage towers, etc. as well as the fragmentation of habitats as a result of a 120 m wide treeless belt running across the forest areas. This impact will be permanent and long-term. Reptiles occupying various microhabitats that will be destroyed during the project construction will be the most vulnerable to the work connected to the construction phase.

The RVA construction phase impacts are identical to the APV (subsection 6.1.4.6.1.8). **The significance was assessed as low for the majority of impacts. The moderate significance is connected to the felling of trees.**

6.2.1.6.1.9 Birds

In the area analysed, a series of bird species in their breeding period, as well as in the dispersal periods, migration and wintering, were found. The project implemented will have the greatest impact on two groups of birds: 1) the breeding avifauna and 2) the migratory avifauna. In the case of the breeding avifauna, the impact will be rarely limited to the spot/location of the nest, and rather will affect a broader area connected to the breeding territory of individual bird species. Such territories may be very extensive and in many cases may overlap with the planned project. In the case of the breeding avifauna, as in the case of the migratory avifauna, the forecast high risk of bird collisions with the overhead line during the operation phase will be of greatest significance.

The list of bird species found in the area of the planned project is presented in Table 6.101.

The construction phase impacts will mainly involve the transformation of the environment which will be caused by partial destruction of habitats, e.g. deforestation of the permanent and technological belts, excavations, occupation of land by the customer substation, erection of high-voltage towers, etc. as well as the fragmentation of habitats as a result of a 120 m wide treeless belt and new access roads running across the forest areas. This impact will be permanent and long-term. The breeding bird species occupying various habitats that will be partially destroyed during construction works will be most vulnerable to the construction phase work.

Most of the construction phase impacts on birds will be **of moderate or small scale, and the significance of impact will be low or moderate. The greatest impacts on birds will be connected to the construction of HV towers and a 220 or 275 kV overhead line. These will be exceptionally negative impacts, permanent, of a very high scale and significance in terms of the entire continent** [Table 6.102].

Table 6.101. Bird species found in the planned project area for the Rational Alternative Variant (RAV) including their conservation status as well as the quality of resources, the species was classified as. List of bird species that may be affected by the project [Source: internal materials]

No.	Species		Status[1]	Protection[2]	IUCN[3]	Annex 1 DP[4]	PRDBA[5]	RLBP[6]	SPEC[7]	Resource type[8]	Permanent technical belt, temporary technical belt
	Species name	Binomial nomenclature									
1.	Stock dove	*Columba oenas*	LB, M	SP	LC	-	-	-	-	Low value	Breeding, sections of breeding areas >1 pair, migratory
2.	Common wood pigeon	*Columba palumbus*	CB, M	G	LC	-	-	-	-	Low value	Breeding, sections of breeding areas >1 pair, migratory
3.	European nightjar	*Caprimulgus europaeus*	LB, M	SP	LC	Yes	-	-	SPEC3	High value	Breeding, sections of breeding areas >1 pair, migratory
4.	Common cuckoo	*Cuculus canorus*	LB, M	SP	LC	-	-	-	-	Low value	Breeding, sections of breeding areas >1 pair, migratory
5.	Common crane	*Grus grus*	CB, M	SP	LC	Yes	-	-	SPEC2	Moderate value	Breeding, sections of breeding areas >1 pair, migratory
6.	Eurasian woodcock	*Scolopax rusticola*	LB, M	G	LC	-	-	-	-	Low value	Breeding, sections of breeding areas >1 pair, migratory
7.	Green sandpiper	*Tringa ochropus*	LB, M	Strict/active	LC	-	-	-	-	Moderate value	Breeding, sections of breeding areas >1 pair, migratory
8.	Long-eared owl	*Asio otus*	CB, M	SP	LC	-	-	-	-	Low value	Breeding, sections of breeding areas >1 pair, migratory
9.	Tawny owl	*Strix aluco*	CB, M	SP	LC	-	-	-	-	Low value	Breeding, sections of breeding areas >1 pair, migratory
10.	Eurasian sparrowhawk	*Accipiter nisus*	LB, M	SP	LC	-	-	-	-	Low value	Breeding, sections of breeding areas >1 pair, migratory
11.	Northern goshawk	*Accipiter gentilis*	LB, M	SP	LC	-	-	-	-	Low value	Breeding, sections of breeding areas >1 pair, migratory
12.	Common buzzard	*Buteo buteo*	CB, M	SP	LC	-	-	-	-	Low value	Breeding, sections of breeding areas >1 pair, migratory
13.	Eurasian wryneck	*Jynx torquilla*	LB, M	SP	LC	-	-	-	SPEC3	Low value	Breeding, sections of breeding areas >1 pair, migratory

No.	Species		Status[1]	Protection[2]	IUCN[3]	Annex 1 DP[4]	PRDBA[5]	RLBP[6]	SPEC[7]	Resource type[8]	Permanent technical belt, temporary technical belt
	Species name	Binomial nomenclature									
14.	European green woodpecker	*Picus viridis*	LB, M	Strict/active	LC	-	-	-	-	Low value	Breeding, sections of breeding areas >1 pair, migratory
15.	Black woodpecker	*Dryocopus martius*	CB, M	Strict/active	LC	Yes	-	-	-	High value	Breeding, sections of breeding areas >1 pair, migratory
16.	Great spotted woodpecker	*Dendrocopos major*	CB, M	SP	LC	-	-	-	-	Low value	Breeding, sections of breeding areas >1 pair, migratory
17.	Eurasian hobby	*Falco subbuteo*	LB, M	Strict/active	LC	-	-	-	-	Low value	Breeding, sections of breeding areas >1 pair, migratory
18.	Golden oriole	*Oriolus oriolus*	LB, M	SP	LC	-	-	-	-	Low value	Breeding, sections of breeding areas >1 pair, migratory
19.	Red-backed shrike	*Lanius collurio*	CB, M	SP	LC	Yes	-	-	SPEC2	High value	Breeding, sections of breeding areas >1 pair, migratory
20.	Eurasian jay	*Garrulus glandarius*	CB, M	SP	LC	-	-	-	-	Low value	Breeding, sections of breeding areas >1 pair, migratory
21.	Coal tit	*Periparus ater*	LB, M	SP	LC	-	-	-	-	Low value	Breeding, sections of breeding areas >1 pair, migratory
22.	European crested tit	*Lophophanes cristatus*	LB, M	SP	LC	-	-	-	SPEC2	Low value	Breeding, sections of breeding areas >1 pair, migratory
23.	Marsh tit	*Poecile palustris*	LB, M	SP	LC	-	-	-	-	Low value	Breeding, sections of breeding areas >1 pair, migratory
24.	Willow tit	*Poecile montanus*	LB, M	SP	LC	-	-	-	SPEC3	Low value	Breeding, sections of breeding areas >1 pair, migratory
25.	Eurasian blue tit	*Cyanistes caeruleus*	CB, M	SP	LC	-	-	-	-	Low value	Breeding, sections of breeding areas >1 pair, migratory
26.	Great tit	*Parus major*	CB, M	SP	LC	-	-	-	-	Low value	Breeding, sections of breeding areas >1 pair, migratory
27.	Woodlark	*Lullula arborea*	CB, M	SP	LC	Yes	-	-	SPEC2	High value	Breeding, sections of breeding areas >1 pair, migratory

No.	Species		Status[1]	Protection[2]	IUCN[3]	Annex 1 DP[4]	PRDBA[5]	RLBP[6]	SPEC[7]	Resource type[8]	Permanent technical belt, temporary technical belt
	Species name	Binomial nomenclature									
28.	Icterine warbler	*Hippolais icterina*	LB, M	SP	LC	-	-	-	-	Low value	Breeding, sections of breeding areas >1 pair, migratory
29.	Wood warbler	*Phylloscopus sibilatrix*	LB, M	SP	LC	-	-	-	-	Low value	Breeding, sections of breeding areas >1 pair, migratory
30.	Willow warbler	*Phylloscopus trochilus*	LB, M	SP	LC	-	-	-	SPEC3	Low value	Breeding, sections of breeding areas >1 pair, migratory
31.	Common chiffchaff	*Phylloscopus collybita*	LB, M	SP	LC	-	-	-	-	Low value	Breeding, sections of breeding areas >1 pair, migratory
32.	Long-tailed tit	*Aegithalos caudatus*	LB, M	SP	LC	-	-	-	-	Low value	Breeding, sections of breeding areas >1 pair, migratory
33.	Eurasian blackcap	*Sylvia atricapilla*	CB, M	SP	LC	-	-	-	-	Low value	Breeding, sections of breeding areas >1 pair, migratory
34.	Garden warbler	*Sylvia borin*	LB, M	SP	LC	-	-	-	-	Low value	Breeding, sections of breeding areas >1 pair, migratory
35.	Lesser whitethroat	*Sylvia curruca*	LB, M	SP	LC	-	-	-	-	Low value	Breeding, sections of breeding areas >1 pair, migratory
36.	Common whitethroat	*Sylvia communis*	LB, M	SP	LC	-	-	-	-	Low value	Breeding, sections of breeding areas >1 pair, migratory
37.	Eurasian treecreeper	*Certhia familiaris*	LB, M	SP	LC	-	-	-	-	Low value	Breeding, sections of breeding areas >1 pair, migratory
38.	Eurasian nuthatch	*Sitta europaea*	LB, M	SP	LC	-	-	-	-	Low value	Breeding, sections of breeding areas >1 pair, migratory
39.	Eurasian wren	*Troglodytes troglodytes*	CB, M	SP	LC	-	-	-	-	Low value	Breeding, sections of breeding areas >1 pair, migratory
40.	Common starling	*Sturnus vulgaris*	CB, M	SP	LC	-	-	-	SPEC3	Low value	Breeding, sections of breeding areas >1 pair, migratory
41.	Mistle thrush	*Turdus viscivorus*	CB, M	SP	LC	-	-	-	-	Low value	Breeding, sections of breeding areas >1 pair, migratory

No.	Species		Status[1]	Protection[2]	IUCN[3]	Annex 1 DP[4]	PRDBA[5]	RLBP[6]	SPEC[7]	Resource type[8]	Permanent technical belt, temporary technical belt
	Species name	Binomial nomenclature									
42.	Song thrush	*Turdus philomelos*	CB, M	SP	LC	-	-	-	-	Low value	Breeding, sections of breeding areas >1 pair, migratory
43.	Common blackbird	*Turdus merula*	CB, M	SP	LC	-	-	-	-	Low value	Breeding, sections of breeding areas >1 pair, migratory
44.	Fieldfare	*Turdus pilaris*	LB, M	SP	LC	-	-	-	-	Low value	Breeding, sections of breeding areas >1 pair, migratory
45.	Spotted flycatcher	*Muscicapa striata*	LB, M	SP	LC	-	-	-	SPEC2	Low value	Breeding, sections of breeding areas >1 pair, migratory
46.	European robin	*Erithacus rubecula*	LB, M	SP	LC	-	-	-	-	Low value	Breeding, sections of breeding areas >1 pair, migratory
47.	Thrush nightingale	*Luscinia luscinia*	LB, M	SP	LC	-	-	NT	-	Low value	Breeding, sections of breeding areas >1 pair, migratory
48.	Red-breasted flycatcher	*Ficedula parva*	LB, M	SP	LC	Yes	-	-	-	High value	Breeding, sections of breeding areas >1 pair, migratory
49.	European pied flycatcher	*Ficedula hypoleuca*	LB, M	SP	LC	-	-	NT		Low value	Breeding, sections of breeding areas >1 pair, migratory
50.	Common redstart	*Phoenicurus phoenicurus*	LB, M	SP	LC	-	-	-	-	Low value	Breeding, sections of breeding areas >1 pair, migratory
51.	Goldcrest	*Regulus regulus*	LB, M	SP	LC	-	-	-	SPEC2	Low value	Breeding, sections of breeding areas >1 pair, migratory
52.	Common firecrest	*Regulus ignicapilla*	LB, M	SP	LC	-	-	-	-	Low value	Breeding, sections of breeding areas >1 pair, migratory
53.	Dunnock	*Prunella modularis*	LB, M	SP	LC	-	-	-	-	Low value	Breeding, sections of breeding areas >1 pair, migratory
54.	Tree pipit	*Anthus trivialis*	LB, M	SP	LC	-	-	-	SPEC3	Low value	Breeding, sections of breeding areas >1 pair, migratory
55.	Common chaffinch	*Fringilla coelebs*	CB, M	SP	LC	-	-	-	-	Low value	Breeding, sections of breeding areas >1 pair, migratory

No.	Species		Status[1]	Protection[2]	IUCN[3]	Annex 1 DP[4]	PRDBA[5]	RLBP[6]	SPEC[7]	Resource type[8]	Permanent technical belt, temporary technical belt
	Species name	Binomial nomenclature									
56.	Hawfinch	*Coccothraustes coccothraustes*	LB, M	SP	LC	-	-	-	-	Low value	Breeding, sections of breeding areas >1 pair, migratory
57.	Eurasian bullfinch	*Pyrrhula pyrrhula*	LB, M	SP	LC	-	-	-	-	Low value	Breeding, sections of breeding areas >1 pair, migratory
58.	Greenfinch	*Chloris chloris*	LB, M	SP	LC	-	-	-	-	Low value	Breeding, sections of breeding areas >1 pair, migratory
59.	Common linnet	*Linaria cannabina*	LB, M	SP	LC	-	-	-	SPEC2	Low value	Breeding, sections of breeding areas >1 pair, migratory
60.	Common redpoll	*Acanthis flammea*	LB, M	SP	LC	-	-	-	-	High value	Breeding, sections of breeding areas >1 pair, migratory
61.	Red crossbill	*Loxia curvirostra*	LB, M	SP	LC	-	-	-	-	Low value	Breeding, sections of breeding areas >1 pair, migratory
62.	Eurasian siskin	*Spinus spinus*	LB, M	SP	LC	-	-	-	-	Low value	Breeding, sections of breeding areas >1 pair, migratory
63.	Yellowhammer	*Emberiza citrinella*	CB, M	SP	LC	-	-	-	SPEC2	Low value	Breeding, sections of breeding areas >1 pair, migratory
64.	Black stork	*Ciconia nigra*	M	Strict/active	LC	Yes	-	-	-	Low value	migratory
65.	Grey heron	*Ardea cinerea*	M	PP	LC	-	-	-	-	Low value	migratory
66.	White-tailed eagle	*Haliaeetus albicilla*	M	SP	LC	Yes	LC	-		Low value	migratory
67.	Red kite	*Milvus milvus*	M	Strict/active	NT	Yes	NT	-	SPEC1	Low value	migratory
68.	Hoopoe	*Upupa epops*	M	Strict/active	LC	-	-	-	-	Low value	migratory
69.	Lesser spotted woodpecker	*Dryobates minor*	M	SP	LC	-	-	-	-	Low value	migratory
70.	Common kestrel	*Falco tinnunculus*	M	Strict/active	LC	-	-	-	SPEC3	Low value	migratory
71.	Red-footed falcon	*Falco vespertinus*	M	SP	NT	-	EXP	RE	SPEC1	Low value	migratory

No.	Species		Status[1]	Protection[2]	IUCN[3]	Annex 1 DP[4]	PRDBA[5]	RLBP[6]	SPEC[7]	Resource type[8]	Permanent technical belt, temporary technical belt
	Species name	Binomial nomenclature									
72.	Merlin	*Falco columbarius*	M	SP	LC	Yes	-	-	-	Low value	migratory
73.	Peregrine falcon	*Falco peregrinus*	M	Strict/active	LC	Yes	CR	VU	-	Low value	migratory
74.	Redwing	*Turdus iliacus*	M	SP	NT	-	-	EN	SPEC1	Low value	migratory
75.	Brambling	*Fringilla montifringilla*	M	SP	LC	-	-	-	SPEC3	Low value	migratory

[1]LB – likely breeding, CB – confirmed breeding (Wilk [419]), M – migrant, visitor or recorded in the survey area

[2]Pursuant to the Regulation of the Minister of the Environment of 16 December 2016 on the protection of animal species (Journal of Laws of 2016, item 2183, as amended): SP – strictly protected species; Strict/active – strictly protected species, active protection permissible; PP – species under partial protection; pursuant to the Regulation of the Minister of the Environment of 11 March 2015 on the development of a list of game species (Plot of Laws of 2005, No. 45, item 433): G – game species

[3]IUCN – classification according to the International Union for the Conservation of Nature, the extinction risk of species: LC – least concern, NT – near-threatened (BirdLife 2020)

[4]Bird species listed in Annex I of the Birds Directive [89]

[5]Bird species listed in the Polish Red Data Book of Animals, concerns breeding birds: CR – species critically endangered, EN – species strongly endangered, EXP – extinct as a breeding species in Poland, LC – least-concern, NT – near-threatened, VU – vulnerable (Głowaciński [124])

[6]Polish Red List of Birds: CR – critically endangered; EN – endangered, NT – near-threatened, RE – regionally extinct, VU – vulnerable (Wilk et al. [418])

[7]The SPEC (Species of European Conservation Concern) categories of special concern assigned by the BirdLife International federation: SPEC1 – species of global conservation concern, SPEC 2 – endangered species, the European population of which exceeds 50% of the global population and their conservation status was assessed as unfavourable, SPEC 3 – endangered species, the European population of which does not exceed 50% of the global population and their conservation status was assessed as unfavourable (BirdLife 2020)

[8]Type of resources – compliant with the environmental inventory (Appendix 1. Report on inventory surveys)

Table 6.102. Construction phase impacts on the birds present in the planned project area and in its immediate vicinity – RAV [Source: internal materials]

No.	Impacts	Nature of impact	Type of impact	Impact range	Temporal scope of impact	Impact scale	Impact sensitivity	Impact significance	Comments
1.	Excavations for the HV towers	Negative	Direct	Local, site-specific	Momentary/short-term	Low	Low	Low	After completion of work, not visible in the area

No.	Impacts	Nature of impact	Type of impact	Impact range	Temporal scope of impact	Impact scale	Impact sensitivity	Impact significance	Comments
2.	HV towers with and overhead line	Extremely negative	Direct, permanent	Local, site-specific and also on a continental scale – involves migratory birds	Permanent, long-term	Very high	Very high	Significant	Impact also in the project operation phase; after the completion of work, the towers with the overhead line will dominate the space within the technical belt, they will pose a lethal threat to birds – migratory as well as birds of the local population
3.	Construction of the customer substation, cable chambers and a 400 kV line	Negative	Direct, permanent	Local, site-specific	Permanent/long-term	Moderate	Low	Low	Impact also in the project operation phase, during the operation phase of the 400 kV overhead line connecting the customer substation with the PSE substation, significant negative impacts may occur (subsection 6.1.5.7.1.9)
4.	Tree felling	Negative	Direct, indirect, permanent	Local, site-specific	Permanent/long-term	Moderate	Moderate	Moderate	Impact also in the project operation phase
5.	Technical belts, access roads, traffic of vehicles	Negative	Direct, indirect, permanent	Local, site-specific	Permanent/long-term	Moderate	Moderate	Moderate	Impact also in the project operation phase
6.	Noise, disturbance	Negative	Direct, indirect	Local, site-specific	Momentary/short-term	Low	Low	Low	Ceases after the construction phase
7.	Contamination	Negative	Direct, indirect	Local, site-specific	Momentary/short-term	Low	Low	Low	Ceases after the construction phase

6.2.1.6.1.10 Mammals

Similarly to the APV, mammals in the area of the RAV overhead line are represented by species relatively common across Poland. Most of them adapt well to the changes in the environment. With the exception of small mammals connected to a particular habitat, the remaining animals use large areas of land and many habitats, and are not assigned to any specific site [Table 6.103].

The construction phase impacts will mainly involve the transformation of the environment which will be caused by partial destruction of habitats, e.g. deforestation of the permanent technical and technological belts, excavations, occupation of land by the customer substation, high-voltage towers, etc. as well as the fragmentation of habitats as a result of a 120 m wide treeless belt and new access roads running across the forest areas. This impact will be permanent and long-term. Mammals occupying various microhabitats that will be destroyed during the project construction will be the most vulnerable to the work connected to the construction phase.

The use of space will change the most for bats. Large structures and the overhead line will force the flying bats to avoid the obstacles. However, also in this case, no significant negative impact of the overhead line on animals is expected. Bats move with very high precisions and easily locate and memorise new topography of the space they use. They adapt quite well to anthropogenic changes. Also, no cases of mass bat collisions with HV overhead lines are known.

Most of the construction phase impacts on mammals will be similar to the ones in the APV and will have a **moderate or small scale and be of low significance. The highest impact on mammals will be connected to the felling of trees and traffic of vehicles. These will be the impacts of moderate scale and significance** [Table 6.104].

Table 6.103. Species of mammals in the area of the planned project in the Rational Alternative Variant (RAV) including their conservation status [Source: internal materials]

No.	Species		Conservation status[1]	Threat category[2]	Permanent technical belt	Temporary technical belt	Comments
	Species name	Binomial nomenclature					
1.	Grey wolf	*Canis lupus*	S	NT	-	-	The species can potentially occur within the entire area connected to the project
2.	Eurasian otter	*Lutra lutra*	PP	LC	-	-	-
3.	Stoat	*Mustela erminea*	PP	LC	-	-	The species can potentially occur within the entire area connected to the project
4.	Northern white-breasted hedgehog	*Erinaceus roumanicus*	PP	LC	-	-	The species may occur in the areas connected to the project near the village of Osieki Lęborskie
5.	European beaver	*Castor fiber*	PP	LC	-	-	-
6.	European water vole	*Arvicola amphibius*	PP	LC	-	-	The species can potentially occur in the waterlogged parts of the area connected to the project
7.	Wood mouse	*Apodemus sylvaticus*	PP	LC	-	-	The species can potentially occur in the waterlogged or more heavily overgrown parts of the area connected to the project
8.	Red squirrel	*Sciurus vulgaris*	PP	LC	-	-	-
9.	Common shrew	*Sorex araneus*	PP	LC	-	-	The species can potentially occur in the waterlogged parts of the area connected to the project
10.	Eurasian pygmy shrew	*Sorex minutus*	PP	LC	-	-	The species can potentially occur in the waterlogged parts of the area connected to the project
11.	European mole	*Talpa europaea*	PP	LC	-	Confirmed	The species can potentially occur within the entire area connected to the project
12.	Bats	*Chiroptera*	SP	-	Confirmed	Confirmed	The species can potentially occur within the entire area connected to the project
13.	Other mammal species	-	Not under protection	LC	Confirmed	Confirmed	The species can potentially occur within the entire area connected to the project

[1]Pursuant to the Regulation of the Minister of the Environment of 16 December 2016 on the protection of animal species (Journal of Laws of 2016, item 2183, as amended): SP – species under strict protection, PP – species under partial protection
[2]NT – near threatened, LC – least concern

Table 6.104. Assessment of the construction phase impacts on mammals present in the planned project area and its immediate vicinity – Rational Alternative Variant (RAV) [Source: internal materials]

No.	Impacts	Nature of impact	Type of impact	Impact range	Temporal scope of impact	Impact scale	Impact sensitivity	Impact significance
1.	Excavations for the HV towers	Negative	Direct	Local, site-specific	Momentary/short-term	Moderate	Low	Low
2.	Construction of a power substation and cable chambers	Negative	Direct, permanent	Local, site-specific	Permanent/long-term	Moderate	Low	Low
3.	Tree felling	Negative	Direct, indirect, permanent	Local, site-specific	Permanent/long-term	Moderate	Moderate	Moderate
4.	Technical belts, access roads, traffic of vehicles	Negative	Direct, indirect, permanent	Local, site-specific	Permanent/long-term	Moderate	Moderate	Moderate
5.	Noise, disturbance	Negative	Direct, indirect	Local, site-specific	Momentary/short-term	Low	Low	Low
6.	Contamination	Negative	Direct, indirect	Local, site-specific	Momentary/short-term	Low	Low	Low

6.2.1.6.2 Impact on protected areas

6.2.1.6.2.1 Wpływ na obszary chronione inne niż Natura 2000

The construction phase impact on the **Coastal Protected Landscape Area** in the RAV, similarly to the APV, will be connected to construction works, the presence of construction machinery and equipment, the construction of excavations and will cease after the construction works and restoration works are completed.

The impact on the Coastal Protected Landscape Area in the construction phase will be mainly connected to the felling of trees within:

- the permanent technical belt with a width of approx. 70 m and a length of 5.2 km – it covers a surface area of approx. 35 ha;
- the technological belt with a width of 25 m from the external overhead lines and a length of approx. 5.2 km, as a result of the necessary deforestations – it covers a surface area of approx. 25 ha.

As a result of the RAV implemented, trees will be felled across a maximum 60 ha surface area.

Summing up, the construction phase impact on the Coastal Protected Landscape Area for the RAV will be higher than in the APV. This is mainly connected to the larger surface area of land occupied as well as the felling planned for a 120 m wide strip of land along a 5.2 km section. The overhead line construction will be implemented in sections, the work will concentrate in points, at the locations of towers.

Regardless of the variant selected, the planned project involves the necessity to construct cable chambers. The construction phase impacts on the ecological area "Torfowisko" [Peat bog] in Szklana Huta were identified with reference to the impacts on surface waters (subsection 6.1.4.2), hydrological conditions and groundwater (subsection 6.1.4.3) as well as the ecological area itself (subsection 6.1.4.6.2.1). **The construction phase impacts on the ecological area "Torfowisko" [Peat bog] in Szklana Huta in the RAV will be higher due to the necessity to erect overhead line towers with dimensions 10 x 8 m and a depth of up to 4 m. The construction of such deep excavations in this area may entail the necessity to conduct dewatering, which may result in the formation of a cone of depression, peat drainage and its degradation.**

The impacts of the planned project in the RAV will be **irreversible, permanent, of large scale and significance** [Table 6.105].

The assessment of the protected areas resistance to the construction phase impacts for the RAV is identical as for the APV and is presented in subsection 6.1.4.6.2.1 [Table 6.57].

Table 6.105. Characteristics of the construction phase impacts on the protected area other than Natura 2000 sites in the Rational Alternative Variant (RAV) [Source: internal materials]

No.	Impacts	Forms of environmental protection	Nature of impact	Type of impact	Impact range	Temporal scope of impact	Impact scale	Impact sensitivity	Impact significance
1.	Removal of trees and shrubs within the permanent and temporary belts	Coastal Protected Landscape Area	Negative	Direct, primary, irreversible	Local	Permanent	High	High	Important
		Ecological area “Torfowisko” [Peat bog] in Szklana Huta		Indirect, secondary, reversible			High	High	Important
2.	Contamination as a result of accidental leaks from machinery and vehicles	Coastal Protected Landscape Area	Negative	Direct, primary, irreversible	Local	Medium-term	Moderate	High	Moderate
		Ecological area “Torfowisko” [Peat bog] in Szklana Huta				Permanent	High	High	Important

6.2.1.6.2.2 Impact on Natura 2000 site Białogóra (PLH220003)

The construction phase impact on the special habitat protection area Białogóra PLH220003 will be definitely higher than in the case of the APV due to a larger surface area occupied. The project will run across this area along a 450 m section and will involve tree felling on a surface area of approx. 5 ha.

The identification and assessment of impacts on protected areas within the European Natura 2000 network is presented in subsection 6.3.

Summing up, the construction phase impact on the special habitat protection area Białogóra PLH220003 for the RAV will be higher than in the APV. This is mainly connected to the surface area of the land occupied as well as the felling planned in a 120 m wide strip of land along a 5.2 km section. The planned project will cause a direct threat to habitat 2180. As a result of the overhead line construction, habitat 2180 will be destroyed on a surface area of 12 600 m^2. This will be a permanently deforested area without the possibility of returning to the previous condition [Table 6.106].

Table 6.106. Matrix defining the significance of the construction phase impact on the Natura 2000 sites in the Rational Alternative Variant (RAV) [Source: internal materials]

Impact significance		**Receptor sensitivity**				
		Irrelevant	**Low**	**Moderate**	**High**	**Very high**
Scale (size) of impact	Irrelevant	Negligible	Negligible	Negligible	Negligible	Low
	Low	Negligible	Negligible	Low	Low	Moderate
	Moderate	Negligible	Low	Low	Moderate	Moderate
	High	Negligible	Low	Moderate	Important	Significant
	Very high	Low	Moderate	Moderate	Significant	Significant

6.2.1.6.2.3 Impact on wildlife corridors

The construction phase involving the felling of trees, construction of excavations and erection or towers, as well as the construction of a customer substation and a 400 kV overhead line will cause a spatial discontinuity of the Coastal wildlife corridor of a supra-regional importance. The overhead line construction will be implemented in sections work will be performed in points at the locations of towers. In total, it will occupy a 120 m wide and 5.2 km long surface area, and its impacts will be the same as in the APV. The differentiating factor will be a larger surface of the area occupied.

Summing up, the impact on the wildlife corridors will be higher than in the case of the APV. The impacts of the planned project will be negative, direct, primary, reversible, local, and permanent [Table 6.107].

Table 6.107. Matrix defining the significance of the construction phase impact on wildlife corridors in the Rational Alternative Variant (RAV) [Source: internal materials]

Impact significance		**Receptor sensitivity**				
		Irrelevant	**Low**	**Moderate**	**High**	**Very high**
Scale (size) of impact	Irrelevant	Negligible	Negligible	Negligible	Negligible	Low
	Low	Negligible	Negligible	Low	Low	Moderate
	Moderate	Negligible	Low	Low	Moderate	Moderate
	High	Negligible	Low	Moderate	Important	Significant
	Very high	Low	Moderate	Moderate	Significant	Significant

6.2.1.6.2.4 Impact on biodiversity

The construction phase impact on biodiversity in the RAV will be higher than in the case of the APV due to a larger surface area occupied and intended for tree felling, which entails loss of habitats. The main impacts will affect birds as a result of the construction of HV towers and a 220 or 275 kV overhead line. These will be exceptionally negative impacts, permanent, of a very large scale and of significant impact in terms of the entire continent. These will be negative impacts, permanent, of a very large scale and of significant impact in terms of the entire continent [Table 6.108].

Table 6.108. Matrix defining the significance of the construction phase impact on biodiversity in the Rational Alternative Variant (RAV) [Source: internal materials]

Impact significance		**Receptor sensitivity**				
		Irrelevant	**Low**	**Moderate**	**High**	**Very high**
Scale (size) of impact	Irrelevant	Negligible	Negligible	Negligible	Negligible	Low
	Low	Negligible	Negligible	Low	Low	Moderate
	Moderate	Negligible	Low	Low	Moderate	Moderate
	High	Negligible	Low	Moderate	Important	Significant
	Very high	Low	Moderate	Moderate	Significant	Significant

6.2.1.7 Impact on cultural amenities, monuments and archaeological objects and sites

There are no monuments entered into the register of historical monuments of the Pomorskie Voivodeship, documentation sites nor archaeological objects within the area of the technological belts designated for the purposes of the planned project.

The construction of an 220 or 275 kV overhead line will not affect the cultural values, monuments, archaeological sites or objects.

6.2.1.8 Impact on the use and development of the land area and tangible goods

The impact on the use and development of the land area and tangible goods for the RAV in the construction phase will be greater than in the case of the APV, due to a larger surface area of land occupied and greater limitation of the forest tourist function in this area. These will be significant impacts.

The route of the 220 or 275 kV overhead line will involve permanent clearing of trees:

- within the permanent technical belt with a width of approx. 70 m and a length of 5.2 km – it covers 57 forest plots and a surface area of approx. 35 ha;
- within the technological belt with a width of 25 m from the external overhead lines and a length of approx. 5.2 km – it covers 47 forest plots and a surface area of approx. 25 ha.

The existing forest use will be supplemented with a new function of electricity transmission. The 220 or 275 kV overhead line will dominate the forest surroundings.

After the customer substation and the 400 kV overhead line are constructed, it will become impossible to continue agricultural activities in that area, the biologically active area and the infiltration of precipitation water into groundwater will decrease. The vegetation cover in this area will be destroyed through the removal of the existing vegetation cover as well as indirectly through the change of the soil and water relations. The load on the access roads to the substation and the line will increase, which will contribute to the negligible increase in the emission of dust (car traffic) and flue gases coming primarily from the car engines.

The impact on tangible goods in the construction phase will involve the use of the same road infrastructure as in the APV.

The construction phase impact on the use and development of land and on tangible goods was assessed as significant [Table 6.109].

Table 6.109. Matrix defining the significance of the construction phase impact on the use and development of land as well as tangible goods in the RAV [Source: internal materials]

Impact significance		**Receptor sensitivity**				
		Irrelevant	**Low**	**Moderate**	**High**	**Very high**
Scale (size) of impact	Irrelevant	Negligible	Negligible	Negligible	Negligible	Low
	Low	Negligible	Negligible	Low	Low	Moderate
	Moderate	Negligible	Low	Low	Moderate	Moderate
	High	Negligible	Low	Moderate	Important	Significant
	Very high	Low	Moderate	Moderate	Significant	Significant

6.2.1.9 Impact on landscape, including the cultural landscape

The RAV impact on landscape in the construction phase will be greater than in the case of the APV due to a larger surface area occupied. The differentiating factor will be the specific appearance of the high 4-circuit towers and the overhead line. These will be significant impacts [Table 6.110].

Table 6.110. Matrix defining the significance of the construction phase impact on landscape, including the cultural landscape in the RAV [Source: internal materials]

Impact significance		**Receptor sensitivity**				
		Irrelevant	**Low**	**Moderate**	**High**	**Very high**
Scale (size) of impact	Irrelevant	Negligible	Negligible	Negligible	Negligible	Low
	Low	Negligible	Negligible	Low	Low	Moderate
	Moderate	Negligible	Low	Low	Moderate	Moderate
	High	Negligible	Low	Moderate	Important	Significant
	Very high	Low	Moderate	Moderate	Significant	Significant

6.2.1.10 Impact on population, health and living conditions of people

The construction phase impact on population, health and living conditions of people for the RAV will be similar to the one in the APV. The differentiating factors for the RAV will be a greater distance (approx. 420 m) from the Rehabilitation and Holiday Centre for disabled people and shorter duration of the construction works. In consequence, the construction phase impact of noise and pollution on the people present at the premises of the Centre will be lower.

The significance of the construction phase impact on population, health and living conditions of people was assessed as low [Table 6.111].

Table 6.111. Matrix defining the construction phase impact on population, health and living conditions of people in the Rational Alternative Variant (RAV) [Source: internal materials]

Impact significance		**Receptor sensitivity**				
		Irrelevant	**Low**	**Moderate**	**High**	**Very high**
Scale (size) of impact	Irrelevant	Negligible	Negligible	Negligible	Negligible	Low
	Low	Negligible	Negligible	Low	Low	Moderate
	Moderate	Negligible	Low	Low	Moderate	Moderate
	High	Negligible	Low	Moderate	Important	Significant
	Very high	Low	Moderate	Moderate	Significant	Significant

6.2.2 Operation phase

In the operation phase, the planned project in the form of a 220 or 275 kV overhead line is a practically maintenance-free. The operation phase will entail the highest impact in relation to the customer substation and the 400 kV overhead line.

6.2.2.1 Impact on geological structure, coastal zone, soils and access to raw materials and deposits

6.2.2.1.1 Impact on geological structure

The failure-free operation of the planned project does not involve contamination of the soil environment. The operation of the customer station and episodic use of access roads to towers will not result in significant emission of gaseous or particulate pollutants or in the emission of sewage that could contaminate the soil environment.

The main operation phase impact will be a permanent spot occupation of land by the tower foundations as well as a permanent deforestation of a strip of land with a surface area of approx. 60 ha. There are also plans for a 1 ha surface area around the power substation to be occupied by the facilities permanently fixed to the land.

Permanent occupation of the land will also be related to the operation of 4 cable chambers with a maximum side length of several meters. Each cable chamber will be equipped with an inspection hatch used also for the maintenance purposes. Cable chambers will be designed to prevent the water from collecting and to provide safe access to the devices located inside.

Within the substation area, infrastructural and technological facilities which do not generate emissions into the ground will be present. The construction of a station area drainage system is planned. The system will be equipped with pre-treatment devices, thus, no impact on the surface formations is expected (subsection 6.1.5.1.1).

During operation, service work will be conducted at the overhead line towers using the existing access roads.

The impact of the planned project in the RAV on the geological structure is identical as in the APV. The differentiating factor is a greater spatial range.

The impact connected to permanent deforestation within the technical and technological belts concerns all types of surface formations. On aeolian sands, the impact connected to the permanent deforestation was assessed as negative and significant, since as a result of deforestation the aeolian processes may be triggered.

In the RAV, the impact of the planned project related to the deforestation is similar to the APV – of low significance or negligible as well as local.

6.2.2.1.2 Impact on the topography and dynamics of the coastal zone

Deforestation of dunes within an approx. 120 m wide strip and the erection of power grid masts involves a high probability of triggering aeolian processes within the Wydmy Lubiatowskie dunes. As a result of triggering such processes, significant changes to the nature of the relief may occur both within the investment belt as well as in the neighbouring areas. As a result of the aeolian processes triggering, the elements of infrastructure can become uncovered or buried by the sandy aeolian material transported. The dune processes may significantly affect the neighbouring habitats.

The operation phase impact on the topography and dynamics of the coastal zone was assessed as important and of local range in the RAV.

6.2.2.1.3 Impact on soils

As a result of the planned project operation which will have an impact on soils, a permanent occupation of land for the following purposes will occur:

- deforested strip of land with a surface area of approx. 60 ha;
- power tower foundations;
- customer substation;
- cable chambers;
- 400 kV line tower sites;
- access roads.

The operation of the planned project will not be a source of significant negative impacts on soil. Due to untroubled operation, no impact on the soil-water relations in the neighbouring areas is expected. The natural, local drainage regime will be maintained.

Within the substation area, infrastructural and technological facilities which do not generate emissions into the ground will be present. The construction of a station area drainage system is planned. The system will be equipped with pre-treatment devices, thus, no impact on soil is expected.

As a result of the construction of a customer substation, towers for the 400 kV overhead line and the maintenance of a permanently deforested strip of land, the nature of soils within this area will be changed and their productivity reduced.

The impact connected to the permanent deforestation within the permanent technical and technological belts concerns all types of soils. The significance of impact was assessed as important in the case of arenosols, in the area of which as a result of deforestation aeolian process may be triggered and the thin soil cover may be destroyed. In the case of hydrogenic soils (peat), the impact was assessed as positive, because the removal of trees will positively affect the moorshification processes by slowing them down.

6.2.2.1.4 Impact on the access to raw materials and deposits

Since the planned project is situated at a distance of more than 4 km from the nearest deposit, no operation phase impacts are expected on deposits.

No operation phase impacts of the planned project on the possibility to execute the Żarnowiec concession No. 5/2019/Ł for the prospection, exploration and production of hydrocarbons of 13 June 2019, owned by ShaleTech Energy Sp. z o.o., is expected.

6.2.2.2 Impact on the quality of surface waters

The impact of the planned project in the form of a 220 or 275 kV overhead line on the quality of surface waters during the operation phase will be connected to potential contaminations as a result of accidental leaks from machinery and vehicles due to maintenance works. In the assessment of impact on the quality of surface waters, particular attention was paid to two ponds within the boundaries of the ecological area “Torfowisko” [Peat bog] in Szklana Huta. The scale of impacts on ponds, which the access roads to the cable chambers run through, was assessed as high, and the significance of impact as important. However, it should be remembered that the contaminations of soil and water are unlikely and concern only short-term maintenance works. In the phase of the 220 or 275 kV overhead line operation, no impact on the surface waters, including the environmental objectives specified for SWBs in the Vistula River Basin Management Plan (2016), will occur. In the operation phase, the planned project will not introduce any contaminating substances to the environment, including surface and groundwater, as well as to the ground, and will not cause any changes to the water circulation. The precipitation water from the tower foundations will infiltrate the substrate around them.

Consequently, the assessment of impact on surface water quality was identified as low, local in extent and significant in relation to the potential contamination of ponds within the boundaries of the “Torfowisko” [Peat bog] in Szklana Huta ecological area.

The potential impact connected to the operation of the customer substation and the 400 kV overhead line was described in subsection 6.1.5.2.

6.2.2.3 Impact on hydrogeological conditions and groundwater

In the operation phase, no impact of the 220 or 275 kV overhead line on hydrological conditions and groundwater will occur. The potential impacts may be related to maintenance works or possible contaminations as a result of accidental leaks. In the assessment of impact on the quality of surface waters, particular attention was paid to the two ponds within the boundaries of the ecological area “Torfowisko” [Peat bog] in Szklana Huta. The use of the road leading through the ecological area as an access road to the cable chambers for the purposes of maintenance works gives rise to a potential risk of contamination of the waters within this area, caused by the possibility of the penetration of petroleum products from construction vehicles and machinery. In this context, the scale of impact on ponds was assessed as high, and the significance of impact as important. However, it should be remembered that the contaminations of soil and water are unlikely and concern only short-term maintenance works.

At the stage of the 220 or 275 kV overhead line operation, no impact on groundwater, including the environmental objectives specified for GWBs in the Vistula River Basin Management Plan (2016), will occur.

The impact on groundwater was assessed to be of low significance and local rextent, as in the case of the APV. The scale of impact on small ponds – was assessed as high and significant.

The potential impact connected to the operation of the customer substation and the 400 kV overhead line was described in subsection 6.1.5.3.

6.2.2.4 Impact on climate, including greenhouse gas emissions and impacts relevant for adaptation to climate change, impact on atmospheric air (air quality)

Due to forest clearance within a 120 m wide belt, an increase in insolation and air temperature, as well as a decrease in humidity and an increase in ventilation are expected. As a result of such changes, habitat changes may occur connected to the disappearance of shade-loving species and the introduction of species requiring greater insolation. Such impacts, due to the necessity of maintaining deforested areas, will be permanent and irreversible.

The extra high voltage lines heat up and release heat to the environment during operation, however, this impact can only be distinguished in the immediate vicinity of the cable, and the line is located several metres above the ground, so there will be no change in the microclimate even in the immediate vicinity of the planned line.

Summing up, no operation phase impacts of the planned project on the climate are expected; there will also be no greenhouse gas emissions nor impacts relevant to the climate change adaptation.

6.2.2.5 Impact on ambient noise

Permissible noise levels in the environment are specified in subsection 6.1.5.5.1.

6.2.2.5.1 The forecast impact of the planned project on the acoustic climate of the environment

Due to the fact that in the case of a 220 kV overhead line constructed using a three-circuit AFL-8525 mm^2 bundle, the corona discharge practically does not occur, the available literature on the issues of power line impacts in terms of emission of noise to the environment, provides only the results of noise studies around 400 kV lines (subsection 6.1.5.5.2).

6.2.2.5.2 Results of the noise level calculations for 220 or 275 kV overhead lines

The calculations of the forecast distribution of sound level in the vicinity of the planned 4-circuit overhead line were carried out for a characteristic (representative) line cross-section (the same, for which the distribution calculations of the electric and magnetic fields were carried out), i.e. in the place with the smallest distance of the line conductors from the ground.

With the specified power line design (tower series and type) and the adopted phase configuration, the value of phase voltage determined, as well as in specified weather conditions (good and bad weather), the noise level around the power line caused by corona discharge depends mainly upon the distance of phase conductors from the ground. Its level decreases with the distance from the line conductors, however, it reaches its highest value within the cross section in which the distance of phase conductors from the ground is the smallest – typically in the middle of a power line span.

Due to the fact that the maximum value of sound level in the vicinity of the line should be expected for the smallest distance of the conductor from the ground ($h = h_{min}$), the calculations were conducted for the smallest design distance of the phase-to-ground conductor which is:

- 6.7 m for a 4-circuit line designed to operate at a rated voltage of U_{n1} – 220 kV;
- 7.1 m for a 4-circuit line designed to operate at a rated voltage of U_{n2} – 275 kV.

The calculations of the sound level distribution were carried out at the heights of: 1.5, 4 and 5 m above the ground level, assuming an operation of a line equipped with 3 x AFL-8525 mm^2 bundle circuits in compliance with the project assumptions. The results of calculations indicated that regardless of the atmospheric conditions (also in bad weather conditions) and the rated voltage of the line (220 or 275 kV), the corona discharge from the conductors will not occur, because when conductors of such a large diameter are used and arranged into a three-core bundle (conductors arranged in the vertices of an equilateral triangle with a side length of 40 cm), the intensity of the electric field on the surface of the conductors does not exceed the critical intensity E_0, which in the most unfavourable atmospheric conditions is approx. 12 $kV \cdot cm^{-1}$. This means that the 4-circuit overhead line equipped with type AFL-8525 mm^2 bundle conductors (three-core bundle), operating both at 220 kV and 275 kV, is not a source of noise identified with such analytical as well as measurement methods. This applies to any weather conditions.

It should be underlined here that in the case of an overhead line operating at a voltage of 220 or 275 kV, the decisive factor for the possible occurrence of corona discharge, apart from the atmospheric conditions, is the diameter of the conductor used. Assuming that in the construction of the planned 4-circuit overhead line the conductors of a smaller diameter will be used (the expected line load fully justifies the possibility of using conductors with a lower load capacity), for example, of a type AFL-8350 mm^2 in the form of a three-core bundle, with the conductors arranged in the vertices of an equilateral triangle with a side length of 40 cm, then at an operating voltage of the 275 kV line (for a line equipped with type AFL-8350 ^{2} conductors operating at 220 kV, the corona discharge will also not occur because the electric field intensity on the surface of the conductors will not reach the critical intensity, which when exceeded causes the occurrence of corona discharge from the surface of the conductors), the occurrence of a non-intense corona discharge can be expected, which will give rise to the noise of the levels recorded, above all in bad weather conditions (drizzle, light rain, rime). This is confirmed by the results of the calculations conducted and presented in Table 6.112 as well as in a graphic form (isolines) in Figures Figure 6.34–Figure 6.36. The calculation results are presented in the form of sound level distribution graphs in the previously characterised cross-section (where $h = h_{min}$), up to a distance of ±100 m from the centreline of the overhead line.

The determined sound level distributions, the results of which are presented in Table 6.112 refer to bad weather conditions (L_{Aeq}), long-term periods (L_T) as well as day-evening-night levels (L_{DEN}) for the calculation heights of 1.5, 4 and 5 MAGL.

Table 6.112. Calculation results for the forecast corona discharge noise distribution at a height of 1.5; 4.0 and 5 MAGL accompanying the operation of a 275 kV rated voltage 4-circuit overhead line erected using a three-core bundle made of AFL-8350 mm^2 cables [Source: internal materials]

No.	Distance from the centre line [m]	Height of 1.5 MAGL				4.0 MAGL				5.0 MAGL			
		$L_{Aeq,bw}$	$L_{Aeq,gw}$	L_T	L_{DEN}	$L_{Aeq,bw}$	$L_{Aeq,gw}$	L_T	L_{DEN}	$L_{Aeq,bw}$	$L_{Aeq,gw}$	L_T	L_{DEN}
1.	-100	19.8		10.3	16.7	19.8		10.3	16.7	19.8		10.3	16.7
2.	-85	20.8		11.3	17.7	20.8		11.3	17.7	20.8		11.3	17.7
3.	-70	22.0		12.5	18.9	22.0		12.5	18.9	22.0		12.5	18.9
4.	-55	23.5		14.0	20.4	23.5		14.0	20.4	23.5		14.0	20.4
5.	-45	24.7		15.2	21.6	24.8		15.2	21.6	24.8		15.2	21.6

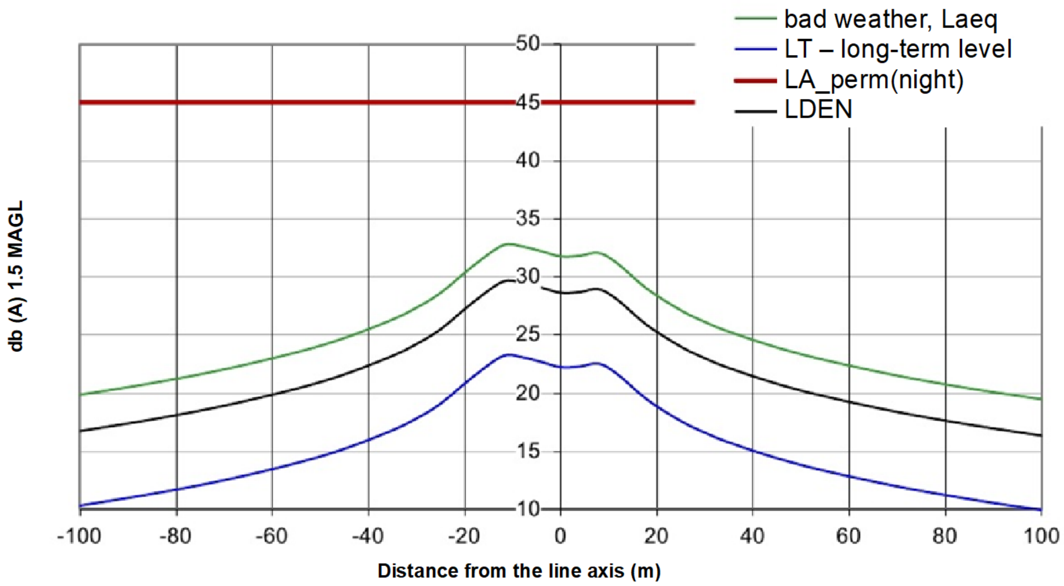
No.	Distance from the centre line [m]	Height of 1.5 MAGL				4.0 MAGL				5.0 MAGL			
		$L_{Aeq,bw}$	$L_{Aeq,gw}$	L_T	L_{DEN}	$L_{Aeq,bw}$	$L_{Aeq,gw}$	L_T	L_{DEN}	$L_{Aeq,bw}$	$L_{Aeq,gw}$	L_T	L_{DEN}
6.	-35	26.3		16.8	23.2	26.4		16.9	23.3	26.4		16.9	23.3
7.	-30	27.3		17.8	24.2	27.4		17.9	24.3	27.5		18.0	24.4
8.	-25	28.6		19.1	25.5	28.8		19.3	25.7	28.9		19.4	25.8
9.	-18	31.0		21.5	27.9	31.8		22.3	28.7	32.1		22.6	29.0
10.	-12	32.7		23.2	29.6	34.8		25.3	31.7	36.2		26.7	33.1
11.	-8	32.6		23.1	29.5	34.2		24.6	31.0	35.1		25.6	32.0
12.	-4	32.2		22.7	29.1	33.6		24.0	30.4	34.5		24.9	31.3
13.	0	31.7		22.2	28.6	32.5		23.0	29.4	32.8		23.3	29.7
14.	4	31.8		22.3	28.7	32.8		23.3	29.7	33.2		23.7	30.1
15.	8	32.0		22.5	28.9	34.3		24.8	31.2	35.9		26.4	32.8
16.	12	31.1		21.5	27.9	32.3		22.8	29.2	32.8		23.2	29.6
17.	18	28.9		19.4	25.8	29.3		19.8	26.2	29.4		19.9	26.3
18.	25	27.1		17.6	24.0	27.2		17.7	24.1	27.3		17.7	24.1
19.	30	26.1		16.6	23.0	26.2		16.7	23.1	26.2		16.7	23.1
20.	35	25.3		15.7	22.1	25.3		15.8	22.2	25.3		15.8	22.2
21.	45	23.9		14.4	20.8	23.9		14.4	20.8	23.9		14.4	20.8
22.	55	22.8		13.3	19.7	22.8		13.3	19.7	22.8		13.3	19.7
23.	70	21.5		12.0	18.4	21.5		12.0	18.4	21.5		12.0	18.4
24.	85	20.4		10.9	17.3	20.4		10.9	17.3	20.4		10.9	17.3
25.	100	19.4		9.9	16.3	19.5		9.9	16.3	19.5		9.9	16.3

L_T – long-term level, L_{DEN} – day-evening-night level, $L_{Aeq,bw}$ – A-weighted equivalent sound level in bad weather, $L_{Aeq,gw}$ – A-weighted equivalent sound level in good weather

Forecast corona discharge noise distribution at a height of 1.5 MAGL
4-circuit line 4x275 kV

Suspension height of the lower phase **h= 7,10 m** Span no.

Towers Operating cables 3xAFL-8 350 mm^2 Span **PP**



Isoline range [m]	height MAGL [m]	Side of the line	50 dB [m]	**45 dB** [m]	40 dB [m]
Bad weather (Laeq)	**1,5**	**L**	**b.z.**	**b.z.**	**b.z.**
		P	**b.z.**	**b.z.**	**b.z.**
Level L (DEN (z))	**1,5**	**L**	**b.z.**	**b.z.**	**b.z.**
		P	**b.z.**	**b.z.**	**b.z.**

1) An average value of the isoline range of a given value was determined. This range can change within the limits of the calculation uncertainty, which in the model adopted is +/- 2.4 dB

Bad weather – an average rainfall intensity of 1.2 mm/h was used for the calculations

n/r – no range. Level of noise in the entire cross-section does not exceed the criterion value (at a given height above ground level)

The permissible noise values were adopted according to the Regulation of the Minister of the Environment of 14 June 2007 on permissible noise levels in the environment (Journal of Laws of 2007, No. 120 item 826) tables 2 and 4

50 dB isoline
Determines the range of the permissible value acc. to the Reg. of the Min. of the Env., item 2a-c, daytime (LaeqD) and LDEN

45 dB isoline
Determines the range of the permissible value acc. to the Reg. of the Min. of the Env., item 2a-c, night-time LN, and item 1a-c, daytime LaeqD as well as LDEN

40 dB isoline
Determines the range of the permissible value acc. to the Reg. of the Min. of the Env., item 1a-c, night-time LaeqN and LN

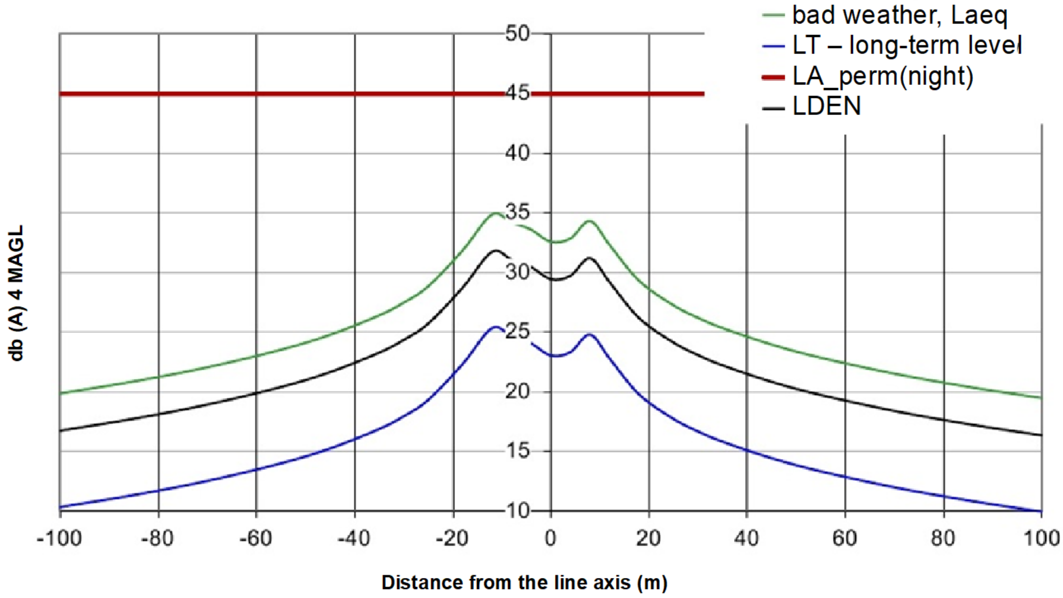
The typical dirt coefficient k = 0.6 at a scale 0.4–1 was adopted for the calculations.
For normal conductors (typical, slightly dirty surface) k = 0.6.
For clean conductors in good technical condition k = 0.4.

Figure 6.34. Calculation results for the forecast corona discharge noise distribution at a height of 1.5 MAGL accompanying the operation of a 275 kV rated voltage 4-circuit overhead line erected using a three-core bundle made of AFL-8350 mm^2 cables [Source: internal materials]

Forecast corona discharge noise distribution at a height of 4 MAGL
4-circuit line 4x275 kV

Suspension height of the lower phase h= 7,10 m Span no.

Towers Operating cables $3xAFL\text{-}8\ 350\ mm^2$ Span PP



Isoline range [m]	height MAGL [m]	Side of the line	50 dB [m]	**45 dB** [m]	40 dB [m]
Bad weather (Laeq)	4	L	b.z.	b.z.	b.z.
		P	b.z.	b.z.	b.z.
Level L (DEN (z))	4	L	b.z.	b.z.	b.z.
		P	b.z.	b.z.	b.z.

1) An average value of the isoline range of a given value was determined. This range can change within the limits of the calculation uncertainty, which in the model adopted is +/- 2.4 dB

Bad weather – an average rainfall intensity of 1.2 mm/h was used for the calculations

n/r – no range. Level of noise in the entire cross-section does not exceed the criterion value (at a given height above ground level)

The permissible noise values were adopted according to the Regulation of the Minister of the Environment of 14 June 2007 on permissible noise levels in the environment (Journal of Laws of 2007, No. 120 item 826) tables 2 and 4

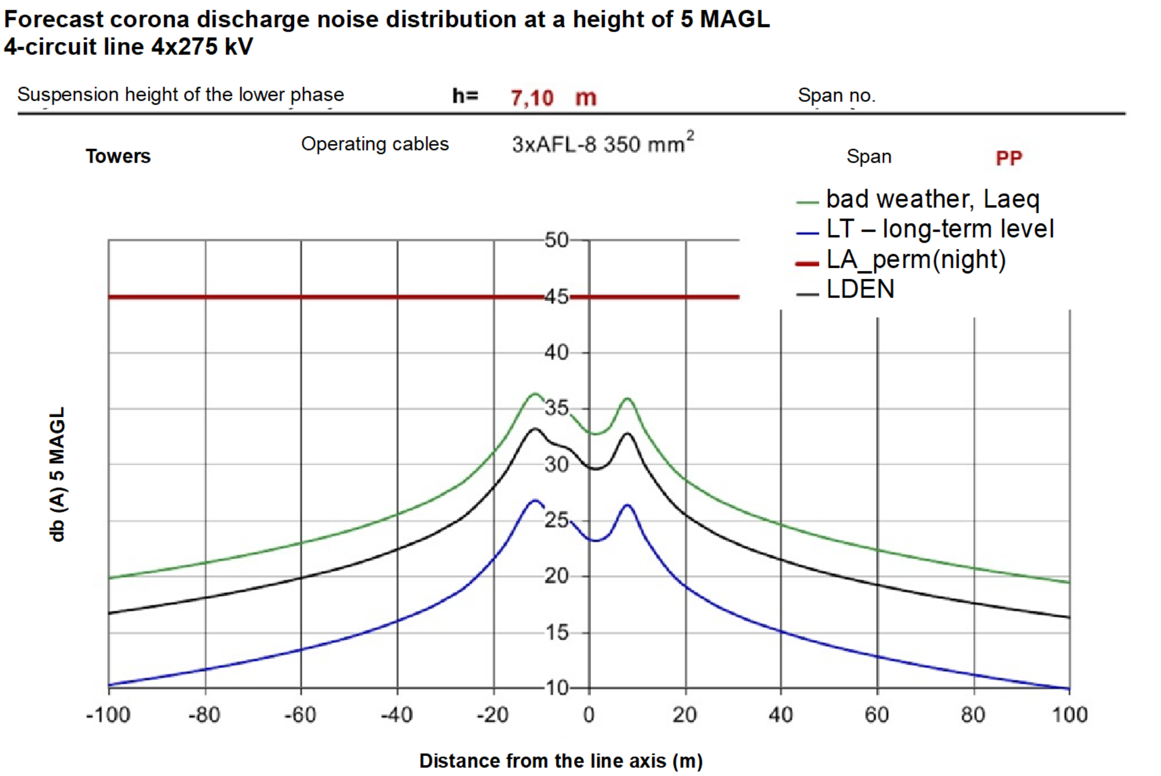
50 dB isoline
Determines the range of the permissible value acc. to the Reg. of the Min. of the Env., item 2a-c, daytime (LaeqD) and LDEN

45 dB isoline
Determines the range of the permissible value acc. to the Reg. of the Min. of the Env., item 2a-c, night-time LN, and item 1a-c, daytime LaeqD as well as LDEN

40 dB isoline
Determines the range of the permissible value acc. to the Reg. of the Min. of the Env., item 1a-c, night-time LaeqN and LN

The typical dirt coefficient k = 0.6 at a scale 0.4–1 was adopted for the calculations.
For normal conductors (typical, slightly dirty surface) k = 0.6.
For clean conductors in good technical condition k = 0.4.

Figure 6.35. Calculation results for the forecast corona discharge noise distribution at a height of 4.0 MAGL accompanying the operation of a 275 kV rated voltage 4-circuit overhead line erected using a three-core bundle made of AFL-8350 mm² cables [Source: internal materials]



Isoline range [m]	height MAGL [m]	Side of the line	50 dB [m]	**45 dB** [m]	40 dB [m]
Bad weather (Laeq)	5	L	b.z.	b.z.	b.z.
		P	b.z.	b.z.	b.z.
Level L (DEN (z))	5	L	b.z.	b.z.	b.z.
		P	b.z.	b.z.	b.z.

[1]. An average value of the isoline range of a given value was determined. This range can change within the limits of the calculation uncertainty, which in the model adopted is +/- 2.4 dB

Bad weather – an average rainfall intensity of 1.2 mm/h was used for the calculations

n/r – no range. Level of noise in the entire cross-section does not exceed the criterion value (at a given height above ground level)

The permissible noise values were adopted according to the Regulation of the Minister of the Environment of 14 June 2007 on permissible noise levels in the environment (Journal of Laws of 2007, No. 120 item 826) tables 2 and 4

50 dB isoline
Determines the range of the permissible value acc. to the Reg. of the Min. of the Env., item 2a-c, daytime (LaeqD) and LDEN

45 dB isoline
Determines the range of the permissible value acc. to the Reg. of the Min. of the Env., item 2a-c, night-time LN, and item 1a-c, daytime LaeqD as well as LDEN

40 dB isoline
Determines the range of the permissible value acc. to the Reg. of the Min. of the Env., item 1a-c, night-time LaeqN and LN

The typical dirt coefficient k = 0.6 at a scale 0.4–1 was adopted for the calculations.
For normal conductors (typical, slightly dirty surface) k = 0.6.
For clean conductors in good technical condition k = 0.4.

Figure 6.36. Calculation results for the forecast corona discharge noise distribution at a height of 5.0 MAGL accompanying the operation of a 275 kV rated voltage 4-circuit overhead line erected using a three-core bundle made of AFL-8350 mm^2 cables [Source: internal materials]

Figure 6.34–Figure 6.36 at the bottom of the sheet under the graphs contain information on the range (from the centreline) of the isolines 40, 45 and 50 dB for all the parameters calculated (L_{Aeq}, L_T, L_{DEN}). In case this value is not exceeded in any location, the annotation in the item “range” says: “no range”. It should be underlined that the isoline ranges presented on the figures mentioned above concern a cross-section in which the distance of the phase conductors from the ground is the

smallest (h_{min} = 7.1 m). In the case of the line cross-sections for which the distance of the phase conductors from the ground is greater, the ranges of isolines are correspondingly smaller.

6.2.2.5.3 Analysis of the noise level calculation results for 220 or 275 kV overhead lines

As mentioned in the earlier sections of the study, the permissible value usually applied in the assessments of noise accompanying the operation of overhead power lines is 40 or 45 dB at night.

Acknowledging that the 40 and 50 dB levels will also be of interest for the comparison purposes, Table 6.112 compiles the predicted ranges of the different isolines (40, 45 and 50 dB) for all cases (the most unfavourable from the point of noise impact on the environment) adopted for calculations (middle of span, calculations in the location where the distance of the conductors from the ground is the smallest: for 220 kV 4-circuit line – h_{min} = 6.7 m, for 275 kV line – h_{min} = 7.1 m, whereas for line 400 kV – h_{min} = 12.0 m).

The results of sound level distribution calculations in the vicinity of the planned 4-circuit line operating at 220 or 275 kV show that:

- when the 4-circuit line is equipped with type AFL-8525 mm^2 three-core bundles, the corona discharge will not occur regardless of the line operating voltage (220 or 275 kV) adopted;
- when the 4-circuit line is equipped with three-core bundles made of conductors with a smaller diameter, i.e., type AFL-8350 mm^2, the corona discharge will occur only with the line operating at 275 kV voltage, however, the maximum sound level value calculated for the most unfavourable conditions of the line operation (bad weather) will not exceed a value of 35 dB in any location below the line (4.0 MAGL).

The calculation results obtained indicate clearly that regardless of the line rated voltage (220 or 275 kV) and the type of phase conductors used, the permissible sound level value adopted for residential areas (45 dB) will not be exceeded in any location below the 4-circuit line and in its vicinity.

The impacts on ambient noise were considered to have low significance and local scope.

6.2.2.5.4 Analysis of the noise level calculation results for the customer substation

As part of the RAV, a customer substation will be erected, the operation of which involves emission of noise. The calculations are presented in subsection 6.1.5.6.1. The calculations show that at all observations points at the boundary of the planned residential development, the night-time (40 dB) and day-time (50 dB) noise limits for single-family development will not be exceeded.

The impact of noise from a customer substation in the operation phase will be low.

6.2.2.6 Electromagnetic field impact

6.2.2.6.1 4-circuit overhead power line

The results of calculations of the maximum intensity values for the electric field (E) and the magnetic field (H) determined at a height of 2.0 MAGL with the most environmentally unfavourable line operating conditions adopted, i.e.:

- U_{n1} – 220 kV at the permissible loading of each circuit of the 4-circuit line with a current of $I_{(220\ kV)}$ = 830 A;
- U_{n2} – 275 kV at the permissible loading of each circuit of the 4-circuit line with a current of $I_{(275\ kV)}$ = 890 A;

the results are presented in Table 6.113.

The results of the calculations of the expected distributions of the maximum values of both field components in the vicinity of a 4-circuit line are presented:

- in Figure 6.37 and Figure 6.38 – for the line with a rated voltage of U_{n1} = 220 kV, $I_{(220\ kV)}$ = 830 A, at the smallest distance of the phase circuits from the ground h_{min} = 6.7 m;
- in Figure 6.39 and Figure 6.40 – for the line with a rated voltage of U_{n1} = 275 kV, $I_{(275\ kV)}$ = 890 A, at the smallest distance of the phase circuits from the ground h_{min} = 7.1 m.

Table 6.113. Results of calculations for the expected maximum values of the electric field (E) and magnetic field (H) intensities as well as the width of the area in which the residential developments are not allowed (E > 1 kV·m^{-1}), in the vicinity of the 4-circuit overhead line operating at a voltage of: Solution 1N U_{n1} = 220 kV, at each circuit loading with a current of $I_{(220\ kV)}$ = 830 A and Solution 2: U_{n2} = 275 kV, at each circuit loading with a current of $I_{(275\ kV)}$ = 890 A. Calculations conducted at a height of 2.0 MABGL [Source: internal materials]

Rated line voltage **U_{n1} = 220 kV** **Maximum load of a single line circuit** **$I_{(220\ kV)}$ = 830 A**		**Rated line voltage** **U_{n1} = 275 kV** **Maximum load of a single line circuit** **$I_{(220\ kV)}$ = 890 A**	
Maximum expected electric field intensity value E [kV·m^{-1}]	Maximum expected magnetic field intensity value H [A·m^{-1}]	Maximum expected electric field intensity value E [kV·m^{-1}]	Maximum expected magnetic field intensity value H [A·m^{-1}]
10.7	38.7	12.5	38.2
Width of the area below the overhead line, in which the construction of residential developments is not allowed – land on which E >1 kV·m^{-1}			
-31 m ÷ +31 m	-	-34 m ÷ +34 m	-

To determine the maximum expected value of the electric field intensity (E_{max}) for a transitory or emergency situation (e.g. one circuit disabled), the calculations were conducted for a situation in which a single line circuit (upper circuit) is disabled, and the second circuit operates at rated conditions. These calculations were carried out for the same cross-section for which the calculations for the line operation at rated conditions (both circuits enabled) were conducted. The compilation of calculation results for the line emergency operation are presented in Table 6.114.

Table 6.114. Results of calculations for the expected maximum values of the electric field (E) and magnetic field (H) intensities as well as the width of the area in which the residential developments are not allowed (E >1 kV·m^{-1}) in the vicinity of the 4-circuit overhead line operating in emergency conditions (upper circuit disabled) at a voltage of: Solution 1N: U_{n1} = 220 kV, at lower circuit loading with a current of $I_{(220\ kV)}$ = 830 A and Solution 2: U_{n2} = 275 kV, at lower circuit loading with a current of $I_{(275\ kV)}$ = 890 A. Calculations conducted at a height of 2.0 MABGL [Source: internal materials]

Rated line voltage **lower circuit U_{n1} = 220 kV, upper circuit excluded** **Maximum load of the line lower circuit** **$I_{(220\ kV)}$ = 830 A**		**Rated line voltage** **lower circuit U_{n1} = 275 kV, upper circuit excluded** **Maximum load of the line lower circuit** **$I_{(220\ kV)}$ = 890 A**	
Maximum expected electric field intensity value E [kV·m^{-1}]	Maximum expected magnetic field intensity value H [A·m^{-1}]	Maximum expected electric field intensity value E [kV·m^{-1}]	Maximum expected magnetic field intensity value H [A·m^{-1}]
9.1	30.5	10.5	29.9
Width of the area below the overhead line, in which the construction of residential developments is not allowed – land on which E >1 kV·m^{-1}			
-27 m ÷ +27 m	-	-29 m ÷ +29 m	-

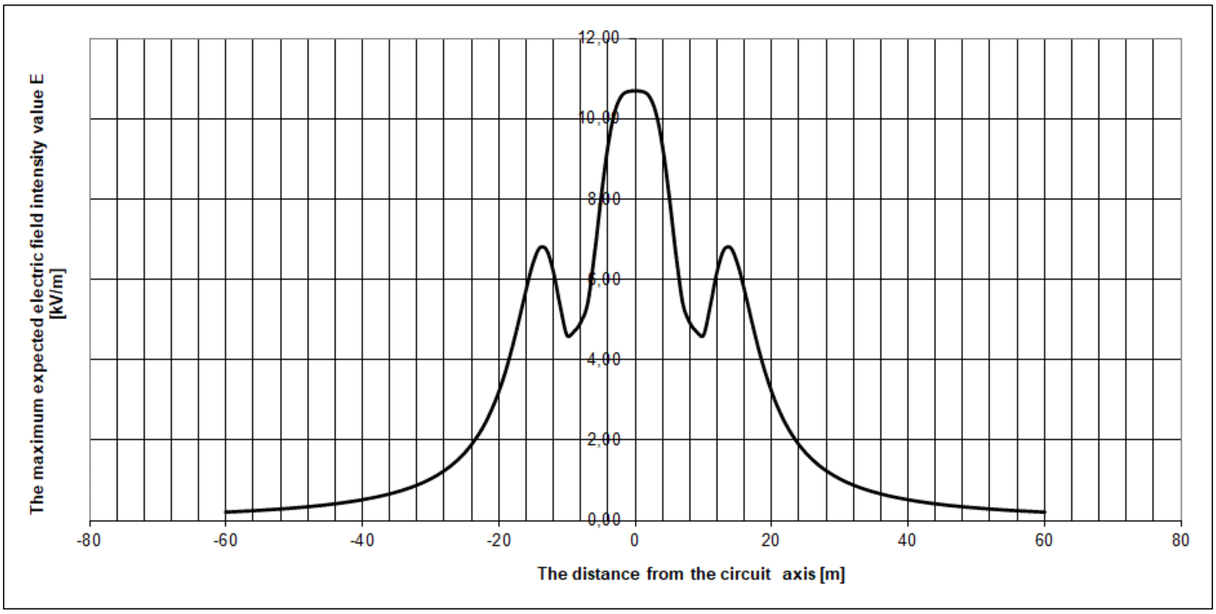


Figure 6.37. Expected maximum value of the electric field intensity (E) at a height of 2.0 MAGL as a function of distance from the axis of a 4-circuit overhead line. Calculations were made for an overhead line with a rated voltage of U_{n1} = 220 kV and a maximum load of a single line circuit $I_{(220\,kV)}$ = 830 A [Source: internal materials]

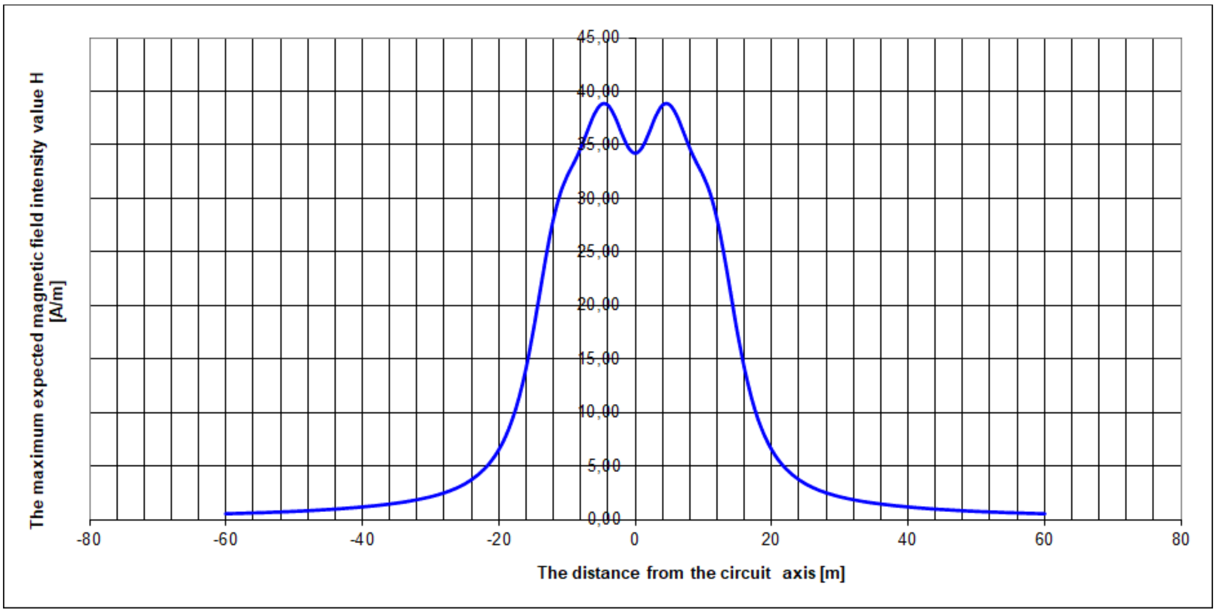


Figure 6.38. Expected maximum value of the magnetic field intensity (H) at a height of 2.0 MAGL as a function of distance from the axis of a 4-circuit overhead line. Calculations were made for an overhead line with a rated voltage of U_{n1} = 220 kV and a maximum load of a single line circuit $I_{(220\,kV)}$ = 830 A [Source: internal materials]

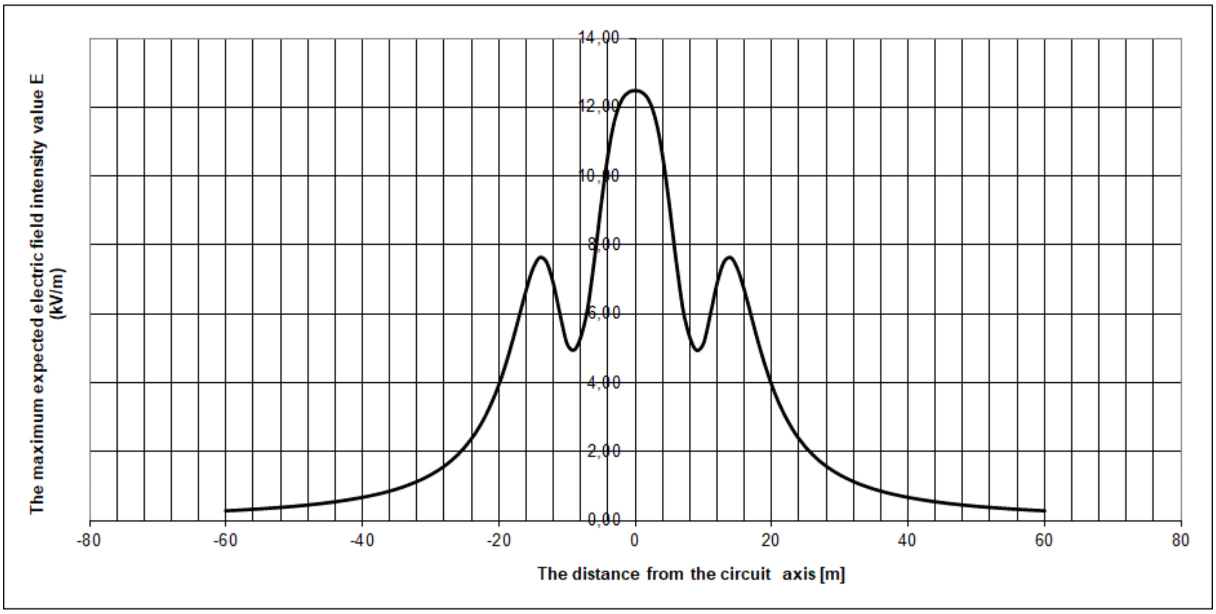


Figure 6.39. Expected maximum value of the electric field intensity (E) at a height of 2.0 MAGL as a function of distance from the axis of a 4-circuit overhead line. Calculations were made for an overhead line with a rated voltage of U_{n2} = 275 kV and a maximum load of a single line circuit $I_{(220\ kV)}$ = 890 A [Source: internal materials]

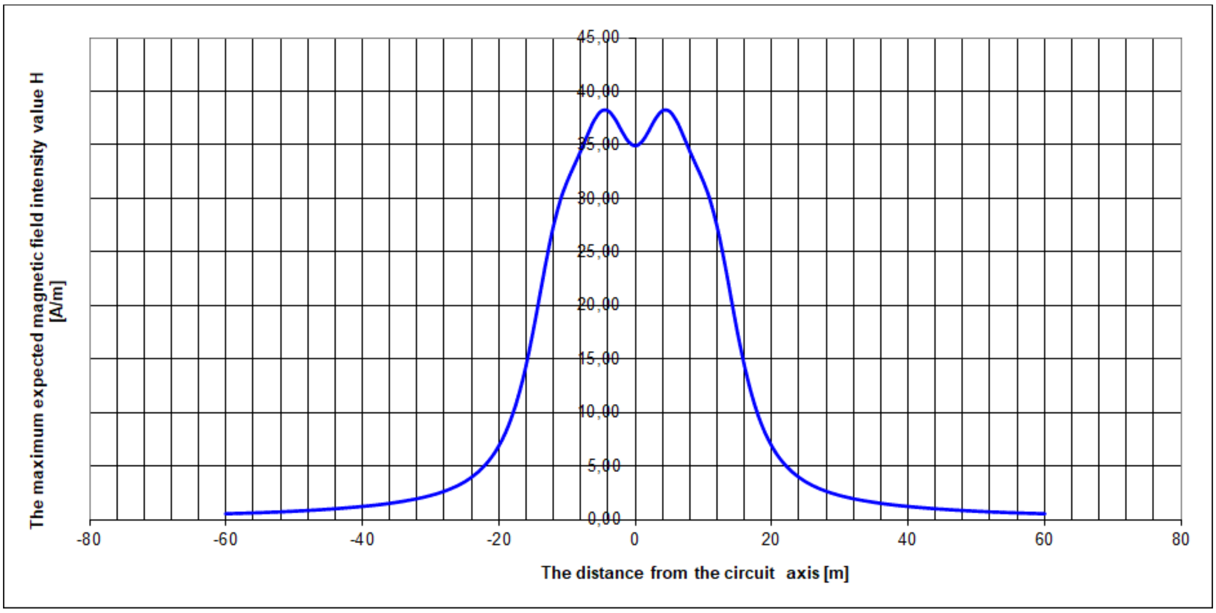


Figure 6.40. Expected maximum value of the magnetic field intensity (H) at a height of 2.0 MAGL as a function of distance from the axis of a 4-circuit overhead line. Calculations were made for an overhead line with a rated voltage of U_{n1} = 275 kV and a maximum load of a single line circuit $I_{(220\ kV)}$ = 890 A [Source: internal materials]

The calculations conducted for the smallest distance of the phase conductors from the ground ($h = h_{min}$) indicated that the intensity of the electric field (E) below the line (at any location at a height of 2.0 MAGL) will not exceed the value of 10.7 kV·m^{-1} for the line with a rated voltage of U_{n1} = 220 kV and 12.5 kV·m^{-1} for the line with a rated voltage of U_{n2} = 275 kV, and these values may occur only at the maximum slack of conductors i.e. at the most unfavourable operating conditions of the line. It should be noted that in both cases, i.e. for the 4-circuit line with a rated voltage of U_{n1} = 220 kV and U_{n2} = 275 kV, the expected calculated maximum values of the electric field intensity exceed the permissible limit value for this quantity (E_{perm} = 10 kV·m^{-1}) established in the applicable regulations. They do not permit for the electric fields to exceed the value of 10 kV·m^{-1}, in places accessible to people, for example, the vicinity of overhead lines.

