Part 2

DOCUMENTATION FOR THE PURPOSES OF THE TRANSBOUNDARY IMPACT ASSESSMENT PROCEDURE

for the Project involving the construction and operation of the First Polish Nuclear Power Plant with a capacity of up to 3,750 MWe, in the territory of the following communes: Choczewo, or Gniewino and Krokowa

Volume VI of the EIA Report — Non-Technical Summary

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świadomie o atomie
energia jądrowa w Polsce

Polskie Elektrownie Jądrowe sp. z o.o.

Glossary

Term/ Abbreviation	Definition
ALARA	An optimisation principle in radiological protection, according to which the exposure to ionising radiation should be reduced to a level that is as low as reasonably achievable
ALARP	A radiological protection principle — as low as reasonably practicable
ASA	Administrative Site Area - an area the extent of which is determined by boundaries of the communes situated in the Site Area
ASR	Administrative Site Region - an area the extent of which is determined by boundaries of the communes situated within the Site Region
BAT	Best available techniques/technology
BWR	Boiling Water Reactor
CLOR	Central Laboratory of Radiological Protection
CWS	Circulating water system
Technical Advisor	Jacobs Clean Energy Limited - Investor’s Technical Advisor
AP1000 Plant Vendor	Westinghouse Electric Company
DUM	Director of the Maritime Office in Gdynia
The Birds Directive	Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds
The Habitats Directive	Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild flora and fauna
NPP/ Nuclear Power Plant	The First Polish Nuclear Power Plant comprising three nuclear power units with AP1000 reactors with a total capacity of up to 3,750 MWe, in the territory of the following communes: Choczewo, or Gniewino and Krokowa
Nuclear Power Plant	A nuclear facility within the meaning of the Atomic Law Act of 29 November 2000
EUR Organisation	Organisation of European Utilities for the development of common specifications for new NPPs in Europe EUR / EUR (Specification Document - European Utility Requirements)
EURATOM	European Atomic Energy Community
GDOŚ	General Director for Environmental Protection
GEZ	Communal Register of Monuments
GHG	Greenhouse Gases
GIOŚ	Chief Inspectorate for Environmental Protection
GIS	Geographical Information System
Site communes	For Variant 1 – Lubiatowo - Kopalino site: the rural commune of Choczewo, and for Variant 2 – Żarnowiec site: the rural communes of Krokowa and Gniewino
GUPW	Main useful aquifer
GUS	Statistics Poland
ICRP	International Commission on Radiological Protection
IMO	International Maritime Organisation
IPCC	Intergovernmental Panel on Climate Change
SWB	Surface Water Bodies

Term/ Abbreviation	Definition
GWB	Groundwater Water Bodies
Ramsar Convention	Convention on Wetlands of International Importance, especially as Waterfowl Habitat, signed in Ramsar on 2 February 1971
KPn	Northern Ecological Corridor
NPS	National Power System
LPI	Local Information Point
LWR	Light Water Reactor
IAEA	International Atomic Energy Agency
MOLF	Marine off-loading facility
MPZP	Local Land Development Plan
NRC	US Nuclear Regulatory Commission
Site area	The area within a 5-kilometre distance from the boundaries of the planned site of a nuclear facility, and, in justified cases related to the ground structure of crucial importance for its stability during the construction of the facility and after, the area extended insofar as needed to obtain sufficient data and to assess ground stability
Project Area	The area within which the construction and subsequent operation of the NPP is planned
ONR	Office for Nuclear Regulation
RUA	Restricted Use Area
OP	Radioactive waste
RES	Renewable Energy Sources
PAA	President of the National Atomic Energy Agency/ National Atomic Energy Agency
PCB	Polychlorinated biphenyls
PCSR	Pre-Construction Safety Report
EMF	Electromagnetic radiation
PEP2040	Energy Policy of Poland until 2040 - the Announcement of 2 March 2021 by the Minister of Climate and Environment on the energy policy of the State until 2040
PEW	Specific electrolytic conductivity
PIG-PIB	Polish Geological Institute — National Research Institute
PM_{10}, PM10	Particulate matter with aerodynamic diameter of grains up to 10 µm
$PM_{2.5}$, PM2.5	Particulate matter with aerodynamic diameter of grains up to 2.5 µm
SEM	State Environmental Monitoring
Decision/ GDOŚ Decision	Decision of the General Director for Environmental Protection of 25 May 2016 (DOOŚ-OA.4205.1.2015.23) determining the scope of the environmental impact assessment report regarding the Project involving the construction and operation of the First Nuclear Power Plant in Poland with a capacity of up to 3,750MWe, in the territory of the following communes: Choczewo, or Gniewino and Krokowa
PNPP	The Polish Nuclear Power Programme - Resolution No. 141 of the Council of Ministers of 2 October 2020 on updating the multi-annual program called "The Polish Nuclear Power Programme"
PPW	First aquifer

Term/ Abbreviation	Definition
Project	Construction and operation of the First Polish Nuclear Power Plant with a capacity of up to 3,750 MWe, in the territory of the following communes: Choczewo, or Gniewino and Krokowa
PSEZ	Pomeranian Special Economic Zone
PWKZ	Pomorskie Voivodeship Monument Conservator
PWR	Pressurised Water Reactor
EIA Report	The Environmental Impact Assessment Report regarding the Project involving the construction and operation of the First Nuclear Power Plant in Poland with a capacity of up to 3,750MWe, in the territory of the following communes: Choczewo, or Gniewino and Krokowa
MSFD	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
WFD	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
Site Region	The area within a 30-kilometre distance from the boundaries of the planned nuclear facility site
ROV	Remotely Operated Vehicle
EIA Regulation	Regulation of the Council of Ministers of 9 November 2010 on projects likely to have a significant impact on the environment
SBO	Station Black-Out
SEZ	Special economic zone
ANN	Artificial neutron networks
SWS	Service water system
TEN-E	Trans-European Networks for Energy
TEN-T	Trans-European Transport Networks
TSS	Traffic Separation System
EU	European Union
Nature Conservation Act	Nature Conservation Act of 16 April 2004
EIA Act	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
EPL Act	Environmental Protection Law Act of 27 April 2001
Water Law Act	The Water Law Act of 20 July 2017
WENRA	Western European Nuclear Regulators' Association
WEZ	Voivodeship Register of Monuments
Applicant / Investor	Polskie Elektrownie Jądrowe sp. z o.o. (PEJ sp. z o.o.)
SF	Spent Fuel
PAHs	Polycyclic aromatic hydrocarbons
Assumed Project Area	The Assumed Project Area was determined under the preparation of preliminary siting criteria for the NPP construction, to conduct the environmental survey and site investigation programme

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VI.1 Preliminary information

VI.1.1 Introduction and details of the Applicant (Investor)

The environmental impact report (EIA Report) is required in the proceedings for the issuance of the decision on environmental conditions for the project under the name of "Construction and operation of the First Polish Nuclear Power Plant with a capacity of up to 3,750 MWe, in the territory of the following communes: Choczewo, or Gniewino and Krokowa." The obligation to prepare the Report is set out in the provisions of the Act of 3 October 2008 on providing access to information about the environment and its protection, participation of the public in environmental protection and assessments of the environmental impact (EIA Act).

The Investor in the project is:

Polskie Elektrownie Jądrowe sp. z o.o. with its registered office in Warsaw (PEJ sp. z o.o.)

ul. Mokotowska 49, 00-542 Warsaw

KRS (National Court Register) number: 0000347416

The investor plans to implement the project involving the construction of a nuclear power plant which will comprise three nuclear power units with AP1000 reactors with a capacity of up to 3,750 MWe (electric megawatts) (Project, NPP) along with the infrastructure ensuring their proper operation, in the commune of Choczewo. The Investor does not expect the implementation of the Project to take place in stages. The proceedings, under which the EIA Report is submitted, cover the Project with parameters including the scenario of a complete implementation of the investment project.

The Project involving the construction and operation of a nuclear power plant is a strategic project aimed at creating a new, safe and stable, as well as emission-free source of power generation, and then its safe and reliable operation. At the same time, the Project assumes that the constructed nuclear power plant, through its operation in the National Power System, will ensure stable electricity supply to customers and enable stabilisation of the transmission system. In addition, the creation of a new source of power generated in the nuclear power plant will increase the diversification of generation units and ensure greater competitiveness on the electricity market, as well as strengthen the domestic market of energy producers. At the same time, as a carbon-free source, it will contribute directly to the achievement of climate goals in terms of reduction of carbon emissions. Moreover, the Project, by strengthening the energy market, is part of the activities undertaken by the EU and Poland aimed at ensuring universal and uninterrupted access to electricity.

The aim of the EIA Report is to determine the environmental effects of the Project. The Report presents the results of the environmental impact assessment of the Project carried out in accordance with the Decision of the Director General for Environmental Protection of 25 May 2016 (DOOŚ-OA.4205.1.2015.23), on determining the scope of the environmental impact assessment report (Decision, GDOŚ Decision).

The site investigeation and environmental survey programme launched by the Investor has been developed in accordance with the requirements of the Decision. All the results collected during the surveys were used to develop the necessary modelling and analyses, which were then presented in the EIA Report. The data presented in the EIA Report have been determined in accordance with the scope of the Decision, describing the considered site variants and technical sub-variants, as well as the accompanying infrastructure, which may cause the accumulation of impacts along with the impact of the Project. The applicant was supported on an ongoing basis by a dedicated team of the Technical Advisor (Jacobs Clean Energy Limited), consisting of experienced experts and specialists who participated in the preparation of similar documentation for other nuclear power plants around the world.

The EIA report is a key piece of evidence in the administrative proceedings for assessing Project's environmental impact, which is part of the procedure for the issuance of the decision on environmental conditions and one of the most important elements of the procedure to facilitate the determination of all potential risks related to the implementation of the planned Project.

The decision on environmental conditions is issued at the end of the proceedings and reflects all its stages: from the submission of the application, to the arrangements, analysis of the documentation attached to the application, and public consultation. The purpose of the decision on environmental conditions is primarily to determine the conditions for the implementation of the Project in terms of environmental protection. The Investor is obliged to obtain the above decision prior to receiving the decision on determination of the site for the investment in a nuclear power facility, issued under the Act of 29 June 2011 on preparing and implementing investments in a nuclear power facility and associated investments.

VI.1.2 Classification of the Project

The project covers all activities carried out in the site area of the power plant, including: works related to the preparation of the construction site, construction of the internal infrastructure of the power plant, and the construction and operation of all elements of the nuclear power facility, i.e. the nuclear power plant. Those include all activities and technologically related projects that, at the development, construction, and commissioning stages and during the operational phase of a nuclear power plant, ensure the technological completeness and functionality of the Project. Understood in this way, the Project allows for the production of electricity in the process of converting thermal energy generated in the process of fission of the nuclei of heavy elements (in the vast majority uranium and plutonium) in a nuclear reactor.

Described in this way, the Project and all the technologically related equipment is subsumed into the category of “nuclear power plants and other nuclear reactors, including their decommissioning, with the exception of research installations for the production or processing of fissionable or fertile materials with a nominal power of not more than 1 kW at a continuous thermal load” and thus has the status of a project that can always have a significant impact on the environment within the meaning of Article 59 of the EIA Act, in conjunction with paragraph 2(1)(4) of the Regulation of the Council of Ministers of 9 November 2010 on projects likely to have significant effects on the environment (EIA Regulation).

VI.1.3 Administrative proceedings and current status of the Project

The environmental impact assessment, which is part of the proceedings for the issuance of the decision on environmental conditions for the construction of a nuclear power plant, is carried out by the competent body, i.e. the General Director for Environmental Protection (GDOŚ). The Investor applied for the decision on environmental conditions for the Project with the application of 5 August 2015. On 22 September 2015, GDOŚ issued a decision on the need to conduct proceedings on the Project's transboundary impact on the environment and on 2 December 2015 it was sent to the following countries: Germany, Czechia, Slovakia, Ukraine, Belarus, Lithuania, Russia, Latvia, Estonia, Finland, Sweden, the Netherlands, Hungary, Denmark, and Austria. In addition, information on the initiation of proceedings was sent to all countries within 1,000 km of the potential sites of the power plant. On 25 May 2016, GDOŚ issued the Decision in which it specified that the scope of the EIA Report should be consistent with Article 66 of the EIA Act and take into account the issues presented in the Decision. At the Investor’s request, on 4 June 2016, GDOŚ suspended the proceedings in question until the submission of the EIA Report by the Applicant.

VI.1.4 Associated projects necessary for the functioning of the Project

The implementation of the Project requires the design and construction of a number of separate investments necessary both for the construction of the NPP and its subsequent operation (Associated investments). The planned associated investments will be implemented as separate projects, regardless of the main Project, on the basis of separate administrative decisions. The Associated Projects that will be implemented for the purpose of the construction and operation of the NPP include: (1) Maritime transport infrastructure – Marine off-loading facility (MOLF), (2) Road transport infrastructure – construction of a new technical road connecting the MOLF with the Project Area, (3) Road transport infrastructure – construction of new road sections and reconstruction of existing ones, (4) Railway transport infrastructure – construction of new sections of the railway line and reconstruction of the existing ones, (5) Accommodation base for the NPP staff, (6) High and medium voltage power grids – 110 kV and 15 kV, (7) Extra high voltage power grids – 400 kV, (8) Water supply and wastewater infrastructure, (9) Telecommunications and teletechnical networks, (10) Local Information and Training Centre with an NPP training simulator, (11) Place of deposition of spoil from excavation works in the sea (deposit site).

In addition to the above-mentioned projects planned for implementation, the associated infrastructure of the NPP also includes existing projects that will be used at the construction stage and during the operational phase of the Project, but there is no need to modernise or rebuild them. These include: (1) Sea ports in Gdańsk and Gdynia, (2) Lech Wałęsa Airport in Gdańsk.

VI.1.5 Justification for the implementation of the Project

Justification and benefits of the introduction of nuclear power in Poland – the Energy Policy of Poland Until 2040

The current Energy Policy of Poland until 2040 (PEP2040) is in line with the objectives of the European Union's(EU) climate and energy policy, including its long-term vision of striving for the EU's climate neutrality by 2050. PEP2040 assumes a deep energy transformation, with about 80% of the expenditures forecasted in PEP2040 in the electricity generation sector planned for zero-emission capacities, i.e. renewable energy sources (RES) and nuclear power. One of the three pillars of PEP2040 is the "Zero-emission energy system", and among the eight specific objectives, in addition to the development of RES, including the implementation of offshore wind energy, the implementation of nuclear power and the implementation of the governmental Polish Nuclear Power Programme (PNPP) adopted in 2014 and updated in 2020 were indicated. The conclusion is that at the level of the strategic document which defines directions of the energy transformation in Poland until 2040, the implementation of nuclear power and implementation of offshore wind power are considered actions of the same rank which are to achieve the same strategic goal (it was assumed that in 2040, nuclear power plants and offshore wind power will have a similar share in the electricity generation in Poland, that is, 16% and 19%, respectively). At the same time, PEP2040 indicates that the expected commissioning dates of further nuclear units result from the expected power losses in the National Power System (NPS), as well as an increase in demand for electricity. According to PEP2040, the entire nuclear programme assumes the construction of 6 nuclear power units by 2043. A number of benefits of the use of nuclear power in Poland are listed: (1) implementation of commitments in the field of climate and energy policy, (2) reduction of emissions of dust and gas pollutants from the power sector, (3) diversification of the directions of supply of primary energy carriers, (4) replacement of ageing generation assets operating within the basic system load, (5) reliable and stable energy supply and low electricity costs for consumers, (6) a business impulse for the development of regions, (7) the development of many branches of domestic industry (reindustrialisation) and new specialisations and technologies throughout the supply chain of components and products, (8) creation and maintenance of new, sustainable and well-paid jobs.

Economic aspects – Polish Nuclear Power Programme

The explanatory memorandum to the Polish Nuclear Power Programme adopted on 28 January 2014 by the Council of Ministers and updated on 2 October 2020, refers to three key aspects of the implementation of nuclear power in Poland: energy security, environment and climate, and economy.

Energy security

In terms of energy security, the PNPP pointed out that the construction and operation of nuclear power plants will increase the level of diversification of both the fuel base in the power sector and the directions of supply of primary energy carriers. According to the PNPP: "*Nuclear fuel will allow for (...) the diversification of the directions of supply of primary energy carriers by purchasing it from NATO member states or from other politically stable countries with a well-established market economy with which Poland has good relations." In addition, as a member of the EU and European Atomic Energy Community, Poland will benefit from support and security of fuel supply within EU purchase coordination mechanisms."* The future energy mix should be built in such a manner as not only to meet the requirements of decarbonisation, but also to ensure the stability of the system with a significant, as compared to the current state, increased power of distributed sources, largely including the uncontrollable sources. It is also necessary to take into account not only the conditions of the NPS but also the future, increased role of the Polish transmission system within the European Union and trans-European networks. Polish conditions are also important – the depletion of domestic deposits of available fossil fuels.

Environment and climate – carbon footprint in the life cycle of a nuclear power plant

According to the PNPP, *"the environmental advantages of nuclear power are primarily the lack of direct CO_2 emissions during operation (...), as well as the lack of emissions of other substances harmful to the environment and human health: NO_x, SO_2, CO, dust, mercury and other heavy metals and polycyclic aromatic hydrocarbons."* Nuclear power is also characterised by very low usage of the concrete mix and steel per unit of electricity generated, saving valuable raw materials: rare earth metals and silver, or the smallest use of space per unit of generated electricity. The PNPP states that "*Nuclear power is also an important element in the protection of biodiversity (...) may in the future be an important element limiting the negative impact of some projects on birds of prey, bats, insects, etc. by the possibility of abandoning the implementation of energy acquisition projects showing negative impact on nature in favour of the construction of new nuclear power plants".* The use of nuclear technology is a low-carbon option for Poland, with greenhouse gas emissions at a level comparable to renewable energy. Greenhouse gas emissions in the Project life cycle are two orders of magnitude lower than the life cycle emissions of an analogous project using gas or coal.

Economy – stability of electricity prices and improvement of the competitiveness of economy

The implementation of nuclear power can contribute to stopping the increase of energy costs for end users. Nuclear power plants are the most inexpensive sources of energy, taking into account the full cost account (investor, system, network, environmental, health, other external costs) and the factor of long operating time after the depreciation period. This applies to final customers, including individual and industrial customers, for whom electricity costs are an important budget item. As noted in the PNPP, "*the implementation of nuclear power will have a stabilising effect on electricity prices levels in the domestic market over a time frame of at least 60 years*".

Technological aspects

Nuclear fission reaction and nuclear reactors

The source of energy produced in nuclear power plants is the self-sustaining, controlled fission reaction of nuclei of heavy elements (in the vast majority uranium and plutonium), which takes place in nuclear reactors. The vast majority (over 95%) of the energy emitted during fission can be collected in the form of heat. With the fission of one nucleus of uranium U-235, about 207 MeV (megaelectron-volts) of energy are released. This is a huge amount compared to the energy that can be released in even the most energy-efficient (exothermic) chemical reactions, which does not exceed a dozen or so eV. Therefore, nuclear power plants need incomparably less fuel than conventional thermal power plants fired with fossil fuels. The world's most widespread nuclear power technologies include light water reactors (LWRs), such as pressurised water reactors (PWRs) and boiling water reactors (BWRs).

The current status of global nuclear power industry

Currently, more than 440 nuclear power units are operated in more than 30 countries around the world, with a total installed capacity of almost 400 GWe. They generate more than 2,500 TWh of electricity, which is more than 10% of the world's total production. In 19 countries, more than 50 nuclear units are currently under construction. More than 100 units with a total capacity of approximately 120 GWe are in the process of being prepared for construction or planned. Most nuclear units are currently being constructed in China and India, where the demand for new sources of electricity is still growing.

History of nuclear power in the world and in Poland

The history of the use of nuclear power for electricity generation dates back to the early 1950s. The following decades gave the society newer, improved technical and technological solutions, which today are referred to as the next generations. Based on the conclusions of accidents at nuclear power plants (Three Mile Island – 1979, Chernobyl – 1986, Fukushima – 2011), designers and leading power utilities decided to design a new generation NPP with significantly improved nuclear safety features. NPP with generation III/III+ reactors use passive solutions (i.e. self-acting – not requiring energy supply or external control) to a more significant extent than those with generation II reactors, especially in safety systems designed to control and reduce the effects of severe accidents related to the meltdown of the reactor core. Generation III/III+ reactors, compared to generation II reactors, are characterised by: (1) standard design solutions, (2) simplified and more powerful design, (3) higher uptime and longer design life, (4) significantly higher safety, (5) minimised environmental impact, and (6) a significantly higher degree of fuel burnout, resulting in a reduction in nuclear fuel consumption and in the amount of high-activity radioactive waste. Generation III+ reactors are a development of generation III by significant improvement of reactor designs. The most recognisable features of generation III+ include the use of inherent and passive safety features, the use of additional safety systems to control and reduce the effects of severe accidents associated with the core melt, as well as increased resilience to extreme external hazards (in particular those caused by man, including the impact of a large commercial aircraft), and ensuring safety in the event of a total station black-out (SBO).

The beginnings of the use of nuclear power in Poland are associated with the establishment of the Nuclear Research Institute (IBJ) in 1955. In 1958, the first EWA nuclear research reactor in Poland was built and put into service at the IBJ. In 1974, the MARIA reactor was commissioned and built from scratch in Poland. The reactor is still in operation today. In 1982, the government of the People's Republic of Poland decided to build the first NPP by Lake Żarnowiecke ("Żarnowiec" NPP). It was to have a gross total capacity of 1,860MWe and was to consist of four nuclear power units with VVER-400 reactors (W-213 model). However, the implementation of this construction came at a time of severe economic crisis and social unrest in the country. In 1990, the new, independent government of Poland decided to abandon the construction of the "Żarnowiec" NPP (at the estimated advancement of about 40%).

Technological solution adopted in PNPP

In accordance with the PNPP, one of the main factors that affect the amount of capital expenditure and the level of risk involved in construction is the maturity of the technology and experience in the construction and operation of units of a particular type. Since the adoption of the Polish Nuclear Power Programme by the Council of Ministers in 2014, significant progress has been made in the implementation of certain types (models) of reactors, which is why the Council of Ministers recommended the choice of the PWR technology when adopting the updated PNPP in 2020. It was considered to be the safest in terms of the possibility of conducting an efficient administrative procedure related to the issuance of a building permit for the NPP, as well as one that minimises the costs of all activities related to the construction process, also in terms of public expenditure.

VI.1.6 The Project in the context of strategic documents

The Project is a type of investment that has not been implemented in Poland so far. This is a demanding investment challenge in terms of organisation, technology and finances. At the same time, it is an investment that supports the implementation of environmental goals set by Poland and those required by the EU, primarily related to the reduction of greenhouse gas emissions. These objectives are reflected in a number of strategic and planning documents. Below are the strategic documents adopted by the EU, national and regional documents that are considered important in terms of their significance for the Project, as well as those that the Investor was obliged to discuss in the EIA Report on the basis of the GDOŚ Decision. The review omitted those documents whose time horizon is shorter than the expected time of preparation of the EIA Report for the Project.

At the international level, the following strategic documents can be mentioned: (1) Green Paper. A 2030 framework for climate and energy policies, (2) the European Green Deal, (3) Energy Roadmap 2050, (4) Policy framework for climate and energy in the period from 2020 to 2030, (5) European energy security strategy, (6) Energy efficiency and its contribution to energy security and the 2030 framework for climate and energy policy, (7) European Council's conclusions of 24 October 2015 on 2030 Climate and energy policy framework, (8) A framework strategy for a resilient energy union with a forward-looking climate change policy.

At the national level, the following strategic documents can be listed: (1) Polish Nuclear Power Programme, (2) Energy Policy of Poland until 2040, (3) National Energy and Climate Plan for the years 2021-2030, (4) Strategic adaptation plan for sectors and areas sensitive to climate change until 2020, with a perspective until 2030, (5) 2030 National Environmental Policy – the Development Strategy in the Area of the Environment and Water Management, (6) Productivity Strategy 2030, (7) Assumptions for the National Program for the Development of Low-emission Economy, (8) National Plan for the Management of Radioactive Waste and Spent Fuel, (9) Strategy for Responsible Development until 2020 (with a perspective until 2030), (10) National Regional Development Strategy 2030, (11) National Security Strategy of the Republic of Poland 2020.

At the regional level, the following strategic documents can be mentioned: (1) Development Strategy of the Pomorskie Voivodeship 2030, (2) Territorial Contract for the Pomorskie Voivodeship, (3) Programme for the Development of the Power Industry taking into account renewable sources in the Pomorskie Voivodeship until 2025.

Documents in the field of spatial planning at the national and regional level: (1) Spatial development plan for internal marine waters, territorial sea and exclusive economic zone, (2) Spatial development plan of the Pomorskie Voivodeship, (3) Spatial development plan of the Gdańsk-Gdynia-Sopot Metropolitan Area 2030, (4) Concept of Spatial Development of the Country 2030.