The calculations of the magnetic field (H) intensity distribution conducted for the smallest distance of the phase conductors from the ground ($h = h_{min}$) indicated that the intensity of the magnetic field (H) below the line (at any location at a height of 2.0 MAGL) will not exceed in any location the value of: 38.7 A·m^{-1} for the line with a rated voltage of U_{n1} = 220 kV ($I_{(220\ kV)}$ = 830 A·circuit^{-1}) and 38.2 A·m^{-1} for the line with a rated voltage of U_{n2} = 275 kV ($I_{(275\ kV)}$ = 890 A·circuit^{-1}), and these values may occur only at the maximum slack of conductors, i.e. at the most unfavourable operating conditions of the line.

The results obtained for the calculation analysis indicate that in no location below the 4-circuit overhead line, regardless of the rated voltage selected (U_{n1} = 220 kV or U_{n2} = 275 kV), the intensity of the magnetic field *H* will not exceed the permissible value specified in the regulations for the places accessible to people and for areas intended for residential development (H = 60 A·m^{-1}).

The calculations conducted for the line emergency operation (upper circuits disabled) and the smallest distance of the phase conductors from the ground ($h = h_{min}$) indicated that the intensity of the electric field (E) below the line (at any location at a height of 2.0 MAGL) will not exceed the value of 9.1 kV·m^{-1} for the line with a rated voltage of U_{n1} = 220 kV and 10.5 kV·m^{-1} for the line with a rated voltage of U_{n2} = 275 kV, and these values may occur only at the maximum slack of conductors, i.e. at the most unfavourable operating conditions of the line.

It is worth noting that in the case of the 4-circuit line emergency operation (upper circuits disabled), the calculated maximum value of the electric field intensity exceeds the permissible value of that quantity (E_{perm} = 10 kV/m^{-1}) specified in the regulations applicable for the places accessible to people only when the line operates at a voltage of U_{n2} = 275 kV.

The calculations of the magnetic field (H) intensity distribution conducted for the line emergency operation (upper circuits disabled) and the smallest distance of the phase conductors from the ground ($h = h_{min}$) indicated that the intensity of the magnetic field (H) below the line (at any location at a height of 2.0 MAGL) will not exceed the value of 30.5 A·m^{-1} for the line with a rated voltage of U_{n1} = 220 kV ($I_{(220\ kV)}$ = 830 A·circuit^{-1}) and 29.9 A·m^{-1} for the line with a rated voltage of U_{n2} = 275 kV ($I_{(275\ kV)}$ = 890 A·circuit^{-1}), and these values may occur only at the maximum slack of conductors, i.e. at the most unfavourable operating conditions of the line.

Moreover, the results of the calculation analysis conducted for the 4-circuit line emergency operation (upper circuits disabled) indicate that in no place below the 4-circuit overhead line, regardless of the rated voltage selected (lower circuits voltage: U_{n1} = 220 kV or U_{n2} = 275 kV, upper circuits voltage 0 kV) the voltage of the magnetic field *H* will exceed the permissible value specified for the places accessible to people and the areas intended for the residential development (H = 60 A·m^{-1}).

The operation phase impacts of the EMFs, due to the possibility of the permissible electric field intensity value to be exceeded, will be significant.

6.2.2.6.2 Two single-circuit 400 kV lines

The EMF impact for the two single-circuit 400 kV overhead lines in the RAV will be the same as in the APV (subsection 6.1.5.6.2). **These will be negligible impacts.**

6.2.2.7 Impact on nature and protected areas

6.2.2.7.1 Impact on abiotic elements in the offshore area

6.2.2.7.1.1 Fungi

During the project operation phase, the potential impacts on the biota of fungi and lichens will be the same as in the case of the APV (subsection 6.1.5.7.1.1). The differentiating factor will be a larger surface area of permanently deforested land.

These will be local impacts of low significance.

6.2.2.7.1.2 Lichens

During the project operation phase, the potential impacts on the biota of lichens will be the same as in the case of the APV (subsection 6.1.5.7.1.2). The differentiating factor will be a larger surface area of permanently deforested land.

These will be local impacts of low significance.

6.2.2.7.1.3 Mosses and liverworts

During the project operation phase, the potential impacts on mosses and liverworts will be the same as in the case of the APV (subsection 6.1.5.7.1.3). The differentiating factor will be a larger surface area of permanently deforested land.

These will be local impacts of low significance.

6.2.2.7.1.4 Vascular plants and natural habitats

During the project operation phase, the potential impacts on the vascular plants and natural habitats will be the same as in the case of the APV (subsection 6.1.5.7.1.4). The differentiating factor will be a larger surface area of permanently deforested land.

These will be local impacts of low significance.

6.2.2.7.1.5 Forest complexes

The route of the 220 or 275 kV overhead line will involve a permanent deforestation within a technical belt with a width of approx. 70 m and a length of approx. 5.2 km – it covers a maximum surface area of 35 ha, as well as within the technological belt with a width of 25 m from the external overhead lines and a length of approx. 5.2 km – it covers a surface area of approx. 25 ha.

The route of the underground cable lines within the permanent technical belt will run across 57 forest plots belonging to the RDSF in Gdańsk. Fresh coniferous forests (62%) and fresh mixed coniferous forests (13%) with pine as a dominant species are predominant in this area. More than 66% of the surface area of forests is occupied by commercial forests. The following categories of protective forests are also present there: soil-protective and water-protective forests.

In compliance with the Environmental Protection Plan for the years 2014–2023 of the Choczewo Forest District (RDSF in Gdańsk), the surface area of the Choczewo Forest District is 17 572 ha. The permanent deforestations will have a local range. The loss of forest resources for the entire Choczewo Forest District will be 0.35%.

The impacts of the planned project connected to the felling of trees will be **negative, direct, primary, reversible, local and permanent. Due to the scale of the planned tree felling, the impact will be significant.**

6.2.2.7.2 Impact on biotic elements in the onshore area

6.2.2.7.2.1 Invertebrates

During the project operation phase the potential impacts on the fauna of invertebrates will be the same as in the case of the APV and may involve the destruction of habitats and microhabitats as a result of maintenance works. The differentiating factor will be a larger surface area of permanently deforested land.

These will be local impacts of low significance.

6.2.2.7.2.2 Ichthyofauna

During the operation phase, no impacts on ichthyofauna are expected. Due to the extremely low water levels, which have been observed for many years, despite the presence of potential hiding places, shading, stream bed diversity etc., the watercourses surveyed are characterised by a low ichthyological diversity (subsection 3.19.1.7).

6.2.2.7.2.3 Herpetofauna

The space along the entire project length will be dominated by HV towers and line. A currently non-existent spatial obstacle will be created. This will be a long-term impact, however, it will not be significantly negative for the amphibians and reptiles. The animals will be able to adjust to the new space.

These will be local impacts of low significance.

6.2.2.7.2.4 Birds

In the operation phase, the space along the entire project length will be dominated by HV towers and line. A currently non-existent spatial obstacle will be created. These will entail a long-term and definitely negative as well as permanent impact on birds, resulting mainly from:

- the collisions of birds with overhead lines;
- permanent habitat fragmentation.

It is a known and very dangerous phenomenon, especially hazardous in the area of bird migratory corridors. Part of one of the most important bird migratory routes in Central Europe, i.e. the East Atlantic Flyway, which connects the breeding grounds in northern Europe with wintering grounds located in southern and western Europe, Africa, and also in Asia, for a small number of species, is located in the area of the planned project. Millions of migratory birds fly over the project area, travelling towards wintering grounds in autumn, and towards breeding grounds in spring. Bird flight altitudes vary greatly and depend mainly on the weather conditions. High risk of bird collision with the planned HV line is forecast. In the case of migratory birds, the impact will be significant on a continental scale too. Collisions with the overhead power line will also involve local birds, nesting in the area of the planned project [Table 6.115].

Table 6.115. Operation phase impacts on the birds present in the planned project area and in its immediate vicinity – RAV [Source: internal materials]

Impacts	Nature of impact	Type of impact	Impact range	Temporal scope of impact	Impact scale	Impact sensitivity	Impact significance
HV towers with and overhead line	**Extremely negative**	Direct, permanent	Local, site-specific and also on a continental scale – involves migratory birds	Permanent, long-term	Very high	Very high	Significant
Tree felling	Negative	Direct, indirect, permanent	Local, site-specific	Permanent/long-term	Moderate	Moderate	Moderate

6.2.2.7.2.5 Mammals

During the project operation phase the potential impacts on mammals will be the same as in the case of the APV and may involve animal disturbance as a result of maintenance works. After the construction phase is completed, the land will be subject to succession process, new habitats that will be used by animals will be formed which will mitigate the effects of the land transformation and fragmentation. In a long-term perspective, the project will not generate negative impacts on mammals.

These will be local impacts of low significance.

6.2.2.7.3 Impact on protected areas

6.2.2.7.3.1 Impact on protected areas other than Natura 2000 sites

6.2.2.7.3.1.1 Coastal Protected Landscape Area

The operation phase impact of the 220 or 275 kV overhead line will greatly affect the landscape protected as part of the Coastal Protected Landscape Area. The operation phase involving the need to maintain permanent deforestation within a 120 m wide strip over a length of approx. 5.2 km will result in the creation of an empty space dominated by the silhouette of 4-circuit towers that taper towards the top. The conductors that disappear into the landscape with the increasing viewing distance result in lower impact on the space. On the one hand, the planned overhead line will definitely be a distinctive element within the mid-forest surroundings, on the other hand, the forest will attenuate its visibility.

The remaining operation phase impacts will mainly concern birds (subsection 6.2.2.7.2.4).

The operation phase impact on the Coastal Protected Landscape Area will be higher than in the case of the APV. **These will be significant impacts.**

6.2.2.7.3.1.2 Ecological area “Torfowisko” [Peat bog] in Szklana Huta

The impact on the ecological area “Torfowisko” [Peat bog] in Szklana Huta for the RAV will be the same as in the case of the APV and limited to the impacts connected to maintenance works.

The scale of impact on the ecological area was assessed as high, and the significance of impact as important. However, it should be remembered that the contaminations of soil and water are unlikely and concern only short-term maintenance works.

No impact on the ecological area “Źródliska Bezimiennej” [the Bezimienna Springs] will occur.

Table 6.116. Characteristics of the operation phase impacts on the protected area other than Natura 2000 sites in the Rational Alternative Variant (RAV) [Source: internal materials]

No.	Impacts	Forms of environmental protection	Nature of impact	Type of impact	Impact range	Temporal scope of impact	Impact scale	Impact sensitivity	Impact significance
1.	Removal of trees and shrubs within the permanent and technological belts	Coastal Protected Landscape Area	Negative	Direct, primary, irreversible	Local	Permanent	High	High	Significant
		Ecological area “Torfowisko” [Peat bog] in Szklana Huta		Indirect, secondary, reversible			Low	Moderate	Low
2.	Contamination as a result of accidental leaks from machinery and vehicles	Coastal Protected Landscape Area	Negative	Direct, primary, irreversible	Local	Medium-term	Moderate	High	Moderate
		Ecological area “Torfowisko” [Peat bog] in Szklana Huta				Permanent	High	High	Important

6.2.2.7.3.2 Impact on Natura 2000 sites

The planned project will cause a direct threat to habitat 2180 which is subject to protection within the boundaries of the Special Area of Conservation "Białogóra" PLH220003. As a result of the overhead line construction, habitat 2180 will be destroyed within a surface area of 12 600 m^2. This will be a permanently deforested area without the possibility of returning to the previous condition.

The impact on Natura 200 sites is presented in Subsection 6.3.

This will be a significant impact of a local range.

6.2.2.7.3.3 Impact on wildlife corridors

The planned project crosses the Coastal wildlife corridor of a supra-regional scale. The creation of a deforested space with dominant 4-circuit towers will interrupt the spatial continuity of the Coastal wildlife corridor within a 120 m wide and 5.2 km long belt.

These will be significant impacts of a regional scale.

As shown in subsection 6.2.2.7.2.4, the location of the Mediterranean flyway migratory route poses a risk of high bird mortality as a result of collisions with the planned HV line. In the case of migratory birds, the impact will also be significant on a continental scale.

This will be a significant impact of a transboundary range.

6.2.2.7.3.4 Impact on biodiversity

The highest impact on biodiversity will be connected to the potential collisions of birds with the overhead line (subsection 6.1.5.7.4).

Thus, the **impact on biodiversity can be considered significant.**

6.2.2.8 Impact on cultural amenities, monuments and archaeological objects and sites

In the operation phase, the 220 or 275 kV overhead line will have no impact on cultural values, monuments and archaeological sites and objects due to its location beyond their occurrence as well as at a significant distance from them.

6.2.2.9 Impact on the use and development of the land area and tangible goods

A technological belt is delimited for the overhead line which covers an area of land where the limitations connected to the property development occur. Its width depends on the rated voltage of the line and the type of towers used.

For the 220 kV line, the width of the technological belt is 2 x 25 m from the centreline in both directions. The necessity to maintain a permanent deforestation due to the operation of a mid-forest overhead line will have a major local impact on the use and development of the land area.

6.2.2.10 Impact on landscape, including the cultural landscape

The 220 or 275 kV overhead line will be a new, linear element of landscape anthropisation in the mid-forest environment. The interference in the landscape will be significant and local in range.

6.2.2.11 Impact on population, health and living conditions of people

The most important nuisances related to the functioning of the project discussed involve emission of noise and electromagnetic radiation from the 220 or 275 overhead line.

The 220 or 275 kV overhead line:

- will cause the exceedance of the permissible value of the 50 Hz electric field (10 $kV \cdot m^{-1}$);
- will not cause the exceedance of the permissible value of the 50 Hz magnetic field (60 $A \cdot m^{-1}$) in the areas accessible to people;
- in no location below the 4-circuit overhead line, regardless of the rated voltage selected (U_{n1} = 220 kV or U_{n2} = 275 kV), the intensity of the magnetic field *H* will exceed the permissible value specified in the regulations for the places accessible to people and for areas intended for residential development (H = 60 $A \cdot m^{-1}$);
- in the case of the 4-circuit line emergency operation (upper circuits disabled), the calculated maximum value of the electric field intensity exceeds the permissible value of that quantity (E_{perm} = 10 $kV \cdot m^{-1}$) specified in the regulations applicable for the places accessible to people, only when the line operates at a voltage of U_{n2} = 275 kV;
- in the case of the 4-circuit line emergency operation (upper circuits disabled), in no place below the 4-circuit overhead line, regardless of the rated voltage selected (lower circuits voltage: U_{n1} = 220 kV or U_{n2} = 275 kV, upper circuits voltage 0 kV) will the voltage of the magnetic field *H* exceed the permissible value specified for the places accessible to people and the areas intended for the residential development (H = 60 $A \cdot m^{-1}$);
- regardless of the rated voltage of the line (220 or 275 kV) and the type of phase conductors used, the permissible sound level value adopted for residential areas (45 dB) will not be exceeded in any location below the 4-circuit line nor in its vicinity;
- will improve the functioning of the power system in the region.

However, due to the mid-forest location and a significant distance from the residential areas, their impact on people will involve the restriction of forest tourist functions in the region. These will be moderate impacts of a local scale.

6.2.3 Decommissioning phase

A complete removal of the 220 or 275 kV overhead line is predicted. At that point, the impacts that will occur will be the reverse of the construction phase impacts.

The decommissioning phase will last 3 months, thus the duration of the impact will be shorter.

The impact assessment presented in subsection 6.2.1 is identical for the decommissioning phase.

The decommissioning of the project will involve the disassembly technology and the construction demolition works. Decommissioning will include the removal by authorised companies of the disassembled line elements (conductors, towers and their foundations) as well as the waste generated from the location of the project to the location of their final utilisation or dumping.

The land areas left after the decommission of towers will be recultivated to their intended land use.

Analogically to the impacts presented for the construction phase, the decommissioning phase impacts will be the following:

- the impact on the surface layer of lithosphere due to excavations conducted to remove the tower foundations and their backfilling;
- potential, periodical drainage of excavations;
- periodical emission of noise due to disassembly works and vehicle transport of waste, construction (demolition) equipment and personnel;
- removal and destruction of vegetation within the range and surroundings of the excavations;

- periodical disturbance of fauna;
- possible physical impacts on the protected natural habitats when accessing the decommissioned tower sites;
- deterioration of the landscape aesthetic values due to the work carried out;
- generation of waste as a result of the disassembly of the connection infrastructure elements [Table 6.117].

Table 6.117. Compilation of the maximum quantities of waste estimated to be generated during the overhead line decommissioning phase [Source: internal materials]

Waste code	Waste type	Maximum quantity estimated [Mg]
08	**Wastes from surface treatment, including paints, varnishes and enamels**	
15 02 02*	Sorbents, filter materials (including oil filters not otherwise specified), wiping cloths (e.g. rags, wipes), protective clothing contaminated by hazardous substances (e.g. PCB)	0.02
15 02 03	Sorbents, filter materials, wiping cloths (e.g. rags, wipes) and protective clothing other than those mentioned in 15 02 02	0.15
16	**Waste not included in other subgroups**	
16 01 20	Glass	0.12
17	**Construction and demolition wastes**	
17 01 01	Waste concrete and concrete rubble from demolitions and renovations	350
17 02 03	Plastic	0.25
17 04 01	Copper, bronze, brass	0.25
17 04 02	Aluminium	300
17 04 03	Lead	0.25
17 04 05	Iron and steel	315
17 04 07	Mixed metals	0.12
17 04 11	Cables other than those mentioned in 17 04 10	0.05
17 06 04	Insulation materials other than those mentioned in 17 06 01 and 17 06 03	0.03
20	**Municipal wastes**	
20 03 01	Mixed municipal waste	0.4

**hazardous waste*

Pursuant to Article 2.3 of the Waste Act of 14 December 2012 (Journal of Laws of 2013, item 21, as amended), the contractor of works is regarded as the producer of waste generated during construction works. The contractor will be responsible for managing the waste in accordance with the provisions of the above-mentioned Act, i.e. in the first place for preventing waste generation, and in the event of generation – for selective collection and transfer of such waste to entities holding permits for waste transport or collection.

6.3 Assessment of impact on Natura 2000 sites

The general aim of the Natura 2000 sites protection is to maintain or restore the proper conservation status of the species and natural habitats (subject of protection), for the protection of which the sites have been designated.

The planned project, is not related directly or essential for the management of the Natura 2000 sites, therefore, it is necessary to conduct an assessment of its impact on such sites.

The essential element of the preliminary assessment of the BC-Wind OWF impact on the Natura 2000 sites is to determine whether a given Natura 2000 site is within the range of the potential impacts of the BC-Wind OWF.

The assessment of the planned project impact on the Natura 2000 sites was carried out taking into account the recommendations from the European Commission guidebook entitled *Assessment of plans and projects significantly affecting Natura 2000 sites*. *Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC, European Commission DG for Environment, 2001* [272].

In accordance with the guidelines, the assessment of impact on the Natura 2000 sites can be divided into 4 stages:

Stage 1: Identification:

- Area management
- Description of the project
- Area characteristics
- Impact significance assessment
- Results

Stage 2: Main assessment:

- Information required
- Impact forecast
- Conservation objectives
- Mitigation measures
- Results

Stage 3: Scoping and consideration of alternatives:

- Identification of alternative solutions
- Assessment of alternative solutions
- Results

Stage 4: Assessment in the case when there are no alternatives and negative impacts persist:

- Identification of compensating measures
- Assessment of compensating measures
- Results

Because during the assessment, no possibility of the occurrence of significant negative impacts on the Natura 2000 sites was found, the assessment was completed at stage 2. Main assessment.

Pursuant to the Nature Conservation Act of 16 April 2004 (Journal of Laws of 2004, No. 92, item 880, as amended), within the Natura 2000 site, there is a ban on significant negative impact on the Natura 2000 site objects of protection, including in particular:

- significant deterioration of the status of natural habitats or habitats of plant and animal species, for the protection of which the Natura 2000 site was established;

- significant negative impact on species, for the protection of which the Natura 2000 site was established;
- significant deterioration of the Natura 2000 site integrity or its interconnection with other sites.

Pursuant to the EU guidelines, the potential negative impact on the integrity of the Natura 2000 site, understood as the coherence of structural and functional factors determining the sustainable duration of the populations of species and natural habitats for the protection of which a Natura 2000 site was designed or established, was adopted as crucial (Article 5(1d) of the Nature Conservation Act).

Taking into consideration the location of the planned project, including its route in the offshore and onshore areas, the assessment of its impact on the Natura 2000 sites was carried out with the division into offshore and onshore parts, with the following two sites taken especially into consideration, i.e. Przybrzeżne wody Bałtyku (PLB990002) and Białogóra (PLH220003).

6.3.1 Przybrzeżne wody Bałtyku (PLB990002)

The following map [Figure 6.41] presents the location of the planned project in both variants (APV and RAV) against the Natura 2000 site Przybrzeżne wody Bałtyku (PLB990002). In both variants, the planned project runs across a Natura 2000 site, and in its southern part, it runs along the same route.

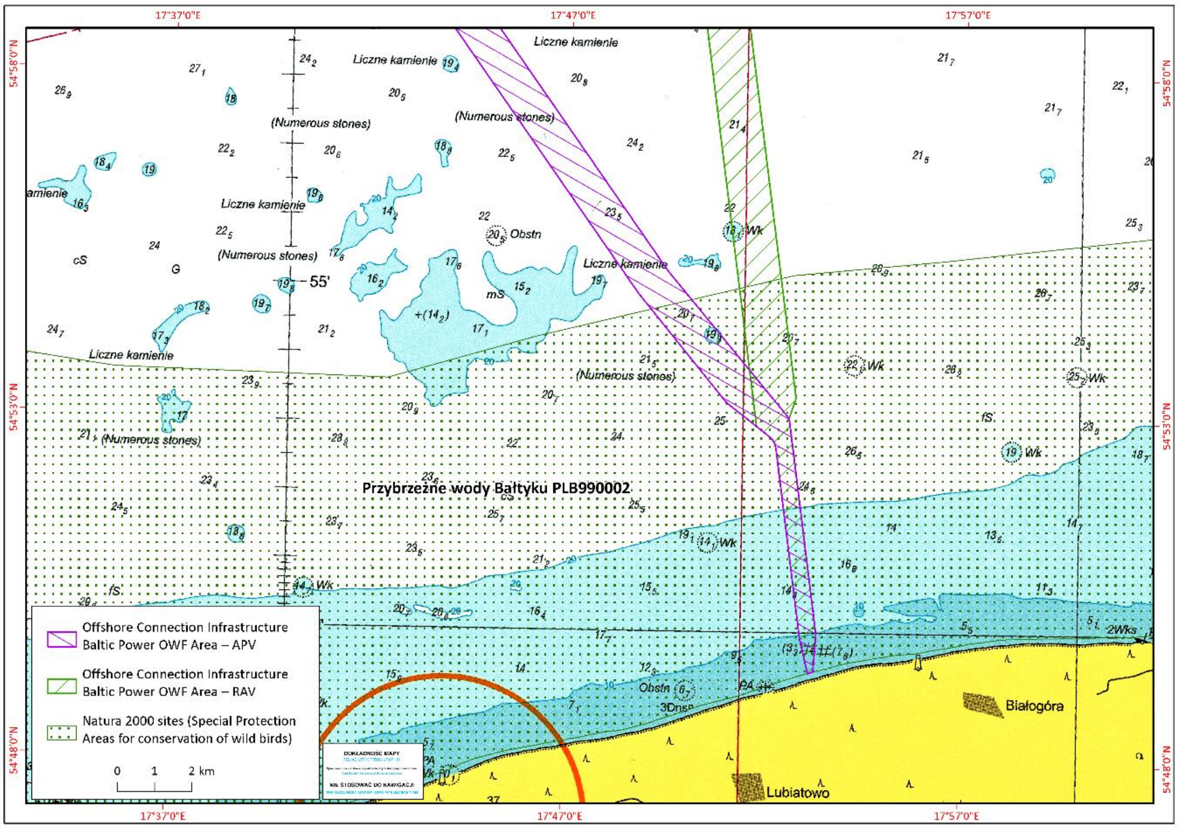


Figure 6.41. Location of the planned project in both variants against the Natura 2000 site Przybrzeżne wody Bałtyku (PLB990002) [Source: internal materials]

The assessment was carried out for the species, which are subject of protection within the Przybrzeżne wody Bałtyku site (PLB990002), in accordance with the applicable SDF. Moreover, the following studies were used:

- Meissner W., *Przybrzeżne wody Bałtyku*, [in:] Wilk T., Jujka M., Krogulec J., Chylarecki P. (ed.), Ostoje ptaków o znaczeniu międzynarodowym w Polsce, The Polish Society for the Protection of Birds (OTOP), Marki 2010: 531–532;
- Tomiałojć L., Stawarczyk T., *Awifauna Polski. Rozmieszczenie, liczebność i zmiany*, Vol. I–II, Polish Society Of Wildlife Friends "pro Natura", Wrocław 2003: 1–865;
- Sikora A., Chylarecki P., Meissner W., Neubauer G. (ed.), *Monitoring ptaków wodno-błotnych w okresie wędrówek*. *Poradnik metodyczny,* General Directorate for Environmental Protection, Warsaw 2011: 1–158.

When assessing whether an impact will be significant, reference was made to the appropriate conservation status as defined in the Nature Conservation Act:

- **the relevant conservation status of the species** – the sum of the effects on the species which may in the foreseeable future affect the distribution and abundance of its population within the country or Member States of the European Union or the natural range of that species; species where data on the dynamics of the population of this species indicate that the species is a permanent component of the habitat suitable for it, the natural range of the species is not diminished or reduced in the foreseeable the future and a suitably large habitat for the maintenance of the population of this species there is and is likely to still exist (Article 5(24) of the Nature Conservation Act);
- **the appropriate conservation status of the natural habitat** − the sum of the impacts on the natural habitat and its typical species, which may in the foreseeable future affect the natural distribution, structure, functions or survival of its typical habitats. species within the country or Member States of the European Union or the natural range of this habitat, where the natural habitat range and the areas occupied by that habitat within its reach do not change or increase the structure and functions that are necessary for the long-term maintenance of the habitat, they exist and are likely to continue to exist and the habitat typical of that habitat is in the proper state of protection (Article 5(25) of the Nature Conservation Act);
- **integrity of a Natura 2000 site and coherence of the Natura 2000 network**.

6.3.1.1 Identification

6.3.1.1.1 Area management and the project description (Step 1 and 2)

The authority responsible for the management of the area is the Director of the Maritime Office in Gdynia and the Director of the Słowiński National Park in the offshore area of the Słowiński National Park. The planned project is not directly related to or essential for the management of a Natura 2000 site.

Table 6.118 presents the identification matrix for the project involving the construction and operation of cable lines within the boundaries of the Natura 2000 site Przybrzeżne wody Bałtyku (PLB990002).

Table 6.118. Identification matrix for the project involving the construction and operation of cable lines within the boundaries of the Natura 2000 site Przybrzeżne wody Bałtyku (PLB990002) [Source: internal materials]

Identification matrix	Applicant Proposed Variant (APV)	Rational Alternative Variant (RAV)
Project short description:	The project involves the construction of a 220 or 275 kV AC cable connection in the seabed from the Offshore Substations to the location of the horizontal directional drilling beneath the coastal zone. The maximum length of cable lines within the boundaries of the Natura 2000 site: approx. 11.5 km. Project elements include: • preparatory work, involving the clearing of the seabed before the construction of a trench; • construction of trenches for cable lines; • cable laying in the trenches; • cable laying on the seabed; • construction of straight-through cable joints; • conduct of a horizontal directional drilling beneath the coastal zone; • cable system measurements. All the operations indicated above will take place within the boundaries of the technical belt in the Natura 2000 site. During the operation phase, the planned project will involve the supervision and servicing of cables. In case of a failure, cables will be repaired.	The project involves the construction of a 220 or 275 kV AC cable connection in the seabed from the Offshore Substations to the location of the horizontal directional drilling beneath the coastal zone. The maximum length of cable lines within the boundaries of the Natura 2000 site: approx. 11 km. Project elements include: • preparatory work, involving the clearing of the seabed before the construction of a trench; • construction of trenches for cable lines; • cable laying in the trenches; • cable laying on the seabed; • construction of straight-through cable joints; • conduct of a horizontal directional drilling beneath the coastal zone; • cable system measurements. All the operations indicated above will take place within the boundaries of the technical belt in the Natura 2000 site. During the operation phase, the planned project will involve the supervision and servicing of cables. In case of a failure, cables will be repaired.
Description of the project individual elements that will probably have an impact on the environment	Construction phase: • presence and traffic of vessels involved in the construction of subsea cable lines; • cable laying in the seabed and on its surface. Operation phase: • presence and traffic of vessels involved in the periodical inspections of the subsea cable lines; • presence and traffic of vessels involved in the repair of subsea cables;	Construction phase: • presence and traffic of vessels involved in the construction of subsea cable lines; • cable laying in the seabed and on its surface. Operation phase: • presence and traffic of vessels involved in the periodical inspections of the subsea cable lines; • presence and traffic of vessels involved in the repair of subsea cables;

Identification matrix	**Applicant Proposed Variant (APV)**	**Rational Alternative Variant (RAV)**
	• repair of subsea cables. Decommissioning phase: none	• repair of subsea cables. Decommissioning phase: none
Description of each indirect, direct or secondary impact of the project on the Natura 2000 site, predictable as a simple consequence of individual features	Construction phase: • vessels disturbing the birds that are subject to protection in the area; • destruction of the seabed organism complexes along the route of the cable line construction (depletion of the benthivorous bird food supply in the area); Operation phase: • vessels disturbing the birds that are subject to protection in the area; • emergence of benthic organisms on the structures protecting the subsea cables laid on the seabed Decommissioning phase: none	Construction phase: • vessels disturbing the birds that are subject to protection in the area; • destruction of the seabed organism complexes along the route of the cable line construction (depletion of the benthivorous bird food supply in the area); Operation phase: • vessels disturbing the birds that are subject to protection in the area; • emergence of benthic organisms on the structures protecting the subsea cables laid on the seabed Decommissioning phase: none
Distance from the Natura 2000 sites	Within the boundaries of the Natura 2000 site Przybrzeżne Wody Bałtyku (PLB990002)	Within the boundaries of the Natura 2000 site Przybrzeżne Wody Bałtyku (PLB990002)

6.3.1.1.2 Characteristics of the Natura 2000 site (Step 3)

The Przybrzeżne wody Bałtyku site (PLB990002) extends along the Polish coast and includes the coastal zone up to a depth of approx. 20 m. It was delineated as part of the Birds Directive. The subjects of protection there are the razorbill, the black-guillemot, the long-tailed duck, the European herring gull, the velvet scoter and the common scoter [Table 6.119]. This area is one of the European Important Bird Areas E 80. During the wintering period, the black-throated diver and the red-throated diver reside there. The long-tailed duck as well as the black guillemot and the velvet scoter can also be encountered in the area [>1% of the migratory route population (C3)]. A detailed description of the Przybrzeżne Wody Bałtyku site (PLB990002) is included in subsection 3.7.2.

Table 6.119. Basic information on the subjects of protection – seabirds in the Przybrzeżne wody Bałtyku site (PLB990002) [Source: internal materials]

Species		**Population type**	**Assessment of the area for the population***	**Population size in the area [number of individuals]**	
Species name	**Binomial nomenclature**			**Minimum**	**Maximum**
European herring gull	*Larus argentatus*	Wintering	C	8000	15 000
Black guillemot	*Cepphus grylle*	Wintering	B	1500	1500
Razorbill	*Alca torda*	Wintering	C	500	1000
Long-tailed duck	*Clangula hyemalis*	Wintering	B	90 000**	120 000**
Velvet scoter	*Melanitta fusca*	Wintering	C	14 000**	20 000**
Common scoter	*Melanitta nigra*	Wintering	C	5000	8000
		Passing	C	3000	3000

**Estimation of the species population size and density in relation to the national population; class ranges: A– 100 ≥ p > 15%; B– 15 ≥ p > 2%; C– 2 ≥ p > 0%; area assessment for population D – species which are not the subject of protection in the area)*
*** In the SDF, the size of the population was given incorrectly. The values cited here were taken from BirdLife International (2020) Important Bird Areas factsheet: Central Polish coastal waters. Downloaded from http://www.birdlife.org on 11.06.2020] containing the data provided in the SDF form*

6.3.1.1.3 Impact significance assessment (Step 4)

The impacts generated during the BP OWF CI construction and operation phases on the Natura 2000 site Przybrzeżne wody Bałtyku (PLB990002) will affect the subjects of protection in this area, i.e. six bird species [Table 6.119].

In the construction phase, the main sources of impact on seabirds, which are the subject of protection in the Przybrzeżne Wody Bałtyku site (PLB990002), within the area of the planned project, will be:

- the traffic of vessels involved in the construction of cable lines resulting in the scaring of birds;
- noise and vibration resulting in deterring fish that constitute food for piscivorous bird species (razorbill);
- the resuspension of seabed sediments causing water turbidity and hampering the feeding of piscivorous bird species (razorbill);

- the destruction of benthic complexes along the transmission cable route. It may lead to the reduction of feeding areas of benthivorous birds (velvet scoter, long-tailed duck, common scoter) as well as piscivorous birds (razorbill).

During the operation phase, no impacts that could significantly affect the subjects of protection of the Natura 2000 site will occur. Periodical inspections of subsea cables will be carried out at least once every five years, most likely by a single, relatively small vessel. The necessity of conducting possible repairs of subsea cables may occur almost exclusively in emergency situations and is very unlikely due various types of cable line protections: their durable design, burial in the seabed sediment or proper protection if they are laid on the seabed, as well as a special avoidance zone for cable lines established by the Director of the Maritime Office in Gdynia.

Due to the same method of the planned project implementation adopted in the APV and in the RAV variants, the set of impacts identified and the assessment of their effect on the subjects of protection in the Przybrzeżne Wody Bałtyku site (PLB990002) are identical.

6.3.1.2 Main assessment

6.3.1.2.1 Impact on the objects of protection in the area and their conservation status

The subjects of protection of the Natura 2000 site Przybrzeżne wody Bałtyku (PLB990002) – the six bird species listed in Table 6.119, are the most important resource of this area from the point of view of its functioning. However, it should be noted that these species occur within the entire Natura 2000 site discussed, but also outside its boundaries often in greater numbers. For that reason, the significance of this receptor and its sensitivity in the context of the impact analysis was specified as moderate.

6.3.1.2.1.1 Construction phase impacts

The traffic of vessels involved in the construction of cable lines will cause the scaring of birds within the area of such works. This impact is limited only to the period of the construction work performance and to the nearest sea area. The scaring effect will most probably not involve the European herring gull, the individuals of which often accompany vessels sailing at sea. What is more, for that reason, its abundance in the offshore area in the construction phase may even periodically increase. It is not expected that the scaring effect is intensified by the noise generated by vessels.

Due to the short-term, local and reversible scope of the impact causing the scaring of birds – the objects of protection in the Natura 2000 site, its scale for the majority of species was determined as low, and in the case of the European herring gull as irrelevant. Therefore, the significance of the scaring impact resulting from the traffic of vessels for the long-tailed duck, the velvet scoters, the razorbill and the common guillemot was assessed as **low**, and in the case of the European herring gull as **negligible**.

The underwater noise generated during the construction works will result in the scaring of fish and a decrease in their abundance in the area of the underwater operations. This will reduce the food supply for the razorbill. The range of this impact will depend on the intensity of noise. However, this impact will be of local, short-term and reversible nature. Its scale was determined as low. The significance of this impact was assessed to be **low**.

The destruction of macrozoobenthos on the seabed covered by the underwater operations may potentially lead to the depletion of the benthivorous bird food supply, e.g. the velvet scoter and the long-tailed duck. However, the macrozoobenthos surveys did not show that the qualitative and quantitative resources of macrozoobenthos in the planned project area could indicate an exceptionally rich food supply for these species (see subsections 3.7.1.2 and 6.1.1.5.1.2). After the completion of construction, within a few years, the damaged macrozoobenthos will become regenerated. Thus, this impact will be of mid-term, local and reversible character. Therefore, its scale was assessed as low. The significance of the impact was assessed to be **low**.

Water turbidity as a result of the seabed sediment resuspension, during the cable line construction, may prevent the benthivorous birds as well as piscivorous birds from locating food under water. The spatial and temporal range of this impact will depend mainly on the volume and type of the seabed sediments disturbed as well as the direction and force of sea currents. However, an impact of a character other than local or short-term is not anticipated. It will also be reversible, because it will cease after the completion of underwater operations. The significance of this impact was assessed to be **low**.

6.3.1.2.1.2 Operation phase impacts

At the operation stage, no significant impact of the BP OWF CI on seabirds– the subjects of protection in the Przybrzeżne Wody Bałtyku site (PLB990002) is predicted. Periodical inspections of cable lines (1 inspection per five years at minimum) will involve the scaring of birds only in the immediate vicinity of the vessel in operation. In this part of the sea, the traffic of vessels is intensive due to the presence of the shipping route of cargo vessels, therefore, a short-term presence of a single vessel does not contribute to a visible increase in bird-scaring in the area. After the construction phase is finished, the restoration of macrozoobenthos complexes, constituting the possible food supply for benthivorous birds, will begin. At the operation stage, all the impacts identified for the construction phase will cease.

The operation of the cable line may have a positive impact on the Natura 2000 sites subjects of protection. Establishing a protection zone for the cable lines may involve restrictions on some forms of commercial fishing within its boundaries and in effect the by-catch of birds – mainly ducks diving into the fishing nets. At this stage, it is impossible to determine the scale of this impact, and as a result it was not assessed.

Summing up, the impacts on seabirds subject to protection within the Przybrzeżne wody Bałtyku site (PL990002) in the operation phase were assessed as irrelevant.

6.3.1.2.1.3 Impact on the integrity of area and interconnections with other Natura 2000 sites

Pursuant to the definition from the Nature Conservation Act of 16 April 2004 (Journal of Laws of 2004, No. 92, item 880), the integrity of the Natura 2000 site is "*the coherence of structural and functional factors determining the sustainable duration of the populations of species and natural habitats for the protection of which a Natura 2000 site has been designed or designated.*" The analysis showed that impacts on the subject of protection of the Przybrzeżne wody Bałtyku (PLB990002) site will mainly involve local and short-term scaring of protected bird species during the construction phase as well as unlikely depletion of the food supply for benthivorous birds, which will cease during the operation phase of the project. The significance of those impacts was assessed as **low** and in one case as **negligible**.

The implementation of the planned project will not entail changes in the functioning of site PLB990002 and will not contribute to changes in the population of species which are the subjects of its protection. Therefore, it should be assumed that the implementation of the project at each stage will not negatively affect the integrity of the Przybrzeżne wody Bałtyku site PLB990002.

In accordance with the information contained in the Standard Data Form for the Przybrzeżne Wody Bałtyku site (PLB990002), no connections of this site with other sites of the Natura 2000 network were found [117]. The PLB990002 site is an extensive strip of marine coastal waters, and the planned project will be located within a small area of its eastern part. The nearest marine special protection area for birds – Zatoka Pucka PLB220005, in which wintering species are also under protection, is located at a distance of approx. 18.3 km from the area of the planned project. Therefore, the possible scaring of birds during the construction phase and at a significantly smaller scale during the operation phase, will involve only the individuals residing within the PLB990002 site and will cause their short-term relocation to other, probably not distant, regions of the same site. Due to the scale of the project and the local, short-term and reversible scope of its impact on the environment, it is not probable that the planned project could impact other sites from the Natura 2000 network. Summing up, no negative impact on the connectivity of this site with other Natura 2000 sites is expected at any stage of the project.

6.3.1.3 Summary of the impact assessment

The impact of the planned project during the construction phase on seabirds which are the subject of protection in the Przybrzeżne wody Bałtyku (PLB990002) site, taking into account all the potential impacts identified, is assessed to be **low** for the long-tailed duck, velvet scoter and razorbill and **negligible** for the European herring gull.

No impacts were identified that could significantly affect the subjects of protection of this Natura 2000 site during the operation phase.

6.3.2 Białogóra (PLH220003)

The map [Figure 6.42] and Table 6.120 present the location of the planned project in both variants against the technical/technological belts delineated for the purposes of the project implementation. As has been demonstrated, the planned project is located within the boundaries of the additional APV belt and in all belts delineated for the purposes of the overhead line implementation (RAV).

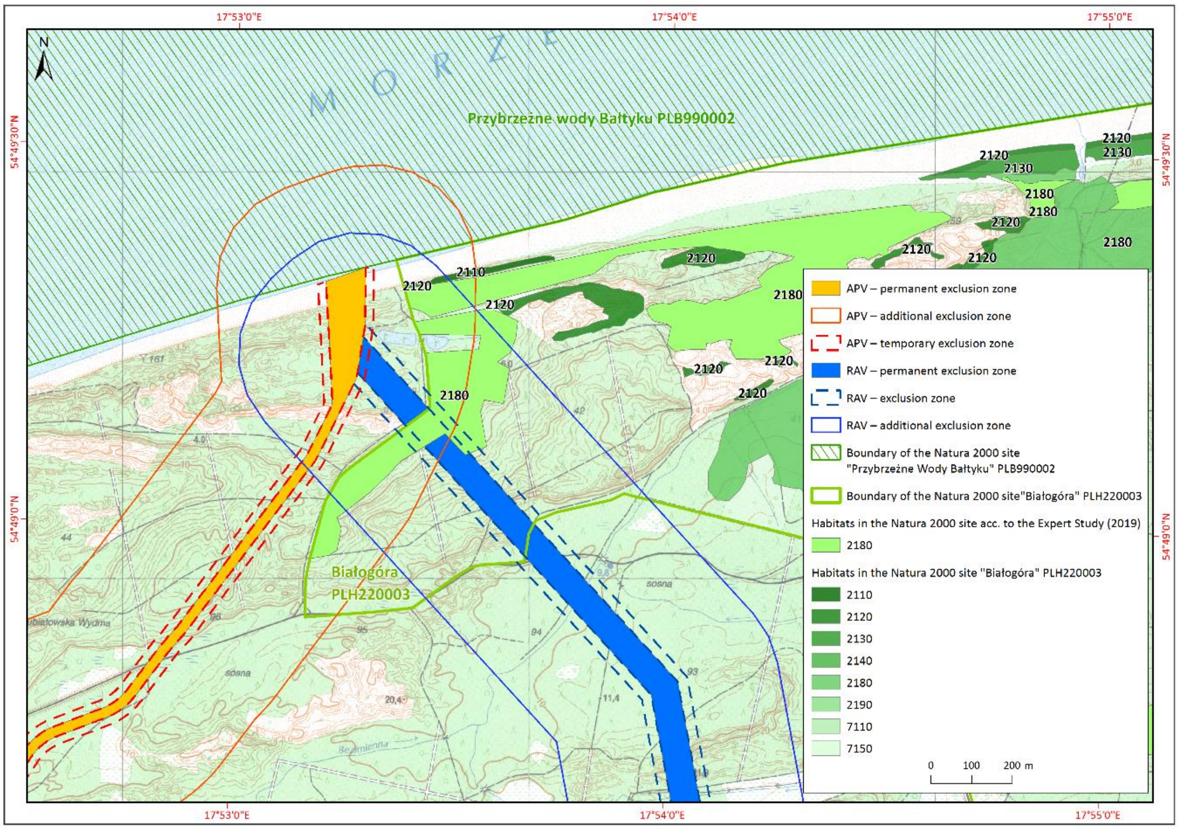


Figure 6.42. Location of the planned project in both variants against the habitats of the Natura 2000 site Białogóra (PLH220003) [Source: internal materials]

Table 6.120. Location of the planned project in both variants, within the technical/technological belts, against the habitats of the Natura 2000 site Białogóra (PLH220003) [Source: internal materials]

Natura 2000 site	Applicant Proposed Variant (APV)			Rational Alternative Variant (RAV)		
	Technical belts			Technical/technological belts		
	Permanent 25 m (up to 80 m in the area of the cable chamber locations)	**Temporary** 20 from the external cable lines	**Additional** 250 from the external cable lines	**Permanent** 70 m	**Technological** 25 m from the external overhead lines	**Additional** 250 from the external cable lines
	Area directly connected to the construction works, covers the places, in which the surface layer of the ground and groundcover will be destroyed, and the trees and shrubs will be removed. The removal of trees and shrubs is permanent	Constitutes the so-called “auxiliary belt”, in which environmental impact is possible during the construction phase, due to construction works, storage sites for excavated soil, vehicle parking areas and access roads	Area through which the access roads can be routed. If the work is properly organised, the project will not have a negative impact on the environment of the additional technical belt	Area directly connected to the construction works, includes spot places of the tower locations as well as large-scale tree-felling areas, in which the surface layer of the ground and groundcover will be destroyed, and the trees and shrubs will be removed. The removal of trees and shrubs is permanent	Area required for the correct operation of the power line and its equipment	Area through which the access roads can be routed. If the work is properly organised, the project will not have a negative impact on the environment of the additional technical belt
SPA Białogóra (PLH220003)	-	-	+	+	+	+

The assessment was carried out for those species and habitats, which are the subjects of protection in a particular area, in accordance with the applicable SDF, and the proper conservation status of the species and habitats as well as the threats were adopted in compliance with the protective task plan established for the Natura 2000 site in accordance with the Regulation of the Regional Director for Environmental Protection in Gdańsk of 30 April 2014 on establishing the protective task plan for the Natura 2000 site Białogóra (PLH220003) (Official Journal of the Pomeranian Voivodeship of 2014, item 1916) amended by the Regulation of the Regional Director for Environmental Protection in Gdańsk of 17 February 2016 (Official Journal of the Pomeranian Voivodeship of 2016, item 1082). Moreover, the following studies made available by RDEP in Gdańsk were used:

- *Monitoring stanu ochrony siedlisk przyrodniczych w granicach obszaru Natura 2000 Białogóra (PLH220003)* [Monitoring of the conservation status of natural habitats within the Natura 2000 site Białogóra (PLH 220003)] [64];
- *Monitoring stanu ochrony siedliska przyrodniczego 2190 Wilgotne zagłębienia międzywydmowe w granicach obszaru Natura 2000 Białogóra (PLH220003), z wyłączeniem terenu rezerwatu przyrody Białogóra* [Monitoring of the conservation status of the natural habitat 2190 Humid dune slacks within the Natura 2000 Białogóra site (PLH220003), excluding the Białogóra nature reserve] [65];
- *Ekspertyza na potrzeby uzupełnienia stanu wiedzy o siedliskach przyrodniczych: 2180, 4010, 7110, 7150 na obszarze Natura 2000 Białogóra (PLH220003), w ramach projektu POIS.02.04.00-00-0191/16 pn. „Inwentaryzacja cennych siedlisk przyrodniczych kraju, gatunków występujących w ich obrębie oraz stworzenie Banku Danych o Zasobach Przyrodniczych”* [An Expert study for the purposes of supplementing the knowledge on natural habitats 2180, 4010, 7110, 7150 within the Natura 2000 site Białogóra (PLH220003), as part of the project POIS.02.04.00-00-0191/16 entitled “Inventory Survey of the Polish valuable natural habitats, species present within them as well as the creation of Natural Resources Data Bank”] [195].

When assessing whether an impact will be significant, reference was made to the favourable conservation status as defined in the Nature Conservation Act:

- **the relevant conservation status of the species** – the sum of the effects on the species which may in the foreseeable future affect the distribution and abundance of its population within the country or Member States of the European Union or the natural range of that species; species where data on the dynamics of the population of this species indicate that the species is a permanent component of the habitat suitable for it, the natural range of the species is not diminished or reduced in the foreseeable the future and a suitably large habitat for the maintenance of the population of this species there is and is likely to still exist (Article 5(24) of the Nature Conservation Act);
- **the appropriate conservation status of the natural habitat** − the sum of the impacts on the natural habitat and its typical species, which may in the foreseeable future affect the natural distribution, structure, functions or survival of its typical habitats. species within the country or Member States of the European Union or the natural range of this habitat, where the natural habitat range and the areas occupied by that habitat within its reach do not change or increase the structure and functions that are necessary for the long-term maintenance of the habitat, they exist and are likely to continue to exist and the habitat typical of that habitat is in the proper state of protection (Article 5(25) of the Nature Conservation Act);
- **integrity of a Natura 2000 site and coherence of the Natura 2000 network**.

6.3.2.1 Identification

6.3.2.1.1 Management of Białogóra site (PLH220003) and the project description (Step 1 and 2)

The body responsible for the management of the site is the Regional Director for Environmental Protection in Gdańsk. The planned project is not related directly to or essential for the management of a Natura 2000 site. Table 6.121 contains the identification matrix for the project involving the construction and operation of the BP OWF CI within the boundaries and in the vicinity of the Natura 2000 site Białogóra (PLH220003).

Table 6.121. Identification matrix for the project involving the construction and operation of an underground cable line and an overhead line (RAV) within the boundaries of the Natura 2000 site Białogóra (PLH220003) [Source: internal materials

Identification matrix	Applicant Proposed Variant (APV)	Rational Alternative Variant (RAV)
Project short description:	The project involves the construction of an 220 or 275 kV AC underground cable connection with an auxiliary infrastructure. Length of the underground cable line – approx. 6.5 km. Project elements include: • preparatory works, organisation of construction facilities, equipment base and material supplies, tree felling including the grabbing of roots for the construction of access roads, construction of access roads and a reversing yard; • felling of trees including the grabbing of roots at the location intended for the cable line; • erection of a trench for the cable lines; • laying of cables in the trench, pavement slabs, bentonite pouring, covering with foil, attachment of marking bands; • execution of horizontal directional drillings in places crossed using trenchless method; • construction of straight-through cable joints; • installation of cross-bonding connections; • installation of cable heads at the customer substation; • installation of transition cable joints; • connection of the cable control system; • cable system measurements. All the operations indicated above will take place within the boundaries of the permanent and temporary technical belt – outside the Natura 2000 site. During the operation phase, the planned project will involve a permanent tree-felling within a strip with a width of 25 m (apart from the borehole locations) and a temporary tree-felling within a strip with width of 20 m from the external cable lines – outside the Natura 2000 site.	The project involves the construction of a 220 or 275 kV overhead line with an auxiliary infrastructure. Length of the overhead line – approx. 5.2 km. Project elements include: • felling of the tree stand in the area intended for the overhead line; • construction of excavations for the tower foundations and the earthing; • assembly of prefabricated foundations or erection of field, chamber or pile foundations on site; • backfilling of foundations with soil compacting; • installation of towers on the foundations; • installation of accessories and cables on the towers, • implementing anti-corrosion protections for the towers; • restoration of the area around the towers to its previous condition. All the operations indicated above will take place within the boundaries of the permanent technical and technological belts – within the boundaries of the Natura 2000 site. During the operation phase, the planned project will involve a permanent deforestation within a 120 m wide strip of land – within the Natura 2000 site boundaries.
Description of the project individual elements that will probably have an impact on the environment	The traffic of construction vehicles on the road which constitutes a fragment of the Natura 2000 site western boundary along an approx. 900 m section. No tree-felling is planned along this road.	As a result of the project implementation, the following will take place: • permanent occupation of land and modification of the relief within the boundaries of the permanent belt with a surface area of approx. 35 ha as well as in the technological belt with a surface

Identification matrix	Applicant Proposed Variant (APV)	Rational Alternative Variant (RAV)
		area of approx. 25 ha; • dewatering as a result of pile driving in the area with high level of groundwater deposition.
Description of each indirect, direct or secondary impact of the project on the Natura 2000 site, predictable as a simple consequence of individual features	The dimensions and scale of the planned project: a road with a length of approx. 900 m and a width of approx. 5 m, which constitutes a fragment of the western boundary of the Natura 2000 site. Occupation of land within the boundaries of the Natura 2000 site: the scope of the planned project is not connected to the surface area of land occupied within the boundaries of the Natura 2000 site, and constituting its boundary as an access road to the construction site in the area of cable chambers. Resource requirements: none. Emissions: • contamination as a result of accidental leaks from machinery and vehicles; • air pollution due to the combustion of fuels in the engines of construction machinery; • noise from the construction machinery and vehicles. Construction duration: approx. 36 months.	Dimensions and scale of the planned project within the boundaries of the Natura 2000 site: • length of the overhead line within the boundaries of the Natura 2000 site – approx. 445 m; • width 120 m: ○ permanent technical belt within the boundaries of the Natura 2000 site – approx. 70 m, ○ technological belt within the boundaries of the Natura 2000 site – 25 m on each side from the external lines. Occupation of land within the Natura 2000 site – 52 000 m^2: permanent technical belt within the boundaries of the Natura 2000 site – approx. 27 000 m^2; technological belt within the boundaries of the Natura 2000 site – 25 m^2. Resource requirements: construction phase requirements: electricity, mechanical equipment, fuel for machine power, machine consumables, construction materials Emissions: • waste – residual plant matter from tree and shrub grubbing, soil and ground, municipal waste; • air pollution due to the combustion of fuels in the engines of construction machinery; • noise from the construction machinery and vehicles. Construction duration: approx. 18 months.
Distance from the Natura 2000 sites	For the purposes of the planned project implementation, the following technical belts were designated: • permanent (25 m wide, 80 m in the area of cable chambers) – approx. 70 m from the boundaries of the Natura 2000 site Białogóra (PLH220003); • temporary (20 m from the external cable lines) – approx. 50 m from the boundaries of the Natura 2000 site. The planned project is located within the boundaries of the additional technical belt.	The planned project is located within the boundaries of the Natura 2000 site in all three technical/technological belts.

6.3.2.1.2 Characteristics of the Natura 2000 site (Step 3)

In accordance with the SDF (updated – October 2020), the surface area of the site is 1132.8 ha. The area is one of two places on the Gdańsk Pomerania coast, where the processes of paludification of the mineral substrate take place at present. The habitats listed in Annex I to the Council Directive 92/43/EEC – 10 types – occupy almost 40% of the area. In the area, there is a complex of peatlands and forests unique to the southern shores of the Baltic Sea which create a natural series of ecological succession. Plant communities of Atlantic character, which are very rare on a national scale, were also found there: *Eleocharitetum multicaulis*, *Rhynchosporetum fuscae*, *Ericetum tetralicis*, *Myricetum gale*, occur there in dense patches and cover relatively large surfaces. Also a coastal form of marshy coniferous forest with *Erica tetralix* and *Myrica gale*, a humid, rare on a regional scale, form of crowberry coniferous forest, fragments of well-preserved bog birch forest and birch and oak as well as beech and oak forests (the last ones only at the forehead of a parabolic dune) were found there. The flora of vascular plants and spore plants including lichen flora, with many species of Atlantic range type is unique. A number of these species is present there in populations of several hundreds and thousands of representatives, e.g. *Drosera intermedia*, *Rhynchospora fusca*, *Myrica gale* and *Erica tetralix*. The only site in Pomerania, and one of 5 in Poland of *Eleocharis multicaulis* is present there. This area has exceptional landscape value.

The above description concerns the centre part of the area, i.e. the regions under reserve protection, of the Białogóra and Babnica nature reserves. The surface area of the planned project is located at the western boundary of the Natura 2000 site, on dune embankments and accumulations, where the plant communities mentioned above (except for *Ericetum tetralicis*) and the species characteristic of them no longer occur.

Table 6.122 presents the subjects of protection of the Natura 2000 site Białogóra (PLH220003).

Table 6.122. Subjects of protection of the Natura 2000 site Białogóra (PLH220003) – outside the area of the planned project in the Applicant Proposed Variant (APV) [Source: Natura 2000 Standard Data Form, http://geoserwis.gdos.gov.pl/mapy/]

Code	**Name**	**Total surface area of the habitat within the area [ha]**
2110	Embryonic shifting dunes	2.61
2120	Shifting dunes along the shoreline with *Ammophila arenaria* (“white dunes”)	19.48
2130	Fixed coastal dunes with herbaceous vegetation ("grey dunes")	12.91
2140	Decalcified fixed dunes with *Empetrum nigrum*	6.46
2180	Wooded dunes of the Atlantic, Continental and Boreal region	309.25
2190	Humid dune slacks	38.86
4010	Northern Atlantic wet heaths with *Erica tetralix*	12.91
7110	Active raised bogs	6.46
7150	Depressions on peat substrates of the Rhynchosporion	6.46
91D0	Bog woodland	40.78

6.3.2.1.3 Impact significance assessment (Step 4)

6.3.2.1.3.1 Applicant Proposed Variant

The planned project will not be implemented within the boundaries of the Natura 2000 site Białogóra (PLH220003). Within the boundaries of the additional technical belt, which includes the area in the buffer zone of 250 m from the permanent technical belt and constitutes a potential area of impact of the project, there is a fragment of the Natura 2000 site Białogóra (PLH220003), including the following natural habitats that are the subjects of protection within this area:

- 2110 Embryonic shifting dunes;
- 2120 Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes");
- 2180 Wooded dunes of the Atlantic, Continental and Boreal region.

The implementation of the planned project will not impact the above-mentioned habitats directly, only the road which constitutes its western boundary will be used as an access road to the construction site in the area of cable chambers. Due to the close proximity of the planned works, an assessment of the potential impact on these habitats was carried out.

6.3.2.1.3.2 Rational Alternative Variant

The planned project will be implemented within the boundaries of the Natura 2000 site Białogóra (PLH220003), where the following nature habitats, which are subject to protection within the area, can be found:

- 2110 Embryonic shifting dunes;
- 2120 Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes");
- 2180 Wooded dunes of the Atlantic, Continental and Boreal region.

6.3.2.2 Main assessment

6.3.2.2.1 2110 Embryonic shifting dunes

6.3.2.2.1.1 Short characteristics of the habitat

Within the entire Natura 2000 site Białogóra (PLH220003), the habitat occupies a surface area of approx. 2.61 ha, from which, within the area of additional belts:

- the APV covers a surface area of 1155 m^2;
- the RAV covers a surface area of 570 m^2.

The habitat is represented by the following communities: *Honckenyo-Agropyretum juncei* and *Elymo-Ammophiletum*. Embryonic shifting dunes include dynamic ecosystems occurring within the narrow strip of the Baltic coast in the zone clearly influenced by a specific coastal climate. The habitat is highly dynamic depending on the processes taking place at the border between the beach and the dune system. This type of habitat in the accumulation section of the sea coast is a kind of a precursor of the process of formation of plant communities building stable dunes. In most cases, the habitat is very unstable and in a relatively short time may become substituted by habitat 2120 Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes") and the *Elymo-Ammophiletum* community or destroyed by increased sea abrasion.

The embryonic coastal dunes located at the border between the beach and the white dune are characterised by a small number of species. They are inhabited by sea sandwort (*Honckenya* *peploides*), European searocket (*Cakile maritima*) and a clump of European beachgrass (*Ammophila arenaria*), sand ryegrass (*Leymus arenarius*) and sand couch-grass (*Agropyron junceum*).

The habitat is particularly vulnerable to the following hazards:

- existing: trampling, excessive use – from the beach side, the pressure of beachgoers is present (sunbathing at the foot of the dune, "wild passages"), it is present for 3–4 month throughout the year;
- potential:
  - erosion – potentially threatened by abrasion; due to the dynamics of the processes, every stretch of the coastline is potentially threatened by abrasion,
  - the location of beach facilities, set up in the holiday season within the habitat zone, serving recreation purposes may contribute to the destruction of the habitat, increasing human pressure.

6.3.2.2.1.2 Habitat conservation status

In accordance with the monitoring of the conservation status of natural habitats [64] the surface of the habitat was assessed as Favourable (FV). The structure and function of the habitat were assessed as Unfavourable – inadequate (U1), mainly due to the unfavourable assessment of the cardinal indicator "condition and growth form of dune-forming grass species" (majority of barren specimens). The indicator "mechanical damage" also received an Unfavourable rating as the front dune patches are subject to moderate tourist pressure (trampling). The remaining indicators have a Favourable rating (FV). The conservation prospects of the habitat in the area are Unfavourable – inadequate (U1). This is related to the current tourist pressure. The sea coast section monitored is characterised by high dynamics of coastal processes, as a result the habitat patches may be destroyed by abrasion. Dune reinforcement works are also probable.

6.3.2.2.1.3 Habitat 2110 impact assessment

6.3.2.2.1.3.1 Applicant Proposed Variant

The habitat analysed is located at a distance of approx. 140 m from the temporary belt, where the construction works will take place and approx. 100 m from the access road to the cable chamber area, which will be frequented by construction vehicles and machinery.

6.3.2.2.1.3.2 Rational Alternative Variant

The habitat analysed is located at a distance of approx. 190 m from the technological belt and approx. 100 m from the access road to the cable chamber area, which will be frequented by construction vehicles and machinery.

Due to a significant distance, the planned project will not constitute an indirect or direct threat to the 2110 habitat in either of the variants analysed.

In the operation phase, no impacts will occur in either of the variants analysed.

6.3.2.2.2 2120 Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes")

6.3.2.2.2.1 Short characteristics of the habitat

Within the entire Natura 2000 site Białogóra (PLH220003), the habitat occupies a surface area of approx. 19.48 ha, from which, within the area of additional belts:

- the APV covers a surface area of 680 m^2;
- the RAV covers a surface area of 680 m^2.

The shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes") include dunes that formed as a result of accumulation of marine sand carried onto the beach from the seabed and then transferred inland. They create an unstable system of dune embankments and molehills which are under a constant influence of sea winds. The occurrence, conservation and status of the habitat are determined by the constant movement of the substrate made of poor sands under the influence of winds and a relatively high humidity. As a result, in the white dunes habitat, there are unfavourable conditions for the majority of plant species.

The coastal "white dunes" are characterised by the presence of a small number of species. They are inhabited by clumps of European beachgrass (*Ammophila arenaria*), less often sand ryegrass (*Leymus arenarius*) as well as purple marram (*Calammophila baltica*) with a low coverage level not exceeding 30–40%. In places less exposed to sand deposition, the following species can be found *Festuca villosa*, beach pea (*Lathyrus japonicus subsp. maritimus*) and sand sedge (*Carex arenaria*).

The habitat is particularly vulnerable to the following threats:

- existing:
  - trampling, excessive use – from the beach side, the pressure of beachgoers is present (sunbathing at the foot of the dune, "wild passages"), it is present for 3–4 month throughout the year,
  - erosion – along a 1/3 section of the habitat, abrasion and a dune cliff, 0.5–2 m high are present (steep slopes from the sea side of abrasive origin on dune embankments);
- potential:
  - erosion – abrasion as a result of storms may lead to significant loss of habitat area,
  - recreational development, the location of beach facilities, set up in the holiday season within the habitat zone, serving recreation purposes may contribute to the increase in human pressure or direct destruction of the habitat,
  - refuse and solid waste – possible littering due to human pressure, mainly from tourists.

6.3.2.2.2.2 Habitat conservation status

In accordance with the monitoring of the conservation status of natural habitats [64], the habitat surface within the area has not changed since 2012 and was assessed as Favourable (FV). The structure and function of the habitat were assessed as Favourable (FV). In most plots, all indicators related to this parameter have Favourable values (FV), only in two locations, the currently present abrasion process was observed. The conservation prospects of the habitat in the area are Unfavourable – inadequate (U1). Habitat patches are located within the zones subject to impacts of the sea and wind action, and may, therefore, be destroyed or their boundaries may be altered in the long term. The processes mentioned above are totally natural, thus, the unfavourable rating of the parameter does lower the overall rating. Apart from the factors mentioned above, dune reinforcement may pose a potential threat to the habitat. Tourist pressure in its current intensity does not pose a serious threat.

6.3.2.2.3 Assessment of impact on habitat 2120

6.3.2.2.3.1 Applicant Proposed Variant

The habitat analysed is located at a distance of approx. 75 m from the temporary belt, where the construction works will take place and approx. 65 m from the access road to the cable chamber area, which will be frequented by construction vehicles and machinery.

6.3.2.2.3.2 Rational Alternative Variant

The habitat analysed is located at a distance of approx. 155 m from the temporary belt, where the construction works will take place and approx. 65 m from the access road to the cable chamber area, which will be frequented by construction vehicles and machinery.

Due to a significant distance, the planned project will not constitute an indirect or direct threat to the 2120 habitat.

In the operation phase, there will be no impacts, therefore, there is no need for introducing minimising measures nor monitoring suggestions.

6.3.2.2.4 Wooded dunes of the Atlantic, Continental and Boreal region 2180

6.3.2.2.4.1 Short characteristics of the habitat

Within the entire Natura 2000 site Białogóra (PLH220003), the habitat occupies a surface area of approx. 309.25 ha, out of which:

- 64 000 m^2 within the area of the additional temporary belt in the APV;
- 12 600 m^2 within the boundaries of the permanent technological and technical belts, where permanent tree-felling will take place, and 76 000 m^2 in the additional belt.

The habitat covers diversified forest ecosystems that grow on coastal dunes. Forest ecosystems within the habitat area are located on coastal dunes exclusively in the zone of direct influence of the specific coastal climate, within a narrow strip of the Baltic Sea coast. In the case of *Empetro nigri-Pinetum* the main component of the tree stands is the Scots pine (*Pinus sylvestris*), and it is accompanied by the silver birch (*Betula pendula*) while in depressions and more humid locations – the downy birch (*Betula pubescens*), common oak (*Quercus robur*) and common beech (*Fagus sylvatica*). The ground cover is dominated by shrubbery, mainly lingonberry (*Vaccinium vitis-idaea*), black crowberry (*Empetrum nigrum*), common heather (*Calluna vulgaris*), and European blueberry (*Vaccinium myrtillus*) in places. The ground cover is most commonly mossy with a share of such species as mountain fern moss (*Hylocomium splendens*), red-stemmed feathermoss (*Pleurozium schreberi*), neat feather-moss (*Pseudoscleropodium purum*) as well as species from the *Dicranum* genus. In the moist form in the ground cover the following species are present: the cross-leaved heath (*Erica tetralix*), bog blueberry (*Vaccinium uliginosum*), marsh Labrador tea (*Ledum palustre*) as well as rarely sweetgale (*Myrica gale*).

In the case of the *Betulo-Quercetum* community, the main natural components of the tree stand are common oak (*Quercus robur*), silver birch (*Betula pendula*) and downy birch (*Betula pubescens*). In Poland, the tree stands also include Scots pine (*Pinus sylvestris*). The characteristic feature of the community is also a strongly-developed layer of shrubs, especially in the case of moist forms. They are mainly formed by common honeysuckle (*Lonicera periclymenum*), alder buckthorn (*Frangula alnus*), rowan (*Sorbus aucuparia*), alpine current in places (*Ribes alpinum*) as well as common hazel (*Corylus avellana*). The ground cover is usually lush and dense, although the degree of density and dynamics of the ground cover depends on the location within the dunes. The following species can be commonly found there: eagle fern (*Pteridium aquilinum*), common honeysuckle (*Lonicera periclymenum*), purple moor-grass (*Molinia caerulea*), European blueberry (*Vaccinium myrtillus*) as well as chickweed-wintergreen (*Trientalis europaeus*), bent grass (*Deschampsia flexuosa*) and hairy wood-rush (*Luzula pilosa*).

The habitat is particularly vulnerable to the following threats:

- existing:
  - rubbish and solid waste – possible littering due to human pressure, mainly from tourists,
  - trampling, excessive use – the habitat is exposed to trampling, littering and contamination caused by humans in the vicinity of access roads leading to the beach,
  - hiking, horse riding and riding on non-motorised vehicles,
  - mushroom, berry picking, etc.,
  - management and use of forests and plantations,
  - forest clearance,
  - droughts and reduced precipitation,
  - alien invasive species – fruiting specimens of alien species were found in two locations – wild black cherry (*Prunus serotina*), which may spread in patches of the habitat,
  - removal of dead and dying trees – too little dead wood in habitat patches leads to a decline in the conservation status of the habitat;
- potential:
  - forest management unadjusted to the requirements of the habitat conservation – application of total deforestation may lead to the reduction in the tree stand age, deformations of the vertical and spatial structure of the tree stand, excessive compactness of tree stands results in a disturbed development of forest lower layers – which prevents the development of heliotropic ground cover species, reduction of the natural pine reforestation,
  - reduction or loss of specific habitat characteristics.

6.3.2.2.4.2 Habitat conservation status

In accordance with the monitoring of the conservation status of natural habitats [64] the surface of the habitat in the area was assessed as Favourable (FV). At the same time, during monitoring works, it was found that the general surface of the habitat in the area (beyond the territory of nature reserves) is larger than the one provided in the protective task plan. It was suggested to carry out a field verification of the distribution and size of habitat patches.

The structure and function of the habitat were assessed as Unfavourable – inadequate (U1). Part of the habitat patches is characterised by favourable rating of all indicators comprising this parameter, while in the remaining patches deformations causing a lower rating are observed (young age or uniform age structure of the stand, presence of spruce, deficit of dead wood, lack of some characteristic species). All deformations observed are connected to the improperly conducted forest management.

Due to the commercial use of the habitat patches, its conservation prospects in the area are Unfavourable – inadequate (U1). Tourist pressure in its current intensity does not pose a serious threat.

In 2019, an expert study was prepared "*Ekspertyza na potrzeby uzupełnienia stanu wiedzy o siedliskach przyrodniczych: 2180, 4010, 7110, 7150 na obszarze Natura 2000 Białogóra (PLH220003), w ramach projektu POIS.02.04.00-00-0191/16 pn. „Inwentaryzacja cennych siedlisk przyrodniczych kraju, gatunków występujących w ich obrębie oraz stworzenie Banku Danych o Zasobach Przyrodniczych*" [An Expert study for the purposes of supplementing the knowledge on natural habitats 2180, 4010, 7110, 7150 within the Natura 2000 site Białogóra (PLH220003), as part of the project POIS.02.04.00-00-0191/16 entitled "Inventory Survey of the Polish valuable natural habitats, species present within them as well as creation of Natural Resources Data Bank"] [195], in accordance with which an overall assessment of habitat 2180 in the Natura 2000 site Białogóra (PLH220003) was prepared. The poor overall conservation status was determined by the parameter "structure and functions", within which the characteristic floristic combination of the ground cover and dominant species were the lowest rated indicators. Withdrawal of the species characteristic for the *Empetro nigri-Pinetum* community in the Pobrzeże Słowińskie was signalled by Matuszkiewicz [238] on the basis of historical analyses [427] and modern phytosociological materials, while the surveys conducted for the purposes of this expert study confirm this tendency [238]. When trying to pin point the causes of this phenomenon, he takes into consideration the correlation between the age of the tree stand and the presence of characteristic species, which begin to disappear in the oldest, more than 100-year old, tree stands. This may entail a disturbance of the natural forest dynamics due to forest management, which generates excessive illumination and growth of highly-competitive shrubbery, [mainly European blueberry (*Vaccinium myrtillus*) and/or common heather (*Calluna vulgaris*)] as well as the introduction of artificial reforestations. Commercial, often young tree stands which can be assigned to the *Empetro nigri-Pinetum* community (degeneration at the plant community level) represent a degenerate-regenerate form of phytocenoses with a far-reaching structural and spatial decomposition. The deficient nature of these communities may be locally affected by intensive trampling by tourists, beachgoers, and mushroom pickers, etc.

6.3.2.2.4.3 Habitat 2180 impact assessment

6.3.2.2.4.3.1 Applicant Proposed Variant

The analysed habitat is located in a direct vicinity of the access road, which will be frequented by construction vehicles and machinery, leading to the cable chamber area. In the construction phase, the following impacts may occur:

- contamination as a result of accidental leaks from machinery and vehicles;
- air pollution due to the combustion of fuels in the engines of construction machinery;
- noise from the construction machinery and vehicles.

6.3.2.2.4.4 Measures minimising impact on habitat 2180 and monitoring suggestions

The main measures minimising the construction phase impacts affecting habitat 2180, will be its delineation along the eastern border of the access road and posting information boards that prevent its trampling. Moreover, the prerequisite for the implementation of construction works should be permitting only roadworthy vehicles and construction equipment in working order. In the construction phase, environmental supervision should be ensured.

6.3.2.3 Summary of the impact on the area of Białogóra site (PLH220003)

6.3.2.3.1 Applicant Proposed Variant

The implementation of the planned project in the APV will have no direct or indirect impact on the Natura 2000 habitats: 2110 Embryonic shifting dunes and 2120 Shifting dunes along the shoreline, due to a significant distance from the planned works and the route of the access road to these habitats. Thanks to the application of measures minimising the negative impact on habitat 2180 Wooded dunes of the Atlantic, Continental and Boreal region, no significant negative impact on the integrity of the area is expected.

The planned project will not have a significant negative impact on the subjects of protection of the Natura 2000 site, and especially, the following outcomes will be avoided:

- significant deterioration of the status of natural habitats or the habitats of plant and animal species, for the protection of which the Natura 2000 site was established;
- significant negative impact on species, for the protection of which the Natura 2000 site was established;
- significant deterioration of the Natura 2000 site integrity or its interconnection with other sites.

Moreover, the planned project, due to its character and location, will not affect the possibility of implementing conservation measures and achieving targets set out in the Protective task plan for the Natura 2000 site Białogóra (PLH220003).

6.3.2.3.2 Rational Alternative Variant

The planned project will cause a direct threat to habitat 2180. As a result of the overhead line construction, habitat 2180 will be destroyed on a surface area of 12 600 m^2. This will be a permanently deforested area without the possibility of returning to the previous condition.

7 Cumulative impacts of the planned project (concerning existing, currently implemented and planned projects and activities), including impacts on the Natura 2000 sites Białogóra (PLH220003) and Przybrzeżne wody Bałtyku (PLB990002)

7.1 Existing, currently implemented and planned projects with the decision on environmental conditions

While preparing this EIA Report, the RDEP (Regional Directorate for Environmental Protection) in Gdańsk and the communes of Choczewo and Krokowa were requested to disclose the list of projects, for which the proceedings regarding the issued DECs (decision on environmental conditions) are being conducted, or for which the DEC has been issued within the last 3 years, the impacts of which may lead to an accumulation of negative impacts when combined with the planned project [Table 7.1].

Table 7.1. List of projects which may cause cumulative impacts when combined with the planned underground cable line [Source: internal materials]

Authority issuing the DEC	Project name, stage of the DEC procedure	Short description	Assessment of the impact accumulation probability
Choczewo commune	Decision of 24 April 2019 (ref. no.: IKS.6220.01.2019.ZW) finding that there is no need to conduct an environmental impact assessment for the project entitled “Modernisation of the petrol station in Choczewo” and, at the same time, determining the environmental conditions for the said project.	The project concerns the extension and reconstruction of the existing petrol station involving: • the underground multi-chamber tank; • new pumps; • new tank emptying station. The planned modernisation of the station does not include LPG storage and distribution. The station is located in the north-eastern part of the village of Choczewo on the plots no. 100/13, 100/4, 100/5 within the precinct 006 Choczewo.	The planned project is being implemented within the area of the village of Choczewo, at a distance of approximately 3.5 km from the planned connection. No accumulation of negative impacts is expected.
RDEP in Gdańsk	Resolution of 19 July 2020 (ref. No.: RDOŚ-Gd-WOC.43.26.2020.MJ.8) approving the project implementation in terms of its impact on the Natura 2000 site Białogóra (PLH220003) for the project „Construction of the base station BT 44803 Białogóra including an antenna system, free-standing telecommunication cabinets, cable ducts and a power feeding line, on the plot no. 86 in Białogóra”	The project involves the construction of the base station BT 44803 Białogóra to improve the quality and extend the range of services as well as to ensure the correct transmission within the network. The base station will be located in a rural area; there are no built-up areas in the immediate vicinity. The base station will consist of the following elements: • controllers, transceivers and power supply devices; • sector antennas mounted on a tower (5 pcs); • radio link antennas (5 pcs); • antenna line elements.	The base station BT 44803 Białogóra including an antenna system, free-standing telecommunication cabinets, cable ducts and a power feeding line will be located on the plot no. 86 in Białogóra – i.e. at a distance of 5.5 km from the planned connection. No accumulation of negative impacts is expected.

Pursuant to the Decision no. 184/2020 (RDOŚ-Gd-WOO.4210.74.2011.PW.MS.KSZ) of 8 April 2020, a decision refusing to determine environmental conditions for the project consisting in the construction of a wind farm complex near the villages of Osieki Lęborskie – Lublewo – Choczewo – Choczewko – Przebendowo – Słajkowo in the Choczewo commune together with necessary auxiliary infrastructure has been issued.

Due to considerable distances between the projects as well as their impacts being limited to the area of the project, the planned project is not expected to cause either cumulative impacts or accumulation of the impacts of the planned project in combination with the above-mentioned projects.

On 25 May 2016, the General Directorate for Environmental Protection in Warsaw issued a notice (Ref. no. DOOŚ-OA.4205.1.2015.24) informing the parties to the proceedings for issuing a decision on environmental conditions for the project, consisting in the construction and operation of Poland's first nuclear power plant with a capacity of up to 3750 MWe in the area of the communes of: Choczewo or Gniewino and Krokowa, on issuing by the General Directorate the resolution of 25.05.2016 (DOOŚ-OA.4205.1.2015.23) specifying the scope of the Environmental Impact Assessment Report.

The project can be implemented in the areas of the communes of Choczewo or Gniewino and Krokowa in the Pomeranian Voivodeship, in one of the three specific location alternatives: Lubiatowo-Kopalino, Choczewo and Żarnowiec [Figure 7.1], which were selected at the stage of the environmental impact assessment and confirmed at the stage of the decision on establishing the nuclear installation location.

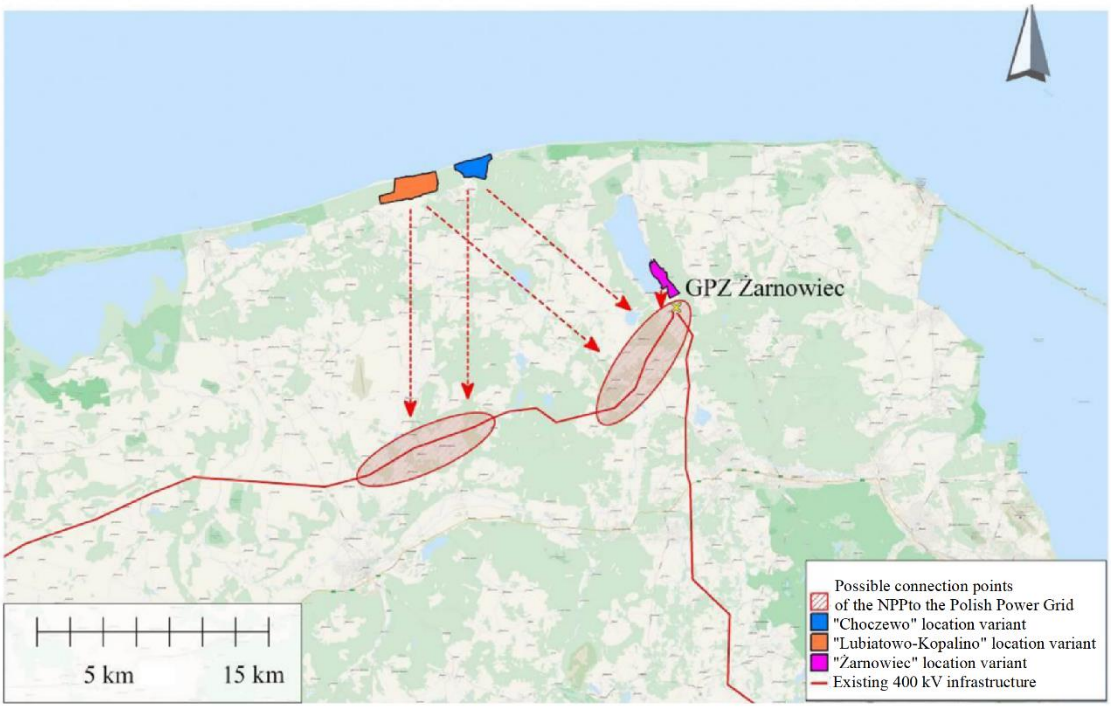


Figure 7.1. Alternative locations considered for Poland's first nuclear power plant with possible points connecting it to the National Power System [Source: Poland's First Nuclear Power Plant. Project Information Sheet. PGE EJ 1 Sp. z o.o., 2015]

The following decisions were issued by the Director of the Maritime Office in Gdynia for the project in question (https://sipam.gov.pl/geoportal):

- Decision no. 7/19 of 8 August 2019 for the laying and maintenance of cables and pipelines for the purpose of the cooling system of the nuclear power plant in the area of the territorial sea for the Lubiatowo-Kopalino Site;
- Decision no. 6/19 of 8 August 2019 for the laying and maintenance of cables and pipelines for the purpose of the cooling system of the nuclear power plant in the area of the territorial sea for the Żarnowiec Site.

According to the data provided by the Maritime Office in Gdynia (https://sipam.gov.pl/geoportal) concerning the Choczewo location variant, no decision for the laying and maintenance of cables and pipelines for the purpose of the cooling system of the nuclear power plant has been issued. In the region of the Choczewo location variant, decisions for the laying and maintenance of cables transmitting electricity from the OWF within the internal sea waters and territorial sea are applicable.

The Lubiatowo-Kopalino variant is located at a distance of approx. 5 km to the west, whereas the Żarnowiec variant is located at a distance of approx. 15 km to the east of the planned project. However, it is difficult to predict whether and when, and in which variant, the nuclear power plant will be built, as well as how long the construction phase will last. If the Lubiatowo-Kopalino variant is selected, with the nuclear power plant being built at the same time as the BP OWF CI, the accumulation of impacts may occur in relation to:

- **climate and air quality** – the accumulation of impacts related to the air pollutant emissions may result from the increased volume of traffic of the vehicles involved in the construction works and material transportation. It is assumed that owing to the distance between the locations of both projects (approx. 5 km from each other) and good air circulation, the accumulation of impacts on the air and climate will not persist and will not cause the deterioration of air quality nor local climate. These will be medium-term impacts of a regional scale;
- **population and living conditions** – it may happen that the vehicles involved in both projects will use the same access roads as the inhabitants of the adjacent areas. However, it should be noted that the BP OWF CI construction in the onshore part is expected to progress fairly quickly and will be carried out section by section, therefore the accumulation of impacts will be medium-term and local.

The cumulative impacts of the nuclear power plant being built according to the Lubiatowo-Kopalino variant in combination with the BP OWF CI will be limited to the construction phase, as the operation phase of the BP OWF CI proceeds practically automatically, being limited to maintenance work, which will take place once a year. These will be medium-term, regional and local impacts.

To conclude: if the planned project is implemented simultaneously with other projects, the impacts associated with the construction phase might be related to physical transformations of the land topography, including its cover, land occupation, increased vehicle traffic, emission of noise and vibration. During the operation phase, significant impacts on air, noise, electromagnetic fields, forests, protected areas, land use and development, landscape, population and its health and living conditions, may occur.

7.2 Planned infrastructure-related projects

Due to the proposed OWF construction, a need has emerged for the extension of power networks to transmit the power generated by those farms. Currently, the construction of OWFs is planned by the subsidiaries of PGE Polska Grupa Energetyczna S.A (Elektrownia Wiatrowa Baltica 2 Sp. z o.o., Elektrownia Wiatrowa Baltica 3 Sp. z o.o., Elektrownia Wiatrowa Baltica 1 Sp. z o.o.), Orlen S.A. (Baltic Power Sp. z o.o.) and C-Wind Polska Sp. z o.o. Table 7.2 presents a list of decisions issued by the Director of the Maritime Office in Gdynia concerning the laying and maintenance within the internal sea waters and territorial sea of cables evacuating power from OWFs.

Table 7.2. List of binding decisions issued by the Director of the Maritime Office in Gdynia [Source: data of the Maritime Office in Gdynia, https://sipam.gov.pl/geoportal]

Decision no.	Applicant	Subject of the decision
Decision no. I/DS/20 of 06.11.2020	Elektrownia Wiatrowa Baltica 2 Sp. z o.o.	Laying and maintenance, within the internal sea waters and territorial sea, of cables transmitting electricity from the project entitled *„Zespół Morskich Farm Wiatrowych o maksymalnej łącznej mocy 1500 MW oraz infrastruktura techniczna, pomiarowo-badawcza i serwisowa związana z etapem przygotowawczym, realizacyjnym i eksploatacyjnym*" [literally: "Offshore Wind Farms Complex with a maximum total power output of 1500 MW together with technical, test and measurement, and service facilities related to the preparation, construction and operation stages"]

Decision no.	Applicant	Subject of the decision
Decision no. 2/DS/20 of 06.11.2020	Elektrownia Wiatrowa Baltica 3 Sp. z o.o.	Laying and maintenance, within the internal sea waters and territorial sea, of cables transmitting electricity from the project entitled *„Zespół Morskich Farm Wiatrowych o maksymalnej łącznej mocy 1050 MW oraz infrastruktura techniczna, pomiarowo-badawcza i serwisowa związana z etapem przygotowawczym, realizacyjnym i eksploatacyjnym”* [literally: “Offshore Wind Farms Complex with a maximum total power output of 1500 MW together with technical, test and measurement, and service facilities related to the preparation, construction and operation stages”]
Decision no. 5/20 of 28.09.2020	Baltic Power Sp. z o.o.	Laying and maintenance of cables and pipelines within the internal sea waters and territorial sea for the project entitled *„Budowa przyłącza elektroenergetycznego Morskiej Farmy Wiatrowej Baltic Power do Krajowej Sieci Przesyłowej”* [literally: “Construction of the Baltic Power Offshore Wind Farm power connection to the National Power System”]
Decision no. 9/DS/20 of 25.01.2021	Elektrownia Wiatrowa Baltica – 1 Sp. z o.o.	Laying and maintenance of subsea cables within the internal sea waters and territorial sea for the project entitled *„Zespół Morskich Farm Wiatrowych Baltica – 1”* [literally: Offshore Wind Farms Complex – Baltica 1”]

The Baltic Power Sp. z o.o. company with the letter of 20 December 2019, corrected on 31 March 2021, applied for a permit for laying and maintaining cables for the project *„Budowa przyłącza elektroenergetycznego Morskiej Farmy Wiatrowej Baltic Power do Krajowej Sieci Przesyłowej”* [literally: “Construction of the Baltic Power Offshore Wind Farm power connection to the National Power System”]. This area includes the area of the internal sea waters and territorial sea [for the Exclusive Economic Zone, the decision approving the location of the cables was issued by the Minister of Maritime Economy and Inland Navigation by the letter of 7 July 2020 (ref. no. DGM.WZRMPP.3.430.24.2020.NZ.1) – Decision 1/K/20]. The Director of the Maritime Office in Gdynia requested the opinion of competent ministers with the letter (ref. no.: INZ1.1.8104.10.1.2019.MGw) and has received positive opinions. Thus, the Director of the Maritime Office issued a positive decision concerning the location of the above-mentioned project (Decision no. 5/20) in the letter of 28 September 2020 (ref. no. INZ1.1.8104.10.13.2019.MGw). The permit was issued for a period of 35 years. The planned project will involve the laying of high voltage (HV) or extra high voltage (EHV) AC or DC power cables including the necessary telecommunications and associated infrastructure. In the area of the territorial sea, it is planned to use the method of cable burying in the seabed or laying on the seabed with additional protection, whereas, in the shore zone, the directional drilling method is planned.

With the letter of 27 June 2019 (supplemented on 22 August 2019 and 14 October 2019, and corrected on 19 September 2019 and 20 April 2020) the Elektrownia Wiatrowa Baltica 2 Sp. z o.o. company applied for a permit for laying and maintenance, within the internal sea waters and territorial sea, of the cables transmitting electricity from the project entitled *„Zespół Morskich Farm Wiatrowych o maksymalnej łącznej mocy 1500 MW oraz infrastruktura techniczna, pomiarowo-badawcza i serwisowa związana z etapem przygotowawczym, realizacyjnym i eksploatacyjnym”* [literally: ”Offshore Wind Farms Complex with a maximum total power output of 1500 MW together with technical, test and measurement, and service facilities related to the preparation, construction and operation stages”]. In response to this application, a decision of the Minister of Transport, Construction and Maritime Economy no. MFW/4//12 (ref. no. GT7/62/1157765/decyzja/2012) of 16 April 2012 on the permit for the construction and use of artificial islands, structures and equipment in the Polish Maritime Areas was issued. Thus, the Director of the Maritime Office issued a positive decision concerning the location of the above-mentioned project (Decision no. 1/DS/20) in the letter of 6 November 2020 (ref. no. INZ5DS.8104.1.11.2020.AGB). The permit was issued for a period of 35 years. The planned project will involve the laying and maintenance of high voltage (HV) or extra high voltage (EHV) AC or DC power cables including the necessary telecommunication and associated infrastructure, using the method of cable burying in the seabed or laying on the seabed with additional protection, whereas, in the shore zone, the directional drilling method is planned. During the cable exploitation phase, inspections of particularly vulnerable areas (e.g. crossings with the existing infrastructure) shall be carried out once a year, while a full inspection of the entire length of the cable lines shall be carried out not more often than at 5-year intervals.

On 27 June 2019, Elektrownia Wiatrowa Baltica 3 Sp. z o.o. company applied for the permit for laying and maintenance, within the internal sea waters and territorial sea, of cables transmitting electricity from the project entitled *„Zespół Morskich Farm Wiatrowych o maksymalnej łącznej mocy 1050 MW oraz infrastruktura techniczna, pomiarowo-badawcza i serwisowa związana z etapem przygotowawczym, realizacyjnym i eksploatacyjnym*" [literally: "Offshore Wind Farms Complex with a maximum total power output of 1500 MW together with technical, test and measurement, and service facilities related to the preparation, construction and operation stages"]. The application was supplemented on 22 August 2019 and 14 October 2019, and corrected on 19 September 2019 and 20 April 2020. In response to the application, a decision of the Minister of Transport, Construction and Maritime Economy no. MFW/5/12 (ref. no. GT7/62/1157768/decyzja/2012) of 16 April 2012 on the permit for the construction and use of artificial islands, structures and equipment in the Polish Maritime Areas was issued. The Director of the Maritime Office issued a positive decision concerning the location of the above-mentioned project (Decision no. 2/DS/20) in the letter of 6 November 2020 (ref. no. INZ5DS.8104.2.11.2020.AGB).

Before issuing the above-mentioned decisions, the Director of the Maritime Office in Gdynia issued the decision (Decision no. 5/18 of the DMO in Gdynia of 23 November 2018) repealing the previously binding decision of 31 July 2014 concerning the laying and maintenance of subsea cables comprising offshore infrastructure for power transmission – eastern part (MTI-E) in the area of the territorial sea of the Republic of Poland. The Applicant – Inwestycje Infrastrukturalne Sp. z o.o. in the letter of 29 June 2018 requested the previous decision to be repealed. The Applicant's aim was to safeguard the space for future OWF investors, however, due to the fact that individual investors have commenced their work and the route for the proposed power cables has been specified, the area covered by the previous decision will not be designated for further development within the given scope.

7.2.1 Cable tray

On 31 August 2021, C-Wind Polska Sp. z o.o. applied for a decision on environmental conditions for the project entitled "*Budowa infrastruktury przesyłowej energii elektrycznej z Morskiej Farmy Wiatrowej BC-Wind do Krajowego Systemu Elektroenergetycznego*" [literally: "Construction of the power transmission infrastructure from the BC-Wind offshore wind farm to the National Power System"].

On 23 September 2021, Elektrownia Wiatrowa Baltica-2 Sp. z o.o. and Elektrownia Wiatrowa Baltica-3 Sp. z o.o. applied for a decision on the environmental conditions for the project entitled "*Infrastruktura Przyłączeniowa MFW Baltica B-2 i B-3*" [literally: "Baltica B-2 and B-3 OWF Connection Infrastructure"].

In the offshore part, the BP OWF CI Development Area is located in the Exclusive Economic Zone, in the territorial sea and internal sea waters. West of the BP OWF CI Development Area, it is planned to build the connection infrastructure for the Baltica 2 and Baltica 3 OWFs, while east of the area, the connection infrastructure for the BC-Wind OWF [Figure 7.2].

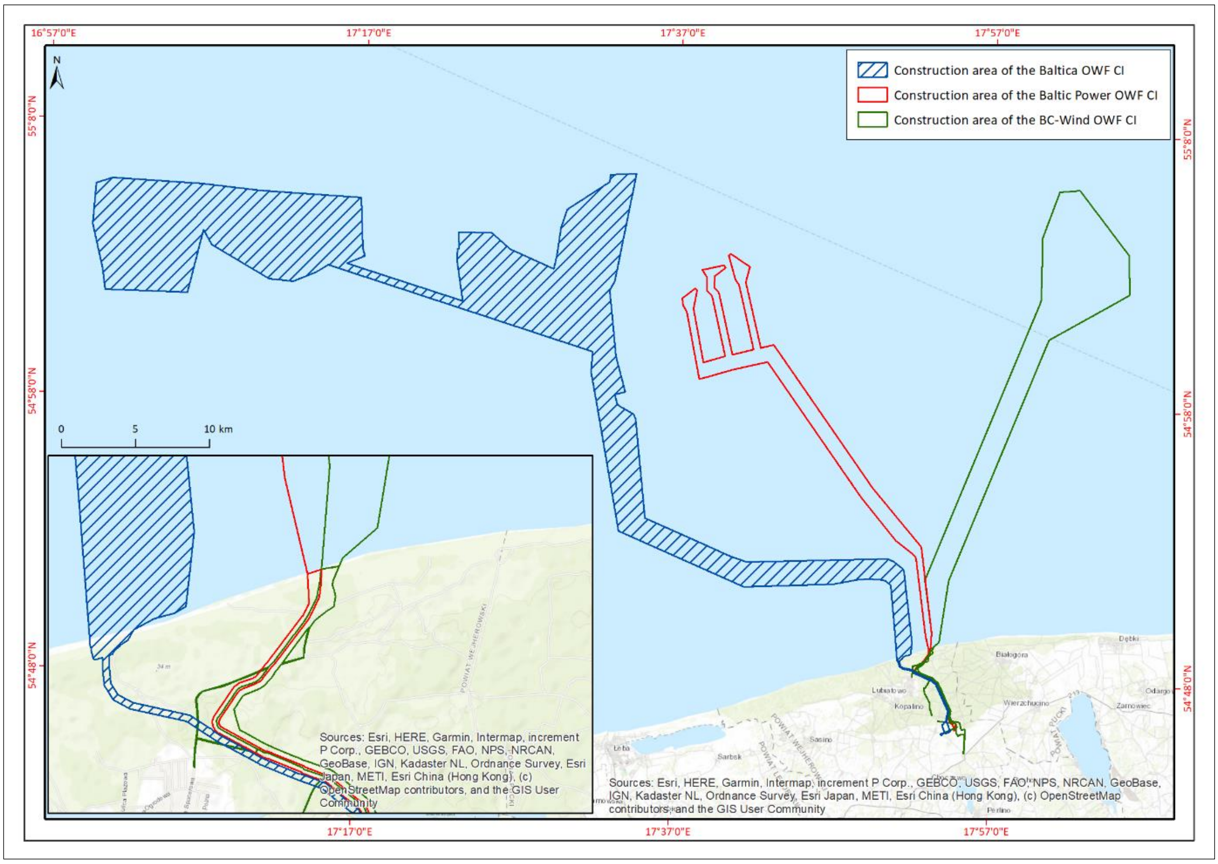


Figure 7.2. Development areas for the Connection Infrastructures of the Baltic Power OWF, Baltica OWF and BC-Wind OWF [Source: internal materials]

In the case of the Baltica OWF CI, the assumed length of a single cable line will be up to 89 km, while in the case of the BC-Wind OWF CI, it will be up to 33 km. In the exclusive economic zone, the routes of all three construction areas will be located within the offshore wind farms. In the territorial sea, their routes will converge. Approximately 7 km from the shoreline up to the drilling locations, these areas will run parallel to each other.

In the case of the onshore part, as agreed with the Choczewo Forest Inspectorate, the transmission infrastructures leading from the OWF were designed to be routed through a cable tray [Figure 7.3], minimising the negative environmental impacts maximally by:

- minimising the tree felling area thanks to routing the connection infrastructure of the OWF investors through a common cable tray;
- bypassing the environmentally valuable areas indicated by the Choczewo Forest Inspectorate at the stage of arrangements;
- using the cable technology and horizontal directional drilling as the least harmful to the environment.

The connections of individual investors are at different development stages. Construction works for cable lines will be performed at different times. The construction of the Baltica 2 and Baltica 3 OWF CI may be an exception. According to the information received from the Applicant, which results from the cooperation with the other investors, the construction of the Baltica 2 and Baltica 3 OWF CI may coincide with the construction of the BP OWF CI.

The Baltica 2 and 3 OWF CI Development Area is located in the northern part at a distance of approx. 1.8 km to the west of the BP OWF CI. From km 35+300 of the BP OWF CI, the projects are routed through a common corridor. In this case, the accumulation of negative impacts related to the construction phase such as the operation of machines and equipment used in construction works and their presence on the road between the villages of Osieki Lęborskie and Lubiatowo, may arise. It should be noted that the trench for the BP OWF CI will be made in sections with a length of 1 km, and the time of it staying open will not exceed 1 week, which will reduce the likelihood of construction crews appearing simultaneously at the same sections. Due to the location of the planned projects in the forest area and away from inhabited areas, these impacts will not cause nuisance for local residents. The construction phase for the Baltica 2 and 3 OWF CI and the BP OWF CI will involve a temporary and local restriction on the tourism function of the regional forests.

The southern part of the BC-Wind OWF CI Development Area is adjacent to the east side of the BP OWF CI. As part of the project, there is a plan to build the following: approx. 33 km of subsea cable line within the internal sea waters, territorial sea and exclusive economic zone, as well as 8.5 km of an underground cable line, including the necessary service road, and an onshore transformer substation (hereinafter referred to as: OTS), including a 1.5 km long access road in the Choczewo commune area. At the same time, the planned project involves the construction of a section of the overhead line constituting the 400 kV connection between the OTS and the connection point at the substation owned by Polske Sieci Energetyczne (hereinafter referred to as: PSE).

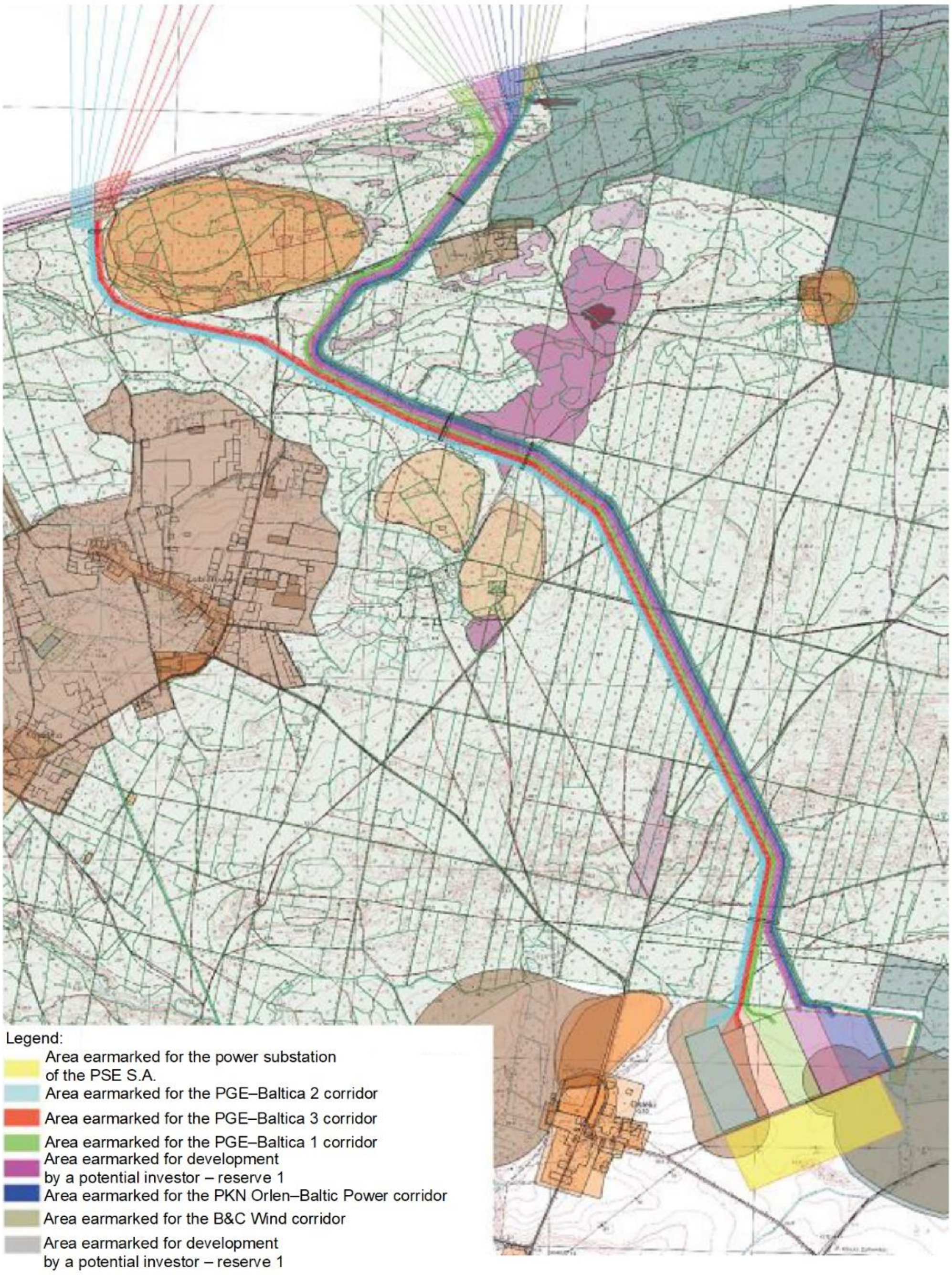


Figure 7.3. Route of the cable tray in the Choczewo commune area [Source: Applicant data

Due to the lack of data, at the current investment stage, it is impossible to assess the cumulative impacts in the context of electromagnetic fields and thermal actions in the common cable tray, including an analysis of the cumulative impact on the Natura 2000 sites Białogóra (PLH220003) and Przybrzeżne wody Bałtyku (PLB990002). However, it is important to emphasise that the planned connections and customer substations will be located outside the Natura 2000 site Białogóra (PLH220003).

7.2.2 PSE substation

The planned project, at its final section in the form of a 400 kV overhead line, enters the PSE substation, which will be used for electric power transmission and distribution. This substation is located south of the BP OWF CI, on an area of approx. 0.3 km^2, in part of the plot no. 25/3 (Kierzkowo precinct, Choczewo commune, Wejherowo district, Pomeranian voivodeship), on agricultural lands and tree- and shrub-covered arable lands.

The investor in the planned project is the state-owned enterprise Polskie Sieci Elektroenergetyczne S.A. On 10.08.2021, an application was made for a decision on the environmental conditions for the project entitled "*Budowa stacji elektroenergetycznej 400 kV Choczewo*" [literally: "Construction of a 400 kV power substation Choczewo"].

The PSE substation shall be equipped with a 400 kV switchyard constructed using AIS technology and the 3S+2SO arrangement. The busbar systems (tubular version) shall be divided into sections (section A and B). The sections A and B shall be connected to each other by a longitudinal busbar coupler. Each section shall be equipped with a transverse busbar coupler, system earthing switches, bypass busbar couplers and voltage measurement bays. Two bypass busbars (tubular version) shall be installed. The linear bays for overhead terminals shall be equipped with anchor portals and cable line bays will have an enclosed cable termination station. Lightning protection shall be provided through the use of interception air rods, lightning masts and lightning rods installed on anchor portals. The station auxiliary system shall be based on power supply from transformers (0.4 kV), auxiliary transformers fed from an external MV network and an emergency power generator.

In the PSE substation area, the following components are expected to be located:

- 400 kV overhead switchyard constructed using the 3S+2SO arrangement;
- auxiliary building;
- guardhouse;
- power generator (on paved ground);
- internal road system, including parking sites and yards;
- cable ducts and conduits system;
- water supply system (supply from a water main and/or deep well);
- drainage system for buildings, roads, cable ducts etc.;
- rainwater drainage system with a storage and absorbent reservoir;
- fire water tanks with water connection points for firefighters;
- cesspool (sanitary sewerage system);
- exterior lighting;
- external fencing (made of concrete or panels) and regulatory fencing (interior – made of panels).

Furthermore, as part of the PSE substation, auxiliary infrastructure such as utility connections and road exits shall be built.

In the immediate vicinity of the PSE substation, the substations owned by the entities to be connected (OWF intermediary substations) will be located. These substations are still in the development phase, therefore, due to the lack of data on the planned infrastructure, it is impossible to assess the cumulative impacts for the planned project.

7.3 Identification of impacts which may cause cumulative impacts

In the vicinity of the offshore part of the BP OWF CI area, there are areas in which similar activities related to laying of subsea power cables of other investors are planned. Therefore, the accumulation of underwater noise resulting from construction works being conducted simultaneously within the areas of more than one of these projects, may result in cumulative impacts, particularly in the zone up to approx. 7 km from the shoreline, where these areas are closest to each other.

For the same reason, i.e. the proximity of construction areas of other investors and the possibility of simultaneous cable laying and burying in the seabed, the phenomenon of impact accumulation may also occur in connection with an increase in the concentration of suspended solids in the water depth and their sedimentation.

As regards the onshore part of the BP OWF CI, possible impact accumulations are related to noise generation as a result of machine and equipment operation in the construction phase and the noise generated as a result of electrical power equipment operation within the customer substation and the PSE substation during their operation phase.

7.4 Assessment of cumulative impacts

7.4.1 Underwater noise

The noise impact range is relatively small for individual vessels, however, in the case of two or more noise sources, which results from simultaneous implementation of similar projects, an increase in the noise level may be substantial, especially in the area between them.

Although the noise generated by the vessels to be used for the purpose of construction and operation of the planned projects increases the environmental noise, it has a small range, which is only significant within a few hundred metres of the sound source. However, the scale and scope of this impact increase with the number of vessels involved in the construction of all the planned cable connections, hence, the noise increases in a larger area and the impact duration is longer. The accumulation of underwater noise may result in this phenomenon extending to a larger sea area than in the case of the activities carried out by one investor.

Taking into account the specificities of the project construction phase, including, in particular, its linear nature, with the progress of work, the increased underwater noise levels will pertain to more sea areas around the vessels in operation, at the same time releasing the areas where the cable has already been buried or laid on the seabed. For reasons of safety of underwater operations, the vessels used for cable laying and burying will have to operate at considerable distances from each other, which will additionally mitigate the possible accumulation of underwater noise.

Considering the above, including a significant possibility of marine mammals and fish avoiding sea areas characterised by a temporarily increased level of underwater noise, it can be assumed that this cumulative impact will be short-term (in the context of the entire southern part of the offshore connection infrastructure development areas), local, and its significance will be moderate at most.

7.4.2 Suspended solids

The modelling results for the dispersion of suspended solids created as a result of works related to cable laying and burial indicate that short-term changes concerning both an increase in the suspended solids content in the water depth and their sedimentation on the seabed.

In the northern routes of the transmission infrastructures, the distances between the areas where the works are to be carried out by different investors are so long that even if the works are carried simultaneously, they will not result in the accumulation of the increase in suspended solids content in the water depth. The accumulation of their sedimentation on the seabed will also not take place.

The situation may be different in the southern part of the routes of the offshore connection infrastructure development areas. The maximum width of the corridor in which the cables of all three investors are planned to be laid is approx. 3.4 km. If the works are carried out simultaneously, the impact accumulation within the impact range is likely to occur, particularly with regard to an increase in the concentration of suspended solids in the water depth. Such situation, depending on the choice of the cable burial method, the hydrodynamic conditions prevailing during the works and the type of seabed sediments, may last up to several dozens of hours (in the case of the mass flow excavation method) from the moment of the interference in the seabed. After the geological reconnaissance, the soil conditions may enable the application of the ploughing technology, in which the area of soil structure disturbance is smaller, and the amount of sediments becoming suspended is significantly smaller than for the methods analysed in this report.

Considering different development stages of the projects of individual investors, possible deliveries of offshore power cables and order of engagement of specialist vessels and equipment used during cable burial, the situation when these projects are implemented simultaneously is unlikely to occur. The actual manner in which different investors will carry out their works will result from safety of underwater operations at sea and the necessity to designate safety zones around the areas where these works are to be carried out. Therefore, despite the theoretical possibility of accumulation of the impacts related to an increase in the concentration of suspended solids in the water depth and their subsequent sedimentation, the actual accumulation will be a short-term, reversible and local phenomenon, and the significance of this impact will be moderate at most.

7.4.3 Noise

As a result of implementing two projects in the onshore area, i.e. the Baltic Power OWF customer substation and the PSE substation, the accumulation of impacts regarding noise, both during the construction and operation phase, is likely to occur.

The construction works for the PSE substation are planned for August 2023–May 2026 and may accumulate with the planned project along the section of the access road leading from Osieki Lęborskie to the substation. The construction of the PSE substation, as well as of the BP OWF CI, will involve operation of machines and equipment used in construction works, i.e. excavators, bulldozers, lifting devices, self-propelled graders and vehicles transporting building materials – rigid dump trucks. As indicated in the database *Update of noise database for prediction of noise on construction and open sites* developed by Hepworth Acoustics Ltd at the request of DEFRA (*Department for Environment, Food and Rural Affairs*) [154], a typical noise level at a distance of 10 m from its source is around 70–85 dB [Table 7.3].

Table 7.3. Noise sources during the construction phase [Source: internal materials based on Update of noise database for prediction of noise on construction and open sites. Phase 3: Noise measurement data for construction plant used on quarries, 2006 [154]]

Source type	**Typical noise level at a distance of 10 m from an operating device [dB(A)]**
Soil stripping by a bulldozer	87
Pneumatic hammer (e.g. used for demolition of concrete structures)	90
Caterpillar excavator	85
Trucks (dump trucks, concrete pumps, concrete mixers)	82

Although the construction phase is characterised by a relatively high noise emission into the environment, it should be noted that its duration is episodic in nature, and upon the completion of construction works, the acoustic environment returns to its natural state.

Summing up: the accumulation of impacts related to noise emission may result from the increased volume of traffic of the vehicles involved in the construction works and material transportation. During the phase of construction of the customer substation and PSE substation, it may happen that the vehicles involved in both projects will use the same access roads as the inhabitants of the adjacent areas. However, it should be taken into consideration that the project construction in the onshore area is expected to progress quickly and the accumulation of impacts will occur only for a short time and locally.

As part of this EIA Report, the cumulative sound level was calculated for the operation phase of the planned customer substation and the PSE substation. The acoustic data concerning the substation were introduced to the calculation program on the basis of the Project Information Sheet entitled „Construction of the 400 kV Choczewo substation" [187. 32 sources of noise with a sound power level of 64.1 dB, the elements of busbar systems and outgoing line sections installed (in accordance with the design assumptions) at a height of 14 m were introduced to the program.

The calculations conducted for the noise levels show that at all observations points at the boundary of the planned residential development, the night-time (40 dB) and day-time (50 dB) noise limits for single-family development will not be exceeded [Figure 7.4].

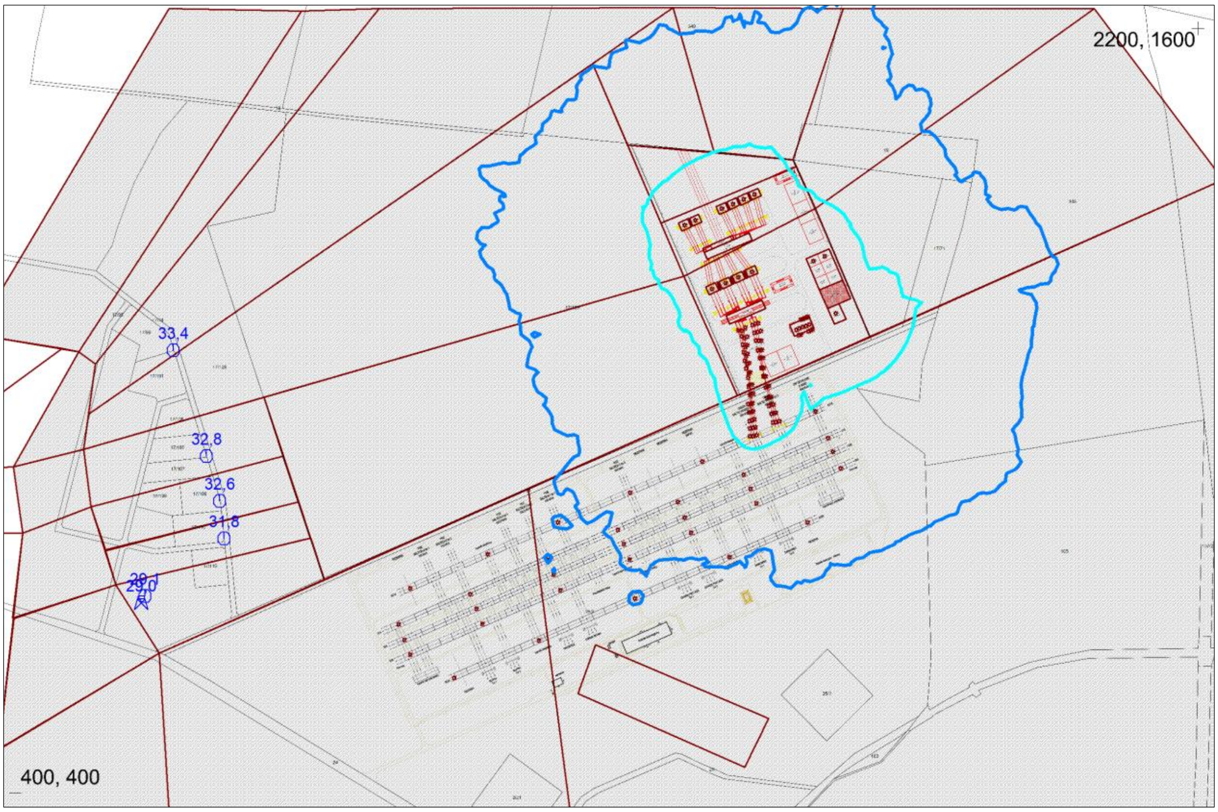


Figure 7.4. Visualisation of the calculation results for daytime and night-time – cumulative impacts with the PSE substation [Source: Applicant's data]

The calculation results for the projected noise level emitted to the environment at observation points and at the facade for daytime and night-time are presented in Table 7.4.

Table 7.4. Equivalent sound levels L_{AeqT} emitted to the environment by the planned Baltic Power Sp. z o.o. customer substation and the PSE substation (Choczewo)

<u>Hałas Przemysłowy Zewnętrzny (Outdoor Industrial Noise)</u> HPZ ' 2001 Windows software: Version: March 2012 +GRUNT License of the Acoustics Laboratory of the Building Research Institute: HPZ-0217 ARS VITAE Wrocław	
Project description:	Orlen + PSE substations daytime and night-time
	Cumulative impact
	Allowance was made for the ground impact in accordance with PN-ISO 9613-2 (simplified method)
Air temperature = 10°C	Relative humidity (RH) = 70%

A-weighted equivalent sound level at specified observation points

No.	Symbol	x [m]	y [m]	z [m]	L_A [dB]
1.	P1	640.0	1095.0	6.5	33.4
2.	P2	691.1	928.9	8.5	32.8
3.	P3	711.0	858.0	9.5	32.6
4.	P4	717.3	799.7	10.5	31.8
5.	P5	597.6	708.9	12.5	29.1

A-weighted equivalent sound level at specified observation points

No.	Symbol	x [m]	y [m]	z [m]	L_A [dB]
1	E1	591.2	698.4	12.0 16.0 20.0	29.0 28.8 28.9

The sound levels established for night-time (40 dB) and daytime (50 dB) in the area of the nearest protected development, including the planned and existing residential developments, will not be exceeded also in the situation when both substations, i.e. the Baltic Power Sp. z o.o. customer substation and the PSE substation Choczewo, operate simultaneously.

In view of the above, the cumulative impact of noise during the operation stage of the Baltic Power Sp. z o.o. substation and the PSE substation has been considered to be of low significance.

8 Transboundary impact

The planned project – BP OWF CI – development area is located at least approximately 117 km from the Poland's land border, and approximately 61.5 km from the sea border, i.e. the Polish Exclusive Economic Zone. Considering the planned project location, scale and implementation method, it is not expected that the implementation thereof would result in transboundary impacts on most of the environmental elements in any of the phases. The exception is the identified negative impact on birds undertaking migration along the East Atlantic Flyway.

9 Analysis and comparison of the variants considered and the variant most beneficial to the environment

Issues related to the project variants, including descriptions and comparison of the technical parameters of the two options analysed, i.e. the APV and the RAV, are included in subsection 2.3. In view of the specific nature of the planned project, namely the integration of the power generated by the Baltic Power OWF into the NPS, the location of the planned project for both options results from the locations of the Baltic Power OWF Area and PSE substation on land. The location of the offshore part of the planned project implemented according to the APV is defined by the site selection decision – Decision No. 1/K/20 of the Minister of Maritime Economy and Inland Navigation of 23 July 2020 and Decision No. 5/20 of the Director of the Maritime Office in Gdynia of 28 September 2020. In the case of the RAV, an alternative offshore route for the cable lines has been proposed [Figure 2.12]. The type and scope of offshore works to be carried out according to this variant would be the same as for the APV. The factor differentiating both variants is the route length, i.e. approximately 33.2 km in the case of the APV and approximately 40.0 km in the case of the RAV.

The method and location of the power cable landfall are identical for both variants.

In the case of the offshore part, the BP OWF CI starting point – the cable chamber location, as well as the end point – the current terminals at the PSE substation, are the same. The Applicant had to make a decision on the type of line which would be optimal in this case. The decision also concerned the line location. The Applicant Proposed Variant would involve conducting the connection in the form of a multi-circuit underground EQHV cable line over a distance of approx. 6.5 km. In the case of the RAV, the entire onshore section would be an approx. 5.2 km long overhead power line with a different routing [Figure 2.13]. As experience shows, building public acceptance for overhead line construction is extremely difficult. The concerns relate mainly to the EM field and noise emission as well as the negative impact on the landscape. In this respect, in view of the current technical, economic and social situation, the construction of an underground cable line is increasingly the optimal choice. The necessity of laying cables for electrical grids is also indicated by the strategy document "Energy Policy of Poland until 2040". The ongoing development in power cable construction technology, e.g. applying robust cross-linked polyethylene (XLPE) insulation has significantly reduced the failure rate of underground cable lines and has, thus, facilitated making decisions on constructing such power lines.

The Rational Alternative Variant was developed as a guarantee that the project connecting the Baltic Power OWF to the NPS will be implemented. Should construction of the power connection according to the APV be unfeasible, e.g. due to adverse environmental conditions or a serious conflict with other users of the area, which could not be predicted before conducting environmental surveys and spatial analysis, the Applicant would initiate the process of applying for the issuance of a location decision for the RAV and proceeding the project in a different spatial and/or technological configuration.

The results of the environmental impact assessment of the APV and RAV, both for the offshore and onshore parts, as well as for the construction and operation phases, are compared in Table 9.1. In the case of construction phase, the changes identified were mostly short-term, reversible and local, and the impact significance was assessed as negligible or low. Table 9.1 includes only those impacts which will be moderate, significant or substantial. Failure-free operation of the planned project will not cause significant environmental impacts. The impacts associated with the operation phase will be long-term, however, they will be limited to be of local significance.

Table 9.1. Comparison of the impact assessment results for the options being considered – the Applicant Proposed Variant (APV) and the Rational Alternative Variant (RAV) [Source: internal materials]

Component	Applicant Proposed Variant (APV)	Rational Alternative Variant (RAV)
OFFSHORE AREA		
Construction phase		
Impact on the geological structure, seabed sediments, access to raw materials and deposits	Negligible	Negligible
Impact on the seawater quality	Low	Low
Impact on the seabed sediment quality	Negligible	Negligible
Impact on climate, including greenhouse gas emissions and impacts relevant for adaptation to climate change, impact on atmospheric air (air quality)	Low	Low
Impact on ambient noise	Low	Low
Impact on phytobenthos	Moderate	-
Impact on macrozoobenthos	Low	Low
Impact on ichthyofauna	Negligible	Negligible
Impact on marine mammals	Moderate	Moderate
Impact on seabirds	Low	Low
Impact on Natura 2000 sites – Przybrzeżne Wody Bałtyku (PLB990002)	Low	Low
Impact on wildlife corridors	Negligible	Negligible
Impact on biodiversity	Moderate	Moderate
Impact on cultural values, monuments and archaeological sites and features	Negligible	Negligible
Impact on the use and development of the sea area and tangible property	Negligible	Negligible
Impact on landscape, including the cultural landscape	Negligible	Negligible
Impact on population, people's health and living conditions	Negligible	Negligible
Operation phase		
Impact on the geological structure, seabed sediments, access to raw materials and deposits	Negligible	Negligible
Impact on seawater quality	Negligible	Negligible
Impact on seabed sediment quality	Negligible	Negligible
Impact on climate, including greenhouse gas emissions and impacts relevant for adaptation to climate change, impact on atmospheric air (air quality)	Negligible	Negligible
Impact on ambient noise	Negligible	Negligible

Component	**Applicant Proposed Variant (APV)**	**Rational Alternative Variant (RAV)**
Impact on the electromagnetic field	Negligible	Negligible
Impact on phytobenthos	Negligible	Negligible
Impact on macrozoobenthos	Low	Low
Impact on ichthyofauna	Negligible	Negligible
Impact on marine mammals	Low	Low
Impact on seabirds	Negligible	Negligible
Impact on Natura 2000 sites – Przybrzeżne Wody Bałtyku (PLB990002)	Low	Low
Impact on wildlife corridors	-	-
Impact on biodiversity	Moderate	Moderate
Impact on cultural values, monuments and archaeological sites and features	Negligible	Negligible
Impact on the use and development of the sea area and tangible property	Negligible	Negligible
Impact on landscape, including the cultural landscape	-	-
Impact on population, people's health and living conditions	Negligible	Negligible
ONSHORE AREA		
Construction phase		
Impact on geological structure:		
• wind erosion	Moderate	Moderate
• oil and grease contamination (roads, storage yards, back-up facilities)	Moderate	Moderate
Impact on the topography and dynamics of the coastal zone:		
• deforestation	Low	Important
Impact on soils:		
• wind erosion	Moderate	Moderate
• contamination with greases and oils	Moderate	Moderate
Impact on the quality of surface waters:		
• runoff of slurry from the construction site in the vicinity of waterlogged areas and watercourses	Important	Important
• contamination as a result of accidental leaks from machinery and vehicles	Important	Important
• removal of trees and shrubs – change of the insolation conditions of watercourses	Moderate	Moderate
Impact on hydrogeological conditions and groundwater:		
• fluctuations of the groundwater level due to drainage	Important	Important
• contamination as a result of accidental leaks from machinery and vehicles	Important	Important
Impact on biotic elements in the onshore area:		

Component	Applicant Proposed Variant (APV)	Rational Alternative Variant (RAV)
• lichens	Important	Important
• mosses and liverworts	Negligible	Important
• vascular plants and natural habitats	Important	Important
• forests	Important	Important
• herpetofauna	Moderate	Moderate
• birds	Moderate	Significant
• mammals	Moderate	Moderate
Impact on protected areas other than Natura 2000 sites:		
• Coastal Protected Landscape Area	Moderate	Important
• ecological site “Torfowisko” [Peat bog] in Szklana Huta	Important	Important
Impact on Natura 2000 sites – Białogóra (PLH220003)	Low	Significant
Impact on wildlife corridors	Moderate	Significant
Impact on biodiversity	Low	Significant
Impact on the use and development of the land area and tangible goods	Low	Important
Impact on landscape, including the cultural landscape	Moderate	Significant
Impact on population, health and living conditions of people	Moderate	Low
Operation phase		
Impact on geological structure	None	Important
Impact on the topography and dynamics of the coastal zone	None	Important
Impact on soils	Moderate	Important
Impact on the quality of surface waters	Important	Important
Impact on hydrogeological conditions and groundwater	Important	Important
Impact on ambient noise:		
• noise from a customer substation	Low	Significant
• noise from the 400 kV overhead line	Moderate	Moderate
Electromagnetic field impact:		
• EMF emitted by the underground cable line	Negligible	-
• EMF emitted by the 220 or 275 kV overhead line	-	Significant
• EMF emitted by the 400 kV overhead line	Negligible	Negligible
Impact on biotic elements in the onshore area:		
• forests	Important	Significant
• birds	Significant	Significant

Component	**Applicant Proposed Variant (APV)**	**Rational Alternative Variant (RAV)**
Impact on protected areas other than Natura 2000 sites:		
• Coastal Protected Landscape Area	Moderate	Significant
• ecological site "Torfowisko" [Peat bog] in Szklana Huta	Important	Important
Impact on Natura 2000 sites – Białogóra (PLH220003)	Low	Significant
Impact on wildlife corridors	Important	Significant
Impact on biodiversity	Moderate	Significant
Impact on the use and development of the land area and tangible goods	Low	Significant
Impact on landscape, including the cultural landscape	Important	Significant
Impact on population, health and living conditions of people	Moderate	Significant

The analysis of environmental data and the previous use of the area intended for the construction of the BP OWF CI indicates that it is possible to implement the project according to the APV. The implementation of this option, as indicated in the impact analysis included in section 6, the summary of which is presented in Table 9.1, will be more beneficial to the environment compared to the RAV implementation. As indicated in the table above, the greatest impacts will be related to the construction phase. During the BP OWF CI operation phase, significant and important impacts will occur, however, as a result of applying mitigation measures, they will be reduced.

In summary, the comparison of both options, including in particular the potential impacts resulting therefrom, revealed that the implementation of the BP OWF CI according to the APV is the option least burdensome to the environment and other users of the area.

10 Comparison of the technological solutions proposed with the technological solutions meeting the requirements referred to in Article 143 of the Environmental Protection Law

Pursuant to Article 143 of the Act of 27 April 2001 – Environmental Protection Law (Journal of Laws of 2001, No. 62, item 627, as amended), the technologies used in the newly commissioned systems should meet the requirements which consider, in particular:

- the use of substances with a low hazard potential;
- the effective generation and use of energy;
- ensuring rational consumption of water and other raw materials as well as consumables and fuels;
- the use of waste-free and low-waste technologies and possibility of waste recovery;
- indication of the type, range and size of emissions;
- the use of comparable processes and methods which have been effectively applied on industrial scale;
- scientific and technical progress.

According to Article 3 item 6 of the Environmental Protection Law (Journal of Laws of 2001, No. 62, item 627, as amended), "installation" shall mean:

- a stationary technical unit;
- a group of stationary technical units which are technologically linked together, being under the management of the same entity, and located in the area of the same plant;
- structures which are not technical units nor groups thereof, the operation of which may cause emission.

10.1 Use of substances with a low hazard potential

During the project construction and operation phases, hazardous waste described in subsections 2.4.2 and 2.4.3 may be produced. Such waste will be stored at designated sites in a manner which is selective and safe for people and the environment; subsequently, it will be transferred to authorised waste collectors, thus limiting the potential hazards. The customer substation operation may cause leakage of electrical insulating oils into the ground and the release of SF6 insulating gas or refrigerants from the cooling system into the atmosphere. The customer substation will be equipped with sealed oil sumps connected to a rainwater pre-treatment system. In addition, trays or pans to contain the electrolyte in the event of spillage will be used. Preventing the release of SF6 insulating gas to the atmosphere will be performed by automatic gas density monitoring. The station will not generate process sewage. The Applicant will take all necessary measures resulting from the legal provisions and good practices to reduce the risks.

10.2 Effective generation and use of energy

The planned project will not involve power generation but its transmission by means of an underground cable line as well as its processing and transformation. It will be ensured that the power required for the planned project is used rationally. In the case of the customer substation, the primary power demand will be satisfied internally by means of MV/0.4 kV transformers, external back-up supply – by means of MV lines, emergency supply – internally by means of a power generator. Heat supply will be satisfied by means of electric heaters powered from the station auxiliary system. During the construction phase, electricity required to power construction equipment will come from power generators, while during the operation phase, due to the use of modern technological solutions, including the use of a new type of phase conductors, electrical transmission losses will be reduced.

10.3 Ensuring rational consumption of water and other raw materials as well as consumables and fuels

The use of water, raw materials, consumables and fuels will be mostly related to the construction phase and maintenance works. During the operation of the planned project, there will be no need to use these resources. As for the customer substation, it will not be intended for permanent staff presence. The same people should not occupy it more than 4 hours per day. Consequently, the amount of water used and sanitary sewage generated will be less than in a small household. It confirms the rationality of the planned project in terms of resource use.

10.4 Use of waste-free and low-waste technologies and possibility of waste recovery

During the construction phase, the waste will be collected selectively at locations specially designated and adapted for this purpose, under conditions preventing the release of harmful substances into the environment. It will be ensured that they are collected by eligible entities responsible for waste management or reuse. The waste management will comply with the applicable Act of 14 December 2012 on waste (Journal of Laws of 2016, item 2183, as amended). The underground power line operation will not produce any waste with the exception of minor amounts of waste related to maintenance works or removal of possible failures.

10.5 Type, range and size of emissions

During the operation phase, the planned project in the form of an underground cable line will be a source of heat and EMF emission, which have been described in detail in this EIA Report. In the event of a failure, the customer substation will be a source of noise, EMF, heat and gas emissions into the atmosphere. The construction phase will result in noise emissions and release of pollutants from fuels burnt in vehicle engines into the atmosphere as well as waste and waste water generation. These emissions will be short-term and local.

10.6 Use of comparable processes and methods which have been effectively applied on an industrial scale

The dynamic development of the cable networks has been observed worldwide. The primary objective of the cable line development is to ensure high reliability of transmission and compliance with the relevant standards as well as economic and environmental requirements. The fulfilment of the above tasks occur through:

- the introduction of conductive, insulating and structural materials characterised by enhanced operating parameters;
- modernisation and improvement of the technological parameters of production lines;
- conducting tests within the optimal range during the production cycle and thereafter, as well as after the cable line installation and during its operation;

- providing quality and reliability analyses of the cables on the basis of the statistical data and failure rates as well as the development of databases.

The selected technologies and materials which will be used for the construction of the underground power line and customer substation conform to the current EU standards and can be considered optimal for a project of this type – these technologies have been widely used in Poland, EU countries and in other parts of the world.

10.7 Scientific and technical progress

The solutions used during the project implementation will be best available techniques and technologies that are currently in use globally and are characterised by safety and high efficiency. All the work associated with the project implementation will be supervised by site managers experienced in construction of similar facilities, environmental specialists, expert construction and engineering supervision in accordance with the applicable provisions.

In view of the above, as part of the planned project, best available techniques (BAT) are to be applied as provided for in the Act of 27 April 2001 – Environmental Protection Law (Journal of Laws of 2001, No. 62, item 627, as amended).

This catalogue of requirements refers to the newly commissioned industrial systems and equipment, which are a source of environmental hazards. The OWF connection infrastructure, due to the technological characteristics of the construction, operation and decommissioning phases as well as the special conditions of operation in the marine and land environment, requires verification of these requirements at an early stage of project planning.

The structural elements of the OWF connection infrastructure are to be made of materials which are neutral to seawater and ground substrate (seabed) as well as to the soils in which the power cables will be buried onshore. Resistance to erosion, corrosion or chemical compounds present in seawater, seabed sediment and soil is an essential prerequisite for failure-free operation of power cables.

Efficiency and safety of the energy transmission from the Baltic Power OWF to the NPS will be among the basic criteria used when selecting cable types and their offshore and onshore routing. The overriding criterion of energy efficiency is ensuring that energy waste in transmission installations is kept at the lowest possible level.

The consumption of water, consumables, raw materials and fuels will take place during the process of laying subsea cables. During 20−30 years of operation, the cables will require the use of consumables and fuels for maintenance service activities.

Emissions and their range will mainly relate to the impacts resulting from the process of laying cables on the seabed and in the ground during the construction phase. These impacts will not significantly affect either the marine or land environment. No significant electromagnetic interactions or thermal actions are expected to occur during the operation phase.

The experiences related to the construction and operation of power cables offshore and onshore enable the selection and implementation of the most efficient and proven solutions for power transmission from the Baltic Power OWF to the NPS, meeting the requirements of the most advanced technologies, resistant to the conditions of operation in the marine and land environments, while keeping the energy waste at the lowest possible level, and affecting the natural environment to the smallest extent.

11 Description of the prospective measures to avoid, prevent and limit negative impacts on the environment

OFFSHORE AREA

The measures anticipated to reduce the adverse impact of the BP OWF CI implementation on seabirds and marine mammals are listed below. In the case of other elements of the environment, which were the subject of the impact analysis (see section 6), no need for measures mitigating the negative impact of the investment in each phase of its implementation was identified.

General recommendations:

- construction of subsea cable lines in the shortest possible time, using high-tech equipment and vessels;
- limiting the number of vessels operating simultaneously in the construction area to the necessary minimum;
- application of the least environmentally harmful technologies for the construction of subsea cable lines – ploughing preferred.

Seabirds:

- intensification of the pace of construction works in the months of April–September, when the number of birds in this sea area is the lowest;
- limiting sources of strong light directed upwards at night; this mainly concerns the periods of bird migration. The Applicant declares that they will limit the light emission to the necessary level, resulting from the applicable regulations and work safety standards.

Marine mammals:

- proper planning of cable laying activities to avoid the mating, moulting, and breeding periods of sensitive species – ideally from May to October;
- carrying out the work in the best possible weather conditions and using good quality equipment (particularly important in the case of vessels with DP) in order to reduce as much as possible the noise levels generated;
- use of deterring sounds/MMO observations before the commencement of work. The movement of vessels alone will be detected by mammals when the noise source appears at a considerable distance from the individual. Therefore, the likely avoidance response will occur before the dangerous levels of impact occur.

ONSHORE AREA

General recommendations

1. Use of trenchless methods in the form of Horizontal Directional Drilling in the area of the Wydmy Lubiatowskie dunes and the waterlogged valley – limited interference in the structure, stability and layout of habitats.
2. Use of minimising measures preventing the drainage of the area in the form of sheet piling in the locations of point excavations for the application of trenchless methods as well as in the waterlogged area to preserve waterlogged habitats – valuable to plants and animals.

3. Construction site facilities will not be located in the areas of: river valleys, wetlands and protected areas.
4. Construction sites will be protected against the ingress of harmful substances into the soil and will be equipped with a sufficient quantity of sorbents for the removal of possible spills and leaks of oil and petroleum products.
5. Good technical condition of construction and transport equipment and adequate planning of works within the construction site will be ensured.
6. Possible spills of petroleum products from the equipment and machinery operating at the construction site will be eliminated immediately, and the contaminated soil will be removed and disposed of.
7. Construction works will be carried in such a way as to maximally reduce the amount of construction waste generated, the materials used during the performance of construction works will be used rationally. Construction works will be carried out with due diligence.
8. The contractor will mark the location for the storage of waste at the construction site, and will also provide bins and containers for their selective collection. Hazardous waste will be collected in marked, tightly closed containers. The contractor will ensure the proper protection of a storage zone to limit the impact of atmospheric conditions and access by third parties. Waste will be stored in a separate place accessible to the waste collecting companies and ensuring systematic removal of waste from the construction site by the companies dealing in waste disposal or recovery. The contractor as well as the waste collectors will hold appropriate permits for carrying out activity connected to waste management.
9. Environmental supervision will be ensured during the phase of construction in the field, conducted by: a botanist, a herpetologist, an ornithologist, and a mammalogist.
10. Noise emission limits:
    - construction works which may potentially impact the residents of the Rehabilitation and Holiday Centre for disabled people (ul. Spacerowa 38, Lubiatowo) will be carried out only during daytime with the exception of Sundays and holidays to the extent possible (with the exception of works which have to be carried out in a continuous manner, e.g. drilling), and the schedule of works will be communicated to the management of the centre;
    - noise-generating equipment will be positioned as far as (technically) possible from the buildings of the Rehabilitation and Holiday Centre for disabled people;
    - equipment providing effective noise protection will be used.
11. Restrictions concerning the implementation of the project in the vicinity of the environmental protection forms.

    Natura 2000 site Białogóra (PLH220003):

    - during the construction, the access road to cable chambers (from km 33+550 to 33+740) will be delineated along the eastern boundary of the Natura 2000 site Białogóra (PLH220003) and habitat 2180 and information boards will be placed with the following message “Protected habitat. No trespassing;”

- roadworthy construction vehicles and machinery will be permitted.

Ecological area "Torfowisko" [Peat bog] in Szklana Huta

- application of methods which prevent the appearance of a cone depression and drainage of protected peats within the ecological area "Torfowisko" [Peat bog] in Szklana Huta. During the construction phase of the cable chambers, in the case dewatering is necessary it will be short-term;
- the final section of the access road to the cable chambers (from km 33+550 to 33+740) will be separated with a fence on both sides of the road from the ecological area. The preservation of the ecological areas in their present state will be the primary protective measure along this section of the project;
- roadworthy construction vehicles and machinery will be permitted.

Measures minimising the impact on habitats and protected species

12. Measures to mitigate impacts on lichens:
    - within the permanent technical belt and the collision of the planned project route with the resources of lichen species of high nature value a Permit of the Regional Director for Environmental Protection must be obtained for derogations from the prohibitions concerning the plant species under protection: grey reindeer lichen (*Cladonia rangiferina*), reindeer lichen (*Cladonia portentosa*), salted starburst lichen (*Imshaugia aleurites*), bristly beard lichen (*Usnea hirta*), tree reindeer lichen (*Cladonia arbuscula*), cartilage lichen (*Ramalina fraxinea*), dotted ribbon lichen (*Ramalina fastigiata*), pierced lichen (*Pertusaria pertusa*), covered lichen (*Pertusaria hymenea)*, powder-headed tube lichen (*Hypogymnia tubulosa*), *Pleurosticta acetabulum* [Table 11.1];

Table 11.1. Lichen species at risk of damage as a result of the project implementation – permanent technical belt [Source: internal materials]

No.	Approximate chainage in APV	Geographical coordinates	Species within the boundaries of the project	Type of impact	Minimising measures
1.	33+500	54°49'16.680" N 17°53'16.681" E	Grey reindeer lichen *Cladonia rangiferina*	The plots will be destroyed in the area of the cable chamber location	RDEP permit for derogations from the prohibitions concerning the plant species under protection
2.	34+023	54°49'01.388" N 17°53'06.360" E	Reindeer lichen *Cladonia portentosa*	In the trench zone or in the area of other direct actions the plots shall be destroyed	Horizontal Directional Drilling in the area of the Wydmy Lubiatowskie dunes
3.	34+035	54°49'01.020" N 17°53'05.341" E	Salted starburst lichen *Imshaugia aleurites*	In the trench zone or in the area of other direct actions the plots shall be destroyed	Horizontal Directional Drilling in the area of the Wydmy Lubiatowskie dunes
4.	34+190	54°48'56.761" N 17°53'00.780" E	Bristly beard lichen *Usnea hirta*	In the trench zone or in the area of other direct actions the plots shall be destroyed	Horizontal Directional Drilling in the area of the Wydmy Lubiatowskie dunes
5.	34+540	54°48'47.761" N	Tree reindeer lichen	In the trench zone or in	RDEP permit for

No.	Approximate chainage in APV	Geographical coordinates	Species within the boundaries of the project	Type of impact	Minimising measures
		17°52’48.421” E	*Cladonia arbuscula*	the area of other direct actions the plots shall be destroyed	derogations from the prohibitions concerning the plant species under protection
6.	35+217	54°48’32.698” N 17°52’23.098” E	Salted starburst lichen *Imshaugia aleurites*	In the trench zone or in the area of other direct actions the plots shall be destroyed	RDEP permit for derogations from the prohibitions concerning the plant species under protection
7.	35+280	54°48’31.021” N 17°52’22.980” E	Bristly beard lichen *Usnea hirta*	In the trench zone or in the area of other direct actions the plots shall be destroyed	RDEP permit for derogations from the prohibitions concerning the plant species under protection
8.	36+110	54°48’18.961” N 17°53’03.541” E	Pierced lichen *Pertusaria pertusa*	In the trench zone or in the area of other direct actions the plots shall be destroyed	Horizontal directional drilling of a waterlogged valley
9.	36+340 36+375	54°48’15.901” N 17°53’15.360” E 54°48’15.721” N 17°53’17.098” E	Covered lichen *Pertusaria hymenea*	In the trench zone or in the area of other direct actions the plots shall be destroyed	RDEP permit for derogations from the prohibitions concerning the plant species under protection
10.	38+850	54°47’09.718” N 17°54’28.918” E	Tree reindeer lichen *Cladonia arbuscula*	In the trench zone or in the area of other direct actions the plots shall be destroyed	RDEP permit for derogations from the prohibitions concerning the plant species under protection
11.	39+485	54°46’50.041” N 17°54’31.680” E	Powder-headed tube lichen *Hypogymnia tubulosa*	In the trench zone or in the area of other direct actions the plots shall be destroyed	RDEP permit for derogations from the prohibitions concerning the plant species under protection
12.	40+400	54°46’25.798” N 17°54’53.521” E 54°46’26.101” N 17°54’54.360” E 54°46’27.721” N 17°55’00.778” E 54°46’28.081” N 17°55’02.100” E 54°46’28.138” N 17°55’03.000” E	*Pleurosticta acetabulum*	The plots may be destroyed in the area planned for the location of the 400 kV overhead line and near the southern boundary of the customer substation	RDEP permit for derogations from the prohibitions concerning the plant species under protection
13.	40+400	54°46’26.338” N 17°54’54.961” E 54°46’26.641” N 17°54’56.160” E 54°46’26.760” N 17°54’56.581” E 54°46’27.058” N	Cartilage lichen *Ramalina fraxinea*	The plots may be destroyed in the area planned for the location of the 400 kV overhead line and near the southern boundary of the customer substation	RDEP permit for derogations from the prohibitions concerning the plant species under protection

No.	Approximate chainage in APV	Geographical coordinates	Species within the boundaries of the project	Type of impact	Minimising measures
		17°54’57.718” E 54°46’27.058” N 17°54’58.438” E 54°46’27.480” N 17°54’59.400” E			
14.	40+400	54°46’28.560” N 17°55’03.540” E	Dotted ribbon lichen *Ramalina fastigiata*	Southern boundary of the customer substation – plots may be destroyed	RDEP permit for derogations from the prohibitions concerning the plant species under protection

- within the temporary technical belt in the case of the need for felling trees inhabited by the following lichen species: reindeer lichen (*Cladonia portentosa*), bristly beard lichen (*Usnea hirta*), salted starburst lichen (*Imshaugia aleurites*), tree reindeer lichen (*Cladonia arbuscula*), farinose cartilage lichen (*Ramalina farinacea*), pierced lichen (*Pertusaria pertusa*), powder-headed tube lichen (*Hypogymnia tubulosa*) – a Permit of the Regional Director for Environmental Protection must be obtained for derogations from the prohibitions concerning the above-mentioned plant species under protection [Table 11.2];
- in places where it will not be necessary to fell trees, work related to the protection of trees and fencing should be carried out under the supervision of a lichenologist.

Table 11.2. Lichen species at risk of damage as a result of the project implementation – temporary technical belt [Source: internal materials]

No.	Approximate chainage in APV	Geographical coordinates	Species within the boundaries of the project	Type of impact	Minimising measures
1.	33+500	54°49'16.156” N 17°53’11.878” E	Reindeer lichen *Cladonia portentosa*	The plots will be destroyed in the area of the cable chamber location	RDEP permit for derogations from the prohibitions concerning the plant species under protection/tree protection under the supervision of a lichenologist
2.	33+970 34+000 34+050	54°49'03.421” N 17°53’06.601” E 54°49'01.380” N 17°53’07.800” E 54°49'00.840” N 17°53’04.318” E	Reindeer lichen *Cladonia portentosa*	In the trench zone or in the area of other direct actions the plots shall be destroyed	Horizontal Directional Drilling in the area of the Wydmy Lubiatowskie dunes
3.	34+160	54°48'58.438” N 17°53’00.060” E	Bristly beard lichen *Usnea hirta*	In the trench zone or in the area of other direct actions the plots shall be destroyed	Horizontal Directional Drilling in the area of the Wydmy Lubiatowskie dunes
4.	34+450	54°48'50.641” N 17°52’50.638” E	Bristly beard lichen *Usnea hirta*	In the trench zone or in the area of other direct actions the plots shall be	RDEP permit for derogations from the prohibitions concerning the plant species under

No.	Approximate chainage in APV	Geographical coordinates	Species within the boundaries of the project	Type of impact	Minimising measures
				destroyed	protection
5.	34+620 34+670 34+750 34+775 35+180	54°48'45.298” N 17°52’46.498” E 54°48'44.398” N 17°52’45.058” E 54°48'44.341” N 17°52’39.241” E 54°48'44.280” N 17°52’37.740” E 54°48'34.621” N 17°52’23.160” E	Salted starburst lichen *Imshaugia aleurites*	In the trench zone or in the area of other direct actions the plots shall be destroyed	RDEP permit for derogations from the prohibitions concerning the plant species under protection
6.	35+350	54°48'29.638” N 17°52’25.320” E	Tree reindeer lichen *Cladonia arbuscula*	In the trench zone or in the area of other direct actions the plots shall be destroyed	RDEP permit for derogations from the prohibitions concerning the plant species under protection
7.	36+100	54°48'18.061” N 17°53’01.741” E	Farinose cartilage lichen *Ramalina farincea (L.)*	In the trench zone or in the area of other direct actions the plots shall be destroyed	Horizontal directional drilling of a waterlogged valley (km from 35+830 to 36+250)
8.	36+100	54°48'19.681” N 17°53’03.840” E	Pierced lichen *Pertusaria pertusa*	In the trench zone or in the area of other direct actions the plots shall be destroyed	Horizontal directional drilling of a waterlogged valley (km from 35+830 to 36+250)
9.	38+810	54°47’11.101” N 17°54’29.340” E	Tree reindeer lichen *Cladonia arbuscula*	In the trench zone or in the area of other direct actions the plots shall be destroyed	RDEP permit for derogations from the prohibitions concerning the plant species under protection
10.	39+640	54°46’45.840” N 17°54’36.601” E	Powder-headed tube lichen *Hypogymnia tubulosa*	In the trench zone or in the area of other direct actions the plots shall be destroyed	RDEP permit for derogations from the prohibitions concerning the plant species under protection

- Measures mitigating the impact on **mosses and liverworts:**
  - within the permanent technical belt, there are 2 species of the following protected mosses and liverworts: the bog groove-moss (*Aulacomnium palustre*) and the crisped pincushion moss (*Ulota crispa).* They occur in the area of the Horizontal Directional Drilling across the Wydmy Lubiatowskie dunes and across the waterlogged valley [Table 11.3].

Table 11.3. Moss and liverwort species at risk of damage as a result of the project implementation – permanent technical belt [Source: internal materials]

No.	Approximate chainage in APV	Geographical coordinates	Species within the boundaries of the project	Type of impact	Minimising measures
1.	33+840	54°49’05.880” N 17°53’12.100” E	Bog groove-moss *Aulacomnium palustre*	In the trench zone or in the area of other direct actions the plots shall be destroyed	Horizontal Directional Drilling in the area of the Wydmy Lubiatowskie dunes

- Measures mitigating the impact on **vascular plants and natural habitats:**
  - in the area of cable chamber location and the collision of the planned project route with the resources of vascular plant species of high nature value, it is possible to apply minimisation measures consisting in replanting the specimens together with an appropriate portion of the substrate beyond the direct impact zone carried out under the environmental supervision. Such a minimising measure requires the Permit of the Regional Director for Environmental Protection for derogations from the prohibitions concerning the following plant species under protection and concerns species from the families Pyrolaceae and Orchidaceae: the creeping lady's-tresses (*Goodyera repens*) and the one-flowered wintergreen (*Moneses uniflora* (L.) A. Gray) [Table 11.4];
  - within the temporary technical belt, in the case of the risk of damaging the plots of the broad-leaved helleborine (*Epipactis helleborine* (L.) Crantz), the species should be replanted together with an appropriate portion of the substrate beyond the direct impact zone carried out under the environmental supervision [Table 11.5];
  - for the wooded dunes of the Atlantic, Continental and Boreal region habitat (2180), the most effective method of the planned project implementation is the use of Horizontal Directional Drilling. Where possible, in the case of the following habitats: *Luzulo-Fagetum* beech forests (9110) and wooded dunes of the Atlantic, Continental and Boreal region (2180), a Permit of the Regional Director for Environmental Protection for derogations from the prohibitions concerning the following plant species under protection must be obtained.