The Project does not contradict the environmental objectives resulting from the above documents. First of all, the cited documents indicate environmental goals for improving the quality of the environment and reducing climate change by reducing greenhouse gas emissions. In this respect, the planned Project is fully consistent with these environmental objectives and will significantly contribute to their achievement if it is completed, while ensuring a stable low-carbon source of electricity.

VI.1.7 Assumptions and methodology of the EIA Report

Entity developing the EIA Report

The implementation of the Project was approved by the resolution of the Council of Ministers of 13 January 2009 on activities undertaken in the field of nuclear power development, one of the provisions of which was to indicate PGE Polska Grupa Energetyczna S.A. as the entity responsible for cooperation in the preparation and implementation of the PNPP. In order to implement the program, a special purpose vehicle PGE EJ 1 sp. z o.o. (currently Polskie Elektrownie Jądrowe sp. z o.o.) was established, which is responsible for development of the EIA Report. It is the first study of this type in Poland prepared for a nuclear power plant, which is why during the entire process of its preparation the applicant was supported on an ongoing basis by a dedicated team of the Technical Advisor, consisting of experienced experts who participated in the preparation of similar documentation for other nuclear power plants around the world. In addition to Jacobs Clean Energy Limited, Polish research institutions and a wide range of specialists and experts experienced in preparing EIA Reports for large infrastructure projects were involved.

General concept for the preparation of the EIA Report

The concept of preparing the EIA Report takes into account both formal and legal requirements resulting from the provisions of Polish and Community law, as well as methodological requirements resulting from best practices, and above all the requirements set out in the GDOŚ Decision. The concept is based on the general assumption that, due to the specificity of the Project, particular attention should be paid to the identification of impacts that may cause changes in the environment, in particular with regard to its most valuable or sensitive elements. This approach makes it necessary to identify the causative factors that may cause changes in the environment – resulting from the characteristics of the Project and the characteristics of the environment in terms of the possibility of these changes. The preparation of this EIA Report was a complex and time-consuming process, as it required prior conduct of an extensive survey programme (unique in the scale of all investments carried out so far in Poland) for selected site variants, and then thorough elaboration of the collected data.

The preparation of this EIA Report took place in the following 8 stages: Stage 1: Determination of the programme of the surveys of the current status of the environment and commencement of its implementation, Stage 2: Identification of the current status of the environment, Stage 3: Detailing the knowledge about the Project in terms of technical data and technological solutions, Stage 4: Identification and assessment of the Project's environmental impact, Stage 5: Development of the results of the assessment of the Project's environmental impact, Stage 6: Multi-criteria analysis in terms of identification of the most environmentally favourable variant, the variant proposed by the applicant and the rational alternative variant, Stage 7: Identification of actions aimed at preventing, limiting or compensating the negative environmental impacts and determining the scope of environmental monitoring, Stage 8: Determination of difficulties encountered in preparing the EIA Report and preparation of a summary of the said report in non-technical language.

<u>Structure of the EIA Report</u>

Due to the extensiveness and multidimensionality of the issues presented in the Report, it was divided into six volumes: VOLUME I – Preliminary information, VOLUME II – Project characteristics and emissions, VOLUME III – Environmental characteristics, VOLUME IV – Environmental impact assessment, TOM V – Summary – results of assessments and conclusions, VOLUME VI – Non-technical summary. Each of these volumes characterises a distinct issue in an exhaustive way. In order to maintain a clear layout of the content and consistency of this report, the volumes are additionally divided into chapters and subchapters. On the other hand, the results of the analyses, mathematical modelling, data summaries, expert assessments and graphic studies are presented in appendices to individual Volumes. Moreover, each volume contains a glossary in which the most important concepts and abbreviations used in the chapters (which are also relevant to the appendices to individual Volumes) are explained, as well as a list of references.

<u>Fulfilment of the requirements of the GDOŚ Decision</u>

When preparing the EIA Report, the Applicant took into account all the requirements relating to the scope of the report contained in the GDOŚ Decision, which also involves the comments submitted by the countries exposed as part of the transboundary proceedings, thus fulfilling the statutory requirements regarding the content of the report required by Article 66 of the EIA Act.

<u>Organisation of supervision and oversight of the process of preparing the EIA Report</u>

Determination of the environmental effects of the Project was a long-term process requiring the processing of a huge amount of data sets for each of the considered site variants. The interdisciplinary nature of the surveys, and at the same time the large area and scope of the surveys, as well as dispersed research teams (the work was carried out in Poland and abroad) preparing reports on the survey results and other expert studies constituting the basis for the preparation of the EIA Report documentation, resulted in the need to systematise and organise the process at all stages of its preparation, including e.g. in the area of documentation management, management of source data from research and analyses (also in native formats), supervision of the supply chain (external contractors of surveys and expert studies), ensuring consistency of obtained research results and analyses. At the same time, in order to obtain the required quality of the results of the works, an appropriate supervision and oversight process had to be implemented so that it would be possible to monitor the entire process and then implement remedial or corrective actions. Before commencing the preparation of the EIA Report, an independent review of the methodologies and results of the site investigation and environmental survey programme was carried out. This review was entrusted to the Technical Advisor, due to their extensive experience (including nuclear experience) and technical knowledge in the area of newly built nuclear facilities.

In addition, in order to ensure proper control and supervision over the preparation of the EIA Report, in cooperation with the Technical Advisor, supervision and oversight processes were adopted, under which reviews were carried out at different levels of progress. These two activities were separate and they involved the following: (1) Supervision – approval of methodologies, detailed checking and review of content (modelling results, technical data, chapters and subchapters, etc.) and verification of subchapters; (2) Oversight – identification of relevant risks, gaps, weaknesses in the EIA Report, including activities related to data compilation, confirmation of compliance with the provisions of Polish law and international guidelines, management of configuration, consistency, checking and approval, and proposing solutions for identified risks, gaps, weaknesses and monitoring the implementation of these solutions.

In the process of preparing individual chapters of the EIA Report, as well as in the case of supervision and oversight, it was important to maintain the separation of assigned roles, i.e. between authors, persons performing activities as part of work reviews, supervision and persons performing activities as part of oversight. This also concerned the process of checking and approving individual chapters of the EIA Report, as well as the final version of the entire EIA Report.

VI.1.8 Considered Project variants

Description of the process of selection of the considered site variants

The construction process of each building structure, including a nuclear power plant, is associated with the need to obtain a number of administrative decisions. Each of these decisions is bound by a common objective, namely the implementation of a safe investment from the point of view of fulfilling environmental, location, and construction restraints. What distinguishes nuclear facilities from conventional building structures are safety aspects. In the case of nuclear power plants, safety is understood in two ways, namely, as the possible impact of the structure on the environment and the impact of the environment on the nuclear facility itself.

The process of selecting the site for a nuclear power plant consists of a number of activities, the "step by step" implementation of which allows for completing the process of selecting the site in a top-down manner. Geographical regions were considered first and then the by specific site considerations, such as the availability of water sources, distance from high-risk plants, or other elements specific to the considered site to prove that the site is safe with regard to the operation of the facility. When selecting the site in question, macro-spatial and safety criteria were taken into account (e.g. seismic and karst phenomena, economic activity qualified as plants with an increased or high risk of a serious industrial accident). In addition, transport, geographical and spatial, hydrological, hydrogeological and engineering geology (geotechnical) criteria were taken into account, as well as regional conditions and technical and technological requirements, including the possibility of connection to the power grid and local infrastructure. The criteria used allowed, through the use of the ranking procedure, for the indication of potential sites, for which a full-range, long-term site investigation and environmental survey programme was then commenced in accordance with the relevant legislative requirements (Polish and EU) and industry guidelines (e.g. of the International Atomic Energy Agency – IAEA, the Us Nuclear Regulatory Commission, NRC). The PNPP adopted by the Council of Ministers presents the potential sites for a nuclear power plant in Poland. Among them were, "Lubiatowo - Kopalino", "Żarnowiec" and "Choczewo", all located in the Pomorskie voivodeship.

In the years 2011-2015, the first stage of site investigations and environmental surveys was carried out, in particular for the sites of "Żarnowiec", "Choczewo", and "Lubiatowo - Kopalino", and the preliminary results were verified for the occurrence of a "fundamental defect". Additional analyses carried out at the beginning of 2015 showed a risk of significant impacts on the Natura 2000 site, therefore, in 2015, the Investor launched activities aimed at reliable and independent verification of this risk. At the same time, bearing in mind the possibility of losing the site of "Choczewo", the Investor began to analyse the possibility of changing the seaside location. The internal analysis covered the area adjacent to the site of "Choczewo". On 11 January 2016 the Investor submitted to GDOŚ an application to change the content of the application for the issuance of a decision on environmental conditions for implementation of the project and the application to determine the scope of the report on the environmental impact of the project, by removing one site variant, i.e. "Choczewo". On the basis of internal analyses, the "Lubiatowo - Kopalino" site variant was selected. The site investigation and environmental survey programme launched by the Investor has been developed in accordance with the requirements of the Decision for two Project site variants:

1. Variant 1 — Lubiatowo - Kopalino site: Commune of Choczewo (cadastral district Jackowo), Wejherowo poviat.
2. Variant 2 — Żarnowiec site: commune of Gniewino (cadastral district Nadole) Wejherowo poviat and commune of Krokowa (cadastral district Kartoszyno), Puck poviat.

As part of the analysed Project, sub-variants were analysed, which differ depending on the cooling system used by the power plant:

1. Variant 1 — Lubiatowo - Kopalino site:
   - Sub-variant 1A – open cooling system (direct cooling with seawater);
   - Sub-variant 1B – closed cooling system – cooling with the use of evaporative cooling towers with natural draught, operating on seawater;
   - Sub-variant 1C – closed system – cooling with the use of evaporative cooling towers with natural draught, operating on fresh water (desalinated seawater);
2. Variant 2 — Żarnowiec site:
   - Sub-variant 2A – cooling with the use of evaporative cooling towers with natural draught, operating on seawater;
   - Sub-variant 2B – closed cooling system – cooling with the use of evaporative cooling towers with natural draught, operating on fresh water (desalinated seawater);

The open cooling system has been eliminated from further consideration for Variant 2 – Żarnowiec site due to the considerable distance of the NPP site from the sea.

<u>Rational variant most favourable for the environment, variant proposed by the applicant, rational alternative variant</u>

When preparing the EIA Report in question and wishing to reliably fulfil the requirements of the EIA Act and the GDOŚ Decision, the Applicant performed a comparative analysis and a multi-criteria analysis to indicate the proposed variant. As a result of the comparative and multi-criteria analyses, in which the considered sites and the cooling system technologies were surveyed, sub-variants 1A and 1B (in Variant 1 – Lubiatowo - Kopalino site) received the highest scores.

Based on the results of the analyses carried out, it can be concluded that:

- the **variant proposed** by the Applicant is Variant 1 — Lubiatowo - Kopalino site – **sub-variant 1A** – it is the sub-variant that received the highest score taking into account environmental aspects along with other criteria,
- the rational variant **most favourable for the environment** is Variant 1 — Lubiatowo - Kopalino site – **sub-variant 1B** – this sub-variant obtained better or the same ratings compared to technical sub-variant 1A in individual environmental impact assessment criteria (the difference between sub-variants 1B and 1A is insignificant),
- the rational **alternative variant** is Variant 1 — Lubiatowo - Kopalino site – **sub-variant 1B** – sub-variant 1B was classified in second place in terms of multi-criteria analysis ratings, hence it was indicated by the Investor as an alternative variant.

Analyses have shown that sub-variants 1C, 2A and 2B are feasible, but the result of the assessment indicated that they perform worse than sub-variants 1A and 1B. Sub-variant 1B received the highest score taking into account only environmental criteria, and sub-variant 1A received the score positioning it in the second place. However, when taking into account environmental aspects together with the other criteria, the highest number of points was obtained by sub-variant 1A, and sub-variant 1B turned out to be the second in order.

Sub-variant 1B received the highest score in terms of environmental aspects, but the sensitivity analysis carried out showed that technical sub-variant 1A performs best with regard to a number of criteria on environmental aspects that are related to some of the most obvious environmental impacts of the Project (e.g. impacts on landscape, vehicle traffic at the construction stage and impact on the acoustic environment). As a result, if society considered these criteria (the weights of which were relatively low in this analysis) to be more important, sub-variant 1A would be environmentally more advantageous than technical sub-variant 1B.

Description of the expected environmental impact in the event that the Project is not implemented

The need to characterise the variant when the Project is not implemented, also known as the zero variant, in the EIA Report results directly from national regulations, which indicate that the report should also contain a description of the expected effects on the environment in the event that the Project is not implemented, taking into account available environmental information and scientific knowledge.

Particular attention should be paid to the fact that the possible choice of the zero variant does not mean the complete absence of anthropogenic impacts, since in the case of both sites under consideration, human pressure has long been clearly visible. A spectacular example in this case is the completely transformed, potential site ofVariant 2 — Żarnowiec site, of course, with only the unfinished part with the unfinished nuclear power plant being taken into account. Both this area and the areas immediately adjacent to it have been very strongly altered as a result of human activity. In the case of the second variant analysed in the Report – Variant 1 — Lubiatowo - Kopalino site, one should think of anthropogenic pressure in a similar context (past and present times), both in the context of tourism, but also intensive forestry activity. As for the future, i.e. the zero variant and the lack of implementation of the investment, it can at least be assumed that the current trends, or in other words – impacts, will continue in the coming years, but only under a very simplified assumption that the entire region will remain in a phase of longer stabilisation or even stagnation. This could, of course, be the case in a situation of some deep recession in the economy, or the occurrence of events with far-reaching geopolitical, climatic consequences, or consequences similar in scale or nature. However, there are many indications that these areas will soon undergo changes, but of a completely different nature. When it comes to the large investment plans in offshore wind energy (in this case significant transformations will include not only the offshore part, but to a large extent the land part – the evacuation of power inland, further into the country), or the enormous pressure from tourism, one should bear in mind a significant change in the current nature of the proposed site of the NPP. These examples clearly show that the absence of the Project will not stop the changes that will "affect" this region in the near future. From a purely pragmatic point of view, on a local scale, the lack of implementation of the Project will certainly help avoid the degradation of environmental elements related in particular to the construction phase, e.g. soils, biologically active areas and many others. The effects on a local scale, considered e.g. in socio-economic terms, are not that clear-cut, taking into account the potential loss of a significant number of jobs, jobs related to the construction and operation of the power plant, one can talk about significantly negative effects of the zero variant. However, when analysing its potential impact on a national scale, or taking into account the transboundary aspects, it is the zero variant that should be considered the most unfavourable for the environment as a result of the abandonment of the Project and the far-reaching consequences for the climate.

It can be stated with full conviction that as a result of the still undeveloped technologies for storing energy from unstable generation sources, i.e. RES, the lack of implementation of the Project will result in the need to obtain huge amounts of energy from fossil fuels, i.e.: hard coal and lignite and natural gas.

VI.1.9 Legal framework for the Project

The importance of the Project and its complexity is determined by the fact that its implementation is regulated by numerous laws, EU directives and international conventions, with which the Project must comply. The national legal framework for the nuclear safety of nuclear facilities has been prepared in Polish legislation and is sufficient to carry out investments in the construction of a nuclear power plant and then its operation in a manner safe for people and the environment. As regards the national regulations relating to the Project, it is first of all necessary to indicate the provisions of the Atomic Law Act of 29 November 2000. This is one of the most important legal acts relating to the implementation of the Project, which, together with the implementing regulations, contains legal standards, the fulfilment of which is required to ensure the operation of power plants taking into account the requirements of nuclear safety and radiological protection. Another act significant from the point of view of the Project is the Act of 29 June 2011 on preparation and implementation of investments in nuclear power facilities and associated projects. The issuance of a construction permit for a nuclear power plant will take place in accordance with the provisions of the Building Law Act of 7 July 1994.

In the field of international law, it is necessary to distinguish, first of all, the Convention on Environmental Impact Assessment in a Transboundary Context, drawn up in Espoo on 25 February 1991, which was ratified by Poland on 30 April 1997. Within the framework of international law, the Convention drawn up in Helsinki on 9 April 1992 on the Protection of the Marine Environment of the Baltic Sea Area will also apply to the environmental impact assessment procedure. As part of the impact assessment procedure, EU directives that have been transposed into the EIA Act and the Water Law Act of 20 July 2017 are also applicable. Therefore, in order to continue the implementation of the Project, it is necessary to obtain a decision on environmental conditions containing consent for the implementation of the Project. The public administration body competent for issuing the decision on environmental conditions is the Director General for Environmental Protection.

By joining the European Union, Poland has also become a member of the European Atomic Energy Community (EURATOM). Due to the fact that Poland is a member of the EU and EURATOM, it has transposed into its legislation directives that aim to ensure nuclear safety and radiological protection – this applies to: Council Directive 2009/7/EURATOM, Council Directive 2011/70/EURATOM and Council Directive 2013/59/EURATOM. Poland has also implemented the provisions of the conventions to which it is a party and which it has ratified, ensuring that the provisions of the Atomic Law Act are consistent with these conventions. In this respect, conventions in the areas of nuclear safety, civil liability, security of nuclear materials and facilities, nuclear safeguards and non-proliferation of nuclear weapons can be distinguished.

VI.2 Characteristics of the Project and emissions

This chapter presents a detailed description of the Project implemented with the use of three nuclear power units with AP1000 reactors and a total capacity of up to 3,750 MWe along with the infrastructure ensuring their proper operation. A description of the accompanying infrastructure necessary for the implementation and proper operation of the nuclear facility was also made, which does not fall within the scope of the Project, but affects the accumulation of impacts referred to in Volume IV of the EIA Report. Separate administrative proceedings will be conducted for these investments.

In addition, it contains key information necessary to determine the type, scope and scale of the Project, as well as explains its specificity, including its location, type of technology, method and schedule of implementation, demand for energy and natural resources, types and amounts of emissions and the risk of external and internal events and their impact on the safety of a nuclear facility.

The information contained in Volume II is the starting point for determining the types and magnitude of the Project's impact on the environment, referred to in Volume IV of the EIA Report.

VI.2.1 Project description

The entity responsible for the direct preparation of the investment process (i.e. responsible for conducting site investigations and environmental surveys and obtaining the necessary permits) is the special purpose vehicle Polskie Elektrownie Jądrowe sp. z o.o.

According to the Articles of Association, Polskie Elektrownie Jądrowe sp. z o.o. performs tasks aimed at ensuring the energy security of the Republic of Poland, consisting e.g. in supporting government administration in activities aimed at:

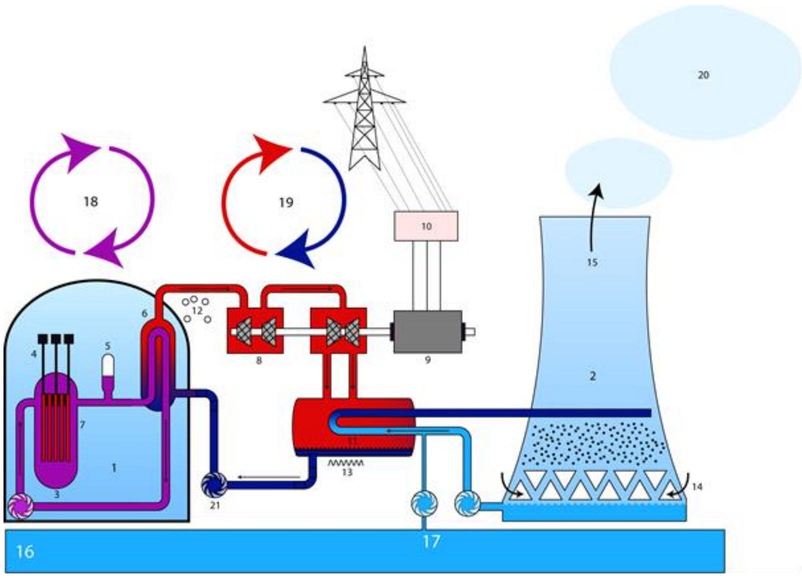
1) implementation of the Polish Nuclear Power Programme, which assumes the construction of 6-9 GWe of installed capacity in the nuclear power industry based on large, proven pressurised water reactors (PWR),
2) implementation of the Agreement between the Government of the Republic of Poland and the Government of the United States of America on cooperation towards the development of a civil nuclear power program and the civil nuclear power sector in the Republic of Poland, signed in Upper Marlboro on October 19, 2020 and in Warsaw on October 22, 2020 (Intergovernmental Agreement), including by acting as a Special Purpose Vehicle within the meaning of the Intergovernmental Agreement.

Bearing in mind the above conditions, this report was prepared on the basis of the AP1000 technology of Westinghouse Electric Company LLC, i.e. the only available American technology that meets the criteria contained in the PNPP (proven pressurised water reactors). At the same time, it should be emphasised that the submission of the report in this form does not entail the selection of the reactor technology for the first nuclear power plant in Poland, but is a stage of preparatory activities for the implementation of the PNPP and the implementation of the Intergovernmental Agreement. The advancement of activities leading to obtaining the decision on environmental conditions for the First Polish Nuclear Power Plant will avoid or limit deviations from the schedule of investment implementation adopted in the PNPP in the event that the Council of Ministers chooses the AP1000 technology in the future. At the same time, the above does not preclude the possibility of using the data collected by the Company to prepare a report based on another technology, if the Council of Ministers establishes cooperation regarding the joint implementation of the project involving the construction of nuclear power plants with a country other than the United States of America.

VI.2.2 Description of the technology and infrastructure of the nuclear power plant

In a nuclear power plant, the source of energy is the controlled chain reaction of fission of the nuclei of uranium and plutonium atoms contained in nuclear fuel, accompanied by the release of thermal energy. This energy is used to heat the water of the "primary circuit", which is under pressure that is so high that the water does not boil. In a steam generator (heat exchanger), the thermal energy transferred by the "primary circuit" heats the water of the "secondary circuit", which has much lower pressure than the "primary circuit". Therefore, the water boils and evaporates, and the generated steam is directed to the blades of the steam turbine, resulting in its rotation. The two circuits: "primary" and "secondary" are a characteristic feature of Pressurised Water Reactors (PWR). The turbine is connected on a common shaft with a synchronous generator (forming the so-called turbine set), in which electricity is generated with a voltage of approximately 27kV at the output terminals of the generator. In a unit transformer, the voltage is raised to 400kV, allowing for the transmission of electricity over long distances with reduced losses.

The technological process of generating electricity in a nuclear power unit with a pressurised water reactor (PWR) is schematically shown in the figure below [Figure VI.2.2- 1].



1. Reactor cooling system, 2. Cooling tower, 3. Reactor, 4. Control rods, 5. Pressuriser, 6. Steam generator, 7. Reactor core, 8. Steam turbine, 9. Generator, 10. Unit transformer, 11. Turbine condenser, 12. Main steam, 13. Condensate, 14. Air, 15. Humid air, 16. Baltic Sea, 17. Make-up of water losses in a closed cooling system, 18. Primary circuit, 19. Secondary circuit, 20. Steam, 21. Feedwater pump

Figure VI.2.2- 1 Block diagram of a nuclear power plant with a closed cooling system
Source: https://commons.wikimedia.org/wiki/File:Nuclear_power_plant-pressurized_water_reactor-PWR.png

The steam that lost its energy in the turbine (as a result of which its energy has been converted into the mechanical energy of the rotational movement of the turbine set rotor) is condensed in the condenser after leaving the turbine. Water from a large water reservoir (e.g. the sea) is used as a cooling medium in the condenser – "open cooling system" or water cooled in a cooling tower – "closed cooling system".

Due to the limited fresh water resources, a seawater desalination system based on the technology of reverse osmosis (membrane water purification) will be used for the technological processes of a nuclear power plant, where fresh water will be required. The brine resulting from desalination will be directed back to the sea.

For the commissioning and start-up of the power unit, auxiliary steam will be necessary, which will be produced in the auxiliary boiler house (oil boilers) or in electric steam generators. The auxiliary boiler house can also be used to heat buildings during the shutdown of all nuclear units.

A pressurised water reactor has a number of safety systems to protect it from accidents or to mitigate and limit the effects of potential accidents. The most important security systems include:

- Reactor protection and monitoring system, which will ensure automatic shutdown of the reactor in the event that the technological parameters exceed certain safety limits;

- The passive reactor cooling system, ensuring its effective cooling in the event of a failure. The operation of this system is based on the use of natural forces and phenomena (gravity, evaporation and condensation, compressed gas energy and natural convection). No power supply is needed here, and all the processes take place spontaneously (without the need for operator intervention);
- The reactor containment with passive cooling, in which the reactor is located along with other components, the so-called nuclear steam generation system. In operational states vacuum is maintained in the containment, which prevents uncontrolled release of radioactive substances into the environment. In the event of a failure, the passive containment cooling system ensures that heat is dissipated from the reactor and inside the containment directly into the ambient air.