Table 11.4. Protected plant species and natural habitats at risk of damage as a result of the project implementation – permanent technical belt [Source: internal materials]

No.	Approximate chainage in APV	Geographical coordinates	Species/habitat within the boundaries of the project	Type of impact	Minimising measures
1.	33+450	54°49'18.0” N 17°53’16.4” E	Creeping lady's-tresses (*Goodyera repens*)	The plots will be destroyed in the area of the cable chamber location	Replanting of specimens together with an appropriate portion of the substrate beyond the direct impact zone carried out under the environmental supervision in accordance with the Permit of the Regional Director for Environmental Protection for derogations from the prohibitions concerning the following plant species under protection

No.	Approximate chainage in APV	Geographical coordinates	Species/habitat within the boundaries of the project	Type of impact	Minimising measures
2.	33+490	54°49'16.9” N 17°53’16.8” E	One-flowered wintergreen *Moneses uniflora* (L.) A. Gray	The plots will be destroyed in the area of the cable chamber location	Replanting of specimens together with an appropriate portion of the substrate beyond the direct impact zone carried out under the environmental supervision
3.	34+480	54°48'49.9” N 17°52’49.4” E	Black crowberry *Empetrum nigrum* L.	In the trench zone or in the area of other direct actions the plots shall be destroyed	RDEP permit for derogations from the prohibitions concerning the plant species under protection
4.	34+490 34+495 34+500	54°48'49.1” N 17°52’49.9” E 54°48'49.0” N 17°52’51.0” E 54°48'48.7” N 17°52’50.5” E	Broad-leaved helleborine *Epipactis helleborine* (L.) Crantz	In the trench zone or in the area of other direct actions the plots shall be destroyed	Replanting of specimens together with an appropriate portion of the substrate beyond the direct impact zone carried out under the environmental supervision in accordance with the Permit of the Regional Director for Environmental Protection for derogations from the prohibitions concerning the following plant species under protection
5.	34+500	54°48'48.7” N 17°52’49.9” E	Sand sedge *Carex arenaria* L.	In the trench zone or in the area of other direct actions the plots shall be destroyed	RDEP permit for derogations from the prohibitions concerning the plant species under protection
6.	33+470 to 33+730 33+770 to 33+920/ 34+560 to 35+800	-	Wooded dunes of the Atlantic, Continental and Boreal region (2180)	In the excavation zone or in the area of other direct activities habitat patches shall be destroyed	Horizontal Directional Drilling in the area of the Wydmy Lubiatowskie dunes Permit of the Regional Director for Environmental Protection for derogations from the prohibitions concerning the following plant species under protection due to forest clearance
7.	36+275 to 36+410	-	*Luzulo-Fagetum* beech forests (9110)	In the excavation zone or in the area of other direct activities habitat patches shall be destroyed	Permit of the Regional Director for Environmental Protection for derogations from the prohibitions concerning the following plant species under protection due to forest clearance

Table 11.5. Protected plant species and natural habitats at risk of damage as a result of the project implementation – temporary technical belt [Source: internal materials]

No.	Approximate chainage in APV	Geographical coordinates	Species/habitat within the boundaries of the project	Type of impact	Minimising measures
1.	34+450 34+550	54°48'49.5” N 17°52’52.4” E 54°48'47.8” N 17°52’47.3” E	Broad-leaved helleborine *Epipactis helleborine* (L.) Crantz	In the trench zone or in the area of other direct actions the plots shall be destroyed	Replanting of specimens together with an appropriate portion of the substrate beyond the direct impact zone carried out under the environmental supervision in accordance with the Permit of the Regional Director for Environmental Protection for derogations from the prohibitions concerning the following plant species under protection
2.	34+570	54°48'46.6” N 17°52’48.6” E	Sand sedge *Carex arenaria* L.	In the trench zone or in the area of other direct actions the plots shall be destroyed	RDEP permit for derogations from the prohibitions concerning the plant species under protection
3.	33+470 to 33+730 33+770 to 33+920 34+560 to 35+800	-	Wooded dunes of the Atlantic, Continental and Boreal region (2180)	In the excavation zone or in the area of other direct activities habitat patches shall be destroyed	Horizontal Directional Drilling in the area of the Wydmy Lubiatowskie dunes Permit of the Regional Director for Environmental Protection for derogations from the prohibitions concerning the following plant species under protection due to forest clearance
4.	36+275 to 36+410	-	*Luzulo-Fagetum* beech forests (9110)	In the excavation zone or in the area of other direct activities habitat patches shall be destroyed	Permit of the Regional Director for Environmental Protection for derogations from the prohibitions concerning the following plant species under protection due to forest clearance

- Measures mitigating the impact **on herpetofauna:**
  - in the case of amphibians in the area of the waterlogged valley and reptiles in the area of the Wydmy Lubiatowskie dunes, trenchless methods will be applied;
  - prior to the construction beginning, herpetological supervision shall protect amphibian migration sites and areas adjacent to the key sites of amphibian occurrence with newt fencing preventing animals from entry into the construction site and onto the access roads. Table 11.6 provides the sections requiring temporary fencing for amphibians.

Table 11.6. Sections requiring temporary fencing for amphibians [Source: internal materials]

No.	Approximate chainage in APV	Length of the section to be fenced off [m]	Location	Comments
1.	33+600 34+400	100 150	Wydma Lubiatowska dune – horizontal drilling	Place of an abundant occurrence (and breeding) of a number of reptile species

No.	Approximate chainage in APV	Length of the section to be fenced off [m]	Location	Comments
2.	35+830 36+250	150 150	Waterlogged valley – horizontal drilling	Place of an abundant occurrence (and breeding) of a number of amphibian species
3.	40+000	150	Forest edge in the area of the customer substation constituting the construction site facilities	Place of an abundant occurrence (and breeding) of a number of amphibian species

- Measures mitigating the impact **on avifauna**
  - carrying out tree felling works outside the bird breeding season, in the autumn-winter period, between 15 September and 28 February;
  - installing bird scarers on the 400 kV line connecting the customer substation with the PSE substation, e.g. FireFly diverters.
- Proposed measures to mitigate the negative impact of the planned project on **mammals, including bats**:
  - the construction site will be fenced;
  - the environmental supervision entity shall be notified of any emergencies requiring intervention or unforeseen situations involving animals;
  - there is no need for post-development monitoring with regard to mammals, including bats, since no impacts of the project on mammals that would require post-development monitoring are anticipated.

12 Proposal for the monitoring of the planned project impact and information on the available results of other monitoring, which may be important for establishing responsibilities in this area

Pursuant to the Art. 66 of the EIA Act a proposal to monitor the impact of the planned project in its construction and operation or use phases is presented in this section, in particular, the impact on the forms of nature protection, referred to in the Art. 6, paragraph 1 of the Nature Conservation Act of 16 April 2004 (Journal of Laws of 2004, No. 92, item 880, as amended), including the objectives and the subject of protection of the Natura 2000 site, and the continuity of the wildlife corridors connecting them, as well as the information on the available results of other monitoring, which may be important for establishing responsibilities in this area.

OFFSHORE AREA

The results of the environmental surveys of the BP OWF CI development area as well as the identification of potential impacts have shown that the environmental resources in the project area are typical for the coastal waters of the southern part of the Baltic Sea and that such resources would not be affected by significant impacts. The project will have the greatest impact on the marine environment in the construction phase, mainly due to the disturbance of the seabed, which will result in the destruction of the animal and, to a lesser extent, sporadically recorded plant benthic communities within the strip of the cable line construction, as well as in the scaring of fish and marine mammals from the area of underwater operations. The restoration of benthic communities will begin directly after the completion of underwater operations. The qualitative and quantitative benthic resources will stabilise after a few days from the completion of the construction phase at the latest. The restoration time is likely to be much shorter as the zoobenthos species travelling on the seabed (including most mussel species) will relocate from the seabed areas adjacent to the construction area. Underwater operations will also generate underwater noise which will scare away fish and marine mammals. It is anticipated that due to the noise characteristics and its duration, the scaring of animals will have a local scale and will cease after the completion of such works. The traffic of vessels involved in construction works will also temporarily scare away the marine mammals and seabirds within a small area. It should be underlined that the BP OWF CI area is constantly used for navigation and fishing, thus, the presence of vessels involved in the project will not change the nature of this area and will not cause, with the exception of activities directly related to the interference with the seabed, the emergence of new environmental impacts in this part of the Baltic Sea. In the operation phase, the impact will be much smaller than during the construction phase and will result from the inspections of cable lines carried out at least once every 5 years using non-invasive methods. The decommissioning phase will involve the removal of the connection infrastructure from service, without dismantling its components and it will not generate environmental impacts. On the basis of the previous experiences describing the response of the marine environment elements on the impacts generated by projects with characteristics similar to the project discussed as well as due to the relatively small anticipated impact of the BP OWF CI on the marine environment in every phase of its implementation, it is suggested that no environmental monitoring be carried out to identify and assess the impact of the investment on the marine environment. The information cited above indicate that such a monitoring is not justified in the context of gaining new knowledge and will not contribute to improving the protection and status of the environment, because the scope of impacts identified, their influence on the elements of the environment as well as the receptors' response to the impacts are known and do not require further studies.

The Applicant – Baltic Power sp. z o.o. and Northland Power – will carry out monitoring for the purpose of the Baltic Power OWF, the wide scope of which will involve the impacts and elements of the environment identified also in the BP OWF CI. Thus, the data from this monitoring can be used for the environmental impact assessment of the project in question.

12.1 Information on the available results of other monitoring, which may be important for establishing responsibilities in this area

There is reliable data provided by the State Environmental Monitoring (SEM) carried out by CIEP in accordance with the Water Law (Water Framework Directive) and implementing regulations, i.e. the Regulation of the Minister of Maritime Economy and Inland Navigation dated 9 October 2019 on the forms and methods of monitoring uniform bodies of surface water and ground water (Journal of Laws of 2019, item 2147) and the Regulation of the Minister of Maritime Economy and Inland Navigation dated 11 October 2019 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 2019, item 2149).

The environmental monitoring of the Polish part of the Baltic Sea is carried out as part of the SEM. This monitoring includes the surveys of the following parameters:

- physico-chemical: temperature, salinity, oxygen concentration, Secchi disc visibility, content of nutrients, heavy metals and persistent organic pollutants;

biological: phytoplankton, zooplankton, phytobenthos and macrozoobenthos.

As part of the Marine Strategy Framework Directive, the level of harmful substances in the water and in marine organisms as well as the content of radionuclides in the water and in sediments are also monitored. In addition, ichthyofauna and optional microbiology surveys are carried out, as well as the surveys of hydrographic conditions, waste in the marine environment and underwater noise. The results of this monitoring are collected and stored in the Oceanographic Database at the Gdynia Maritime Branch of the IMWM-NRI and in the "ICHTIOFAUNA" database at the Chief Inspectorate for Environmental Protection in Warsaw.

ONSHORE AREA

12.2 Proposal for the monitoring of the project impact

As a result of the environmental impact assessment and analyses conducted, the authors of the EIA Report recommend:

- conducting measurements of the electric and magnetic component of the electromagnetic field for the overhead line and cable circuits in the calculation cross-sections indicated in the contents of the report (in the cross-sections, in which the distributions of individual components of the electromagnetic field were calculated), however, above the cable circuits (lines) only the measurements of the distribution of the magnetic field component should be carried out. Such measurements should be carried out before the object is put into service (during commissioning), in accordance with the requirements specified in the Regulation of the Minister of Climate of 17 February 2020 on the methods of checking compliance with permissible levels of electromagnetic fields in the environment (Journal of Laws of 2020, item 258);

- conducting noise measurements at the boundary of the areas protected against noise, in particular at observation points (P1–P5) as well as at the calculation point on the building facade (E1) indicated in the contents of the EIA Report. The measurements should be carried out before the object is put into service (during commissioning), in accordance with the requirements specified in the Regulation of the Minister of the Environment of 30 October 2014 on the requirements for conducting measurements of emission volumes and measurements of the amount of water consumed (Journal of Laws of 2019, item 2286).

12.3 Information on the results available for other monitoring, which may be important for establishing responsibilities in this area

Within the framework of SEM, as part of the task entitled "Bird monitoring including Natura 2000 Special Protection Areas", a number of bird monitoring surveys is carried out, which may be important for establishing the obligations of monitoring the impact of the planned project, including [289]:

- the Monitoring of Wintering Seabirds (MWS), covering the monitoring of species of average abundance and abundant species of anseriformes wintering in the Polish zone of the Baltic Sea, including basic species (red-throated diver, black-throated diver, horned grebe, red-necked grebe, long-tailed duck, velvet scoter, common scoter, black guillemot, razorbill and common guillemot) and additional species (great crested grebe, European herring gull, great black-backed gull, common gull and black-headed gull).

The results of these monitoring surveys are also collected and made available by the Chief Inspectorate for Environmental Protection in Warsaw.

In accordance with the Regulation of the Minister of Climate of 17 February 2020 on the methods of maintaining permissible levels of electromagnetic fields in the environment (Journal of Laws of 2020, item 258), such measurements should be carried out:

- directly before the plant or devices are put into operation;
- each time the operating conditions of the installation or equipment change, including those caused by changes in the equipment of the installation or equipment, insofar as these changes may lead to the changes in the levels of electromagnetic fields of which the installation or equipment is the source;
- each time there is a change to the existing planning and development of the property resulting in a change to the presence of places accessible to the public in the vicinity of the plant or equipment – at the written request of the owner or manager of the property on which the change occurred.

The results of the above-mentioned electromagnetic field measurements will be submitted to the Voivodeship Inspector of Environmental Protection and the State Provincial Sanitary Inspector within 30 days from the measurements.

Moreover, the monitoring of noise from the customer substation and 400 kV overhead line is recommended.

13 Limited use area

The issue of the creation of a limited use area (LUA) is regulated by the provisions of Art. 135 paragraph 1 of the Environmental Protection Law (Journal of Laws of 2001, No. 62, item 627 as amended): "*If the environmental review or the environmental impact assessment required under the provisions 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 assessments or the post-implementation analysis show that, despite the application of technical, process and organisational solutions available, the environmental quality standards outside the premises of the plant or other facility cannot be met, then a limited use area is created for a wastewater treatment plant, municipal waste landfill, composting plant, communication route, airport, overhead power line and substation as well as a radiocommunication, radio navigation and radiolocation system*".

The lines and stations mentioned in Article 135(1) will be implemented as part of the planned project, therefore, they may require creating a LUA.

The validity of establishing a LUA with respect to the planned BP OWF CI should be examined by analysing whether the environmental quality standards cannot be met outside the area of the planned cable lines, customer substation and the 400 kV line.

The analysis of the EMF and noise impacts included in this EIA Report showed that the environmental quality standards will not be exceeded. The results of the noise level distribution calculations in the vicinity of the two single-circuit 400 kV overhead lines to be run parallelly at a distance of 30 m, indicate that:

- the maximum value of the sound level in the most unfavourable operating conditions of the line (bad weather) will not exceed at any point beneath the line (at the height of 4.0 MAGL) the value of 52.8 dB, which means an exceedance by 7.8 dB of the permissible value established in the Regulation of the Minister of the Environment of 14 June 2007 on permissible noise levels in the environment (Journal of Laws of 2007, No. 120, item 826, as amended) [Table 3.27; subsection 3.17] for the residential development areas at 45 dB;
- the area of land under the above-mentioned system of parallel 400 kV overhead lines, where the calculation analyses indicate that the permissible value of 45 dB (for the areas of residential development) is exceeded, extends (at the height of 4.0 MASL) to the distance of 39 m from the line axis in both directions;
- in the vicinity of the system of 400 kV overhead lines running parallelly, it is not possible to implement housing development due to the possibility of exceeding the permissible noise level (45 dB) in an area with a width of 78 m (2 x 39 m).

According to the local spatial development plan "Wiatraki w Lublewie" [Windmills in Lublewo], Choczewo Municipality (Resolution No. XIV/144/2008 of Choczewo Commune Council dated 19 March 2008, Official Journal the of Pomeranian Voivodeship no. 58 of 24 June 2008, item 1658), the area intended for the 400 kV line is an agricultural area (11 R); field cultivation, breeding, horticulture, orcharding; the location of residential functions within agricultural settlements is excluded; the location of farm buildings, sheds and arbours is permitted to serve agricultural production. In this respect it is not an acoustically protected area; therefore, no need for a LUA has been indicated.

14 Analysis of possible social conflicts related to the planned project, including the analysis of impacts on the local community

The planned project will be implemented in the offshore and onshore area, which will entail various potential social conflicts. Some of such conflicts will be resolved before they are triggered, e.g. a potential conflict with other investors planning to build a linear infrastructure in the offshore area will be resolved with location permits issued by the Minister relevant for the matters of the maritime economy and the Director of the Maritime Office in Gdynia, and in the onshore area by including the project in the studies of conditions for spatial development and local plans. Other potential conflicts may emerge at the pre-implementation and implementation stages of the project.

The sea area in which the planned project is located fulfils various functions resulting from the hitherto human activity and the natural resources present there. The most comprehensive list of the forms of the current and planned future use of sea space has been developed for the purpose of the preparation of Maritime Spatial Plan of Polish Sea Areas (MSPPSA) (Journal of Laws of 2021, item 935).

According to the PMA division resulting from the MSPPSA, the offshore part of the BP OWF CI is located in the following sea areas and sub-areas [Figure 14.1]:

1) Sea area POM.46.E;
2) Sea area POM.16.Pw, including:
    a. Sub-area 16.201.I
3) Sea area POM.34.T, including:
    a. Sub-area 34.926.B
4) Sea area POM.54.T, including:
    a. Sub-area 54.926.B
    b. Sub-area 54.201.I
5) Sea area POM.41a.P, including:
    a. Sub-area 41a.201.I
    b. Sub-area 41a.926.B
6) Sea area POM.40a.C, including:
    a. Sub-area 40a.201.I
    b. Sub-area 40a.712.R

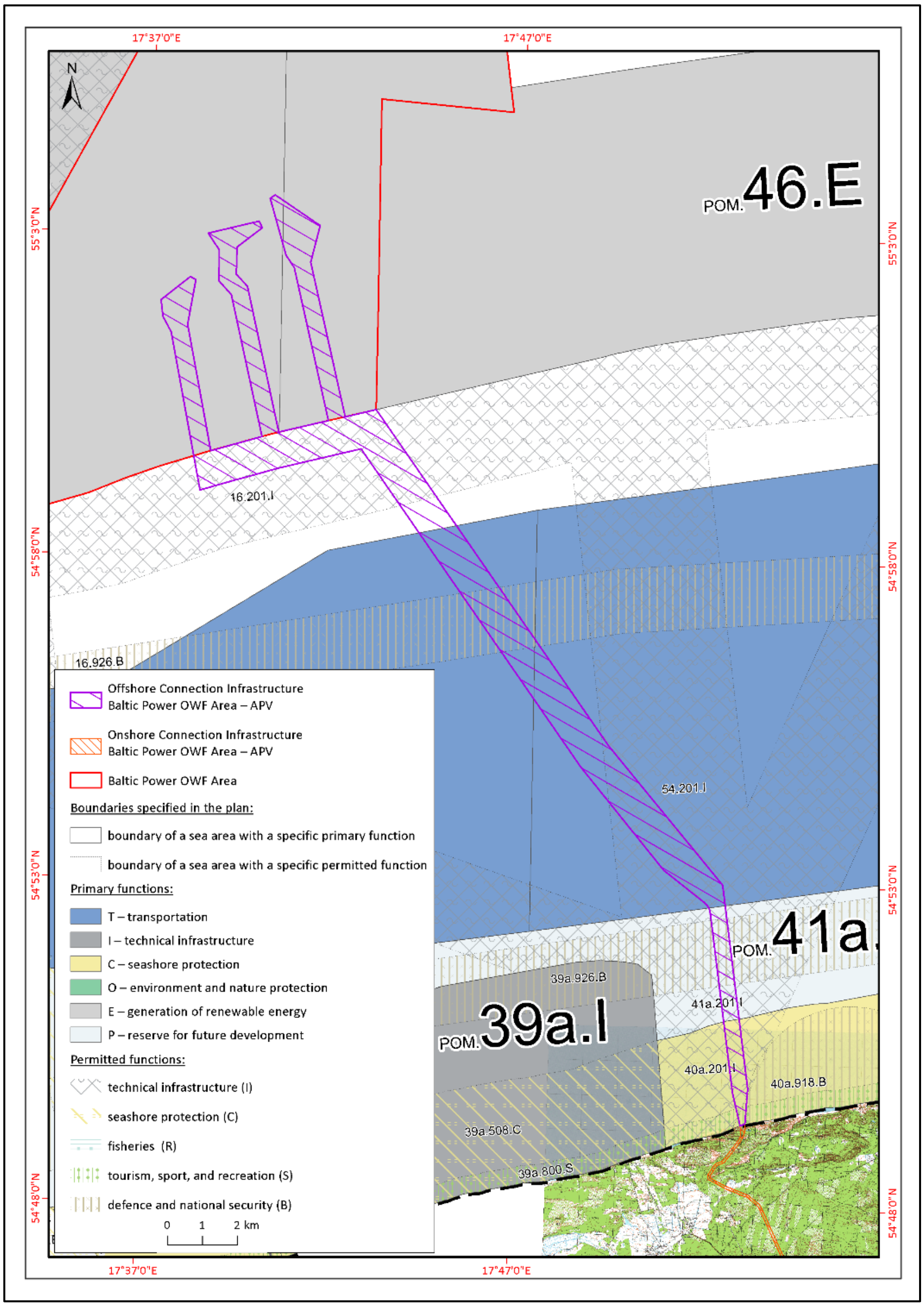


Figure 14.1. Location of the Baltic Power OWF Connection Infrastructure in relation to the sea areas and sub-areas designated in the Maritime Spatial Plan of Polish Sea Areas [Source: internal materials based on the drawing of MSPPSA]

Pursuant to § 1, section 3, point 5 of Annex No. 1 to draft MSPPSA, entitled "General considerations," the planned project has been classified as "technical infrastructure", i.e.

"function: technical infrastructure – means:

a) the possibility of locating telecommunications cables, substation infrastructure as well as laying and maintaining power cables, including internal and external connection infrastructure for offshore wind farms, (…)"

The following is a characterisation of the sea areas and sub-areas in the context of allowing the construction and operation of connection infrastructure within their boundaries.

POM.46.E sea area

Primary function: generation of renewable energy.

Permitted functions: aquaculture; scientific research; cultural heritage; technical infrastructure; exploration, prospecting and extraction of minerals from deposits; fisheries; artificial islands and structures; transport, tourism, sport and recreation.

Provisions pertaining to the location of technical infrastructure:

within the entire sea area:

- *the implementation of the function is limited to:*
    - *the infrastructure essential for the implementation of the function of energy acquisition,*
    - *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 surface of the seabed, and if this is impossible due to environmental or technological constraints, other permanent safeguards should be applied to allow the safe use of anchored set nets."*

POM.16.Pw sea area

Primary function: reserve for future development with permission for extraction.

Permitted functions: aquaculture; scientific research; cultural heritage; technical infrastructure; defence and national security; exploration, prospecting and extraction of minerals from deposits; fisheries; artificial islands and structures; transport, tourism, sport and recreation.

Provisions pertaining to the location of technical infrastructure within the sea area:

- *− the implementation of the function is limited to the following methods which do not endanger navigational safety;*
- *the new linear elements of technical infrastructure are required to be laid under the seabed surface, and if this is impossible due to environmental or technological constraints, other permanent safeguards should be used to ensure navigational safety;*

1) the sub-area ***16.201.I*** *is designated for laying and maintenance of the linear elements of technical infrastructure – external connection infrastructure for offshore wind farms, including the planned DC connection between Poland and Lithuania;*

POM.34.T sea area

Primary function: transport

Permitted functions: scientific research; cultural heritage; technical infrastructure; seashore protection, defence and national security; exploration, prospecting and extraction of minerals from deposits; fisheries; tourism, sport and recreation.

Provisions pertaining to the location of technical infrastructure:

within the entire sea area:

- *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;*
- *the new linear elements of technical infrastructure are required to be laid under the seabed surface, and if this is impossible due to environmental or technological constraints, other permanent safeguards should be used to ensure navigational safety;*

a) the sub-area 34.923.B is designated as the training grounds P-22 and P-23 and the sub-area ***34.926.B*** *as the fairways of the Polish Navy (0023, 0024, 0026, 0304, 0305).*

POM.54.T sea area

Primary function: transport

Permitted functions: scientific research; cultural heritage; technical infrastructure; defence and national security; exploration, seashore protection; prospecting and extraction of minerals from deposits; fisheries; tourism, sport and recreation.

Provisions pertaining to the location of technical infrastructure:

within the entire sea area:

- *the implementation of the function is limited to the following 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;*
- *the new linear elements of technical infrastructure are required to be laid under the seabed surface, and if this is impossible due to environmental or technological constraints, other permanent safeguards should be used to ensure navigational safety;*
- *it is forbidden to lay the linear elements of the technical infrastructure referred to in Annex 1, § 5 sec. 2 (i.e. Unless detailed decisions provide otherwise, the implementation of the remaining linear elements, other than those mentioned in section 1, is required to be carried out in the infrastructural corridors referred to in § 11 section 1 items 1–3, 5–7 and 9, with the exception of the situations where it is impossible for environmental, technological, economic or national security reasons), outside the designated sub-areas* ***54.201.I,*** *54.202.I and 54.203.I, with the exception of the DC connection between Poland and Lithuania.*

The sub-area 54.923.B is designated as the training grounds P-14, P-15, P-16 and P-18 and ***the sub-area 54.926.B as the fairways of the Polish Navy (0301, 0302, 0303, 0304).*** *The change of the existing state of development of the sea area requires obtaining the opinion of the minister responsible for national defence. During the activities carried out by the Polish Armed Forces, the implementation of other functions in the sub-areas may be precluded;*

The sub-area ***54.201.I*** *is designated for laying and maintenance of the linear elements of technical infrastructure – including external connection infrastructure for offshore wind farms and the planned DC connection between Poland and Lithuania;*

POM.41a.P sea area

Primary function: reserve for future development.

Permitted functions: scientific research; cultural heritage; technical infrastructure; defence and national security; seashore protection; exploration, prospecting and extraction of minerals from deposits; fisheries; transport; tourism, sport and recreation.

Provisions pertaining to the location of technical infrastructure:

within the entire sea area:

- *the implementation of the function is limited to the following methods which:*
  - *do not endanger navigational safety;*
  - *do not endanger the ecological function of spawning grounds and the survival of the early development stages (eggs and larvae) of commercial fish species;*
  - *do not have a significant negative influence on the welfare of birds wintering and resting during migration or in the period of their numerous occurrence from the beginning of November to the end of April;*
- *the new linear elements of technical infrastructure are required to be laid under the seabed surface, and if this is impossible due to environmental or technological constraints, other permanent safeguards should be used to ensure navigational safety;*

The sub-area 41a.201.I is designated for laying and maintenance of the linear elements of technical infrastructure – external connection infrastructure for offshore wind farms and the planned DC connection between Poland and Lithuania;

The sub-area 41a.923.B is designated as the training ground P-15, while the sub area 41a.924.B is designated as the anchorages K-6 and K-7 and the sub-area 41a.926.B as the fairways of the Polish Navy (0205, 0206). The change of their existing state of development must be agreed with the minister responsible for national defence. During the activities carried out by the Polish Armed Forces, the implementation of other functions in the sub-areas may be precluded;

POM.40a.C sea area

Primary function: seashore protection.

Permitted functions: scientific research; cultural heritage; a port or harbour operation; technical infrastructure; defence and national security; exploration, prospecting and extraction of minerals from deposits; fisheries; artificial islands and structures; transport, tourism, sport and recreation.

Provisions pertaining to the location of technical infrastructure:

within the entire sea area:

- *the implementation of the function is limited to the following 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;*
  - *do not have a significant negative influence on the welfare of birds wintering and resting during migration or in the period of their numerous occurrence from the beginning of November to the end of April;*
- *the new linear elements of technical infrastructure are required to be laid:*
  - *perpendicularly to the shoreline if possible,*
  - *under the seabed surface, and if this is impossible due to environmental or technological constraints, other permanent safeguards should be used to ensure navigational safety;*

- *minimum 3 m below the mean depth of the bottom of depressions between the sandbanks;*
- *it is forbidden to cross the linear elements of technical infrastructure, unless it is impossible due to technological constraints.*

*The sub-area **40a.201.I** is designated for laying and maintenance of the linear elements of technical infrastructure – external connection infrastructure for offshore wind farms and the planned DC connection between Poland and Lithuania;*

*The sub-areas **40a.712.R** (Piaśnica River estuary) and 40a.713.R (Czarna Woda watercourse estuary) are designated to protect the two-way migration of fish."*

The provisions of the MSPPSA indicate that the planned project can be carried out with the assumed technology within the boundaries of the above-described sea areas and sub-areas. A fragment of sea area POM.54.T is an exception, in which the laying of technical infrastructure was limited to the subareas established for that particular purpose. Exceptions can only be made for environmental, technological, economic or national security reasons. The issue of the possibility of locating the BP OWF CI within sea area POM.54.T was agreed with the marine administration, which issued a positive opinion in response to the Applicant's application, issuing a location decision – decision no. 5/20 of the Director of the Maritime Office in Gdynia of 28 September 2020.

The analysis of the location of the planned project in relation to the current and planned use of sea space indicated that fishermen may submit their concerns regarding the continuation of their activities in an unchanged manner. Such a situation may take place especially when safety zones are delineated for cable lines on the basis of the Director of the Maritime Office in Gdynia. This conflict seems unlikely due to the low importance of the statistical rectangles in which the project will be located in the overall fishery.

The analysis of the data on fish catches in the years 2017–2019 (data provided by the Fisheries Monitoring Centre of the Fisheries Department of the Ministry of Marine Economy and Inland Navigation) indicated that with reference to the catches in the entire area of the PMA, the fisheries in statistical rectangles N7, N8, O6, O7 and O8, within the area of which the planned project is located, did not constitute significant fishing locations. In the case of cod, the share of catches constitutes only approx. 0.18% (max. 0.5% in rectangle N8 in 2017), flounder approx. 0.12% (max. 0.3% in rectangle N7 in the years 2017 and 2019), and herring approx. 0.03% (max. 0.2% in rectangle O8 in 2017). Smaller catches, but with a higher average share of total catches in the entire PMA, were characteristic for turbot (*Scophthalmus maximus*), Atlantic salmon (*Salmo salar*) and sea trout (*Salmo trutta m. trutta*): 1.0% (max. 4.0% in rectangle N7 in 2017), 0.85% (max. 6.2% in rectangle O7 in 2018) and 0.56% (max. 2.0% in rectangle O8 in 2017), respectively. Despite slightly higher share in the total catches, also in the case of those species, it cannot be concluded that statistical rectangles N7, N8, O6, O7 and O8 are significant areas in terms of catching turbot, salmon or trout.

Additionally, the area of the planned project construction occupies only a small part of the surface area of the statistical rectangles – 1.3% of the N8 and O8 rectangles at maximum [Table 14.1].

Table 14.1. Surface area of statistical rectangles N7, N8, O6, O7 and O8 within the boundaries of the Baltic Power OWF Connection Infrastructure development area [Source: internal materials]

Statistical rectangle	Statistical rectangle surface covered by the proposed location of the OWF Area [km^2]	Statistical rectangle surface covered by the proposed location of the OWF Area [%]
N7	2.30	0.6

Statistical rectangle	Statistical rectangle surface covered by the proposed location of the OWF Area [km^2]	Statistical rectangle surface covered by the proposed location of the OWF Area [%]
N8	5.22	1.3
O6	0.41	0.8
O7	21.05	5.3
O8	5.11	1.3

The area occupied will be even smaller, taking into consideration the fact that the width of the construction belt for each of a maximum of 4 cable lines will not exceed 20 m and that the landfall of export cables will be constructed using a trenchless method (e.g. Horizontal Directional Drilling) up to a depth of approx. 13 m, measured from the water table to the seabed. This will most likely help to completely eliminate the impact of the project on ichthyofauna occurring up to this depth as well as the impact on fishery in rectangle O6, within which the maximum depth of water does not exceed 10 m.

Potential conflicts in the offshore area may also arise from the identification of, for example, objects of cultural heritage (e.g. historical wrecks) or objects hazardous to the environment and humans (UXO, unconventional warfare) in the development area of the planned project. In such a situation, the Applicant will notify the relevant state bodies and will closely cooperate with them on solutions protecting the newly-discovered objects of cultural heritage as well as the environment and humans against exposure to post-war warfare.

The analysis of the use so far and the future development of the sea area, in which the implementation of the planned project is planned, does not indicate that there are probable social conflicts, other than those indicated above, determined by the construction and exploitation of the offshore part of the OWF.

In the onshore area, the planned project will be located in a mid-forest surroundings, far from residential, service and tourist developments of the Lubiatowo and Osieki Lęborskie towns, on the land belonging to the Choczewo Forest District, within the range of the Coastal Protected Landscape Area. Such a location of the project means that potential social conflicts may involve:

- protests of the land owners against the occupation of plots for the location of the customer substation (conflicts arising on economic grounds);
- protests of the inhabitants of residential, residential-service and tourist buildings in the surrounding area, fearing the PEM emitted by underground cable lines and fearing the PEM and noise emitted by the customer substation (conflicts arising on sociological grounds);
- protests of the inhabitants and ENGOs against the location of the BP OWF CI within the reach of the environmental protection forms and the Wydmy Lubiatowskie dunes (conflicts arising on ecological grounds);

Considering, on the one hand, the necessity to locate the transmission infrastructure, and on the other the tourist potential of the commune, from the very beginning, the Applicant conducted a series of activities aimed at familiarising the inhabitants and the commune authorities with the nature of the project, thus significantly reducing the risk of social conflicts. Table 14.2 presents a cycle of information and consultation meetings which were held with the inhabitants of the Choczewo commune.

Table 14.2. List of information and consultation meetings held in the Choczewo commune [Source: Applicant's data]

Information and consultation meetings with the Choczewo commune council	
May 2020	Meeting with the Head of the Choczewo commune
September 2020	Meeting with the councillors of the Choczewo commune
October 2020	Meeting with the councillors of the Choczewo commune
March 2021	Meeting with the councillors of the Choczewo commune
Meetings with the residents – informational	
28 September 2020	Meeting with the inhabitants of the Łętowo village
28 September 2020	Meeting with the inhabitants of the Zwartówko and Gościęcino villages
29 September 2020	Meeting with the inhabitants of the Starbienino village
29 September 2020	Meeting with the inhabitants of the Choczewko village
30 September 2020	Meeting with the inhabitants of the Choczewko village
01 October 2020	Meeting with the inhabitants of the Słajkowo village
01 October 2020	Meeting with the inhabitants of the Kopalino Site village
16 June 2021	Meeting with the inhabitants in the Choczewo commune council

The community of the Choczewo commune and its local authorities were included in the information process on the project already at the designing stage. Communication activities were and are carried out jointly, both by the Applicant – the Baltic Power, but also by the representatives of the Transmission System Operator, as well as other entities involved in the development of the OWF projects: PGE Baltica (Polska Grupa Energetyczna S.A.) and Ocean Winds. This has helped to avoid a situation in which a number of entities carry out communication activities on individual projects which, from the perspective of the local community, constitute a broadly understood power infrastructure.

Table 14.3 presents the possible areas of social conflicts, divided into project stages. It also contains a description of the measures already being implemented as well as those planned, which enable the management of individual areas in a responsible manner compliant with the best practices.

Table 14.3. Possible areas of social conflicts connected to the location of the Baltic Power OWF Connection Infrastructure [Source: internal materials]

Conflict area	Extended description	Measures preventing or reducing the risk of conflict	Project stage at which the measures are applied
Conflict of data. No information or inaccurate information about the project, its scope or effects	The Choczewo commune community is not included in the investment process. No information on the project, information is unavailable or access to information is inhibited In effect, there is social unrest, reliable information about the company's plans is replaced by rumours and speculations	• Presentation of the project to the local authorities • Regular meetings with the representatives of the local government, providing information on the project progress • Presentation of the project during meetings with the communities from the areas directly covered by the project or adjacent to it (two rounds of meetings) • Providing informational materials on the project in the commune • Informational meetings with organisations operating in the area covered by or adjacent to the project (Rehabilitation and Holiday Centre for disabled people, ul Spacerowa 38, Lubiatowo) • Launching a contact box for people who want to ask the Applicant questions • Direct meetings with the inhabitants interested in the project (apart from the round of consultation meetings) • Providing information on the questions concerning the project arising on an on-going basis • Publication of information about the project in local media	Project phase All mitigating measures mentioned for this factor have been implemented or are being continuously implemented
Ownership. No consent of the land owners on the location of the project (substation and cables)	The owners of land on which the project implementation is planned do not give their consent to the implementation of the project within the area of their property	• Professionally conducted negotiations • Reliable method of property valuation (survey)	Project phase All mitigating measures mentioned for this factor have been implemented. Agreement has been reached with the property owners on the location of the project and the terms of the property acquisition. This applies both to the property owners on which the substation implementation is planned and to the State Forests across which cables will be routed from the offshore wind farm
Decrease in the tourist	The community fears that the	• For the customer substation a location has been selected far away from the most attractive	Project phase

Conflict area	Extended description	Measures preventing or reducing the risk of conflict	Project stage at which the measures are applied
attractiveness of the project area	project will negatively affect the tourists, thus decreasing the interest in staying and resting in Choczewo commune	tourist areas. The facility will be constructed on an agricultural plot, which is currently overgrown with a tree nursery • In the course of joint work of the entities involved in its construction, the entire infrastructure was accumulated and concentrated in a single area, which significantly limited the impact of these facilities to one fragment of the commune • A decision was made to select a cable laying technology, which significantly reduces the aesthetic impact of the cable line (as opposed to the towers of the overhead line), particularly in the area near the beach and therefore with the greatest potential for tourism • Cable landfall was designed in such a way so that the infrastructure is completely invisible from the beach level, which is where tourists reside in the summer • The cable route was designed in such a way so that they bypass the most attractive area of the Wydmy Lubiatowskie dunes. To additionally reduce the impact on the areas adjacent to the dune, the horizontal directional drilling technology will be used • The local community and the local authorities were informed about the measures that the Applicant had undertaken to limit the impact on the tourism in the commune • Due to the need to carry out a forest clearance in the area of the cable location, the Applicant will work closely with the local government of the commune and the State Forests in order to choose the optimal way to develop the clearance area (e.g. ecological/nature trail, bicycle route, etc.).	All mitigating measures mentioned for this factor have been implemented or are being continuously implemented
Impact on the natural environment	The local community is afraid that the project will negatively affect the environment, in particular the area directly adjacent to the beach and the forest, across which the cable will be routed	• For the location of the project, an area was selected outside the Natura 2000 site boundaries to bypass the commune areas which have the highest nature value • An agreement was reached with other OWF operators to agree on one common area for the location of cables, thus significantly reducing the impact of the project to a single belt in the forest area	Project phase All mitigating measures mentioned for this factor have been implemented
Value of areas adjacent to the project	The community fears that the project will result in a decrease in land values	• For the implementation of the project, areas used for agricultural purposes, where the commune does not expect dynamic residential development, were selected. This is confirmed by the provisions of the study of conditions and directions of spatial development of the Choczewo commune and the local spatial development plan • The areas covered by the project are located outside the areas of high tourist activity • The project is partially implemented directly near a forest area, which is owned by the State	Project phase All mitigating measures mentioned for this factor have been implemented

Conflict area	Extended description	Measures preventing or reducing the risk of conflict	Project stage at which the measures are applied
		Forests. It also constitutes a natural aesthetic barrier on one side of the facility • The planned project will be implemented at a distance of approx. 900 m from the buildings of the Osieki Lęborskie village	
Concerns connected to the cable line and customer substation impact on the health of inhabitants	The community fears that the cable line and the substation will be a source of impacts, which may affect the quality of life or be a risk to health.	• The Applicant organised a series of information meetings, during which it explained in detail the issues connected to the impacts of the cable line and the substation. • The issue of the project impact was also discussed during the meetings with the councillors • The Applicant prepared and presented visualisations depicting the areas of the planned project, showing that it is located outside the developed areas • The currently binding regulations regarding noise and PEM levels to be met by the Applicant mean that the facilities will not have a negative impact on the health of the community	Project phase All mitigating measures mentioned for this factor have been implemented or are being continuously implemented
Nuisance connected to the construction phase of the project	The community may experience discomfort as a result of the construction process of the cable line and the substation (clearance, construction)	• The Applicant will inform the local authorities and village administrators from the areas affected by the construction in advance about the details of work, principles of implementation, deadlines, etc. • A non-specialist information pamphlet on the construction will be prepared which will communicate to the community the most important information about the construction phase • During the construction phase, a hotline will be launched for the inhabitants where they can get information about the ongoing works and report any nuisance related to the construction • The Applicant will provide information on an ongoing basis about the planned works and any possible nuisance associated with them via the commune website and village administrators • In the construction phase, the Baltic Power will introduce minimising measures suggested in the EIA Report	Construction phase
Permanent vicinity of the power infrastructure	The presence of the substation facility in close proximity to the town may affect the character of the town and permanently change its surroundings	• Regular good-neighbourly activities spread over some time, e.g. supporting youth development or addressing the needs of the local community living in the vicinity of the substation infrastructure	Operation phase

Summing up: the construction of the underground cable line and the customer substation on arable land class 4b and 5, outside the boundaries of the environmental protection forms and at an appropriate distance from the residential development of the Osieki Lęborskie village (approx. 900 m), eliminates the nuisance, such as noise or deterioration of the landscape values. It also eliminates the concerns of the inhabitants about the acoustic and PEM impacts on human health and living conditions.

As results of the analysis of the EMF distribution (see subsection 0), protests in fear of PEM, while understandable, have no factual basis. As the calculations have shown, there are no objective health reasons for social conflicts due to this issue. Also, in terms of the predicted noise levels, there are no objective health reasons for social conflicts. In subsection 6.1.5.5 of this EIA Report, it is indicated that in the APV the permissible noise levels will not be exceeded.

The proper public consultation stage is foreseen within the environmental impact assessment procedure, where the environmental report will be made available to the interested parties. It will be possible to submit comments and applications following the beginning of a 30-day procedure of public participation in the proceedings. The comments submitted during the public consultations should be addressed in the justification to the decision.

15 Indication of difficulties resulting from technical shortcomings or gaps in the state of the art encountered during the preparation of the report

When preparing the Report on the BC OWF CI Environmental Impact Assessment, no obstacles were encountered due to technical shortcomings.

The main difficulties encountered during the preparation of this EIA Report were due to the lack of detailed data and information on other investment projects that will be carried out in the future in the vicinity of the project in question, i.e. the BP OWF CI. On the basis of the generally available data and the analysis of the records of the Maritime Spatial Plan of the Polish Sea Areas (MSPPSA) (Journal of Laws of 2021, item 935), it can be determined that the offshore area of the planned project will be also intended for the construction of the connection infrastructure of other OWFs. In accordance with the MSPPSA, the possibility of locating, for example, the connection infrastructure in the territorial sea will be limited to sea subareas marked as "Technical Infrastructure" (symbol: I). In sea areas intended for other purposes, the MSPPSA provisions significantly hinder its construction or even exclude it. Taking into consideration, the number of planned OWFs located in the vicinity of the Baltic Power OWF, it should be expected that in those subareas located between km 150 and 180 of the coast, within the next couple of years, from several to over a dozen kilometres of HV or EHV power cables will be laid. The route of cables channelled through the corridor layout of the subareas identified in the MSPPSA will be concentrated in the vicinity of the coast, where the possibility of laying infrastructure has been narrowed to one common subarea designated as 40a.201.I, the southern boundary of which is between km 161 and 163 of the coastline. It is anticipated that near the coast the cable lines will run relatively close to one another, i.e. at a distance of at least several dozen of meters. After the landfall of the power cables is completed, their route will be determined also by the directions of the spatial development of the Choczewo commune as well as the location of the power substation of Polskie Sieci Elektroenergetyczne S.A. The route of the cable lines will be channelled into a single infrastructural corridor, in accordance with the amendment to the Study of the Conditions and Directions of Spatial Development proceeded by the Choczewo commune (announcement of the Head of the Choczewo commune of 18 December 2020). The cable tray common for various projects may involve a cumulation of the environmental impacts resulting from the construction, operation and possible disassembly of some power lines. However, a proper analysis and assessment of the cumulative environmental impact is impossible without the information on technical and technological parameters of the planned projects and the duration of their implementation. Lack of this knowledge constituted the biggest obstacle encountered when preparing this EIA Report. In order to make the assessment of cumulative impacts as reliable as possible, the most unfavourable variant of the above-mentioned projects implementation was assumed and the time overlap of their construction, exploitation and decommissioning (see section 7).

In the case of gaps in the state-of-art, it should be noted that there are no data on the impact of EMF emitted by the LV lines of extra high voltage on marine and terrestrial organisms within the range of its field.

The environmental impacts associated with the construction, operation and decommissioning phases of the planned project are well recognised for this type of project, therefore the formulation of potential environmental impacts and the formulation of mitigation measures was rather straightforward.

16 Summary of the information on the project

The planned project including the construction, operation and decommissioning phases of the BP OWF CI is located in Polish Maritime Areas and in the area of the Choczewo commune. The starting point of the project will be the lead-out of export cables from the Baltic Power OWF Area, and the end point, the current terminals on the PSE S.A. customer substation.

The location of the project construction site in the offshore areas is determined by: Decision no. 1/K/20 of the Ministry of Maritime Economy and Inland Waterways of 23 July 2020 and Decision no. 5/20 of the Director of the Maritime Office in Gdynia of 28 September 2020. There are plans to apply for an amendment to both decisions in order to take into account the proposed changes to the boundary of the construction site of the area described in detail in subsection 2.1.2.

The surface area of the Connection Infrastructure development area is 34.60 km^2 in the offshore area, and 0.54 km^2 in the onshore area (including: 0.45 km^2 of the cable route construction area, 0.08 km^2 customer substation construction area and 0.003 km^2 construction area of the overhead cable line that connects the planned project with the PSE power substation).

The project will comprise the following elements:

- EHV power cable lines, located in the offshore area within the boundaries of the exclusive economic zone, the territorial sea and internal sea waters;
- crossing the shoreline in the area of 160.5 km of the seashore (according to the Maritime Office shoreline chainage) using a trenchless method;
- cable chambers located on land, where subsea and underground cable lines are to be connected;
- EHV power lines, located in the onshore area in the Choczewo commune (Wejherowo district, Pomeranian Voivodeship);
- customer substation;
- overhead 400 kV power line connecting the customer substation with the PSE substation.

A list of the most important parameters for the BP OWF CI is provided in Table 16.1.

Table 16.1. Most important parameters of the Baltic Power OWF for the Applicant Proposed Variant (APV) [Source: own materials]

Parameter	**Value/description**
Length of the grid connection line in the offshore area (assuming that the export cables are led from each of a maximum of three Baltic Power OWF substations)	Approx. 46.8 km
Length of the HDD or HDD Intersect trenchless technology landfall section between the offshore and onshore power cable route (including the offshore and the onshore section)	Approx. 1.5 km
Length of the grid connection line in the onshore area	Approx. 6.5 km
Type of power cables in the offshore area	Three-core AC subsea cables
Type of power cables in the onshore area	Single-core AC earth cables
Operating voltage of power cables	220 kV or 275 kV
Maximum number of cables in the offshore area	4 single cable lines
Maximum number of cable lines in the onshore area	12 cables arranged in 4 circuits, 3 cables per

Parameter	Value/description
	circuit
Cable landfall method	Trenchless method – horizontal directional drilling (HDD or HDD Intersect)
Method of power cable laying in the offshore area	Buried in the seabed or laid on the seabed surface, secured
Method of power cable laying in the onshore area	Buried in the ground
Method of connecting a customer substation to a PSE substation	Overhead power line
Length of the overhead power line	Approx. 270 km

The concept for the planned project was developed on the basis of information on the commonly used technological and technical solutions for the implementation of such projects. The information and data collected on the environment allowed to verify the assumptions made in order to minimise the impact on the natural environment and other users of the area in which the construction of the BP OWF CI is planned.

Following the termination of operations, there are no further plans to excavate export cables from the seabed or the ground, or to dismantle the subscriber substation and the 400 kV overhead line. Therefore, the decommissioning phase shall involve the close-down of the infrastructure and it will not be necessary to use raw materials for the purposes of disassembly work.

The analysis of impacts indicated that in the offshore area of the planned project there will be no significant impacts at any stage of its implementation, however, majority of them will be negligible and rarely, of low significance in terms of environmental impact. In the case of the harbour porpoise, it was indicated that generation of underwater noise may generate a moderate impact

Table 16.2 presents the assessment results of the impact that the planned project will have on the elements of the environment in individual phases of its implementation for the APV and RAV in the offshore area. Table 16.3 presents the assessment results of the impact that the planned project will have on the elements of the environment in individual phases of its implementation in the onshore area for the APV, whereas Table 16.4 for the RAV.

Table 16.2. Assessment results of the planned project impact in the APV and RAV on the elements of the environment in individual phases of its implementation in the offshore area [Source: internal materials]

Receptor	Construction phase	Operation phase	Decommissioning phase
Seabed geological structure, seabed sediment structure, access to raw materials and deposits	Negligible (2)	Negligible (1)	-
Seawater quality	Negligible (3) Low (2)	Negligible (1)	-
Seabed sediment quality	Negligible (3) Low (2)	Negligible (1)	-
Climate	Negligible (1)	Negligible (1)	-
Air quality	Low (1)	Negligible (1)	-
Ambient noise	Low (1)	Negligible (1)	-
Phytobenthos	Moderate (1)	Negligible (1)	-

Receptor	Construction phase	Operation phase	Decommissioning phase
	Negligible (2)		
Macrozoobenthos	Low (1) Negligible (3)	Low (3)	-
Ichthyofauna	Negligible (4)	Negligible (4)	-
Marine mammals	Negligible (4) Low (1) Moderate (1)	Low (1) Moderate (1)	-
Seabirds	Low (4) Negligible (1)	Negligible (1)	Low (4) Negligible (1)
Natura 2000 sites	Low (4) Negligible (1)	-	-
Other protected areas	-	-	-
Wildlife corridors	Negligible (1)	-	-
Biodiversity	Moderate (1) Low (4) Negligible (2)	Moderate (1) Negligible (4)	-
Cultural values, monuments and archaeological sites and objects	Negligible (1)	Negligible (1)	-
Use and management of the sea area and tangible property	Negligible (2)	Negligible (1)	-
Landscape	Negligible (1)	-	-
Population	Negligible (1)	Negligible (1)	-

Table 16.3. Assessment results of the planned project impact in the Applicant Proposed Variant (APV) on the elements of the environment in individual phases of its implementation in the onshore area [Source: internal materials]

Receptor	Construction phase	Operation phase	Decommissioning phase
Geological structure, coastal zone, soils, and access to raw materials and deposits	Moderate (4) Low (17) Negligible (32)	Important (1) Moderate (2) Low (6) Negligible (3)	-
Quality of surface waters	Important (2) Moderate (5) Low (4) Negligible (2)	Important (1) Low (2)	-
Hydrological conditions and groundwater	Low (2)	Important (1) Low (2)	-
Climate and air quality	Low (1) Negligible (2)	-	-
Ambient noise	Low (1)	Moderate (1)	-
Electromagnetic field	-	Negligible (1)	-
Fungi	Low (4)	Low (1)	-
Lichens	Important (4)	Low (1)	-
Mosses and liverworts	Low (4)	Low (1)	-

Receptor	Construction phase	Operation phase	Decommissioning phase
Vascular plants and natural habitats	Important (4)	Low (1)	-
Forest complexes	Important (5) Moderate (8) Low (5) Negligible (8)	Significant (1)	-
Invertebrates	Negligible (2)	Low (1)	-
Ichthyofauna	Negligible (1)	-	-
Herpetofauna	Moderate (2) Low (6)	Low (1)	-
Birds	Moderate (2) Low (6)	Significant (1) Moderate (1)	-
Mammals	Moderate (2) Low (6)	Low (1)	-
Natura 2000 sites	Low (1)	Low (1)	-
Other protected areas	Important (1) Moderate (2) Low (1)	Important (1) Low (1)	-
Wildlife corridors	Negligible (1)	Low (1)	-
Biodiversity	Moderate (1)	Important (1) Low (1)	-
Cultural values, monuments and archaeological sites and objects	Negligible (1)	-	-
Use and management of the sea area and tangible property	Low (1)	Low (1)	-
Landscape	Moderate (1)	Important (2) Low (1)	-
Population	Moderate (1)	Moderate (1)	-

Table 16.4. Assessment results of the planned project impact in the RAV on the elements of the environment in individual phases of its implementation in the onshore area [Source: internal materials]

Receptor	Construction phase	Operation phase	Decommissioning phase
Geological structure, coastal zone, soils, and access to raw materials and deposits	Important (1) Moderate (4) Low (16) Negligible (22)	Important (1) Moderate (2) Low (6) Negligible (3)	Important (1) Moderate (4) Low (16) Negligible (22)
Quality of surface waters	Important (2) Moderate (1)	Important (1) Low (2)	Important (2) Moderate (1)
Hydrological conditions and groundwater	Important (1) Low (1)	Important (1) Low (2)	Important (1) Low (1)
Climate and air quality	Low (1) Negligible (2)	-	Low (1) Negligible (2)
Ambient noise	Low (1)	Moderate (1) Low (1)	Low (1)

Receptor	Construction phase	Operation phase	Decommissioning phase
Electromagnetic field	-	Significant (1) Negligible (1)	-
Fungi	Low (4)	Low (1)	Low (4)
Lichens	Important (4)	Low (1)	Important (4)
Mosses and liverworts	Low (4)	Low (1)	Low (4)
Vascular plants and natural habitats	Important (4)	Low (1)	Important (4)
Forest complexes	Important (12) Moderate (3)	Significant (1)	Important (12) Moderate (3)
Invertebrates	Negligible (4)	Low (1)	Negligible (4)
Ichthyofauna	Negligible (1)	-	Negligible (1)
Herpetofauna	Moderate (2) Low (6)	Low (1)	Moderate (2) Low (6)
Birds	Significant (1) Moderate (1) Low (4)	Significant (1) Moderate (1)	Significant (1) Moderate (1) Low (4)
Mammals	Moderate (2) Low (4)	Low (1)	Moderate (2) Low (4)
Natura 2000 sites	Significant (1)	Significant (1)	Significant (1)
Other protected areas	Important (3) Moderate (1)	Significant (1) Important (1) Moderate (1) Low (1)	Important (3) Moderate (1)
Wildlife corridors	Significant (1)	Significant (1)	Significant (1)
Biodiversity	Significant (1)	Significant (1)	Significant (1)
Cultural values, monuments and archaeological sites and objects	-	-	-
Use and management of the sea area and tangible property	Important (1)	Significant (1)	Important (1)
Landscape	Significant (1)	Significant (1)	Significant (1)
Population	Low (1)	Moderate (1)	Low (1)

For the purpose of avoiding, preventing or reducing the potential negative impacts identified for the BP OWF CI, it is predicted that:

OFFSHORE AREA

The measures anticipated to reduce the adverse impact of the BP OWF CI implementation on seabirds and marine mammals are listed below. In the case of other elements of the environment, which were the subject of the impact analysis (see section 6), no need for measures mitigating the negative impact of the investment in each phase of its implementation was identified.

General recommendations:

- construction of subsea cable lines in the shortest possible time, using high-tech equipment and vessels;

- limiting the number of vessels operating simultaneously in the construction area to the necessary minimum;
- application of the least environmentally harmful technologies for the construction of subsea cable lines – ploughing preferred.

Seabirds:

- intensification of the pace of construction works in the months of April–September, when the number of birds in this sea area is the lowest;
- limiting sources of strong light directed upwards at night; this mainly concerns the periods of bird migration. The Applicant declares that they will limit the light emission to the necessary level, resulting from the applicable regulations and work safety standards.

Marine mammals:

- proper planning of cable laying activities to avoid the mating, moulting, and breeding periods of sensitive species – ideally from May to October;
- carrying out the work in the best possible weather conditions and using good quality equipment (particularly important in the case of vessels with DP) in order to reduce as much as possible the noise levels generated;
- use of deterring sounds/MMO observations before the commencement of work. The movement of vessels alone will be detected by mammals when the noise source appears at a considerable distance from the individual. Therefore, the likely avoidance response will occur before the dangerous levels of impact occur.

ONSHORE AREA

General recommendations:

- Use of trenchless methods in the form of Horizontal Directional Drilling in the area of the Wydmy Lubiatowskie dunes and the waterlogged valley – limited interference in the structure, stability and layout of habitats.
- Use of minimising measures preventing the drainage of the area in the form of sheet piling in the locations of point excavations for the application of trenchless methods as well as in the waterlogged area to preserve waterlogged habitats – valuable to plants and animals.
- Construction site facilities will not be located in the areas of: river valleys, wetlands and protected areas.
- Construction sites will be protected against the ingress of harmful substances into the soil and will be equipped with a sufficient quantity of sorbents for the removal of possible spills and leaks of oil and petroleum products.
- Good technical condition of construction and transport equipment and adequate planning of works within the construction site will be ensured.
- Possible spills of petroleum products from the equipment and machinery operating at the construction site will be eliminated immediately, and the contaminated soil will be removed and disposed of.
- Construction works will be carried in such a way as to maximally reduce the amount of construction waste generated. The materials used during the performance of construction works will be used rationally. Construction works will be carried out with due diligence.

- The contractor will mark the location for the storage of waste at the construction site, and will also provide bins and containers for their selective collection. Hazardous waste will be collected in marked, tightly closed containers. The contractor will ensure the proper protection of the storage zone to limit the impact of atmospheric conditions and access by third parties. Waste will be stored in a separate place accessible to the waste collecting companies and ensuring systematic removal of waste from the construction site by the companies dealing in waste disposal or recovery. The contractor as well as the waste collectors will hold appropriate permits for carrying out activity connected to waste management.
- Ensuring environmental supervision during the phase of construction in the field, conducted by: a botanist, a herpetologist, an ornithologist, and a mammalogist.

Noise emission limits:

- construction works which may potentially impact the residents of the Rehabilitation and Holiday Centre for disabled people (ul. Spacerowa 38, Lubiatowo) will be carried out only during day-time with the exception of Sundays and holidays to the extent possible (with the exception of works which have to be carried out 24 $h \cdot d.^{-1}$, e.g. drilling), and the schedule of works will be communicated to the management of the centre;
- noise-generating equipment will be positioned as far as (technically) possible from the buildings of the Rehabilitation and Holiday Centre for disabled people;
- equipment providing effective noise protection will be used.

Restrictions concerning the implementation of the project in the vicinity of the environmental protection forms.

Natura 2000 site Białogóra (PLH220003):

- during the construction, the access road to cable chambers (from km 33+550 to 33+740) will be delineated along the eastern boundary of the Natura 2000 site Białogóra (PLH220003) and habitat 2180 and information boards will be placed with the following message “Protected habitat. No trespassing;”
- roadworthy construction vehicles and machinery will be permitted.

Ecological area “Torfowisko” [Peat bog] in Szklana Huta

- application of methods which prevent the appearance of a cone depression and drainage of protected peats within the ecological area "Torfowisko" [Peat bog] in Szklana Huta. During the construction phase of the cable chambers, in the case the drainage is necessary it will be short-term;
- the final section of the access road to the cable chambers (from km 33+550 to 33+740) will be separated with a fence on both sides of the road fromthe ecological area. The preservation of the ecological areas in their present state will be the primary protective measure along this section of the project;
- roadworthy construction vehicles and machinery will be permitted.

Measures minimising the impact on habitats and protected species

Measures to mitigate impacts on lichens:

- in the permanent technical belt and collision area of the planned project route with the resources of lichen species of high nature value, a Permit of the Regional Director for Environmental Protection must be obtained for derogations from the prohibitions concerning the plant species under protection: grey reindeer lichen (*Cladonia rangiferina*), reindeer lichen (*Cladonia portentosa*), salted starburst lichen (*Imshaugia aleurites*), bristly beard lichen (*Usnea hirta*), tree reindeer lichen (*Cladonia arbuscula*), cartilage lichen (*Ramalina fraxinea*), dotted ribbon lichen (*Ramalina fastigiata*), pierced lichen (*Pertusaria pertusa*), covered lichen (*Pertusaria hymenea*), powder-headed tube lichen (*Hypogymnia tubulosa*), *Pleurosticta acetabulum* within the temporary technical belt in the case of the need for felling trees inhabited by the following lichen species: reindeer lichen (*Cladonia portentosa*), bristly beard lichen (*Usnea hirta*), salted starburst lichen (*Imshaugia aleurites*), tree reindeer lichen (*Cladonia arbuscula*), farinose cartilage lichen (*Ramalina farinacea*), pierced lichen (*Pertusaria pertusa*), powder-headed tube lichen (*Hypogymnia tubulosa*) – a Permit of the Regional Director for Environmental Protection must be obtained for derogations from the prohibitions concerning the above-mentioned plant species under protection;
- in places where it will not be necessary to fell trees, work related to the protection of trees and fencing should be carried out under the supervision of a lichenologist.

Measures mitigating impact on mosses and liverworts:

- within the permanent technical belt, there are 2 species of protected mosses and liverworts: the bog groove-moss (*Aulacomnium palustre*) and the crisped pincushion moss (*Ulota crispa).* It occurs in the area of the Horizontal Directional Drilling across the Wydmy Lubiatowskie dunes and across the waterlogged valley.

Measures mitigating the impact on vascular plants and natural habitats:

- in the area of cable chamber location and the collision of the planned project route with the resources of vascular plant species of high nature value, it is possible to apply minimisation measures consisting in replanting the specimens together with an appropriate portion of the substrate beyond the direct impact zone carried out under the environmental supervision. Such a minimising measure requires the Permit of the Regional Director for Environmental Protection for derogations from the prohibitions concerning the following plant species under protection and concerns species from the families Pyrolaceae and Orchidaceae: the creeping lady's-tresses (*Goodyera repens*) and the one-flowered wintergreen (*Moneses uniflora* (L.) A. Gray);
- within the temporary technical belt, in the case of risk of damaging the plots of the broad-leaved helleborine (*Epipactis helleborine* (L.) Crantz), the species should be replanted together with an appropriate portion of the substrate beyond the direct impact zone carried out under the environmental supervision;
- for the wooded dunes of the Atlantic, Continental and Boreal region habitat (2180), the most effective method of the planned project implementation is the use of Horizontal Directional Drilling. Where possible, in the case of the following habitats: *Luzulo-Fagetum* beech forests (9110) and wooded dunes of the Atlantic, Continental and Boreal region (2180), a Permit of the Regional Director for Environmental Protection for derogations

from the prohibitions concerning the following plant species under protection must be obtained.

Measures mitigating the impact on herpetofauna:

- in the case of amphibians in the area of the waterlogged valley and reptiles in the area of the Wydmy Lubiatowskie dunes, trenchless methods will be applied;
- prior to the construction beginning, herpetological supervision shall protect amphibian migration sites and areas adjacent to the key sites of amphibian occurrence with newt fencing preventing animals from entry into the construction site and onto the access roads. Table 11.6 provides the sections requiring temporary fencing for amphibians.

Measures mitigating the impact on avifauna:

- carrying out tree felling works outside the bird breeding season, in the autumn-winter period, between 15 September and 28 February;
- installing bird scarers on the 400 kV line connecting the customer substation with the PSE substation, e.g. FireFly diverters.

Proposed measures to mitigate the negative impact of the planned project on mammals, including bats:

- the construction site will be fenced off;
- the environmental supervision entity shall be notified of any emergencies requiring intervention or unforeseen situations involving animals;
- there is no need for post-development monitoring with regard to mammals, including bats, since no project impacts on mammals that would require post-development monitoring are anticipated.

This EIA Report describes the project impact on the environment in a complete and exhaustive manner. In the case of the RAV, a series of negative significant impacts was identified, including on the Natura 2000 network site, resulting from the construction of a power overhead lines along the entire onshore section of the connection.

Due to the envelope nature of this report, each of the possible project implementation methods will have a smaller impact than the one described in the Report. An example of this is the selection of the construction method for subsea cable lines. The impact analysis included the jetting technology, which is characterised by the highest, among the methods analysed for the construction phase, levels of underwater noise generated and seabed sediment resuspension. The adoption of a different method for the construction of the cable lines, including, for example, the most commonly used method of ploughing, will result in impacts of smaller scale and significance.

17 Sources of information and materials used

1. Aktualizacja Programu ochrony powietrza dla strefy aglomeracji trójmiejskiej, w której został przekroczony poziom dopuszczalny pyłu zawieszonego PM10 oraz poziom docelowy benzo(a)pirenu. [Update of the Program for the Improvement of Air Quality in Tri-City Agglomeration zone where the permissible level of PM10 suspended dust and the target level of benzo(a)pyrene were exceeded]. Pomeranian Province Regional Assembly, 2020.
2. Update of the preliminary environmental assessment of the marine waters status, Warsaw 2018; available at: http://rdsm.gios.gov.pl/images/aktualizacja_wstepnej_oceny_stanu_srodowiska_wod_morskich.pdf
3. Update of the preliminary environmental assessment of the marine waters status. Chief Inspectorate for Environmental Protection, Warsaw 2018.
4. Alloway B.J., Ayres D.C., Chemiczne podstawy zanieczyszczenia środowiska. PWN Publishing House, Warsaw 1999.
5. Andersson M.H., Andersson S., Ahlsén J., Andersson B.L., Hammar J., Persson L.K.G., Pihl J., Sigray P., Wikström A., A framework for regulating underwater noise during pile driving. A technical Vindval report, Report 6775. Swedish Environmental Protection Agency, Stockholm 2016.
6. Andersson M.H., Offshore wind farms – ecological effects of noise and habitat alteration on fish. Doctoral dissertation. Stockholm University, 2011.
7. Andrulewicz E., Napieralska D., Otremba Z., The environmental effects of the installation and functioning of the submarine SwePol link HVDC transmission line. A case study of the Polish Marine Area of the Baltic Sea. Journal of Sea Research 2003, 49: 337–345.
8. Araújo M.B., Pearson R.G., Thuiller W., Erhard M., Validation of species – climate impact models under climate change. Global Change Biology 2005, 11: 1504–1513.
9. Argent D.G., Flebbe P.A., Fine sediment effects on brook trout eggs in laboratory streams. Fish. Res. 1999, 39: 253–262.
10. Aro E., The spatial and temporal distribution patterns of cod (*Gadus morhua callarias L.*) in the Baltic Sea and their dependence on environmental variability – implications for fishery management. Department of Ecology and Systematics. University of Helsinki, 2000.
11. Atangana Njock P.G.A., Zheng Q., Zhang N., Xu Y.-S., Perspective review on subsea jet trenching technology and modeling. Journal of Marine Science and Engineering 2020, 8 (460): 1–27.
12. Atlas grzybów [Mushrooms and Fungi of Poland]; available at: https://www.grzyby.pl
13. Augustowski B. (ed.), Bałtyk Południowy, Ossolineum, Wrocław–Warsaw–Gdańsk–Łódź 1987.
14. Auld A.H., Schubel J.R., Effects of suspended sediment on fish eggs and larvae. A laboratory assessment. Estuarine, Coastal and Shelf Science 1978, 6: 153–164.
15. Balayev L.A., The Behavior of Ecologically Different Fish in Electric Fields II. Threshold of Anode Reaction and Tetanus. Journal of Ichthyology 1980, 21 (1): 134–143.
16. Bald J., Hernández C., Uriarte A., Castillo J.A., Ruiz P., Ortega N. Enciso Y.T., Marina D., Acoustic characterization of 26 submarine cable installation in the Biscay Marine Energy Platform (BIMEP). Bilbao Marine Energy Week, Bilbao, 20–24 April 2015.
17. Bank Danych o Lasach; available at: https://www.bdl.lasy.gov.pl/portal/mapy.
18. Barańska A., Opioła R., Kruk-Dowgiałło L. (eds.), Monitoring gatunków i siedlisk morskich w latach 2016–2018. Biuletyn Monitoringu Przyrody 18. Biblioteka Monitoringu Przyrody GIOŚ, Warsaw 2018: 1–48.
19. BCTC – British Columbia Transmission Corporation, Application for an Environmental Assessment Certificate for the Vancouver Island Transmission Reinforcement Project. May 2006.

20. Bednarska M., Brzeska-Roszczyk P., Dawidowicz D., Dembska G., Drgas A., Dworniczak J., Fey D., Gajewski J., Gajewski L., Gajewski Ł., Galer-Tatarowicz K., Hac B., Kaczmarek N., Kałas M., Kapiński J., Keslinka L., Koszałka J., Kruk-Dowgiałło L., Kubacka M., Kuzebski E., Meissner W., Nermer T., Opioła R., Osipowicz I., Osowiecki A., Pazikowska-Sapota G., Rudowski S., Skov H., Spich K., Szefler K., Świstun K., Thomsen F., Typiak M., Tyszecki A., Wąś M., Wróblewski R., Yalçın G., Zydelis R., Environmental Impact Assessment Report for the Baltica Offshore Wind Farm, Gdańsk 2017.
21. Bergström L., Kautsky L., Malm T., Ohlsson H., Wahlberg M., Rosenberg R., Capetillo N.A., The effects of wind power on marine life. A synthesis. Report 6512. Swedish Environmental Protection Agency, Stockholm 2012.
22. Bergström L., Kautsky L., Malm T., Rosenberg R., Wahlberg M., Capetillo N.A., Wilhelmsson D., Effects of offshore wind farms on marine wildlife – a generalized impact assessment. Environmental Research Letters 2014, 9: 1–12.
23. Bergström L., Sundqvist F., Bergström U., Effects of an offshore wind farm on temporal and spatial patterns in the demersal fish community. Mar. Ecol. Prog. Ser. 2013, 485: 199–210.
24. Berthold P., Bird Migration. A General Survey, Oxford University Press, 1993.
25. Birjukov N.P., Baltijskij shprot (Biologikheskije sostojanie i khozaijstviennoie ispolzovanie). Published by: Leningrad State University, Leningrad; 1980: 1–142.
26. Birklund J., Anholt Offshore Wind Farm. Benthic Fauna. Baseline Surveys and Impact Assessment. Final Report. DHI Group; Energinet.dk, Hørsholm 2009.
27. Birklund J., Petersen A., Development of the fouling community on turbine foundations and scour protections in Nysted Offshore Wind Farm, 2003. Report. DHI Water and Environment, 2004.
28. Birklund J., Sensitivity of benthic fauna and flora, [in:] Benthic Communities and Environmental Impact Assessment of the planned Rødsand 2 Offshore Wind Farm. Dong Energy, 2007.
29. Birklund J., Surveys of Hard Bottom Communities on Foundations in Nysted Offshore Wind Farm and Schönheiders Pulle in 2004. Report No. 52878. DHI Water and Environment, 2005: 1–52.
30. Birklund J., Wijsman J.W.M., Aggregate extraction. A review on the effect on ecological functions. Report Z3297.10. SANDPIT Fifth Framework Project No. EVK3CT200100056. DHI Water & Environment; WL | Delft Hydraulics, 2005: 1–54.
31. Blackwell S.B., Lawson J.W., Williams M.T., Tolerance by ringed seals (Phoca hispida) to impact pipe-driving and construction sounds at an oil production island. J. Acoust. Soc. Am. 2004, 115: 2346–2357.
32. Błeńska M., Osowiecki A., Brzeska P., Kruk-Dowgiałło L., Barańska A., Dziaduch D., Badania bentosu na obszarze Morskiej Infrastruktury Przyłączeniowej (MIP). Final report with survey results, [in:] Morska infrastruktura przesyłowa energii elektrycznej. Raport o oddziaływaniu na środowisko, Vol. III, section 2, subsection 2.3. Biuro Doradztwa Ekologicznego i Inwestycyjnego Sp. z o.o., Warsaw 2015.
33. Bochert R., Zettler M.L., Long-term exposure of several marine benthic animals to static magnetic fields. Bioelectromagnetics 2004, 25: 498–502.
34. Bojakowska I., Kryteria zanieczyszczenia osadów wodnych. Przegląd Geologiczny 2001, 49 (3): 213–218.
35. Bolałek J. (ed.), Fizyczne, biologiczne i chemiczne badania morskich osadów dennych. University of Gdańsk Publishing House, Gdańsk, 2010.
36. Bone Q., Marshall N.B., Blaxter J.H.S., Biology of Fishes. Springer Science+Business Media, B.V., 1995.

37. Borkowski T., Siłownie okrętowe. Notatki z wykładów część I. Maritime University in Szczecin, 2009 (mimeo).
38. Bouma S., Lengkeek W., Benthic communities on hard substrates of the offshore wind farm Egmond aan Zee (OWEZ). Including results of samples collected in scour holes. Final report. Bureau Waardenburg bv, 2012.
39. Bourg A., Loch J., Mobilization of heavy metals as affected by pH and redox conditions, [in:] Biogeodynamics of pollutants in soils and sediments. Springer-Verlag, Berlin-Heidelberg 1995: 87–102.
40. Bouty C., Schafhirt S., Ziegler L., Muskulus M., Lifetime extension for large offshore wind farms. Is it enough to reassess fatigue for selected design positions?, Energy Procedia 2017, 137: 523–530.
41. Boynton W.R., Garber J.H., Summers R., Kemp W.M., Inputs, transformations and transport of nitrogen and phosphorus in Chesapeake Bay and selected tributaries. Estuaries 1995, 18 (1B): 285–314.
42. Braeckman U., Provoost P., Gribsholt B., Gansbeke D.V., Middelburg J.J., Soetaert K., Vincx M., Vanaverbeke J., Role of macrofauna functional traits and density in biogeochemical fluxes and bioturbation, Marine Ecology Progress Series 2010, 399: 173–186.
43. Brakelmann H., Kabelverbindung der Offshore-Windfarmen Kriegers Flak und Baltic I zum Netzanschlusspunkt. Report commissioned by the Offshore Ostsee WindAG, 2005: 1–71.
44. Brims Underwater Noise Assessment. Underwater Noise Assessment Report. SSE Renewables Developments (UK) Ltd. Document Number: L-100183-S00-REPT-001. Xodus Group, Chilworth, Southampton; available at: http://marine.gov.scot/datafiles/lot/Brims_Tidal/Supporting_Documents/Brims%20Underwater%20Noise%20Assessment%20Report.%20Xodus%20(2015).pdf.
45. BRISK – Sub-regional risk of spills of oil and hazardous substances, 2009–2012.
46. Brodin Y., Andersson M.H., The marine splash midge *Telmatogon japonicas* (Diptera; Chironomidae) – extreme and alien? Biol. Invasions 2009, 11: 1311–1317.
47. Brzeska-Roszczyk P., Kruk-Dowgiałło L., Natural valuation of the Polish marine areas (Baltic) based on phytobenthos, Bulletin of the Maritime Institute in Gdańsk 2018, 33 (1): 204–211.
48. Bulleri F., Airoldi L., Artificial marine structures facilitate the spread of a nonindigenous green alga, *Codium fragile* ssp. tomentosoides, in the north Adriatic Sea. J. Appl. Ecol. 2005, 42: 1063–1072.
49. Carman R., Carbon and nutrients, [in:] Perttila M. (ed.), Contaminants in the Baltic Sea Sediments. Results of the 1993 HELCOM/ICES Baltic Sea Sediment Baseline Study. MERI, Report Series of the Finnish Institute of Marine Research No. 50, Helsinki 2003.
50. Carman R., Rahm L., Early diagenesis and chemical characteristics of interstitial water and sediments in the deep deposition bottoms of the Baltic Proper. J. Sea Res., 1996, 37: 25–47.
51. Carter L., Burnett D., Drew S., Marle G., Hagadorn L., Bartlett-McNeil D., Irvine N., Submarine Cables and the Oceans. Connecting the World. UNEP-WCMC Biodiversity Series No. 31. ICPC/UNEP/UNEP-WCMC, 2009.
52. Central Geological Database (CBDG); available at: https://www.geoportal.gov.pl/.
53. Centre for Marine and Coastal Studies Ltd, East Anglia THREE Limited, East Anglia THREE Offshore Windfarm. Appendix 9.2. Electromagnetic Field Environmental Appraisal, Environmental Statement. Volume 3. Document Reference – 6.3.9 (2), 2015: 1–44.
54. Chapman D.W., Critical review of variables used to define effects of fines in redds of large salmonids. Trans. Am. Fish. Soc. 1988, 117: 1–21.
55. Chmielniak T., Technologie energetyczne. WNT Publishing House, Warsaw 2018. 1–564.