The operation of passive safety systems ensures the safety of the reactor for a period of 72 hours (3 days) from the beginning of the failure without any involvement of the operator and in the absence of electrical power supply. After 3 days, the actions necessary to ensure the safe dissipation of heat from the containment boil down to the make-up of the water in the tank of the passive containment cooling system, using a pump which, in the absence of a normal power supply, can be powered by a (stationary) low-voltage diesel generator or by a mobile generator set.

In addition, the use of two circuits in this type of reactor – primary and secondary – means that the cooling water of the reactor does not enter into physical contact with the steam driving the steam turbine, which additionally prevents radioactive substances from being released from the reactor building.

When it comes to providing the electricity necessary for the operation of the power plant and safe shutdown of the units, apart from two reserve and independent 110kV power lines, the nuclear power plant will be equipped with low-voltage generators with a capacity of 80kW and medium-voltage generators with a capacity of 5,200kW.

The nuclear power plant will be additionally equipped with protection, access control, and environmental monitoring systems, including early warning systems to warn against weather conditions which may interfere with the normal operation of the power plant.

The development plans provide for two fences. The first, external fence will run around the area of the NPP. The nuclear infrastructure facilities and some conventional and balance of plant facilities will be located in a separate zone, secured by an additional fence (internal fence). In addition, the area of the power plant and its facilities will be divided into appropriate safety zones, with access restrictions – due to the need to provide physical protection, as well as radiological protection.

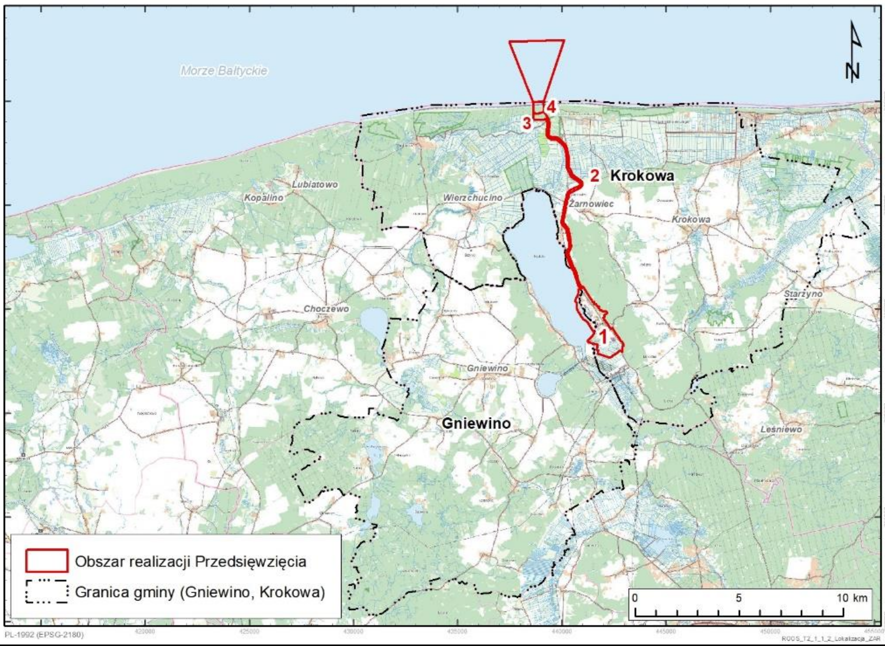
Facilities such as the training facility, simulator building, public information centre, car parks, passenger bus stop and helipad will be located outside the NPP area fencing.

The Project Area, which will include all construction works related to the implementation of the Project and its subsequent operation for Variant 1 – Lubiatowo - Kopalino site and Variant 2 – Żarnowiec site is presented in the figures below [Figure VI.2.2- 2], [Figure VI.2.2- 3].

Obszar realizacji Przedsięwzięcia	Project Area
Granica gminy Choczewo	Boundary of the Choczewo commune

Figure VI.2.2- 2 Project Area Variant 1 — Lubiatowo - Kopalino site

Source: In-house study



Obszar realizacji Przedsięwzięcia	Project Area
Granica gminy (Gniewino, Krokowa)	Commune boundary (Gniewino, Krokowa)

Figure VI.2.2- 3 Project Area Variant 2 — Żarnowiec site

Source: In-house study

In the case of Variant 1 – Lubiatowo - Kopalino site, the land part accounts for approximately 27% of the total Project Area (approximately 688 ha), of which forest land accounts for about 85% (approximately 585 ha), and arable land, including wasteland, about 14% (approximately 96 ha). Developed land (including developed arable land) covers an area of approximately 0.2 ha.

In the case of Variant 2 – Żarnowiec site, the land part accounts for approximately 50% of the total Project Area (approximately 464 ha), of which the largest part is covered by developed and urbanised land – approximately

47% (approximately 218 ha), arable land covers about 36% (approximately 167 ha), and forest land accounts for approximately 15% of the land part of the Project Area (approximately 70 ha).

In both site variants, for the marine part, the spatial development plan for internal marine waters, the territorial sea and the exclusive economic zone on a scale of 1:200 000 provides for separate water regions 39a.I (Variant 1) and 39b.I (Variant 2) dedicated to the elements of the Project and the infrastructure accompanying the NPP.

Due to the conditions related to the distance of the area with NPP generation units from the source of supplementary water for the cooling system (i.e. the Baltic Sea) and the availability of the area, the land part of the Project Area in Variant 2 – Żarnowiec site has been divided into 4 sub-areas: Subarea 1 – the main area of the NPP, where the generation units will be located; Subarea 2 – the area of the pipelines supplying make-up water to the cooling systems connecting the NPP with the area of the pumping station (Subarea 3) situated on the coast, from where the where the intake of water for the cooling systems will take place; Subarea 3 – pumping station with facilities and infrastructure necessary for its proper operation and Sub-area 4 – the zone between the pumping station and the coast, in which the make-up water channels/pipelines will be located along with the necessary technical infrastructure.

VI.2.3 Comparison of the proposed technique with the best available technique (BAT)

According to the Regulation of the Minister of the Environment of 27 August 2014 on types of installations that may cause significant pollution of individual natural elements or the environment as a whole, a nuclear power plant is not considered an installation required to obtain an integrated permit. No BAT reference document (BREF), which describes technologies applied in the nuclear power sector, current emission and consumption levels, and technologies considered best in the sector, has been developed for the NPP, either.

The EURATOM Treaty has entrusted the European Community e.g. with the task of establishing uniform safety standards to protect the health of workers and the general public in all Member States against exposure to ionising radiation (Council Directive 2013/59/Euratom of 5 December 2013).

This directive took into account the recommendations of the International Commission on Radiological Protection (ICRP). The most recent recommendations of the ICRP (2007) on activities involving radioactive substances include the following principles:

- justification of the application,
- optimisation of radiological protection – the basic international radiological protection principle – ALARA (as low as reasonably achievable),
- application of individual doses that do not exceed dose limits or dose constraints.

In Poland, any activity related to the design, construction and operation of a nuclear power plant is primarily regulated by the Atomic Law Act together with implementing acts.

At the same time, in accordance with the Environmental Protection Law Act of 27 April 2001 (EPL Act) the technology used in newly commissioned plants should meet the following requirements:

- application of substances of little hazard potential,
- efficient generation and use of energy,
- ensuring rational use of water and other raw materials and materials and fuels,
- the use of zero-waste and low-waste technologies as well as options of recovery of the waste generated,
- type, extent and volume of emissions,
- use of comparable processes and methods that have been effectively applied on an

industrial scale,

- scientific and technical progress.

In determining what constitutes the best available techniques/technology (BAT), account shall be taken e.g. of:

- comparable processes, facilities or methods that have been successfully tried,
- technological progress and changes in scientific knowledge and understanding,
- the economic feasibility of such techniques.

It follows that BAT will change over time in the light of technological progress, economic and social factors and changes in scientific understanding.

Detailed identification and application of BAT solutions will be a task to be carried out at the further stage of the Project implementation, that is, in the procedure of a re-assessment of the Project's environmental impact.

VI.2.4 Construction phase

The construction phase of the Project was divided into three stages: development, construction, and commissioning.

The development stage will include e.g. sweeping the area for explosives along with the removal of possible unexploded ordnance and duds, pre-emptive archaeological works along with securing and removing possible artefacts from the construction site, clearance of trees, grading of the area, demolition of the existing buildings, preparation of construction site facilities, i.e. fencing of the area, preparation of temporary roads with car parks, removal of collisions with the identified underground infrastructure, preparation of employee welfare areas and workshop and storage facilities, construction of a technical infrastructure network around the construction site (including electrical, water supply and wastewater, telecommunications and teletechnical systems), as well as the construction of drainage systems with a retention basin and clearwell storage tanks and separators. Depending on the progress of works and compliance with the provisions of the law, there is also the possibility of extending the scope of the development works to cover other works described in the EIA Report.

Then the construction stage will begin, during which construction and assembly works will be carried out, which include i.a.: construction of embankments for the target elevations of the area, excavations for foundations with possible replacement of soil under building structures depending on the adopted foundation technology and the identified soil and water conditions, foundation works including possible piling, reinforced concrete works, assembly of the structures of buildings, installation of insulated panel system (including windows, doors, gates) and roof, installation works (water and waste water installation, central heating and ventilation, fire protection system, electrical and teletechnical systems, etc.), outdoor networks, installation of technological equipment and systems including the installation of a reactor, turbine set and other auxiliary equipment and finishing works.

The final stage will involve the commissioning of the nuclear unit. At this stage, surveys are carried out to confirm that the entire plant operates in a safe manner and in accordance with the design assumptions. As part of this stage, tests of the systems, structures, and components of the nuclear unit, hot functional tests, loading of nuclear fuel, achieving criticality and low-power physical tests of the reactor (< 5%) will be carried out, followed by power increases (10%, 25%, 50%, 75%, 90% and 100%) and synchronisation of the turbine set with the grid (NPS), as well as the trial run of the power plant at rated capacity. Then, until the President of the PAA issues an operating license, the unit will function on the basis of the commissioning license.

It is assumed that all stages the works will be carried out at least 6 days a week, in two shifts, between 07:00 and 22:00, provided that the works that cannot be stopped due to the construction/production technology will be carried out 24h/day.

During the construction phase, proceedings related to permits and licenses, such as commissioning licences, occupancy permits and operating license, will be conducted. The construction phase ends with the entry of the nuclear unit into operation.

VI.2.5 Operational phase

From the perspective of issuing relevant permits and licenses for the NPP, the operational phase of the Project will begin on the date of the issuance of the operating license for the nuclear facility, referred to in Article 4(1)(2) of the Atomic Law Act. This license is issued by the President of the National Atomic Energy Agency (PAA). The process of starting the operational phase will take place successively for the individual nuclear units of the power plant, due to the time shift associated with the construction of individual units.

In the EIA Report, the operational phase is described in accordance with Polish and international terminology commonly used in the nuclear power industry, according to which the operational states of a nuclear power unit include normal operation and anticipated operational occurrences.

Normal operation includes such modes of operation as, for example: power operation, start-up, shutdown, hot reserve or refuelling.

“Anticipated operational occurrences” shall mean disturbances in normal operation that do not pose a hazard to humans or the environment. They are defined in Article 3(39a) of the Atomic Law Act.

A special state of normal operation is the shutdown of the unit for refuelling, during which inspections and repairs of the unit are concurrently carried out. After each successive start-up of the unit, the unit has to be synchronised with the power grid. The periods between each successive refuelling are called fuel campaigns.

It was assumed that the refuelling would take place after 17 months from the commissioning. The duration of the fuel campaign depends on the type of repair carried out during the refuelling. There are three types of repairs: routine, interim and overhauls. The period between overhauls is 130 months and is preceded by routine and interim repairs (alternately) at intervals of 18 and 19 months.

VI.2.6 Decommissioning phase

Pursuant to Article 3(9) of the Atomic Law Act, the decommissioning of a nuclear facility is understood as bringing an facility to a condition not requiring restrictions from the point of view of nuclear safety and radiological protection in the performance of any activity. According to the Investor's assumptions, the decommissioning of the nuclear facility will end with obtaining the so-called "greenfield" status.

The costs related to the financing of the disposal of spent fuel and radioactive waste, as well as the costs of NPP decommissioning itself, will be covered from the decommissioning fund. Fees will be paid to the fund for each MWh produced during the operation, in accordance with applicable law.

The process of decommissioning a nuclear unit with an AP1000 reactor will take a total of about 22 years and is divided into three stages. The first stage lasts about 10 years, while the next one lasts about 6 years. During these stages, further elements of the nuclear power plant are successively removed, following decontamination. During the decommissioning of the NPP, the level of contamination of all radioactive and potentially radioactive elements is measured.

For the purposes of this EIA Report, it was assumed that in the decommissioning phase the equipment and machinery used will be similar to those used in the construction phase.

VI.2.7 Project implementation schedule

The schedule of the Project presented in this chapter reflects the state of knowledge about the Project at the time of preparation of the EIA Report. The schedule of the Project includes information obtained from the Plant Vendor and that available in the public domain e.g. on the websites of nuclear regulators: the American US NRC and British ONR (Office for Nuclear Regulation).

In both site variants, the Project schedule assumes that the works will commence in 2023 (as part of the construction phase – development stage), which is in line with the PNPP updated in October 2020.

Variant 1 — Lubiatowo - Kopalino site

The schedule for Variant 1 – Lubiatowo - Kopalino site assumes the duration of the construction phase of approximately 10 years, which consists of the development stage (3 years), construction stage (6 years), and commissioning stage (1 year). It is assumed that the first unit will be handed over 10 years after the start of the development stage. The next nuclear units will be put into operation at one-year intervals, so the entire construction phase for all units will be completed after about 12 years.

Once the commissioning is complete, the operational phase will begin. The adopted generation III + technology allows for 60 years of operation from the commissioning of each nuclear unit, regardless of the analysed site variants and sub-variants of the Project. Bearing in mind the experience from the current operation of generation II nuclear power plants, it can be assumed that the operational phase can be significantly extended, provided that a detailed inspection of the technical condition of the main components allows for it.

To estimate the decommissioning period, it was assumed that all nuclear units will be decommissioned one after another with a 1-year interval, so that in total the decommissioning phase of the entire NPP in the case of Variant 1 – Lubiatowo - Kopalino site, will last about 24 years.

Variant 2 — Żarnowiec site

The duration of the development stage will be similar to that in Variant 1 – Lubiatowo - Kopalino site, however, due to the process of expropriation and liquidation of the existing production plants located in this area, it has been extended by 1 year.

The construction stage will be extended due to the postponement of the start of the construction of nuclear unit no. 2 compared to the first unit by 5 years. The construction of the last nuclear unit will be postponed in relation to the construction of unit no. 2 by 1 year. As in the case of Variant 1 – Lubiatowo - Kopalino site, the duration of the commissioning stage for a single nuclear unit will be 1 year.

In the case of Variant 2 – Żarnowiec site, the construction phase for the entire power plant will last 17 years.

The operational and decommissioning phases for individual nuclear units do not depend on the site variant and are analogous to those for Variant 1 – Lubiatowo - Kopalino site. The differences in the duration of the construction phase for the entire NPP will also affect the duration of the decommissioning phase, which for three nuclear units in the case of Variant 2 – Żarnowiec site, will amount to approximately 28 years.

VI.2.8 Projected number of permanent and temporary employees involved in the implementation of the Project

The number of employees employed in each phase of the Project does not depend on the site variant of the NPP.

It is estimated that at the development stage the total number of employees involved will not exceed approximately 1,750 employees, of which about 7.5% are middle management staff, and the remaining people are skilled and unskilled workers.

It is assumed that at the development stage, employees from the local labour market will be hired, therefore a dedicated accommodation base will not be prepared for this period. The staff will be accommodated in the existing hotel/accommodation base, including private accommodation, which will be the responsibility of the Contractor employed to carry out these works.

The maximum number of employees employed at the construction stage will amount to approximately 8,000 people and will change successively depending on the worksite.

It is assumed that during the operational phase, approximately 860 employees will work at the NPP site. The largest group of about 250 people will be operators working in shifts (6 shifts of about 35 people + about 40 operators during the day).

It was assumed that in the decommissioning phase, about 1,000 people will work each year.

VI.2.9 Demand for natural resources (including raw materials), electricity, materials and chemical products

Cut and fill balance

The area intended for the development of the NPP, regardless of the site variant and sub-variant, will require levelling and raising the ground level to the following values:

1. Variant 1 — Lubiatowo - Kopalino site:
   - approximately 9.5 m above sea level for the area, where the main nuclear facilities together with the technical infrastructure of the NPP will be located (nuclear island),
   - approximately 8.3 m above sea level for the remaining area where the remaining facilities together with the technical infrastructure of the NPP will be located;
2. Variant 2 — Żarnowiec site:
   - approximately 9.0 m above sea level for Subarea 1, where the main nuclear facilities together with the technical infrastructure of the NPP will be located (nuclear island),
   - approximately 6.5 m above sea level for the remaining Subarea 1, on which the remaining facilities together with the technical infrastructure of the NPP will be located,
   - approximately 5.0 m above sea level for Subarea 3 where the remaining facilities together with the technical infrastructure will be located.

The below table [Table VI.2.9- 1] presents the approximate cut and fill balance for all sub-variants.

Table VI.2.9- 1 Aggregate cut and fill balance

Volume of cut and fill (thousand m^3)	Excavations	Embankments	Balance
	A	B	A-B
Variant 1 — sub-variant 1A	5,400	3,400	2,000
Variant 1 — sub-variant 1B	4,840	3,390	1,450
Variant 1 — sub-variant 1C	6,550	3,540	3,010
Variant 2 — sub-variant 2A and 2B — Subarea 1	2,006	4,361	- 2,355
Variant 2 — sub-variant 2A and 2B — Subarea 3 and 4	46.5	213	- 166.5

Source: In-house studies based on the NPP Site General Arrangement. Jacobs Clean Energy, 2021.

Water demand

The greatest demand for water will occur during the operational phase for domestic and technological needs (demineralised water and water for the NPP cooling system) and for fire protection purposes. During the NPP decommissioning phase, water will be used for residential and welfare purposes and for technological processes related to the demolition of individual buildings and technical infrastructure of the NPP.

<u>Construction phase</u>

The demand for water during the construction phase does not depend on the site variant of the Project.

At the development stage, water will be used mainly for domestic purposes and for the organisation of the construction site. At the initial stage of development, water will be transported by bowsers until the groundwater intake and water treatment plant are commissioned as part of associated infrastructure.

It is assumed that at the development stage, the demand for water will be on average about 1,050 m^3 per day.

At the construction stage, the only source of water supply will be the intake of groundwater. It is assumed that the demand will be approximately 1,856 m^3 per day (Qav = 105 m^3/h).

The commissioning stage will generate additional demand for water for process purposes, and for the commissioning of nuclear power units. This demand is included in the description of the operational phase.

Operational phase

During the operational phase, the demand for water does not depend on the site variant of the Project, but on the sub-variant under consideration, i.e. the type of cooling system used.

The main source of water supply at this stage will be the Baltic Sea. Seawater will be desalinated or used without desalination, regardless of the cooling system considered in a given sub-variant. The demand for seawater during the period of operation is shown in the table below [Table VI.2.9- 2].

Table VI.2.9- 2 Demand for seawater

System	Entire power plant (3 units)
	m³/year
Seawater demand of the desalination plant (sub-variant 1A)	**4,965,567,353**
Demand for seawater for the desalination plant (sub-variant 1A)	**1,410,000**
Demand for seawater for the make-up of conventional island circuits (sub-variants 1B and 2A)	**138,000,000**
Seawater demand of the desalination plant (sub-variants 1B and 2A)	**3,141,000**
Seawater demand of the desalination plant (sub-variants 1C and 2B)	**105,900,000**

Source: In-house study based on the Water Study. Jacobs Clean Energy Limited, 2021

Decommissioning phase

It is assumed that the demand for water in the decommissioning phase will be similar for both site variants. It was assumed that the source of water for residential and welfare purposes and technological processes related to demolition will be in the first place desalinated seawater from the existing seawater desalination system, and then water from groundwater intakes. It was also assumed that the demand for water for demolition works should not exceed the demand for water as at the construction stage (estimated at approximately 1,856 m^3 per day).

Electricity demand

The demand for electricity does not depend on the site variant of the Project.

The expected demand for connection capacity at the development and construction stages will be approximately 50 MWe. It is estimated that the average capacity utilisation rate during the construction phase will not exceed 0.4 – electricity consumption will amount to approximately 175,000 MWh/year.

Energy consumption at the commissioning stage, along with the commissioning of further nuclear power units, will gradually increase until it reaches the same level as in the operational phase.

In the operational phase, electricity will be used both to power process needs and general construction systems. Electricity consumption during this phase was estimated at no more than 6% of the gross energy production of the NPP, assuming the highest rate among all the technical sub-variants considered. Annual electricity consumption, assuming that the capacity utilisation rate of the power plant will be 0.9, will amount to approximately 1,770,000 MWh/year.

During the decommissioning phase, it was assumed that the amount of energy needed to carry out the decommissioning of a nuclear unit with an installed capacity of 1,000 MWe constitutes about 75% of the energy consumed during its construction.

Fuel demand, including demand for nuclear fuel

Construction phase

The main demand for conventional fuels, i.e. diesel and petrol, will involve the operation vehicles and construction machinery and tools at the development and construction stages.

During the development stage for Variant 1 – Lubiatowo - Kopalino site, it was estimated that the demand for diesel fuel will amount to approximately 5 million litres, and to about 75,000 litres for petrol. For Variant 2 – Żarnowiec site, this demand will amount to approximately 14 million litres of diesel fuel and approximately 125,000 litres of petrol, respectively.

However, it is estimated that at the construction stage for Variant 1 – Lubiatowo - Kopalino site, the demand for diesel oil will amount to approximately 206 million litres, while for petrol – about 2.7 million litres, and for Variant 2 – Żarnowiec site, it will be about 217 million litres of diesel oil and about 2.8 million litres of petrol, respectively.

The demand for conventional fuel and nuclear fuel at the commissioning stage does not depend on the site variant for the Project and as the next units are commissioned, the demand will be analogous to that at the operational phase.

The initial loading of the AP1000 reactor core consists of 157 fuel assemblies. For the initial loading of the AP1000 reactor core, the following number of fuel assemblies with different levels of enrichment are provided:

- 53 assemblies with U-235 uranium isotope enrichment of 2.35%;
- 52 assemblies with U-235 uranium isotope enrichment of 3.40%;
- 52 assemblies with U-235 uranium isotope enrichment of 4.45%.

In addition, it is assumed that at the commissioning stage, an auxiliary boiler house fired with fuel oil will be used to heat the NPP buildings in the heating season. It can last three years (three heating seasons). Its consumption at this stage may amount to approximately 22,000 m^3/year. In addition, the auxiliary boiler house will be used for the first commissioning of nuclear units from the cold state – the operating time of about 7 days was assumed for the boiler house, which is about 2% of annual consumption.

Operational phase

During the operational phase, continuous operation of devices using fuel combustion is not assumed. Conventional fuel, i.e. diesel oil, will be used periodically to carry out power tests for emergency diesel generators and fire pumps, therefore its annual demand will be approximately 130 m^3 for one nuclear unit, i.e. approximately 390 m^3 for the entire NPP (3 units).

The auxiliary boiler house may be an additional receiver of conventional fuel, the operation of which is assumed in the absence of heat supply for residential and welfare purposes or commissioning of a nuclear unit. The maximum fuel oil consumption by the auxiliary boiler room is estimated at approximately 2,000 m^3/year.

To estimate the planned demand for nuclear fuel for the NPP, a reference 18-month fuel campaign and about 64-68 pcs of fresh fuel assemblies for refuelling in each campaign were adapted.

The amount of natural uranium (in U_3O_8 mass equivalent) needed to produce fuel assemblies for the entire 60-year operating life of a power plant consisting of 3 units for the reference AP1000 technology is about 48,700 tonnes.

Fuel consumption in the operational phase does not depend on the site variant for the Project.

Decommissioning phase

As of today, it is difficult to estimate the fuel demand during the decommissioning phase of the Project, because it is difficult to predict what technologies and energy sources will be available in about 70–90 years from now and how the process of dismantling and demolition of all facilities will take place. However, it is not assumed that the fuel demand will be higher than in the construction phase and that it will differ significantly depending on the site variant for the Project.

Demand for bulk materials

The demand for bulk materials does not depend on the site variant for the Project.

In the construction phase, the demand for bulk materials will be approximately 5.3 million tonnes, and in the operational phase they will be used only in small quantities, e.g. during renovation works. In turn, the bulk materials will be required during the decommissioning phase to backfill the excavations left after the underground service infrastructure and foundations are removed.

Demand for chemical products

Construction phase

The works undertaken at the development stage in both site variants (due to their nature and scope) largely do not require the use of chemical products, with the exception of sorbents (including calcium chloride) used to neutralise unintentional oil or fuel leaks from vehicles or construction machinery, and in winter – for possible de-icing of roads on the construction site. In addition, for Variant 2 – Żarnowiec site, due to the need to carry out demolition works, technical gases (in amounts insignificant from the point of view of environmental impact) will be used for cutting steel structures.

A similar situation will occur in the case of construction works. In addition, during construction, technical gases and specialised welding pastes will be used in welding works. In addition to paints and varnishes, the painting works of structures and installations will require the use of appropriate solvents. It is assumed that the demand for chemical products at the construction stage for both site variants will be identical.

At the on-site concrete batching plants and in the laboratory operating for their needs plasticisers, accelerators (polycarbohydrates, other compounds), alkaline and acid neutralising compounds, radiation absorbers (ferrite compounds used in the production of concrete mix intended for the construction of the reactor building) will be used.

It is assumed that the demand for chemical products at the commissioning stage for both site variants will be the same. As the work progresses, the types and quantities of chemical compounds will change until in the final phase they are identical to the chemical compounds used in the operational phase.

At the commissioning stage, chemical products will be used mainly to clean and fill the installations. The process of chemical cleaning (etching of pipelines) is carried out in the case of pipelines of steam and oil systems using chemical products such as hydrofluoric acid and lime for its neutralisation, hydrogen peroxide, corrosion inhibitor, formic acid, hydrochloric acid, sulphuric acid and ammonia water. The products for filling the systems include gaseous sulphur hexafluoride for filling busducts and extinguishing chambers of generator circuit breakers, hydrogen for filling generator coolers, nitrogen for the maintenance of fire extinguishing systems of electrical buildings, gases for filling air conditioners, transformer oil and turbine oil.

Operational phase

During the operational phase, chemicals are used in the technological process to adjust water parameters in the reactor cooling system (primary circuit) (especially boric acid – to compensate for excess core reactivity) and in the water-steam working circuit (secondary circuit) and in other systems cooling the equipment, as well as in water treatment systems for the NPP and air conditioning systems. Technical gases such as, e.g.: compressed air, hydrogen, nitrogen or carbon dioxide will also be used for proper operation and during maintenance and repair activities of the NPP.

Decommissioning phase

As at the date of the EIA Report, it is difficult to estimate the consumption and types of chemicals used in the decommissioning phase, because it will depend on the technology of demolition of buildings and the method of disposal of dismantled elements of NPP components. Most likely, the majority of chemicals will be used for decontamination, i.e. cleaning of the NPP components and facilities of radioactive substances.

VI.2.10 Predicted types and volumes of emissions, including waste, resulting from the implementation of the Project

Non-radioactive emissions into the atmosphere

During the implementation of the Project, non-radioactive pollutants will be emitted into the air. The direct source of these pollutants will be, e.g. on-site concrete batching plants located at the NPP construction site, construction machinery and equipment, point energy sources to power the equipment and sources of fugitive emissions from the NPP area. An additional source of pollution will be indirect sources, from which emissions will arise outside the Project Area. This concerns especially transport of materials and equipment and transport of employed personnel, as well as the use of the accommodation base.

The main air pollutants will be formed as a result of the combustion of fuels for the propulsion of construction machinery and will include e.g.: nitrogen oxides (NO_x), carbon monoxide (CO), sulphur dioxide (SO_2) and particulate matter with a diameter of up to 10 µm (PM_{10}) (0.01 mm), including particulate matter with the greatest impact on human health with a diameter of up to 2.5 µm ($PM_{2.5}$) (0.0025 mm) formed during excavation, movement of construction equipment or during concrete works.

The estimates of annual atmospheric emissions of pollutants not containing radioactive substances generated in individual phases of the Project are presented in the table below [Table VI.2.10- 1], taking into account the division into the considered site variants (Variant 1 and Variant 2) and their sub-variants (1A, 1B, 1C, 2A and 2B).

To simplify the table, the results are presented only for the construction technology for the elements of the open trench cooling system, which has a slightly greater impact than the technology using drilling machines (trenchless).

Table VI.2.10- 1 Annual emissions of selected pollutants not containing radioactive substances

Site variant and sub-variant (category)	Annual Emissions (total from all sources [Mg/year])				
	NO_x	CO	SO_2	PM_{10}	$PM_{2.5}$
Construction phase					
Variant 1 — sub-variant 1A	2,973	1,656	242	5,022	604
Variant 1 — sub-variant 1B	2,413	1,413	242	5,014	596
Variant 1 — sub-variant 1C	2,416	1,414	242	5,014	596
Variant 2 — sub-variant 2A	3,374	1,951	322	3,475	462
Variant 2 — sub-variant 2B	2,804	1,703	322	3,468	454
Operational phase					
Variant 1 — sub-variant 1A	28	21	21	51	12
Variant 1 — sub-variant 1B	28	21	21	232 [1)]	12 [1)]
				890 [2)]	12 [2)]
Variant 1 — sub-variant 1C	28	21	21	127 [1)]	15 [2)]
				402 [2)]	26 [2)]
Variant 2 — sub-variant 2A	35	19	19	288 [1)]	18 [1)]
				1,011 [2)]	18 [2)]
Variant 2 — sub-variant 2B	35	19	19	174 [1)]	21 [1)]
				475 [2)]	33 [2)]

[1)] for a drift value of 0.01% [2)] for a drift value of 0.05%

Source: In-house study

It is assumed that in the decommissioning phase, the amount of emissions of pollutants not containing radioactive substances into the air will not be greater than in the construction phase.

Emissions of pollutants containing radioactive substances into the air

At the construction stage, it is not expected that any actions resulting in atmospheric emissions that contain radioactive substances will be undertaken.

The first emissions of radioactive substances from the NPP into the air will occur during the commissioning stage after the reactor reaches its critical state.

In operational states (routine) emissions of radioactive substances into the air take place through the main ventilation stack of the power unit and (in a small amount) through the turbine building vent. The vast majority of emissions are radioactive noble gases, which are dispersed in the upper layers of the atmosphere without contaminating the land or water surface. In addition, radionuclides occurring in nature are emitted: carbon-14 and tritium. In contrast, emissions of radioactive aerosols (such as iodine, caesium or strontium isotopes) are very small, as they are effectively removed by appropriate treatment systems. Due to the short half-life of most isotopes (about a few minutes) and the high point of their release into the atmosphere, they do not pose any threat in terms of radiological protection, neither to the local community nor to the employees of the nuclear power plant.

In the decommissioning phase, fission reactions no longer take place in the reactor, so the amount of radioactive substances emitted into the environment will be much lower than in the operational phase. Radioactive emissions into the air will fall to a minimum level when nuclear fuel is removed from reactors and spent fuel pools. Finally, the decommissioned NPP will be brought to such a condition where the level of ionising radiation will not differ significantly from the natural background.

Emission of non-radioactive wastewater

For the development stage, it is assumed that the maximum amount of residential wastewater and process wastewater (not containing radioactive substances), regardless of the selected site variant and sub-variant, will amount to approximately 565 m^3 per day, and to approximately 1,785 m^3 per day for the construction stage.

During the construction of the NPP in both site variants, a new temporary wastewater treatment plant (along with a wastewater system) will be built. The treated wastewater will be discharged directly into the sea at a distance of at least 1km from the coastline. However, wastewater coming from the area of construction works carried out in Variant 2 – Żarnowiec site in Subarea 2, will be removed by means of septic tankers to the KPK Żarnowiec wastewater treatment plant, and from Subareas 3 and 4, it will be discharged through the planned wastewater system to the existing municipal wastewater system running from Dębki to the Żarnowiec wastewater treatment plant.

At the commissioning stage, the types and composition of wastewater and their quantities will gradually begin to change from those typical for the construction phase to those typical for the operational phase. During the operational phase, the following types of wastewater will be generated:

1) Wastewater independent of the cooling system used (sub-variants 1A, 1B, 1C, 2A and 2B):
    a) residential wastewater,
    b) industrial wastewater (e.g. process wastewater, the concentrated solution from the water demineralisation system, the concentrated solution from seawater desalination plants, wastewater from fire protection systems, etc.);
2) Wastewater additionally generated by the use of a closed cooling system (sub-variants 1B, 1C, 2A, 2B):
    a) blowdown from the service water system (SWS),
    b) blowdown from the circulating water system (CWS).

It is assumed that, irrespective of the site variant and sub-variant, in the operational phase, a new wastewater treatment plant discharging treated by a common system into the sea will operate on the NPP site. The quantities of wastewater are provided in table [Table VI.2.10- 2].

Table VI.2.10- 2 Types and quantities of non-radioactive wastewater generated during the operational phase

No.	Type of wastewater	Entire NPP (3 units)	
		Annual average flow	Annual volume
		m^3/h	$m^3/year$
3.	Process wastewater Variant 1 — sub-variant 1A	567,000	4,966,920,000
4.	Process wastewater (Variant 1 and 2 — sub-variant 1B and 2A)	8,766	76,794,315
5.	Process wastewater (Variant 1 and 2 — sub-variant 1C and 2B)	4,233	37,085,328

* *Cooling water – open cooling system cooling water*

Source: In-house study

The amount of wastewater generated during the decommissioning phase will not be greater than during the construction of the Project.

Emission of wastewater containing radioactive substances

Construction phase

The first emissions of wastewater containing radioactive substances may occur at the nuclear commissioning stage, and their volume will increase along with the gradual increase in its capacity. However, these emissions will be much lower than the average emissions generated during the operational phase.

Operational phase

It is assumed that the volume of wastewater containing radioactive substances generated during the operational phase will be similar in both site variants and the associated sub-variants.

During the operational phase of the nuclear power plant, emissions of radioactive substances are a constant and routine element of operation, while their amount and activity is fairly small.

In operational states, treated wastewater, which may contain permissible trace amounts of radioactive substances, will be discharged into the waters of the Baltic Sea.

The radioactive substances that may be found in treated wastewater is definitely dominated by tritium (approximately 99.98% of total activity). The second most active radionuclide is the C-14 carbon isotope, which accounts for more than half of the activity of the remaining radionuclides (except tritium). It should be noted that tritium and C-14 carbon occur naturally in the environment: in the air (both of these radionuclides), in seawater (tritium). Apart from tritium and C-14 carbon, relatively small amounts of activated products of erosion and corrosion of construction materials of the reactor and its cooling system will be emitted.

The discharge of radionuclides in liquid form, containing mostly tritium (emitting beta radiation that is not particularly strongly penetrating), which will quickly be dispersed in seawater, will have a negligible radiological impact on humans (according to calculations and analyses, the impact of the "water path" is less than 1% of the total radiological impact of the NPP on the environment in operational states).

Decommissioning phase

Due to the fact that in the decommissioning phase fission reactions no longer take place in the reactor, the volumes of radioactive substances emitted to the environment during the decommissioning of the NPP will be negligible. Once the operation of the NPP ends, there will still be a certain amount of liquid or solid radioactive waste, generated during the operation of the NPP, that will have to be processed. The subsequent generation of radioactive waste – in liquid or in solid form – will be associated with the NPP dismantling works, including decontamination. Finally, the decommissioned NPP will be brought to such a condition which will not require any inspections from the point of view of radiological protection, i.e. one in which the level of ionising radiation will not differ significantly from the natural background.

Waste (other than radioactive)

Construction phase

It has been estimated that during the development stage – regardless of the selected sub-variant– approximately 37,000 tonnes of conventional waste will be generated for Variant 1 and approximately 825,000 tonnes of conventional waste for Variant 2, of which approximately 785,000 tonnes are waste generated during the demolition works.

As a result of the construction works, it is expected that a significant volume of land masses will be produced (approximately 7 – 10 million tonnes), which will mostly be managed in the NPP area after the completion of construction works. For Variant 1 – Lubiatowo - Kopalino site, due to the positive balance of soil masses, it is assumed that a certain part of the excess soil will be used outside the Project Area, so it will be considered waste (230–480,000 tonnes, depending on the cooling variant). For Variant 2 – Żarnowiec site, the cut and fill balance is negative, i.e. part of the soil/aggregates will have to be transported to the site.

In connection with the construction works carried out on land, mainly conventional waste will be generated, such as concrete waste and concrete rubble; metal waste, including iron and steel; wood waste; waste residues of chemical substances, i.e. lubricants, other oils, paints, sorbents; packaging containing residues of substances, including hazardous substances or contaminated with them, packaging of all kinds of paints, varnishes, lubricants and other technical liquids used at the stage of construction works; packaging made of paper and cardboard, plastic packaging, packaging of various types of equipment and materials used at the stage of construction works; wiping fabrics and protective clothing or municipal waste from employee welfare facilities.

Furthermore, waste from the drainage system of temporary yards and roads on the construction site will be generated, i.e. waste from settling tanks and separators.

At the construction stage for both NPP sites in the marine part, works related to the construction of channels / pipelines for the intake of cooling water and the discharge of cooling water along with treated industrial wastewater will be carried out. It is assumed that the spoil from dredging works at sea in the form of non-cohesive sediments (sands, gravels) will be re-used, e.g. to fill the channels/pipelines of the cooling system. On the other hand, the remaining part of the spoil – cohesive sediments (clays, loams, silts), will be deposited on a deposit site located at sea.

During the commissioning (excluding nuclear commissioning) of the NPP, typical conventional waste related to operational tests and mechanical/electrical commissioning (spent oils, chemicals, materials and packaging, etc.) and commissioning of process systems and components will be generated.

It has been estimated that during the assumed construction period of the NPP, taking into account the commissioning stage, approximately 137,000 tonnes of conventional waste will be generated for Variant 1 – Lubiatowo - Kopalino site and approximately 141,000 tonnes for Variant 2 – Żarnowiec site, regardless of the selected sub-variant and option.

It should be borne in mind that the commissioning stage will successively concern each of the three nuclear units under construction. Consequently, in addition to the waste typical to the construction stage, this stage will gradually begin to generate the types and quantities of conventional waste typical for the operational phase.

Operational phase

The types and quantities of conventional waste generated during the operational phase will not depend on site variants, but only on their sub-variants.

During the operational phase, waste such as e.g. municipal waste will be generated mainly in relation to the presence of employees in administrative and office buildings; wastes from cleaning roads, yards, maintenance of greenery in the NPP area; medical waste from the first aid centre; solid and liquid chemical waste from the activities of the chemical laboratory; wastes from the operation of an auxiliary boiler house fired with fuel oil (filters, spare parts, oil-polluted wiping material); wastes from maintenance, repairs and renovation of administrative and office buildings as well as technical buildings and equipment or waste from the treatment and processing of water.

The technological solutions proposed for the NPP will prevent the uncontrolled release of pollutants into the environment.

Below [Table VI.2.10- 3] is a summary of the amount of conventional waste generated during the operational phase, taking into account the division into the considered sub-variants.

Table VI.2.10- 3 Types and volumes of conventional waste generated during the operational phase

Type of cooling system (sub-variants)	Non-hazardous conventional waste [thousand tonnes]	Hazardous conventional waste [thousand tonnes]
Open (sub-variant 1A)	75	11
Closed (sub-variant 1B, 1C, 2A and 2B)	87	12

Source: In-house study

Decommissioning phase

Bearing in mind that the process of decommissioning of the NPP will begin in about 70 years at the earliest, it is difficult to predict its course and determine the target ways of management of waste generated as a result of the demolition of NPP facilities and infrastructure. At the stage of the building permit design, a preliminary strategy for the decommissioning of the planned NPP will be defined.

Most of the waste generated will not be radioactive or its activity will be negligible. Today's experience shows that waste from the dismantling and decommissioning of the NPP is mainly conventional waste (approximately 90%), typical for the demolition of industrial facilities.

The remaining waste, even after undergoing appropriate treatment, can be treated in part as conventional waste, and only a small portion of such waste will be radioactive waste.

For the decommissioning phase, a waste management plan will be drawn up and solutions will be proposed to maximise the reuse, recycling and recovery of waste.

The types and quantities of conventional waste generated during the decommissioning phase will not depend on site variants, but only on their sub-variants. It is estimated that in the decommissioning phase, about 210,000 tonnes of conventional waste may be generated in sub-variant 1A, while in other sub-variants, i.e. 1B, 1C, 2A and 2B, approximately 250,000 tonnes of conventional waste may be generated.

Radioactive waste and spent nuclear fuel

Radioactive waste will be produced already during the commissioning stage of the construction phase (during nuclear commissioning) and then during the operational and decommissioning phases of the Project. Spent fuel, in turn, will only appear during the operational phase (at the time of the first fuel reloading).

Gaseous, liquid and solid radioactive waste is produced during the operation of a nuclear power plant. Radioactive waste is managed by minimising the produced quantities and their impact on the personnel, the public and the environment. Correct management of radioactive waste effectively protects people and the environment against the harmful impact of the ionising radiation it emits. That is why the following principles will be observed in the treatment and storage of radioactive waste:

- minimising the amount of waste generated (at the "source"),
- suitable separation of waste (separate collection of liquid waste and waste suitable for fragmentation, pressing, incineration, etc.);
- volume reduction (pressing, evaporation, etc.),
- solidification and packaging of waste to ensure chemical and physical stability,
- storage of waste in places with an appropriate geological structure and the use of all possible technologies and barriers that effectively isolate waste from people and the environment.

The total annual amount of unprocessed solid radioactive waste generated for the representative AP1000 reactor technology is approximately 195 m^3/year, i.e. approximately 585 m^3/year for three units.

All radioactive waste (depending on its form) will undergo different forms of processing, eventually resulting in treated atmospheric emissions and atmospheric emissions with reduced activity (to air and marine waters) referred to above; as well as solid (including solidified) radioactive waste placed in containers suitable for temporary storage at the NPP site and subsequently for transportation for disposal at a national radioactive waste disposal facility.

Radioactive waste will be stored divided into three types of waste in three separate buildings: high-level, medium-level and low-level waste. Low- and medium-level waste will be transported to the final disposal site at a new low- and medium-level national radioactive waste disposal facility, which is to be created to ensure the possibility of disposal of waste not only from nuclear power plants, but also from the processes of generation and use of radioisotopes in medicine and economy.

Spent fuel is a special type of radioactive material. Spent fuel assemblies unloaded from the reactor core are highly radioactive and, as a result of radioactive decay, emit a significant amount of heat, so they will first be stored for up to 10 years in spent fuel pools (located in auxiliary buildings of individual nuclear units). Then, the spent fuel will be loaded into special containers and placed in a dry spent fuel store on the Project site, where it can be safely stored for the next several decades. Ultimately, high-level radioactive waste will be transported to a deep radioactive waste disposal facility in accordance with the "National Plan for radioactive waste and spent fuel management" adopted on October 21, 2020. The new radioactive waste disposal facility (new national low- and medium-level waste disposal facility and deep radioactive waste disposal facility) will be separate projects carried out in accordance with Polish law by the Radioactive Waste Neutralisation Plant (ZUOP).

The estimated annual amount of spent fuel produced in the NPP with three units with AP1000 reactors will be about 27m^3/year.

Noise

At the stage of development, the biggest sources of noise will be activities such as removal of trees and shrubs, grading and demolition works (especially in Variant 2 – Żarnowiec site) and construction of facilities and temporary roads. The corrected values of the sound power level L_W [dB(A)] can reach up to 125 dB(A).

The most arduous activities carried out at the construction stage are foundation works, construction of the reactor building and construction of a seawater desalination plant. The corrected values of the sound power level L_W [dB(A)] can reach up to 129 dB(A).

It should be noted that in the course of construction works at sea, the noise level from working machines will be between 166 and 203 dB(A).

During the commissioning of the first nuclear unit, sound with a power level of 80–114 dB(A) will be generated.

During the operational phase, in addition to the main systems of the NPP, the noise sources in the case of sub-variant 1A will include pumps and desalination plant facilities generating sound with a power level between 80 dB(A) and 87 dB(A), while in the case of the other sub-variants (i.e. 1B, 1C, 2A and 2B) the noise sources will include cooling towers, pumps and desalination plant facilities that will generate noise with a sound power level between 80 dB(A) and 119 dB(A).

In the decommissioning phase, the noise emissions in the case of both site variants will not exceed the estimated values specified for the construction stage.

Vibrations

At the development stage for Variant 1 – Lubiatowo - Kopalino site, no significant vibration sources were identified. On the other hand, for Variant 2 – Żarnowiec site, the possibility of emissions of significant vibrations associated with the demolition of facilities of the unfinished Żarnowiec nuclear power plant, i.a. mainly those related to the crushing of concrete, is anticipated.

During the construction phase, the main source of vibrations will be works related to piling to reinforce the substrate and those related to sheet pile driving to stabilise the embankments and slopes of deep excavations, as well as vibrations associated with railway transport.

In Variant 1 – Lubiatowo - Kopalino site, 534 potential vibration receptors of medium sensitivity and 3 potential receptors of high sensitivity were identified. However, for Variant 2 – Żarnowiec site, 551 potential receptors with medium sensitivity and 3 receptors with high sensitivity were identified.

For the commissioning and operational phases, regardless of the site variant, no generation of vibrations of a significant range is expected. Railway transport for the purposes of transport of NPP employees, and occasional freight transport, will be indirect sources of vibrations.

During the decommissioning phase it was assumed that, regardless of the site variant, vibration emissions would not exceed the vibrations anticipated at the construction stage.

Electromagnetic field

Potential electromagnetic field (EMF) emissions during all phases of the Project do not depend on the site variant selected for the implementation of the Project.

The sources of electromagnetic fields in the construction phase, in the low frequency range (50 Hz) will include e.g.: 0.4 kV aggregates, two cable lines at 110 kV, a 110/15 kV power station, several to a dozen or so 15/0.4 kV power stations, 15 kV cable lines, 0.4 kV cable line and electric load points. Apart from the abovementioned sources, additional sources at the commissioning and operation stage will include the 400kV extra high voltage lines used for evacuation of power from the NPP to the NPS.

The values achieved by the EMF will not exceed the limit values laid down in the applicable regulations. If, however, in certain places it would be impossible to comply with these standards, zones will be fenced off in such places, restricting the access of unauthorised people; outside these zones, the values of the magnetic fields will not exceed the permissible values.

Regarding medium frequencies and microwave radiation, the only equipment that may be a source of such emissions will include GSM and GPS equipment, whose radiation may be considered negligible.

In the decommissioning phase, the emission rates of electromagnetic fields will be similar to those occurring during the construction phase.

Heat emission to the environment

The amount of heat emitted and its source do not depend on the site variant in which the Project will be implemented.

At the stage of development and construction works, the amount of heat emissions will be insignificant, and its sources will be mainly the heated container buildings and, possibly, power generators.

At the time of commissioning and operation, the largest heat emissions will be related to the cooling of nuclear power units. Depending on the sub-variant of the cooling system of the unit, the heat dissipated from the condenser and the engine room components will be released to the environment via the channels/pipelines of the cooling system to the Baltic Sea (sub-variant 1A) or through cooling towers to the air (sub-variants 1B, 1C, 2A and 2B). Regardless of the sub-variant, the maximum thermal output of the condenser and the engine room equipment will occur at the maximum NPP load and will amount to approximately 2,400 MW for one nuclear unit, i.e. approximately 7,200 MW for the entire NPP.

An additional, but insignificant source of heat emissions to the environment will be diesel generators, power transformers, and heated buildings.

During the decommissioning of the NPP, the only heat emitter, with the exception of heated container buildings in the auxiliary facilities is the spent nuclear fuel immersed in special pools for spent nuclear fuel, which will remain there for a period of around 10 years.

Light pollution

During construction, particularly intense lighting will be present during the works at night, e.g. concrete works, which cannot be interrupted for technological reasons.

Regardless of the NPP site variant, the light coming from the lighting of the construction site will be visible from nearby towns, but it is assumed that its intensity will not be burdensome for their residents.

In the case of Variant 1 – Lubiatowo - Kopalino site, the light will be visible at a distance of approximately 3 to 4 km, and in the case of Variant 2 – Żarnowiec site, at a distance of approximately 1.5 to 2 km from the Project Area.

It is assumed that the selection of the intensity and sources of light for the lighting of the NPP area during operation will be made in such a way as to cause as little light pollution of the night sky and landscape as possible while meeting the safety and security requirements of the NPP.

In the decommissioning phase, the light intensity will be similar to the lighting used in the construction phase of the NPP.

Precipitation water

It is assumed that during construction rainwater will be drained from paved areas and the container base after prior treatment in separators. Rainwater will be discharged by means of temporary rainwater drainage: in the case of Variant 1 – Lubiatowo - Kopalino site to the Baltic Sea or the Kanał Biebrowski, while for Variant 2 – Żarnowiec site, from Subarea 1 to Lake Żarnowieckie, from Subarea 2 to drainage ditches, and from Subareas 3 and 4 to the Baltic Sea or the Kanał Białogórski.