56. Chojnicki B.H., Urbaniak M., Danielewska A., Strzeliński P., Olejnik J., Pomiary wymiany dwutlenku węgla oraz biomasy w ekosystemach leśnych – stacja pomiarowa w Tucznie, Studia i Materiały Centrum Edukacji Przyrodniczo-Leśnej 2009, 11, 2 (21): 247–256.
57. Cieślikiewicz W., Paplińska-Swerpel B., Długoterminowe modelowanie falowania wiatrowego Bałtyku w okresie 1958–2001. Inżynieria Morska i Geotechnika 2005, 26 (4): 313–321.
58. Cieśliński S., Czyżewska K., Fabiszewski J., Red list of the lichens in Poland. Czerwona lista porostów w Polsce, [in:] Mirek Z., Zarzycki K., Wojewoda W., Szeląg Z. (eds.), Red list of plants and fungi in Poland. Czerwona lista roślin i grzybów Polski. W. Szafer Institute of Botany of PAS, Krakow 2006: 71–90.
59. Coates D., Hoey G., Colson L., Vincx M., Vanaverbeke J., Rapid macrobenthic recovery after dredging activities in an offshore wind farm in the Belgian part of the North Sea. Hydrobiologia 2015, 756 (1): 3–18.
60. Cohen E., Grosslein M., Sissenwine M., Steimle F., A comparison of energy flow on Georges Bank in the North Sea. ICES CM 1980/L:64, 1980: 1–13.
61. Collier C.T., Anulacion B.F., Arkoosh M.R., Dietrich J.P., Incardona J.P., Johnson L., Ylitalo G.M., Myers M.S., Effects on Fish of Polycyclic Aromatic Hydrocarbons (PAHS) and Naphthenic Acid Exposures. Fish Physiology 2013, 33: 195–255.
62. Copping A., Freeman M., Gorton A., Hemery L., Risk retirement – decreasing uncertainty and informing consenting processes for marine renewable energy development. J. Mar. Sci. Eng. 2020, 8 (3): 172.
63. Czubiński Z., Zagadnienia geobotaniczne Pomorza. Badania Fizjograficzne nad Polską Zachodnią 1950, 2 (4): 440–658.
64. Ćwiklińska P., Monitoring stanu ochrony siedlisk przyrodniczych w granicach obszaru Natura 2000 Białogóra PLH220003. AIRA Ekspertyzy botaniczne, 2016.
65. Ćwiklińska P., Monitoring stanu ochrony siedliska przyrodniczego 2190 Wilgotne zagłębienia międzywydmowe w granicach obszaru Natura 2000 Białogóra PLH220003, z wyłączeniem terenu rezerwatu przyrody Białogóra. AIRA Ekspertyzy botaniczne, 2018.
66. Daan N., Bromley P.J., Hislop J.R.H., Nielsen N.A., Ecology of North Sea fish. Netherlands Journal of Sea Research 1990, 26 (2–4): 343–386.
67. Dadlez R., Mojski J.E., Słowańska B., Uścinowicz S., Zachowicz J., Rzeźba dna, [in:] Mojski J.E. (ed.), Atlas geologiczny Południowego Bałtyku 1:500 000, Table I. Wydawnictwo Kartograficzne Polskiej Agencji Ekologicznej, Sopot–Warsaw 1995.
68. Dadlez R., Przekroje geologiczne, utwory przedkenozoiczne, [in:] Mojski J.E. (ed.), Atlas geologiczny południowego Bałtyku – 1:500 000, Table X. Wydawnictwo Kartograficzne Polskiej Agencji Ekologicznej, Sopot–Warsaw 1995.
69. Dadlez R., Szkic tektoniczny, [in:] Mojski J.E. (ed.), Atlas geologiczny Południowego Bałtyku 1:500 000, Table III. Wydawnictwo Kartograficzne Polskiej Agencji Ekologicznej, Sopot–Warsaw 1995.
70. Dähne M., Peschko V., Gilles A., Lucke K., Adler S., Ronneberg K., Siebert U., Marine mammals and windfarms: effects of alpha ventus on harbour porpoises, [in:] Federal Maritime and Hydrographic Agency, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, Beierdorf A., Wollny-Goerke K. (eds.), Ecological Research at the Offshore Windfarm alpha ventus. Springer Spektrum, Wiesbaden 2014: 133–149.
71. Dalaklis D., Besikci W.B., Larsson J., Christodoulou A., Johansson T.M., Pålsson J., Nilsson H., Saathoff F., Siewert M., Juszkiewicz W., Peach D., South Baltic Oil Spill Response Through Clean-up with Biogenic Oil Binders Project: The SBOIL Handbook. Summarizing the essential information about oil spill contingency planning, regulations and oil spill exercises in the South Baltic Sea region, when using biogenic oil binders. Maritime University of Szczecin, Szczecin 2019.

72. Danheim J., Bergstroöm, Birchenough S.N.R., Brzana R., Boon A.R., Coolen J.W.P., Dauvin J.C., De Mesel I., Derweduwen J., Gill A.B., Hutchison Z.L., Jackson A.C., Janas U., Martin G., Raoux A., Reubens J., Rostin L., Vanaverbeke J., Wilding T.A., Wilhelmsson D., Degraer S., Benthic effects of offshore renewables. Identification ofknowledge gaps and urgently needed research. ICES Journal of Marine Science 2020, 77 (3): 1092–1108.
73. Danish Offshore Wind – Key Environmental Issues. DONG Energy, Vattenfall, The Danish Energy Authority and The Danish Forest and Nature Agency, November 2006.
74. Davutluoglu O.I., Seckin G., Kalat D.G., Yilmaz T., Ersu C.B., Spetiation and implications of heavy metal content in surface sediments of Akyatan Lagoon-Turkey. Desalination 2010, 206: 199–210.
75. Dąbrowska H., Kopko O., Turja R., Lehtonen K.K., Góra A., Polak-Juszczak L., Warzocha J., Kholodkevich S., Sediment contaminants and contaminant levels and biomarkers in caged mussels (*Mytilus trossulus*) in the southern Baltic Sea. Marine Environmental Research 2013, 84: 1–9.
76. De Backer A., Buyse J., Hostens K., A decade of soft sediment epibenthos and fish monitoring at the Belgian offshore wind farm area. Chapter 7, [in:] Degraer S., Brabant R., Rumes B., Vigin L. (eds.), Environmental Impacts of Offshore Wind Farms in the Belgian Part of the North Sea. Empirical Evidence Inspiring Priority Monitoring, Research and Management, Series ‘Memoirs on the Marine Environment’, Brussels, Royal Belgian Institute of Natural Sciences, OD Natural Environment, Marine Ecology and Management, 2020: 79–114.
77. de Groot S.J., The consequences of marine gravel dredging of spawning of herring, Clupea harengus. Journal of Fish Biology 1980, 16: 605–611.
78. De Mesel I., Kerckhof F., Norro A., Rumes B., Degraer S., Succession and seasonal dynamics of the epifauna community on offshore wind farm foundations and their role as stepping stones for non-indigenous species. Hydrobiologia 2015, 756 (1): 37–50.
79. Degraer S., Brabant R., Rumes B. (eds.), Offshore wind farms in the Belgian part of the North Sea. Heading for an understanding of environmental impacts. Royal Belgian Institute of Natural Sciences, Management Unit of the North Sea Mathematical Models, Marine ecosystem management unit, 2012.
80. Dembska G., Metale śladowe w osadach Portu Gdańskiego. PhD thesis. Faculty of Biology, Oceanography and Geography of the University of Gdańsk, Gdańsk 2003.
81. Dembska G., Sapota G., Galer-Tatarowicz K., Littwin M., Zegarowski Ł., Aftanas B., Rudowski S., Makurat K., Wnuk K., Ciesielski P., Gajewski L., Nowak K., Edut J., Cichowska D., Wróblewski R., Szefler K., Koszałka J., Badania warunków fizyczno-chemicznych osadów na obszarze MFW Bałtyk Środkowy II. Final Report with Survey Results, Gdańsk 2015.
82. Desprez M., Physical and biological impact of marine aggregate extraction along the French coast of the Eastern English Channel: short- and long-term post-dredging restoration, ICES Journal of Marine Science 2000, 57 (5): 1428–1438.
83. Dethlefsen V., Cameron P., Berg A., von Westernhagen H., Malformations of embryos of spring spawning fishes in the southern North Sea. Int. Counc. Explor. Sea C.M. 1986/E:21.
84. Diederichs A., Brandt M., Nehls G., Does sand extraction near Sylt affect harbour porpoises?, Impacts of Human Activities. Wadden Sea Ecosystem No. 26, 2010: 199–203.
85. Dojlido J.R., Chemia wód powierzchniowych. Wydawnictwo Ekonomia i Środowisko, Białystok 1995.
86. Dushkina L.A., Biologia morskikh sel’dej w rannem ontogezeze. Akademia Nauk SSSR, MOSKVA izd. “NAUKA” 1988: 1–192.
87. Dyndo M., Wiśniewska D.M., Rojano-Doñate L., Madsen P.T., Harbour porpoises react to low levels of high frequency vessel noise. Scientific Reports 2015, 5: 11083.

88. Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive) (Official Journal of the European Union L 164/19 of 25/06/2008).
89. Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds (EU Birds Directive) (Official Journal of the European Union L 20/7 of 26/01/2010).
90. Dziaduch D., Barańska A., Osowiecki A., Badania bentosu na obszarze Morskiej Infrastruktury Przyłączeniowej (MIP). Raport końcowy z oceną oddziaływania, [in:] Morska infrastruktura przesyłowa energii elektrycznej. Raport o oddziaływaniu na środowisko, Vol. IV, section 2. Biuro Doradztwa Ekologicznego i Inwestycyjnego Sp. z o.o., Warsaw 2015.
91. Dziubińska A., Szaniawska A., Short-term study on the early succession stages of fouling communities in the coastal zone of Puck Bay (southern Baltic Sea). Oceanological and Hydrobiological Studies 2010, XXXIX (4): 3–16.
92. Engell-Sørensen K., Possible effects of the offshore windfarm at Vindeby on the outcome of fishing. The possible effects of electromagnetic fields. Report to SEAS, Denmark, 2002.
93. Engell-Sørensen K., Skyt P.H., Evaluation of the effect of sediment spill from offshore wind farm construction on marine fish. Report to SEAS, Denmark 2001.
94. Epstein S.G., Human exposure to aluminium. Environ. Geochem. Health 1990, 12 (1–2): 65–70.
95. ESPOO REPORT, Nord Stream 2. W-PE-EIA-POF-REP-805-040100EN, English Version. Ramboll, April 2017.
96. Essink K., Ecological effects of dumping of dredged sediments; options for management. Journal of Coastal Conservation 1999, 5: 69–80.
97. European Environment Agency (EEA), Air pollution from electricity-generating large combustion plants. An assessment of the theoretical emission reduction of SO2 and NOX through implementation of BAT as set in the BREFs. EEA Technical report No. 4, 2008; available at: https://www.eea.europa.eu/publications/technical_report_2008_4.
98. European Environment Agency (EEA); available at: https://www.eea.europa.eu.
99. Falkowska L., Bolałek J., Łysiak-Pastuszak E., Analiza chemiczna wody morskiej. Volume 2. Pierwiastki biogeniczne N, P, Si, Fe, Publishing House of the University of Gdańsk, Gdańsk 1999.
100. Fałtynowicz W., Kukwa M., Czerwona lista porostów zagrożonych na Pomorzu Gdańskim, [in:] Czyżewska K. (ed.), Zagrożenia porostów w Polsce, Monogr. Bot. 2003, 91: 63–77.
101. Fałtynowicz W., Kukwa M., Lista porostów i grzybów naporostowych Pomorza Gdańskiego, Acta Bot. Cassub., Monogr. 2006, 2: 1–98.
102. Fałtynowicz W., The lichens of Western Pomerania (NW Poland). An ecogeographical study. Polish Bot. Stud. 1992, 4: 1–182.
103. Feger E.W., Pattern in the development of a marine community. Limnol. Oceanogr. 1971, 16 (2): 241–253.
104. Feistel R., Günter N., Wasmund N. (eds.), State and evolution of the Baltic Sea, 1952–2005. A detailed 50-year survey of meteorology and climate, physics, chemistry, biology, and marine environment, A John Wiley & Sons, Inc., Hoboken 2008.
105. Fey D.P., Jakubowska M., Greszkiewicz M., Andrulewicz E., Otremba Z., Urban-Malinga B., Are magnetic and electromagnetic fields of anthropogenic origin potential threats to early life stages of fish? Aquatic Toxicology 2019, 209: 150–158.
106. Filipiak J., Malinowska M., Selected extreme weather events on the Polish coast of the Baltic Sea in the period 2001–2014. Oceanological and Hydrobiological Studies 2016, 45 (3): 405–423.

107. Fisher C., Slater M., Effects of electromagnetic field on marine species. A literature review. No. 0905-00-001. Oregon Wave Energy Trust (OWET), September 2010; available at: https://tethys.pnnl.gov/sites/default/files/publications/Effects_of_Electromagnetic_Fields_on_Marine_Species.pdf.
108. Fisher T.R., Harding L.W., Stanley D.W., Ward L.G., Phytoplankton, nutrients, and turbidity in the Chesapeake, Delaware, and Hudson estuaries. Estuarine Coastal and Shelf Science 1988, 27 (1): 61–93.
109. Fissel D.B., Jiang J., Three-dimensional numerical modelling of sediment transport for coastal engineering projects in British Columbia, Canada. OCEANS'11 MTS/IEEE KONA, Waikoloa 2011, 1–9.
110. Formicki K., Winnicki A., Reactions of fish embryos and larvae to constant magnetic fields. Italian J. Zool. 1998, 65: 479–482.
111. Fröstner U., Inorganic pollutants, particularly heavy metals in estuaries, [in:] Olausson E., Cato I. (eds.), Chemistry and Biochemistry of Estuaries. John Wiley & Sons, Chichester 1980: 307–348.
112. Gaj K., Pochłanianie CO_2 przez polskie ekosystemy leśne. Leśne Prace Badawcze 2012, 7 (1): 17–21.
113. Galer K., Makuch B., Wolska L., Namieśnik J., Toksyczne związki organiczne w osadach dennych: problemy związane z przygotowaniem próbek i analizą. Chem. i Inż. Ekol. 1997, 4 (3): 285.
114. Gawlikowska E., Seifert K., Bojakowska I., Piaseczna A., Kwecko P., Tomassi-Morawiec H., Król J., Explanations to the geoenvironmental map of Poland, 1:50 000. Arkusz Choczewo (4). Polish Geological Institute – National Research Institute, Warsaw 2009.
115. Gdaniec-Pietryka M., Mechlińska A., Wolska L., Gałuszka A., Namieśnik J., Remobilization of polychlorinated biphenyls from sediment and its consequences for their transport in river waters. Environ. Monit. Assess. 2013, 185 (5): 4449–4459.
116. Gdaniec-Pietryka M., Specjacja fizyczna i mobilność analitów z grupy wielopierścieniowych węglowodorów aromatycznych i polichlorowanych bifenyli na granicy faz osad denny-woda. PhD Thesis. Gdańsk University of Technology, Gdańsk 2008.
117. General Directorate of Environmental Protection (GDEP), Standard Data Form (SDF) for Natura 2000 site PLB990002 Przybrzeżne wody Bałtyku, Developed on: 2002-05, updated on: 2019-11; available at: https://natura2000.eea.europa.eu/Natura2000/SDF.aspx?site=PLB990002.
118. General Directorate of Environmental Protection (GDEP), Standard Data Form (SDF) for Natura 2000 site – Przybrzeżne wody Bałtyku (PLB990002).
119. GeoLOG – application of the Central Geological Database (CBDG) of the Polish Geological Institute – National Research Institute; available at: https://geolog.pgi.gov.pl/.
120. GeoSMoRP – Flood Risk Monitoring System; available at: http://www.smorp.pl/imap/.
121. Gibbs M., Hewitt J., Effects of sedimentation on macrofaunal communities. A synthesis of research studies for Arc, Technical Report No. 264. National Institute of Water & Atmospheric Research Ltd, Hamilton 2004: 1–48.
122. Gill A.B., Desender M., Risk to Animals from Electromagnetic Fields Emitted by Electric Cables and Marine Renewable Energy Devices, [in:] Copping A.E., Hemery L.G., OES-Environmental 2020 State of the Science Report: Environmental Effects of Marine Renewable Energy Development Around the World. Report for Ocean Energy Systems (OES), 2020: 86–103.
123. Gill A.B., Huang Y., Gloyne-Philips I., Metcalf J., Quayle V., Spencer J., Wearmouth V., COWRIE 2.0 Electromagnetic Fields (EMF). Phase 2. EMF-sensitive fish response to EM emissions from sub-sea electricity cables of the type used by the offshore renewable energy industry. Commissioned by COWRIE Ltd (project reference COWRIE-EMF-1-06), 2009.

124. Głowaciński Z. (ed.), Polska czerwona księga zwierząt. Kręgowce, Państwowe Wydawnictwo Rolnicze i Leśne, Warsaw 2001.
125. Głowaciński Z., Sura P. (eds.), Atlas płazów i gadów Polski. Status, rozmieszczenie, ochrona, z kluczami do oznaczania. PWN Publishing House, Warsaw 2018.
126. Chief Inspectorate for Environmental Protection; available at: https://www.gios.gov.pl/pl
127. Gminny Program Opieki nad Zabytkami w gminie Choczewo na lata 2017–2020. Choczewo 2016.
128. Gosz E., Horbowy J., Ruczyńska W., Testes specific accumulation of tributyltin in turbot Scophthalmus maximus from the southern Baltic Sea. Marine Pollution Bulletin 2011, 62: 2563–2567.
129. Grant A., Briggs A.D., Toxicity of sediments from around a North Sea oil platform: are metals or hydrocarbons responsible for ecological impacts? Marine Environmental Research 2002, 53: 95–116.
130. Gregory R.S., Northcote T.G., Surface, planktonic, and benthic foraging by juvenile chinook salmon (*Oncorhynchus tshawytscha*) in turbid laboratory conditions. Can. J. Fish. Aquat. Sci. 1993, 50: 233–240.
131. Griffin F.J., DiMarco T., Menard K., Newman J.A., Smith E.H., Vines C.A., Cherr G.N., Larval Pacific Herring (*Clupea pallasi*) Survival in Suspended Sediment. Estuaries and Coasts 2012, 35: 1229–1236.
132. Griffin F.J., Smith E.H., Vines C.A., Cherr G.N., Impacts of suspended sediments on fertilization, embryonic development, and early larval life stages of the pacific herring, *Clupea pallasi*. Biol Bull 2009, 216 (2): 175–187.
133. SMDI Advisory Group (ed.), Baltic Pipe offshore gas pipeline – Polish part. Environmental Impact Assessment Report, 2019; available at: http://bip.szczecin.rdos.gov.pl/files/obwieszczenia/142530/Raport_OOS_BP_czesc_polska.pdf (accessed on: 30.04.2021).
134. SMDI Advisory Group (ed.), Baltic Pipe offshore gas pipeline – Polish part. Espoo Report. Non-specialist abstract, 2019; available at: https://www.baltic-pipe.eu/wp-content/uploads/2019/04/Polska-Raport_PL.pdf.
135. Grygiel W., Biologiczna charakterystyka zasobów szprotów bałtyckich, [in:] Horbowy J. (ed.), Zadanie 1, opracowanie roczne statutowego tematu badaw. DOT16/NB/Zasoby „Dynamika populacji ważniejszych ryb użytkowych w świetle czynników środowiskowych wraz z implikacjami dotyczącymi racjonalnego gospodarowania zasobami". National Marine Fisheries Research Institute, Gdynia 2016 (mimeo).
136. Grygiel W., Biologiczna charakterystyka zasobów szprotów, [in:] Horbowy J. (ed.), Zadanie 1 – Biologiczna charakterystyka zasobów dorszy, śledzi, szprotów i płastug. Opracowanie roczne statutowego tematu badaw. DOT16/NB/Zasoby „Dynamika populacji ważniejszych ryb użytkowych w świetle czynników środowiskowych wraz z implikacjami dotyczącymi racjonalnego gospodarowania zasobami". National Marine Fisheries Research Institute, Gdynia 2017 (mimeo).
137. Grygiel W., Biologiczna charakterystyka zasobów szprotów, [in:] Horbowy J. (ed.), Zadanie 1 – Biologiczna charakterystyka zasobów dorszy, śledzi, szprotów i płastug. Opracowanie roczne statutowego tematu badaw. DOT18/NB/Zasoby „Dynamika populacji ważniejszych użytkowo gatunków ryb południowego Bałtyku". National Marine Fisheries Research Institute, Gdynia 2018 (mimeo).
138. Grygiel W., Wyszyński M., Temporal (1980–2001) and geographic variation in the sexual maturity at age and length of herring and sprat inhabiting the Southern Baltic. Bulletin of the Sea Fisheries Institute 2003, 159 (2): 3–33.

139. Gudelis W.K., Jemielianow J.M. (eds.), Geologia Morza Bałtyckiego. Wydawnictwa Geologiczne, Warsaw 1982.
140. Guenther H., Hasselmann S., Janssen P.A.E.M., The WAM model cycle 4. No. DKRZ-TR--4(REV.ED.). Deutsches Klimarechenzentrum (DKRZ), Hamburg 2002.
141. Gusev A.A., Jurgens-Markina E.M., Growth and production of the bivalve Macoma balthica (Linnaeus, 1758) (Cardiida: Tellinidae) in the Southern Part of the Baltic Sea. Russian Journal of Marine Biology 2012, 38 (1): 56–63.
142. Gutteter-Grudziński J.M., Studium efektywności odolejania okrętowych wód zęzowych z wykorzystaniem sekcji hydrocyklonów i koalescencyjnych przegród porowatych. Wydawnictwo Naukowe Akademii Morskiej w Szczecinie, Szczecin 2012.
143. Hammar L., Andersson S., Rosenberg R., Adapting offshore wind power foundations to local environment. Report 5828. The Swedish Environmental Protection Agency, 2008.
144. Hammar L., Perry D., Gullström M., Offshore Wind Power for Marine Conservation. Open Journal of Marine Science 2016, 6: 66–78.
145. Hammar L., Wikström A., Molander S., Assessing ecological risks of offshore wind power on Kattegat cod. Renewable Energy 2014, 66: 414–424.
146. Hansen P.D., von Westernhagen H., Rosenthal H., Chlorinated hydrocarbons and hatching success in Baltic herring spawners. Mar. Environ. Res. 1985, 15: 59–76.
147. HELCOM Environment of The Baltic Sea area 1994–1998. Balt. Sea Environ. Proc. No. 82B. Helsinki Commission – Baltic Marine Environment Protection Commission, Helsinki 2002.
148. HELCOM, Biodiversity in the Baltic Sea – An integrated thematic assessment on biodiversity and nature conservation in the Baltic Sea. Balt. Sea Environ. Proc. No. 116B. Helsinki Commission – Baltic Marine Environment Protection Commission, Helsinki 2009.
149. HELCOM, Climate change in the Baltic Sea Area. HELCOM thematic assessment in 2013, Balt. Sea Environ. Proc. No. 137. Helsinki Commission – Baltic Marine Environment Protection Commission, Helsinki 2013.
150. HELCOM, Distribution of Baltic seals. HELCOM core indicator report, 2018; available at: https://helcom.fi/media/core%20indicators/Distribution-of-Baltic-seals-HELCOM-core-indicator-2018.pdf (accessed on: 30.04.2021).
151. HELCOM, HELCOM Guidelines for the Disposal of Dredged Material at Sea – Adopted in June 2007.
152. HELCOM, HELCOM Thematic assessment of biodiversity 2011–2016. Supplementary report to the HELCOM 'State of the Baltic Sea' report (pre-publication). Helsinki Commission – Baltic Marine Environment Protection Commission, Helsinki 2018.
153. HELCOM, Noise sensitivity of animals in the Baltic Sea. Balt. Sea Environ. Proc. No. 167, Helsinki Commission – Baltic Marine Environment Protection Commission, Helsinki 2019.
154. Hepworth Acoustics Ltd, Update of noise database for prediction of noise on construcion and open sities. Phase 3: Noise measurement data for contruction plant used on quarries. Department for Environment, Food and Rural Affairs (Defra), 2006: 12–13.
155. Hermannsen L., Beedholm K., Tougaard J., Madsen P.T., High frequency components of ship noise in shallow water with a discussion of implications for harbor porpoises (*Phocoena phocoena*). J. Acoust. Soc. Am. 2014, 136 (4): 1640–1653.
156. Hermannsen L., Tougaard J., Beedholm K., Nabe-Nielsen J., Madsen P.T., Characteristics and propagation of airgun pulses in shallow water with implications for effects on small marine mammals. PLoS ONE 2015, 10 (7): e0133436.
157. Hinchey E.K., Schaffner L., Hoar C., Vogt B., Batte L., Response of estuarine benthic invertebrates to sediment burial: the importance of mobility and adaptation. Hydrobiologia 2006, 556 (1): 85–98.

158. Hiscock K., Tyler-Walter H., Jones H., High Level Environmental Screening Study for Offshore Wind Farm Developments – Marine Habitats and Species Project. Report from the Marine Biological Association to The Department of Trade and Industry New & Renewable Energy Programme (AEA Technology, Environment Contract: W/35/00632/00/00), 2002.
159. Hiscock K., Tyler-Walters H., Assessing the sensitivity of seabed species and biotopes – the marine Life Information Network (MarLIN). Hydrobiologia 2006, 555: 309–320.
160. Hornsea Offshore Wind Farm. Project Two – Environmental Statement. Volume 5 – Offshore Annexes. Annex 5.1.6 – Cable Burial Plume Assessment, 2015.
161. Hummel H., Sokołowski A., Bogaards R., Wołowicz M., Ecophysiological and genetic traits of the baltic clam *Macoma balthica* in the Baltic. Differences between populations in the Gdańsk Bay due to acclimatization or genetic adaptation? Internat. Rev. Hydrobiol. 2000, 85: 621–637.
162. Hutchison Z., Bartley M., Degraer S., English P., Khan A., Livermore J., Rumes B., King J., Offshore wind energy and benthic habitat changes. Lessons from Block Island Wind Farm. Oceanography 2020, 33 (4): 58–69.
163. Hvidt C.B., Klaustrup M., Leonard S.B., Pedersen J., Fish at the cable trace Nysted offshore wind farm. Final report 2004. Prepared for ENERGI E2 A/S 2006.
164. ICES, Effects of Extraction of Marine Sediments on Fisheries. Cooperative Research Report No. 182. International Council for the Exploration of the Sea, Copenhagen 1992.
165. ICES, Effects of extraction of Marine Sediments on the Marine Ecosystem – Report of the Working Group on the Effects of Extraction of Marine Sediments on the Marine Ecosystem. ICES Cooperative Research Report No. 247. International Council for the Exploration of the Sea, Copenhagen 2001: 1–80.
166. Informatyczny System Osłony Kraju (ISOK – IT System of the Country's Protection Against Extreme Hazards); available at: https://wody.isok.gov.pl
167. Explanatory Notes to the Natura 2000 Standard Data Form. Version 2012.1. General Directorate for Environmental Protection, 2012: 1–46.
168. Institute of Meteorology and Water Management – National Research Institute IMWM-NRI report: Klimat Polski 2020; available at: https://www.imgw.pl/badania-nauka/klimat.
169. Institute of Oceanography of the University of Gdańsk; available at: https://ocean.ug.edu.pl/pages/pl/intro.php.
170. Jacques Whitford Ltd, Vancouver Island Transmission Reinforcement Project Technical Data Report: Potential Effects of Alkylbenzene Release to the Marine Environment. Prepared for British Columbia Transmission Corporation. Project No. BCV50466.27, 2006.
171. Jacquin L, Petitjean Q., Côte J., Laffaille P., Jean S., Effects of Pollution on Fish Behavior, Personality, and Cognition. Some Research Perspectives. Front. Ecol. Evol. 2020, 8: 86.
172. Jakubowska M., Urban-Malinga B., Otremba Z., Andrulewicz E., Effect of low frequency electromagnetic field on the behaviour and bioenergetics od the polychaete Hediste diversicolor. Marine Environmental Research 2019, 150: 104766.
173. Janas U., Kendzierska H., Benthic non-indigenous species among indigenous species and their habitat preferences in Puck Bay (southern Baltic Sea). Oceanologia 2014, 56 (3): 603–628.
174. Janßen H., Augustin C.B., Hinrichsen H.H., Kube S., Impact of secondary hard substrate on the distribution and abundance of Aurelia aurita in the western Baltic Sea Mar. Pollut. Bull. 2013, 75: 224–234.
175. Jasco Research Ltd, Vancouver Island Transmission Reinforcement Project. Atmospheric and Underwater Acoustics Assessment. Report prepared for British Columbia Transmission Corporation 2006: 1–49.

176. Jensen B.S., Klaustrup M., Skov H., EIA Report – Fish. Horns Rev 2 Offshore Wind Farm. Doc. No. 2676-03-001 – rev 4. Bio/consult as, 2006.
177. Jędrzejewski W., Nowak S., Stachura K., Skierczyński M., Mysłajek R. W., Niedziałkowski K., Jędrzejewska B., Wójcik J. M., Zalewska H., Pilot M., Górny M., Kurek R.T., Ślusarczyk R. Projekt korytarzy ekologicznych łączących Europejską Sieć Natura 2000 w Polsce. Mammal Research Institute, Polish Academy of Sciences, Białowieża 2011.
178. Jędrzejewski W., Nowak S., Stachura K., Skierczyński M., Mysłajek R.W., Niedziałkowski K., Jędrzejewska B., Wójcik J.M., Zalewska H., Pilot M., Projekt korytarzy ekologicznych łączących Europejską Sieć Natura 2000 w Polsce. Study prepared for the Ministry of the Environment (Agreement No. 13/N/2004 of 29 December 2004) as part of the Phare programme PL0105.02 "Implementation of the European Ecological Network in Poland". Mammal Research Institute, Polish Academy of Sciences, Białowieża 2005.
179. Jędrzejewski W., Nowak S., Stachura K., Skierczyński M., Mysłajek R.W., Niedziałkowski K., Jędrzejewska B., Wójcik J.M., Zalewska H., Pilot M., Górny M., Kurek R.T., Ślusarczyk R., Projekt korytarzy ekologicznych łączących Europejską Sieć Natura 2000 w Polsce. Mammal Research Institute, Polish Academy of Sciences, Białowieża 2011.
180. Johansson A.T., Andersson M., Ambient underwater noise levels at Norra Midsjöbanken during construction of the Nord Stream Pipeline. FOI-R-3469-SE. Swedish Defence Research Agency (FOI Totalförsvarets forskningsinstitut), Stockholm 2012.
181. Johnston D.W., Wildish D.J., Avoidance of dredge spoil by herring (Clupea harengus harengus). Bulletin of Environmental Contamination and Toxicology 1981, 26: 307–314.
182. Junghans H., Winkler H., Szuba M., Feldberechnungen von Mehrleiter-Freileitungssystemen mittels BC-Modellbildung (Wissenschaftliche Berichte der Technischen Hochschule Leipzig; H. 16), [in:] Computerintegrierte Systeme fuer die industrielle Elektroenergietechnik. 4 Wissenschaftliche Konferenz, Leipzig, 10-12 Oktober 1989. Leipzig 1989: 25–34.
183. Junghans H., Winkler H., Szuba M., Theoretische Analyse des elektrischen Feldes beliebiger Freileitungssysteme-Modell-bildung. Elektrie 1989: 350–352.
184. Kabata-Pendias A., Pendias H., Biochemia pierwiastków śladowych. PWN Publishing House, Warsaw 1993.
185. Kajzer Z., Barcz M., Guentzel S., Jasiński M., Liczebność ptaków wodno-błotnych na zachodnim wybrzeżu Bałtyku w sezonach 2008/2009–2010/2011. Ptaki Pomorza 2012, 3: 87–99.
186. Kaptur G., Bałtyk cierpi – ratujmy go wszyscy. Czas Morza 1999, 2 (12): 23–27.
187. Karta Informacyjna Przedsięwzięcia pn. Budowa SE 400 kV Choczewo. [Project Specification Sheet for the construction of the 400 kV Choczewo substation]. PSE, 2021.
188. Kastelein A.R., Helder-Hoek L., Hearing thresholds, for underwater sounds, of harbor seals (*Phoca vitulina*) at the water surface. The Journal of the Acoustical Society of America 2018, 143: 2554–2563.
189. Kastelein R.A., Hoek L., de Jong C.A.F., Wensveen P.J., The effect of signal duration on the underwater detection thresholds of a harbor porpoise (*Phocoena phocoena*) for single frequency-modulated tonal signals between 0.25 and 160 kHz. Journal of the Acoustical Society of America 2010, 128: 3211–3222.
190. Kastelein R.H., Manon H., Helder-Hoek L., Van de Voorde S., ter Hofstede R., van der Meij H., Behavioral Responses of Harbor Seals (*Phoca vitulina*) to FaunaGuard Seal Module Sounds at Two Background Noise Levels. Aquatic Mammals 2017, 43: 347–363.
191. Kaszubowski L.J., Coufal R., Analiza geologiczno-inżynierska dna polskiej części Morza Bałtyckiego, Bulletin of the Polish Geological Institute 2011, 446: 341–350.
192. Kaźmierczakowa R., Bloch-Orłowska J., Celka Z., Cwener A., Dajdok Z., Michalska-Hejduk D., Pawlikowski P., Szczęśniak E., Ziarnek K., Polska czerwona lista paprotników i roślin

kwiatowych. Polish red list of pteridophytes and flowering plants, Institute of Nature Conservation PAS, Cracow 2016.

193. Kerckhof F., Jacques T., Degraer S., Norro A., Early development of the subtidal marine biofouling on a concrete offshore windmill foundation on the Thornton Bank (southern North Sea): first monitoring results. International Journal of the Society for Underwater Technology 2010, 29 (3): 137–149.
194. Kerckhof F., Rumes B., Degraer S., About "mytilisation" and "slimeification". A decade of succession of the fouling assemblages on wind turbines off the Belgian coast, [in:] Degraer S., Brabant R., Rumes B., Vigin L. (eds.), Environmental Impacts of Offshore Wind Farms in the Belgian Part of the North Sea. Marking a Decade of Monitoring, Research and Innovation. Royal Belgian Institute of Natural Sciences, OD Natural Environment, Marine Ecology and Management Section, Brussels 2019: 73–84.
195. Kiaszkiewicz K., Ekspertyza na potrzeby uzupełnienia stanu wiedzy o siedliskach przyrodniczych: 2180, 4010, 7110, 7150 w obszarze Natura 2000 Białogóra PLH220003, w ramach projektu POIS.02.04.00-00-0191/16 pn. "Inwentaryzacja cennych siedlisk przyrodniczych kraju, gatunków występujących w ich obrębie oraz stworzenie Banku Danych o Zasobach Przyrodniczych". Paludella Pracownia Przyrodnicza, Torzym 2019.
196. Kiørboe T., Frantsen E., Jensen C., Nohr O., Effects of suspended sediment on development and hatching of herring (Clupea harengus) eggs. Estuarine and Coastal Shelf Science 1981, 13: 107–111.
197. Kjelland M.E., Woodley C.M., Swannack T.M., Smith D.L., A review of the potential effects of suspended sediment on fishes. Potential dredging-related physiological, behavioral, and transgenerational implications. Environment Systems and Decisions 2015, 35: 334–350.
198. Klöppel H., Fliedner A., Kordel W., Behaviour an ecotoxicology of aluminium in soil and water – review of the scientific literature. Chemosphere 1997, 35: 353–363.
199. Kloppmann M.H.F., Böttcher U., Damm U., Ehrich S., Mieske B., Schultz N., Zumholz K., Erfassung von FFH-Anhang II-Fischarten in der deutschen AWZ von Nord- und Ostsee. Final report for the German Federal Agency of Nature Conservation, 2003.
200. Koehler A., The gender-specific risk to liver toxicity and cancer of flounder (*Platichthys flesus* (L.)) at the German Wadden Sea coast, Aquat Toxicol. 2004, 70 (4): 257–276.
201. Köller J.A., Koppel J., Peters W. (ed.), Offshore wind energy. Research on environmental impacts. Springer Verlag, Berlin Heidelberg 2006.
202. European Commission, Long-term Strategy by 2050; available at: https://ec.europa.eu/clima/policies/strategies/2050_pl (accessed on: 17.11.2020).
203. The concept of the ecological network of Pomeranian Voivodeship for the needs of spatial planning. Pomeranian Office for Regional Planning, Gdańsk, 2014.
204. Kondracki J., Geografia regionalna Polski. PWN Publishing House, Warsaw, 2011.
205. Koops F.B.J., Electric and magnetic fields in consequence of undersea power cables, [in:] Effects of Electromagnetic Fields on the Living Environment: Proceedings of the International Seminar on Effects of Electromagnetic Field on the Living Environment., 2000: 189–210.
206. Kozaczka E., Grelowska G., Propagation of Ship-Generated Noise in Shallow Sea. Polish Maritime Research 2018, 25: 37–46.
207. Kramarska R., Krzywiec P., Dadlez R., Mapa geologiczna dna Bałtyku bez utworów czwartorzędowych, 1:500 000. Polish Geological Institute – National Research Institute, Gdańsk–Warsaw 1999.
208. Kramarska R., Osady na głębokości 1 m poniżej powierzchni dna, [in:] Mojski J.E. (ed.), Atlas geologiczny Południowego Bałtyku 1:500 000, Table XXI. Wydawnictwo Kartograficzne Polskiej Agencji Ekologicznej, Sopot–Warsaw 1995.

209. Kramarska R., Osady powierzchni dna, [in:] Mojski J.E. (ed.), Atlas geologiczny Południowego Bałtyku 1:500 000, Table XXV. Wydawnictwo Kartograficzne Polskiej Agencji Ekologicznej, Sopot–Warsaw 1995.
210. Kramarska R., Przekroje geologiczne (I), [in:] Mojski J.E. (ed.), Atlas geologiczny Południowego Bałtyku 1:500 000, Table XIX. Wydawnictwo Kartograficzne Polskiej Agencji Ekologicznej, Sopot–Warsaw 1995.
211. Kraus G., Köster F., Duration, frequency and timing of sprat spawning in the Central Baltic. An analysis based on gonad maturity. International Council for the Exploration of the Sea, C.M. 2001/J:25.
212. Krost P., Goerres M., Sandow V., Wildlife corridors under water: an approach to preserve marine biodiversity in heavily modified water bodies. Journal of Coastal Conservation 2017, 22: 87–104.
213. Kruk-Dowgiałło L., Kramarska R., Gajewski J. (eds.), Natural Habitats of the Polish Zone of the Baltic Sea. Volume 1: Boulder Area of the Słupsk Bank, Maritime Institute in Gdańsk, Polish Geological Institute – National Research Institute, 2011.
214. Krzemieniewski M., Teodorowicz M., Debowski M., Pesta J., Effects of a constant magnetic field on water quality and rearing of European sheatfish *Silurus glanis* L. larvae. Aquacult. Res. 2004, 35: 568–573.
215. Krzymiński W. (ed.)., Aktualizacja wstępnej oceny środowiska wód morskich, Work commissioned by the Chief Inspectorate of Environmental Protection, Warsaw 2018. 1–869.
216. Krzymiński W. (ed.), Wstępna ocena stanu środowiska wód morskich polskiej strefy Morza Bałtyckiego. Report for the European Commission, Chief Inspectorate for Environmental Protection, 2013.
217. Kuklik I., Skóra K.E., Foka szara (*Halichoerus grypus*), [in:] Głowaciński Z. (ed.), Polska czerwona księga zwierząt. Kręgowce. Państwowe Wydaw. Rolnicze i Leśne, Warsaw 2001: 98–100.
218. Kuklik I., Skóra K.E., Morświn (*Phocoena phocoena*), [in:] Głowaciński Z. (ed.), Polska czerwona księga zwierząt. Kręgowce. Państwowe Wydaw. Rolnicze i Leśne, Warsaw 2001: 82–84.
219. Ladich F., Fay R.R., Auditory evoked potential audiometry in fish. Reviews in Fish Biology and Fisheries 2013, 23: 317–364.
220. Langhamer O., Artificial reef effect in relation to offshore renewable energy conversion. State of the art. The Scientific World Journal 2012, (1): 1–8.
221. Langhamer O., Wilhelmsson D., Engström J., Artificial reef effect and fouling impacts on offshore wave power foundations and buoys – a pilot study. Estuarine, Coastal and Shelf Science 2009, 82: 426–432.
222. Lazarus M., Afranowicz-Cieślak R., Czerwona księga roślin naczyniowych Pomorza Gdańskiego. Tom 1, Zagrożone gatunki nadmorskich plaż, wydm i solnisk oraz wód słonawych strefy przymorskiej. University of Gdańsk Publishing House, Gdańsk, 2020.
223. Leonhard S., EIA Report. Benthic communities. Horns Rev 2 Offshore Wind Farm. No. 2706-03-003 rev. 4, 2006.
224. Leonhard S., Pedersen J., Benthic communities at Horns Rev before, during and after construction of Horns Rev Offshore Wind Farm. Final Report. Annual Report 2005. No. 2572-03-005 rev. 4, 2006.
225. Lepparänta M., Myrberg K., Physical Oceanography of the Baltic Sea. Springer, Berlin–Heidelberg–New York 2009.
226. Lerchl A., Zachmann A., Ali M.A., Reiter, R.J., The effect of pulsing fields on pineal melatonin synthesis in a teleost fish (brook trout, *Salvelinus fontinalis*). Neuroscience Letters 1998, 256: 171–173.

227. Lidzbarski M., Objaśnienia do mapy hydrogeologicznej Polski w skali 1:50 000. Arkusz Choczewo (0004) [Explanations to the Detailed Geological Map of Poland at a scale of 1:50 000, Choczewo sheet (0004)], Warsaw 2000.
228. Lidzbarski M., Objaśnienia do mapy hydrogeologicznej Polski w skali 1:50 000. Arkusz Choczewo (0004) [Explanations to the Detailed Geological Map of Poland at a scale of 1:50 000, Choczewo sheet (0004)]. Polish Geological Institute – Marine Geology Branch, Warsaw 2000.
229. Lindén O., The influence of crude oil on the ontogenetic development of the Baltic herring, Clupea harengus membras L. Ambio 1976, 5: 136–140.
230. Linie i stacje elektroenergetyczne w środowisku człowieka. Informator. PSE – Operator S.A., Biuro Konsultingowo-Inżynierskie „EKO-MARK", Warsaw 2005.
231. Lipnicki L., Czerwona lista porostów zagrożonych w Borach Tucholskich. Monogr. Bot. 2003, 91: 79–90.
232. Lüdeke J., Offshore Wind Energy. Good Practice in Impact Mitigation And Compensation. Journal of Environmental Assessment Policy and Management 2017, 19 (1): 1750005.
233. Madsen P.T., Wahlberg M., Tougaard J., Lucke K., Tyack P., Wind turbine underwater noise and marine mammals. Implications of current knowledge and data needs. Marine Ecology – Progress Series 2006, 309: 279–295.
234. Malinga M., Opioła R., Barańska A., Świstun K., Aninowska M., Przewodniki metodyczne – 1351 Morświn. Publication commissioned by the Chief Inspectorate for Environmental Protection, 2018; available at: http://morskiesiedliska.gios.gov.pl/images/1351_Morswin_OST.pdf.
235. Mańkowski W., Rumek A., Sukcesja obrastania przedmiotów podwodnych przez rośliny i zwierzęta w cyklach rocznych. Stud. i Mat. Ocean. 1975, 9: 15–44.
236. Marcinkowski T., Olszewski T., Morska Infrastruktura Przyłączeniowa – Baltic Power. Results of model calculations. Suspended solids dispersion in the Baltic Power MTI Area. Gdańsk–Gdynia 2021.
237. Marino A.A., Becker R.O., Biological effects of extremely low frequency electric and magnetic fields. A review. Physiological Chemistry and Physics 1977, 9 (2): 131–147.
238. Matuszkiewicz J.M., Analiza zmian w borach nadmorskich na Pobrzeżu Słowińskim od czasu badań Teofila Wojterskiego, [in:] Matuszkiewcz J.M. (ed.), Geobotaniczne rozpoznanie tendencji rozwojowych zbiorowisk leśnych w wybranych regionach Polski. Monografie 8. Polish Academy of Sciences, Stanisław Leszczycki Institute of Geography and Spatial Organization, Warsaw 2007: 35–59.
239. Maurer D., Keck R.T., Tinsman J.C., Leatham W.A., Wethe C., Lord C., Church T.M., Vertical migration and mortality of marine benthos in dredged material: a synthesis. Internationale Revue der Gesamten Hydrobiologie 1986, 71: 49-63.
240. Meissner K., Schabelon H., Bellebaum J., Sordyl H., Impacts of Submarine Cables on the Marine Environment. A Literature Review. Report by Institute of Applied Ecology (IfAÖ). Report for German Federal Agency for Nature Conservation (BfN), 2006.
241. Meissner K., Sordyl H., Literature Review of Offshore Wind Farms with Regard to Benthic Communities and Habitats, [in:] Zucco C., Wende W., Merck T., Köchling I., Köppel J. (eds.), Ecological Research on Offshore Wind Farms. International Exchange of Experiences. Part B: Literature Review of Ecological Impacts. BfN Skripten 186. Bundesamt für Naturschutz (BfN), Bonn 2006: 1–46.
242. Meissner W., Przybrzeżne wody Bałtyku, [in:] Wilk T., Jujka M., Krogulec J., Chylarecki P. (ed.), Ostoje ptaków o znaczeniu międzynarodowym w Polsce. Ogólnopolskie Towarzystwo Ochrony Ptaków, Marki 2010: 531–532.
243. Meissner W., Ptaki jako ofiary zanieczyszczeń mórz ropą i jej pochodnymi. Wiadomości Ekologiczne 2005, 51: 17–34.

244. Meissner W., Ptaki morskie, [in:] Sikora A., Chylarecki P., Meissner W., Neubauer G. (ed.), Monitoring ptaków wodno-błotnych w okresie wędrówek. Poradnik metodyczny, GDEP, Warsaw 2011: 93–102.
245. Merck T., Assessment of the environmental impacts of cables. Biodiversity Series No. 437/2009. OSPAR Commission, 2009.
246. Messieh S.N., Wildish S.N., Peterson R.H., Possible Impact from Dredging and Spil Disposal on the Miramichi Bay Herring Fishery. Canadian Technical Report of Fishery and Aquatic Science No. 1008. Minister of Supply and Services Canada, St. Andrews 1981: 1–37.
247. Miąc J., Groth M., Wołowicz M., Seasonal changes in the *Mya arenaria* (L.) population from Inner Puck Bay. Oceanologia 1997, 39 (2): 177–195.
248. Michaud E., Desrosiers G., Mermillod-Blondin F., Sundby B., Stora G. The functional group approach to bioturbation: II. The effects of the *Macoma balthica* community on fluxes of nutrients and dissolved organic carbon across the sediment–water interface, Journal of Experimental Marine Biology and Ecology 2006, 337: 178–189.
249. Miętus M., Sztobryn M., Stan środowiska polskiej strefy przybrzeżnej Bałtyku w latach 1986–2005, Institute of Meteorology and Water Management, National Research Institute, Warsaw 2011.
250. Migaszewski Z.M., Gałuszka A., Podstawy geochemii środowiska. Wydawnictwa Naukowo-Techniczne, Warsaw 2007.
251. Miller D.C., Muir C.L., Hauser O.A., Detrimental effects of sedimentation on marine benthos: what can be learned from natural processes and rates?, Ecological Engineering 2002, 19: 211–232.
252. Mojski J.E. (ed.), Atlas geologiczny Południowego Bałtyku – 1:500 000. Wydawnictwo Kartograficzne Polskiej Agencji Ekologicznej, Sopot–Warsaw 1995.
253. Momigliano P., Denys G.P.J., Jokinen H., Merilä J., *Platichthys solemdali* sp. nov. (Actinopterygii, Pleuronectiformes). A New Flounder Species From the Baltic Sea. Frontiers in Marine Science 2018, 5 (255): 1–21.
254. Moore P.G., Inorganic particulate suspensions in the sea and their effects on marine animals. Oceanogr. Mar. Biol. Ann. Rev. 1977, 15: 225–363.
255. Musiał E., Obciążalność cieplna oraz zabezpieczenia nadprądowe przewodów i kabli. "Informacje o normach i przepisach elektrycznych" Monthly magazine published by the Association of Polish Electrical Engineers 2008, 107: 3–41.
256. Nalcor Energy, Labrador-Island Transmission Link. Environmental Impact Statement. Chapter 3 – Project Description, 2012.
257. Nedwell J., Howell D., A review of offshore windfarm related underwater noise sources. Report No. 544 R 0308. Report commissioned by COWRIE. Subacoustech Ltd, Southampton 2004.
258. Newcombe C.P., MacDonald D.D., Effects of suspended sediments on aquatic ecosystems. North American Journal of Fisheries Management 1991, 11: 72–82.
259. Newton I., The Migration Ecology of Birds. Elsevier – Academic Press, Amsterdam–London 2008.
260. Nissling A., Dahlman G., Fecundity of flounder, *Pleuronectes flesus*, in the Baltic Sea—reproductive strategies in two sympatric populations. J. Sea Res. 2010, 64, 190–198.
261. Nissling A., Larsson R., Population specific sperm production in European flounder *Platichthys flesus*. Adaptation to salinity at spawning. J. Fish Biol. 2018, 93: 47–52.
262. Nissling A., Westin L., Hjerne O., Reproductive success in relation to salinity for three flatfish species, dab (*Limanda limanda*), plaice (Pleuronectes platessa), and flounder (Pleuronectes flesus), in the brackish water Baltic Sea. ICES Journal of Marine Science 2002, 59: 93–108.

263. NMFS, National Marine Fisheries Service, *Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing: Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts*, NOAA Technical Memorandum NMFS-OPR-55. U.S. Department of Commerce, NOAA, 2016 (July).
264. Nord Stream 2. Environmental And Social Monitoring In Swedish Waters, 2019. Document No. W-PE-EMO-PSE-REP-805-M02019EN-02. Ramboll, June 2020; available at: https://www.nord-stream2.com/en/pdf/document/448/.
265. Normandeau Associates Inc., Exponent Inc., Tricas T., Gill A., Effects of EMFs from Undersea Power Cables on Elasmobranchs and Other Marine Species. Final Report. OCS Study BOEMRE 2011-09. U.S. Department of the Interior, Bureau of Ocean Energy Management, Regulation and Enforcement. Pacific OCS Region, Camarillo 2011: 1–426.
266. Normant-Saremba M., Marszewska L., Kerckhof F., First record of the North-American amphipod Melita nitida Smith, 1873 in Polish coastal waters. Oceanological and Hydrobiological Studies 2017, 46 (1): 108–115.
267. NorthConnect KS, High Voltage Direct Current Cable Infrastructure. UK Environmental Impact Assessment Report. HVDC Cable Infrastructure EIAR Volume 1: Non-Technical Summary. No. NCGEN-NCT-X-RA-0003, July 2018; available at: https://northconnect.no/uploads/downloads/Britain/HVDC-Cable-Infrastructure-UK-EIAR-Volume-1-NTS.pdf.
268. NorthConnect, Cable Protection Analysis Report. NorthConnect KS, 2018: 1–87.
269. NSR Environmental Consultants, Basslink: draft integrated impact assessment statement summary report. Chapters 10–18. Hawthorn East, Vic. 2001.
270. O’Neil P., Chemia środowiska. PWN Publishing House, Warsaw–Wrocław 1998.
271. Obolewski K., Konkel M., Strzelczak A., Piesik Z., Distribution and the role of *Cerastoderma glaucum* (Poiret, 1789) in the Polish Baltic Sea coast. Baltic Coastal Zone 2007, 11: 13–24.
272. Assessment of plans and projects significantly affecting Natura 2000 sites, Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC, European Commission, 2001.
273. OGIMET – Weather Information Service; available at: https://www.ogimet.com.
274. Öhman M.C., Sigray P., Westerberg H., Offshore windmills and the effects of electromagnetic fields on fish. Ambio 2007, 36: 630–633.
275. Operat siedliskowy Nadleśnictwo Choczewo. Część I, Opis ogólny. Elaborat. [Habitat Survey Report of the Choczewo Forest District. Part I, General description. Study]. Bureau for Forest Management and Geodesy, Regional Office in Gdynia 2012.
276. Opioła R., Gajewski J., Kaczmarek N., Barańska A., Bojke A., Brocławik O., Brzezińska A., Celmer Z., Cuttat F., Dembska G., Drgas A., Druzd N., Dworniczak J., Dziaduch D., Edut J., Eisen M., Fey D., Flasińska A., Gajewski Ł., Galer-Tatarowicz K., Grygiel W., Horbowa K., Jasper B., Kałas M., Kapiński J., Kołakowska E., Kubacka M., Kunicki M., Kuzebski E., Lisimenka A., Littwin M., Marcinkowski T., Meissner W., Mirny Z., Misiewicz E., Mortensen L., Nermer T., Nocoń M., Olenycz M., Olszewski T., Ostrowska D., Pazikowska-Sapota G., Pick D., Radtke K., Rydzkowski P., Sadowska U., Sarnocińska J., Schack H., Schmidt B., Schönberger L., Skov H., Strzelecki D., Stöber U., Suska M., Szczepańska K., Szymanek L., Thomsen F., Tuhuteru N., Wróblewski R., Wyszyński M., Załęski K., Report on the Environmental Impact Assessment of the Baltic Power Offshore Wind Farm, Gdańsk–Gdynia 2020.
277. Orbicon, Horns Rev 3 Offshore Wind Farm – HR3-TR-025. Fish Ecology. Technical report no. 5. Energinet.dk, 2014.
278. Osowiecki A., Łysiak-Pastuszak E., Kruk-Dowgiałło L., Błeńska M., Brzeska P., Kraśniewski W., Lewandowski Ł., Krzymiński W., Development of tools for ecological quality assessment in

the Polish marine areas according to the Water Framework Directive. Part IV – preliminary assessment. Oceanological and Hydrobiological Studies 2012, 41 (3): 1–10.

279. OSPAR Commission, Assessment of the environmental impact of offshore wind-farms. OSPAR Biodiversity Series, Publication Number: 385/2008: 1–34.
280. OSPAR Commission, Background Document on potential problems associated with power cables other than those for oil and gas activities. Publication Number: 370/2008: 1–50.
281. OSPAR Commission, Guidelines on Best Environmental Practice (BEP) in Cable Laying and Operation. Agreement 2012-2. OSPAR 12/22/1, Annex 14.
282. OSPAR Commission, Overview of the impacts of anthropogenic underwater sound in the marine environment. Publication Number: 441/2009: 1–109.
283. OSPAR Commission, Underwater Noise; available at: https://www.ospar.org/work-areas/eiha/noise (accessed on: 30.04.2021).
284. Otremba Z., Andrulewicz E. Physical fields during construction and operation of wind farms by example of Polish maritime areas. Polish Maritime Research 2014, 21, 4 (84): 113–122.
285. Otremba Z., Jakubowska M., Urban-Malinga B., Andrulewicz E., Potential effects of electrical energy transmission – the case study from the Polish Marine Areas (southern Baltic Sea). Oceanological and Hydrobiological Studies 2019, 48 (2): 196–208.
286. Państwowe Gospodarstwo Wodne Wody Polskie [Polish Waters National Water Management]; available at: https://wodypolskie.bip.gov.pl
287. Polish Geological Institute – National Research Institute; available at: https://www.pgi.gov.pl/.
288. State Environmental Monitoring (SEM), Data of the State Environmental Monitoring regarding phytobenthos in the Polish Maritime Areas, 2002–2019.
289. State Environmental Monitoring, Monitoring of Polish Birds. Monitoring ptaków z uwzględnieniem obszarów specjalnej ochrony ptaków Natura 2000, lata 2015–2018. Etap VI, Zadanie 11. Syntetyczny raport końcowy z realizacji Monitoringu Ptaków Polski w latach 2015–2018. Chief Inspectorate for Environmental Protection, Marki 2018.
290. Parkman R.H., Curtis C.D., Vaughan D.J., Metal fixation and mobilization in sediments of the Afon Goch Estuary – Dulas Bay, Anglesey. Appl. Geochem. 1996, 11: 203–210.
291. Partridge G.J., Michael R.J., Direct and indirect effects of simulated calcareous dredge material on eggs and larvae of pink snapper *Pagrus auratus*. Journal of Fish Biology 2010, 77 (1): 227–240.
292. Petersen J K., Malm T., Offshore windmill farms. Threats to or possibilities for the marine environment. Ambio 2009, 35: 75–80.
293. Pęcherzewski K., Zawartość i rozmieszczenie substancji organicznych azotu i fosforu w osadach dennych południowego Bałtyku, [in:] Siudziński K. (ed.), Ekosystemy Morskie. Polish Academy of Sciences, Biology Institute, Fisheries Research Institute, Departament of Oceanography, Gdynia 1972: 51–76.
294. Pędzisz K., Awaryjność linii kablowych średniego napięcia. Przegląd Elektrotechniczny – Konferencje 2007, 5 (3): 180–183.
295. Phua C., van den Akker S., Baretta J., van Dalfsen M., Ecological Effects of Sand Extraction in the North Sea. Report, 2004: 1–22.
296. Piechocki A., Wawrzyniak-Wydrowska B., Guide to freshwater and marine mollusca of Poland. Bogucki Wydawnictwo Naukowe, Poznań 2016: 1–279.
297. Pikies R., Jurowska Z., Mapa geologiczna dna Bałtyku, 1:200 000, Arkusz Puck. [Geological Map of the Baltic Seabed at a scale of 1:200 000. Puck sheets]. Polish Geological Institute, Wydawnictwo Kartograficzne Polskiej Agencji Ekologicznej S.A., Warsaw 1994.

298. Pikies R., Jurowska Z., Objaśnienia do mapy geologicznej dna Bałtyku, 1:200 000. Arkusz Puck [Explanations to the Geological Map of the Baltic Seabed at a scale of 1:200 000. Puck sheets]. Polish Geological Institute, Warsaw 1995.
299. Pikies R., Morfogeneza dna, [in:] Mojski J.E. (ed.), Atlas geologiczny Południowego Bałtyku 1:500 000, Table XXIV. Wydawnictwo Kartograficzne Polskiej Agencji Ekologicznej, Sopot–Warsaw 1995.
300. Pilot implementation of species and marine habitats monitoring in 2015–2018. Maritime Institute in Gdańsk, DHI Polska Sp. z o.o. commissioned by CIEP.
301. Piotrowska H., Zróżnicowanie i dynamika nadmorskich lasów i zarośli w Polsce. Bogucki Wydawnictwo Naukowe, Poznań–Gdańsk 2003.
302. Plan Gospodarki Niskoemisyjnej dla gminy Choczewo. Fundacja Poszanowania Energii, Gdańsk 2015.
303. PN-ISO 9613-2:2002. Acoustics – Attenuation of sound during propagation outdoors – General method of calculation.
304. Podwodne Dziedzictwo – stowarzyszenie na rzecz poszukiwania, ochrony i upowszechniania dziedzictwa Morza Bałtyckiego, Duński parowiec S/S Elie [Underwater Heritage - Association for the exploration, conservation and promotion of Baltic Sea heritage, Danish S/S Elie]; available at: https://www.podwodnedziedzictwo.pl/dunski-parowiec-s-s-elie/.
305. Polak-Juszczak L., Trace metals in flounder, *Platichthys flesus* (Linnaeus, 1758), and sediments from the Baltic Sea and the Portuguese Atlantic coast. Environ. Sci. Pollut. Res. 2013, 20: 7424–7432.
306. Poléo A.B.S., Johannessen H.F., Harboe M.J., High voltage direct current (HVDC) sea cables and sea electrodes. Effects on marine life. Department of Biology, University of Oslo, Oslo, 2001: 1–50.
307. Polish Wind Energy Association, The future of offshore wind in Poland. PWEA Report, May 2019.
308. Polivajko A.G., O sostave nerestovogo stada baltiyskogo šprota, Fischerei-Forschung. Wissenschaftliche Schriftenreihe 1982: 43–50.
309. Pomeranian Heritage Conservation Officer, Regional Heritage Conservation Office in Gdańsk, Regional register of historic monuments; available at: https://www.ochronazabytkow.gda.pl/wojewodzka-ewidencja-zabytkow/.
310. Popper A.N., Hawkins A.D., An overview of fish bioacoustics and the impacts of anthropogenic sounds on fishes. J. Fish. Biol. 2019, 94: 692–713.
311. Popper A.N., Hawkins A.D., Fay R.R., Mann D.A., Bartol S., Carlson T.J., Coombs S., Ellison W.T., Gentry R.L., Halvorsen M.B., Løkkeborg S., Rogers P.H., Southall B.L., Zeddies D.G., Tavolga W.N., Sound Exposure Guidelines for Fishes and Sea Turtles. A Technical Report prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI. ASA S3/SC1.4 TR-2014. Spinger Cham, Heidelberg–New York–Dordrecht–London 2014: 1–16.
312. Popper A.N., Hawkins A.D., The importance of particle motion to fishes and invertebrates. The Journal of the Acoustical Society of America 2018, 143: 470–486.
313. Poradnik przygotowania inwestycji z uwzględnieniem zmian klimatu, ich łagodzenia i przystosowania do tych zmian oraz odporności na klęski żywiołowe. Ministry of the Environment, Department of Sustainable Development, Warsaw 2015.
314. Posford Duvivier Environment, Hill M.I., Guidelines on the impact of aggregate extraction on European Marine Sites. Countryside Council for Wales (UK Marine SACs Project), 2001.
315. HPZ'2001 Windows software: Version: March 2012. License of the Acoustics Laboratory of the Building Research Institute: HPZ-0217 for Ars Vitae.
316. Program ochrony środowiska dla gminy Choczewo na lata 2019–2022 z perspektywą do 2025 roku, Choczewo 2019.

317. Prus P., Popek Z., Pawlaczyk P., Dobre praktyki utrzymania rzek. WWF Polska, Warsaw 2018.
318. Przewoźniak M., Ochrona przyrody i krajobrazu Kaszub. Studium krytyczne z autopsji. Bogucki Wydawnictwo Naukowe, Gdańsk–Poznań 2017.
319. Rakowska A., Elektroenergetyczne linie napowietrzne i kablowe w pracach CIGRE. XIII Sympozjum „Nowoczesne rozwiązania w budownictwie sieciowym", Ostrów Wielkopolski, 11.01.2017.
320. Rambøll, Sæby Offshore Wind Farm. Fish. Background Memo. Revision 3. Ref. ROGC-S-RA-000017, København 2014; available at: https://naturstyrelsen.dk/media/137800/atr08a_fish_saeby_april-2015.pdf.
321. Environmental Impact Assessment Report for the project "Construction of Piła Krzewina-Plewiska 400 kV power line", proeko, Gdańsk 2018; available at: https://urzad.dopiewo.pl/ROS_KRZ-PLE_streszczenie_27_03_2018.pdf.
322. Report on the State of the Environment in the Pomeranian Voivodeship in 2018. VIEP, Gdańsk 2020.
323. Rellini M., Torchia G., Rellini G., Seasonal Variation of Fish Assemblages in the Loano Artificial Reef (Ligurian Sea Northwestern-Mediterranean). Bull. Mar. Sci. 1994, 55 (2–3): 401–417.
324. Reszko M., Plan przeciwdziałania zanieczyszczeniom olejowym [Oil Pollution Prevention Plan]. Baltic Power Offshore Wind Farm, 2020.
325. Reubens J., Braeckman U., Vanaverbeke J., Van Colen C., Degraer S., Vincx M., Aggregation at windmill artificial reefs: CPUE of Atlantic cod (Gadus morhua) and pouting (Trisopterus luscus) at different habitats in the Belgian part of the North Sea. Fisheries Research 2013, 139: 28–34.
326. Reubens J., Degraer S., Vincx M., Aggregation and feeding behaviour of pouting (Trisopterus luscus) at wind turbines in the Belgian part of the North Sea. Fisheries Research 2011, 108: 223–227.
327. Review of Cabling Techniques and Environmental Effects Applicable to the Offshore Wind Farm Industry. Technical Report. Department for Business, Enterprise and Regulatory Reform (BERR) in association with the Department for Environment, Food and Rural Affairs (DEFRA), 2008: 1–159.
328. Richardson W.J., Malme C.I., Green Jr C.R., Thomson D.H., Marine mammals and noise. Academic Press, San Diego 1995.
329. Richling A., Ostaszewska M. (eds.), Geografia fizyczna Polski, PWN Publishing House, Warsaw 2005.
330. Rönbäck P., Westerberg H., Sedimenteffekter på pelagiska fiskägg och gulesäckslarver. Fiskeriverket, Kustlaboratoriet, Frölunda 1996.
331. Rostin L., Martin G., Herkul K., Environmental concerns related to the construction of offshore wind parks: Baltic Sea case, [in:] Coastal Processes III. WIT Transactions on Ecology and the Environment. WIT Press, Southampton 2013: 131–140.
332. Rousseau C., Baraud F., Leleyter L., Gil O., Cathodic protection by zinc sacrificial anodes. Impact on marine sediment metallic contamination. Journal of Hazardous Materials 2009, 167 (1–3): 953–958.
333. Regulation of the Minister of the Environment of 30 October 2014 on the requirements for conducting measurements of emission volumes and measurements of the amount of water consumed (Journal of Laws of 2019, item 2286).
334. Regulation of the Council of Ministers of 18 October 2016 on the Vistula River Basin Management Plan (Journal of Laws 2006, no. 2016, item 1911).
335. Rucińska-Zjadacz M., Rudowski S., Morpholithodynamic conditions of the tip of the Hel Peninsula, the Baltic Sea. Oceanological and Hydrobiological Studies 2015, 44 (2): 181–192.

336. Ruhle E. (ed.), Mapa geologiczna Polski bez utworów kenozoicznych i kredowych, 1:500 000. Wydawnictwa Geologiczne, Warsaw 1978.
337. Rumiński J., Mapa litogenetyczna Polski 1:50 000. Arkusz Choczewo. Polish Geological Institute – National Research Institute, Warsaw 2007.
338. SAMBAH II LIFE, Spatio-temporal Monitoring of the Baltic Proper Harbour Porpoise and its Habitat; available at: https://portal.helcom.fi/meetings/EG%20MAMA%2013-2019-641/presentations/presentation%207%20SAMBAH%20II%20LIFE_2.pdf.
339. SAMBAH, Final report for LIFE+ project SAMBAH LIFE08 NAT/S/000261 covering the project activities from 01/01/2010 to 30/09/2015. Annex 7.2.19 Habitat modelling report, 2016.
340. SAMBAH, Final report for LIFE+ project SAMBAH LIFE08 NAT/S/000261 covering the project activities from 01/01/2010 to 30/09/2015, 2016.
341. SAMBAH, Heard but not seen. Non-technical Report Static Acoustic Monitoring of the Baltic Sea Harbour Porpoise. LIFE08 NAT/S/000261; available at: http://www.sambah.org/Non-technical-report-v.-1.8.1.pdf (accessed on: 30.04.2021).
342. SAMBAH, LIFE – After Life Conservation Plan. SAMBAH – Static Acoustic Monitoring of the Baltic Sea Harbour Porpoise. LIFE08 NAT/S/000261; available at: http://www.sambah.org/SAMBAH-After-Life-Conservation-Plan_Final-PL.pdf.
343. SAMBAH, Słyszane – nie widziane. Non-technical Report Static Acoustic Monitoring the Baltic Harbour Porpoise. LIFE08 NAT/S/000261 (Polish version); available at: http://www.sambah.org/Laymans-Report_A5-v-1.6-print_PL.pdf.
344. Sapota M.R., Bałazy P., Mirny Z., Modification in the nest guarding strategy – one of the reasons of the round goby (*Neogobius melanostomus*) invasion success in the Gulf of Gdańsk? Oceanological and Hydrobiological Studies 2014, 43: 21–28.
345. Sawicki A., Rola lasu w bilansie węgla oraz jej odzwierciedlenie w badaniach naukowych. Przegląd Leśniczy 2009, 19 (4): 5.
346. Schreiber M., Gellermann M., Gerdes G., Rehfeldt K., Maßnahmen zur Vermeidung und Verminderung negativer ökologischer Auswirkungen bei der Netzanbindung und – integration von Offshore-Windparks. Gutachten im Auftrag des BMU, FKZ 0327530. Final report, 2004: 1–217.
347. Siepak J. (ed.), Analiza specjacyjna metali w próbkach wód i osadów dennych. Publishing House of AMU, Poznań 1998.
348. Sikora A. (ed.), Atlas rozmieszczenia ptaków lęgowych Polski 1985–2004. Bogucki Wyd. Nauk., Poznań 2007.
349. Sikora A., Chylarecki P., Meissner W., Neubauer G. (ed.), Monitoring ptaków wodno-błotnych w okresie wędrówek. *Poradnik metodyczny,* General Directorate for Environmental Protection, Warsaw 2011: 1–158.
350. Sissenwine M.P., Cohen E.B., Grosslein M.D., Structure of the Georges Bank ecosystem. Rapports et Procès-Verbaux des Réunions – Conseil International pour l'Exploration de la Mer 1984, 183: 243–254.
351. Sitkiewicz P., Wróblewski R., Zmienność strefy brzegowej w rejonie Władysławowa na podstawie analizy zdjęć lotniczych, [in:] Kostrzewski A., Zwoliński Z., Winowski M. (ed.), Geoekosystem wybrzeży morskich, 2. Uwarunkowania i funkcjonowanie geoekosystemów wybrzeży morskich. Institute of Geoecology and Geoinformation, Department of Geoecology, Biała Góra Environmental Monitoring Station, Centre for Integrated Environmental Monitoring, Poznań–Białogóra 2013: 111–114.
352. Skjellerup P., Maxon C., Tarpgaard E., Thomsen F., Schack H., Tougaard J., Teilmann J., Madsen K., Michaelsen M., Heilskov N., Marine mammals and underwater noise in relation to pile driving – Working Group 2014. Report to the Danish Energy Authority. Project: Effects of offshore renewables on marine mammals, 2015.

353. Skompski S., Objaśnienia do szczegółowej mapy geologicznej Polski 1:50 000. Arkusz Choczewo (4). Wydawnictwa Geologiczne, Warsaw 1985.
354. Skompski S., Szczegółowa mapa geologiczna Polski 1:50 000. Arkusz Choczewo (4). Wydawnictwa Geologiczne, Warsaw 1985.
355. Spagnolo A., Cuicchi C., Biasi A., Ferra C., Montagnini L., Punzo E., Salvalaggio V., Santelli A., Strafella P., Fabi G., Effects of the installation of offshore pipelines on macrozoobenthic communities (northern and central Adriatic Sea). Marine Pollution Bulletin 2019, 138: 534–544.
356. Stankeviciute M., Jakubowska M., Pazusiene J., Makaras T., Otremba Z., Urban-Malinga B., Fey D., Greszkiewicz M., Sauliute G., Barsiene J., Andrulewicz E., Genotoxic and cytotoxic effects of 50 Hz 1 mT electromagnetic field on larval rainbow trout (Oncorhynchus mykiss), Baltic clam (Limecola balthica) and common ragworm (Hediste diversicolor). Aquatic Toxicology 2019, 208: 109–117.
357. Stenberg C., Støttrup J., van Deurs M., Berg C., Dinesen G., Mosegaard H., Grome T., Leonhard S., Long-term effects of an offshore wind farm in the North Sea on fish communities. Marine Ecology Progress Series 2015, 528: 257–265.
358. Stiller J., Rakowska A., Grzybowski A., Oddziaływanie linii kablowych najwyższych napięć prądu przemiennego (AC) na środowisko. Institute of Electrical Power Engineering, Poznan University of Technology, Poznań 2006.
359. Stone R.B., Pratt H.L., Parker R.O., Davis G.E., A comparison of fish populations on an artificial and natural reef in the Florida Keys. Mar. Fish. Rev. 1979, 41 (9): 1–11.
360. A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy. European Commission's Communication (COM 2015/80 final), 2015.
361. Polish National Strategy for Adaptation to Climate Change by 2020 with the perspective by 2030. Ministry of the Environment 2013: 1–60; available at: https://bip.mos.gov.pl/fileadmin/user_upload/bip/strategie_plany_programy/Strategiczny_plan_adaptacji_2020.pdf.
362. Struhsaker J.W., Effects of benzene (a toxic component of petroleum) on spawning Pacific herring, *Clupea harengus palassi*. U.S. Nat.Mar. Fish. Serv. Fish. Bull. 1977, 75: 43–49.
363. Stryjecki M., Mielniczuk K., Biegaj J., Przewodnik po procedurach lokalizacyjnych i środowiskowych dla farm wiatrowych na polskich obszarach morskich. Foundation for Sustainable Energy, Warsaw 2011.
364. Stryjecki M., Mielniczuk K., Wytyczne w zakresie prognozowania oddziaływań na środowisko morskich farm wiatrowych, GDEP, Warsaw 2011; available at: https://fnez.pl/wp-content/uploads/2020/06/Wytyczne.pdf (accessed on: 11.02.2014).
365. Surowska B., Wybrane zagadnienia z korozji i ochrony przed korozją. Lublin University of Technology, Lublin 2002.
366. Sutton S.J., Lewin P.L., Swingler S.G., Review of global HVDC subsea cable projects and the application of sea electrodes. Electrical Power and Energy Systems 2017, 87: 121–135.
367. Sveegaard S, Teilmann J, Galatius A., Abundance survey of harbour porpoises in Kattegat, Belt Seas and the Western Baltic, July 2012. Note from DCE – Danish Centre for Environment and Energy, 2013: 1–11.
368. Sweden Offshore Wind AB, Wind Farm – Kriegers Flak. Environmental Impact Assessment. Report No. 11335735. Vattenfall Group, 2007.
369. Szaniawska A., Baltic Crustaceans, Springer International Publishing AG, 2018: 1–199.
370. Szaniawska A., Gospodarka energetyczna bezkręgowców bentosowych występujących w Zatoce Gdańskiej. Habilitation thesis. Publishing House of University of Gdańsk, 1991.
371. Szlinder-Richert J., Usydus Z., Drgas A., Persistent organic pollutants in sediment from the southern Baltic: risk assessment. Journal of Environmental Monitoring 2012, 14: 2100–2107.

372. Szuba M., Pole magnetyczne w otoczeniu linii i rozdzielni wysokiego napięcia. Energetyka 1992, 8: 269–274.
373. Szymelfening M., Urbański J., Andrulewicz E. (eds.), Morze Bałtyckie – o tym warto wiedzieć. Polish Ecological Club. East Pomerania Branch, Gdańsk 1998.
374. Taormina B., Bald J., Want A., Thouzeau G., Lejart M., Desroy N., Carlier A., A review of potential impacts of submarine power cables on the marine environment. Knowledge gaps, recommendations and future directions. Renewable and Sustainable Energy Reviews 2018, 96: 380–391.
375. Temple H.J., Terry A., (ed.), The Status and Distribution of European Mammals. Office for Official Publications of the European Communities, Luxembourg 2007.
376. The BACC II Author Team, Second Assessment of Climate Change for the Baltic Sea Basin. Springer Cham, Heidelberg–New York–Dordrecht–London 2015.
377. Thiel R., Winkler H.M., Urho L., Zur Veränderung der Fischfauna, [in:] Lozán J.L., Lampe R., Matthäus W., Rachor E., Rumohr H., von Westernhagen H., Warnsignale aus der Ostsee – Wissenschaftlich Fakten. Parey Verlag, Berlin 1996: 181–188.
378. Thomas L., Burt L., SAMBAH Statistical methods and results, [in:] SAMBAH. End-of-project conference. Report. Kolmården, 8th December 2014. Annex 7.3.5, 2014: 23–38.
379. Thomsen F., Lüdemann K., Kafemann R., Piper W., Effects of offshore wind farm noise on marine mammals and fish. Biola, Hamburg, Germany on behalf of COWRIE Ltd., 2006.
380. Thomsen F., Stöber U., Yalçin G., Sehested H.I., See more Environmental Impact Assessment of the Baltica 2 and 3 Offshore Wind Farms. Numerical Modelling of Noise Propagation from Pile Driving. Technical report. Denmark 2017.
381. Tomiałojć L., Stawarczyk T., Awifauna Polski. Rozmieszczenie, liczebność i zmiany, PTPP „pro Natura", Wrocław 2003.
382. Topham E., Gonzalez E., McMillan D., João E., Challenges of decommissioning offshore wind farms. Overview of the European experience. Journal of Physics: Conference Series 1222, 012035, 2019.
383. Topham E., McMillan D., Bradley S., Hart E., Recycling offshore wind farms at decommissioning stage. Energy Policy 2019, 129: 698–709.
384. Tougaard J., Persson L., Andersson M.H., Pajala J., Tegowski J., Mantuchek R., Betke K., Wahlberg M., Folegot T., Verfuss U., Sigray P., Sea information about the acoustic soundscape (BIAS): Standards for measurements and signal processing, [in:] Evans P. (ed.), Proceedings of the ECS/ASCOBANS/ACCOBAMS joint workshop on introducing noise into the marine environment: Held at the European Cetacean Society's 28th Annual Conference, Liège, Belgium, 6th April 2014, 2015: 77–81.
385. Trwają badania obecności morświnów w przybrzeżnej strefie polskiej części Bałtyku [Ongoing study of the presence of harbour porpoises in the coastal zone of the Polish part of the Baltic Sea]. Hel Marine Station of the Institute of Oceanography of the University of Gdańsk; available at: https://hel.ug.edu.pl/2021/04/23/trwaja-badania-obecnosci-morswinow-w-przybrzeznej-strefie-polskiej-czesci-baltyku/ (accessed on: 30.04.2021).
386. Trzeciak A., Wstęp do chemii nieorganicznej środowiska. Publishing House of the University of Wrocław, Wrocław 1995.
387. Turner C.H., Ebert E.E., Given R.R., Fish Bulletin 146. Man-Made Reef Ecology. State of California, The Resources Agency Department of Fish and Game, San Diego 1969: 1–221.
388. European Union, Climate Action and the Green Deal; available at: https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/climate-action-and-green-deal_pl
389. UNISENSE A/S, Ramsing N., Gundersen J., Seawater and Gases. Tabulated physical parameters of interest to people working with microsensors in marine system, 2000.