It was assumed that the maximum monthly rainfall for the Project Area in Variant 1 – Lubiatowo - Kopalino site, will amount to approximately 172,000 m^3, while for the Project Area in Variant 2 – Żarnowiec site, it will amount to approximately 158,000 m^3.

In order to drain the excavations, tanks (sediment lagoons) with a capacity of approximately 1500 m^3 will be built at the construction stage, to which water contaminated with fine fraction pumped from deep excavations and drainage of the area will be discharged. Depending on the location variant, clean water (after sedimentation) will be discharged from the reservoirs to the Baltic Sea, the Biebrowski Kanał, Lake Żarnowieckie, the Piaśnica River, Białogórska Struga, the Kanał Białogórski or drainage ditches.

VI.2.11 Hazards and major accidents

VI.2.11.1 External events that may endanger the safety of a nuclear power plant

In the context of the analysis of the safety of nuclear power plants, an analysis of external events was carried out, as for events originating from outside the fenced area of the power plant, but which may become an initiating event that may have serious consequences for nuclear safety, e.g. natural hazards (such as floods, extreme conditions and meteorological phenomena), and external hazards caused by human activity (such as aircraft crash, fires and explosions, release of toxic gases). In addition, external events occurring on the site of the power plant, the source of which is located on the premises of the nuclear power plant, but outside buildings related to nuclear safety, were distinguished. Examples of such events include transport accidents at the power plant, as well as fires from neighbouring power plant buildings which are not related to nuclear safety.

External events can occur as a single event or as a combination of two or more external events. During the analyses, such combined events were identified that could negatively affect the safety of the nuclear power plant.

For the purpose of preparing the EIA Report, activities such as identification of potential external events and their screening analysis were carried out from the point of view of the importance of specified events for the safety of the NPP. Further detailed analyses of the impact of external events on the safety of the nuclear power plant will be carried out as part of the preparation of the Preliminary Safety Report, which will constitute the main part of the nuclear safety documentation required to be submitted together with the application to the President of the National Atomic Energy Agency for a permit to build a NPP.

Types of external events

The basic classification of external events includes their division into external natural events (such as floods and various extreme meteorological conditions) and external anthropogenic events – caused as a result of human activity (such as air crash and gas explosions).

A total of 183 external events were initially identified, and after the screening analysis, the list of possible external events was reduced to 40. For the most important events from the point of view of ensuring nuclear safety, appropriate quantitative analyses (deterministic or statistical) were performed.

Analysis of the resilience of the Project to extreme events, phenomena and natural conditions, with a particular regard for primary and secondary effects of climate change

For the purposes of the EIA Report, an analysis of extreme events, phenomena and natural conditions was carried out in the context of their impact on the safety of the NPP. The analysis shows that some external natural events will not adversely affect the safety of the NPP. However, the other will be taken into account at the design, implementation or operational stage of the NPP. An example of such activities is, i.a., raising of the area where nuclear facilities will be located, above the expected rise in sea level, or strengthening of the structure of buildings so that they survive hurricanes and storms, as well as constant weather monitoring and implementation of appropriate procedures in the event of extreme events.

This analysis takes particular account of the primary and secondary effects of climate change, including heat and drought, extreme rainfall and floods (including coastal), hurricanes and whirlwinds, sea level fluctuations, storms, coastline regression (erosion, abrasion) and periods of extreme frost and snow. Adequate mitigation measures for the NPP for the primary and secondary effects of climate change have been identified.

Selected anthropogenic hazards

<u>Terrorist or sabotage activities</u>

The current risk assessment associated with acts of terror in the Pomorskie Voivodeship shows a very rare probability of their occurrence (1 on a five-point scale), and the effects are assessed as D (on a 5-point scale from A to E). Risk acceptance occurs at a tolerable level.

In order to prevent terrorist attacks and prevent their potential consequences, an appropriate system of physical protection of the nuclear facility will be designed, and the competent security authorities will be involved to supervise the protection of the country's critical infrastructure facility.

<u>Potential external explosions</u>

Analyses have shown that hazardous facilities such as gas and oil transmission networks, mines and storage facilities for natural gas and petroleum products are located at distances that will not pose a threat to the NPP (regardless of the location variant).

The system of road and rail network is designed in such a way as to limit the possibility for vehicles capable of transporting dangerous goods approaching the critical NPP facilities. In addition, vehicle inspections will be carried out before entering the NPP site (at a safe distance from facilities important for its safety).

Potential risks related to traffic of sailing vessels and accidents in maritime transport were also analysed. The results of these analyses will be taken into account when determining appropriate countermeasures when designing the NPP.

Both location variants are adequately distant from the existing airports. However, bearing in mind the potential threat from air transport, a decision may be made at the stage of the construction project on the possible modification of air traffic rules for a specific class of aircrafts, including a ban on flights.

Explosions related to military facilities and activities

Bearing in mind the location of the nearest existing military complexes and using the opinion of the General Staff of the Polish Army, it was stated that military facilities (bases and training grounds) located at a great distance from the Project Area (in both location variants) do not pose a threat to the security of the NPP in the context of the effects of a possible explosion.

Impact of external events on the safety of the AP1000 nuclear power unit

The pre-construction safety report (PCSR) for the AP1000 nuclear reactor, which was submitted to the UK Office for Nuclear Regulation (ONR) in 2017, shows that the impact of external events on safety will be relatively small. The applied design solutions for this unit make it extremely resistant to the loss of safety functions of facilities and systems.

Further detailed safety analyses will be carried out at the stage of preparation of the Preliminary Safety Report for the nuclear power plant (i.e. at the design stage).

VI.2.11.2 Internal events that may endanger the safety of a nuclear power plant

The following internal events may occur, which may affect the safety of power plants, the source of which is within the boundaries of the fence of the power plant or inside its facilities:

- internal fires,
- internal flooding,
- damage to pressure parts of various systems on the site of the power plant,
- internal explosions,
- impacts of objects with high kinetic energy, including those resulting from explosions inside power plant buildings,
- release of toxic, corrosive and flammable substances,
- collapses, improper handling of loads – including accidents related to the fall of fuel sets,
- biological contaminants,
- transport accidents in the NPP area,
- electromagnetic interaction from power plant systems and equipment.

Detailed safety analyses for internal threats will be carried out and presented in the Preliminary Safety Report, which is the main part of the nuclear safety documentation required to be submitted together with the application to the President of the National Atomic Energy Agency for a NPP building permit.

VI.2.11.3 Risk of accident resulting in environmental contamination

Risk of a serious industrial failure

The analysis of the quantities and types of chemical substances which will be stored on the premises of the NPP shows that, regardless of the sub-variant selected, the NPP should be included in the category of plants at high risk of a major industrial accident, in particular due to the types and quantity of stored and used harmful chemicals.

Risk of a major accident in a nuclear context

The probability of a severe failure in a Generation III/III+ NPP related to the degradation of the reactor core, including its meltdown, is less than one in a million years and the probability of large releases of radioactive substances into the surroundings of the NPP in the event of a severe accident is less than one in every 10 million years.

The probability of an initiating event leading to a failure without melting the reactor core is about 7.8 x 10^{-7} per reactor per year, while the probability of an event initiating a failure with the melting of the reactor core is 1.7 x 10^{-7} per reactor per year.

Risk of a natural disaster

In the site region of both site variants, there is no tectonic zone because of which the area might fail to be considered consistent with the requirements for siting a nuclear facility. There are no risks associated with river floods, either. As a result of the analysis of the maximum expected sea level, the elevation of the nuclear power plant was determined not lower than: for Variant 1 – Lubiatowo - Kopalino site 9.5 m above sea level for nuclear facilities (nuclear island) and 8.3 m above sea level for other facilities and for Variant 2 – Żarnowiec site 9.0 m above sea level for nuclear facilities (nuclear island), 6.5 m above sea level for other facilities of the NPP and 5.0 m above sea level for cooling water pumping stations situated near the seashore (Sub-area 3).

Geological hazards such as filtration deformations, erosion and accumulation phenomena, weak-bearing soils, landslides and karst phenomena will be taken into account at the design stage of the NPP in such a way that they do not threaten the nuclear facility. The impact of extreme weather events will also be taken into account.

At the stage of preparing this report, no serious hazards were identified which would prevent the construction of the NPP in each of the site variants. The above-mentioned conditions will be taken into account at the design, construction and operational stages of the NPP.

Risk of a construction disaster

Nuclear power plant facilities shall be designed with high safety reserves in relation to the extreme values of parameters and loads (including possible combinations thereof) associated with these external and internal events/hazards. They are characterised by high quality of workmanship and control regime during operation – which prevents their damage, and even more so construction disasters, as a result of which NPP generation III / III + facilities are resistant to extreme hazards / external events.

Preventing the occurrence of emergency situations

Preventive measures against emergency situations will be adopted in all phases of the Project. Countermeasures are to cover both the occurrence of an industrial failure and an accident in a nuclear context. The measures to be taken into account include, among others, appropriate procedures and care for their compliance, proper organisation of the construction site, appropriate construction of the reactor, its safety systems and NPP facilities (in particular: reactor buildings and engine rooms, as well as buildings and auxiliary facilities important from the point of view of ensuring nuclear safety and radiological protection).

VI.2.12 Associated infrastructure not covered by an application for the decision on environmental conditions

In addition to the implementation of the Project, a number of associated investments will be carried out, necessary for the construction and subsequent operation of the nuclear facility. The planned associated investments will be executed as separate projects, independent of the main Project and under separate administrative decisions. As part of the associated investments, as an accompanying infrastructure of the NPP not covered by the application, the following will be implemented:

Marine off-loading facility (MOLF) and haulage road

Due to the requirements for the transport of oversized elements, which are components of the NPP and which are impossible to transport by land, it is planned to build a marine structure for off-loading near the location of each NPP site variant. Oversized cargo will be delivered by sea to intermediate ports in Gdansk or Gdynia, from which, after reloading to smaller vessels, they will be transported to the planned MOLF facility, respectively for each NPP location. Then, using a self-propelled transport platform, they will be transported (by a land haulage road built as part of the associated infrastructure), directly to the Project Area.

Due to the conditions of the shore and the seabed, it was assumed that the MOLF facility would be an openwork steel and reinforced concrete structure, supported on piles. It will be perpendicular to the coastline to the depth of the seabed of about 5–6 m. Flat-bottomed "ro-ro" barges (roll-on/roll-off – entry onto the barge and exit from the barge on wheels) will be moored to the facility. The width of the MOLF deck will be 17 m, so as to allow free passage of a self-propelled platform with a load with width of up to 15 m. The clearance under the MOLF over the coastline will be about 5 m.

In Variant 1 – Lubiatowo - Kopalino site, the total length of the MOLF facility will be approximately 1.1 km, and the length of the haulage road approximately 0.9 km (2 km in total).

In Variant 2 – Żarnowiec site, the total length of the MOLF facility will be approximately 0.7 km, and the length of the haulage road approximately 10.3 km (11 km in total). Along the haulage road, pipelines of make-up water will be built for the NPP cooling system and discharge pipelines for treated industrial wastewater along with the necessary infrastructure.

Roads

The existing road system near the location of both NPP variants – its technical parameters and capacity – were analysed. The analysis was carried out starting from national roads, i.e. from the A1 motorway, connecting the north with the south of the country to poviat and communal roads located in the immediate vicinity of the Project's location. Local conditions have been taken into account, including the proximity of a large urban agglomeration and coastal areas attractive for tourists, which are eagerly visited in the summer season. Traffic simulations were carried out taking into account local traffic, seasonal traffic and traffic generated by construction vehicles of the NPP. The analyses show that the existing road system is insufficient and its reconstruction is ineffective from the point of view of NPP's needs. Therefore, it was proposed to build a new road connection from the junction on the national road S6 (Kashubian Route) in Strzebielino to both location variants or from the junction in Łęczyce directly to the location of the NPP in Variant 1.

For Variant 1 – Lubiatowo - Kopalino site, the length of the new road connection from the Strzebielino junction will be approximately 40.5 km and it will be based mainly on the reconstruction of existing poviat roads (nos. 1455G, 1438G and 1430G) and communal roads (Łęczyce, Luzino, Gniewino). Alternatively, the construction of a road from the junction in Łęczyca to a new track with a length of approximately 30 km is being considered.

For Variant 2 – Żarnowiec site, the length of the new road connection will be approximately 23.5 km and will be based mainly on the reconstruction of existing poviat roads (nos. 1446G, 1445G and 1526G) and communal roads (Łęczyce, Luzino, Gniewino).

However, the final route of the main access road to the NPP will be the subject of separate analyses and environmental impact assessment procedures.

Railways

For the purposes related to the implementation of the Project, it is planned to reconstruct the disused section of railway line no. 230 between Wejherowo and Garczegorze and include it in the railway line no. 202 between Gdańsk Główny and Stargard. As part of the reconstruction of the railway line no. 230, it is assumed to build a new, electrified single-track railway line with passing tracks with a travel speed of up to 80 km/h.

In Variant 1, it is planned to rebuild the entire section of line 230 from Wejherowo to Garczegorze, i.e. on the length of approximately 63 km and the related new railway line with a length of approximately 9 km in the vicinity of Choczewo, leading to the Project Area. Additionally, a rail link will be constructed in order to enable railway rolling stock to travel towards Garczegorze, without the need to change the train front end. However, bearing in mind the current standards for the construction of new railway lines, i.e. up to a speed of 120 km/h, the possibility of delineating a railway line, partly after a new track, is being considered. For this purpose, the location of a new alternative railway corridor was analysed, connecting line 229 south of Łeba directly with the location of the NPP and on the section from Choczewo to Rybno.

In Variant 2, rebuilding of line 230 on the Wejherowo – Rybno section (approximately 13 km) and reconstruction of the dismantled former railway siding no. 230A from line no. 230 to the Project Area (approximately 9 km) are planned.

In the Project Area for both location variants, a new railway line for passenger service is planned, which will include a passenger platform with a length of approximately 300 m and a freight platform. During the operational stage of the Project, 10 passenger train journeys are planned each day, whereas the frequency of journeys may change depending on needs. Cargo train traffic will be negligible — it has been assumed that on average 1 cargo train will travel quarterly throughout the entire operational lifecycle of the NPP.

High and medium voltage power grids (110 kV and 15 kV)

For Variant 1 – Lubiatowo - Kopalino site, for the purpose of powering the NPP construction site (demand of approximately 50 MW) and at the commissioning and backup power supply stage in the operational phase of the NPP (demand of approximately 100 MW), it is planned to build an underground 110 kV cable line from two independent power points: one of the 400/110 kV Żarnowiec power station, the other from the 110/15 kV GPZ Jackowo power station (from the direction of Lębork). Both underground 110 kV cable lines will be run along the rebuilt 230 railway line and will be terminated at the 110/15 kV power station located in the Project Area, which is part of the NPP infrastructure.

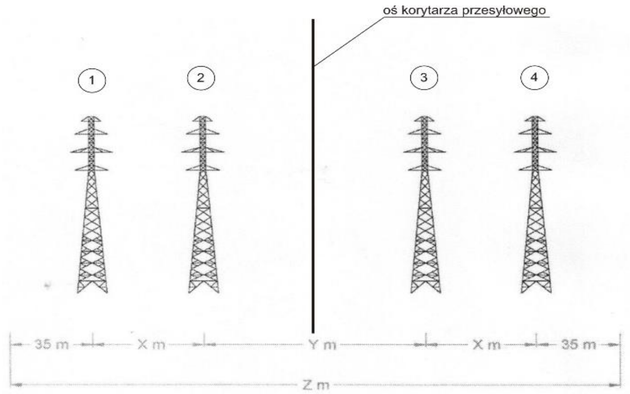
In addition, at the stage of development works, it may be necessary to create a connection to the local 15 kV medium voltage distribution network, which can be routed by an underground cable line from the existing 15 kV overhead line located in Słajszewo, at a distance of approximately 1.6 km from the Project Area.

For Variant 2 – Żarnowiec site, the existing 15/0.4 kV stations in this area can be used for the purposes of development works, while for the purpose of powering the NPP construction site and for the needs of backup power supply in the NPP operational phase, it is planned to build a double-circuit 110 kV cable line with a length of approximately 1.5 km from the existing 400/110 kV Żarnowiec power station and terminate it with a 110/15 kV power station located in the Project Area.

However, the final locations of the 110 kV and 15 kV power connection points will depend on the transmission network and distribution network operators and will be specified in the connection conditions issued at the request of the NPP’s Investor.

Highest voltage power grids (400 kV)

With regard to the implementation of the transmission network for the evacuation of power from the NPP, two 400 kV current circuits are planned independently for each nuclear unit, with one circuit constituting the basis for the power evacuation from the unit, and the other circuit constituting the reserve of power evacuation from the adjacent nuclear unit [Figure VI.2.12- 1]. Each of the current circuits will have a capacity of up to 1,800 MW of electrical power and will be able to work independently. Bearing in mind the possibility of a potential expansion of the NPP with another, fourth power unit, the land reserve for the fourth double-circuit power line will be taken into account at the design stage of the network of power evacuation lines.



oś korytarza przesyłowego	axis of the transmission corridor

Figure VI.2.12- 1 Transmission corridor (right-of-way) of four 400 kV lines

Source: Study of HV corridors. Jacobs Clean Energy Limited, 2020

Z [m] is the width of the right-of-way composed of the sum of the sections according to the formula below:

$$Z = 2 \times (35 + X) + Y,$$

whereas a value of *35* [m] from the edge of the right-of-way to the axis of the extreme line is conditioned by maintaining a safe distance, above which the permissible levels of electromagnetic field will not be exceeded for areas intended for permanent presence of people. The remaining dimensions will depend on the structure of the poles and the construction technology used, as well as on the operating conditions of power lines determined by the transmission network operator.

After analysing the possible routes of the 400 kV line corridor for Variant 1 – Lubiatowo - Kopalino site, three potential corridors were selected, the shortest of which is both environmentally and technically beneficial, and was selected as optimal. It also has the least impact on the exposure in the landscape and the current land development.

Due to the short distance of Variant 2 – Żarnowiec site from the potential connection point (approximately 1.5 km), one route of the 400 kV line corridor has been selected, which will require partial wiring of four crossed 400 kV lines used to evacuate power from the neighbouring "EW Żarnowiec" pumped-storage power plant.

Nevertheless, the final location of the NPP connection point to the National Power System (and thus the route of the 40 kV line corridor) will require detailed network and field analyses, and will result from the conditions for connection of nuclear units to the transmission network, which the NPP Investor may request the transmission network operator to determine only after obtaining a decision on the location of the nuclear facility.

Residential infrastructure

The type and place of accommodation of employees are conditioned by the phases of implementation of the Project. During the construction phase, at the development stage, employees will be accommodated mainly in the existing base of hotels, guesthouses and private accommodation, while at the construction stage, a container base for approximately 1,000 employees will be located within the Project Area. In addition, as part of the associated infrastructure, a second accommodation base will be created for about 50% of the maximum number of all employees involved in the construction stage, i.e. for about 4,000 people. The remainder of the employees will be located in the existing private sector accommodation base.

As a result of the analyses, the location of the housing base in Choczewo was selected, distant from the location of the NPP in Variant 1 by approximately 9 km by rail and approximately 16 km by car/bus, and in Variant 2 by approximately 20 km by car/bus. Due to the lack of a railway line in Variant 2 – Żarnowiec site, bus transport will be organised. In the vicinity of the Project Area in Variant 1 – Lubiatowo - Kopalino site, there will be a car park for approximately 2,300 vehicles, while in Variant 2 – Żarnowiec site, a car park for approximately 3,500 vehicles is planned.

Local Information and Training Centre

As part of the associated infrastructure, a Local Information and Training Centre (LIC), combining both the function of an information centre for the nuclear power plant and radiological protection, and a training and conference centre with hotel facilities for 800 people, which will include a conference room, a cinema room, lecture halls, a room with an exhibition on nuclear power and office and welfare rooms. During the construction phase of the NPP, LiCs will additionally provide housing facilities for accommodation of senior staff. The establishment of a training centre with a simulator for future NPP operators on the premises of the LIC is not excluded. The location of the LIC in the Gniewino commune, Wejherowo district, has been preliminarily determined, however, due to the location requirements for the NPP simulator, the final location of the LIC will be the subject of consideration at a later stage of the Project.

Water supply and sewage system infrastructure

For the purpose of supplying the NPP with potable water and in the construction phase with water for technological processes (demand at the level of 1,860 m^3/d), a new water intake will be created, which will include 4 wells drilled to a depth of approximately 100 m and a working capacity of 35 m^3/h each (configuration of 3 working wells and 1 standby well). In order to compensate for the daily unevenness of water intake and peak demand up to 158 m^3/h, construction of 2 treated water retention tanks with a capacity of approximately 300 m^3 each is planned. From the groundwater intake, raw water will be pumped to the new water treatment plant (SUW). Both the water intake and the treatment plant (SUW) will be located in the vicinity of the Project Area for each of the location variants.

The balance of domestic and process wastewater from the NPP construction facilities will amount to approximately 1,785 m^3/d. For such a demand, construction of a sewage treatment work with a technological system consisting of two mechanical-chemical-biological treatment lines with nitrogen removal is planned in the immediate vicinity of the Project Area, where each is designed for a flow of approximately 900 m^3/d. Wastewater after treatment will be directed by discharge sewerage directly into the Baltic Sea, and the place of discharge will be located at a distance of not less than 1 km from the seashore. At this stage, it is allowed that the built sewage treatment work can be used in all phases of the Project.

The predicted concentrations in the wastewater of substances from the construction site are presented in the table below [Table VI.2.12- 1].

Table VI.2.12- 1 Limit indicators on discharge into the Baltic Sea and predicted concentrations in treated wastewater

Parameter	Maximum permitted concentration level according to applicable standards	Assumed concentration in treated sewage from the planned treatment work
BOD_5 mg O_2/l	15	< 15
COD mg O_2/l	125	< 125
Total suspensions mg/l	35	< 35
Total nitrogen mg N/l	15	< 15
Total phosphorus mg P/l	2	< 2

Source: The Regulation of the Minister of Maritime Economy and Inland Navigation of 12 July 2019 on substances particularly harmful to the aquatic environment and the conditions to be met when discharging wastewater into waters or ground, as well as discharging stormwater or thaw water into waters or for water devices

Telecommunications and teletechnical infrastructure

In order to provide telephone communications and broadband access to IT services for the planned NPP, an ICT cable fibre optic network will be built as part of the associated infrastructure with reference to a minimum of 2 independent backbone network nodes of the telecommunications operator selected by the NPP Investor.

Similarly, in the case of providing emergency communications and crisis management, it will be necessary to build telecommunication infrastructure from scratch with reference to the nearest network nodes. The technical services of the National Police Headquarters – the administrator of the ICT network – are responsible for servicing telecommunications systems related to departmental communication, including emergency communication in

Poland. The network nodes important from the point of view of NPP site variants are located in the Poviat/Municipal Police Headquarters, while the main node is located in the Voivodeship Police Headquarters in Gdańsk. All other institutions responsible for crisis management are connected to this network, including the unit operating at the Voivode of Pomorskie Voivodeship.

This involves the need to integrate the NPP into the telecommunications infrastructure related to crisis management through a minimum of 2 independent network nodes. It is assumed that the main node will be the node located in the Provincial Police Headquarters in Gdańsk (POL20 layer) and the POL35 – Słupsk layer node. In the absence of technical possibilities to connect the NPP to the Słupsk node, the NPP will be included in a minimum of 2 POL300 nodes – e.g. Puck, Wejherowo, Lębork.

The method of integrating the NPP into the telecommunications infrastructure for the purposes of emergency communications will be determined at the stage of obtaining the location permit, and the detailed technical solution – at the stage of arrangements with operators/administrators of crisis management telecommunications systems.

Place of deposit of spoil material in the sea (dumping site)

During dredging works in the sea, regardless of the location variant under consideration, two types of bottom spoil will be formed for development: cohesive (clays, sandy clays, silts) and non-cohesive (sands, gravels) in connection with the construction of cooling water or make-up water ducts / pipelines or the MOLF. Before the start of the excavation works, additional sand and gravel tests will be carried out for the content of pollutants and the possibility of their reuse, e.g. to replenish beaches or for construction purposes. Preliminary studies carried out in this area have shown the absence of chemical impurities.

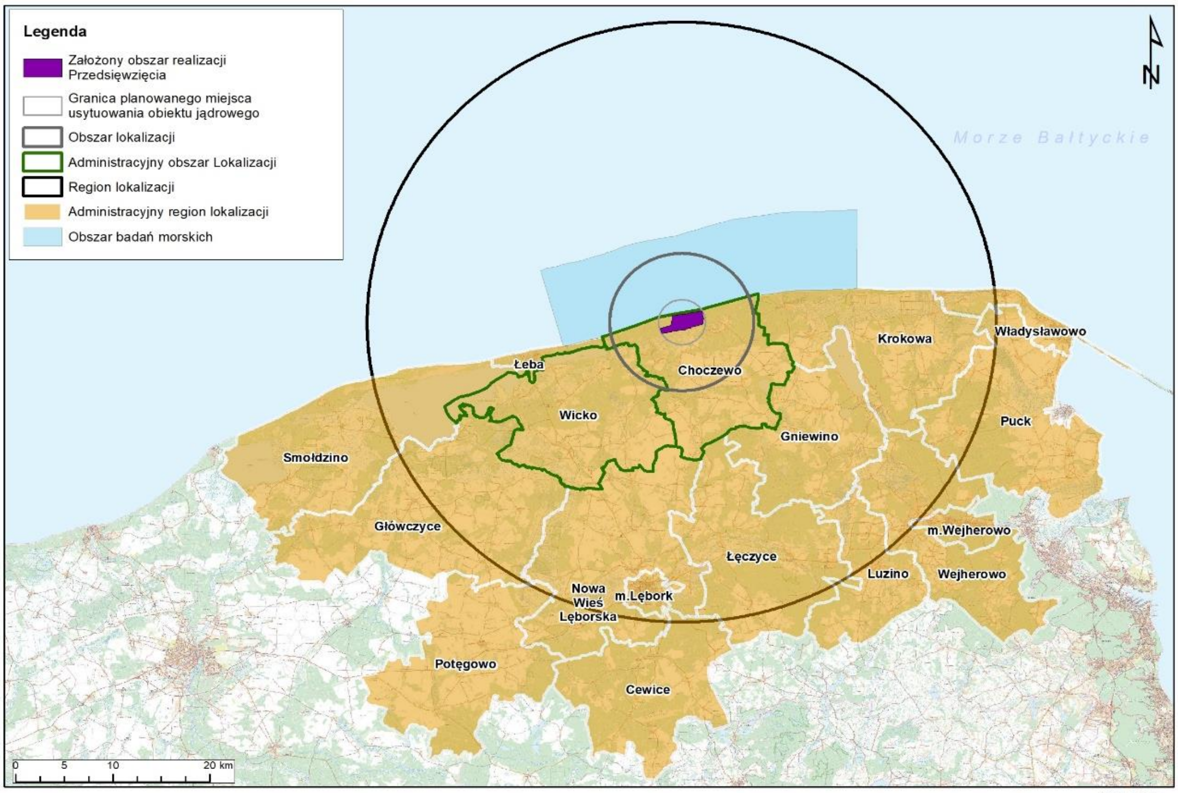
Based on preliminary calculations, it is assumed that the area of the dumping site will amount to approximately 130 ha, on which the spoil (cohesive soils) in the amount of approximately 3.3 million m^3 will be deposited. The adopted parameters of the dumping site make it possible to deposit the spoil in each of the considered sub-variants. For both NPP site variants, due to their mutual location, it is optimal to locate the dumping site in the POM.39a.I reservoir located at a distance of approximately 3.8 km from the coastline, at a depth of approximately 17.5–21 m.

VI.3 Environmental characteristics

VI.3.1 Area adopted for environmental survey

In accordance with the EIA Act and the GDOŚ Decision, the detailed studies of the natural elements of the environment carried out for the purposes of preparing this EIA Report covered the expected impact of the planned project on the environment. The first research in this area began in the first quarter of 2017. Determination of the scope of the environmental survey program was preceded by collecting all information available at that stage regarding the Project, but it should be kept in mind that at that time the target boundaries of the Project Area (described as part of the Project's characteristics) had not been yet precisely determined.

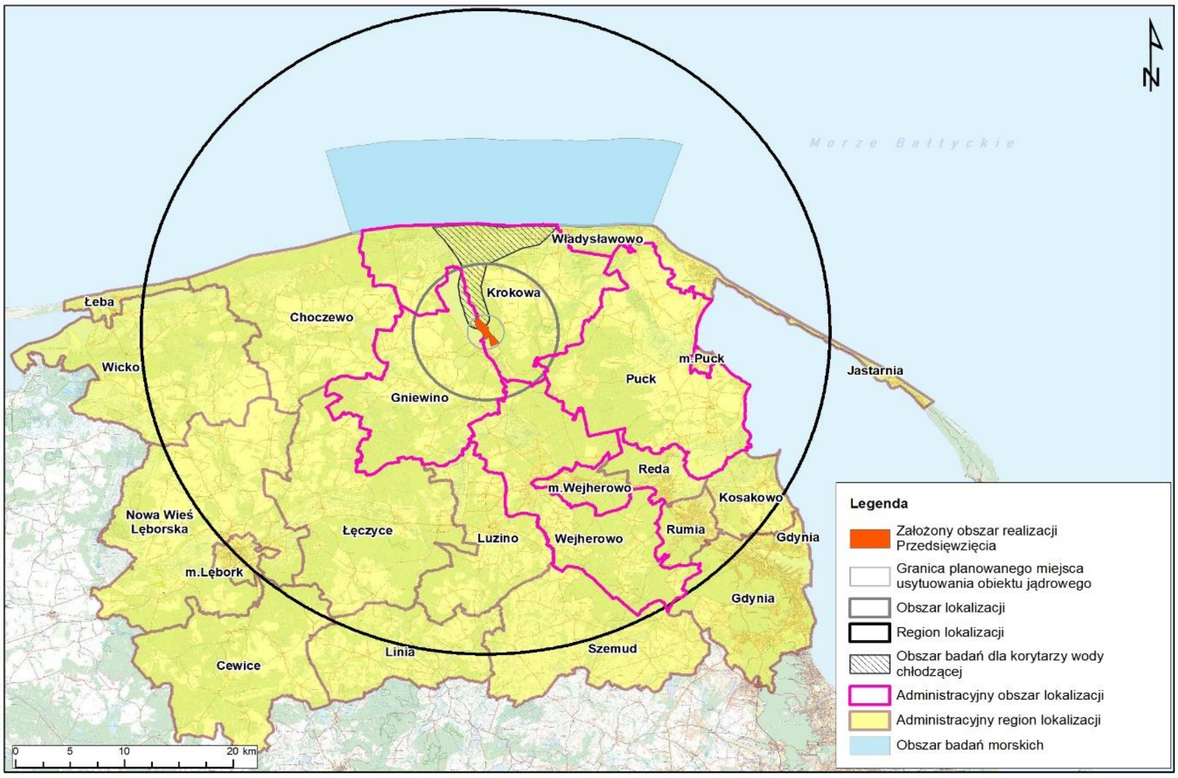
For the purpose of carrying out the surveys for each of the location Variants considered and their sub-variants, the areas constituting the basis for determining the territorial scope of the research for individual components of the environment were then identified [Figure VI.3.1- 1] and [Figure VI.3.1- 2]. This approach made it possible to carry out a comprehensive program of environmental research in the forecasted area of the Project's impact. When determining the above-mentioned research areas, the different specificity and scope of research on individual components of the environment, as well as various formal and legal requirements for individual components of the environment, and formal and legal requirements and industry guidelines for nuclear facilities were taken into account.



Legenda	Legend
Założony obszar realizacji Przedsięwzięcia	Assumed Project Area
Granica planowanego miejsca usytuowania obiektu jądrowego	Boundaries of the planned site for the nuclear facility
Obszar lokalizacji	Site Area
Administracyjny obszar Lokalizacji	Administrative Site Area
Region lokalizacji	Site Region
Administracyjny region lokalizacji	Administrative Site Region
Obszar badań morskich	Marine survey area

Figure VI.3.1- 1 Areas adopted for environmental survey – Variant 1 — Lubiatowo - Kopalino site

Source: In-house study



Legenda	Legend
Założony obszar realizacji Przedsięwzięcia	Assumed Project Area
Granica planowanego miejsca usytuowania obiektu jądrowego	Boundaries of the planned site for the nuclear facility
Obszar lokalizacji	Site Area
Region lokalizacji	Site Region
Obszar badań dla korytarzy wody chłodzącej	Survey area for cooling water corridors
Administracyjny obszar lokalizacji	Administrative Site Area
Administracyjny region lokalizacji	Administrative Site Region
Obszar badań morskich	Marine survey area

Figure VI.3.1- 2 Areas adopted for environmental survey – Variant 2 — Żarnowiec site

Source: In-house study

To sum up, the adopted research areas, which are the basis for the performance of environmental survey, cover the Project Area and the area where potential impacts related to the implementation of the Project may occur for each of the considered Site Variants and their sub-variants.

It should be emphasised that the current state of individual components of the environment is presented in relation to the adopted survey areas. At the same time, it was the starting point for assessing the Project's impact on the environment.

VI.3.2 Description of natural (biotic) elements of the environment for the analysed Variants in the Project impact area (land, transitional and marine areas)

VI.3.2.1 Variant 1 — Lubiatowo - Kopalino site

The assumed Project Area in Variant 1 Lubiatowo - Kopalino site includes in its major part the coastal strip and unfixed white and grey dunes along with species of flora and fauna characteristic only for these habitats, as well as the area of open waters of the Baltic Sea. The natural values of the land area are characterised by high value primarily in the field of: natural habitats, vascular plants, fungi and lichens, and terrestrial invertebrates. The presence of dunes, wetlands and permanent reservoirs and watercourses determined the high natural value of the analysed area. This value decreases significantly towards the south. However, the maritime area is characterised by the greatest natural value due to the occurrence of rich avifauna.

The natural significance of individual areas located in the assumed Project Area is reflected in the occurrence of numerous protected areas within its borders, established on the basis of national and international law. The following protected areas are located in the land part of the Project Area: Słowiński National Park (only buffer zone), Choczewskie Cisy Nature Reserve, Mierzeja Sarbska Nature Reserve, Seaside Protected Landscape Area, ecological sites: Osoczne Oczko, Peat bog in Szklana Huta, Źródliska Bezzimiennej, Gajówka and Natura 2000 areas: Białogóra PLH220003, Mierzeja Sarbska PLH220018, Piaśnickie Łąki PLH220021, Jeziora Choczewskie PLH220096, Lasy Lęborskie PLB220006. Marine survey area of the Project in the analysed Variant is located entirely in the special protection area (SPA) of birds — Przybrzeżne wody Bałtyku PLB990002. Protected areas established under international law and occurring in the survey area overlap with the above-mentioned national protected areas.

In order to fully identify the elements of the natural environment of the Project Area and the designated buffers from its borders, for the purposes of this EIA Report, field surveys were carried out in the years 2017–2020, taking into account the marine and land parts of the analysed area. Studies of the land part included: plant communities and natural habitats, vascular plants, bryophytes, macroscopic and lichenised fungi, invertebrates (terrestrial and freshwater), ichthyofauna, herpetofauna (amphibians and reptiles), avifauna, chiropterofauna and other mammals. The subject of the natural survey in the marine area were such biotic elements of the marine environment as: phyto- and zooplankton, benthos including phyto- and zoobenthos, ichthyofauna, including adult fish and ichthyoplankton, avifauna and marine mammals. Below are the synthetic results of the research carried out in the above-mentioned scope.

VI.3.2.1.1 Land area

- Plant communities and natural habitats

The research covered primarily plant communities and natural habitats protected by national and international law. In the survey area, 123 patches of habitats of importance to the Community were recorded, covering an area of approximately 983 ha, classified into 12 natural habitat types: 2120 Shifting dunes along the shoreline with *Ammophila arenaria* (‘white dunes') (*Elymo-Ammophiletum*); 2130* Fixed coastal dunes with herbaceous vegetation (‘grey dunes’) (*Helichryso-Jasionetum litoralis*); 2180 Wooded dunes of the Atlantic, Continental and Boreal region; 3150 Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition*-type vegetation; 6510 Lowland hey meadows (*Alopecurus pratensis*, *Sanguisorba officinalis*) (*Arrhenatherion*); 7140 Transition mires and quaking bogs (mostly with vegetation of the *Scheuchzerio-Cariceteanigrae nigrae* type); 9110 *Luzulo-Fagetum* beech forests; 9130 *Asperulo-Fagetum* beech forests (*Dentario glandulosae-Fagenion, Galio odorati-Fagenion*); 9160 Sub-Atlantic and medio-European oak or oak-hornbeam forests of the *Carpinion betuli (Stellario-Carpinetum*); 9190 Old acidophilous oak woods with *Quercus robur* on sandy plains (*Quercetea robori-petraeae*); 91D0* Bog woodland; 91E0* Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*) (*Salicetum albo-fragilis, Populetum albae, Alnenion glutinoso-incanae,* alder forests on percolating mires).

- Vascular plants

Research on vascular plants was carried out in selected forest, water and waterside complexes, as well as scrub, meadow, dune and peat bog complexes showing potentially favourable conditions for the occurrence of species of naturally valuable vascular plants. The subject of the survey were plants of the following species: protected under EU and national law, as well as rare and endangered species and invasive species.

In the area of research, a total of 16 protected, rare and endangered vascular plant species were surveyed at 255 sites. The species under strict protection included: cross-leaved heath (*Erica tetralix)*, bog-myrtle (*Myrica gale*), while the species under partial protection include the bird's-nest orchid (*Neottia nidus-avis)*, the white waterlily (*Nymphaea)*, the common restharrow (*Ononis repens)*.

In addition, six invasive species of alien vascular plants were surveyed: the Himalayan balsam (*Impatiens glandulifera)*, the prickly cucumber (*Echinocystis lobata)*, the Japanese knotweed (*Reynoutria japonica)*, the black cherry (*Padus serotina)*, the beach rose (*Rosa rugosa)* and the Canadian waterweed (*Elodea canadensis)*.

- Bryophytes

The research was carried out in selected forest, water and over-water complexes, as well as scrub, meadow, dune and peat bog complexes showing potentially favourable conditions for the occurrence of species of naturally valuable bryophytes. The subject of the survey were bryophyte species: protected under EU and national law, rare and endangered species, species that are indicators of primeval forests and invasive alien species.

In the survey area for bryophytes, a total of 40 protected, rare and endangered species of bryophytes were inventoried. These include species such as the anomodon moss (*Anomodon attenuatus*), leucobryum moss – *Leucobryum glaucum*, flat Neckera – *Neckera complanata*. In addition, two alien, locally invasive species were surveyed, i.e. the heath star moss (*Campylopus introflexus*) and the cape thread-moss (*Orthodontium lineare*).

- Macroscopic fungi (Macromycetes)

The research was conducted in selected forest, dune and peat areas showing potentially favourable conditions for the occurrence of species of valuable macroscopic fungi. The subject of the survey were species of macroscopic fungi: protected under national law, rare and endangered and invasive alien species.

As part of the inventory, a total of 67 species of macrofungi were found in the survey area, out of which 6 species were identified to be under strict protection (*Antrodia albobrunnea, Hydnellum aurantiacum, Hydnellum ferrugineum, Hydnellum peckii, Sarcodon glaucopus, Sarcodon scabrosus*) and three under partial protection (*Inonotus obliquus, Suillus flavidus, Xerocomus parasiticus*). The species included in the list of endangered species in Poland (Red List) accounted for 25 taxa.

The conducted research also allowed to find 1 species new to Poland (Lat. *Artomyces microsporus*) and 1 alien species (Lat. *Aureoboletus projectellus*). There are also 11 species from the Register of Rare and Endangered Species and 20 species of fungi that have been identified as rare species – known from several sites around Poland and infrequently occurring in Europe.

- Lichenised fungi (lichen)

The survey was conducted in selected forest and dune areas showing potentially favourable conditions for the occurrence of species of naturally valuable lichenised fungi (lichens). The subject of the survey were lichen species: protected under EU and national law, rare and endangered, and species that are indicators of primeval forests.

In the survey area for lichenised fungi, a total of 18 protected, rare and endangered species of lichenised fungi (lichens) were surveyed. These include: elegant camouflage lichen - *Melanohalea elegantula*, *Melanohalea exasperata* and *Ramalina fastigata* (species under strict protection), true Iceland lichen - *Cetraria islandica*, shrubby cup lichen - *Cladonia arbuscula*, cream cup lichen - *Cladonia portentosa*, reindeer lichen - *Cladonia rangiferina*, *Hypogymnia tubulosa*, *Imshaugia aleurites*, *Pleurosticta acetabulum*, *Ramalina farinacea*, *Usnea dasopoga*, *Usnea hirta* (species covered by partial protection), as well as the oakmoss - *Evernia prunastri*, *Graphis scripta*, *Melanelixia glabratula* (*Melanelia glabra*).

- Terrestrial invertebrates

The survey focused on terrestrial invertebrate species: protected under EU and national law, valuable, rare and endangered species, and invasive species. Very high biodiversity of terrestrial invertebrates was found in the survey area. This is evidenced by the demonstration of a number of very valuable and unique species of terrestrial invertebrates, including 2 species so far not demonstrated in Poland (*Acrotrichis insularis* and *Meotica exilima*), species known only from one site in the country (*Agathidium nudum, Euplectus infirmus*), or species recognised as relics of primeval forests (*Carabus intricatus, Stenagostus rhombeus, Micridium halidaii, Dropephylla linearis*). However, the Project Area itself did not present high biodiversity.

During the research in the 2020 season, 39 species of diurnal butterflies from 4 families were found. Most of the butterflies found for the survey area of Variant 1 – Lubiatowo - Kopalino site are thermophilic (mesophilic) or ubiquitous species. These are quite common species, numerous and widely distributed throughout the country, including in anthropogenic areas.

In the survey area of Variant 1, 3,484 dragonflies belonging to 34 species were found. The core of the grouping were eurytopic species, such as the azure damselfly, red-eyed damselfly, common winter damselfly, four-spotted chaser, black-tailed skimmer, or downy emerald. Tyrfophilic and tyrphobonist species have been observed (large white-faced darter, northern white-faced darter, dark whiteface, white-faced darter), associated with water pineapple (green hawker), nenufar vegetation (lilypad whiteface), or sphagnobionts (Eurasian baskettail). In the study area, no occurrence and reproduction of the green snaketail was found.

During the study of mayflies, two species, *Ephemera vulgata* and *Eph. Danica* were found, which are widespread in Poland and considered common. The third species of this family, *Ephemera lineata*, is not expected to occur in the survey area.

During the research on xylophages, no protected species or species listed in the Annexes to Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild flora and fauna (Habitat Directive) have been found. Only two species included in the Red List have been recorded: the lesser stag beetle and the hoverfly *Temnostoma vespiforme*.

During the study, 21 species of hymenoptera were recorded, mainly from the Apidae family (a total of 15). Of these, 8 species were bumblebees subject to partial species protection, observed in relative numbers. The most frequently noted were: the common carder bee - *Bombus pascuorum*, white-tailed bumblebee - *B. lucorum complex*, early bumblebee - *B. pratorum* and large earth bumblebee - *B. terrestris*. At two sites (within one surveyed area) the presence of *Epeoloides coecutiens* was found. It occurs in many places in different parts of Poland.

The sand hopper was found in more than half of the survey area. The density in the places of occurrence was on average from 32 to 222 individuals/m^2 on a given survey route. Both adults and juveniles were found, which indicates good prospects for the conservation of the species in the studied area.

- Freshwater invertebrates

The survey covered all areas of freshwater occurrence in the area designated for the inventory (ponds, lakes, canals, watercourses, springs and adjacent meadows). The survey focused on fresh water invertebrate species: protected under EU and national law, valuable, rare and endangered species, and invasive species. 2 freshwater invertebrates covered by species protection have been found here: the large white-faced darter – *Leucorrhinia pectoralis* and a caddisfly *Crunoecia irrorata*. Despite the search, the presence of other protected aquatic invertebrate species from Appendixes II and IV of the Habitats Directive has not been found.

In the case of macrozoobenthos, representatives of 34 bottom macroinvertebrate taxa representing 6 invertebrate phyla were also found. The largest number of taxa (12 taxa) was registered at the site located on the Lubiatówka River. The highest value of the Margalef's diversity index was recorded at the site on the Chełst River.

The taxonomic composition of the studied aquatic ecosystems is typical of flowing waters and small reservoirs and mostly includes eurytope taxa with a wide tolerance to environmental factors. Most of them are native taxa. The presence of representatives of an invasive alien species – the New Zealand mud snail – *Potamopyrgus antipodarum* was recorded only at the site on the Lubiatówka River.

- Ichthyofauna

The research covered: the Chełst and Choczewka rivers, the Biebrowski Kanał, as well as the unnamed kanał and the Lake Kopalińskie. The survey included ichthyofauna species, including those protected under EU and national law, valuable and rare species on the Red List and invasive alien species.

In the spring period, in the watercourses covered by the study, five species of ichthyofauna were found: the river trout - *Salmo trutta m. fario*, the ninespine stickleback - *Pungitius pungitius*, the European perch - *Perca fluviatilis*, the European river lamprey - *Lampetra fluviatilis*, the three-spined stickleback - *Gasterosteus aculeatus*. In the summer period, 9 species were found: pike - *Esox lucius*, the perch, the river trout, the gudgeon - *Gobio gobio*, the ide - *Leuciscus idus*, the common dace - *Leuciscus leuciscus*, the stickleback, the tench - *Tinca tinca* and the common roach - *Rutilus rutilus*. In the autumn period, one species was found at these sites, i.e. the river trout.

Survey fishing was also carried out on Lake Kopalińskie in the studied location. 7 species of fish were found in the reservoir: the perch - *Perca fluviatilis*, the common roach - *Rutilus rutilus*, the common rudd - *Scardinius erythrophthalmus*, the common bream - *Abramis brama*, the white bream - *Blicca bjoerkna*, the bitterling - *Leucaspius delineatus* and rose *Rhodeus sericeus amarus*.

- Herpetofauna – amphibians

The research covered a total of 23 water reservoirs (including drainage ditches, canals, and ponds). The survey focused on amphibian herpetofauna species protected under EU and national law, valuable and rare species included in the Red List and invasive alien species.

As a result of the conducted research, the occurrence of 12 species of amphibians was recorded: the smooth newt - *Lissotriton vulgaris*, the great crested newt - *Triturus cristatus*, the common toad - *Bufo bufo*, the European green toad - *Bufotes viridis*, the natterjack toad - *Epidalea calamita*, common spadefoot toad - *Pelobates fuscus*, the European tree frog - *Hyla arborea*, the common frog - *Rana temporaria*, the moor frog - *Rana arvalis*, the pool frog - *Pelophylax lessonae*, the edible frog - *Pelophylax kl. esculentus* and the marsh frog - *Pelophylax kl. ridibundus*, as well as frogs belonging to the group of green frogs with undetermined species affiliation. The most commonly observed species were the common frog, the pool frog and the common newt.

- Herpetofauna – reptiles

Reptile surveys were conducted at designated sites important from the point of view of biodiversity (ecotone sites). The survey focused on reptile herpetofauna species protected under EU and national law, valuable and rare species included in the Red List and invasive alien species.

As a result of the conducted survey, the occurrence of 4 species of reptiles was recorded: the sand lizard - *Lacerta agilis*, the viviparous lizard - *Zootoca vivipara*, the slow worm - *Anguis fragilis* and the common European viper - *Vipera berus*. The most numerous species was the viviparous lizard. The slow worm and the sand lizard were also observed in large numbers. The least numerous species in the studied area was the common European viper. In the research area, there was no record of reptile species under strict protection: the European pond turtle - *Emys orbicularis* and the smooth snake - *Coronella austriaca*, as well as invasive species: the red-eared slider - *Trachemys elegans* and other alien species of turtles that can winter in the Polish climate.

- Avifauna

The research was conducted in 3 separate periods: of breeding, wintering and migration, in order to illustrate the full phenological profile for avifauna. The survey focused on bird species protected under EU and national law, valuable and rare species included in the Red List and invasive alien species.

Survey during the breeding season allowed to determine the presence of 142 species of birds in the studied area. Among them, 20 are listed in Annex I of Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds (the Birds Directive), 128 species are under strict protection. The ten most abundant species considered valuable include: the woodlark - *Lullula arborea*, the red-backed shrike - *Lanius collurio*, the common grasshopper warbler - *Locustella naevia*, the red-breasted flycatcher -

Ficedula parva, the European nightjar - *Caprimulgus europaeus*, the common quail - *Coturnix coturnix*, the common crane - *Grus grus*, the mallard duck - *Anas platyrhynchus*, the river warbler - *Locustella fluviatillis*, the barred warbler - *Curruca nisoria*. The least numerous valuable species are: white-tailed eagle - *Haliaeetus albicilla*, the common sandpiper - *Actitis hypoleucos*, the Savi's warbler - *Locustella luscinioides*, the greylag goose - *Anser anser*, the Eurasian hobby - *Falco subbuteo*, the gadwall - *Marca stepera*, the whooper swan - *Cygnus cygnus*, the Eurasian coot - *Fuilica atra*, the common kestrel - *Falco tinnunculus*, the European penduline tit- *Remiz pendulinus*, the great grey shrike - *Lanius excubitor*, European turtle dove - *Steptopelia turtur*, the long-eared owl - *Asio otus*, the Blyth's reed warbler - *Acrocephalus dumetorum*.