390. Urban-Maliga B., Warzocha J., Zalewski M., Effects of the invasive polychaete Marenzelleria spp. on benthic processes and meiobenthos of a species-poor brackish system. Journal of Sea Research 2013, 80: 25–34.
391. URS Corporation, Draft environmental impact report for the proposed TransBay Cable Project, vol. 1, section 1.0–11.0, Appendix A, 2006.
392. Maritime Office in Gdynia – website; available at: https://www.umgdy.gov.pl/.
393. Usero J., Gamero M., Morillo J., Gracia I., Comparative study of three sequential extraction procedures for metals in marine sediments. Environmental International 1998, 24 (4): 487–496.
394. Uścinowicz S., Geochemia osadów powierzchniowych Morza Bałtyckiego. Polish Geological Institute – National Research Institute, Warsaw 2011.
395. Uścinowicz S., Miąższość plejstocenu, [in]: Mojski J.E. (ed.), Atlas geologiczny południowego Bałtyku – 1:500 000, Table XIII. Wydawnictwo Kartograficzne Polskiej Agencji Ekologicznej, Sopot–Warsaw 1995.
396. Uścinowicz S., Miąższość holocenu, [in]: Mojski J.E. (ed.), Atlas geologiczny Południowego Bałtyku – 1:500 000, Table XXIII. Wydawnictwo Kartograficzne Polskiej Agencji Ekologicznej, Sopot–Warsaw 1995.
397. Uścinowicz S., Miąższość plejstocenu, [in]: Mojski J.E. (ed.), Atlas geologiczny Południowego Bałtyku – 1:500 000, Table XIV. Wydawnictwo Kartograficzne Polskiej Agencji Ekologicznej, Sopot–Warsaw 1995.
398. Uścinowicz S., The Baltic Sea Continental Shelf, [in]: Chiocci F., Chivas A. (eds.), Continental Shelves of the World. Their Evolution During the Last Glacio-Eustatic Cycle, The Geological Society of London, 2014.
399. Uścinowicz S., Zachowicz J., Mapa geologiczna dna Bałtyku w skali 1:200 000. Arkusz Łeba, Słupsk. Polish Geological Institute, Warsaw 1988.
400. Uścinowicz S., Zachowicz J., Objaśnienia do mapy geologicznej dna Bałtyku w skali 1:200 000. Arkusz Łeba, Słupsk. Polish Geological Institute, Warsaw 1991.
401. Utne-Palm A.C., Effects of larvae ontogeny, turbidity, and turbulence on prey attack rate and swimming activity of Atlantic herring larvae. Journal of Experimental Marine Biology and Ecology 2004, 310: 147–161.
402. Veldhuizen P., Meijer B., Truijens J., Vree D., Gockel P., Lammers L., Track S., 2009 Polenergia Offshore Wind Developments for projects Middle Baltic II and Middle Baltic III. High Level Technical Design Options Study. Royal Haskoning DHV – Enhancing Society Together. Version 1 – initial concept. Rev. 2.0 – 4 February 2014.
403. Vethaak A.D., Wester P.W., Diseases of flounder *Platichthys flesus* in Dutch coastal and estuarine waters, with particular reference to environmental stress factors. II. Liver histopathology. Dis. Aquat. Org. 1996, 26: 99–116.
404. von der Leyen U., A Union that strives for more. My agenda for Europe. Political Guidelines for the Next European Commission (2019–2024); available at: https://ec.europa.eu/info/sites/info/files/political-guidelines-next-commission_pl.pdf (accessed on: 17.11.2020).
405. Vuorinen I., Antsulevich A., Maximovich N., Spatial distribution and growth of the common Mytilus trossulus L. in the archipelago of SW-Finland, northern Baltic Sea. Boreal Environment Research 2002, 7: 41–52.
406. Wandzel T., Babka okrągła Neogobius melanostomus (Pallas, 1811) – nowy komponent ichtiocenozy południowego Bałtyku. Rola w ekosystemie i rybołówstwie. Monograph. National Marine Fisheries Research Institute, Gdynia 2003: 1–76.
407. Vector layer with description: Shipwrecks in Polish maritime areas and other objects. Maritime Administration Spatial Information System; available at: https://sipam.gov.pl/.

408. Warzocha J., Rzemykowska H., Gromisz S., Szymanek L., Fauna denna, [in:] Gic-Grusza G., Kryla-Straszewska L., Urbański J., Warzocha J., Węsławski J.M. (ed.), Atlas siedlisk dna polskich obszarów morskich. Waloryzacja przyrodnicza siedlisk morskich. Broker-Innowacji Gabriela Gic-Grusza, Gdynia 2009: 60–85.
409. Wedemeyer G.A., McLeay D.J., Goodyear C.P., Assessing the tolerance of fish and fish populations to environmental stress: the problems and methods of monitoring [in:] Cairns V.W., Hodson P.V., Nriagu J.O. (ed.), Containment effects on fisheries. John Wiley & Sons, Inc., New York 1984.
410. Weiner J., Życie i ewolucja biosfery. PWN Publishing House, Warsaw 2005.
411. Westerberg H., Begout-Anras M.L., Orientation of silver eel (Anguilla anguilla) in a disturbed geomagnetic field, [in:] Moore A., Russel I. (ed.), Advances in fish telemetry. Proceedings of the Third Conference on Fish Telemetry in Europe, held in Norwich, England, 20–25 June. Centre for Environment, Fisheries and Aquaculture Science (CEFAS), Lowestoft, 2000.
412. Westerberg H., Rännbäek P., Frimansson H., Effects of suspended sediments on cod egg and larvae and on the behaviour of adult herring and cod. International Council for the Exploration of the Sea, CM 1996/E:26: 1–13.
413. Westin D.T., Olney C.E., Rogers B.A., Effects of Parental and Dietary Organochlorines on Survival and Body Burdens of Striped Bass Larvae. Transactions of the American Fisheries Society 1985, 114 (1): 137–145.
414. Węsławski J.M., Waloryzacja dna morskiego, [in:] Gic-Grusza G., Kryla-Straszewska L., Urbański J., Warzocha J., Węsławski J.M. (ed.), Atlas siedlisk dna polskich obszarów morskich. Waloryzacja przyrodnicza siedlisk morskich. Broker-Innowacji Gabriela Gic-Grusza, Gdynia 2009: pp. 14–15, 86–87, 92–93.
415. Wilding T., Gillb A., Boonc A., Sheehand E., Dauvine J., Pezye J., O'Beirn F., Janas U., Rostin L., De Mesel I., Turning off the DRIP ('Data-rich, information-poor') – rationalizing monitoring with a focus on marine renewable energy developments and the benthos. Renewable and Sustainable Energy Reviews 2017, 74: 848–859.
416. Wilhelmsson D., Malm T., Fouling assemblages on offshore wind power plants and adjacent substrata. Estuar. Coast. Shelf Sci. 2008, 79: 459–446.
417. Wilhelmsson D., Malm T., Thompson R., Tchou J., Sarantakos G., McCormick N., Luitjens S., Gullström M., Patterson Edwards J.K., Amir O., Dubi A., Greening blue energy: identifying and managing the biodiversity risks and opportunities of offshore renewable energy. International Union for Conservation of Nature (IUCN), Gland 2010: 1–102.
418. Wilk T., Chodkiewicz T., Sikora A., Chylarecki P., Kuczyński L., Czerwona lista ptaków Polski. Polish Society for the Protection of Birds, Marki 2020.
419. Wilk T., Kryteria lęgowości ptaków – materiały pomocnicze. Version 3 – 16.02.2016, Polish Society for the Protection of Birds, Marki 2016.
420. Wilmann R., Muscheln und Schnecken der Nord-und Ostsee. Neumann-Neudamm, Melsungen 1989: 1–310.
421. Wilson J.C., Elliott M., Cutts N.D., Mander L., Mendao V., Perez-Dominguez R., Phelps A., Coastal and offshore wind energy generation. Is it environmentally benign? Energies 2010, 3: 1383–1422.
422. Wiśniewski B., Wolski T., Katalogi wezbrań sztormowych i obniżeń posztormowych poziomów morza oraz ekstremalne poziomy wód na polskim wybrzeżu. Szczecin 2009: 1–156.
423. Wiśniewski S., Dembska G., Grynkiewicz M., Sapota G., Aftanas B., Badania form fosforu w osadach powierzchniowych strefy brzegowej Zatoki Gdańskiej i osadach dennych kanałów portowych Gdańska i Gdyni. Ekologia i Technika 2006, XIV (supl.): 113–116.

424. Witt G., Occurrence and transport of polycyclic aromatic hydrocarbons in the water of the Baltic Sea. Marine Chemistry 2002, 79: 49–66.
425. Wojciechowski A., Ewolucja jezior przybrzeżnych Niziny Gardzieńsko-Łebskiej na tle rozwoju środkowego wybrzeża Bałtyku w świetle badań malakologicznych, Landform Analysis 2008, 7: 154–171.
426. Wojterski T., Bory bagienne na Pobrzeżu Zachodniokaszubskim. Badania Fizjograficzne nad Polską Zachodnią, ser. B 1963, 12: 139–191.
427. Wojterski T., Bory sosnowe na wydmach nadmorskich na polskim wybrzeżu. Państwowe Wydawnictwo Naukowe – Poznań Branch 1964: 1–217.
428. Wolski T., Wiśniewski B., Changes of Maximum Sea Levels at Selected Gauge Stations on the Polish and Swedish Baltic Coast. Scientific Papers of the University of Szczecin. Studies and Papers of the Faculty of Economic Sciences and Management 2012, 29: 209–227.
429. Wolski T., Wiśniewski B., Musielak S., Baltic Sea datums and their unification as a basis for coastal and seabed studies. Oceanological and Hydrobiological Studies 2016, 45 (2): 239–258.
430. Woodruff D., Schultz I., Marshall K., Ward J., Cullinan V., Effects of Electromagnetic Fields on Fish and Invertebrates. Task 2.1.3: Effects on Aquatic Organisms Fiscal Year 2011 Progress Report. Environmental Effects of Marine and Hydrokinetic Energy. PNNL-20813 Final. Pacific Northwest National Laboratory, Richland 2012.
431. Worzyk T., Submarine Power Cables. Design, Installation, Repair, Environmental Aspects. Springer-Verlag, Berlin Heidelberg 2009: 1–296.
432. Wpływ zmian klimatu na środowisko, gospodarkę i społeczeństwo (zmiany, skutki i sposoby ich ograniczania, wnioski dla nauki, praktyki inżynierskiej i planowania gospodarczego), project of the Institute of Meteorology and Water Management as part of the Innovative Economy Operational Programme, Priority Axis 1, Measure 1.3, Submeasure 1.3.1 (POIG.01.03.01-14-011/08-00).
433. Wszołek T., Modelowanie zjawisk wibroakustycznych w systemach przesyłowych najwyższych napięć. Scientific Publishing House of the Institute for Sustainable Technologies – National Research Institute, Radom, 2013.
434. Wszołek T., Prognozowanie poziomu L_{DWN} hałasu ulotu w liniach elektroenergetycznych WN. Przegląd Elektrotechniczny 2006, 1: 283–286.
435. Wszołek T., Ustalenie standardowych szerokości pasów technologicznych dla istniejących linii 220 i 400 kV. Energoprojekt, Kraków 2006.
436. Yelverton J.T., Richmond D.R., Fletcher E.R., Jones R.K., Safe distance from underwater explosions for mammals and birds. AD-766 952. Lovelace Foundation for Medical Education and Research, Albuquergue 1973.
437. Zachowicz J., Uścinowicz S., Jegliński W., Zaleszkiewicz L., Mapa geodynamiczna polskiej strefy brzegowej Bałtyku południowego w skali 1:10 000. Arkusz Stilo (33). Polish Geological Institute, Warsaw 2007.
438. Zachowicz J., Uścinowicz S., Jegliński W., Zaleszkiewicz L., Mapa geodynamiczna polskiej strefy brzegowej Bałtyku południowego w skali 1:10 000. Arkusz Lubiatowo (34). Polish Geological Institute, Warsaw 2007.
439. Department of Operational Oceanography of the Maritime Institute in Gdańsk, Ciekawe wraki. Wraki 2014. Parowiec; available at: http://zoo.im.gda.pl/o-zakladzie/ciekawe-wraki/wraki-2014/parowiec/.
440. Zalewska T., Jakusik E., Łysiak-Pastuszak E., Krzymiński W. (eds.), Bałtyk Południowy w 2011 roku. Charakterystyka wybranych elementów środowiska. Institute of Meteorology and Water Management – National Research Institute, Warsaw 2012.

441. Zalewska T., Radionuklidy pochodzenia antropogenicznego, [in:] Bałtyk Południowy w 2011 roku. Charakterystyka wybranych elementów środowiska. Institute of Meteorology and Water Management – National Research Institute, Warsaw 2012.
442. Zawadzka E., Miotk-Szpiganowicz G., Krzymińska J., Witak M., Badania rzeźby dna i analizy biostratygraficzne osadów jeziornych przybrzeża mierzei jeziora Łebsko, [in:] Florek W. (ed.), Geologia i Geomorfologia Pobrzeża Południowego Bałtyku, Vol. 6, Pomeranian Academy in Słupsk, Słupsk 2005. 105–119.
443. Zawadzka-Kahlau E., Morfodynamika brzegów wydmowych południowego Bałtyku. University of Gdańsk Publishing House, Gdańsk, 2013.
444. Zawadzka-Kahlau E., Wicher W., Rozwój mierzei jeziora Sarbsko w świetle badań morfologicznych, geofizycznych i sedymentologicznych, [in:] Florek W. (ed.), Geologia i geomorfologia Pobrzeża i południowego Bałtyku, Tom 4. Pomeranian Academy in Słupsk, Słupsk 2003. 155–172.
445. Znosko J. (ed.), Atlas tektoniczny Polski. Wydawnictwo Kartograficzne Polskiej Agencji Ekologicznej, Warsaw 1998.
446. Zucco C., Wende W., Merck T., Köchling I., Köppel J. (eds.), Ecological research on offshore wind farms. International exchange of experiences (Project No. 804 46 001). Part B: Literature review of ecological impacts. BfN-Skripten 186. Bundesamt für Naturschutz (BfN), Bonn 2006: 1–284.
447. Żmudziński L., Świat zwierzęcy Bałtyku. Atlas makrofauny, Wydawnictwa Szkolne i Pedagogiczne, Warsaw 1990.
448. Żuchowicz-Wodnikowska I., Czyżewski K., Metody określania emisji i imisji hałasu przemysłowego w środowisku. Manual – Building Research Institute (ITB) no. 338/96, Warsaw 2003.

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20 Non-specialist abstract

20.1 Introduction

20.1.1 Preface

This document constitutes the Abstract of the Environmental Impact Assessment Report for the Connection Infrastructure of the Baltic Power Offshore Wind Farm (hereinafter referred to as: BP OWF CI). The Applicant planning the implementation of the BP OWF CI is Baltic Power Sp. z o.o., a subsidiary of Polski Koncern Naftowy ORLEN and Northland Power NP BALTIC WIND B.V.

The Environmental Impact Report was prepared in cooperation of MEWO S.A. and the Maritime Institute of the Gdynia Maritime University with the following subcontractors: National Marine Fisheries Research Institute and EKO-KONSULT Sp. z o.o. company.

The planned project consists in the construction and operation of power transmission lines including a customer substation and the associated infrastructure. Table 20.1 summarises the basic parameters of the planned project in the Applicant Proposed Variant (hereinafter referred to as: APV). The purpose of the planned project is to connect the BP OWF to the National Power System.

Table 20.1. Basic parameters of the Connection Infrastructure of the Baltic Power Offshore Wind Farm in the Applicant Proposed Variant [Source: internal materials]

Parameter	**Parameter value**	
	Offshore Part	**Onshore part**
Maximum voltage range (AC) [kV]	220 or 275	220 or 275
Maximum number of cables [items]	4	12 (4 circuits, 3 cables each)
Maximum cable line length [km]	33.2	6.5
Technical strip maximum width [m]	20	25

20.1.2 Project classification

Regional Director for Environmental Protection in Gdańsk on 22 July 2021, acting pursuant to: the Resolution of the President of the National Water Management Authority, River Basin Management in Gdańsk; the Resolution of the Director of the Maritime Office in Gdynia and the Opinion of the State Border Sanitary Inspector in Gdynia, decided to recognise, due to the impact on the Natura 2000 sites, the necessity to carry out an environmental impact assessment for the BP OWF CI.

The Regional Director for Environmental Protection in Gdańsk specified the scope of the Environmental Impact Assessment Report compliant with Article 66 of the EIA Act including the impact assessment for Natura 2000 sites pursuant to Article 6.3 of the Council Directive 92/43/EEC in the scope of the project impact on the subjects of protection of the Natura 2000 sites Białogóra (PLH2200030) and Przybrzeżne wody Bałtyku (PLB990002) and also on the species under legal protection. Moreover, the environmental impact assessment will cover the scope indicated by the Director of the Maritime Office in Gdynia.

The main component of the planned project will be a multi-circuit power line connecting the Baltic Power OWF with the substation of Polskie Sieci Elektroenergetyczne S.A. (hereinafter referred to as: PSE). The connection of the customer substation with the PSE substation – the power line will take the form of overhead wires, hence according to § 3(1)(7) of the Regulation of the Council of Ministers of 10 September 2019 on projects likely to have a significant impact on the environment (Journal of Laws of 2019, item 1839), the planned project is qualified as a project with a potentially significant impact on the environment.

The implementation of the planned project in the onshore area will require a permanent deforestation of an area larger than 1 ha, which also qualifies the project as potentially having a significant impact on the environment, in accordance with § 3(1)(88) of the above-mentioned regulation. Moreover, as part of the planned project, along the cable line route, paved access roads will be constructed with a length of approx. 5 km, which, pursuant to § 3(1)(62) of the above-mentioned resolution are also considered projects that may potentially significantly affect the environment.

20.1.3 The basis for the EIA Report

The basis for the EIA Report were location decisions issued by the Minister of Maritime Economy and Inland Waterways and the Director of the Maritime Office in Gdynia, the results of environmental surveys and environmental inventory carried out in the years 2018–2021 for the purposes of this EIA Report, strategic, programming and planning documents at international, national, regional and local levels as well as applicable legal regulations.

Moreover, when preparing this EIA Report, reports on environmental impact assessment or other documentation for projects completed, implemented or planned, located closest to the planned project were used.

20.1.4 Findings of strategic and planning documents

The planned project complies with the arrangements of many policies and strategies, in particular, the ones concerning environmental protection (reduction of pollution emissions), sustainable development (use of renewable energy sources) and energy security (independence from external energy sources). The planned project is consistent with the environmental objectives of the applicable strategic and planning documents analysed.

20.1.5 Methodology of assessment of the planned project impacts

When preparing this EIA Report, the results of environmental surveys and inventory surveys carried out in 2020−2021 were used. The study also takes into account the results of the information meetings, which were used to clarify the issues of public interest and to develop the part of the report dedicated to the analysis of possible social conflicts.

When preparing the Report, first of all, the guidelines, manuals and other materials on the subject of the study, as well as the experience of the team of authors and generally applicable good practices were used. The assessment of potential impacts of the planned project has a character of a study and analytical work. When preparing the EIA Report, analyses of descriptive and cartographic materials were carried out, the impact assessment methodology was applied, as well as the interpretation of the results of the surveys and inventories conducted.

The Report contains an analysis of the planned project in terms of techniques and technologies applied as well as operating conditions. Among others, the information contained in the documentation of the planned project was used and the potential impact of similar activities that may accumulate was analysed. On the basis of the data available, environmental surveys and environmental inventories, significant environmental, spatial and social conditions were determined.

On this basis, potential impacts and risks related to the planned project were identified. The scope and reach of the expected environmental impact were also determined. Comparisons were made with analogous cases in terms of environmental conditions and the size and nature of impacts. The approach adopted to assess the scale and the significance of impacts allowed identifying comprehensive actions aimed at avoiding, preventing and limiting negative impacts related to the planned project.

20.2 Description of the planned project

20.2.1 General characteristics of the planned project

20.2.1.1 Subject and scope of the project

The project in question involves the construction and operation of the BP OWF CI in the offshore and onshore area of the Republic of Poland. The scope of the planned project includes three main phases: construction, operation, and decommissioning, which in this case will consist in the discontinuation of operation of the BP OWF CI. The project will comprise the following elements:

- underground EHV power cable lines located in the offshore and onshore areas;
- cable chambers located on land;
- customer substation;
- 400 kV overhead line.

Table 20.2 presents the basic parameters characterising the planned project in the variant proposed for implementation by the Applicant.

Table 20.2. List of key parameters of the planned project [Source: internal materials]

Parameter	Value/description
Length of the grid connection line in the offshore area (assuming that the export cables are led from each of a maximum of three Baltic Power OWF substations)	Approx. 46.8 km
Length of the HDD or HDD Intersect trenchless technology landfall section between the offshore and onshore power cable route (including the offshore and onshore sections)	Approx. 1.5 km
Length of the grid connection line in the onshore area	Approx. 6.5 km
Operating voltage of power cables	220 kV or 275 kV
Maximum number of cables in the offshore area	4 single cable lines
Maximum number of cable lines in the onshore area	12 cables arranged in 4 circuits, 3 cables per circuit
Cable landfall method	Trenchless method, e.g. horizontal directional drilling (HDD or HDD Intersect)
Method of power cable laying in the offshore area	Buried in the seabed or laid on the seabed surface, secured
Method of power cable laying in the onshore area	Buried in the ground
Method of connecting the customer substation to the PSE substation	Overhead power line
Length of the overhead power line	Up to 270 m

20.2.1.2 Project location and the sea area occupied by the project

The Development Area of the BP OWF CI is located within the maritime area of the Republic of Poland – in the exclusive economic zone, in the area of the territorial sea and internal sea waters, as well as onshore, in the Choczewo commune area (Wejherowo district, Pomeranian voivodeship).

The starting point of the planned project shall be the exit of the cables from the substations that constitute part of the Baltic Power OWF.

The land-sea interface of the offshore and onshore area, i.e. the cable line landfall, is in plots No. 3/7 and 3/6, Kierzkowo precinct, Choczewo commune (Wejherowo district, Pomeranian voivodeship). The corridor through which the BP OWF CI will enter from the offshore onto the onshore area shall be located in the area of 160.5 km of the seashore (according to the Maritime Office shoreline chainage). The planned project will be implemented within the boundaries of the coastal strip.

The BP OWF CI will enter the customer substation with an input voltage of 220 kV or 275 kV and output voltage of 400 kV. The planned substation is located in plot no. 17/129, Kierzkowo precinct, Choczewo commune on arable land of class 5. The current terminals of the PSE substation constitute the endpoint of the planned project.

The surface area of the BP OWF CI Development Area in the offshore area is 34.60 km^2 (including: 8.46 km^2 in the Exclusive Economic Zone, 27.57 km^2 in the territorial sea and 0.01 km^2 in the internal sea waters), as well as in the onshore area – 0.54 km^2 (including: 0.45 km^2 of the cable route construction area, 0.08 km^2 customer substation construction area and 0.003 km^2 construction area of the overhead cable line that connects the planned project with the PSE power substation).

The area of the construction works shall be limited to the necessary minimum within the Development Area boundaries. It is planned that in the offshore area, for each of a maximum of 4 cable lines, the construction belt shall be up to 20 m wide, thus, the largest actual seabed surface area covered by the construction works (for all 4 cable lines) shall be up to 4.0 km^2, representing up to approx. 11.5% of the Development Area. In the onshore area, the width of the technical belt for the entire multi-circuit cable line shall be 25 m at maximum, i.e. the actual surface area covered by construction works shall be approx. 0.16 km^2.

In the onshore Development Area, a land with a surface area of approx. 6000 m^2 (0.6 ha) shall be designated, within which horizontal directional drilling will be conducted. A construction site and storage site for machinery and materials necessary for the drillings shall be organised within that area. The subsea cables landed shall be connected to the onshore cables in cable chambers. After the construction site is closed down, a small surface area around the cable chambers shall be fenced off to ensure their protection. The maximum surface area covered by the protection area of each of a maximum of 4 cable chambers shall be approx. 80 m^2 (up to 320 m^2 in total).

20.2.1.3 Stages of the project implementation

The Applicant acknowledges that the planned project may be implemented continuously as well as in stages.

20.2.2 Description of technological solutions

Electric power will be transmitted from the Baltic Power OWF with three-wire power cables of the highest voltage with an operating voltage of 220 kV or 275 kV. Power cables will be used including a necessary telecommunication infrastructure (optical fibre), which shall enable communication with the Baltic Power OWF.

From a maximum of three substations located in the Baltic Power OWF Area, a maximum of four subsea cables shall be routed. In the OWF Area, the cable lines will run at a distance of approx. 1.45 km apart. Outside the OWF boundary, up to a depth of approx. 22 m, the cable lines shall be laid at a distance of approx. 200 m apart. Next, after the bending of the route, the cables shall converge towards one another to a distance of approx. 100 m. Along the further section, it is planned to bury the cables in the seabed sediment at a maximum depth of 4 m. A power cable can be buried in the seabed using two main technologies: SLB – simultaneous laying and burial of a cable in the seabed sediment, and PLB (Post Lay Burial) – cable burying proceeded by cable laying on the seabed.

The Applicant cannot exclude that some sections of the cable lines shall not be buried but laid on the seabed instead. This shall result, for example, from the unfavourable environmental conditions that will preclude the cable from being buried. In such a case, the cable section shall be laid on the seabed and secured against damage or destruction using protective measures standard in such situations such as: concrete mattresses, sand bags, riprap, PVC pipe sheaths, and concrete protections.

To execute the subsea cable landfall and in the areas of high nature value and difficult to cross with an open trench, trenchless methods are planned in the form of directional drilling: Horizontal Directional Drilling (HDD), DP method, horizontal moling, and HDD Intersect**.**

The cable landfall will be executed using a trenchless method in HDD technology (which enables leading the cable line under obstacles, starting from the ground level, thanks to which no deep excavations are required) or HDD Intersect (which involves conducting pilot drillings at both ends of the section). Each of the maximum of four offshore cable lines shall be landed in a separate drilling made from land in the direction of the sea, or in an exceptional situation, from both sides, the land side as well as the sea side(the HDD Intersect technology). Boreholes on land shall be located at a distance of up to 210 m from the shoreline and at a distance of approx. 20 m from one another. Each of the maximum of four trenches shall have a maximum length of 1.5 km. The drilling opening in the offshore area shall be located outside the near-shore zone, at a depth of approx. 13 m measured from the water table to the seabed. The distance between the borehole outlets in the seabed shall be approx. 100 m. The maximum depth of the borehole will be approx. 50 MBGL.

Four methods of EHV cable line construction in the onshore area are distinguished:

- cable lines laid in the ground;
- cable lines laid in pipes;
- cable lines laid in a cable duct;
- cable lines laid in cable tracks/culverts.

As part of the planned project implementation on land, a total of 12 EHV three-wire AC cables with a copper or aluminium phase wire will be located. Cable lines shall be laid in parallel, mainly in the form of an open trench, at a depth of approx. 2 m, and, if conditions require – a horizontal directional drilling shall be performed. In the direct vicinity of the cables, bentonite (sedimentary rock) shall be used which increases the current-carrying capacity of cables laid in troughs and stabilises them. Afterwards, composite or concrete plates shall be placed on the upper layer of bentonite. Perforated foil or plastic mesh shall be placed above the plates. The remaining part of the trench shall be backfilled with virgin soil.

The cross-bonding method is to be used for the planned project. It involves the change of cable return wire bonding method and the resultant decrease in the induced current intensity in such wires, which reduces the losses in the cable line. Such technologies are recommended for the lines longer than 1 km.

The customer substation shall comprise: a 400 kV switchgear, 400/220/15 kV or 400/275/15 kV autotransformers or transformers, a 220 kV or 275 kV switchgear.

The auxiliary elements will include: buildings for infrastructure, fire pump station, MV/0.4 kV auxiliary facility, as well as cable ducts, indoor circulation, access road, and a fire water tank. Water will be supplied from the nearest water supply system or local water intake in the station area. Sewage shall be disposed to an external sewage system or to a leakproof sewage tank. The construction of a station area drainage system is planned.

The customer substation shall be connected with a short, max. 270-metre section of an overhead 400 kV power line with the PSE substation. In this case, the technology commonly used in these types of projects is to be applied. The end point of the planned project are the current terminals of the PSE power substation.

20.2.3 Project variants considered

20.2.3.1 Applicant Proposed Variant

The starting point of the planned project is the exit of the export cables from the substations that constitute the offshore part of the Baltic Power OWF. Electric power will be transmitted from the Baltic Power OWF using a maximum of four EHV subsea three-wire AC cables with an operating voltage of 220 kV or 275 kV. The length of the grid connection line in the offshore area is approx. 46.8 km. The cable landfalls shall be constructed using a trenchless HDD or HDD Intersect method in the area of 160.5 km of the seashore (according to the Maritime Office shoreline chainage). At the onshore section of the route, in 4 cable chambers, the subsea cable construction parameters shall be adjusted to the conditions onshore. Next, in the onshore part, electric power shall be routed via underground single-core alternating current cables with an operating voltage of 220 kV or 275 kV. The cables shall be laid in 4 cable circuits, 3 cables per circuit. The route of the underground cable line will lead through the forests administered by the RDSF in Gdańsk, within the boundaries of the Choczewo Forest District, within the forest subdistricts of: Szklana Huta and Białogóra. The BP OWF CI will enter the customer substation with an input voltage of 220 kV or 275 kV and output voltage of 400 kV. The planned substation is to be located on arable lands of class 5. The customer substation shall be connected to the PSE substation via an overhead 400 kV power line with a length of approx. 270 m. The current terminals of the PSE substation constitute the endpoint of the planned project.

The length of the grid connection line in the onshore area shall be approx. 6.5 km, while the width of the technical belt shall be approx. 25 m.

20.2.3.2 Rational Alternative Variant

The Rational Alternative Variant compared to the APV assumes extension of the multi-circuit cable line route in the offshore area. The remaining characteristics of the BP OWF CI in the offshore area are the same as in the APV. The length of the grid connection line in the offshore area is approx. 53.6 km. Electric power in the onshore part will be transmitted using a 4-circuit overhead, mid-forest power line. The route of the line will lead through the forests administered by the RDSF in Gdańsk, within the boundaries of the Choczewo Forest District, in the forest subdistricts of: Szklana Huta and

Białogóra – east of the APV. Next, it will enter the customer power substation described in the section on the APV.

The length of the grid connection line in the onshore area will be approx. 5.2 km, while the width of the technical belt will be approx. 100 m. Table 20.3 presents a summary of the technological and technical parameters of the planned project that differentiate the APV and RAV.

Table 20.3. Technological and technical parameters differentiating the Applicant Proposed Variant (APV) and the Rational Alternative Variant (RAV) [Source: internal materials]

Technical parameters	Applicant Proposed Variant (APV)	Rational Alternative Variant (RAV)
Offshore area		
Length of the multi-circuit cable line (assuming that the export cables are led from each of a maximum of three Baltic Power OWF substations)	Approx. 46.8 km	Approx. 53.6 km
Onshore area		
Length of the cable line	Approx. 6.5 km	0 km
Length of the overhead line	Up to 270 m	Approx. 5.2 km
Technical belt width	Cable line – approx. 25 m, cable chamber – 80 m	Approx. 100 m
Depth and width of the trenches	Depth approx. 2m, width a maximum of 2 m for each of a maximum of four-cable circuits. In the area of cable joints, the width of trenches may be up to 6 m	Trenches will be excavated at tower locations. Trench dimensions approx. 10 x 8 m, depth approx. 4 m
Technical characteristics of the cables	Alternating current single-wire cables. Cross-linked polyethylene (XLPE) insulation	-
Number of power lines	A maximum of 4 circuits, 3 cables each	A maximum of 4 circuits, 3 conductors each

Both variants adopted for assessment are rational, they are feasible given the current legal status, technical and technological conditions, as well as the current state of knowledge about environmental conditions.

20.2.4 Description of individual phases of the project

The planned project shall consist of three main phases: construction, operation, and decommissioning, which in the case of this project shall involve the termination of the BP OWF CI operation. It shall be implemented in the offshore and onshore areas, which will involve significant technological and technical differences in the implementation of each of these phases.

20.2.4.1 Construction phase

20.2.4.1.1 Offshore area

The construction phase shall consist in the following three main stages:

1. transport and arrangement of export cables on the seabed;
2. burying of export cables in the seabed sediment;
3. export cable landing.

These works shall be carried out sequentially. Before the commencement of construction, a detailed schedule of works shall be prepared, because they require the use of specialist vessels and equipment, which must be booked well in advance.

Construction works shall be carried out by specialist vessels, for example, Cable Laying Vessels, service vessels, cable barges, and barge towboats. It is assumed that the construction phase (laying up to four cable lines and bringing the cables ashore) will be completed as quickly as possible and will be finalised within a maximum of 9 months from commencement. The start date of construction work will not depend on the time of year.

It is not expected that levelling of the seabed along the cable line routes shall be necessary. The seabed sediment which will be disturbed during the underwater works, shall be used only for burying the cables and shall not be transported to other places of the sea area or transported to the land. It is expected that part of the sediment disturbed will be subject to resuspension into the water depth and re-sedimentation at a certain distance from the location of the underwater works.

Vessels and underwater vehicles involved in the construction of the cable lines shall generate underwater noise. In the case of vessels, the noise shall be generated by the engine running, the sound of the propeller and the operation of the steering engines. In the case of equipment for underwater operations, the highest noise levels will be generated by underwater vehicles operating in the mechanical trenching technology.

In the BP OWF CI construction phase, various types of waste shall be generated as a result of operation of vessels and equipment used for laying the cable line. In the process of the APV implementation, the same types of waste will be generated as in the RAV. The variants will differ in terms of the amount of waste generated. Due to a longer cable line route in the RAV, it is anticipated that the amount of waste generated during the construction phase will be greater than in the case of the APV implementation.

The waste and sewage generated during the construction phase shall be properly stored and secured on vessels, in accordance with a pollution prevention plan in force on each vessel, drawn up in accordance with the requirements of the Act of 16 March 1995 on the prevention of sea pollution from ships (Journal of Laws of 1995, No. 47, item 243, as amended). In harbours, waste and sewage shall be transferred to harbour reception facilities and handled in accordance with the applicable ship-generated waste and cargo residues management plan [Regulation of the Minister of Infrastructure of 21 December 2002 on ship-generated waste and cargo residues management plans (Journal of Laws of 2002 No. 236, item 1989, as amended)].

The vessels and equipment involved in offshore work will consume electricity produced by the combustion of fuel – low sulphur diesel oil (<0.1%). The amount of fuel consumed shall be influenced by many factors, among which the most important are the type and intensity of works, as well as weather conditions during their implementation – the scale of wave motion as well as the strength and direction of the wind, which to a large extent shape the way a vessel is manoeuvred as well as the load of the propulsion engines (including, by the dynamic positioning system).

The application of the jet trenching technology for burying export cables will involve the use of seawater. Specialist devices will collect the water from the environment and inject it under pressure into the surface layer of the seabed sediment, in order to loosen its structure, which will enable cable laying. In this process, neither the chemical composition of the water nor its temperature shall be changed. The entire water collected shall be returned to the environment. Depending on the device used, it is expected that the water flow may reach from approx. 800 to approx. 5000 m^3/h. The water will also be used for the everyday needs of the crews of vessels involved in the construction works. The drinking water tanks shall be refilled during port stopovers. After use, the water is stored in waste water tanks and handed over for treatment during the next port call.

20.2.4.1.2 Onshore area

For the purposes of the project implementation, the performance of the following work is predicted:

- felling of trees in the area planned for the location of the multi-circuit cable line;
- construction of access roads for the project needs;
- erection of trenches for the multi-circuit cable line;
- conducting horizontal directional drilling in the locations where the open trench will not be dug;
- laying of cable line and optical fibres in trenches;
- laying of cable line connections – cable joints, cable heads, feeding services to the customer substation;
- finishing works – backfilling, cable line marking, completion of communication system, ground levelling and reclamation.

The construction phase will require the occupation of a construction belt for earth and assembly works, with a maximum width of 25 m. Construction vehicles and machinery normally used for this type of work will be utilised during the construction phase: cranes, lifts, jib cranes, backhoe loaders, rolls, felling devices, etc. It is expected that the construction phase may last up to 36 months.

The operation of the heavy construction equipment used during construction will be the source of noise emission, the level of which will vary depending on the activities conducted and the type of equipment used. Moreover, the noise connected to the transport of construction materials, equipment and personnel will cover both the area of direct construction works, as well as the areas surrounding the access roads.

The waste and wastewater generated during the construction phase will be managed in accordance with the Waste Act of 14 December 2012 (Journal of Laws of 2013, item 21, as amended). Earth masses will be managed under the conditions and in the manner specified in the decision on the construction permit. Pursuant to Article 2(3) of the Waste Act of 14 December 2012 (Journal of Laws of 2013, item 21, as amended), uncontaminated soil and other naturally occurring material excavated in the course of construction activities, providing it is certain that the material will be used for the purposes of construction in its natural state on the site from which it was excavated, is not treated as waste. The trenches made in connection with the implementation of the planned project will be backfilled with the excavated soil. Small quantities of excess soil, if any, will be handed over to specialist companies in accordance with the applicable regulations.

The drilling fluid remaining after the drilling process completion shall be collected by a specialist company and treated off-site. The Applicant shall allow the use of biodegradable drilling fluid. The type of drilling fluid shall be specified at a later stage of the design work.

Water will be used for drilling fluid in the amount of approx. 930 000 l and for the everyday needs of the staff in the expected quantity of approx. 4 $m^3 \cdot d.^{-1}$. During the construction phase, diesel oil will be used by the equipment operating at the construction site in an expected amount of approx. 2500 $l \cdot d.^{-1}$.

20.2.4.2 Operation phase

20.2.4.2.1 Offshore area

In the operation phase, cyclical inspections of the particularly sensitive places (e.g. crossings with the existing infrastructure), as well as of the entire length of the cable lines, are expected to take place at least once every 5 years.

In the case of a cable line failure, a cable repair may be necessary. This will result in a periodical, increased traffic of vessels in the location of failure.

To minimise the risk of cable damage, and thus, the repair works, effective methods of cable protection shall be developed and implemented during the construction phase, the most important of which will be the burying of the entirety of cable lines in the seabed sediment or protecting them with permanent protective structures, if there is a need to lay line sections on the seabed surface and use the trenchless methods of construction of the cable landfall.

The relatively small service vessels will be able to use the ports located at a smaller distance from the area of the planned project than the ports envisaged for the supporting of vessels in the construction phase, i.e. the ports of Władysławowo, Ustka, Łeba, Hel, Darłówek and Kołobrzeg or Dziwnowo.

The waste and wastewater generated during the operation phase will be properly stored and secured on vessels in accordance with the same requirements as the ones described for the construction phase.

In the operation phase, the demand for power will result exclusively from the planned maintenance works of the BP OWF CI offshore part. The consumption of fuel will be mainly determined by the type and intensity of the work carried out, the size of wave motion as well as the strength and direction of wind, which affect the method of vessel manoeuvring as well as the load of power engines.

Water will be used for the everyday needs of the service vessel crews. The drinking water tanks shall be refilled during port stopovers. Once used, the water is stored in waste water tanks and transferred for treatment during the next port call.

The operation of the power cables shall involve the generation of an electromagnetic field. The special design of the cable sheath significantly reduces the range and strength of the EMF emitted, but it does not eliminate it completely. In order to significantly reduce the impact of EMF on the marine environment, it is planned to bury the cable in the seabed sediment along its entire route up to a maximum depth of 4 m. The EMF intensity decreases with the distance from the conductor. As the analyses have shown, in the case of extra high voltage AC export cables, already at a distance of approx. 1.5 m from the cable, the EMF intensity levels are negligible in the context of the impact on the marine environment. The burying of a cable at this depth or greater will neutralise the impact of EMF on the benthic and pelagic marine organisms sensitive to EMF.

Electric current, flowing through a cable, causes it to heat up, as a result of power losses on the resistance. As the temperature of the cable increases above the ambient temperature, the transfer of heat from the cable to the surrounding environment commences. The heating of sediments may lead to a change in the taxonomic composition of the benthos living on and in the seabed in the immediate vicinity of the cables. According to the OSPAR's (Convention for the Protection of the

Marine Environment of the North-East Atlantic) guide on the best environmental practices in the laying and use of subsea cables, the burial of the cable at a depth of 1 to 3 m under the seabed is sufficient to prevent the rise of the sediment temperature within 0.2 m below the seabed surface, which is associated with heat emission through the power cables under load, to more than the recommended 2°C.

20.2.4.2.2 Onshore area

The operation phase of the underground cable line is a maintenance-free process. Due to the necessity to ensure access to the underground cable infrastructure, a permanent exclusion from forestry use will apply to a strip of land with a width of approx. 25 m along the predominant section of the cable line as well as within an 80 m radius in the cable chamber area. This necessity is due to the risk of cables being damaged by the root systems and their possible failure.

Waste generated during the operation phase will mainly result from the functioning of the customer power substation. The substation does not generate typical process waste but is a source of negligible quantities of waste generated exclusively during its operation.

During the underground cable line operation phase, there will be no need for water, raw materials, other materials, fuels, nor energy. As a result of the customer substation operation, the power demand will be satisfied internally by means of MV/0.4 kV transformers, external back-up supply by means of MV lines, emergency supply internally by means of a power generator. Heat supply will be satisfied by means of electric heaters powered from the station auxiliary system.

Power cables will be the source of an EMF, which in certain situations, at significant values of the intensity of individual field components, may unfavourably affect the environment and the health of people. In order to significantly reduce the impact of EMF on the terrestrial environment, it is planned to install the cable line in trenches with a depth of approx. 2 m. The customer substation will also be the source of electromagnetic field.

The operation of power cables will also involve heat emission. To ensure the best conditions for cable heat dissipation into the environment, the cable lines will be arranged along their entire length in the immediate vicinity of the bentonite.

Numerous results of the noise measurements conducted on the 400 kV upper voltage power substations indicate that the level of the noise emitted from the substations is constant; whereas, the noise of low-level, originating at the substation bus bar systems as well as the linear insertions depends on the atmospheric conditions to a large degree.

20.2.4.3 Decommissioning phase

The operation of the BP OWF CI will be terminated as a result of the Baltic Power OWF decommissioning. After the operation is discontinued, there are no plans to disassemble the subsea and land cable lines, the customer power substation as well as the 400 kV overhead cable line.

20.2.5 Risk of major accidents or natural and construction disasters

20.2.5.1 Types of accidents resulting in environmental contamination

The main environmental threats that may occur during the construction of the BP OWF CI will be the spills of oil derivative substances, mainly diesel, hydraulic, transformer and lubricating oils from ships. To a lesser extent, the marine environment may incidentally be endangered with materials containing hazardous substances, if they were used. During the operation phase, the main cause of marine pollution can be the oil spills originating from service vessels.

Both within the open sea waters and near the coast, the petroleum product spills can constitute a problem with long-lasting effects on fauna, flora, fishery and beaches affected by the contamination. In order to address this risk, all vessels involved throughout the project will meet the requirements and will comply with the regulations resulting from the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78), including in particular the procedures contained in "Shipboard Oil Pollution Emergency Plans".

Various petroleum products (lubricating and diesel oils, petrol) may spill during normal vessel operation. It should be assumed that these will be small (I degree spills, up to 20 m^3).

From the environmental point of view, the most sensitive areas in case of possible spillages will be the coastal area approximately between Ustka in the west and Dębki in the east. Considering the prevailing westerly wind direction and the occurrence of coastal currents, the coastal strip with tourist resorts (Jarosławiec, Rowy) and the harbours in Ustka and Łeba to the west, as well as the town and harbour in Władysławowo, is at risk.

The area of the planned BP OWF CI runs through the Natura 2000 site Przybrzeżne wody Bałtyku (PLB990002), where large concentrations of wintering birds occur periodically. It should be emphasised, however, that in case of a I degree spill, 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.

Spills of petroleum products to the environment in the construction and operation phases may occur as a result of a breakdown or collision of vessels, their sinking or grounding, as well as during seepage and operational leaks from vessels and oil spills related to maintenance and repair of cable lines. In the worst-case scenario, during the construction stage, III degree spills (catastrophic spills, exceeding 50 m^2) will occur. It has been calculated that the probability of serious accidents of vessels is very small, ranging from 10^{-5} (practically impossible – 1 in 100 000 years) to 10^{-2} (rare – 1 in 100 years).

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 5 to 20 km from the BP OWF CI Development Area.

It is not anticipated that during the construction and operation phases, other chemicals could be released in quantities that could cause damage to the natural environment.

Negative impact on humans and the environment may be connected to the disturbance of UXOs and chemical warfare potentially deposited on the seabed. Before the commencement of the construction, the Applicant shall conduct detailed surveys on the presence of unexploded ordnances (UXO) on the seabed. In case any chemical warfare agents/UXOs are found during these surveys, the Applicant 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 Applicant will prepare a plan for handling dangerous objects, both from the point of view of operational work at sea (for example, rules for conducting works in the vicinity of potentially hazardous objects) and from the point of view of possible removal or avoidance 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.

20.2.5.2 Environmental threats

In the BP OWF CI construction phase, the source of the negative impact on the environment can be the following:

- spillage of petroleum products as a result of collision of ships in an emergency situation;
- accidental release of municipal waste or domestic sewage;
- accidental release of chemicals;
- contamination of water and seabed sediments with antifouling agents;
- contamination of soil caused by hazardous substances from spills from vehicles and devices involved in construction work.

As a direct result of emergency situations and incidents, the abiotic environment, especially seawater and to a lesser extent, seabed sediments can become contaminated. On the other hand, these events can also indirectly affect living organisms, those inhabiting or otherwise using the seabed, water depth and the surface of the sea.

The biggest environmental hazards may result from the emergency release of petroleum products into the sea, e.g. as a result of vessel collisions. In the case of III degree oil spill, the oil slick spatial range will be from 5 to 20 km from the spill location.

20.2.5.3 Breakdown 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 the BP OWF CI. The highest risk of a breakdown resulting in a serious threat to the environment concerns the works performed in the offshore area. In order to eliminate or minimise such risks various actions will be taken, including among others:

- development of plans for the safe construction, operation and decommissioning of the BP OWF CI in accordance with the applicable legal regulations for the duration of the project implementation;
- developing rescue plans and training of crews and personnel, including the principles of updating and verification by conducting regular exercises, 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 and operation of the BP OWF CI;
- selecting suppliers as well as certified parts and components of the BP OWF CI;
- accurate marking of the BP OWF CI Area, its facilities and vessels moving within the area;
- planning offshore operations;
- applying the standards and guidelines of the International Maritime Organisation (IMO), recognised classification societies and maritime administration recommendations;
- developing plans of safe navigation in the construction phase;
- 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 Automatic Identification System (AIS);
- continuous monitoring of vessel traffic regarding the vessels involved in the construction and operation phase;

- establishing a coordination centre supervising the respective phases of the project implementation;
- maintaining regular communication lines between the BP OWF CI coordination centre and the coordinator of works at sea and other coordination centres (Maritime Rescue Coordination Centre in Gdynia and maritime administration).

The likelihood of a major accident in the onshore part of the BP OWF CI is lower than in the offshore section. Regular maintenance and servicing are intended to prevent failures.

Equipment failures in power substations are extremely rare, of low scale and are local in terms of impact. In the event of a failure, procedures are in place to limit the consequences by locating the site of the failure and controlling it as quickly as possible in order to secure the uninterrupted operation of the substation.

20.2.5.4 Design, technology and organisational security expected to be applied by the Applicant

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

- threats to human life – evacuation plans, search and rescue plans;
- fire risks on ships involved in the construction and operation phases;
- environmental pollution risks – action plan for counteracting threats and contamination from oil spills by ships involved in the construction and operation phases.

20.2.5.5 Potential causes of breakdowns including extreme situations and the risk of natural and construction disasters

In the case of the offshore area, the greatest potential risks will occur during the construction phase; however, the risk of a disaster is minimal due to the fact that the planning of offshore operations always takes into account weather conditions and the possibility of their change. Every offshore operation has its limitations in terms of visibility, wind speed, sea state or ambient temperatures. Adverse weather conditions such as too strong wind or too high waves can only result in the extension of the construction cycle and an increased demand for energy – fuel consumption. It is not expected that during the construction and operation phases extreme situations could occur that would result in serious damage to the export cables or to the vessels involved in the construction and maintenance work. The nature of the project – laying of cable lines – also excludes the possibility of a construction disaster.

In the operation phase, damage to the underground cable line may be caused by seismic shocks and landslides, i.e. as a result of a natural disaster within the meaning of the Act of 18 April 2002 on the state of natural disaster (Journal of Laws of 2002, No.62, item 558, as amended). However, these events are unlikely in the planned project location. As regards seismic phenomena, the territory of Poland is classified as aseismic (no tremors) and penseismic (rare and weak tremors), where earthquakes occur rarely and are not strong. The area of the planned project is located beyond landslides and areas prone to mass movements, and in majority of its area, there is no risk of flooding.

Overhead lines are at much higher risk of damage, since their spans and towers can break and become overturned, in exceptional cases, during such unfavourable weather events as hurricanes and icing. Pursuant to Article 73 of the Construction Law of 7 July 1994 (Journal of Laws of 1994, No.

89, item 414, as amended), a construction disaster is understood as 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 this context, the planned project, due to its specificity, the location of implementation and the construction of greatest part of the power line route in the form of cable lines buried at a shallow depth (average depth of trenches will be 2 m), will be to a very small degree a potential source of construction disasters and hazard to the immediate surroundings, including people present there. The construction of a short section of an overhead line (up to 270 m in length) will be conducted on a flat land, not overgrown with trees and shrubs, outside urbanised areas, which will favour its smooth and trouble-free implementation minimising the possibility of construction disasters.

20.2.5.6 Risk of major accidents and natural or construction disasters, taking into account the substances and technologies applied, including the risk related to climate change

The risk of a major accident, natural and construction disasters is minimal. The Applicant intends to use the state-of-the-art technologies to ensure high reliability of electricity transmission and to comply with the relevant environmental and economic standards and requirements. The implementation of these tasks will be achieved through:

- the use of conductive, insulating and structural materials characterised by high operating parameters;
- selecting the most reliable and safest methods of power line construction;
- conducting maintenance operations.

The most significant risk may be related to the spills of petroleum products at sea, which can adversely affect the marine and coastal environment. With the standard preventive measures applied and the ones developed for the planned project, the risk of such a spill will be minimal. The probability of such events as ship collisions belongs to the category of very rare events (1 per 100 years). Taking into account the effects in the form of 200 m^3 of diesel oil emission, the risk level is within an acceptable range. Emission of 200 m^3 of diesel oil will cause insignificant damage to the environment because it will disperse within 12 hours.

The effects of climate change observed in recent decades are manifested in particular by an increase in temperature as well as in the frequency and severity of extreme events.

Extreme events (heavy rainfall, floods, deluges, landslides, heat waves, droughts, storms, landslides, etc.) resulting from climate change are projected to increase in frequency and intensity in the future. These phenomena will occur with increasing frequency and intensity and will affect larger areas of the country. Climate change is associated with adverse changes in hydrological conditions. Although the annual sums of precipitation do not change significantly, their character becomes more random and uneven, resulting in longer periods without rainfall, interrupted by sudden and heavy rainfalls. It is not anticipated that the climate change should contribute to the occurrence of major failures or natural and construction disasters in the context of the construction and operation of the planned project The construction of the connection and its maintenance will be carried out taking into consideration the possibility of sudden deterioration of weather conditions, which will be especially important in the case of the offshore area. Procedures for responding to and counteracting such situations will be developed and applied. The fact that a major part of the connection is executed in the form of buried cable lines will help protect their structures from damage or destruction. Constructing the cable line landfall using trenchless methods to bypass the dynamic coastal zone and the coast, which in the long-term perspective are under the greatest influence of the factors resulting from climate change (erosive processes), will enable safe and failure-free functioning of the planned project within the entire operation period.

20.2.6 Relations between the parameters of the project and its impacts

The matrix of connections between the planned project parameters and the impacts is presented in Table 20.4 and Table 20.5.

Table 20.4. Matrix of connections between the project parameters and impacts – offshore part [Source: internal materials]

Parameter	**Type of emission or disturbance**													
	Heat	**EMF**	**Above-water noise**	**Underwater noise**	**Waste**	**Light effects**	**Seabed disturbances**	**Suspended solids**	**Resuspension of contaminants**	**Redeposition**	**Creation of an “ artificial reef”**	**Water contamination**	**Air pollutions**	**Increased traffic and collision risk**
Length and type of cables	X	X												
Method of cable line construction, construction belt width and depth of cable burying	X	X		X			X	X	X	X				
Cable laying on the seabed and their protection against damage and destruction											X			
Traffic of construction, inspection and service vessels			X	X	X	X						X	X	X
Horizontal drilling				X			X	X	X	X		X	X	

Table 20.5. Matrix of connections between the project parameters and impacts – onshore part [Source: internal materials]

Parameter	**Type of emission or disturbance**							
	Destruction of the ground surface – tree felling	**New buildings**	**Noise**	**Waste**	**Sewage**	**EMF**	**Heat**	**Air pollutions**
Length and quantity of cables	X					X	X	
Voltage range						X	X	
Method of cable line construction, width	X		X	X	X			X

Parameter	Type of emission or disturbance							
	Destruction of the ground surface – tree felling	New buildings	Noise	Waste	Sewage	EMF	Heat	Air pollutions
of the permanent and temporary belts, depth of cable burying								
Customer substation components		X	X	X	X	X		X
400 kV overhead line	X	X	X	X		X		
Horizontal drilling			X	X	X			X

20.3 Environmental conditions

OFFSHORE AREA

20.3.1 Location, seabed topography

The variants APV and RAV in the offshore section are located between the Baltic Power OWF Area and the shore in the area of 160.5 km of the seashore (according to the Maritime Office shoreline chainage). They cover a part of the seabed with the depth from approximately 41.0 m to 0.0 MBSL.

In the northern and central part of the BP OWF CI area, the seabed surface takes the form of an accumulation plain with areas of kame terraces. They cover the seabed with a depth from approx. 20.0 to approx. 41.0 MBSL. The seabed is slightly undulated, there are small height differences associated with the presence of sand formations and outcrops of older sediments. The seabed slopes reach 2–3°, up to a maximum of over a dozen degrees within the slopes of the outcrops of older sediments.

Fragments of the seabed in the central part of the area analysed, along with the seabed parts in the northern section of the area, take the form of an abrasive-accumulative plain. It covers the seabed with a depth from approx. 21.0 to approx. 27.0 MBSL (central part of the area) and 38.0 to approximately 41.0 MBSL (northern part of the area) The seabed is even with height differences of 0.5–1.0 m, maximally up to 3.0 m, associated with the presence of sand accumulations on the surface of cohesive sediments and the outcrops of older sediments. The seabed slopes reach 2–3°, up to a maximum of over a dozen degrees within the slopes of the outcrops of older sediments.

In the southern part of the area analysed, there is a foreshore slope. It covers the seabed with a depth from approx. 13 to approx. 25 MBSL. In the southern and central part of the foreshore slope, the seabed is located at a depth of approx. 13 to 19 MBSL. In the northern part, it gently inclines from approx. 16–17 m to approx. 25 m of depth. In this part of the foreshore slope, the seabed slope is approx. 1–2°. The seabed in the northern part is even, in the central and southern part – undulated with numerous sandy formations in the form of bars and domes with a relative height of up to 3 m above the surrounding seabed.

The shallowest part of the seabed in the BP OWF CI route variants analysed is the sandbank zone. It covers a strip of sandy seabed with a width of 1200–1300 m, stretching from the shore into the sea, up to a depth of approximately 13 m. Within this strip, three sandbanks have developed. The sandbank closest to the shore (sandbank 1) has the most varied, wavy course. At the time of the surveys, its ridge was at a depth of approximately 1–2 m and it was located 100–150 m from the waterline. The ridge of sandbank 2 was approximately 300–400 m from the waterline at a depth of 3.5 to 4 m. The ridge of sandbank 3 was located 800–900 m from the shore at a depth of 5–6 m.

20.3.2 Geological structure, seabed sediments, raw materials and deposits

Within the area analysed, the crystalline basement is located at a depth of approximately 3000 m. The sedimentary cover is made up of Palaeozoic formations, mainly: Cambrian sandstones and silt-clay sediments, Silurian clays and Zechstein dolomites, anhydrites and rock salts as well as of Mesozoic formation, mainly: claystones, siltstones and sandstones as well as Cretaceous quartz-glauconite sands and sands with phosphorites. Quaternary formations lie directly on the Paleogene and Neogene sediments represented by sands and silty clays often mixed with carbonaceous substances. The top of the Paleogene and Neogene formations is erosive in nature and is located at a depth of approx. 2 to more than 40 m.

The thickness of the Quaternary formations in the survey area is between 20–30 m on average. These are mainly glacial till and sandy-till sediments, fluvioglacial sandy and sandy-gravelly sediments, as well as local accumulations of clays, silts and fine-grained sands of glacio-lacustrine origin covered with modern marine sands.

Almost the entire seabed of the area analysed is covered with a discontinuous layer of fine- and medium-grained sands. in places, accumulations of multi-grained sediments, boulder clusters and cohesive sediment outcrops occur on the surface, mainly glacial tills and glacio-lacustrine sediments (Pleistocene/Holocene).

The fine- and medium-grained sands form covers with flat, locally rippled surfaces. Within their area, the sand layer thickness is up to several meters. Below sandy sediments, glacio-lacustrine sediments are deposited (northern part of the area analysed and a section of the routes in the southern part) as well as local glacial and fluvioglacial sediments (mainly till, sand and gravel) in the southern part. Below the glacio-lacustrine sediments, glacial and fluvioglacial Pleistocene sediments are predominant in the substratum structure.

In places, peats may occur within the sandbank zone.

No exceedance of the concentration of metals, polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs) was found in the sediment, according to the Regulation of the Minister of the Environment of 11 May 2015 on the recovery of waste outside installations and facilities (Journal of Laws of 2015, item 796), which allows the classification of a sediment as clean in the context of practical applications, and although it does not apply to a sediment transferred within water, they may form the basis for assessing the seabed sediment contamination with chemical compounds.

The mean concentration of nitrogen in the seabed sediments analysed was below the limit of quantification, i.e. 200 mg $N \cdot kg^{-1}$ DW. The nitrogen amount, which could transfer from the sediment to the water depth during construction works will be negligible in comparison to approx. 190 000 tons of the total nitrogen supplied to the Baltic Sea each year with the inflowing river waters.

The content of total phosphorus in the area surveyed did not exceed the values typical for the sediments of the Southern Baltic. The amount of phosphorus that may be released into the water (the so-called available phosphorus) is estimated at 10–20% of the total amount of phosphorus contained in the sediments. The mean concentration of phosphorus in the seabed sediments analysed was 298 mg·kg^{-1} DW for the entire survey period.

The concentrations of persistent organic pollutants (PAHs, PCBs) and hazardous substances, such as metals or mineral oils, in the area surveyed were low and did not exceed the values typical for the sandy sediments of the Southern Baltic as well as the limit values specified in the Regulation of the Minister of the Environment of 11 May 2015 on the recovery of waste outside installations and facilities (Journal of Laws of 2015, item 796).

The sediments analysed were also characterised by a low activity of the radioactive isotope of caesium ^{137}Cs, typical for sandy sediments.

20.3.3 Seawater quality

Seawater within the BP OWF CI area was characterised by an alkaline pH and a relatively good oxygenation, with seasonal variability characteristic of the Southern Baltic waters. The assessment of the water quality index in the BP OWF CI, on the basis of the oxygen content in the near-seabed layer in summer, indicates a good water status (Class 2) (pursuant to the Regulation of the Minister of Maritime Economy and Inland Navigation of 11 October 2019 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 2019, item 2149). The content of suspended solids in particular measurement periods was at a level typical for the waters of the Southern Baltic.

The concentrations of nutrients were characterised by a seasonal variability which is characteristic for the Southern Baltic waters. Waters of the area surveyed were characterised by low (trace level) concentrations of particularly harmful substances.

The waters tested were also characterised by low values of radioactive element activity, typical for the waters of the Southern Baltic. Low concentrations of PAHs, yet slightly higher than the ones cited in literature, were recorded in the BP OWF CI area.

Given that the development area of the BP OWF CI crosses the Jastrzębia Góra – Rowy CWIIIWB5 surface water body, the range of the impacts of this project and its possible impact on that SWB should be examined. Following the analysis of the test results of water quality indicators and seabed sediments in the development area, it should be assumed that the implementation of the BP OWF CI will not affect the achievement of environmental objectives for this surface water body.

20.3.4 Climatic conditions and air quality

The area of the Southern Baltic is located in the humid temperate climate zone with the influence of the Atlantic climate due to prevailing oceanic winds.

The climate specific for the coast and the adjacent sea areas can be classified as a coastal strip climate with small air temperature amplitudes, high humidity, mild winters, cooler summers and strong winds. Winds from the west and south-west directions prevail. In the open sea areas, climatic conditions are characterised by smaller air temperature amplitudes and mean wind velocities higher than in the adjacent land areas.

Taking into account the conclusions and recommendations relating to the coast and the adjacent areas of the Baltic Sea, it has been found that the observed and predicted climate changes will have a negative impact on the functioning of the coastal zones. An adverse influence of the periodic sea level rises is predicted here, resulting mainly from the increase in frequency and intensity of heavy storms. In the case of the Baltic Sea, this refers to a possible increase in the number, intensity and duration of storms, with an increasingly irregular occurrence, i.e. long periods of relative calm may be followed by series of rapidly succeeding storms of considerable force.

An additional factor that accelerates the process of coastal erosion is the warming of winters, the expected result of which will be a reduction in the ice cover protecting the beaches from storm surges, and thereby safeguarding them against coastal erosion. An increase in the frequency of storm floods and more frequent flooding of low-lying areas, as well as the degradation of the coastal cliffs and seashore, which will exert a strong pressure on the infrastructure located in these areas, are very important effects of the climate change.

Due to the increase in the mean water temperature and an increased influx of biogenic pollutants (nitrogen and phosphorus compounds) into the sea, a negative phenomenon that will occur will be the progressive eutrophication, especially on the water surface (algae blooms).

Meteorological conditions are characterised by wind velocity and direction, as well as air temperature, pressure and humidity in the coastal zone above an open sea surface. In 2000, the mean wind velocity over the sea area surveyed was approx. 6.6 m s^{-1}, with the maximum reaching 20.7 m s^{-1}. The prevailing winds were from the south-west direction. Air temperature ranged from approx. -2°C in the winter to approx. 27°C in the summer. Atmospheric pressure varied between 977 and 1043 hPa. The relative humidity was characterised by high variability, oscillating between 25% and 100%.

Due to the lack of detailed information on the current parameters of the air quality over the sea areas intended for the construction of offshore farms, the air quality assessment of the atmosphere layer near the water surface is compared with the information obtained as part of the measurements carried out by the Inspection for Environmental Protection as part of the State Environmental Monitoring for the nearest coastal research station (Łeba).

The onshore area in the coastal zone near Łeba has air quality class A. Similar values should be expected for the nearshore areas. As these sea areas are located away from onshore SO_2 and NO_2 emission sources, these substances are emitted solely by ships while ship traffic intensity is relatively low. The offshore areas surveyed are free from any terrain obstacles impeding the spread of these substances. Therefore, the mean concentrations of the above-mentioned compounds in the air should have significantly lower values.

20.3.5 Ambient noise

The planned project is located in the area of the ambient noise dominated by anthropogenic acoustic sources: vessels, fisheries (and the associated fishing vessels). The results of the collected acoustic data analysis showed that they present values characteristic for the Southern Baltic area.

Due to the importance of areas in the vicinity of the planned project route, for activities related to the implementation of offshore wind farms and linear infrastructure as well as commercial fishing, the levels of underwater noise in the environment are likely to increase when compared to areas with less industrial activity.

20.3.5.1 Underwater noise

Noise is defined as sounds undesired by the receiver, which interfere with the detection of necessary sounds.

The most important underwater noise characteristics applied include: duration and frequency range.

The main anthropogenic component of the Baltic Sea ambient noise is the continuous sound generated by vessel traffic. The frequency of this noise is mostly below 1 kHz but high frequency components are also present. The centre frequency of 2 kHz is within the hearing range of the harbour porpoise, grey seal, ringed seal, and Atlantic herring.

20.3.5.2 Links to other environmental features

Several groups of marine animals are known to use sound for foraging, communication, reproduction and movement. Therefore, an increase in ambient noise levels as a result of the introduction of anthropogenic noise exerts a significant pressure on the marine environment, with probable adverse effects.

In the area of the planned project, animals live in an environment with a relatively constant ambient noise level, in which the potential impact increases with the increasing frequency. However, the total noise levels are most likely not high enough to lead to any impact on hearing.

Surveys of the effects of ship-generated medium- to high-frequency noise components in Danish waters show that noise from different types of ships significantly increases ambient noise levels across the frequency spectrum recorded from 0.025 to 160 kHz at distances of 60 m and 1000 m from the passing vessels. Masking effects may occur due to high frequencies, but the range of these impacts is low. Harbour porpoises held in semi-natural conditions showed a response even to low levels of high-frequency noise from passing ships.

Most sounds of the ambient noise captured at the stations in the survey area do not exceed the harbour porpoise hearing threshold.

20.3.6 Electromagnetic field

In the marine environment, the values of the electric field and the geomagnetic field are similar. In the BP OWF CI area, there are no artificial sources of electromagnetic field. The existing DC transmission system between Poland and Sweden (SwePol Link) is located at a distance of several dozen kilometres from the planned project location.

Changes in the natural electric fields do not have a direct impact on the living organisms. Natural magnetic fields show differences depending on the geographical location. They have a significant impact on some living organisms.

Electromagnetic fields created as a result of electric current flow can change the natural migratory behaviour of marine mammals and fish, they can also be the source of thermal energy introduced into the marine environment.

20.3.7 Description of the natural environment components and protected areas

20.3.7.1 Biotic elements in the maritime area

20.3.7.1.1 Phytobenthos

In the APV of the offshore part of the BP OWF CI, no vascular plants were present in the sandy coastal zone (4.7–6.1 m). However, the following macroalgae were found in the depth range 20.6−23.3 m: filamentous red algae (probably a species of the family Rhodomelaceae) and filamentous brown algae (probably *Pylaiella littorali*s and/or *Ectocarpus siliculosus*). The macroalgae overgrew boulder surfaces very scarcely (macroalgal cover of the seabed <1%). It should be noted that the hard bottom (boulders and cobbles), to which macroalgae can attach, occupies less than 1% of the total area of the APV.

Within the boundaries of the RAV of the offshore part of the BP OWF CI, no phytobenthos occurrence was recorded.

Lack of vascular plants in the nearshore zone and lack or scarce occurrence of macroalgae in deep water areas (>20 m) is typical for Polish maritime areas.

20.3.7.1.2 Macrozoobenthos

The results of the inventory surveys showed that the macrozoobenthos community is not unique for the area, and does not stand out in terms of average abundance and biomass values nor specific natural values, having a “moderate” quality status. It consists of benthic organisms typical of the shallow and medium-deep seabed (up to 35 MBSL) of the near-shore and open waters of the Southern Baltic – i.e. the eastern Gotland Basin.

On the soft bottom (sand and gravel sediments), constituting as much as 99% of the surface area in the planned project area, 23 macrozoobenthos taxa were identified, among them, the polychaetes *Pygospio elegans* and *Marenzelleria* sp. were constant. Those two taxa were also dominant in terms of abundance. The Baltic clam (*Limecola balthica*) had the biggest share in the biomass.

The hard bottom macrozoobenthos (stone clusters), constituting a minute fragment of the BP OWF CI, i.e. less than 1% (approx. 0.3 km^2) of the surface area, located along the APV corridor route at a depth of approx. 22 m, was created by a maximum of 14 taxa of the seabed macrofauna. The bivalve *Mytilus trossulus* (mussel), which is a component of the benthivorous birds and fish diet, was clearly dominant in both the abundance and biomass of the community. This bivalve was also one of 6 species most common in this community. The quality status of the macrozoobenthos communities from the hard bottom was assessed as very good, because this habitat, apart from the aggregation of the bay mussel, included other species typical for this community, such as moss animals, hydrozoans, crustaceans and polychaetes and the fauna accompanying bay mussels.

20.3.7.1.3 Ichthyofauna

In the BP OWF CI area, the occurrence of 31 ichthyofauna taxa was confirmed. The most abundant were: sprat, herring cod and flounder, which form the basis of industrial fishing. The qualitative and quantitative composition of the ichthyofauna in the BP OWF CI area is typical of the Southern Baltic waters, with a clear predominance of cod and flounder in demersal catches, as well as herring and sprat in pelagic catches. The breeding and feeding migration routes of herring, sprat and cod run across the survey area. The area of the planned project provides temporary habitat for adult flounders. Flounder do not spawn directly within the survey area, since the salinity prevailing there is too low to enable successful fertilisation. Shallow waters (up to 1 m in depth) at the very shore are the habitat and feeding area of the flounder fry. The BP OWF CI area is also a habitat for Ammodytidae and the freshwater species migrating periodically from the inland surface waters such as roach, bream, perch and zander. The presence of a few larvae of ammodytids, shorthorn sculpin, longspined bullhead, rock gunnel and turbot was determined in the BP OWF CI area, which indicates that spawning of these taxa may occur in its near-shore zone. Three fish taxa – the common sea snail, straightnose pipefish, and the representatives of gobies belong to partially protected species pursuant to the Regulation of the Minister of the Environment of 16 December 2016 on the protection of animal species (Journal of Laws of 2016, item 2183, as amended).

20.3.7.1.4 Marine mammals

There are four species of marine mammals found in the Baltic Sea: the grey seal (*Halichoerus grypus*), the harbour seal (*Phoca vitulina*), the ringed seal (*Pusa hispida*) and the harbour porpoise (*Phocoena phocoena*). All species of marine mammals are under protection in Poland.

From among the four species of marine mammals occurring in the Baltic Sea, during the period of monitoring in the survey area, sporadic occurrence of porpoises (8 DPD) and a one-off observation of a harbour seal was found. In the area of the planned project, no significant breeding, moulting or resting areas of these mammals were found neither in the sea nor on the beach.

20.3.7.1.5 Seabirds

During surveys, 22 bird species sitting on the water were recorded, including 15 seabird species and 7 species of water birds rarely encountered at sea away from the coast. In terms of the number of individuals, the greatest numbers were recorded for the velvet scoter (17 872 ind. – 59.4%) and long-tailed ducks (10 946 ind. – 36.4%). A share above 1% was also recorded for the European herring gull (528 ind.) and the razorbill (326 ind.). The share of all other species amounted to only 1.2%. Most birds were observed during the winter and spring migration and during the winter period. The summer period was characterised by the lowest number of species and the lowest abundances of species.

20.3.7.2 Protected areas, including Natura 2000 sites

The southern part of the offshore area of the planned project, stretching over 11.1 km, crosses the eastern part of the Natura 2000 site Przybrzeżne wody Bałtyku (PLB990002) in the north-south axis.

The **Natura 2000 site Przybrzeżne wody Bałtyku (PLB990002)** was established by the Regulation of the Minister of Environment of 21 July 2004 on the Natura 2000 special protection areas for birds (Journal of Laws of 2004, No. 229, item 2313). The primary function of the site is to provide protection for birds wintering in the nearshore zone of the Baltic Sea, mainly the long-tailed duck (*Clangula hyemalis*), the velvet scoter (*Melanitta fusca*), the common scoter (*Melanitta nigra*), the black guillemot (*Cepphus grylle*), the razorbill (*Alca torda*) and *Gaviiformes*. The surface of the area is 194 626.73 ha, covering the coastal waters of the Baltic Sea up to a depth of approximately 20 m, and its boundaries extend for 200 km, from the tip of the Hel Peninsula, to the eastern border of the Pomeranian Bay.

Approximately 12% of the velvet scoter, 2% of the common scoter and 35% of the long-tailed duck wintering in the Polish maritime areas gather within the area. Due to its importance for wintering birds, the Przybrzeżne wody Bałtyku PLB990002 site is classified as a bird refuge of European significance (refuge code E 80). In the short-term, high abundances of gulls may be recorded in the area, mainly the European herring gull. It is a phenomenon of synanthropic origin – gulls appear in large numbers over the sea area when they accompany fishing boats in search for easily accessible food source.

6 species of birds listed in Annex I to the Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds are subject to protection in the area. Most of them are species wintering in the Polish Baltic area, with the exception of the European herring gull and the common gull, which may appear over the sea area throughout the year.

20.3.7.3 Wildlife corridors

The migration tactics, as well as 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 (*Somateria mollissima*) 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 seabird autumn migration is very extended in time. Starting in August, a series of water bird species can be observed within the PMA. 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.

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

20.3.7.4 Biodiversity

20.3.7.4.1 Phytobenthos

The macroalgae found in the APV variant of the BP OWF CI were characterised by very low species diversity – probably one species belonging to the family *Rhodomelaceae* and *Pylaiella littoralis* or/and *Ectocarpus siliculosus* occurred. Phytobenthos is not present in the RAV area of the BP OWF CI.

20.3.7.4.2 Macrozoobenthos

In the area of the BP OWF CI, 23 macrozoobenthos taxa were found on the soft bottom (sand and gravel settlements). The most abundant were malacostracans *Malacostraca* and polychaetes *Polychaeta*. The most common taxa were the two species of psammophilous polychaetes: *Marenzelleria* sp. and *Pygospio elegans*. The quantitative analyses of the soft bottom showed that the taxa typical of the shallow and medium-deep seabed (up to 35 MBSL) of the near-shore and open waters of the Southern Baltic (eastern Gotland Basin) dominated in the survey area. In terms of abundance, the polychaetes, including *Pygospio elegans* and *Marenzelleria* sp. dominated, while in terms of biomass, the clear dominant were bivalves with the largest share of *Limecola balthica*.

On the hard bottom of the BP OWF CI area, the occurrence of 14 macrozoobenthos taxa was confirmed. The most taxa were the representatives of Malacostraca. In terms of occurrence, as many as 6 taxa were absolutely constant. These included the representatives of the periphytic fauna, such as the bay mussel (*Mytilus trossulus*), *Gonothyraea loveni* and *Einhornia crustulenta* as well as the accompanying fauna: polychaetes *Bylgides sarsi* and *Pygospio elegans* and the juvenile specimens of the genus *Gammarus*. However, in the abundance and biomass structures of this community, the definite dominant was the bay mussel *Mytilus trossulus*, which is a component of the diet of benthivorous birds and fish, also playing an important habitat-forming role in the environment.

20.3.7.4.3 Ichthyofauna

The BP OWF CI Area is typical for the Southern Baltic in terms of species diversity, with a distinct prevalence of cod and flounder in demersal catches and herring and sprat in pelagic catches. In the surveys, the presence of 31 ichthyofauna taxa was confirmed.

In the case of ichthyoplankton, during the entire survey period, the roe of one species of fish (sprat) and the larvae of 12 taxa were caught. These were gobies, sprat, flounder, herring, ammodytids, shorthorn sculpin, rock gunnel, common seasnail, long-spined bullhead, straightnose pipefish, fourbeard rockling and turbot.

During pelagic catches, 8 fish species were caught, 99% of the biomass being sprat and herring. The presence of garfish, three-spined stickleback, great sand eel, mackerel, lesser sand eel and sea trout individuals was also recorded.

During demersal fish catches, fish belonging to 15 taxa were recorded. Flounder and cod dominated, whereas other species constituted a small by-catches (great sand eel, plaice, shorthorn sculpin, mackerel, perch, zander, scarp, sprat, herring, lumpfish, lesser sand eel, viviparous eelpout and whiting).

During catches using beach seine nets in the coastal zone, 19 fish taxa were recorded. The catches were dominated by lesser sand eel, followed by herring, great sand eel, flounder, and perch.

20.3.7.4.4 Marine mammals

During the surveys of marine mammals in the BP OWF CI area, the presence of the harbour porpoise (8 days of positive detection) and the harbour seal (a single observation) was recorded. It cannot be ruled out that the other two seal species, i.e. the grey seal and the ringed seal also occur in the area.

20.3.7.4.5 Seabirds

Within the area, 22 bird species were identified sitting on the water, including 15 seabird species and 7 species of water birds rarely encountered at sea away from the coast. Most birds, in terms of the number of species and individuals, were observed in the winter period and during the autumn and winter migrations. The results obtained show that the BP OWF CI area is typical in terms of the taxonomic composition and the number of bird observations in the context of the entirety of the coastal waters of the Southern Baltic.

The results obtained clearly show that the area covered by the RAV is used by seabirds more intensively compared to the APV. This is particularly relevant for the long-tailed duck and the velvet scoter. In the case of the razorbill and the European herring gull, no differences between the variants were identified regarding bird density.