Survey during the wintering period showed the presence of 10 species of birds in the studied area, all under strict protection, including one of them requiring active protection. 3 species were listed in the Birds Directive. The most abundant species was the fieldfare - *Turdus pilaris*, the least numerous species was the chaffinch - *Fringilla coelebs*.

Studies during the migration period allowed to find a total of 48,205 individuals of birds belonging to 161 species. Of the birds found, 144 species are under strict protection, 8 species under partial protection, 9 species belonged to the game group, 32 species are listed in Annex I of the Birds Directive, and 21 are listed in the Red List. The five most numerous species are: the common starling - *Sturnus vulgaris*, the long-tailed duck - *Clangula hyemalis*, the European herring gull - *Larus argentatus*, an undefined goose of the *Anser* species, the black-headed gull - *Chroicocephalus ridibundus*. The least numerous species are: the pallid harrier - *Circus macrourus*, the common whitethroat - *Sylvia communis*, the garganey - *Spatula querquedula*, the ruddy turnstone - *Arenaria interpres*, the European serin - *Serinus serinus*, the Caspian gull - *Larus cachinnans*, the little grebe - *Tachybaptus ruficollis*, the dunnock - *Prunella modularis*, the common quail - *Coturnix coturnix*, the osprey - *Pandion haliaetus*, the green sandpiper - *Tringa ochropus*, the short-eared owl - *Asio flammeus*, the Eurasian reed warbler - *Acrocephalus scirpaceus*, the long-eared owl - *Asio otus*.

- Mammals

Chiropterofauna - chiropterofauna studies consisted of recording echolocation signals of bats on 14 constant transects, searching for shelters of breeding colonies and wintering grounds, and conducting constant continuous monitoring in designated places. Studies have shown the presence of 10 species of bats in the analysed area. All domestic species of bats are subject to strict species protection. Of the species found, only two of them belong to rare species: the western barbastelle - *Barbastella barbastellus* and the northern bat - *Eptesicus nilssonii*. The remaining species are common both in the country and the region.

Other species of mammals - studies of other mammal species allowed to determine the presence of 20 species of mammals in the analysed area, and for 6 of them an assessment of the population status was carried out (i.e. for the wolf - *Canis lupus*, the European beaver - *Castor fiber*, otters - *Luther lutra*, the common shrew - *Sorex araneus*, the Eurasian pygmy shrew - *Sorex minutus*). In addition, at least 13 species of small mammals typical of the country and the region were found. There were many rodents, such as: the yellow-necked mouse - *Apodemus flavicollis*, the striped field mouse - *Apodemus agrarius*, the bank vole - *Myodes glareolus*, the Eurasian pygmy shrew - *Sorex minutus* and the common shrew - *Sorex araneus* and the Mediterranean water shrew - *Neomys anomalus*, the wood mouse - *Apodemus sylvaticus*, the harvest mouse - *Micromys minutus*, squirrels - *Sciurus vulgaris* and the martens - *Martes sp*.

When making the natural characteristics of the studied area, the ecological corridors existing in this area were also analysed. The Project Area is within the reach of the Northern Ecological Corridor (KPn), which is one of the sections of pan-European corridors, whose role is to ensure ecological connectivity on a national and continental scale. There are also ecological corridors of supra-regional rank in this area: coastal (covering almost the entire Project Area), South Baltic – running along the Baltic coast and overlapping with the migration routes of birds, as well as ecological corridors of regional rank and corridors of subregional rank adjacent to the Project Area (connectors of regional and supra-regional corridors). Numerous local ecological corridors connect corridors of subregional and regional rank.

The planned Project will be located in the area currently occupied by the habitats of the coastal strip, which is an area of occurrence of numerous plants, bryophytes and fungi, including valuable species. These habitats, due to their distribution, constitute ecological continuity and make it possible for species of the above-mentioned groups of organisms to spread. The coastal strip located between Natura 2000 areas: Białogóra PLH220003 and Mierzeja Sarbska PLH220018 serves as an ecological corridor for vascular plants, plant communities, as well as for bryophytes, macroscopic fungi and lichens.

In the case of terrestrial invertebrates, an important ecological corridor is a strip of beaches and coastal dunes, which are a habitat for special species – halobionts and halophiles (e.g. sand hopper). In other cases, especially in the case of insects, ecological corridors do not play a big role due to the insects' ability to fly allowing for efficient migration. The following rivers were considered important ecological corridors in the case of freshwater invertebrates: Chełst, Choczewka, Lubiatówka, Bezimienna and Biebrowski Kanał, located in the survey area, which may constitute migration routes for aquatic invertebrates.

With regard to amphibians and reptiles, no significant migration routes running through the Project Area were found.

The Project Area is located at a distance of approximately 15 km from the borders of the Słowiński National Park, which is an important area for the European Community as the UNESCO Biosphere Reserve "Man and the Biosphere" and a wetland area designated under the *Convention on wetlands of international importance especially as waterfowl habitat*, signed in 1971 (Ramsar Convention). The area of the Słowiński National Park is an important place of rest and prey for 109 species of migratory avifauna. Particularly important from the point of view of migratory avifauna are the Natura 2000 sites designated to protect migratory bird species and their important habitats, among which the following areas are of importance for the implementation of the planned Project:

– Przybrzeżne wody Bałtyku PLB990002 – coincides with the Project Area in the maritime part, while in the land part it borders with it;
– Pobrzeże Słowińskie (PLB220003) – located about 14 km from the Project Area;
– Lasy Lęborskie (PLB220006) – located about 9 km from the Project Area.

Due to the location of Natura 2000 sites within a radius of 20 km from the Project Area, it is assumed that the entire research site is located within ecological corridors connecting the above-mentioned areas, including corridors of regional and local importance.

Ecological corridors in relation to chiropterofauna can be considered roadside avenues and mid-field trees of a linear nature, along which bats of all species migrate daily between day hideouts and prey grounds, and all such structures should be treated as potential routes of bats. On the basis of literature data and in-house studies, it also appears that these structures are also used during seasonal migrations (spring and autumn). On the other hand, open areas are characterised by low activity. In addition, the edge of the forest adjacent to the southern shore of the Baltic Sea is an important migration corridor, along which spring and autumn flights of Pipistrellus bats (especially the Nathusius's pipistrelle) and Common noctule bats between summer residence places and wintering grounds take place.

Natural ecological corridors for mammals, especially medium and large ones, are forest complexes, linear systems of trees, rivers and river valleys and the strip of sea coast. Some surveyed mammal species are characterised by attachment to habitats with a high degree of naturalness. Natural migration corridors for large mammals are forest areas and connected tree complexes. The coastal strip overgrown with treestands is a continuous element of the landscape. This creates favourable conditions for the migration of large and medium-sized mammals (e.g. ruminants and predators, e.g. wolves).

VI.3.2.1.2 Marine area

The survey of marine biotic elements was carried out in the period from March 2017 to October 2020 in an area of approximately 275 km^2, stretching from 148.5 to 179.5 km of sea shore at a distance of 8.5 km from the coastline into the sea. About 78% of the area is in open sea waters, while 22% of the area is in coastal waters.

- Plankton

Plankton is a complex of organisms consisting of single-celled plants – phytoplankton – and small size animals (of millimetres or less) – zooplankton, which are suspended in the water. Phytoplankton account for about 45% of global annual primary production and are direct food for zooplankton, which in turn provides food for predators, including commercially important fish species.

The results of the conducted studies of phytoplankton and zooplankton indicate that the groups of these organisms in the analysed area show features typical of this plankton group in the southern Baltic Sea. In addition, none of the taxa found in the research area is protected or included in the lists of endangered species.

- Benthos

Benthos is a system of freshwater and saltwater organisms which inhabit the top layer of the bottom of aquatic ecosystems. Benthos is divided into phytobenthos, i.e. plant organisms, and zoobenthos, i.e. animal organisms. Phytobenthos are a group of micro- and macroscopic plant organisms growing on the hard and soft bottom, both fresh and saltwater sea bodies of the euphotic zone.

Phytobenthos in the marine survey area was characterised by an average species diversity (7 species) and scanty and uneven overgrowing of the stony bottom (the coverage of the surface of stones with macroalgae amounted to maximum 15%).

As a result of the survey, a total of 21 macrozoobenthos taxa were found. In terms of share in the total abundance, *Pygospio elegans* dominated (49%), while biomass was dominated by *Limecola balthica* clam (51%). Representatives of macrozoobenthos important in terms of abundance and biomass also included mussels *Mya arenaria*, *Mytilus spp*., *Cerastoderma glaucum* and polychaetes of the genus *Marenzelleria*. The shallow zone (0–3 m) was inhabited almost exclusively by the crustacean *Bathyporeia pilosa*, the zone of 3-5 m by *Bathyporeia pilosa*, *Hediste diversicolor* and *Marenzelleria sp.* while the zone of 5-26 m by *Pygospio elegans*.

The term meiobenthos refers to microscopic, benthic invertebrate animals whose sizes are limited by the mesh size of the sieves used to extract these animals from the sediment: 1 mm and 0.038 mm. Meiobenthos is represented by almost all types of invertebrates, and in particular by such groups as: free-living nematodes (Nematoda), benthic copepods (*Harpacticoida*), free-living flat worms – Turbellaria, as well as oligochaetas and gastrotrichas. The results obtained during the survey indicate the characteristics typical of this plankton group in the southern Baltic Sea.

- Macroalgae and angiosperms

Macroalgae were represented by 7 species: the green algae *Cladophora glomerata*, the brown algae *Ectocarpus siliculosus, Pylaiella littoralis, Sphacelaria cirrosa, Stictyosiphon tortilis* and the red algae *Ceramium diaphanum* and *Vertebrata fucoides*. The red algae *Ceramium diaphanum* are under strict protection in accordance with national law.

- Natural habitats

Within the marine survey area, one type of habitat was found, formed by the filamentous red algae *Vertebrata fucoides*. The area of the habitat is 0.3 km^2, which is 0.11% of the total analysed marine survey area. In the area where phytobenthos was not found, two habitats were distinguished on the basis of the macrozoobenthos structure: the sandy bottom habitat in the photic zone of the Baltic Sea, dominated by the *Limecola balthica* mussel, with an area of 161.84 km^2, and the sandy bottom habitat in the aphotic zone of the Baltic Sea, dominated by the *Limecola balthica* mussel, with an area of approximately 113 km^2.

- Ichthyofauna

Within the marine survey area, a total of 30 fish species were recorded, of which the following were thoroughly analysed in this EIA Report: cod, flounder, sprat, herring, flatfish, the sand launce, the sand eel, perch, roach, zander, bream, smelt, the sand goby, the common seasnail and the river lamprey. In the spring season, fish belonging to 19 taxa were identified. In the summer season the number of taxa reached 24, in the autumn season a total of 19 taxa of fish and lampreys were caught, while in winter this number fell to 10 taxa.

- Ichthyoplankton

During the entire period of ichthyoplankton research carried out in the marine survey area, the roe of two species of fish and larvae and juveniles belonging to 11 fish taxa were caught. The species composition of the roe was dominated by sprat eggs (99.5% share in the total roe abundance during the entire survey period). Cod roe, on the other hand, was negligible in abundance (0.5%).

- Avifauna (including migratory and seabirds)

The seabirds found in the studied area include in particular the following orders: the *Gaviiformes*, the grebes (*Podicipediformes*), the pelicans (*Pelecaniformes)*, the storks (*Ciconiiformes*), the Anseriformes, the Charadriiformes, and only the family of the rails (*Rallidae*) from the order of cranes (*Gruiformes*). For the purposes of this EIA Report, a survey of avifauna was carried out in two zones: coastal and high sea.

The total number of all observed birds in the coastal zone was 32,491 individuals. The most numerous species of the total number of birds observed were: the Long-tailed Duck (46.3%), the Velvet Scoter (26%) and the Herring Gull (9.4%). Eight species from Annex I of the Birds Directive (the horned grebe - *Podiceps auritus*, the Sandwich tern - *Thalasseus sandvicensis*, the common tern - *Sterna hirundo*, the Arctic tern - *Sterna paradisaea*, the black-throated loon - *Gavia arctica*, the red-throated loon - *Gavia stellata*, the common loon - *Gavia immer*, the little gull - *Hydrocoloeus minutus*) were found in the coastal area.

A total of 24 species of waterfowl have been recorded in the high seas zone of the area. The highest abundances were shown for sea ducks: the velvet scoter (66.5%) and the long-tailed duck (31.5%), which together accounted for as much as 98% of birds found during the year. The third most numerous species was the common Scoter, whose number exceeded 1% of the avifauna group. Six species from Annex I of the Birds Directive (the horned grebe, the sandwich tern, the common tern, the black-throated loon, the red-throated loon, the little gull) were found in the survey area in the high-seas zone, but they appeared in very few numbers.

- Mammals

Marine mammals regularly found in Polish Baltic waters include: the common porpoise (*Phocoena phocoena*) and the grey seal (*Halichoerus grypus*). In addition, two other species of seals living in the Baltic Sea are also observed, i.e.: the common seal (Phoca vitulina) and the ringed seal (Phoca hispida). Porpoise appeared sporadically in the marine survey area for the analysed Project during the summer, autumn and winter periods. During the observation from the land, no alive seals were observed, but three dead seals were found. No marine mammals were observed during the survey cruises. In the survey area, the presence of the harbour seal and the ringed seal was also not found.

The marine survey area was also analysed in terms of the occurrence of ecological corridors of ichthyofauna, avifauna and mammals. The results of the conducted research and literature data indicate that the most important migration corridors of the ichthyofauna flowing into the Baltic Sea along the Piaśnica River (a corridor mainly for salmonids and eels, but also used by perches and roaches) and small watercourses flowing into the Baltic Sea: Lubiatówka and Bezimienna (corridors for salmonid fish migrating up and down the river, and perch and roach to a lesser extent). In the case of the open waters of the Baltic Sea, fish migration corridors have not been defined. The migration of seabirds in the Baltic region is very poorly understood, especially in terms of movements of waterfowl, and especially species closely related to the marine environment. It is assumed that some of the movements must take place on the east-west axis and on the northeast-southwest axis, because these axes are the shortest way between breeding grounds and wintering grounds. Birds associated with the marine environment (especially sea ducks, grebes, loons, razorbills) also migrate along the coastline of the southern Baltic Sea. As part of the research of marine mammals, it was confirmed that the Baltic Sea covered by the survey in connection with the planned Project is periodically used by porpoises and grey seals.

VI.3.2.2 Variant 2 — Żarnowiec site

The assumed Project Area in Variant 2 includes a small part of the coastal strip and unfixed white and grey dunes along with species of flora and fauna characteristic only for these habitats. The conducted field research gave grounds to conclude that the natural values of the land area are characterised by high value primarily in the field of: natural habitats, vascular plants, fungi and lichens, and terrestrial invertebrates. The remaining areas of the land part of the analysed area, with a higher natural value, were concentrated mainly in the central part of the survey area – the area after the unfinished construction of the nuclear power plant in Żarnowiec, the surroundings of Lake Żarnowieckie and along the course of the Piaśnica River below the mouth of Lake Żarnowieckie and the coastal strip in the vicinity of Karwieńskie Błota II and Widowo. The second area where the natural value was higher than average were the areas lying in the northern part of the survey area in the strip of the planned cooling system pipeline corridor together with technical infrastructure. These are areas with a high degree of naturalness, which results in the occurrence of well-preserved plant communities characteristic of wet meadows. Also in the coastal strip, there occur species characteristic of this type of habitat, and at the same time rare on a national scale due to specific requirements. The natural values of these areas are also significantly influenced by ditches and drainage channels that give the possibility of living and breeding of amphibians, especially species under strict protection and listed in Annex II to the Habitats Directive. On the other hand, the marine area is characterised by the highest natural value in terms of avifauna, which is primarily related to the observed abundance of bird species important in this region (long-tailed ducks, common scoters and velvet scoters) and, to a lesser extent, the composition and abundance of phytobenthos.

The natural value of individual areas located in the assumed Project Area is reflected in the occurrence of protected areas within its borders, established on the basis of national and international law. The following protected areas are located in the land part of the Project Area, established in accordance with the Act of 16 April 2004 on Nature Protection (Nature Protection Act): Nature Reserves: Piaśnickie Łąki, Widowo, Długosz Królewski in Wierzchucin, Źródliska Czarnej Wody, Białogóra, Zielone, Nadmorski Landscape Park, Seaside Protected Landscape Area, Puszcza Darżlubska Protected Landscape Area, Natura 2000 areas: Białogóra PLH220003, Piaśnickie Łąki PLH220021, Opalińskie Buczyny PLH220099, Jeziora Choczewskie PLH220096, Widowo PLH220054, Orle PLH220019, Trzy Młyny PLH220029, Bielawa i Bory Bażynowe PLH220063, Lasy Lęborskie PLB220006, Puszcza Darżlubska PLB220007, Bielawskie Błota PLB220010 and ecological sites: Porąbski Moczar, Świecińska Topiel, Jezioro Witalicz, Księża Łąka. Marine survey area of the Project in Variant 2 – Żarnowiec site is located entirely in the special protection area (SPA) of birds Przybrzeżne wody Bałtyku PLB990002. Protected areas established under international law and occurring in the survey area overlap with the above-mentioned national protected areas.

In order to fully identify the elements of the natural environment of the Project Area and the designated buffers from its borders, for the purposes of this EIA Report, field surveys of the designated area were carried out in the years 2017–2020, taking into account the marine and land parts. Studies of the land part included: plant communities and natural habitats, vascular plants, bryophytes, macroscopic and lichenised fungi, invertebrates (terrestrial and freshwater), ichthyofauna, herpetofauna (amphibians and reptiles), avifauna, chiropterofauna and other mammals. The subject of the natural survey in the marine area were such biotic elements of the marine environment as: phyto- and zooplankton, benthos including phyto- and zoobenthos, ichthyofauna, including adult fish and ichthyoplankton, avifauna and marine mammals. Below are the synthetic results of the research carried out in the above-mentioned scope.

VI.3.2.2.1 Land area

- Plant communities and natural habitats

The research covered primarily plant communities and natural habitats protected by national and international law. In the Research Area of Variant 2 – Żarnowiec site, 230 patches of habitats important for the Community were recorded, covering an area of approximately 2,456 ha, classified to 14 natural habitat types: 1130 Estuaries; 2120 Shifting dunes along the shoreline (*Elymo-Ammophiletum*); 2180 Wooded dunes of the Atlantic, Continental and Boreal region; 3110 Oligotrophic waters containing very few minerals of sandy plains; 3150 Natural eutrophic lakes with *Nympheion*, *Potamion* - type vegetation; 6410 Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion*); 6510 Lowland hay meadows (*Arrhenatherion*); 7140 Transition mires and quaking bogs (mostly with *Scheuchzerio-Caricetea nigrae* - type vegetation); 9110 Luzulo-fagetum beech forests (*Luzulo-Fagenion*); 9130 Asperulo-Fagetum beech forests (*Dentario glandulosae-Fagenion*, *Galio odorati-Fagenion*); 9160 Sub-Atlantic and medio-European oak or oak-hornbeam forests of the Carpinion betuli (*Stellario-Carpinetum*); 9190 Old acidophilous oak woods (*Quercetea robori-petraeae*); 91D0* Bog woodland; 91E0* Alluvial forests with Alnus glutinosa and Fraxinus excelsior (*Salicetum albo-fragilis, Populetum albae, Alnenion glutinoso-incanae*, alder swamps).

- Vascular plants

Research on vascular plants was carried out in selected forest, water and waterside complexes, as well as scrub, meadow, dune and peat bog complexes showing potentially favourable conditions for the occurrence of species of naturally valuable vascular plants. The subject of the survey were plant species protected under EU and national law, rare and endangered species and invasive species.

In the assumed Project Area, Variant 2, a total of 58 protected, rare and endangered species of vascular plants were surveyed, including 2 species of algae. Among the species under strict protection, the following were found: sedge, the common spotted orchid, the heath spotted-orchid, the round-leaved sundew, *Gladiolus imbricatus*, *Goodyera repens, Hildenbrandia rivularis*, the Siberian iris, the lake quillwort, *Littorella uniflora*, the bog-myrtle, the least water-lily, the adder's-tongue.

In addition, 3 species of invasive vascular plants were inventoried: the Himalayan balsam - *Impatiens glandulifera*, the Japanese knotweed *Reynoutria japonica* and the Sakhalin knotweed - *Reynoutria sachalinensis*.

- Bryophytes

The research was carried out in selected forest, water and over-water complexes, as well as scrub, meadow, dune and peat bog complexes showing potentially favourable conditions for the occurrence of species of naturally valuable bryophytes.

The subject of the survey were bryophyte species: protected under EU and national law, rare and endangered species, species that are indicators of primeval forests and invasive alien species. 46 valuable species of bryophytes were surveyed within the research area, as well as 1 species considered invasive (the heath star moss - *Campylopus introflexus*).

- Macroscopic fungi (Macromycetes)

The research was conducted in selected forest, dune and peat areas showing potentially favourable conditions for the occurrence of species of valuable macroscopic fungi. The subject of the survey were species of macroscopic fungi: protected under national law, rare and endangered and invasive alien species. A total of 35 species of natural value, as well as 1 very rare species, considered by some researchers to be invasive in Poland – *Boletus projectellus*, were inventoried.

However, according to the 2020 survey, 99 species of macroscopic fungi were found, including 78 species valuable and rare on Polish scale, 6 species new to Poland (*Artomyces microsporus*, *Entoloma glaucobasis*, *Entoloma queletii*, *Entoloma violaceoserrulatum*, *Hylodon raduloides*, *Phlebia ochraceofulva*) and 1 alien species (*Aureoboletus projectellus*).

- Lichenised fungi (lichen)

The survey was conducted in selected forest and dune areas showing potentially favourable conditions for the occurrence of species of naturally valuable lichenised fungi (lichens). The subject of the survey were lichen species: protected under EU and national law, rare and endangered species, and species that are indicators of primeval forests.

In the research area, 45 species of natural value were recorded, e.g. species under strict protection, such as: *Anaptychia ciliaris*, the elegant camouflage lichen - *Melanohalea elegantula*, *Melanohalea exasperata*, the scaly dog pelt lichen - *Peltigera praetextata*, *Ramalina fastigiata*, the cartilage lichen - *Ramalina fraxinea*, the hooded ramalina lichen - *Ramalina obtusata*. Three out of the species identified are important for the Community, 5 species were considered to be relics of primeval forests, 26 were under partial or strict species protection, and almost all of them are also included in the national and/or regional red list.

- Terrestrial invertebrates

The survey focused on terrestrial invertebrate species: protected under EU and national law, valuable, rare and endangered species, and invasive species.

In the Project Area of Variant 2, 18 species of protected land invertebrates were recorded: the tree bumblebee - *Bombus hypnorum*, the red-tailed bumblebee - *Bombus lapidarius*, the white-tailed bumblebee - *Bombus lucorum*, the common carder bee - *Bombus pascuorum*, the early bumblebee - *Bombus pratorum*, the red-shanked carder bee - *Bombus ruderarius*, the large earth bumblebee - *Bombus terrestris*, the lesser searcher beetle - *Calosoma inquisitor*, *Carabus convexus* (the species included in the Red List), *Carabus coriaceus*, *Carabus glabratus*, the blue ground beetle – *Carabus intricatus*, *Formica polyctena* ant (including 50 ant-hills), the red wood ant - *Formica rufa* (including 4 ant-hills), the edible snail - *Helix pomatia*, the large white-faced darter - *Leucorrhinia pectoralis* (the species included in Annexes II and IV of the Habitats Directive), the large copper - *Lycaena dispar* (the species included in Annexes II and IV of the Habitats Directive) and the sand hopper - *Talitrus saltator*. In addition, 209 valuable and rare species have been shown, including 20 species on the Red List.

- Freshwater invertebrates

The survey covered all areas of freshwater occurrence in the area designated for the inventory (ponds, lakes, canals, watercourses, springs and adjacent meadows). The survey focused on fresh water invertebrate species: protected under EU and national law, valuable, rare and endangered species, and invasive species.

During the survey of freshwater invertebrates, 3 protected species were found: the large white-faced darter *Leucorrhinia pectoralis* (a species included in Annexes II and IV of the Habitats Directive), the thick shelled river mussel - *Unio crassus* (a species from Annexes II and IV of the Habitats Directive) and the caddisfly – *Crunoecia irrorata*. In addition, 30 valuable and rare species have been recorded. During the study of macrozoobenthos, 46 taxa of freshwater invertebrates were found. The surveys of macrobenthos found one alien species – the New Zealand mud snail - Potamopyrgus *antipodarum*.