20.3.7.5 Environmental valorisation of the sea area

In terms of seabirds, the natural values of the BP OWF CI were assessed as high. The project area is a part of the Natura 2000 special protection area for birds – Przybrzeżne wody Bałtyku (PLB990002), within which 9 bird species are under protection.

20.3.8 Cultural values, monuments and archaeological sites and objects

Two ship wrecks are located within the BP OWF CI area, one of which – a wreck of a steamer from the first half of the 20th century – was acknowledged as a historical object. It is located in the southern, coastal part, common for the APV and the RAV, at a distance of approx. 800 m from the shore. The second ship wreck is located in the RAV area at a distance of approx. 12.4 km from the shore. This wreck is not considered to be an object of cultural heritage.

20.3.9 Use and management of the water area and tangible property

The BP OWF CI area is used mainly for navigation and fishery. In the section from the boundary of the territorial sea up to a distance of about 10 km from the shore, the area crosses one of the most important in the Baltic Sea, the customary transport route, leading, among other, to the sea ports in Gdynia and Gdańsk. In addition to transport vessels in the BP OWF CI area, also other vessels such as fishing vessels which conduct catches in this sea area or sail to other fisheries, and small recreational boats (e.g. sailing yachts) appear there. The BP OWF CI area, both in the APV and RAV, is located within the boundaries of five statistical rectangles: O6, N7, O7, N8 and O8. The analysis of the catch volume and effort in those rectangles showed that they did not constitute important fishing grounds for commercial species in the Polish Maritime Areas.

The northern part of the BP OWF CI area is located within the area of the Baltic Power offshore wind farm with a capacity of 1200 MW, the construction of which is planned in the coming years.

In addition to shipping and fishing, the offshore Development Area of the BP OWF CI is also used sporadically for recreational purposes, e.g. yachting.

20.3.10 Landscape, including the cultural landscape

In the natural marine landscape of the BP OWF CI sea area, commercial ships moving along the customary shipping route to and from the ports of Gdynia and Gdańsk, as well as other smaller vessels, e.g. recreational and fishing boats constitute the permanent structural element of anthropogenic origin. In the future, the northern part of the sea area will be developed with the wind turbines of the Baltic Power OWF. Also, there will be other offshore wind farms in its region. The seashore in the subsea cable landfall area is made of a sandy beach, several dozen meters wide.

20.3.11 Population and living conditions of people

The presence of people in the offshore area of the BP OWF CI is only temporary, resulting from the current use of the sea area (shipping). The BP OWF CI Development Area crosses at a distance of 10 km from the shore the customary shipping route to and from the ports of Gdynia and Gdańsk. It is also located within the boundaries of five statistical rectangles: N7, N8, O6, O7 and O8, where fishing activities are conducted.

ONSHORE AREA

20.3.12 Location, topography of the area

In administrative terms, the planned project in both variants is located in the north-eastern part of the Choczewo commune, Wejherowo district, in the northern part of the Pomeranian Voivodeship.

The planned project is located within the boundaries of the coastal belt: technical and protective, which is located at the boundary between two mesoregions – the Słowińskie Coast and the Żarnowiecka Upland, constituting the Koszalin Coastland macroregion. The route of the planned project in both variants is characterised by considerable diversity of terrain topography: starting with the beach and a wide strip of spit with the Wydmy Lubiatowskie dunes, running across the upland foreground with the Bezimienna Stream valley, reaching the undulated moraine plateau in the area of the customer substation.

20.3.13 Geological structure, seabed sediments, raw materials and deposits

20.3.13.1 Geological structure, geotechnical conditions

The planned project in both variants is located entirely within the Precambrian East-European platform within the boundaries of the Peribaltic Syneclise. On the Paleozoic sediment cover with a thickness of approx. 2500 m, a cover of Mesozoic sediments is deposited with a thickness of approx. 400 m. The sub-Quaternary sediments are represented by Cretaceous formations in the area of the planned customer substation and a 400 kV line. The route of the planned project in its initial section runs across aeolian sands on dunes, with local inserts of alluvial sands from valley bottoms.

In the APV, there are residual glacial tills, humus sands and alluvial muds of valley bottoms as well as endorheic depressions, and also alluvial and aeolian sands. In the RAV, after dunes and valley bottoms, the route runs across humus sands and alluvial mud as well as glacial till residuals, and also alluvial and aeolian sands.

The area of the customer substation and the 400 kV line is located on glacial tills on fluvioglacial sands and gravels, as well as sandy-silty eluvia of glacial tills.

For both variants, the youngest formations are the Holocene dune and beach sands.

20.3.13.2 Topography and dynamics of the coastal zone

In the area of cable landfall, the beach has a width of approx. 30–40 m. This area is located within the shore section described as stable: for the period between the years 1875–1979, the changes of the shoreline location were minor. According to the classification of dune shore changeability, the section analysed should be classified as balanced, with possible occurrence of minor changes.

20.3.13.3 Soils

The route of the planned project in both variants runs mostly across soils of forest areas, only the customer substation and the 400 kV line are located in non-forest areas.

In the APV, podzols and brunic podzols are dominant. Arenosols as well as brunic brown and brown soils also account for a large share. In the RAV, podzols are dominant. Brunic podzols and brown soils, brunic brown soils and arenosols also have a large share.

20.3.13.4 Raw materials and deposits

The planned project in both variants is located entirely within the Żarnowiec concession No. 5/2019/Ł for the prospection, exploration and production of hydrocarbons of 13 June 2019, owned by ShaleTech Energy Sp. z o.o.

No mineral resource deposits nor mining areas are located within the boundaries of the planned project in none of the variants considered nor the areas of their potential impact.

20.3.14 Surface waters and their quality (Water Framework Directive)

The planned project in both variants, according to the hydrographic division of Poland, is situated in the Vistula River basin, in the Lower Vistula water region; in most part in the direct catchment area of the sea and in the catchment area of the Łeba River. Forest-agricultural type of land use is dominant there.

In the surroundings of the planned project in both variants, the hydrographic network comprises of small water courses: Lubiatówka, Bezimienna, and the Biebrowski Canal with the tributary from Kierzkowo.

In the area of the planned project in both variants, there are no surface water intakes nor protection zones for surface water intakes established under local law.

The planned project situated, in both variants, in the water area of the Lower Vistula, shall be implemented within the boundaries of the catchment area of the sea CWDW1801 and the following surface water bodies: the Chełst River to its outlet into Lake Sarbsko RW200017476925.

20.3.15 Hydrogeological conditions and groundwater

The occurrence of groundwater in the area of the planned project in both variants is connected to water-bearing formations in the Quaternary and Tertiary horizons.

In the APV, along the majority of the section, the planned project will be located in an area where the depth of the first aquifer is approximately 10–20 MBGL. Groundwater is at its lowest level just before the waterlogged valley of the Bezimienna Stream. Low water level at a depth of 2–5 MBGL is present along two sections.

In the RAV, along the majority of the section, the planned project will be located in an area where the depth of the first aquifer is approximately 10–20 m. Groundwater is at its lowest level in the area of the waterlogged valley of the Bezimienna Stream. The nearest groundwater intake point is the Lubiatowo intake.

20.3.16 Climatic conditions and air quality

20.3.16.1 Climate and the risk related to climate change

The planned project in both variants is located in the transitional climate zone in Pomerania region, the specificity of which involves high changeability of weather conditions. A typical maritime climate is present there, characterised by small annual, seasonal and daily amplitude of air temperatures, high humidity and windiness. Short and mild winters, cool summers and significant amount of precipitation are typical there.

Extreme events (heavy rainfall, floods, deluges, landslides, heat waves, droughts, storms, landslides, etc.) resulting from climate change are projected to increase in frequency and intensity in the future.

Impacts of climate change in the coastal zone primarily include an increase in the frequency, intensity and duration of storms.

20.3.16.2 Meteorological conditions

In the area of the planned project, west and north-west winds predominate. The average number of days per year with strong wind (v >10 $m \cdot s^{-1}$) and very strong wind (v >15 $m \cdot s^{-1}$) may reach up to 70 here. Further inland, the number of days with strong and very strong wind decreases 5–6 times. Breezes as well as frequently passing low pressure areas causing strong winds, storms and heavy rainfall are all characteristic phenomena.

In the area of Choczewo, the average annual air temperature is 7.2°C. In the area of the planned project, the vegetation period is approx. 180 days. The average annual sum of precipitation is approx. 500 mm, with a predominance of summer precipitation.

20.3.16.3 Air quality

The main sources of air pollution in the area of the Choczewo commune are municipal, domestic, and transport sources, secondary dusting from exposed terrain surfaces; as well as allochthonous pollution coming from outside the commune.

The Low-emission Economy Plan for Choczewo Commune, includes an action plan with regard to decarbonisation. The cable line runs across forest areas, and as a result it should be assumed that there are no exceedances of pollution emission into the air. In the vicinity of the planned project, there are no exceedances of the permissible air pollution concentrations.

20.3.17 Ambient noise

The main acoustic nuisance in the Choczewo commune area is communication noise, mainly along the voivodeship road no. 213 Słupsk–Celbowo and along the district and commune roads.

Within the area of the planned project potential impact, there are acoustically protected areas. This is the area of the Rehabilitation and Holiday Centre for disabled people (ul. Spacerowa 38, Lubiatowo).

In the RAV, within the area of the planned project potential impact, there are no acoustically protected areas. This variant is located at a distance of approx. 420 m from the area of the Rehabilitation and Holiday Centre for disabled people. At a distance of approx. 430 m in the eastern direction at km 41+720, there is a scout hall in Szklana Huta.

The buildings of the village of Osieki Lęborskie nearest to the planned customer substation and 400 kV line are situated at a distance of approx. 900 m to the west, and the buildings of the village of Lubiatowo approx. 530 m from the APV and approx. 1.7 km from the RAV. Single residential homestead housing in Szklana Huta is located at a distance of 630 m from the APV and 1 km from the RAV.

20.3.18 Electromagnetic field (EMF)

The Choczewo commune area is supplied from the National Power System (NPS) from a transformer station MTS Jackowo 110/15 kV. The MTS transformer station is supplied by two HV power overhead lines: HV 110 kV line Opalino and HV 110 kV line Wojciechowo. Back-up supply for the MV lines is provided by 110/15 kV MTS Opalino and Bożepole stations.

The commune power supply infrastructure system includes:

- MTS 110/15 kV Jackowo station (main transformer station);
- the transmitted 15 kV power supplying individual settlement units – 8 overhead lines;
- a series of 15/04 kV transformer stations supplying the end customers.

20.3.19 Description of the natural environment components and protected areas

20.3.19.1 Biotic elements in the onshore area

20.3.19.1.1 Fungi

The occurrence of fungi of high nature value in the area of the planned project in both variants is quite scarce and concentrated only in the northern part of the area. The fungi species occurring there are quite common and widespread, with a high naturalness rate in lowland forest areas.

Among the species of high nature value occurring in the APV, the following should be mentioned: red ring rot, yellow knight, woolly tooth, and dune brittlestem.

Among the species of high nature value occurring in the RAV, the following should be mentioned: chaga, *Postia guttulata*, yellow knight, woolly tooth, *Leccinum niveum*, dune brittlestem, jellied bolete, European destroying angel, and bluing bolete.

20.3.19.1.2 Lichens

The APV route, runs across two areas characterised by significant richness and diversity of lichen, with a large share of species of high nature value (protected, rare, endangered); there are approx. 36 species, among others, silver-lined wrinkle, bristly beard lichen, *Zwackhia viridis*, reindeer lichen, grey reindeer lichen, rim lichen, eagle’s claws lichen, cartilage lichen, dotted ribbon lichen, and farinose cartilage lichen.

The RAV route is characterised by less common occurrence of lichen than in the case of the APV and runs across two areas characterised by significant richness and diversity, both from the point of view of coniferous species and old-growth deciduous species. Among the lichen species occurring there, the following should be mentioned: silver-lined wrinkle, bristly beard lichen, *Zwackhia viridis*, tree reindeer lichen, reindeer lichen, grey reindeer lichen, Griffith's cliostomum lichen, and farinose cartilage lichen.

20.3.19.1.3 Mosses and liverworts

Along the entire route of the APV, there are common terrestrial coniferous forest species, part of which is under partial protection. Among the moss and liverwort species occurring there, the following should be mentioned: white pincushion moss, mountain fern moss, pointed spear-moss, Bruch’s pincushion, common hair-cap moss, bog groove-moss, red-stemmed feathermoss, blunt-leaved bog moss, red bog-moss, and wavy broom moss.

A vast majority of bryophytes typical for groundcover of deciduous and coniferous forests and forest peat depressions, which were recorded in the area of the potential impact of the RAV, are species widespread in Poland and in Gdańsk Pomerania region. They are not endangered neither on the national nor regional scale. In the RAV area, the plots of the following species can be found: white pincushion moss, *Eurhynchium angustirete*, mountain fern moss, pointed spear-moss, crisped pincushion moss, neat feather-moss, common hair-cap moss, red-stemmed feathermoss, wavy broom moss, and broom forkmoss.

20.3.19.1.4 Vascular plants and natural habitats

The vegetation of the area in both variants includes the communities of strips of white dunes, then grey dunes and coastal deciduous and coniferous forests, which further transform into fresh pine forests and mixed coniferous forests.

Along the APV route, 8 plant species of high nature value were confirmed: marsh Labrador tea, black crowberry, one-flowered wintergreen, broad-leaved helleborine, creeping lady's-tresses, sand sedge, stiff clubmoss, and cross-leaved heath. The inventory survey of natural habitats carried out confirmed the presence of four natural habitats: 2120 – Shifting dunes along the shoreline with *Ammophila arenaria* (“white dunes”), 2130 – Fixed coastal dunes with herbaceous vegetation ("grey dunes"), 2180 – Wooded dunes of the Atlantic, Continental and Boreal region and 9110 – *Luzulo-Fagetum* beech forests.

The area that is crossed by the RAV is characterised by a strip-like arrangement of habitats, parallel to the seashore, with relatively well-preserved vegetation. 8 plant species of high nature value were found here – the same as in the APV, with the only difference being the presence of the stag's-horn clubmoss instead of the stiff clubmoss. Three natural habitats are present there: 2130 – Fixed coastal dunes with herbaceous vegetation ("grey dunes"), 2180 – Wooded dunes of the Atlantic, Continental and Boreal region and 91D0 – Bog woodland.

20.3.19.1.5 Forrest complexes

The forests of the Choczewo Forest District represent the typical communities of coastal forests located at the back of grey dunes. The forest health status for pine and mixed stands with their share is good. The stands are characterised by good quality and health. In both variants, fresh mixed coniferous forest and fresh coniferous forests, as well as dry coniferous forests are dominant, giving way in the southern part to fresh mixed forests. These are mainly commercial forests. In the northern part, forests with protective functions are dominant: mainly soil-protective and water-protective. Moreover, there are commercial forests and tree-felling is carried out there.

20.3.19.1.6 Invertebrates

Within the area of the potential impact of both variants, the following invertebrate species were found, for which there are additional indications of their presence in a given space, e.g. nests, feeding sites, larval occurrence, accumulation of individuals in a given space, etc. − blue-winged grasshopper and European paper wasp.

20.3.19.1.7 Ichthyofauna

Due to the extremely low water levels, which have been observed for many years despite the presence of potential hiding places, shading, stream bed diversity etc., the watercourses surveyed are characterised by low diversity. In the watercourses inventoried, the presence of the following fish and lamprey species was confirmed: three spined stickleback, nine-spined stickleback, and European river lamprey.

20.3.19.1.8 Herpetofauna

Two species of amphibians were found in the survey area: the common toad and the common frog, and 3 species of reptiles: the sand lizard, the viviparous lizard and the slow worm. All the species found are under legal protection in Poland.

20.3.19.1.9 Birds

In the planned project potential impact area, in both variants, 63 bird species were found – both in the breeding period, as well as during the migration and wintering periods.

20.3.19.1.10 Mammals

In both variants, mammals are represented by species quite common across the entire country. With the exception of small mammals connected to a particular habitat, the remaining animals inhabiting the area analysed use large areas of land and many habitats;, they are not assigned to any specific site. The following species were identified: grey wolf, Eurasian otter, northern white-breasted hedgehog, stoat, Eurasian beaver, European water vole, wood mouse, red squirrel, common shrew, Eurasian pygmy shrew, European mole, and bats (Chiroptera).

20.3.19.2 Protected areas, including Natura 2000 sites

The APV in its onshore area, is located within the boundaries of the Coastal Protected Landscape Area. Additionally, it is located in direct vicinity to the Natura 2000 sites – special habitat protection area Białogóra (PLH220003) and special bird protection area Przybrzeżne wody Bałtyku (PLB990002), as well as the ecological area "Torfowisko" [Peat Bog] in Szklana Huta.

The RAV is located within the boundaries of the Coastal Protected Landscape Area, the ecological area "Torfowisko" [Peat Bog] in Szklana Huta, and the Natura 2000 site Białogóra (PLH220003). Additionally, it is located in the vicinity of the Natura 2000 site – special bird protection area Przybrzeżne wody Bałtyku (PLB990002).

20.3.19.3 Wildlife corridors

The planned project in both variants is located within the Kashubian Coast wildlife corridor (code KPn-20C).

20.3.19.4 Biodiversity

The biodiversity of the site is not uniform and is connected to the number and heterogeneity of habitats. Variability of biodiversity also depends on the season of the year, the interrelationship between the abundance of the organisms concerned and the study group.

Both variants show relatively high biodiversity. The greatest biodiversity occurs in the area of the Wydmy Lubiatwskie dunes and in the Bezimienna Stream valley.

20.3.19.5 Environmental valorisation of the area

The results of the inventory survey conducted show a relatively high biodiversity in the area of the planned project in both variants. The greatest biodiversity occurs in the area of the Wydmy Lubiatwskie dunes and in the Bezimienna Stream valley.

20.3.20 Cultural values, monuments and archaeological sites and objects

Within the planned project potential impact area, in none of the variants analysed, monuments, sites or archaeological objects were identified. The following archaeological sites are located in the vicinity:

- Osieki Lęborskie site 1 – barrow-type cemetery (approx. 150 m west of the APV potential impact area and approx. 1.1 km of the RAV potential impact area);

- Osieki Lęborskie site 2 – box(shaped) graves (approx. 85 m west of the APV potential impact area and approx. 700 m of the RAV potential impact area).

In addition, ongoing preparatory works have identified 6 archaeological sites – barrows, located approx. 85 m south-west of the APV and approx. 810 m west of the RAV.

20.3.21 Use and management of land and tangible property

Main types of land use with reference to both variants are forests, waterlogged meadows in the Bezimienna Stream valley, arable lands within the area of the customer substation and 400 kV overhead line, local road (Spacerowa street), and fire break lanes as well as surface waters (watercourses and small water reservoirs).

In summer, these areas are visited by a great number of tourists. A street runs there (Spacerowa street) which leads along the Wydmy Lubiatowskie dunes in the eastern direction, and constitutes a fragment of the blue tourist trail. A Rehabilitation and Holiday Centre for disabled people is located there (ul. Spacerowa 38, Lubiatowo), constructed on the premises of a former military unit. Moreover, in the vicinity of the planned project, a fire observation tower is located.

20.3.22 Landscape, including the cultural landscape

The planned project is located within the lowland landscape as well as valleys and depressions. It is located on the Słowińskie Coast and the Choczewo Upland. It runs mainly across forest areas and to a small extent across arable land, which are visible in the area of the designed customer substation – the landscape of these areas should be considered as culturally disharmonious, where the human activity relatively strongly transforms the surrounding landscape. The manifestations of the cultural landscape in the vicinity of the planned project are archaeological sites in the form of cemeteries (Osieki Lęborskie 1 and Osieki Lęborskie 2). Moreover, in the town of Osieki Lęborskie, an object entered into the Voivodeship Register of Monuments is located – a Roman Catholic Church of the Saint Mary's Star of the Sea with a church graveyard.

The planned project will be located within the area of the Coastal Protected Landscape, which is characterised by very high landscape values due to the strip-like arrangement of moraine uplands, extensive coastal plains, dunes and beaches and the seashore. In the area of the shoreline, the planned project runs in direct vicinity of a viewing axis.

20.3.23 Population and living conditions of people

In the planned project impact area in the APV, the area of the Rehabilitation and Holiday Centre for disabled people is situated. In the RAV, within the area of the planned project impact, there are no developed areas. At a distance of approx. 430 m in the eastern direction, there is a scout hall in Szklana Huta.

The buildings nearest to the planned customer substation and 400 kV overhead line are located at the following distances:

- approx. 900 m in the western direction – the village of Osieki Lęborskie;
- approx. 3 km in the north-western direction – the village of Lubiatowo.

Single residential homestead housing in Szklana Huta is located at a distance of 630 m from the APV and 1 km from the RAV.

20.4 Modelling performed for the purposes of the project impact assessment

20.4.1 Modelling of underwater noise propagation

As part of the modelling, the following analyses were carried out: the expected noise levels resulting from the construction and operation of subsea cables were specified, the potential effects on marine mammals and fish that may result from noise emission were determined, and the range from the source at which the impact may be expected were estimated.

The noise generated by operations related to the traffic of vessels and cable burial is of continuous character, with predominantly low frequency components.

The receptors sensitive to noise, which may be present in the vicinity of the planned project, include marine mammals and fish. A wide spectrum of anthropogenic sounds that may occur during the implementation of the planned project is not equally audible by animals. Marine organisms are affected by lower sound energy than the total sound energy introduced into water, since the range of frequencies heard by individual organisms varies depending on the species.

The noise sources will be mobile, so propagation conditions will change over time depending on many factors, i.a., topography and type of the seabed, wave motion, depth, water temperature, direction of vessel traffic and many others; therefore, it is impossible to determine precise impact ranges, and the values provided are estimates based on the knowledge available from surveys conducted under similar projects.

It is expected that none of the noise sources related to the installation or operation of the BP OWF TI will exceed the exposure limits determined on the basis of the injury criteria for marine mammals or fish. The underwater noise emissions predicted for the construction and operation of subsea cables do not pose a risk of injuries to marine mammals or fish, but may cause disturbances in their behaviour.

The maximum ranges of disturbances for marine mammals will be between several hundred metres for large DP vessels and several dozen metres for the noise generated by smaller vessels and installation works. In the case of fish, disturbances will have a greater range due to higher sensitivity of the organisms and may reach up to approx. 1.4 km for large vessels with DP and several hundred metres for smaller vessels and cable burial.

The ranges of disturbances resulting from installation works and the noise emitted by vessels related to the planned project are limited to a small area and will be short-term, thus, they are unlikely to have a significant impact on marine mammals or fish.

Vessels similar to those likely to be used for cable installation will be regularly used to service the transmission infrastructure in the OWF area. The source of noise generated by increased vessel traffic may significantly change the ambient noise level in relation to the initial conditions.

20.4.2 Modelling of noise propagation in the atmosphere

For the calculation of the unit sound power of the designed 220 and/or 275 kV overhead line, the sound propagation model, used and calibrated in the calculations of the noise generated by the 220 and 400 kV lines operating in Poland in the systems with two- and three-conductor bundle in various geometric configurations, may be applied. In this model, the sound power calculations are performed for both the lines under rain conditions and with dry conductors. In the sound propagation model adopted, the main parameters characterising a given conductor in terms of sound power generated as a result of corona discharge phenomena are its diameter as well as the surface type and condition.

The noise level calculations will be carried out using a proprietary program, the algorithm of which is based on the sound propagation model of the overhead line and adapted to domestic conditions. When implementing the said computational model into a specific calculation algorithm, it is necessary to provide the following input data:

- line phase voltage (220 kV and/or 275 kV);
- diameter of the phase conductor designed for use;
- geometry of conductors in the design cross-section;
- distance between the calculation point and each line conductor;
- calculation factor depending on the conductor surface conditions (factor determined experimentally);
- calculation factor depending on weather condition (factor determined experimentally for different rainfall intensity);
- calculation factor depending on the geometry of the conductor system (factor determined experimentally).

The results of the calculations of sound level distribution in the vicinity of the designed line, which will be carried out using the implemented computational model described above, will be presented in the tabular and graphical forms (diagrams), and commented.

Its three-dimensional acoustic model was developed to carry out the calculations of the noise from a customer substation. The source of continuous noise emitted by a substation are first of all (auto)transformers and reactors, and above all the equipment used to cool them (fans). For modelling, it was assumed that all the equipment at the substation will operate simultaneously and without interruption (around the clock), which means the most unfavourable conditions in terms of environmental impact.

20.4.3 Modelling of the distribution of electric and magnetic components of the electromagnetic field

The distribution of the intensity of the electric field E and magnetic field H was calculated using the PolE-M software.

In order to model a specific overhead line, it is required to provide the following technical data:

- coordinates of conductor suspension in the design cross-section, compliant with the series and type of towers in a given span;
- the minimum (smallest permissible) distance between the phase conductors and the ground;
- the maximum line working voltage;
- the maximum line load (maximum long-term phase load current);
- the type of phase conductors and bundle structure (if there is more than 1 conductor per phase),
- phase system in individual circuits.

The calculations of the electric field distribution (similarly to magnetic field) were carried out for a representative span of the analysed 4-circuit power line routed on towers.

The calculations were carried out for the smallest (depending on many factors, the most important of which are: the height of towers, span length, tension of conductors, topography and the presence of facilities under the line) of the designed distance between the phase conductor and the ground of h_{min} = 6.7 m for the line operating at the voltage of 220 kV and h_{min} = 7.1 m for the line operating at the voltage of 275 kV.

20.4.4 Modelling of the thermal impact of HV cable lines

The computational model was developed on the basis of the so-called image method and Kennelly formula assuming the existence of two linear heat sources, i.e. the actual source representing the power loss due to phase conductor resistance and the dielectric losses in the primary insulation of a power line, and its symmetrical representation with regard to the Earth's surface, with identical power value as the actual source adopted with a negative sign.

It is assumed that for a homogeneous centre, the thermal resistance of soil is constant in the entire semi-infinite environment and does not depend on the distribution of the temperature field in the ground. The superposition principle was applied to temperature fields coming from individual cable lines of the system in question in order to map thermal interaction and estimate the cumulative impact coming from all the cable lines of the system in question.

Thermal calculations were made on the basis of an alternative diagram consisting of a system of thermal resistances connected in series.

Basic calculation assumptions:

- number of cable circuits – 4 pcs.;
- laying method – flat;
- axial distances between individual cable circuits – 5 m;
- axial distance between phases in each circuit – 0.3 m;
- laying depth – 2 m;
- soil temperature – 20°C;
- average soil resistivity value – 1 m×K/W;
- cable line load factor – LF = 1;
- both-ends bonding of return wires with cross-bonding;
- symmetrical loading of all circuits;
- frequency – 50 Hz.

Design assumptions for soil conditions are compliant with the IEC 60287-3-1 standard for Poland.

20.4.5 Modelling of suspended solids propagation

The analysis of the spatial distribution and intensity of the propagation of suspended solids released into the water depth during the underwater works related to the laying of the BP OWF CI cable lines was carried out using the MIKE 21 Coupled Model FM 2020 software created and developed by DHI.

When conducting the simulations, the following was taken into account:

- sea currents as the main factor forcing the movement of suspended solids in the water depth;
- sediment sinking process due to its physical structure – single particles sinking and flocculent particles sinking.

Mild to moderate weather conditions were assumed in the simulations, since in reality, only in such conditions it is possible to carry out works connected to the laying and burying of power cables. In the modelling, two technologies used in cable line construction in offshore areas, which are characterised by the greatest impact on the environment, were studied, i.e. jetting and mass flow excavation. The jetting technology is one of those technologies that is taken into consideration for the phase of cable laying in the seabed, whereas, the use of MFE technology is envisaged for the operation phase, when recovering the cable from the seabed for the purposes of its repair becomes necessary. The MFE technology is considered to be the most intrusive to the marine environment, therefore meets the criterion of the worst-case calculation scenario.

To conduct calculations of the suspended solids generation and mode of spreading during power cable laying and burying in the seabed, numerical models were created using the MIKE21 software package. The model enabled conducting calculation simulations according to the following scenarios:

- based on the BP OWF CI cable route adopted:
  - the Applicant Proposed Variant (APV),
  - the Rational Alternative Variant (RAV);
- based on the technology of subsea cable burying in the seabed:
  - construction phase: jetting method with soil displacement, two speeds of the cable laying vessel: 2 km/day and 5 km/day (~85 m·h^{-1} and ~210 m·h^{-1}, respectively), forcings: sea currents, wind,
  - operation phase: mass flow excavation method, two speeds of the cable laying vessel: 2 km/day and 5 km/day (~85 m·h^{-1} and ~210 m·h^{-1}, respectively), forcings: sea currents, wind;
- based on the environmental conditions:
  - spring period – predominance of winds from the W–N sector,
  - summer period – varied wind directions.

Various soil conditions along the cable route were considered as part of the analysis of both technologies, which could have been implemented to the model thanks to the preliminary geophysical identification of the designed BP OWF CI routes. Such an identification enabled the identification of route sections with non-cohesive and cohesive soils.

Performing all the planned simulations produced the following results:

- for the APV route, the scope of disturbance for the **jetting method** assumes the following values:
  - **in non-cohesive (sandy) soils**: the largest size of the suspended solids cloud with a concentration of 30 mg·l^{-1} → approx. 0.2 km from the cable route; the largest distance at which the suspended solids concentration drops below 4 mg·l^{-1} → approx. 2.2 km from the cable route;
  - **in cohesive soils**: the largest size of the suspended solids cloud with a concentration exceeding 100 mg·l^{-1} → approx. 0.3 km from the cable route, more than 30 mg·l^{-1} → approx. 1.3 km from the cable route; the largest distance at which the suspended solids concentration drops below 4 mg·l^{-1} → approx. 11.5 km from the cable route,
  - the thickness of sediments generated from the suspended solids sedimentation in the prevailing area of disturbance does not exceed 1 mm, only locally in the close vicinity of the cable, in the conditions of current stagnation it can reach up to 4.3 mm;

  - the prevailing part of the sea area with suspended solids, outside the route corridor, is characterised by a suspended solids concentration of 5–50 $mg \cdot l^{-1}$;
  - suspended solids concentration exceeding 30 $mg \cdot l^{-1}$ lasts shorter than 16 hours;
- for the RAV route, the scope of disturbance for the **jetting method** assumes the following values:
  - **in non-cohesive (sandy) soils**: the largest size of the suspended solids cloud with a concentration exceeding 30 $mg \cdot l^{-1}$ → approx. 0.5 km from the cable route; the largest distance at which the suspended solids concentration drops below 4 $mg \cdot l^{-1}$ → approx. 6 km from the cable route,
  - **in cohesive soils**: the largest size of the suspended solids cloud with a concentration exceeding 100 $mg \cdot l^{-1}$ → approx. 0.3 km from the cable route, more than 30 $mg \cdot l^{-1}$ → approx. 1.3 km from the cable route; the largest distance at which the suspended solids concentration drops below 4 $mg \cdot l^{-1}$ → approx. 9 km from the cable route,
  - the thickness of sediments generated from the suspended solids sedimentation in the prevailing area of disturbance does not exceed 1 mm, only locally in the close vicinity of the cable, in the conditions of current stagnation it reaches up to 3 mm,
  - the prevailing part of the sea area with suspended solids, outside the route corridor, is characterised by a concentration of 5–50 $mg \cdot l^{-1}$,
  - suspended solids concentration exceeding 30 $mg \cdot l^{-1}$ lasts shorter than 11 hours;
- for the APV route, the scope of disturbance for the **mass flow excavation** method assumes the following values:
  - **in non-cohesive (sandy) soils**: the largest size of the suspended solids cloud with a concentration exceeding 100 $mg \cdot l^{-1}$ → approx. 0.3 km from the cable route, more than 30 mg/l^{-1} → approx. 1.5 km from the cable route; the largest distance at which the suspended solids concentration drops below 4 $mg \cdot l^{-1}$ → approx. 7.5 km from the cable route,
  - **in cohesive soils**: the largest size of the suspended solids cloud with a concentration exceeding 100 $mg \cdot l^{-1}$ → approx. 3 km from the cable route, more than 30 $mg \cdot l^{-1}$ → approx. 8.5 km from the cable route; the largest distance at which the suspended solids concentration drops below 4 $mg \cdot l^{-1}$ → approx. 18.5 km from the cable route,
  - the thickness of sediments generated from the suspended solids sedimentation in the prevailing area of disturbance does not exceed 5 mm, only locally in the close vicinity of the cable, in the conditions of current stagnation, it can reach up to 26 mm,
  - the prevailing part of the sea area with suspended solids, outside the route corridor, is characterised by a concentration of 5–150 $mg \cdot l^{-1}$,
  - suspended solids concentration exceeding 30 $mg \cdot l^{-1}$ lasts shorter than 30 hours;
- for the RAV route, the scope of disturbance for the **mass flow excavation** method assumes the following values:
  - **in non-cohesive (sandy) soils**: the largest size of the suspended solids cloud with a concentration exceeding 100 $mg \cdot l^{-1}$ → approx. 0.1 km from the cable route, more than 30 $mg \cdot l^{-1}$ → approx. 1.2 km from the cable route; the largest distance at which the suspended solids concentration drops below 4 $mg \cdot l^{-1}$ → approx. 7.5 km from the cable route,
  - **in cohesive soils**: the largest size of the suspended solids cloud with a concentration exceeding 100 $mg \cdot l^{-1}$ → approx. 3 km from the cable route, more than 30 $mg \cdot l^{-1}$ →

approx. 9.5 km from the cable route; the largest distance at which the suspended solids concentration drops below 4 mg·l^{-1} → approx. 15 km from the cable route,
  - the thickness of sediments generated from the suspended solids sedimentation in the prevailing area of disturbance does not exceed 5 mm, only locally in the close vicinity of the cable, in the conditions of the current stagnation it can reach up to 20 mm,
  - the prevailing part of the sea area with suspended solids, outside the route corridor, is characterised by a suspended solids concentration of 5–150 mg·l^{-1},
  - suspended solids concentration exceeding 30 mg·l^{-1} lasts shorter than 30 hours.

The main objective of the calculations was to conduct numerical simulations for these methods of cable laying and burying, which cause the greatest disturbance in the marine environment, i.e. the jetting method and the mass flow excavation method. The analysis of the calculation results leads to the following conclusions:

- the momentary values of the maximum suspended solids concentrations, which locally reach up to 200 mg·l^{-1} for the jetting method with soil displacement and exceed 500 mg·l^{-1} for the mass flow excavation method, are definitely higher than the natural concentrations occurring in the survey area. The duration of concentrations higher than 100 mg·l^{-1}, is short-term, not exceeding 16 hours for the former method and 30 hours for the latter method. Moreover, such high concentration values are limited spatially to the direct vicinity of the cable route;
- the increase in the speed of cable laying vessels increases the concentration and the suspended solids scope of impact. Speed is a factor that enables controlling, to a certain extent, the disturbing effects of suspended solids on the environment;
- the calculated durations of the environmental conditions deterioration caused by cable burying (exceedance of the defined suspended solids concentrations) are short-term, and such impacts should be considered short-term as well;
- the thickness of the newly-formed sediment layers for the jetting method in the area adjacent to the BP OWF CI area may reach up to 4.5 mm, and the range, in which the thickness exceeds 1 mm, may reach up to 3 km. These parameters are 3 to 6 times lower compared to the mass flow excavation method;
- with the mass flow excavation method used to bury the cable, the area of the sediment structure disturbed with a high-performance intense water jet is significantly larger than in the case of any other possible method. The water jet disrupts the sediment bonding structure, allowing much of the finest soil to become suspended. In practice, this method is most commonly used only along limited sections, for example, in the location of the crossing of two linear installations, in order to limit the level of sinking of the previously buried installation;
- the burying of cable to the level of 3 m below the seabed is practically the maximum level of burying used. For every project, this level is adopted depending on the present soil conditions and the intensity of the sea area use. The adoption of various (shallower) levels of power cable burial in the area of the Offshore Connection Infrastructure is highly probable in the project analysed;
- during the actual design of individual cables of the offshore connection infrastructure, the results of geotechnical surveys may lead to slight cable route corrections;

after identification, the soil conditions may enable the application of the ploughing technology, in which the area of soil structure disturbance is smaller, and the amount of sediments becoming suspended is significantly smaller than for the methods analysed in this report.

20.5 Description of the environmental impacts predicted in the case the project is not implemented, taking into account the available information on the environment and scientific knowledge

Failure to implement the project consisting in the construction and exploitation of the Baltic Power OWF Connection Infrastructure may take place in two cases, i.e.:

- complete abandonment of offshore wind energy in the PMA, which in consequence means the necessity to generate energy from the existing or other sources;
- abandonment of the Baltic Power OWF project with a power output of 1200 MW with the simultaneous implementation of other OWFs within the Polish EEZ.

For each of the two situations indicated above, the expected impacts on abiotic and biotic elements of a varied degree and extent will not occur. These elements will be subject to the existing impacts resulting from the existing pressures in the marine environment.

20.6 Project impacts identification and assessment

20.6.1 Applicant Proposed Variant (APV)

OFFSHORE AREA

20.6.1.1 Construction phase

20.6.1.1.1 Impact on geological structure, seabed sediments, access to raw materials and deposits

The overall impact of the project during its construction phase was assessed as **negligible** for the general character of the seabed and its structure – the changes will be minor, over a small surface of the seabed, linear (along the cable route). In geological terms, taking into account the nature of deposits forming the seabed surface of the BP OWF CI area, no significant changes in the nature of deposits are expected. Possible changes may occur only locally, where it is necessary to replace weak soil with soil of appropriate parameters, but this will mainly depend on the technology selected. The impact on surface sediments will be **negligible**.

20.6.1.1.2 Impact on the quality of seawater and seabed sediments

Contamination of seawater and/or seabed sediments with the pollutants and nutrients released from the sediments during the BP OWF CI construction process is a direct, negative impact of a local range, short-term or momentary, irreversible, repeatable during the construction period, of medium intensity. The significance of this impact during the construction phase in APV was assessed as **low** for the seawater and as **negligible** for the seabed sediments.

The impact of contamination with petroleum products released during the normal operation of vessels was assessed as **negligible** for the seawater and the seabed sediments. The impact of oil spill as a result of an emergency situation, due to the random and sporadic nature of breakdowns and collisions was assessed to be **low** for the seawater and the seabed sediments.

The analysis of impact resulting from the contamination of seawater and seabed sediments with antifouling agents containing organotin compounds (e.g. TBT) indicated that its significance for both those components of the environment would be **negligible**.

The significance of impact resulting from the contamination of water and seabed sediments by accidental release of municipal waste or domestic sewage was also assessed as **negligible**.

Chemicals and construction waste released accidentally to the water depth will result in impacts, which in the case of water were assessed as **negligible**, and in the case of seabed sediments as **low**.

20.6.1.1.3 Impact on climate, including greenhouse gas emissions and impacts relevant for adaptation to climate change, impact on atmospheric air (air quality)

During the construction phase of the BP OWF CI, the significance of the planned project impact on climate and greenhouse gas emissions will be **negligible**, since there will be no factors that could have any noticeable impact on their change.

The impact on air quality (emission of flue gases from vessels involved in construction work) will be temporary and will cease after the works are completed. Furthermore, since the area is open and unobstructed, pollutant concentrations will be quickly diluted. Therefore, the significance of the impact will be **low**.

20.6.1.1.4 Impact on the ambient noise

The ambient noise in the area of the planned project, will increase beyond the current level due to the rise in the number of vessels involved in the construction and the equipment used for cable laying. It will be a continuous sound in the low frequency range. However, the extent of this impact is restricted in time, to the period of the cable laying works, and in space, as a result of noise attenuation by water – from a few hundred metres for high frequencies to several kilometres from the sound source of low frequencies. The impact will be **low**.

20.6.1.1.5 Impact on nature and protected areas

20.6.1.1.5.1 Impact on biotic elements in the offshore area

20.6.1.1.5.1.1 Phytobenthos

The disturbance of the hard substrate occurring in the area of the BP OWF CI in the form of boulders deposited on the seabed will cause the destruction of the algae overgrowing them. The significance of this impact was assessed to be **moderate**. However, due to minor presence of macroalgae in this area, their loss will not be of significance to the ecosystem. The impact of the increase of suspended solids concentration in the water depth, and thus, of greater water turbidity and their re-sedimentation as well as redistribution of nutrients and contaminants from sediments to the water depth will not significantly affect the status of macroalgae. The significance of those impacts was assessed as **negligible**.

20.6.1.1.5.1.2 Macrozoobenthos

A separate assessment of the project impact on two communities of the seabed fauna (soft and hard bottoms), which differ in terms of significance and sensitivity in the context of various types of impacts, was conducted. As a result of the analysis of the impact of three pressure factors in the construction phase: the content of suspended solids in the water, sedimentation of suspended solids on the seabed and redistribution of pollutants from sediment into water, on the macrozoobenthos of the soft and hard bottoms, those impacts were assessed as **negligible**. The impacts resulting from the disturbance of the seabed sediment structure were assessed as **low**. The distribution of the quality of the macrozoobenthos communities in the BP OWF CI area indicates that most of the surface area of the planned project region is characterised by, first of all, moderate and poor condition of the seabed fauna. The most negative impact will be the physical destruction of benthic organisms, as a result of the disturbance of the seabed sediments during cable burial in the seabed, especially in places where the ecological quality of the communities was higher than moderate; however, they occur only **in spots** along the APV corridor, e.g. within the hard-bottom macrozoobenthos habitat as well as locally on the sandy seabed. Impacts on seabed habitats indirectly result in impacts on higher trophic levels by depleting the food base for the fish and seabirds feeding on benthos (benthivorous animals). However, no significant change in the quality structure of the macrozoobenthos community will take place, because this will be a reversible phenomenon and up to several years, at maximum, after the impacts cessation, the quality structure of macrozoobenthos will be restored. Thus, the food supply for benthivorous animals will be restored. The overall impacts of the construction phase on macrozoobenthos are not significant in nature.

20.6.1.1.5.1.3 Ichthyofauna

To assess the impact of the BP OWF CI construction phase on marine ichthyofauna, the impact of noise and vibration emissions, the increase in suspended solids concentration, the release of pollutants and nutrients from sediments into water as well as the habitat change were analysed. The significance of the impact of the above factors was assessed as **negligible** for all the fish species examined.

20.6.1.1.5.1.4 Marine mammals

The following impacts on marine mammals have been identified as a result of the project:

- noise;
- appearance of suspended solids;
- appearance of pollutants;
- changes in the habitat;
- disturbance on the water surface.

The impact of noise on the harbour porpoise, due to the status of the species population, was assessed as **moderate**, for seals this impact will be **low**. Other impacts were assessed as **negligible**.

20.6.1.1.5.1.5 Seabirds

The installation of transmission cable will result in bird scaring from the worksite. This effect will, however, be local and short-term, as the impact will cease immediately after construction, and the noise generated by the project will not be different from the one generated by numerous vessels sailing in the Baltic Sea. Furthermore, the European herring gull is a species accompanying vessels and its abundance in the survey area may temporarily increase during project construction/ decommissioning. Therefore, the significance of the impact for the long-tailed duck, the velvet scoter, the razorbill, the common guillemot and the common scoter may be regarded as **low**, and for the European herring gull – as **negligible**. The noise generated by transmission cable laying will reduce fish densities in the worksite. This will reduce the food supply for the razorbill and the common guillemot. The range of this impact will depend on the intensity of noise. However, the impact will be local, short-term and reversible and, due to the proximity of neighbouring sea areas that are rich in ichthyofauna, will have a **low significance**. The impact on benthic communities will be short-term as it will cease upon the completion of the works and their resources will return to their original state after some time. Recolonisation of the disturbed seabed area will be gradual and will result in the restoration of the food supply for benthivorous and piscivorous birds. This impact will be local, short-term and reversible and will have a **low significance**. Water turbidity resulting from the re-suspension of seabed sediments due to cable laying will make it more difficult for piscivorous birds to locate food. This will reduce their food supply. The range of this impact will depend on a number of factors, including:

- current direction;
- wave motion;
- volume of the sediment disturbed.

The impact will be local, short-term, reversible and, due to the proximity of neighbouring sea areas which are rich in ichthyofauna, will have a **low significance**.

The impact on seabirds during construction and decommissioning is assessed to be **low** for the long-tailed duck, the velvet scoters, the razorbill and the common guillemot, and **negligible** for the European herring gull.

20.6.1.1.5.2 Impact on protected areas

In the offshore area of the planned project location and in the range of its potential impact there are no territorial forms of protection other than the areas of the Natura 2000 European ecological network. Therefore, no activities related to the construction of the BP OWF CI will cause any impact on such areas.

The impacts of the planned project construction phase on the Natura 2000 site Przybrzeżne wody Bałtyku (PLB990002) will affect the subjects of protection in this area – seabirds. The scaring effect caused by the traffic of vessels, the potential depletion of the food supply of benthivorous birds such as the razorbill and the velvet scoter, as a result of macrozoobenthos destruction along the cable-laying route, the noise scaring the fish which are the food basis of the razorbill as well as the water turbidity making it difficult for diving birds to search for food, were assessed as negative impacts of **low significance**. In one case, the scaring effect was assessed as **negligible** – the European herring gull often accompanies sailing vessels in marine areas, thus, the individuals of this species will not be affected by the scaring effect.

The construction phase impacts were of local, reversible and in most cases short-term character (medium-term in the case of the depletion of food supply for benthivorous birds – regeneration of macrozoobenthos resources may take up to several years).

The impacts will not affect the integrity of the area nor its coherence with other sites of the Natura 2000 network.

20.6.1.1.5.3 Impact on wildlife corridors

In the spring and autumn periods, regular bird migrations take place in the Baltic area; however, the migration tactics and their routes are very poorly recognised.

Given the lack of information on the occurrence, functioning and significance of wildlife corridors in maritime areas, it was conservatively assumed that the value of this resource is medium. Considering the spatial scale of the planned project in relation to the size of the Baltic Sea area and its specificity resulting from the presence of installation vessels moving along with the progress of works, it was assessed that the impact of the BP OWF CI on potential migration routes of migratory species will be **negligible** during the construction phase.

20.6.1.1.5.4 Impact on biodiversity

20.6.1.1.5.4.1 Phytobenthos

Impacts on macroalgal species diversity in the APV are analogous to those found for phytobenthos, i.e.:

- disturbance of the substrate – destruction of macroalgae may occur, which may cause a decrease in the number of species in the area. This is a negative, direct and temporary impact of a large size. The sensitivity of macroalgae species to the impact was determined as moderate, because after the impact cessation, there is possibility that the seabed will become overgrown with other species within a year or several years. The significance of impact on biodiversity was assessed as moderate. It should be remembered, however, that the significance of macroalgae in the area is irrelevant, which means that their loss is not significant for the ecosystem;
- increase in the concentration of suspended solids leading to increased turbidity of the water depth and increased sedimentation – may cause photosynthesis disruption. The impact will be negative, indirect, local and momentary, while its scale will be moderate. The sensitivity of macroalgae to this impact is irrelevant, because naturally in the environment, the macroalgae are buried by sandy sediment as a result of storms and strong seabed currents. The significance of the impact was determined as negligible;
- redistribution of nutrients and contaminants from sediments to the water depth – phytobenthos communities will be temporarily exposed to an increased concentration of nutrients (which may cause an increase in plant mass) and contaminants in the water (which may cause physiological disruption). The impact will be negative, indirect, local and momentary, while its scale will be moderate. The results of sediment chemical analyses, performed for the preparation of this EIA Report, indicate that the concentrations of nutrients (total nitrogen and total phosphorus) in the APV do not exceed values typical of the southern Baltic sediments. Moreover, the concentrations of persistent organic pollutants (i.e. PAHs, PCBs and TBT) and toxic substances such as metals or mineral oils are low and do not deviate substantially from the data from literature regarding sandy sediments of the Southern Baltic. Consequently, the sensitivity of macroalgae to this impact was assessed as irrelevant and the significance of the impact as negligible. The redistribution of nutrients and pollutants from sediments to the water depth will not affect the number of macroalgal species in the area.

20.6.1.1.5.4.2 Macrozoobenthos

The impact of the project that has the most adverse character, possibly leading to a change in biodiversity of the macrozoobenthos in the BP OWF CI Area is the disturbance of seabed sediment structure. Due to a limited area of macrozoobenthos destruction (a maximum of 3 km^2 for 4 cables), and the destruction occurring in fragments, because individual corridors will be at a distance of 100 to 200 m away from one another, this impact will not lead to a significant change in the quality structure of the macrozoobenthos community from the soft and hard bottoms, consisting of taxa typical and common for the shallow and medium-deep seabed (up to 35 MBSL) of the coastal and open waters of the Southern Baltic. The impact will be reversible and up to several years from its cessation its quality structure – biodiversity of macrozoobenthos – will be restored.

20.6.1.1.5.4.3 Ichthyofauna

During the construction phase, negative impact on the ichthyofauna biodiversity can be expected (reduction of the number of species present in the area). It can be assumed that it will mainly result from the avoidance of the area during cable laying works. The noise associated with the process (increased ship traffic, operation of cable laying equipment) may deter particularly the fish with a low reaction threshold such as the clupeids and cod. Area avoidance may also be associated with an increase in suspended solids concentration. However, for both of these factors, the negative impact will be local and short-term, directly related to the area where the work front is focused at a given time.

Habitat alteration associated with the destruction of some of the benthic organisms may result in a reduction of the food supply for benthivorous fish and consequently in the abandonment of the area by benthivorous fish. However, considering the width and surface area of the belt within which the works will be conducted (80 m and 4 km^2, respectively), such effect seems unlikely.

20.6.1.1.5.4.4 Seabirds

The analysis of the possible impacts resulting from the construction activities conducted during the BP OWF CI construction phase indicates that their effects will be mostly short-term and local. This applies to all types of emissions (noise, suspended solids and the release of nutrients from the sediments). Therefore, this project impact on biodiversity can be assessed as low.

20.6.1.1.5.4.5 Marine mammals

A potential negative impact of the project on marine mammals is the temporary exclusion of the area from use as a result of deterrence by the noise generated. This impact was assessed to be **low**.

20.6.1.1.6 Impact on cultural values, monuments and archaeological sites and features

The only historical object – a wreck of a steamer from the first half of the 20th century – lies in the BP OWF CI area at a distance of approx. 800 m from the shore, i.e. outside the zone impacted directly by underwater operations involving interference with the surface layer of the seabed sediment, which will end at 1200 to 1300 m from the seashore. In the construction phase, no direct impact on the ship wrecks located outside the construction site boundaries is expected, whereas, the indirect impact resulting from the re-sedimentation of the seabed sediments disturbed during construction works will be insignificant. Taking into consideration the results of the analysis of suspended solids dispersion, its sedimentation outside the area of underwater operations may cause the wreck to be covered with a layer of very fine sediment with a thickness of no more than a few millimetres. The sedimentation of the sediment will not result in the deterioration of the preservation state of the wrecks and will most probably be removed in a short time as a result of hydrodynamic processes. The significance of this impact was assessed to be **negligible**.

20.6.1.1.7 Impact on the use and development of the sea area and tangible property

During the BP OWF CI construction phase, the impact on the use and development of the sea area will result almost exclusively from the establishment by the Director of the Maritime Office in Gdynia, of the protection zone for the cable lines within which restrictions will apply to protect the subsea cables from damage or destruction. Out of the existing uses of the sea area, the safety zone will limit fishing activities in terms of the use of demersal fishing gear. The analysis of commercial fishing and fishing effort in the statistical rectangles N7, N8, O6, O7 and O8 showed that there are no significant commercial fisheries within their boundaries. It was assessed that the impacts of the BP OWF CI on fisheries during the construction phase will be **negligible**.

20.6.1.1.8 Impact on landscape, including the cultural landscape

In the BP OWF CI construction phase, the potential impact of the project on the landscape, including cultural landscape, will result exclusively from the traffic of vessels involved in the construction works – cable line installation. The largest vessels expected to participate in the construction works are cable-laying vessels, which are up to 150 m long. The length of cable barges and service vessels is up to 100 m, while that of tugboats – up to 50 m. However, their presence will not interfere with the landscape of the sea area covered by the planned BP OWF CI construction, as it is already used for navigation to and from the ports in Gdynia and Gdańsk. It should be noted that the usual navigation route runs at a considerable distance from the shore, i.e. approx. 10 km, while in the case of the construction of the near-shore section of the cable lines, large vessels such as cable-layers, will temporarily sail much closer to the shore and will be clearly visible to observers on the shore. However, this phenomenon will not be a significant deviation from the existing character of the maritime area landscape. The construction of the BP OWF CI will not involve the construction of elements extending above the water surface, so the impact on the landscape resulting from the presence of vessels participating in the cable line construction will cease immediately after the completion of the construction phase. The landfall of export cables will be executed using a trenchless method, thanks to which, no impact on the coastal landscape, including beaches, will occur. Considering the manner of implementation of the planned project and the current use of the sea area, the impact significance on the landscape, including cultural landscape, was assessed as **negligible**.

20.6.1.1.9 Impact on population, health and living conditions of people

During the construction phase, temporary impediments are expected for ships navigating along the usual route to and from the ports in Gdynia and Gdańsk, i.e. the necessity to modify the sailing course due to the presence of vessels involved in the cable line construction. However, this will be a minor impediment and will cease after the construction phase is completed. Cable line construction will also result in a partial exclusion of the statistical rectangle areas from fishing activities – providing a safety zone for subsea cables. Within the entire Polish Maritime Area, the statistical rectangles N7, N8, O6, O7 and O8 do not constitute important fishing grounds for commercial species and are not intensively used by fishermen. During the BP OWF CI construction phase, no impacts on navigation and fisheries are expected that could lead to negative impacts on the well-being and living conditions of people. Therefore, the impact significance was assessed as **negligible**. No impacts on human health are expected to occur during the construction phase.

20.6.1.2 Operation phase

20.6.1.2.1 Impact on geological structure, seabed sediments, access to raw materials and deposits

No changes in the seabed structure are expected during the BP OWF CI operation phase. The overall impact of the project on geological structure, seabed sediments, access to raw materials and deposits can be assessed as **negligible**.

20.6.1.2.2 Impact on the quality of seawater and seabed sediments

Contamination of seawater and/or seabed sediments with petroleum products released during normal operation of vessels during the BP OWF CI operation period is a direct negative impact which is local, temporary or short-term, reversible, repeatable and of low intensity.

The significance of this impact during the operation phase was assessed to be **negligible**, whereas in the case of a breakdown or collision, it was assessed to be **moderate**. Heat emission by the cables is a direct, negative impact of local range, which is long-term, irreversible, constant during the exploitation period, but due to the lack of data it is difficult to determine its intensity. There are almost no survey results and literature reports on the increase in temperature of the seabed sediment and the near-seabed water layer caused by subsea cables, as well as the impact of this phenomenon on their quality.

20.6.1.2.3 Impact on climate, including greenhouse gas emissions and impacts relevant for adaptation to climate change, impact on atmospheric air (air quality)

During the operation phase, periodic inspections of the seabed power cables are foreseen along their entire length. These will take place at least once every 5 years and will be carried out by relatively small service vessels. Therefore, no significant impact on climate, greenhouse gas emissions or air quality is expected.

20.6.1.2.4 Impact on ambient noise

Cables used for energy transmission, buried in the seabed, will not generate noise. Periodic maintenance and repair of the cable, requiring activities similar to those described in detail for the construction phase, will be limited to a smaller area and will be temporary in nature. The impact of ambient noise in the operation phase will be **negligible**.

20.6.1.2.5 Impact on nature and protected areas

20.6.1.2.5.1 Impact on biotic elements in the offshore area

20.6.1.2.5.1.1 Phytobenthos

In the case of the APV, a cable section is laid on the seabed surface and secured against damage or destruction by means of protective measures (e.g. concrete mattresses, riprap, concrete protections), macroalgae may grow on the surface of the protective elements, forming an artificial reef together with periphytic fauna. The protective measures will be applied in seabed areas covered with boulders, which occur at depths exceeding 20 m in the APV variant. Therefore, it can be expected that the structures will be overgrown in negligible quantities mainly by red algae, which will be replaced by mussels and balanuses in the later phase of the artificial reef development. The course of succession of periphyton communities is not fully known and is not always uniform, as it depends on various factors, for example, interspecific competition or type of substrate introduced. The emergence of an artificial reef in the area is regarded as a negative impact (disturbance of the original conditions prevailing before the investment) or positive (local increase of biodiversity). Introduction of hard substrate into the environment, potentially to be overgrown by periphytic flora, should be regarded as a negative/positive, indirect, local and long-term impact. The scale of this impact will be irrelevant, as the boulder areas on which the protection systems may be constructed constitute less than 1% of the total surface of the APV, which means that the surface potentially overgrown by flora will be small. The sensitivity of macroalgae should be considered high as they show a high potential to develop in the presence of hard substrates to which they easily attach. The significance of the impact was assessed as **negligible**.

20.6.1.2.5.1.2 Macrozoobenthos

The analysis of the four main operation phase pressure factors impacting the soft-bottom and hard-bottom macrozoobenthos indicated that a loss of a fragment of macrozoobenthos habitat and the artificial reef effect were assessed as having **low significance**, regardless of the type of the macrozoobenthos community, whereas, the actual impact of electromagnetic field emission and heat emission on the seabed fauna, which is poorly documented in the literature, is impossible to determine. The loss of a fragment of benthos habitat will be local in range, and, first of all, the reversible nature of this impact should be emphasised. The loss of a community comprising an aggregation of mussels on a stony seabed together with the associated fauna will be quickly compensated by the bivalvia ability to colonise, among others, the concrete protection of the cable (artificial reef effect) or the seabed surrounding the cable.

20.6.1.2.5.1.3 Ichthyofauna

To assess the impact of the BP OWF CI operation phase on marine ichthyofauna, the impact of noise and vibrations, emission of toxic chemicals, electromagnetic field and the habitat change impacts were analysed. The significance of the impact of the above factors was assessed as **negligible** for all the fish species examined.

20.6.1.2.5.1.4 Marine mammals

During the operation phase, marine mammals may be impacted by the noise generated by vessel traffic, the operation of underwater equipment and the interference in the seabed during periodic inspections or cable repair works. However, compared to the construction phase, these impacts will be significantly limited in time and space. The significance of this impact on marine mammals was assessed as **moderate** for harbour porpoise and **low** for seals.

20.6.1.2.5.1.5 Seabirds

In the BP OWF CI operation phase, no significant impact on birds is expected. After the installation of the subsea cables, the seabed will be repopulated by benthic communities, which will restore the original feeding areas of benthivorous and piscivorous birds. Thus, the number of birds in the project area during the operation phase is expected to be the same as before the project implementation. Moreover, there will be a positive impact during the operation phase, associated with the reduction of by-catches in the safety zone established over the offshore transmission cable. The impact on all seabirds included in the assessment during the operation phase was assessed as **irrelevant**.

20.6.1.2.5.2 Impact on protected areas

In the offshore area of the planned project location and in the range of its potential impact there are no territorial forms of protection other than the areas of the Natura 2000 European ecological network. Therefore, in the operation phase, the BP OWF CI will not generate any impact on such areas.

20.6.1.2.5.3 Impact on wildlife corridors

In the spring and autumn periods, regular bird migrations take place in the Baltic area; however, the migration tactics and their routes are very poorly recognised.

Given the lack of information on the occurrence, functioning and significance of wildlife corridors in maritime areas, it was conservatively assumed that the value of this resource is medium. Considering the specificity of the BP OWF CI resulting from the fact that it does not disturb – in terms of physical and emission-related aspects – the airspace as well as the water depth, it was assessed that during the operation phase the BP OWF CI will not generate any impacts on potential migration routes of migratory species.

20.6.1.2.5.4 Impact on biodiversity

20.6.1.2.5.4.1 Phytobenthos

When artificial reef (communities of lichen flora and fauna) is formed on cable protection systems placed on the hard bottom, and macroalgae are part of it, species diversity in the area may increase. The cable protection elements may host not only species native to the area, but also new species whose spores have been brought in from other parts of the Baltic Sea with the sea currents. The impact of introduction of additional hard substrate in the area should be assessed as negative (disturbance of the original conditions existing before the commencement of the project) / positive (local increase in species diversity), indirect, local and long-term. The size of this impact will be irrelevant, as the boulder areas on which the protection can be built constitute less than 1% of the total surface area of the APV, which means that the surface which could possibly be overgrown will be small. The sensitivity of macroalgal species was assessed as high because they have a high potential to thrive in the presence of hard substrates to which they easily attach. The significance of the impact was assessed as **negligible**.

20.6.1.2.5.4.2 Macrozoobenthos

In the BP OWF CI operation phase, essentially, no significant changes will take place, let alone an increase in biodiversity in terms of the structure of the seabed-inhabiting benthic habitat, as the cables are planned to be buried in the seabed. The possible destruction of the hard-bottom macrozoobenthos within the APV corridor on a very small surface area, smaller than 0.3 km^2, will be compensated by the overgrowth of the concrete material protecting the cable laid in this location by artificial reef, thus, the project will not change the benthic habitat biodiversity status in the medium-term.

20.6.1.2.5.4.3 Ichthyofauna

The assessment of impacts occurring during the operation phase (noise and vibration, electromagnetic field, release of harmful substances) indicates that they will not be significant. Therefore, no impact on biodiversity is expected. However, a possible impact on ichthyofauna biodiversity can be assumed given the presence of cable protection structures in places where, due to the seabed type, cable burial in the sediment will prove impossible. Structures such as riprap and concrete structures will provide a substrate for the formation of an artificial reef. This may result in a more abundant presence of certain fish species in their vicinity and a possible increase in certain biodiversity indicators. However, it should be emphasised that this phenomenon will have a very localised impact, given the probably small area on which the construction of such structures will be required.

20.6.1.2.5.4.4 Marine mammals

A potential negative impact of the project which may affect marine mammals is the disturbance by the noise generated by ships and underwater equipment used during system maintenance or repair works. However, given the local and short-term nature of this impact, the lack of evidence of significance of the area for particular marine mammal species and the sporadic occurrence of such species, the significance of this impact was assessed as **low**.

20.6.1.2.5.4.5 Seabirds

The analysis of the possible impacts resulting from the BP OWF CI operation indicates that their effects in terms of the changes in biodiversity of seabirds will be exclusively of local and short-term nature and will mainly involve a temporary loss of habitats. This impact was assessed as insignificant for the marine avifauna.

20.6.1.2.6 Impact on cultural values, monuments and archaeological sites and features

During the operation phase, no underwater works are anticipated that would result in seabed interference, except for the *ad hoc* cable repairs in case of damage. Potential impacts on wrecks during the operation phase will result from the sedimentation of sediments mobilised into the water column during the uncovering of a damaged subsea cable section. Mass flow excavation (MFE) of damaged sections of cable lines is associated with more intense resuspension and sedimentation than the technologies planned to be used during the construction phase. It should be noted, however, that the need for the application of MFE technology will only arise in emergency situations and that underwater works will cover only short cable line sections. For this reason, the impact of sedimentation on the surface of wrecks is expected to be smaller than during the construction phase, and will not affect the conservation status of the wrecks. It should be assessed that the scale of impact of the BP OWF CI during the operation phase on the conservation status of the wrecks located within its boundaries and in the surrounding area will be irrelevant and the impact will be **negligible**.

20.6.1.2.7 Impact on the use and development of the sea area and tangible property

During the BP OWF CI operation phase, the impact on the use and development of the sea area will result almost exclusively from the establishment, by the Director of the Maritime Office in Gdynia, of the protection zone for the cable lines, within which prohibitions and restrictions will apply in order to protect the subsea cables from damage or destruction. Out of the existing uses of the sea area, the protection zone will impose the strongest restrictions on fishing activities because the use of demersal fishing gear will most likely be prohibited within the zone. The analysis of commercial fishing and fishing effort in the statistical rectangles N7, N8, O6, O7 and O8 showed that there are no significant commercial fisheries within their boundaries. It was assessed that the impacts of the BP OWF CI on fisheries in this sea area will be **negligible**. During the operation phase, the cable lines will be inspected periodically, at least once every five years. This type of work is usually performed by one vessel. Therefore, no impacts on navigation and other uses of the sea area are anticipated.

20.6.1.2.8 Impact on landscape, including the cultural landscape

Considering the low intensity of works in the operation phase – i.e. cable line inspections, at least once every five years and a low probability of cable repair works – it was assumed that the BP OWF CI will generate no impacts on the landscape, including the cultural landscape, during the operation phase.

20.6.1.2.9 Impact on population, health and living conditions of people

Restrictions on the use of the sea area resulting from establishing a safety zone for the cable lines by the Director of the Maritime Office in Gdynia will most probably result in the exclusion of this part of the sea area from demersal fishing for ichthyofauna. Given the low significance of this part of the Baltic Sea in terms of commercial fishing and the small surface of the sea area predicted to be covered by the restrictions, it is expected that the impacts of the BP OWF CI on the population and living conditions of people due to the restrictions on fisheries are considered **negligible**. No impacts on human health are anticipated.

20.6.1.3 Decommissioning phase

20.6.1.3.1 Impact on geological structure, seabed sediments, access to raw materials and deposits

There are no plans to excavate the export cables from the seabed after the operation phase is finished. As a result, there will be no impact on the geological structure, seabed sediments, access to raw materials and deposits.

20.6.1.3.2 Impact on the quality of seawater and seabed sediments

There are no plans to excavate the export cables from the seabed after the operation phase is finished. Therefore, there will be no impacts on the quality of seawater and seabed sediments.

20.6.1.3.3 Impact on climate, including greenhouse gas emissions and impacts relevant for adaptation to climate change, impact on atmospheric air (air quality)

There are no plans to excavate the export cables from the seabed after the operation phase is finished. Therefore, there will be no impact on climate and air quality.

20.6.1.3.4 Impact on ambient noise

There are no plans to excavate the export cables from the seabed after the operation phase is finished. Therefore, there will be no impact on the ambient noise.

20.6.1.3.5 Electromagnetic field impact

After the operation phase is completed, due to no current flow in the subsea cables, no impacts resulting from the electromagnetic field emission will occur.

20.6.1.3.6 Impact on nature and protected areas

20.6.1.3.6.1 Impact on biotic elements in the offshore area

20.6.1.3.6.1.1 Phytobenthos

There are no plans to excavate the export cables from the seabed after the operation phase is finished. Therefore, no impacts on phytobenthos will occur.

20.6.1.3.6.1.2 Macrozoobenthos

There are no plans to excavate the export cables from the seabed after the operation phase is finished. Therefore, no impacts on macrozoobenthos will occur.

20.6.1.3.6.1.3 Ichthyofauna

There are no plans to excavate the export cables from the seabed after the operation phase is finished. Therefore, no impacts on ichthyofauna will occur.

20.6.1.3.6.1.4 Marine mammals

There are no plans to excavate the export cables from the seabed after the operation phase is finished. Therefore, no impacts on marine mammals will occur.

20.6.1.3.6.1.5 Seabirds

There are no plans to excavate the export cables from the seabed after the operation phase is finished. Therefore, no impacts on seabirds will occur.

20.6.1.3.6.2 Impact on protected areas

There are no plans to excavate the export cables from the seabed after the operation phase is finished. Therefore, no impacts on protected areas will occur.

20.6.1.3.6.3 Impact on wildlife corridors

There are no plans to excavate the export cables from the seabed after the operation phase is finished. Therefore, no impacts on wildlife corridors will occur.

20.6.1.3.6.4 Impact on biodiversity

There are no plans to excavate the export cables from the seabed after the operation phase is finished. Therefore, there will be no impacts on biodiversity.

20.6.1.3.7 Impact on cultural values, monuments and archaeological sites and features

There are no plans to excavate the export cables from the seabed after the operation phase is finished. Therefore, no impact on cultural values, monuments and archaeological objects and sites will occur.

20.6.1.3.8 Impact on the use and development of the sea area and tangible property

There are no plans to excavate the export cables from the seabed after the operation phase is finished. Therefore, no impacts on the use and management of the sea area and tangible property will occur.

20.6.1.3.9 Impact on landscape, including the cultural landscape

There are no plans to excavate the export cables from the seabed after the operation phase is finished. Therefore, no impacts on landscape, including the cultural landscape will occur.

20.6.1.3.10Impact on population, health and living conditions of people

There are no plans to excavate the export cables from the seabed after the operation phase is finished. Therefore, no impacts on population, health and living conditions of people will occur.

ONSHORE AREA

For the purposes of the planned project implementation in the APV the following technical belts have been designated:

- **permanent** with a width of 25 m (up to 80 m near cable chambers) – an area directly connected to the construction works, covering the places where the surface layer of the ground and ground cover will be destroyed, and the trees and shrubs will be removed. The removal of trees and shrubs is permanent;

- **temporary** with a width of 20 m from the external cable lines – constituting the so-called auxiliary belt, in which environmental impact is possible at the construction stage, as a result of construction works, the location of storage places for excavated soil, vehicle parking areas and access roads;
- **additional**, 250 m wide from the external cable lines – an area through which access roads may run.

20.6.1.4 Construction phase

20.6.1.4.1 Impact on geological structure, coastal zone, soils, and access to raw materials and deposits

20.6.1.4.1.1 Impact on geological structure

The main construction phase impacts on geology and surface formations will be connected to:

- the construction of open trenches for cable laying, cable chambers and inlet and outlet chambers at the sections planned for trenchless passages;
- levelling works related to the ground levelling for the erection of a customer substation and cable chambers.

The impacts will also involve wind erosion and possible contamination of the open trenches with greases, oils, etc. as well as carrying out excavations for the two towers of the 400 kV overhead line.

As a result of the assessment, the impact on geological and surface formations was found to be moderate at most. The significance of impact connected to wind erosion was identified as negligible, with the exception of aeolian sands, which are planned to be crossed by an open trench, where the significance of impact was assessed as moderate. The pollution with greases and oils was assessed as **negligible** and of **low importance** and **moderate** with reference to the alluvial muds and humus sands.

20.6.1.4.1.2 Impact on the topography and dynamics of the coastal zone

The main impacts on the topography and dynamics of the coastal zone will be related to:

- levelling works related to the ground levelling for the construction of cable chambers;
- construction of inlet and outlet chambers at the sections planned for trenchless crossing.

The Applicant Proposed Variant will have a minimal effect on the character change of the terrain relief of the area during the construction phase. The important issue during the restoration of the area to its original condition is to ensure the appropriate condition of the vegetation growing on the dune surface, because in the case it was neglected, aeolian processes may be initiated, and consequently, a burial or exposure of the elements of the planned project could take place.

20.6.1.4.1.3 Impact on soils

The main construction phase impacts on the soils will be connected to:

- carrying out open excavations and levelling works;
- movement of heavy construction and assembly equipment;
- drainage of excavations;
- preparation of inlet and outlet chambers for the needs of trenchless crossings;
- the occupation of land for the construction of a customer substation, a 400 kV overhead line, access roads and storage yards.

As a result of the assessment, only moderate impacts related to wind erosion as well as the contamination with greases and oils along the sections of poorly-developed soils located outside the Wydma Lubiatowska dune were found. In the event of oil leaks and spills, potentially the most at risk are the sections of poorly-developed soils on which the new access roads are planned.

20.6.1.4.1.4 Impact on the access to raw materials and deposits

There will be no impact on access to raw materials and deposits.

20.6.1.4.2 Impact on hydrogeological conditions and groundwater

As a result of the project implementation within the permanent and temporary technical belts as well as access roads, storage yards, customer substation and a 400 kV overhead line, surface waters may be exposed to a deterioration of their quality. This regards especially:

- wetlands in the vicinity of the Spacerowa street;
- waterlogged valley with a system of watercourses constituting tributaries of the Bezimienna Stream;
- drainage ditch in the area of the customer substation;
- drainage ditch in the area of the 400 kV overhead line;

The implementation of the project may have a local and short-term negative impact on the elements of water quality, which is primarily related to:

- possible runoff of slurry from the construction site adjacent to the waterlogged areas and watercourses – temporary impact related to torrential rainfall;
- possible pollution as a result of accidental leaks from machines and vehicles – impact in emergency situations which will not take place during the proper conduct of construction works;
- the removal of trees and shrubs within a 25 m wide strip – a local decrease of watercourse shading.

The impacts connected to the runoff of slurry from a construction site will be negative, direct, primary, reversible, local and short-term. The scale of impact is moderate. With regard to the ponds in the ecological area "Torfowisko" [Peat bog] in Szklana Huta, the impacts will be irreversible, permanent, large-scale and of important significance.

The impacts connected to the contamination as a result of accidental leaks from machinery and vehicles will be negative, direct, primary, reversible, local and short-term. The scale of the impact is moderate and negligible for the HDD or HDD Intersect section.

If the lighting conditions for watercourses change, the impacts will be: negative, indirect, primary, irreversible, local and permanent. The scale of impact is low and moderate.

20.6.1.4.3 Impact on climate, including greenhouse gas emissions and impacts relevant for adaptation to climate change, impact on atmospheric air (air quality)

The implementation of the planned project will be related to:

- periodic, local increase in greenhouse gas emissions during the project construction phase (movement of vehicles and machinery on site, deforestation, waste generation);
- periodic increase in energy demand for construction purposes, leading to an indirect increase in greenhouse gas emissions;

- emission of greenhouse gases indirectly related to the energy consumption of the project, e.g. in connection with the use of energy for the production of materials, transport, etc.

The impacts affecting climate will be low.

20.6.1.4.4 Impact on ambient noise

The construction phase of the underground cable lines, customer substation and 400 kV overhead line will generate temporary noise, the source of which will be:

- preparatory works, organisation of construction facilities, equipment base and material supplies;
- performing tree felling with root grabbing for the cable line and access roads construction;
- earthworks carried out by diggers consisting in digging a trench for cable lines;
- execution of horizontal directional drillings in places crossed by trenchless method;
- drainage of excavations with the use of wellpoints;
- earthworks carried out with bulldozers consisting in backfilling the excavations and levelling the area.

The noise generated during the construction phase will be limited in time, with a local impact range and with the application of minimising measures the impact on the Rehabilitation and Holiday Centre in Lubiatowo, will not have a significant negative influence on people's living conditions. The impacts of the planned project will be low.

20.6.1.4.5 Impact on nature and protected areas

20.6.1.4.5.1 Impact on biotic elements in the onshore area

20.6.1.4.5.1.1 Fungi

The main construction phase impacts on the biota of macroscopic fungi will be connected to:

- the construction of open trenches for cable laying, cable chambers and inlet and outlet chambers at the sections planned for trenchless passages;
- the levelling works related to the levelling of the area for the customer substation, 400 kV overhead line towers and the cable chambers.

In such cases, the mycelium will be destroyed, and consequently the plot of species will be eliminated. As a result of the assessment, the impacts were found to be of low significance.

20.6.1.4.5.1.2 Lichens

The main construction phase impacts on the biota of lichen will be connected to:

- the construction of open trenches for cable laying, cable chambers and inlet and outlet chambers at the sections planned for trenchless passages;
- the levelling works related to the levelling of the area for the customer substation, 400 kV overhead line towers and the cable chambers.

In such cases, the thalli will be destroyed, and consequently the plot of species will be eliminated. Sulphur oxides and nitrogen oxides will be emitted as a result of construction machinery operation during the construction phase. As a result of the assessment, the impacts were found to be important.

20.6.1.4.5.1.3 Mosses and liverworts

The main construction phase impacts on the biota of mosses and liverworts will be connected to:

- the construction of open trenches for cable laying, cable chambers and inlet and outlet chambers at the sections planned for trenchless passages;
- the levelling works related to the levelling of the area for the customer substation, 400 kV overhead line towers and the cable chambers.

The species plots will be eliminated. As a result of the assessment, the impacts were found to be negligible.

20.6.1.4.5.1.4 Vascular plants and natural habitats

The main construction phase impacts on vascular plants and natural habitats will be connected to:

- the construction of open trenches for cable laying, cable chambers and inlet and outlet chambers at the sections planned for trenchless passages;
- the levelling works related to the levelling of the area for the customer substation, 400 kV overhead line towers and the cable chambers.

The plot of species will be eliminated and the habitat patch reduced in size. As a result of the assessment, the impacts were found to be important.

20.6.1.4.5.1.5 Forrest complexes

The route of the BP OWF CI will require tree felling:

- in the 25 m wide and 5 km long permanent technical belt (no clearings are planned in the area of trenchless crossings) which covers a maximum area of 15 ha;
- in a temporary technical belt, with a width of 25 m from the external cable lines and an approx. length of 5 km, in connection with the conduct of construction works (except for the area of horizontal drillings) which covers a maximum area of 25 ha.

As a result of the assessment, the impacts were found to be important.

20.6.1.4.5.1.6 Invertebrates

The main construction phase impacts on the invertebrate fauna will be connected to:

- the construction of open trenches for cable laying, cable chambers and inlet and outlet chambers at the sections planned for trenchless passages;
- the levelling works related to the levelling of the area for the customer substation, 400 kV overhead line towers and the cable chambers.

In such cases, the disturbance of invertebrates and a possible destruction of nests will take place.

Such impacts due to the presence of common coastal species of insects in this area may be considered negligible, and not leading to the elimination of the species site. Moreover, the impacts will be connected to aeolian erosion and possible contamination of open trenches with greases, oils, etc. – which may negatively affect the bumblebee nests.

20.6.1.4.5.1.7 Ichthyofauna

During the construction phase, no impact on ichthyofauna is expected.

20.6.1.4.5.1.8 Herpetofauna

The construction phase impacts will involve mainly the environment transformation, which will be caused by partial destruction of the habitats. Most construction phase impacts on herpetofauna will be moderate.

20.6.1.4.5.1.9 Birds

The construction phase impacts will involve mainly the environment transformation, which will be moderate. The greatest impacts on birds will be connected to the felling of trees and the traffic of vehicles.

20.6.1.4.5.1.10 Mammals

The construction phase impacts will involve mainly the environment transformation, which will be caused by partial destruction of the habitats, e.g. deforestation of the permanent technical belt for the construction of trenches. Most construction phase impacts on mammals will be moderate. The highest impact on mammals will be connected to the tree felling and traffic of vehicles.

20.6.1.4.5.2 Impact on protected areas

The construction phase of the planned project will have a moderate impact on the Coastal Protected Landscape Area due to the recreational function of this area.

The planned project impacts in the case of the pollution of the ecological area “Torfowisko” [Peat Bog] in Szklana Huta as a result of accidental leaks from machines and vehicles will be important.

The implementation of the planned project in the APV will have no direct or indirect impact on the Natura 2000 habitats Białogóra (PLH220003), due to a significant distance of the planned works and the route of the access road from those habitats. The project will not have a significant negative impact on the subjects of protection of the Natura 2000 site, and especially, the following outcomes will be avoided:

- significant deterioration of the status of natural habitats or habitats of plant and animal species, for the protection of which the Natura 2000 site was established;
- significant negative impact on species, for the protection of which the Natura 2000 site was established;
- significant deterioration of the Natura 2000 site integrity or its interconnection with other sites.

Moreover, the planned project will not affect the possibility of implementing conservation measures and achieving targets set out in the Protective task plan for the Natura 2000 site Białogóra PLH220003.

20.6.1.4.5.3 Impact on wildlife corridors

The construction phase will cause the interruption of the spatial continuity of the Coastal Wildlife Corridor. The implementation of the planned project related to the use of heavy machinery will result in the migration of species to the neighbouring areas. Since the construction works will generally be carried out during daytime, the scaring will result in a slight and short-term limitation of the functionality of wildlife corridors. Breaking the spatial continuity will occur within a negligible area in relation to the entire wildlife corridor, and the felling of trees carried out in appropriate periods will minimise the potential impacts. The impacts of the planned project will be moderate.

20.6.1.4.5.4 Impact on biodiversity

The planned project does not pose a risk to biodiversity. The analysis of the planned project impact on biotic as well as abiotic elements indicated that apart from short-term, local and, in most cases, reversible impacts of the construction phase, there will be no impacts which could cause a serious risk of a permanent loss of habitats and species.

As a result of the assessment, the impacts were found to be low.

20.6.1.4.6 Impact on cultural values, monuments and archaeological sites and features

The construction of the BP OWF CI will not affect the cultural values, monuments, archaeological sites or objects.

20.6.1.4.7 Impact on the use and development of the sea area and tangible property

The phase of underground cable lines construction will involve a temporary and local restriction of the tourism function of the forests in the area. After the construction of the customer substation, it will become impossible to continue agricultural activities in that area. The impact on tangible goods in the construction phase will involve the use of the road infrastructure. As a result of the assessment, the impacts were found to be low.

20.6.1.4.8 Impact on landscape, including the cultural landscape

In the construction phase of the project, the main impact on the landscape will be the temporary appearance of the construction sites. During the construction phase, tree felling and grubbing will take place, earthworks will be carried out and vehicle traffic related to the transport of materials will occur. Storage yards for the storage of machinery and construction materials will appear. Waste from construction works and sanitary sewage will be generated.

As a result of the assessment, the impacts were found to be moderate.

20.6.1.4.9 Impact on population, health and living conditions of people

The construction will potentially affect people due to periodical nuisances of the construction works, causing emission of pollutants and noise as well as vibrations of the ground. The only periodical nuisances of the construction phase may concern the people staying in the premises of the Rehabilitation and Holiday Centre for disabled people. As a result of the assessment, the impacts were found to be moderate.

20.6.1.5 Operation phase

Underground cable lines in the operation phase are practically maintenance-free, servicing is carried out once a year. During the operation phase, the highest impacts will be related to the customer substation and the 400 kV overhead line.

20.6.1.5.1 Impact on geological structure, coastal zone, soils, and access to raw materials and deposits

20.6.1.5.1.1 Impact on geological structure

During the operation phase of the 400 kV overhead line, no impact on geological structure will occur. Only in the event of the necessity to perform maintenance works and works necessary to repair a failure, may the surface formations be contaminated with petroleum substances from damaged vehicles and machines. In connection with the cable operation, heat will be emitted to the ground.

To ensure the best conditions for cable heat dissipation into the environment, the cable line along its entire length will be laid surrounded by bentonite.

20.6.1.5.1.2 Impact on the topography and dynamics of the coastal zone

During the operation phase, there will be no impact of the planned project in the APV on the topography and dynamics of the coastal zone.

20.6.1.5.1.3 Impact on soils

According to the results of the analysis of the heat emission by the planned power cable, the impact on the soil resulting from the emission of heat to the ground was assessed as moderate and local. The soil resistance to this impact was assessed as moderate. The emitted heat is not expected to change habitats nor species. The impact related to the permanent land occupation for cable chambers concerns arenosols. The impact related to the permanent occupation of land as a result of the construction of a customer substation and a 400 kV overhead line concerns brown soils. They show high resistance to this impact, they were assessed to be of low importance.

The impact on all types of soils (with the exception of hydrogenic soils) was assessed as moderate.

20.6.1.5.1.4 Impact on the access to raw materials and deposits

In the operation phase, no impacts on the deposits are expected.

20.6.1.5.2 Impact on the quality of surface waters

The impacts connected to the contamination as a result of accidental leaks from machinery and vehicles was assessed as low and local. Only the scale of impacts on ponds in the vicinity of the ecological area “Torfowisko” [Peat bog] in Szklana Huta was assessed as high, and the significance of impact as important. The impacts related to the accidental leaks at the customer substation were considered to be low and have local scope.

20.6.1.5.3 Impact on hydrogeological conditions and groundwater

A particularly significant impact of the operation phase on groundwater is associated with the passage of vehicles along the road leading through the "Torfowisko" [Peat bog] ecological area in Szklana Huta. The scale of impact on groundwater in this area was assessed as high, and the impact significance as important.

The importance of impact on hydrogeological conditions and groundwater was assessed as low.

Due to the scale and nature of the planned project, there will be no impact on Groundwater Bodies in the operation phase. Also, the achievement of environmental objectives was not found to be threatened.

20.6.1.5.4 Impact on climate, including greenhouse gas emissions and impacts relevant for adaptation to climate change, impact on atmospheric air (air quality)

No operation phase impacts of the planned project on the climate are expected; also, there will be no greenhouse gas emissions nor impacts relevant to the climate change adaptation.

20.6.1.5.5 Impact on ambient noise

Noise impact of the BP OWF CI in the operation phase will be associated with the functioning of the customer substation and the 400 kV overhead line connecting the customer substation with the PSE substation.

The results of the noise level distribution calculations in the vicinity of the two single-circuit 400 kV overhead lines to be built parallel at a distance of 30 m, indicate that:

- the maximum value of the sound level in the most unfavourable operating conditions of the line will not exceed at any point beneath the line the value of 52.8 dB, which means an exceedance by 7.8 dB of the permissible value established in the Regulation of the Minister of the Environment of 14 June 2007 on permissible noise levels in the environment (Journal of Laws of 2007, No. 120, item 826, as amended) for the residential areas at 45 dB;
- the area of land under the above-mentioned system of parallel 400 kV overhead lines, where the calculation analyses indicate that the permissible value of 45 dB (for the areas of residential development) is exceeded, extends (at the height of 4.0 MASL) to the distance of 39 m from the line axis in both directions;
- in the vicinity of the system of 400 kV overhead lines running in parallel, it is not possible to implement housing development due to the possibility of exceeding the permissible noise level (45 dB) in an area with a width of 78 m (2 x 39 m).

The impacts on ambient noise were considered to be moderate and local.

The calculations conducted for the noise levels from the customer substation show that at all observations points at the boundary of the planned residential development, the night-time (40 dB) and daytime (50 dB) noise limits for single-family development will not be exceeded. The impact of noise from a customer substation in the operation phase will be low.

20.6.1.5.6 Electromagnetic field impact

The results of magnetic field intensity maximum value calculations, which can be expected over the power cable route for both distance between cable circuits (5.0 and 17.0 m), as well as the graphs with magnetic field intensity distributions indicate that the EMF impact in the operation phase will be negligible.

20.6.1.5.7 Impact on nature and protected areas

20.6.1.5.7.1 Impact on biotic elements in the onshore area

20.6.1.5.7.1.1 Fungi

In the project operation phase, potential impacts on the fungal biota may be related to:

- the change of habitat conditions due to the location of the cable connection and the surface area of land occupied;
- service works as well as local damage to the top layer of the soil and habitats.

The significance of these impacts will be low.

20.6.1.5.7.1.2 Lichens

In the project operation phase, potential impacts on the lichen biota are similar to those on the fungal biota and may be associated with the change of habitat conditions and the performance of service works.

The significance of these impacts will be low.

20.6.1.5.7.1.3 Mosses and liverworts

In the project operation phase, potential impacts on mosses and liverworts may be associated with the change of habitat conditions and damage to the top layer of the soil and habitats during service works.

The significance of these impacts will be low.

20.6.1.5.7.1.4 Vascular plants and natural habitats

In the project operation phase, potential impacts on vascular plants and natural habitats may be associated with the change of habitat conditions as well as damage to the top layer of the soil and habitats during service works.

The significance of these impacts will be low.

20.6.1.5.7.1.5 Forrest complexes

The underground cable line route will involve permanent tree-felling within the permanent technical belt – covering a maximum of 15 ha. Permanent deforestations will have a local scope. The impacts of the planned project connected to tree-felling will have important significance.

20.6.1.5.7.1.6 Invertebrates

During the project operation phase the potential impacts on the fauna of invertebrates may involve the destruction of habitats and microhabitats as a result of maintenance works.

The significance of these impacts will be low.

20.6.1.5.7.1.7 Ichthyofauna

The planned project will have no impact on ichthyofauna.

20.6.1.5.7.1.8 Herpetofauna

In the project operation phase, the potential impacts on the herpetofauna may involve the destruction of habitats as a result of service works.

The significance of these impacts will be low.

20.6.1.5.7.1.9 Birds

In the project operation phase, potential impacts on birds may be related to:

- the location of the underground cable lines:
    - the change of habitat conditions due to the location of the cable connection and the surface area of the land occupied,
    - performance of service works and scaring of birds;
- the location of the 400 kV overhead line connecting the customer substation with the PSE substation:
    - the risk of bird collisions with the wires,
    - impediments to migration.

In the long-term, the project involving the construction of underground cable line will not have a negative impact on birds including breeding species, wintering species as well as migrating species. These will be moderate impacts of a local scale.

During the operation phase of the 400 kV overhead line connecting the customer substation with the PSE substation, significant negative impacts may occur.

20.6.1.5.7.1.10 Mammals

During the project operation phase the potential impacts on mammals may involve animal disturbance as a result of maintenance works.

The significance of these impacts will be low.

20.6.1.5.7.2 Impact on protected areas

20.6.1.5.7.2.1 Impact on protected areas other than Natura 2000 sites

Coastal Protected Landscape Area

The main impacts will involve the emergence of a deforested space with a width of 25 m along and approx. 5 km in length. However, this space will not be occupied by anthropogenic elements, which will be visible in the space of the area. Paved roads will be constructed along the infrastructure of the underground cable lines. The impact of the project in the APV on the Coastal Protected Landscape Area during the operation phase will be moderate and of local range.

Ecological area “Torfowisko” [Peat bog] in Szklana Huta

The road leading across the ecological area will be used as access road to cable chambers, which poses potential risk of the surface water, ground water and soil contamination. The scale of impact on the ecological area was assessed as large, and the significance of impact as important. However, it should be remembered that the contaminations of soil and water are unlikely and concern only short-term maintenance works.

Ecological area of the “Źródliska Bezimiennej” site

In the operation phase, the planned project will be limited to service works carried out once a year. As a result, no impacts on the ecological area, located away from the access roads, will occur.

20.6.1.5.7.2.2 Impact on Natura 2000 sites

Thanks to the application of measures minimising the negative impact on habitat 2180 Wooded dunes of the Atlantic, Continental and Boreal region, no significant negative impact on the integrity of the Natura 2000 site Białogóra (PLH220003) is expected.

This will be a local impact of low significance.

20.6.1.5.7.3 Impact on wildlife corridors

The planned project in the form of underground cable line will not cause impacts which could affect the migration routes of birds or other plant or animal species. The planned project will not be an obstacle for the movement of animals. These will be local impacts of low significance.

The operation of the designed 400 kV line along a 270 m section, connecting the customer substation with the PSE substation, may negatively affect the East Atlantic Flyway, due to high risk of bird collision with the planned HV line. These will be significant impacts.

20.6.1.5.7.4 Impact on biodiversity

The planned project does not pose a risk to biodiversity. With the application of minimising measures, the impacts of the BP OWF CI operation phase were assessed as moderate, due to the potential impacts in the area of the ecological area “Torfowisko” [Peat bog] in Szklana Huta and potential impacts of the 400 kV overhead line on birds.

20.6.1.5.8 Impact on cultural values, monuments and archaeological sites and features

In the operation phase, the planned project will not affect the cultural values, monuments, archaeological sites or objects.

20.6.1.5.9 Impact on the use and development of the sea area and tangible property

In the operation phase, the planned project in the permanent technical belt with a width of 25 m, will be subject to some limitations connected to the necessity to ensure power transmission safety. Paved roads ensuring access to cable lines will be constructed along cable lines. The land use near the customer substation will change from agricultural to industrial.

These will be local impacts of low significance.

20.6.1.5.10 Impact on landscape, including the cultural landscape

Due to the nature of the planned project, including, first of all, its underground construction, no negative impact on landscape, including the cultural landscape is expected, since the planned project is to have a mid-forest location. In that case, the significance of these impacts will be low.

The customer substation will constitute a new man-made element in the agricultural landscape, against the forest background, which will make its impact on landscape smaller than in the case of an open-space location. These will be important impacts.

The designed 400 kV line will be visible from the near-by communal road Osieki Lęborskie – Lublewko, as well as the neighbouring development of the Osieki Lęborskie and Lublewko villages. Due to the presence of forests in the surroundings, it will not be visible from Lubiatowo. The 400 kV line impacts on landscape will be important.

20.6.1.5.11 Impact on population, health and living conditions of people

The most important nuisances related to the functioning of the project discussed involve emission of heat, noise and electromagnetic radiation from the underground cable lines and the 400 kV overhead line.

In the APV, the planned project will not result in the deterioration of the environmental living conditions for humans, and its operation will improve the living conditions of the inhabitants in terms of power supply for domestic and commercial needs. These will be moderate impacts.

20.6.1.6 Decommissioning phase

Due to the fact that no decommissioning phase of the BP OWF CI is envisaged, no impact on the environment in that phase will occur.

20.6.2 Rational Alternative Variant (RAV)

OFFSHORE AREA

In the offshore area of the BP OWF CI, the differences between the APV and the RAV will result from a different path and length of the planned cable line routes. The analysis has shown that the RAV implementation will entail the occurrence of impacts, the scale and significance of which will be of an equivalent scale and significance to those identified for the APV. Also, no other elements of the marine environment than those described for the APV are anticipated to be impacted.

ONSHORE AREA

For the purposes of the planned project implementation in the RAV the following belts have been designated:

- **permanent** 70 m wide – the area directly connected to construction works, includes point locations of towers. Within the permanent belt, the surface layer of ground and forest floor litter will be destroyed, the trees and shrubs will be removed due to the location of the overhead line. The removal of trees and shrubs is permanent;
- **technological** 25 m wide from the external overhead lines – the area indispensable for the correct operation of the overhead line and the equipment related, involving permanent clearance;
- **additional** 250 m wide from the external cable lines – area through which access roads may run.

20.6.2.1 Construction phase

20.6.2.1.1 Impact on geological structure, coastal zone, soils, and access to raw materials and deposits

20.6.2.1.1.1 Impact on geological structure

The main construction phase impacts on geology and surface formations will be connected to:

- construction of 4 boreholes at a distance of approx. 210 m from the shoreline and a distance of approx. 20 m from one another;
- construction of excavations for overhead line towers as well as for the purposes of cable chambers and boreholes;
- pile driving;
- levelling works related to levelling of the area for the erection of a customer substation and in the area of cable chambers.

The areas most vulnerable to the construction phase impacts of the planned project are dune areas as well as areas with high level of groundwater deposition.

The impact of the planned 220 or 275 kV overhead line on geological structure will be as insignificant as in the case of the APV.

20.6.2.1.1.2 Impact on the topography and dynamics of the coastal zone

Similarly to the APV, the shore structure will not be disturbed as a result of drilling. The impact on the topography and dynamics of the coastal zone will be higher in the case of the RAV implementation, due to a definitely greater scale of the tree falling areas as well as the higher probability of aeolian processes triggering within the Wydmy Lubiatowskie dunes. These will be important impacts.

20.6.2.1.1.3 Impact on soils

As a result of the assessment, the impacts on soils were confirmed to be moderate at most, similarly as in the case of the APV. They are related to the impact of wind erosion and the risk of contamination of poorly-developed soils with oils and greases.

20.6.2.1.1.4 Impact on the access to raw materials and deposits

Since the planned project is located at a distance of more than 4 km from the nearest deposit, no construction phase impacts on deposits and the access to mineral deposits are expected.

20.6.2.1.2 Impact on the quality of surface waters

As a result of the implementation of the planned project according to the RAV, the impact on the surface waters was found to be smaller than in APV, due to the passages over hydrographic objects conducted without any collisions. The possibility of water contamination as a result of accidental leaks from machinery and vehicles will be analogous. In the case of the RAV, the insolation conditions will be changed within a belt of greater width, which may lead to a change in hydrological conditions.

20.6.2.1.3 Impact on hydrogeological conditions and groundwater

The impact on hydrogeological conditions and groundwater in the RAV will be identical with reference to the ecological area “Torfowisko” [Peat bog] in Szklana Huta and the potential risk of dewatering in that area. It must be noted that the risk of the formation of a cone of depression or potential dewatering of the ecological area is minimal, due to the depth of the groundwater deposition in that area, which was confirmed by drilling. The impact on hydrogeological conditions and groundwater will the same in both variants, although the type of impacts will be different: the APV involves open trenches and the use of trenchless methods, while the RAV will involve point excavations for the construction of towers. The impacts connected to the implementation of the RAV will be important.

20.6.2.1.4 Impact on climate, including greenhouse gas emissions and impacts relevant for adaptation to climate change, impact on atmospheric air (air quality)

It can be expected that the impact on climate, including greenhouse gas emissions, in the case of the RAV, will be lower due to the short duration of the construction phase as well as a smaller quantity of equipment necessary for the implementation of the project.

20.6.2.1.5 Impact on ambient noise

In the case of the overhead line construction, the acoustic impact of noise sources at the construction phase will be irregular, varying daily due to the movement of the equipment, which makes it impossible to present the distribution of the sound field representative for a longer period of time. The line construction will be carried out away from the acoustically protected areas in the mid-forest environment. It can be expected that the impact on the ambient noise in the case of the RAV will be lower, due to a shorter duration of the construction and a different type of the technology used.

20.6.2.1.6 Impact on nature and protected areas

20.6.2.1.6.1 Impact on biotic elements in the onshore area

20.6.2.1.6.1.1 Fungi

The main impacts of the construction phase on fungi will be connected to the construction of excavations for the overhead line towers and cable chambers; pile driving; levelling works related to the levelling of the area for the erection of a customer substation, 400 kV overhead line towers and in the area of cable chambers.

As a result of the assessment, the significance of impact was assessed as low.

20.6.2.1.6.1.2 Lichens

The main construction phase impacts on the biota of lichen will be connected to:

- the construction of excavations for overhead line towers and cable chambers;
- pile driving;
- levelling works related to the levelling of the area for the erection of a customer substation, 400 kV overhead line towers and in the area of cable chambers.

In such cases, the thallus will be destroyed and consequently the plot of species will be eliminated. In the construction phase, sulphur oxides and nitrogen oxides will be emitted as a result of construction machinery operation, which epiphytic lichen species are especially vulnerable to.

As a result of the assessment, the impact was found to be important.

20.6.2.1.6.1.3 Mosses and liverworts

Due to construction works and the elimination of species plots, it was determined that these will be important impacts.

20.6.2.1.6.1.4 Vascular plants and natural habitats

As a result of the construction works conducted in the permanent technical and technological belts, plots of species will be eliminated and the habitat patch surface area will be reduced. As a result of the assessment, these impacts were found to be important.

20.6.2.1.6.1.5 Forrest complexes

The route of the 220 or 275 kV overhead line will involve a permanent clearing of trees. In total, the maximum surface area of tree felling will cover approx. 60 ha. As a result of the assessment, the impacts connected to tree-felling, soil erosion and potential contamination of individual forest habitat types with greases and oils were found to be important.

20.6.2.1.6.1.6 Invertebrates

Due to the presence of common coastal species of insects in this area the impacts may be considered negligible and not leading to the elimination of the species site. Moreover, the impacts will be connected to erosion and possible contamination of open trenches with greases, oils, etc. – which may negatively affect the bumblebee nests.

20.6.2.1.6.1.7 Ichthyofauna

During the construction phase, no impact on ichthyofauna is expected.

20.6.2.1.6.1.8 Herpetofauna

Similarly to the APV, herpetofauna in the area of the alternative line is represented by species relatively common across Poland. Most of them adapt well to the changes in the environment. As a result of the assessment, the impacts were found to be low and moderate in relation to the felling of trees.

20.6.2.1.6.1.9 Birds

The greatest impacts on birds will be connected to the construction of HV towers and a 220 or 275 kV overhead line. These impacts will be important.

20.6.2.1.6.1.10 Mammals

Most of the construction phase impacts on mammals will be similar to the ones in the APV and will have a moderate or small scale and be of low significance. The highest impact on mammals will be connected to the felling of trees and the traffic of vehicles. These impacts will be moderate.

20.6.2.1.7 Impact on protected areas

20.6.2.1.7.1 Impact on protected areas other than Natura 2000 sites

The construction phase impact on the Coastal Protected Landscape Area in the RAV will be higher than in the APV. These will be important impacts. This is mainly connected to the larger surface area of land occupied as well as the felling of trees planned for a 120 m wide strip of land along a 5.2 km section. The overhead line construction will be implemented in sections, a spot concentration of work will occur in the locations of towers.

The construction phase impacts on the ecological area “Torfowisko” [Peat bog] in Szklana Huta in the RAV will be greater due to the necessity to erect 10x8 m overhead line towers dug in up to a depth of 4 m. These impacts will be important.

20.6.2.1.7.2 Impact on Natura 2000 sites

The construction phase impact on the special habitat protection area Białogóra PLH220003 will be definitely higher than in the case of the APV due to a larger surface area occupied. The planned project will cause a direct threat to habitat 2180, i.e. Wooded dunes of the Atlantic, Continental and Boreal region. As a result of the overhead line construction, habitat 2180 will be destroyed on a surface area of 12 600 m^2. This will be a permanently deforested area without the possibility of returning to the previous condition. The impacts of the planned project will be important.

20.6.2.1.8 Impact on wildlife corridors

The construction phase involving the felling of trees, construction of trenches and erection or towers, as well as the construction of a customer substation and a 400 kV overhead line will cause a spatial discontinuity of the Coastal wildlife corridor of a supra-regional importance. The impact on the wildlife corridors will be greater than in the case of the APV. The impacts of the planned project will be important.

20.6.2.1.9 Impact on biodiversity

The construction phase impact on biodiversity in the RAV will be higher than in the case of the APV due to a larger surface area occupied and intended for tree felling, which entails loss of habitats. The main impacts will affect birds as a result of the construction of HV towers and a 220 or 275 kV overhead line. These will be important impacts.

20.6.2.1.10 Impact on cultural values, monuments and archaeological sites and features

As a result of the assessment, no impact on cultural values, monuments, archaeological objects, nor sites was confirmed.

20.6.2.1.11 Impact on the use and development of the land area and tangible goods

The impact on the use and development of the land area and tangible goods in the RAV during the construction phase will be greater than in the case of the APV, due to a larger surface area of land occupied and greater limitation of the forest tourist function in this area.

The impact on tangible goods in the construction phase will involve the use of the same road infrastructure as in the APV.

The construction phase impact on the use and development of land and on tangible goods was assessed as important.

20.6.2.1.12 Impact on landscape, including the cultural landscape

The RAV impact on landscape in the construction phase will be greater than in the case of the APV due to a larger surface area occupied. The differentiating factor will be the specific appearance of the high 4-circuit towers and the overhead line. As a result of the assessment, the impacts were found to be important.

20.6.2.1.13 Impact on population, health and living conditions of people

The construction phase impact on population, health and living conditions of people in the RAV will be similar to the one in the APV. The differentiating factor for the RAV will be a greater distance (approx. 420 m) from the Rehabilitation and Holiday Centre for disabled people and shorter duration of the construction works. In consequence, the construction phase impact of noise and pollution on the people present at the premises of the Centre will be lower. The significance of the construction phase impact on population, health and living conditions of people was assessed as low.

20.6.3 Operation phase

In the operation phase, the planned project in the form of a 220 or 270 kV overhead line is practically maintenance-free. The operation phase will entail the highest impact in relation to the customer substation and the 400 kV overhead line.

20.6.3.1.1 Impact on geological structure

The impact on aeolian sands connected to permanent deforestation was assessed as negative and important, since as a result of deforestation the aeolian processes may be triggered.

20.6.3.1.2 Impact on the topography and dynamics of the coastal zone

Deforestation of dunes in an approx. 120 m wide strip and the erection of power grid masts involves a high probability of triggering aeolian processes within the Wydmy Lubiatowskie dunes. As a result of triggering such processes, important changes to the relief character may occur both within the investment belt as well as in the neighbouring areas. The impact on the topography and dynamics of the coastal zone was assessed as important for the RAV operation phase.

20.6.3.1.3 Impact on soils

The impact connected to the permanent deforestation concerns all types of soils. The significance of impact was assessed as important in the case of poorly-developed soils, in the area of which as a result of deforestation aeolian process may be triggered and the thin soil cover may be destroyed. In the case of hydrogenic (peat) soils, the impact was assessed as moderately positive.

20.6.3.1.4 Impact on the access to raw materials and deposits

Since the planned project is situated at a distance of more than 4 km from the nearest deposit, no operation phase impacts on deposits are expected.

20.6.3.2 Impact on the quality of surface waters and ground water

The assessment of impact on surface water and ground water quality was specified as low, local in extent and important in relation to the potential contamination of ponds within the boundaries of the ecological area "Torfowisko" [Peat bog] in Szklana Huta.

20.6.3.3 Impact on climate, including greenhouse gas emissions and impacts relevant for adaptation to climate change, impact on atmospheric air (air quality)

No operation phase impacts of the planned project on climate are expected; also, there will be no greenhouse gas emissions nor impacts relevant to the climate change adaptation.

20.6.3.4 Impact on ambient noise

The calculation results obtained indicate clearly that regardless of the line voltage (220 or 275 kV) and the type of phase conductors used, the permissible sound level value adopted for residential areas (45 dB) will not be exceeded in any location below the 4-circuit line and in its vicinity.

As part of the RAV, a customer substation will be erected, the operation of which involves emission of noise. As the modelling has shown, at all observations points at the boundary of the planned residential development, the night-time (40 dB) and daytime (50 dB) noise limits for single-family development will not be exceeded.

The impacts on ambient noise were considered to have low significance.

20.6.3.5 Electromagnetic field impact

The operation phase impacts of the EMFs for a 4-circuit overhead line, due to the possibility of the permissible electric field intensity value to be exceeded, will be significant.

The EMF impact for the two single-circuit 400 kV overhead lines in the RAV will be the same as in the APV.

20.6.3.6 Impact on nature and protected areas

20.6.3.6.1 Impact on biotic elements in the onshore area

20.6.3.6.1.1 Fungi

During the project operation phase, the potential impacts on the biota of fungi and lichens will be the same as in the case of the APV. The differentiating factor will be a larger surface area of permanently deforested land.

The significance of these impacts will be low.

20.6.3.6.1.2 Lichens

During the project operation phase, the potential impacts on the biota of lichens will be the same as in the case of the APV. The differentiating factor will be a larger surface area of permanently deforested land.

The significance of these impacts will be low.

20.6.3.6.1.3 Mosses and liverworts

During the project operation phase, the potential impacts on mosses and liverworts will be the same as in the case of the APV. The differentiating factor will be a larger surface area of permanently deforested land.

The significance of these impacts will be low.

20.6.3.6.1.4 Vascular plants and natural habitats

During the project operation phase, the potential impacts on the vascular plants and natural habitats will be the same as in the case of the APV. The differentiating factor will be a larger surface area of permanently deforested land.

The significance of these impacts will be low.

20.6.3.6.1.5 Forrest complexes

The route of the 220 or 275 kV overhead line will involve a permanent deforestation within a technical belt with a width of approx. 70 m and a length of approx. 5.2 km – it covers a maximum surface area of 35 ha, as well as within the technological belt with a width of 25 m from the external overhead lines and a length of approx. 5.2 km – it covers a surface area of approx. 25 ha.

The route of the underground cable lines within the permanent technical belt will run across 57 forest plots belonging to the RDSF in Gdańsk. Fresh coniferous forests (62%) and fresh mixed coniferous forests (13%) with pine as a dominant species are predominant in this area. More than 66% of the surface area of forests is occupied by commercial forests. The following categories of protective forests are also present here; soil-protective and water-protective forests.

In compliance with the Environmental Protection Plan for the years 2014–2023 of the Choczewo Forest District (RDSF in Gdańsk), the surface area of the Choczewo Forest District is 17 572 ha. Permanent deforestations will have a local scope. The loss of forest resources for the entire Choczewo Forest District will be 0.35%.

The impacts of the planned project connected to forest clearance will be important.

20.6.3.6.1.6 Invertebrates

During the project operation phase the potential impacts on the fauna of invertebrates will be the same as in the case of the APV and may involve the destruction of habitats and microhabitats as a result of maintenance works. The differentiating factor will be a larger surface area of permanently deforested land.

The significance of these impacts will be low.

20.6.3.6.1.7 Ichthyofauna

During the operation phase, no impacts on ichthyofauna are expected.

20.6.3.6.1.8 Herpetofauna

The space along the entire project length will be dominated by HV towers and line. A currently non-existent spatial obstacle will be created. This will be a long-term impact, however, it will not be significantly negative for the amphibians and reptiles. The animals will be able to adjust to the new space.

The significance of these impacts will be low.

20.6.3.6.1.9 Birds

In the operation phase, the space along the entire project length will be dominated by HV towers and line. A currently non-existent spatial obstacle will be created. These will entail a long-term and definitely negative as well as permanent impact on birds, resulting mainly from:

- the collisions of birds with overhead lines;
- permanent habitat fragmentation.

High risk of bird collision with the planned HV line is forecast. In the case of migratory birds, the impact will also be on a continental scale. These will be significant impacts.

20.6.3.6.1.10 Mammals

During the project operation phase the potential impacts on mammals will be the same as in the case of the APV and may involve animal disturbance as a result of maintenance works. After the construction phase is completed, the land will be subject to succession process, new habitats that will be used by animals will be formed which will mitigate the effects of the land transformation and fragmentation. In a long-term perspective, the project will not generate negative impacts on mammals.

The significance of these impacts will be low.

20.6.3.6.2 Impact on protected areas

20.6.3.6.2.1 Impact on protected areas other than Natura 2000 sites

20.6.3.6.2.1.1 Coastal Protected Landscape Area

The operation phase impact of the 220 or 275 kV overhead line will greatly affect the landscape protected as part of the Coastal Protected Landscape Area. The operation phase involving the need to maintain permanent deforestation within a 120 m wide belt over a length of approx. 5.2 km will result in the creation of an empty space dominated by the silhouette of 4-circuit towers.

The remaining operation phase impacts will mainly concern birds.

The operation phase impact on the Coastal Protected Landscape Area will be higher than in the case of the APV. These will be significant impacts.

20.6.3.6.2.1.2 Ecological area "Torfowisko" [Peat bog] in Szklana Huta

The impact on the ecological area "Torfowisko" [Peat bog] in Szklana Huta in the RAV will be the same as in the case of the APV and limited to the impacts connected to maintenance works. These will be significant impacts.

No impact on the ecological area "Źródliska Bezimiennej" [the Bezimienna Springs] will occur.

20.6.3.6.2.2 Impact on Natura 2000 sites

The planned project will pose a direct threat to habitat 2180 Wooded dunes of the Atlantic, Continental and Boreal region, which is subject to protection within the boundaries of the Special Area of Conservation "Białogóra" (BLH220003). As a result of the overhead line construction, habitat 2180 will be destroyed on a surface area of 12 600 m^2. This will be a permanently deforested area without the possibility of returning to the previous condition. This will be a significant impact.

20.6.3.6.2.3 Impact on wildlife corridors

The planned project crosses the Coastal wildlife corridor of a supra-regional scale. The creation of a deforested space with dominant 4-circuit towers will interrupt the spatial continuity of the Coastal wildlife corridor within a 120 m wide and 5.2 km long strip. These will be significant impacts.

The location of the Mediterranean flyway migratory route poses a risk of high bird mortality as a result of collisions with the planned HV line. In the case of migratory birds, the impact will also be on a continental scale. This will be a significant impact of a transboundary range.

20.6.3.6.2.4 Impact on biodiversity

The highest impact on biodiversity will be connected to the potential collisions of birds with the overhead line. Thus, the impact on biodiversity can be considered significant.

20.6.3.7 Impact on cultural values, monuments and archaeological sites and features

In the operation phase, there will be no impact on cultural values, monuments and archaeological sites and objects due to its location beyond their occurrence as well as at a significant distance from them.

20.6.3.8 Impact on the use and development of the land area and tangible goods

The necessity to maintain a permanent deforestation due to the operation of a mid-forest overhead line will have a major impact on the use and development of the land area.

20.6.3.9 Impact on landscape, including the cultural landscape

The 220 or 275 kV overhead line will be a new, linear element of landscape in the mid-forest environment. The interference with the landscape will be significant.

20.6.3.10 Impact on population, health and living conditions of people

The most important nuisances related to the functioning of the project discussed involve the emission of noise and electromagnetic radiation from the 220 or 275 overhead line. These will be significant impacts.

20.6.4 Decommissioning phase

A complete removal of the 220 or 275 kV overhead line is predicted. At that point, the impacts that will occur will be the reverse of the construction phase.

20.6.5 Assessment of impact on Natura 2000 sites

20.6.5.1 Natura 2000 site Białogóra (PLH220003)

20.6.5.1.1 Applicant Proposed Variant

The implementation of the planned project in the APV will have no direct or indirect impact on the Natura 2000 habitats. The planned project will not have a significant negative impact on the subjects of protection of the Natura 2000 site, and especially, the following outcomes will be avoided:

- significant deterioration of the status of natural habitats or habitats of plant and animal species, for the protection of which the Natura 2000 site was established;
- significant negative impact on species, for the protection of which the Natura 2000 site was established;

- significant deterioration of the Natura 2000 site integrity or its interconnection with other sites.

Moreover, the planned project, due to its character and location, will not affect the possibility of implementing conservation measures and achieving targets set out in the Protective task plan for the Natura 2000 site Białogóra PLH220003.

20.6.5.1.2 Rational Alternative Variant

The planned project will cause a direct hazard to habitat 2180, i.e. Wooded dunes of the Atlantic, Continental and Boreal region. As a result of the overhead line construction, habitat 2180 will be destroyed on a surface area of 12 600 m^2. This will be a permanently deforested area without the possibility of returning to the previous condition.

20.7 Cumulative impacts of the planned project (including existing, currently implemented and planned projects and activities), including impacts on Natura 2000 sites Białogóra (PLH220003) and Przybrzeżne wody Bałtyku (PLB990002)

20.7.1 Existing, currently implemented and planned projects with the decision on environmental conditions

While preparing this EIA Report, the RDEP (Regional Directorate for Environmental Protection) in Gdańsk and the communes of Choczewo and Krokowa were requested to disclose the list of projects, for which the proceedings regarding the issued DECs (decision on environmental conditions) are being conducted, or for which the DEC has been issued within the last 3 years, the impacts of which may lead to an accumulation of negative impacts when combined with the planned project.

Pursuant to Decision No. 184/2020 (RDOŚ-Gd-WOO.4210.74.2011.PW.MS.KSZ) of 8 April 2020, a decision refusing to determine environmental conditions for the project consisting in the construction of a wind farm complex near the villages of Osieki Lęborskie – Lublewo – Choczewo – Choczewko – Przebendowo – Słajkowo in the Choczewo commune together with necessary auxiliary infrastructure has been issued.

Due to considerable distances between the projects as well as their impacts being limited to the area of the project, the planned project is not expected to cause either cumulative impacts or accumulation of the impacts in combination with the above-mentioned projects.

On 25 May 2016, the General Directorate for Environmental Protection in Warsaw issued a notice (Ref. no. DOOŚ-OA.4205.1.2015.24) informing the parties to the proceedings for issuing a decision on environmental conditions for the project, consisting in the construction and operation of Poland's first nuclear power plant with a capacity of up to 3750 MWe in the area of the communes of: Choczewo or Gniewino and Krokowa, on issuing by the General Directorate the resolution of 25.05.2016 (DOOŚ-OA.4205.1.2015.23) specifying the scope of the Environmental Impact Assessment Report.

The project can be implemented in the areas of the communes of Choczewo or Gniewino and Krokowa in the Pomeranian Voivodeship, in one of the three specific location alternatives: Lubiatowo-Kopalino, Choczewo and Żarnowiec, which were selected at the stage of the environmental impact assessment and confirmed at the stage of the decision on establishing the nuclear installation location

The following decisions were issued by the Director of the Maritime Office in Gdynia for the project in question (https://sipam.gov.pl/geoportal):

- Decision No. 7/19 of 8 August 2019 on the laying and maintenance of cables and pipelines for the purpose of the cooling system of the nuclear power plant in the area of the territorial sea for the Lubiatowo-Kopalino Site;
- Decision No. 6/19 of 8 August 2019 on the laying and maintenance of cables and pipelines for the purpose of the cooling system of the nuclear power plant in the area of the territorial sea for the Żarnowiec Site;

According to the data provided by the Maritime Office in Gdynia (https://sipam.gov.pl/geoportal) concerning the Choczewo location variant, no decision on the laying and maintenance of cables and pipelines for the purpose of the cooling system of the nuclear power plant has been issued. In the region of the Choczewo location variant, decisions on the laying and maintenance of cables transmitting electricity from the OWF within the internal sea waters and territorial sea are applicable.

The Lubiatowo-Kopalino variant is located at a distance of approx. 5 km to the west, whereas the Żarnowiec variant is located at a distance of approx. 15 km to the east of the planned project. However, it is difficult to predict whether and when, and in which variant, the nuclear power plant will be built, as well as how long the construction phase will last. If the Lubiatowo-Kopalino variant is selected, with the nuclear power plant being built at the same time as the BP OWF CI, the accumulation of impacts may occur in relation to:

- **climate and air quality** – the accumulation of impacts related to the air pollutant emissions may result from the increased volume of traffic of the vehicles involved in the construction works and material transportation. It is assumed that owing to the distance between the locations of both projects (approx. 5 km from each other) and good air circulation, the accumulation of impacts on the air and climate will not persist and will not cause the air quality nor local climate to deteriorate. These will be medium-term impacts of a regional scale;
- **population and its living conditions** – it may happen that the vehicles involved in both projects will use the same access roads as the inhabitants of the adjacent areas. However, it should be noted that the BP OWF CI construction in the onshore part has been progressing fairly quickly and has been carried out section by section – the accumulation of impacts will be medium-term and local.

The cumulative impacts of the nuclear power plant built according to the Lubiatowo-Kopalino variant in combination with the BP OWF CI will be limited to the construction phase, since the operation phase of the BP OWF CI proceeds practically automatically, being limited to maintenance work, which will take place once a year. These will be medium-term, regional and local impacts.

To conclude: if the proposed project is implemented simultaneously with other projects, the impacts associated with the construction phase might be related to physical transformations of the land surface, including its cover, land occupancy, increased vehicle traffic, emission of noise and vibration. During the operation phase, significant impacts on air, noise, electromagnetic fields, forests, protected areas, land use and development, landscape, population and its health and living conditions, may occur.

20.7.2 Infrastructure-related planned projects

Due to the planned OWF construction, a need has emerged for the extension of power networks to transmit the power generated by those farms. Currently, the construction of OWFs is planned by the subsidiaries of PGE Polska Grupa Energetyczna S.A (Elektrownia Wiatrowa Baltica 2 Sp. z o.o., Elektrownia Wiatrowa Baltica 3 Sp. z o.o., Elektrownia Wiatrowa Baltica 1 Sp. z o.o.), Orlen S.A. (Baltic Power Sp. z o.o.) and C-Wind Polska Sp. z o.o.

The Baltic Power Sp. z o.o. company with the letter of 20 December 2019, corrected on 31 March 2021, applied for a permit for laying and maintaining cables for the project „Budowa przyłącza elektroenergetycznego Morskiej Farmy Wiatrowej Baltic Power do Krajowej Sieci Przesyłowej" [literally: "Construction of the Baltic Power Offshore Wind Farm power connection to the National Power System"]. This area includes the area of the internal sea waters and territorial sea [for the Exclusive Economic Zone, the decision approving the location of the cables was issued by the Minister of Maritime Economy and Inland Navigation in the letter of 7 July 2020 (ref. no. DGM.WZRMPP.3.430.24.2020.NZ.1) – Decision 1/K/20]. The Director of the Maritime Office in Gdynia requested the opinion of competent ministers in the letter (ref. no.: INZ1.1.8104.10.1.2019.MGw) and has received positive opinions. The Director of the Maritime Office issued a positive decision concerning the location of the above-mentioned project (Decision no. 5/20) in the letter of 28 September 2020 (ref. no. INZ1.1.8104.10.13.2019.MGw). The permit was issued for a period of 35 years. The planned project will involve the laying of high voltage (HV) or extra high voltage (EHV) AC or DC power cables including the necessary telecommunication and associated infrastructure. In the area of the territorial sea, it is planned to use the method of cable burying in the seabed or laying on the seabed with additional protection, whereas, in the coastal zone, the directional drilling method.

With the letter of 27 June 2019 (supplemented on 22 August 2019 and 14 October 2019, and corrected on 19 September 2019 and 20 April 2020) the Elektrownia Wiatrowa Baltica 2 Sp. z o.o. company applied for a permit for laying and maintenance, within the internal sea waters and territorial sea, of cables transmitting electricity from the project entitled „Zespół Morskich Farm Wiatrowych o maksymalnej łącznej mocy 1500 MW oraz infrastruktura techniczna, pomiarowo-badawcza i serwisowa związana z etapem przygotowawczym, realizacyjnym i eksploatacyjnym" [literally: "Offshore Wind Farms Complex with a maximum total power output of 1500 MW together with technical, research and measurement, and service infrastructure related to the preparatory, construction and operation stages"]. In response to this application, a decision of the Minister of Transport, Construction and Maritime Economy no. MFW/4//12 (ref. no. GT7/62/1157765/decyzja/2012) of 16 April 2012 was issued on the permit for the construction and use of artificial islands, structures and equipment in the Polish Maritime Areas. The Director of the Maritime Office issued a positive decision concerning the location of the above-mentioned project (Decision no. 1/DS/20) in the letter of 6 November 2020 (ref. no. INZ5DS.8104.1.11.2020.AGB). The permit was issued for a period of 35 years. The proposed project will involve the laying and maintenance of high voltage (HV) or extra high voltage (EHV) AC or DC power cables including the necessary telecommunication and associated infrastructure, using the method of cable burying in the seabed or laying on the seabed with additional protection, whereas, in the coastal zone, the directional drilling method is planned. During the cable exploitation phase, inspections of the particularly vulnerable areas (e.g. crossings with the existing infrastructure) shall be carried out once a year, while a full inspection of the entire length of the cable lines shall be carried out only once every 5 years.

On 27 June 2019, Elektrownia Wiatrowa Baltica 3 Sp. z o.o. company applied for the permit for the laying and maintenance, within the internal sea waters and territorial sea, of cables transmitting electricity from the project entitled „Zespół Morskich Farm Wiatrowych o maksymalnej łącznej mocy 1050 MW oraz infrastruktura techniczna, pomiarowo-badawcza i serwisowa związana z etapem przygotowawczym, realizacyjnym i eksploatacyjnym" [literally: "Offshore Wind Farms Complex with a maximum total power output of 1500 MW together with technical, test and measurement, and service facilities related to the preparation, construction and operation stages"]. The application was supplemented on 22 August 2019 and 14 October 2019, and corrected on 19 September 2019 and 20 April 2020. In response to the application, a decision of the Minister of Transport, Construction and Maritime Economy no. MFW/5/12 (ref. no. GT7/62/1157768/decyzja/2012) of 16 April 2012 was issued on the permit for the construction and use of artificial islands, structures and equipment in the Polish Maritime Areas. The Director of the Maritime Office issued a positive decision concerning the location of the above-mentioned project (Decision no. 2/DS/20) in the letter of 6 November 2020 (ref. no. INZ5DS.8104.2.11.2020.AGB).

Before issuing the above-mentioned decisions, the Director of the Maritime Office in Gdynia issued the decision repealing (Decision no. 5/18 of the DMO in Gdynia of 23 November 2018) the previously binding decision of 31 July 2014 concerning the laying and maintenance of subsea cables comprising offshore infrastructure for power transmission – eastern part (MTI-E) in the area of the territorial sea of the Republic of Poland. The Applicant – Inwestycje Infrastrukturalne Sp. z o.o. in the letter of 29 June 2018 requested the previous decision to be repealed. The Applicant's aim was to safeguard the space for future OWF investors, however, due to the fact that individual investors have commenced their work and the route of the proposed power cables has been specified, the area covered by the previous decision will not be designated for further development within the given scope.

20.7.2.1 Cable tray

On 31 August 2021, C-Wind Polska Sp. z o.o. applied for a decision on environmental conditions for the project entitled: „Budowa infrastruktury przesyłowej energii elektrycznej z Morskiej Farmy Wiatrowej BC-Wind do Krajowego Systemu Elektroenergetycznego" [literally: "Construction of the power transmission infrastructure from the BC-Wind offshore wind farm to the National Power System"].

On 23 September 2021, Elektrownia Wiatrowa Baltica-2 Sp. z o.o. and Elektrownia Wiatrowa Baltica-3 Sp. z o.o. applied for a decision on the environmental conditions for the project entitled „Infrastruktura Przyłączeniowa MFW Baltica B-2 i B-3" [literally: „Baltica B-2 and B-3 OWF Connection Infrastructure"].

In the offshore part, the BP OWF CI Development Area is located in the exclusive economic zone, in the territorial sea and internal sea waters. West of the BP OWF CI Development Area, it is planned to build the connection infrastructure for the Baltica 2 and Baltica 3 OWFs, while east of the area, the connection infrastructure for the BC-Wind OWF Area.

In the case of the Baltica OWF CI, the assumed length of a single cable line will be up to 89 km, while in the case of the BC-Wind OWF CI, it will be up to 33 km. In the exclusive economic zone, the routes of all three construction areas will be located within the offshore wind farms. In the territorial sea, their routes will converge. Approximately 7 km from the shoreline up to the drilling locations, these areas will run parallel to each other.

In the case of the onshore part, as agreed with the Choczewo Forest Inspectorate, the transmission infrastructures leading from the OWF were designed to be routed through a cable tray, minimising the negative environmental impacts to a maximum extent by:

- minimising the tree felling area thanks to routing the connection infrastructure of the OWF investors through a common cable tray;
- bypassing the environmentally valuable areas indicated by the Choczewo Forest Inspectorate at the stage of agreements;
- using the cable technology and horizontal directional drilling as the least cumbersome for the environment.

The connections of individual investors are at different development stages. Construction work for cable lines will be performed at different times. The construction of the Baltica 2 and Baltica 3 OWF CI may be an exception. According to the information received from the Applicant, which results from the cooperation with the other investors, the construction of the Baltica 2 and Baltica 3 OWF CI may coincide with the construction of the BP OWF CI.

The Baltica 2 and 3 OWF CI Development Area is located in the northern part at a distance of approx. 1.8 km to the west of the BP OWF CI. From km 35+300 of the BP OWF CI, the projects utilise a common corridor. In this case, the accumulation of negative impacts related to the construction phase such as: operation of machines and equipment used in construction work and their presence on the road between the villages of Osieki Lęborskie and Lubiatowo, may arise. It should be noted that the trench for the BP OWF CI will be made in sections with a length of 1 km, and the time of it staying open will not exceed 1 week, which will reduce the likelihood of construction crews appearing simultaneously at the same sections. Due to the location of the proposed projects in the forest area and far from inhabited areas, these impacts will not cause nuisance for local residents. The construction phase for the Baltica 2 and 3 OWF CI and the BP OWF CI will involve a temporary and local restriction on the tourism function of the regional forests.

The southern part of the BC-Wind OWF CI Development Area is adjacent to the east side of the BP OWF CI. As part of the project, there is a plan to build the following: approx. 33 km of subsea cable line within the waters of internal sea, territorial sea and exclusive economic zone, as well as 8.5 km of underground cable line, including the necessary service road, and an onshore transformer substation (hereinafter referred to as: OTS), including a 1.5 km long access road in the Choczewo commune area. At the same time, the proposed project involves the construction of a section of the overhead line constituting the 400 kV connection between the OTS and the connection point at the substation owned by Polske Sieci Energetyczne (PSE).

Due to the lack of data, at the current investment stage, it is impossible to assess the cumulative impacts in the context of electromagnetic fields and thermal impacts in the common cable tray, including the conduct of an analysis of the cumulative impact on the Białogóra (PLH220003) and Przybrzeżne wody Bałtyku (PLB990002) Natura 2000 sites. However, it is important to emphasise that the proposed connections and customer substations will be located outside the Białogóra (PLH220003) Natura 2000 site.

20.7.2.2 PSE Substation

The proposed project, at its final section in the form of a 400 kV overhead line, enters the PSE substation, which will be used for electric power transmission and distribution. This substation is located south of the BP OWF CI, on an area of approx. 0.3 km^2, in part of the plot no. 25/3 (Kierzkowo precinct, Choczewo commune, Wejherowo district, Pomeranian voivodeship), on agricultural lands and tree- and shrub-covered arable lands.

The investor in the planned project is the state-owned enterprise Polskie Sieci Elektroenergetyczne S.A. On 10.08.2021, an application was made for a decision on the environmental conditions for the project entitled: "Budowa stacji elektroenergetycznej 400 kV Choczewo" [literally: „Construction of a 400 kV power substation Choczewo"].

The PSE substation shall be equipped with a 400 kV switchyard constructed using AIS technology and the 3S+2SO arrangement. The busbar systems (tubular version) shall be divided into sections (section A and B). The sections A and B shall be connected to each other by a longitudinal busbar coupler. Each section shall be equipped with a transverse busbar coupler, system earthing switches, bypass busbar couplers and voltage measurement bays. Two bypass busbars (tubular version) shall be installed. The linear bays for overhead terminals shall be equipped with anchor portals and cable line bays will have an enclosed cable termination station. Lightning protection shall be provided through the use of interception air rods, lightning masts and lightning rods installed on anchor portals. The station auxiliary system shall be based on power supply from transformers (0.4 kV), auxiliary transformers fed from an external MV network and an emergency power generator.

In the PSE substation area, the following components are expected to be located:

- 400 kV overhead switchyard constructed using the 3S+2SO arrangement;
- auxiliary building;
- guardhouse;
- power generator (on paved ground);
- internal road system, including parking sites and yards;
- cable ducts and conduits system;
- water supply system (supply from a water main and/or deep well);
- drainage system for buildings, roads, cable ducts etc.;
- rainwater drainage system with a storage and absorbent reservoir;
- fire water tanks with water connection points for firefighters;
- cesspool (sanitary sewerage system);
- exterior lighting;
- external fencing (made of concrete or panels) and regulatory fencing (interior – made of panels).

Furthermore, as part of the PSE substation, auxiliary infrastructure such as utility connections and road exits shall be built.

In the immediate vicinity of the PSE substation, the substations owned by the entities to be connected (OWF intermediary substations) will be located. These substations are still in the development phase, therefore, due to the lack of data on the planned infrastructure, it is impossible to assess the cumulative impacts for the planned project.

20.7.3 Identification of impacts which may cause cumulative impacts

In the vicinity of the offshore part of the BP OWF CI area, there are areas in which similar activities related to the laying of subsea power cables of other investors are planned. Therefore, the accumulation of underwater noise resulting from construction works being conducted simultaneously within the areas of more than one of these projects, may result in cumulative impacts, particularly in the zone up to approx. 7 km from the shoreline, where these areas are closest to each other.

For the same reason, i.e. the proximity of construction areas of other investors and the possibility of simultaneous cable laying and burying in the seabed, the phenomenon of impact accumulation may also occur in connection with an increase in the concentration of suspended solids in the water depth and their sedimentation.

As regards the onshore part of the BP OWF CI, possible impact accumulations are related to noise generation as a result of machine and equipment operation in the construction phase and the noise generated as a result of electrical power equipment operation within the customer substation and the PSE substation during their operation phase.

20.7.4 Assessment of cumulative impacts

20.7.4.1 Underwater noise

The noise impact range is relatively small for individual vessels, however, in the case of two or more noise sources, which results from simultaneous implementation of similar projects, an increase in the noise level may be substantial, especially in the area between them.

Although the noise generated by the vessels to be used for the purpose of construction and operation of the planned projects increases the environmental noise, it has a small range, which is only significant within a few hundred metres of the sound source. However, the scale and scope of this impact increase with the number of vessels involved in the construction of all the planned cable connections, hence, the noise increases in a larger area and the impact duration is longer. The accumulation of underwater noise may result in this phenomenon extending to a larger sea area than in the case of the activities carried out by one investor.

Taking into account the specificities of the project construction phase, including in particular its linear nature, with the progress of work, the increased underwater noise levels will pertain to more sea areas around the vessels in operation, at the same time releasing the areas in which the cable has already been buried or laid on the seabed. For reasons of safety of underwater operations, the vessels used for cable laying and burying will have to operate at considerable distances from each other, which will additionally mitigate the possible accumulation of underwater noise.

Considering the above, including a significant possibility of marine mammals and fish avoiding sea areas characterised by a temporarily increased level of underwater noise, it can be assumed that this cumulative impact will be short-term (in the context of the entire southern part of the offshore connection infrastructure development areas), local, and its significance will be moderate at most.

20.7.4.2 Suspended solids

The modelling results for the dispersion of suspended solids created as a result of works related to cable laying and burial indicate that short-term changes concerning both an increase in the suspended solids content in the water depth and their sedimentation on the seabed.

In the northern routes of the transmission infrastructures, the distances between the areas where the works are to be carried out by different investors are so long that even if the works are carried simultaneously, they will not result in the accumulation of the increase in suspended solids content in the water depth. The accumulation of their sedimentation on the seabed will also not take place.

The situation may be different in the southern part of the routes of the offshore connection infrastructure development areas. The maximum width of the corridor in which the cables of all three investors are planned to be laid is approx. 3.4 km. If the works are carried out simultaneously, the impact accumulation within the impact range is likely to occur, particularly with regard to an increase in the concentration of suspended solids in the water depth. Such situation, depending on the choice of the cable burial method, the hydrodynamic conditions prevailing during the works and the type of seabed sediments, may last up to several dozens of hours (in the case of the mass flow excavation method) from the moment of the interference in the seabed. After the geological reconnaissance, the soil conditions may enable the application of the ploughing technology, in which the area of soil structure disturbance is smaller, and the amount of sediments becoming suspended is significantly smaller than for the methods analysed in this report.

Considering different development stages of the projects of individual investors, possible deliveries of offshore power cables and order of engagement of specialist vessels and equipment used during cable burial, the situation when these projects are implemented simultaneously is unlikely to occur. The actual manner in which different investors will carry out their works will result from the safety of underwater operations at sea and the necessity to designate safety zones around the areas where these works are to be carried out. Therefore, despite the theoretical possibility of accumulation of the impacts related to an increase in the concentration of suspended solids in the water depth and their subsequent sedimentation, the actual accumulation will be a short-term, reversible and local phenomenon, and the significance of this impact will be moderate at most.

20.7.4.3 Noise

As a result of implementing two projects in the onshore area, i.e. the Baltic Power OWF customer substation and the PSE substation, the accumulation of impacts regarding noise, both during the construction and operation phase, is likely to occur.

The construction works for the PSE substation are planned for August 2023–May 2026 and may accumulate with the planned project along the section of the access road leading from Osieki Lęborskie to the substation. The construction of the PSE substation, as well as of the BP OWF CI, will involve operation of machines and equipment used in construction work, i.e. excavators, bulldozers, lifting devices, self-propelled graders and vehicles transporting building materials – rigid dump trucks. As indicated in the database *Update of noise database for prediction of noise on construction and open sites* developed by Hepworth Acoustics Ltd at the request of DEFRA (*Department for Environment, Food and Rural Affairs*) [154], a typical noise level at a distance of 10 m from its source is around 70–85 dB.

Although the construction phase is characterised by a relatively high noise emission into the environment, it should be noted that its duration is episodic in nature, and upon the completion of construction works, the acoustic environment returns to its natural state.

Summing up: the accumulation of impacts related to noise emission may result from the increased volume of traffic of the vehicles involved in the construction works and material transportation.

During the phase of construction of the customer substation and PSE substation, it may happen that the vehicles involved in both projects will use the same access roads as the inhabitants of the adjacent areas. However, it should be taken into consideration that the project construction in the onshore area is expected to progress quickly and the accumulation of impacts will occur only for a short time and locally.

As part of this EIA Report, the cumulative sound level was calculated for the operation phase of the planned customer substation and the PSE substation. The acoustic data concerning the substation were introduced to the calculation program on the basis of the Project Information Sheet entitled „Construction of the 400 kV Choczewo substation" [187]. 32 sources of noise with a sound power level of 64.1 dB – elements of busbar systems and outgoing line sections installed (in accordance with the design assumptions) at a height of 14 m were introduced to the program.

The calculations conducted for the noise levels show that at all observations points at the boundary of the planned residential development, the night-time (40 dB) and daytime (50 dB) noise limits for single-family development will not be exceeded.

The sound levels established for night-time (40 dB) and daytime (50 dB) in the area of the nearest protected development, including the planned and existing residential developments, will not be exceeded also in the situation when both substations, i.e. the Baltic Power Sp. z o.o. customer substation and the PSE substation Choczewo, operate simultaneously.

In view of the above, the cumulative impact of noise during the operation stage of the Baltic Power Sp. z o.o. substation and the PSE substation has been considered to be of low significance.

20.8 Transboundary impact

The planned project – Baltic Power OWF Connection Infrastructure development area is located at least approximately 117 km from the Poland's land border, and approximately 61.5 km from the sea border, i.e. from the Polish Exclusive Economic Zone. Considering the planned project location, scale and implementation method, it is not expected that the implementation thereof would result in transboundary impacts on most of the environmental elements at any stage. The exception is the identified negative impact on birds undertaking migration along the East Atlantic Flyway.

20.9 Analysis and comparison of the variants considered and the variant most beneficial to the environment

In view of the specific nature of the planned project, namely the integration of the power generated by the Baltic Power OWF into the National Power System, the location of the planned project for both variants results from the locations of the wind farm and PSE substation on land. In the case of the RAV, an alternative offshore route for the cable lines has been proposed. The type and scope of offshore works to be carried out according to this variant would be the same as in the APV. The factor differentiating both variants is the route length, i.e. approximately 46.8 km in the case of the APV and approximately 53.6 km in the case of the RAV.

The method and location of the power cable landfall are identical for both variants.

In the case of the offshore part, the BP OWF CI starting point – the cable chamber location, as well as the end point – the current terminals at the PSE substation, are the same. The Applicant had to make a decision on the type of line which would be optimal in this case. The decision also concerned the line location. The APV would involve conducting the connection in the form of a multi-circuit underground extra-high voltage cable line cable line over a distance of approx. 6.5 km. In the case of the RAV, the entire onshore section would be an approx. 5.2 km long overhead power line with a different route.

The Rational Alternative Variant was developed as a guarantee that the project to connect the Baltic Power OWF to the NPS will be implemented. Should construction of the power connection according to the APV be unfeasible, e.g. due to adverse environmental conditions or a serious conflict with other users of the area, which could not be predicted before conducting environmental surveys and spatial analysis, the Applicant would initiate the process of applying for the issuance of a location decision for alternative routing of connection and the implementation of the project in a different spatial and/or technological configuration.

The analysis of environmental data and the previous use of the area intended for the construction of the BP OWF CI indicates that it is possible to implement the project according to the APV. The implementation of this variant will be more beneficial to the environment compared to the RAV.

In summary, the comparison of both variants, including in particular potential impacts resulting therefrom, revealed that the construction and operation of the BP OWF CI according to the APV is the variant least burdensome to the environment and other users of the area.

20.10 Comparison of the technology proposed with the technology compliant with the requirements stated in Art. 143 of the Environmental Protection Law

Pursuant to Article 143 of the Act of 27 April 2001 – Environmental Protection Law (Journal of Laws of 2001, No. 62, item 627, as amended), the technologies used in the newly commissioned systems should meet the requirements which consider, in particular:

- the use of substances with a low hazard potential;
- the effective generation and use of energy;
- ensuring rational consumption of water and other raw materials as well as consumables and fuels;
- the use of waste-free and low-waste technologies and possibility of waste recovery;
- indication of the type, range and size of emissions;
- the use of comparable processes and methods which have been effectively applied on industrial scale;
- scientific and technical progress.

The experiences related to the construction and operation of power cables offshore and onshore enable the selection and implementation of the most efficient and proven solutions for power transmission from the Baltic Power OWF to the NPS, meeting the requirements of the most advanced technologies, resistant to the conditions of operation in the marine and land environments, while keeping the energy waste at the lowest possible level, and affecting the natural environment to the smallest extent. The proposed technology for the construction and operation of the BP OWF CI complies with all the requirements stated in Article 143 of the Act of 27 April 2001 – Environmental Protection Law.

20.11 Description of the prospective actions to avoid, prevent and reduce negative impacts on the environment

OFFSHORE AREA

The measures anticipated to reduce the adverse impact of the BP OWF CI implementation on seabirds and marine mammals are listed below. In the case of other elements of the environment, which were the subject of the impact analysis, no need for measures mitigating the negative impact of the investment in each phase of its implementation was identified.

General recommendations:

- construction of subsea cable lines in the shortest possible time, using high-tech equipment and vessels;
- limit the number of vessels operating simultaneously in the construction area to the necessary minimum;
- application of the least environmentally harmful technologies for the construction of subsea cable lines – ploughing preferred.

Seabirds:

- intensification of the pace of construction works in the months of April–September, when the number of birds in this sea area is the lowest;
- limiting sources of strong light directed upwards at night – this mainly concerns the periods of bird migration. The Applicant declares that they will limit the light emission to the necessary level, resulting from the applicable regulations and work safety standards.

Marine mammals:

- proper planning of cable laying activities to avoid the mating, moulting, and breeding periods of sensitive species – ideally from May to October;
- proper planning of cable laying operations with regard to other projects to be implemented in the area of the project in question in such a manner that different operations do not overlap in time.
- carrying out the work in the best possible weather conditions and with good quality equipment (particularly important in the case of vessels with DP) in order to reduce as much as possible the level of the noise generated;
- use of deterring sounds/MMO observations before the commencement of work. The movement of vessels alone will be detected by mammals when the noise source appears at a considerable distance from the individual, the likely avoidance response will, therefore, occur before dangerous levels of impact occur.

ONSHORE AREA

In order to protect the special natural values made vulnerable by the BP OWF CI, the following mitigation measures have been proposed:

- use of trenchless methods in the form of Horizontal Directional Drilling in the area of the Wydmy Lubiatowskie dunes and the waterlogged valley;
- use of mitigation measures preventing drainage of the area;

- location of construction site facilities outside the areas of: river valleys, wetlands and protected areas;
- construction sites will be protected against the ingress of harmful substances into the soil and will be equipped with a sufficient quantity of sorbents;
- good technical condition of construction and transport equipment and adequate planning of works within the construction site will be ensured;
- possible spills of petroleum products from the equipment and machinery operating at the construction site will be eliminated immediately, and the contaminated soil will be removed and disposed of;
- construction works will be carried out in such a way as to maximally reduce the amount of construction waste generated;
- the contractor will designate the location for the storage of waste at the construction site, and will also provide bins and containers for their selective collection;
- environmental supervision of a botanist, a herpetologist, an ornithologist, and a mammalogist will be ensured during the phase of construction in the field;
- construction works which may potentially impact the residents of the Rehabilitation and Holiday Centre for disabled people (ul. Spacerowa 38, Lubiatowo) will be carried out only during daytime with the exception of Sundays and holidays to the extent possible (with the exception of works which have to be carried out in a continuous manner, e.g. drilling), and the schedule of works will be communicated to the management of the centre;
- noise-generating equipment will be positioned as far as (technically) possible from the buildings of the Rehabilitation and Holiday Centre for disabled people;
- equipment providing effective noise protection will be used;
- during the construction, the access road to cable chambers will be delineated along the eastern boundary of the Natura 2000 site Białogóra (PLH220003) and habitat 2180, and information boards with the following message “Protected habitat. No trespassing” will be displayed;
- use of methods preventing the formation of a cone depression and drainage of protected peats within the ecological area "Torfowisko" [Peat bog] in Szklana Huta. During the construction phase of the cable chambers, in case dewatering is necessary, it will be short-term;
- the final section of the access road to the cable chambers will be separated from the ecological area with a fence on both sides of the road. The preservation of the ecological areas in their present state will be the primary protective measure along this section of the project;
- in the permanent and temporary technical belts as well as within the area of collision of the planned project route with the resources of lichen species of high nature value, a Permit of the Regional Director for Environmental Protection must be obtained for derogations from the prohibitions concerning the plant species under protection;
- in places where tree felling will not be necessary, the work related to the protection of trees and fencing should be carried out under the supervision of a lichenologist;
- within the permanent technical belt, there are 2 species of the following protected mosses and liverworts: bog groove-moss (*Aulacomnium palustre*) and crisped pincushion moss

(*Ulota crispa).* The mitigation measures consist of Horizontal Directional Drilling across the Wydmy Lubiatowskie dunes and across the waterlogged valley;

- in the area of cable chamber location and the collision of the planned project route with the resources of vascular plant species of high nature value, it is possible to apply minimisation measures consisting in replanting the specimens together with an appropriate portion of the substrate beyond the direct impact zone carried out under the environmental supervision. If protected plant species and habitats collide with the planned project, a Permit of the Regional Director for Environmental Protection must be obtained for derogations from the prohibitions concerning the plant species under protection;
- before the construction begins, herpetological supervision shall protect amphibian migration sites and areas adjacent to the key sites of amphibian occurrence with newt fencing preventing animals from entry into the construction site and onto the access roads;
- tree felling works will be carried out outside the bird breeding season, in the autumn-winter period, between 15 September and 28 February;
- installing bird scarers on the 400 kV line connecting the customer substation with the PSE substation, e.g. FireFly diverters.
- fencing the construction site to protect the area against the possibility of animals falling into the trenches;
- the environmental supervision entity shall be notified of any emergencies, cases requiring intervention or unforeseen situations involving animals.

20.12 Proposal for the monitoring of the planned project impact and information on the available results of other monitoring, which may be important for establishing responsibilities in this area

20.12.1 Proposal for the monitoring of the planned project impact

OFFSHORE AREA

The results of the environmental surveys of the BP OWF CI development area as well as the identification of potential impacts have shown that the environmental resources in the project area are typical for the coastal waters of the southern part of the Baltic Sea and that such resources would not be affected by significant impacts. The project will have the greatest impact on the marine environment in the construction phase, mainly due to the disturbance of the seabed during the laying of cable lines, which will result in the destruction of the animal and, to a lesser extent, sporadically recorded plant benthic communities within the strip of the cable line construction, as well as in the scaring of fish and marine mammals from the area of underwater operations. The restoration of benthic communities will begin directly after the completion of underwater operations. The qualitative and quantitative benthic resources will stabilise after a few days from the completion of the construction phase at the latest. The restoration time is likely to be much shorter as the zoobenthos species travelling on the seabed (including most mussel species) will relocate from the seabed areas adjacent to the construction area. Underwater operations will also generate underwater noise which will scare away fish and marine mammals. It is anticipated that due to the noise characteristics and its duration, the scaring of animals will have a local scale and will cease after the completion of such works. The traffic of vessels involved in construction works will also temporarily scare away the marine mammals and seabirds within a small area. It should be underlined that the BP OWF CI area is constantly used for navigation and fishing, thus, the presence of vessels involved in the project will not change the nature of this area and will not cause, with the exception of activities directly related to the interference in the seabed, the emergence of new environmental impacts in this part of the Baltic Sea. In the operation phase, the impact will be much smaller than during the construction phase and will result from the inspections of cable lines carried out at least once every 5 years using non-invasive methods. The decommissioning phase will in fact be the discontinuation of the use of the connection infrastructure, without dismantling its components and it will not generate environmental impacts. On the basis of the previous experiences describing the response of the marine environment elements on the impacts generated by projects with characteristics similar to the project in question as well as due to the relatively small anticipated impact of the BP OWF CI on the marine environment in every phase of its implementation, it is suggested that no environmental monitoring be carried out to identify and assess the impact of the investment on the marine environment. The information cited above indicate that such a monitoring is not justified in the context of gaining new knowledge and will not contribute to improving the protection and status of the environment, because the scope of impacts identified, their influence on the elements of the environment as well as the receptors' response to the impacts are known and do not require further studies.

The Applicant – Baltic Power sp. z o.o. and Northland Power – will carry out monitoring for the purpose of the Baltic Power OWF, the wide scope of which will involve the impacts and elements of the environment identified also in the BP OWF CI. Thus, data from this monitoring can be used for the environmental impact assessment of the project in question.

ONSHORE AREA

It is recommended that compliance with permissible levels of electromagnetic fields in the environment is monitored.

20.13 Limited use area

The analysis of the electromagnetic field and noise impacts included in this EIA Report showed that the environmental quality standards will not be exceeded. The results of the calculations of the noise levels in the area of the proposed 400 kV overhead lines show that the maximum value of the sound level in the most unfavourable operating conditions of the line (bad weather) will not exceed at any point beneath the line (at the height of 4.0 MAGL) the value of 52.8 dB, which means an exceedance by 7.8 dB of the permissible value established in the Regulation of the Minister of the Environment of 14 June 2007 on permissible noise levels in the environment (Journal of Laws of 2014, item 112). However, in accordance with the local spatial development plan "Wiatraki w Lublewie" [Windmills in Lublewo], the area intended for the 400 kV line is an agricultural area; field cultivation, breeding, horticulture, orcharding; where the location of residential functions within agricultural settlements is excluded.

In this respect it is not an acoustically protected area; therefore, no need for introducing mitigation measures and a LUA has been indicated.

20.14 Analysis of possible social conflicts related to the planned project, including the analysis of impacts on the local community

The planned project will be implemented in the offshore and onshore area, which will entail various potential social conflicts. Some of such conflicts will be resolved before they are triggered, e.g.

a potential conflict with other investors planning to build a linear infrastructure in the offshore area will be resolved with location permits issued by the Minister relevant for the matters of the maritime economy and the Director of the Maritime Office in Gdynia, and in the onshore area by including the project in the studies of conditions for spatial development and local plans. Other potential conflicts may emerge at the pre-implementation and implementation stages of the project.

The analysis of the location of the planned project in relation to the current and planned use of sea space indicated that fishermen may submit their concerns regarding the continuation of their activities in an unchanged manner. Such a situation may take place especially when safety zones are delineated for cable lines on the basis of the decision of the Director of the Maritime Office in Gdynia. This conflict seems unlikely due to the low importance of the statistical rectangles in which the project will be located in the overall fishery and the overall minor importance of the fishing grounds within these rectangles in the context of fishery in all Polish sea areas.

Potential conflicts in the offshore area may also arise from the identification of, for example, objects of cultural heritage (e.g. historical wrecks) or objects hazardous to the environment and humans (UXO, unconventional warfare) in the development area of the planned project. In such a situation, the Applicant will notify the relevant state bodies and will closely cooperate with them on solutions protecting the newly-discovered objects of cultural heritage as well as the environment and humans against exposure to post-war warfare.

The analysis of the hitherto use and the future development of the sea area, in which the implementation of the planned project is planned, does not indicate that there are probable social conflicts other than those indicated above, caused by the construction and operation of the offshore BP OWF CI.

In the onshore area, the planned project will be located in a mid-forest surroundings, far from residential, service and tourist developments of the Lubiatowo and Osieki Lęborskie villages, on the land belonging to the Choczewo Forest District, within the range of the Coastal Protected Landscape Area. Such a location of the project means that potential social conflicts may involve:

- protests of the land owners against the occupation of plots for the location of the customer substation;
- protests of the inhabitants of residential, residential-service and tourist buildings in the surrounding area, fearing the electromagnetic fields emitted by underground cable lines and fearing the electromagnetic fields and noise emitted by the customer substation;
- protests of the inhabitants and ENGOs against the location of the BP OWF CI within the reach of the environmental protection forms and the Wydmy Lubiatowskie dunes.

Considering, on the one hand, the necessity to locate the transmission infrastructure, and on the other the tourist potential of the commune, from the very beginning, the Applicant conducted a series of activities aimed at familiarising the inhabitants and the commune authorities with the nature of the project, thus significantly reducing the risk of social conflicts. The community of the Choczewo commune and its local authorities were included in the information process on the project already at the designing stage. For this purpose, a number of meetings both with the authorities and inhabitants of the Choczewo commune took place.

The construction of the customer substation on arable land class 4b and 5, outside the boundaries of the environmental protection forms and at an appropriate distance from the residential development of the Osieki Lęborskie village (approx. 900 m), eliminates the nuisance, such as noise or deterioration of the landscape values. It also eliminates the concerns of the inhabitants about the acoustic and electromagnetic fields impacts on human health and living conditions.

The analyses of the distribution of the electromagnetic field revealed that there are no objective health reasons for social conflicts due to this issue. Also, in terms of the predicted noise levels, there are no objective health reasons for social conflicts.

The current forest use and large-scale tree-felling within the boundaries of the Coastal Protected Landscape Area associated with the planned project may give rise to conflicts concerning the ecology. Protests of environmental non-governmental organisations against the project implementation are probable. Taking into account the biodiversity and the significant value of the area, in the case of the Wydmy Lubiatowskie dunes – the value for tourists, a series of measures intended to avoid, prevent or environmentally compensate for negative environmental impacts, is foreseen to be implemented. Therefore, the grounds for potential social conflicts in this regard have been kept to a minimum.

The proper public consultation stage is foreseen within the environmental impact assessment procedure, where the environmental report will be made available to the interested parties.

20.15 Indication of difficulties resulting from technical shortcomings or gaps in the state of the art encountered during the preparation of the report

When preparing the Report on the BC OWF CI Environmental Impact Assessment, no obstacles were encountered due to technical shortcomings.

The main difficulties encountered during the preparation of this EIA Report were due to the lack of detailed data and information on other investment projects that will be carried out in the future in the vicinity of the project in question. On the basis of the generally available data and the analysis of the records of the Maritime Spatial Plan of the Polish Sea Areas, it can be determined that the offshore area of the planned project will also be intended for the construction of the connection infrastructure of other offshore wind farms. The cable tray common for various projects may involve an accumulation of the environmental impacts resulting from the construction, operation and possible disassembly of some power lines. However, a proper analysis and assessment of the cumulative environmental impact is impossible without the information on technical and technological parameters of the planned projects and the duration of their implementation. Lack of this knowledge constituted the biggest obstacle encountered when preparing this EIA Report. In order to make the assessment of cumulative impacts as reliable as possible, the most unfavourable variant of the implementation of the above-mentioned projects was assumed and the time overlap of their construction, operation and decommissioning.

As far as gaps in contemporary knowledge are concerned, it should be noted that there are no data on the impact of the electromagnetic field emitted by the extra high voltage lines on plants, fungi and animals of all taxonomic groups (it is generally acknowledged that such impact does not occur, though it has not yet been scientifically proven).

The environmental impacts associated with the construction, operation and decommissioning phases of the planned project are well recognised for this type of project, therefore the formulation of potential environmental impacts and the formulation of mitigation measures was rather straightforward.