In the research area for Variant 2, it was found that freshwater invertebrates are characterised by average values and natural values and their species composition does not differ much from the fauna of other regions of northern Poland. A distinctive area is the Piaśnica River, where 2 sites of the thick-shelled river mussel - *Unio crassus* - have been recorded.

- Ichthyofauna

The research covered: the Piaśnica River, the Czarna Woda River, Bychowska Struga, the Białogórski Kanał and a number of small unnamed watercourses and drainage ditches, as well as water reservoirs: Lake Dobre and Lake Żarnowieckie. The survey included ichthyofauna species: those protected under EU and national law, valuable and rare species in the Red List and invasive alien species.

As a result of the conducted research 17 species of fish were found in water courses. Most of them were common species (10 taxa). 6 species of fish were covered by various forms of protection, including two species under partial protection and listed in Annex II to the Habitats Directive.

In the Dobre Lake, 6 species of fish were found, including 1, the European eel *Anguilla anguilla* with the minimum landing size and conservation period. On the other hand, 9 species of fish were found in Lake Żarnowieckie, including 1 under partial protection and listed in Annex II to the Habitats Directive – the spined loach.

- Herpetofauna – amphibians

The survey covered a total of 23 water reservoirs (including drainage ditches, canals, and ponds). The survey focused on amphibian herpetofauna species protected under EU and national law, valuable and rare species included in the Red List and invasive alien species.

On the basis of the conducted field survey in the Project Area, the occurrence of 12 amphibian species was recorded out of 14 generally found in Pomerania. Those were: the smooth newt - *Lissotriton vulgaris*, the great crested newt - *Triturus cristatus*, the common toad - *Bufo bufo*, the European green toad - *Bufotes viridis*, the natterjack toad - *Epidalea calamita*, *Pelobates fuscus* toad, the European tree frog - *Hyla arborea*, the common frog - *Rana temporaria*, the moor frog - *Rana arvalis*, the pool frog - *Pelophylax lessonae*, the edible frog - *Pelophylax kl. esculentus,* the Italian edible frog - *Pelophylax kl. ridibundus*, as well as frogs belonging to the group of green frogs whose species affiliation cannot be determined in the field.

The species most often observed both during the mating and vegetative season were: the common frog, the common toad, the European green toad and the pool frog.

- Herpetofauna – reptiles

Reptile surveys were conducted at designated sites important from the point of view of biodiversity (ecotone sites). The survey focused on the following species: species protected under EU and national law, valuable and rare species included in the Red List and invasive alien species.

In the Project Area of Variant 2 – Żarnowiec location, 4 species of reptiles out of 8 species observed in Pomerania were recorded. Those were: the sand lizard - *Lacerta agilis*, the viviparous lizard - *Zootoca vivipara*, the slow worm - *Anguis fragilis* and the common European viper - *Vipera berus*. The most numerous species were: the sand lizard (223 individuals) and the viviparous lizard (119 individuals). The least numerous species was the common European viper, of which only 2 individuals were observed during the entire research period.

In the research area, there was no record of reptile species under strict protection: the European pond turtle and the smooth snake, as well as the grass snake. There were also no invasive species of reptiles, especially the red-eared slider - *Trachemys elegans* and other "American turtles"

- Avifauna

The research was conducted in 3 separate periods: of breeding, wintering and migration, in order to illustrate the full phenological profile for avifauna. The survey focused on bird species protected under EU and national law, valuable and rare species included in the Red List and invasive alien species.

Survey during the breeding season allowed to determine the presence of 140 species of birds in the studied area. Among them, 19 are listed in Annex I of the Birds Directive, and 127 species are under strict protection. The five most numerous species recognised as valuable are the red-backed shrike - *Lanius collurio*, the red-breasted flycatcher - *Ficedula parva*, the woodlark - *Lullula arborea*, the mallard - *Anas platyrhynchos* and the stock dove - *Columba oenas*. The least numerous valuable species are the Blyth's reed warbler - *Acrocephalus dumetorum*, the northern shoveler - *Anas clypeata*, the garganey - Anas querquedula, the long-eared owl - *Asio otus*, the Montagu's harrier - *Circus pygargus*, the whooper swan - *Cygnus cygnus*, the Eurasian coot - *Fulica atra*, the common snipe - *Gallinago gallinago*, the little bittern - *Ixobrychus minutus*, the black-headed gull - *Larus ridibundus*, the greenish warbler - *Phylloscopus trochiloides*, the common tern - *Sterna hirundo* and the little grebe - *Tachybaptus ruficollis*.

Research during the wintering period showed the presence of 22 species of birds in the studied area. These were: the European herring gull - *Larus argentatus*, the common wood pigeon - *Columba palumbus*, the yellowhammer - *Emberiza citrinella*, the whooper swan - *Cygnus cygnus*, the corn bunting - *Miliaria calandra*, the mallard - *Anas platyrhynchos*, the Eurasian coot - *Fulica atra*, the fieldfare - *Turdus pilaris*, the little gull - *Hydrocoloeus minutus*, the black-headed gull - *Larus ridibundus*, the common gull - *Larus canus*, the white wagtail - *Motacilla alba*, the tufted duck - *Aythya fuligula*, the common crane - *Grus grus*, the common chaffinch - *Fringilla coelebs*, the stock dove - *Columba oenans*, the redwing - *Turdus iliacus*, the mute swan - *Cygnus olor*, the goosander - *Mergus merganser*, the smew - *Mergus albellus*, the common goldeneye - *Bucephala clangula*, the lesser black-backed gull - *Larus fuscus*. Among them, 17 species are under strict protection, 4 species are listed in 1 Appendix of the Birds Directive.

Survey during the migration period allowed to find a total of 86,622 individuals belonging to 163 species. Of the birds found, 146 species are under strict protection, 7 species under partial protection, 10 species belonged to the game group, 31 species are listed in Annex I of the Birds Directive, and 19 are listed in the Red List.

The five most numerous species are: the common starling, the common coot, the tufted duck, the common wood pigeon and the greater white-fronted goose. The least numerous species are: the razorbill, the Montagu's harrier, an unspecified harrier *Circus sp*., the pallid harrier, the corncrake, the ring ouzel, the common rosefinch, the common greenshank, the wood sandpiper, the black-legged kittiwake, the spotted flycatcher, the spotted nutcracker, the Eurasian treecreeper, the little grebe, the grey wagtail, the western yellow wagtail, the common quail, the osprey, the great reed warbler, the oriole.

- Mammals

Chiropterofauna

Chiropterofauna studies consisted of recording echolocation signals of bats on constant transects (14 constant transects), searching for shelters of breeding colonies and wintering grounds, and conducting constant continuous monitoring in designated places. Studies have shown the presence of 8 species of bats in the analysed area. All domestic species of bats are subject to strict species protection. The chiropterofauna of the analysed area was dominated by bats from the genus *Pipistrellus sp*., which accounted for 87% of the individuals – these were all three regularly occurring small species: the soprano pipistrelle - *Pipistrellus pygmaeus* (30%), the common pipistrelle *Pipistrellus pipistrellus* (22%) and the Nathusius' pipistrelle - *Pipistrellus nathusii* (35%). A significant share was also played by the common noctule (9%). The remaining species were recorded much less frequently: the serotine bat - *Eptesicus serotinus* accounted for 2%, while unclassified species of bats from the genus *Myotis sp.* and unclassified species of bats from the group of noctules-serotine bats-vespertilionidae *Nyctalus-Eptesicus-Vespertilio* accounted for 1% each.

Other mammal species

Studies of other mammal species allowed to determine the presence of 28 species of mammals. These included among others: the red deer (*Cervus elaphus*), the European fallow deer (*Dama dama*), the roe deer (*Capreolus capreolus*), the wild boar (*Sus scrofa*), the Eurasian badger (*Meles meles*), the red fox (*Vulpes vulpes*), the common raccoon dog (*Nyctereutes procyonoides*), the Eurasian beaver (*Castor fiber*), the Eurasian otter (*Lutra lutra*), the American mink (*Neovison vison*), the European pine marten (*Martes martes*), the beech marten (*Martes foina*), martnes, the European polecat (*Mustela putorius*), the least weasel (*Mustela nivalis*), the European hare (*Lepus europaeus*), the red squirrel (*Sciurus vulgaris*), the European hedgehog (*Erinaceus europaeus*), the European mole (*Talpa europaea*). In the area of the corridors of the pipelines for water making up the cooling system together with technical infrastructure, with the use of the above-mentioned observation methods, the following species of mammals were detected: the red deer (*Cervus elaphus*), the European fallow deer (*Dama dama*), the roe deer (*Capreolus capreolus*), the wild boar (*Sus scrofa*), the Eurasian badger (*Meles meles*), the red fox (*Vulpes vulpes*), the Eurasian beaver (*Castor fiber*), the Eurasian otter (*Lutra lutra*), the American mink (*Neovison vison*), the beech marten (*Martes foina*), the European polecat (*Mustela putorius*), the Eurasian ermine (*Mustela erminea*), the European hare (*Lepus europaeus*), the European hedgehog (*Erinaceus *europaeus*), the European mole (*Talpa europaea*), the common shrew (*Sorex araneus*), the Eurasian pygmy shrew (*Sorex minutus*), the yellow-necked mouse (*Apodemus flavicollis*), the striped field mouse (*Apodemus agrarius*), the bank vole (*Myodes glareolus*), the tundra vole (*Microtus oeconomus*), the common vole (*Microtus arvalis*). Among the species of natural value listed in Annexes II and IV of the Habitats Directive, the following species were found: the wolf, the European beaver, the otter. In addition, the presence of 8 species under partial protection and 2 invasive species (the American mink and the raccoon dog) was recorded.

When making the natural characteristics of the studied area, the ecological corridors existing in this area were also analysed. The Project Area is within the reach of the Northern Ecological Corridor (KPn), which is one of the sections of pan-European corridors, whose role is to ensure ecological connectivity on a national and continental scale. There are also ecological corridors of supra-regional rank in this area: coastal (covering almost the entire Project Area), South Baltic – running along the Baltic coast and overlapping with the migration routes of birds, as well as ecological corridors of regional rank and corridors of subregional rank adjacent to the Project Area (connectors of regional and supra-regional corridors). Numerous local ecological corridors connect corridors of subregional and regional rank.

Part of the Project occupies a significant area (a corridor with a width of 250 to 400 m) located within the continuity of the ecological complex of spit habitats on the section between Białogóra and Karwia, which constitute a potential gene exchange corridor for many endangered plant species, typical of natural habitats. A part of the planned Investment related to cooling water corridors is also designed on the border of the Piaśnickie Łąki Nature Reserve, where about 50% of the area is covered by two types of habitats from Annex I of the Habitats Directive, i.e. 6410 Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) and 9190 Old acidophilous oak woods with *Quercus robur* on sandy plains. This element of the Project is also located in the Natura 2000 area Piaśnickie Łąki PLH220021, thus crossing it almost along its entire length in the north-south axis. Those areas serve as ecological corridors for vascular plants, plant communities, as well as for bryophytes, macroscopic fungi and lichens. An important ecological corridor for most of the studied groups of organisms is also the coastal range between the Natura 2000 areas Białogóra, Piaśnickie Łąki and Widowo.

In the case of terrestrial invertebrates, an important ecological corridor is a strip of beaches and coastal dunes, which are a habitat for special species – halobionts and halophiles (e.g. sand hopper). In other cases, especially in the case of insects, ecological corridors do not play a significant role due to the insects' ability to fly allowing for efficient migration. The following rivers were considered important ecological corridors in the case of freshwater invertebrates: Piaśnica, Czarna Woda, Bychowska Struga, Białogórska Struga and the Białogórski Kanał.

With regard to amphibians and reptiles, no significant migration routes running through the Project Area were found. On the other hand, the flow capacity of the corridors may be influenced by the water infrastructure supplementing the cooling system, which will cross the corridor connecting the Natura 2000 area Łąki Piaśnickie PLH220021 with the Natura 2000 areas Bielawa and Bory Bażynowe PLH220063 and Trzy Młyny PLH220029.

The results of the survey indicate that the entire avifauna survey site is located within the bird migration corridor, including corridors of regional and local importance.

Ecological corridors in relation to chiropterofauna can be considered roadside avenues and mid-field trees of a linear nature, along which bats of all species migrate daily between day hideouts and prey grounds, and all such structures should be treated as potential routes of movement of bats. On the basis of literature data and in-house studies, it was found that these structures are also used during seasonal migrations (spring and autumn). On the other hand, open areas are characterised by low activity. In addition, the edge of the forest adjacent to the southern shore of the Baltic Sea is an important migration corridor, along which spring and autumn flights of Pipistrellus bats (especially the Nathusius's pipistrelle) and Common noctule bats between summer residence places and wintering grounds take place.

Natural ecological corridors for mammals, especially medium and large ones, are forest complexes, linear systems of trees, rivers and river valleys and a strip of sea coast. Some surveyed mammal species are characterised by attachment to habitats with a high degree of naturalness. Natural migration corridors for large mammals are forest areas and connected tree complexes. The coastal strip overgrown with stands of trees is a continuous element of the landscape. Its presence creates favourable conditions for the migration of large and medium-sized mammals (e.g. ruminants and predators, e.g. wolves).

VI.3.2.2.2 Marine area

The survey of marine biotic elements was carried out in the period from March 2017 to October 2020 in an area of approximately 258 km^2, stretching from 132 to 159.5 km of sea shore at a distance of 8.5 km from the coastline into the sea. Marine survey area for Variant 2 – Żarnowiec site is located in 78% of the area in open sea waters, while 22% of the area is located in coastal waters.

- Plankton

Plankton is a complex of organisms consisting of single-celled plants – phytoplankton – and small size animals (of millimetres or less) – zooplankton, which are suspended in the water. Phytoplankton account for about 45% of global annual primary production and are direct food for zooplankton, which in turn provides food for predators, including commercially important fish species.

The results of the phytoplankton surveys indicate that its highest content was recorded near the mouth of the Piaśnica River, and the minimum content at stations located furthest from the mainland in the area of the mouth of Piaśnica river and the Kanał Karwianka. As a result of the research, no phytoplankton species subject to legal protection have been identified. In the marine survey area for Variant 2 – Żarnowiec site, 4 species alien to the Baltic Sea were found. A total of 29 zooplankton taxa were recorded in the study, among which copepods and the water fleas were the most numerous.

- Macroalgae and angiosperms

As a result of the conducted research, the occurrence of vascular plants on the sandy bottom was not found in the marine survey area. However, trace amounts of macroalgae were recorded in some areas of the rocky bottom, i.e. on pebbles and boulders lying on the sandy bottom, which accounted for 5-6% of the studied area and which were covered primarily with epiphytes, mainly mussels. The occurring macroalgae in the depth zone of 5.4-10 m grow unevenly on 1.5 km^2 of the rocky bottom, which constitute 0.6% of the entire surveyed area.

- Benthos

Benthos is a system of freshwater and saltwater organisms which inhabit the top layer of the bottom of aquatic ecosystems. Benthos is divided into phytobenthos, i.e. plant organisms, and zoobenthos, i.e. animal organisms. Phytobenthos are a group of micro- and macroscopic plant organisms growing on the hard and soft bottom, both fresh and saltwater sea bodies of the euphotic zone.

A total of 17 macrozoobenthos taxa were found in the survey area. In terms of share in the total abundance, *Pygospio elegans* dominated (37%), while biomass was dominated by *Limecola balthica* clam (64%). Representatives of macrozoobenthos important in terms of abundance and biomass also included mussels *Mya arenaria*, *Mytilus spp*., *Cerastoderma glaucum* and polychaetes of the genus *Marenzelleria*. The shallow zone (0 – 3 m) was inhabited almost exclusively by the crustacean *Bathyporeia pilosa*, the zone of 3-5 m by *Marenzelleria sp.* while the zone of 5-26 m by *Pygospio elegans*.

The term meiobenthos refers to microscopic, benthic invertebrate animals whose sizes are limited by the mesh size of the sieves used to extract these animals from the sediment: 1 mm and 0.038 mm. Meiobenthos is represented by almost all types of invertebrates, and in particular by such groups as: free-living nematodes (Nematoda), benthic copepods (*Harpacticoida*), free-living flat worms – Turbellaria, as well as oligochaetas and gastrotrichas. The results obtained during the survey indicate the characteristics typical of this plankton group in the southern Baltic Sea.

- Natural habitats

Within the marine survey area, one type of habitat was found, formed by the filamentous red algae *Vertebrata fucoides*. The area of the habitat is 0.3 km^2, which is 0.1% of the total marine area for the analysed Project variant. The habitat created by *Vertebrata fucoides* is also recorded in another region of the Polish coastal zone – on the Rowy boulder deposit area.

- Ichthyofauna

Within the marine survey area, a total of 30 fish species were recorded, of which the following were thoroughly analysed in the EIA Report: cod, flounder, sprat, herring, flatfish, the sand launce, the sand eel, perch, roach, zander, bream, smelt, the sand goby, the common seasnail and the river lamprey. During the spring season, fish belonging to 21 taxa were identified. In the summer season, the number of taxa reached 23. In the autumn season, fish and lamprey belonging to a total of 17 taxa were caught. In winter, the diversity fell to 12 taxa.

- Ichthyoplankton

During the entire period of ichthyoplankton research carried out in the marine survey area, the roe of two species of fish and larvae and juveniles belonging to 12 fish taxa were caught. The species composition of the roe was dominated by sprat eggs (86.8% share in the total roe abundance during the entire survey period), while roe of the fourbeard rockling had a smaller share (12.5%). Cod roe, on the other hand, was negligible in abundance (0.7%).

- Avifauna (including migratory and seabirds)

The seabirds found in the studied area include in particular the following orders: the loons (*Gaviiformes*), the grebes (*Podicipediformes*), the pelicans (*Pelecaniformes)*, the storks (*Ciconiiformes*), the Anseriformes, the Charadriiformes, and only the family of the rails (*Rallidae*) from the order of cranes (*Gruiformes*). For the purposes of this EIA Report, a survey of avifauna was carried out in two zones: coastal and high sea.

The total number of all observed birds in the coastal zone amounted to 31,746 individuals. The most numerous species of the total number of birds observed were: the Long-tailed Duck (51.7%) and the Herring Gull (17.6%). Nine species from Annex I of the Birds Directive (the horned grebe, the sandwich tern, the common tern, the little tern, the black-throated loon, the red-throated loon, the common loon, the little gull and the Mediterranean gull) and 34 species of birds under strict species protection in Poland were found.

A total of 24 species of waterfowl have been recorded in the high seas zone of the survey area. The highest abundances were shown for two species of sea ducks – the velvet scoter (52.1%) and the long-tailed duck (44.7%), and the third most numerous species was the common scoter. Six species from Annex I of the Birds Directive (the horned grebe, the sandwich tern, the whooper swan, the black-throated loon, the red-throated loon, the little gull) and 20 species of birds under strict species protection in Poland were found.

- Mammals

Marine mammals regularly found in Polish Baltic waters include: the common porpoise (*Phocoena phocoena*) and the grey seal (*Halichoerus grypus*). In addition, two other species of seals living in the Baltic Sea are also observed, i.e.: the common seal (Phoca vitulina) and the ringed seal (Phoca hispida). Porpoise appeared sporadically in the marine survey area for the analysed Project during the summer, autumn and winter periods. During the terrestrial observations carried out under this project, a juvenile grey seal (*Halichoerus grypus*) was once observed on 142.7 km of coastline on 5 April 2017. During the research cruises, a seal not assigned to a particular species was observed once.

The marine survey area was also analysed in terms of the occurrence of ecological corridors of ichthyofauna, avifauna and mammals. The results of the conducted research and literature data indicate that the most important migration corridors of the ichthyofauna flowing into the Baltic Sea along the Piaśnica River and Czarna Woda river, which form a corridor mainly for salmonids migrating up and down the river and for eels migrating from rivers and lakes to spawn in the sea. In addition, carp and perch fish living in the lakes of the Central Coast

(Jamno, Bukowo, Kopań, Wicko, Gardno and Łebsko) migrate between them and the sea areas adjacent to the estuaries of the watercourses. In the marine survey area, as in the entire strip of coastal waters, spawning and feeding migrations associated with the natural life cycle of many species of fish take place. However, this is not a linear journey and can be determined in specific areas.

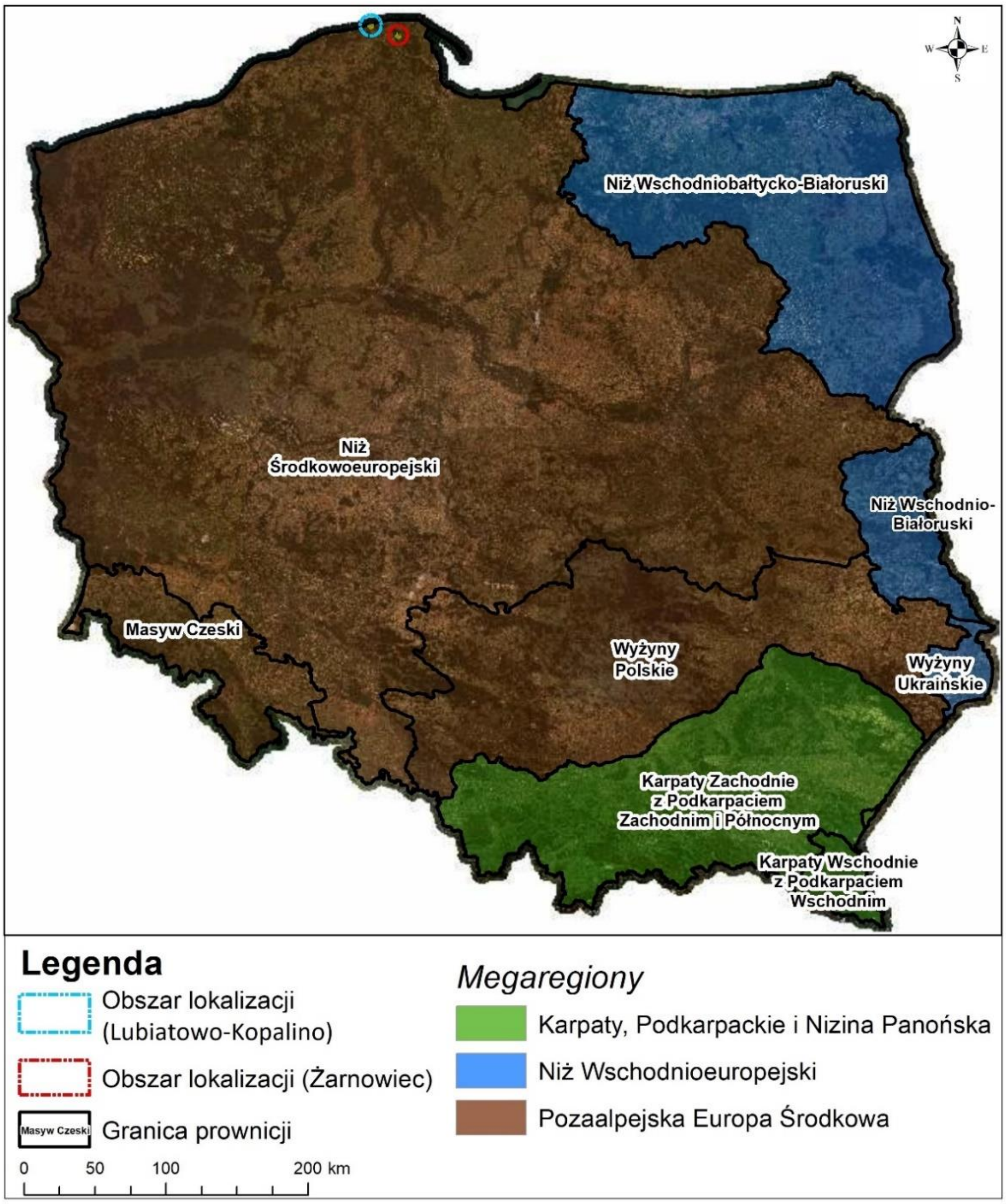
The migration of seabirds in the Baltic region is very poorly understood, especially in terms of movements of waterfowl, and especially species closely related to the marine environment. It is assumed that some of the movements must take place on the east-west axis and on the northeast-southwest axis, because these axes are the shortest way between breeding grounds and wintering grounds. Birds associated with the marine environment (especially sea ducks, grebes, loons, razorbills) also migrate along the coastline of the southern Baltic Sea. As part of the research of marine mammals, it was confirmed that the Baltic Sea covered by the research in connection with the planned Project is periodically used by porpoises and grey seals.

VI.3.3 Description of environmental (abiotic) elements of the analysed variants in the Project impact area (includes land, transitional and marine areas)

VI.3.3.1 Physical-geographical location

Physical-geographical regionalisation is a division in which units, i.e. regions remaining in a certain similarity to each other in terms of location, characteristics in relation to geological structure and topography, climatic conditions, plant communities, water and soil conditions, as well as history, are specified. The individual elements of such a separate unit differ in this view from the neighbouring units.

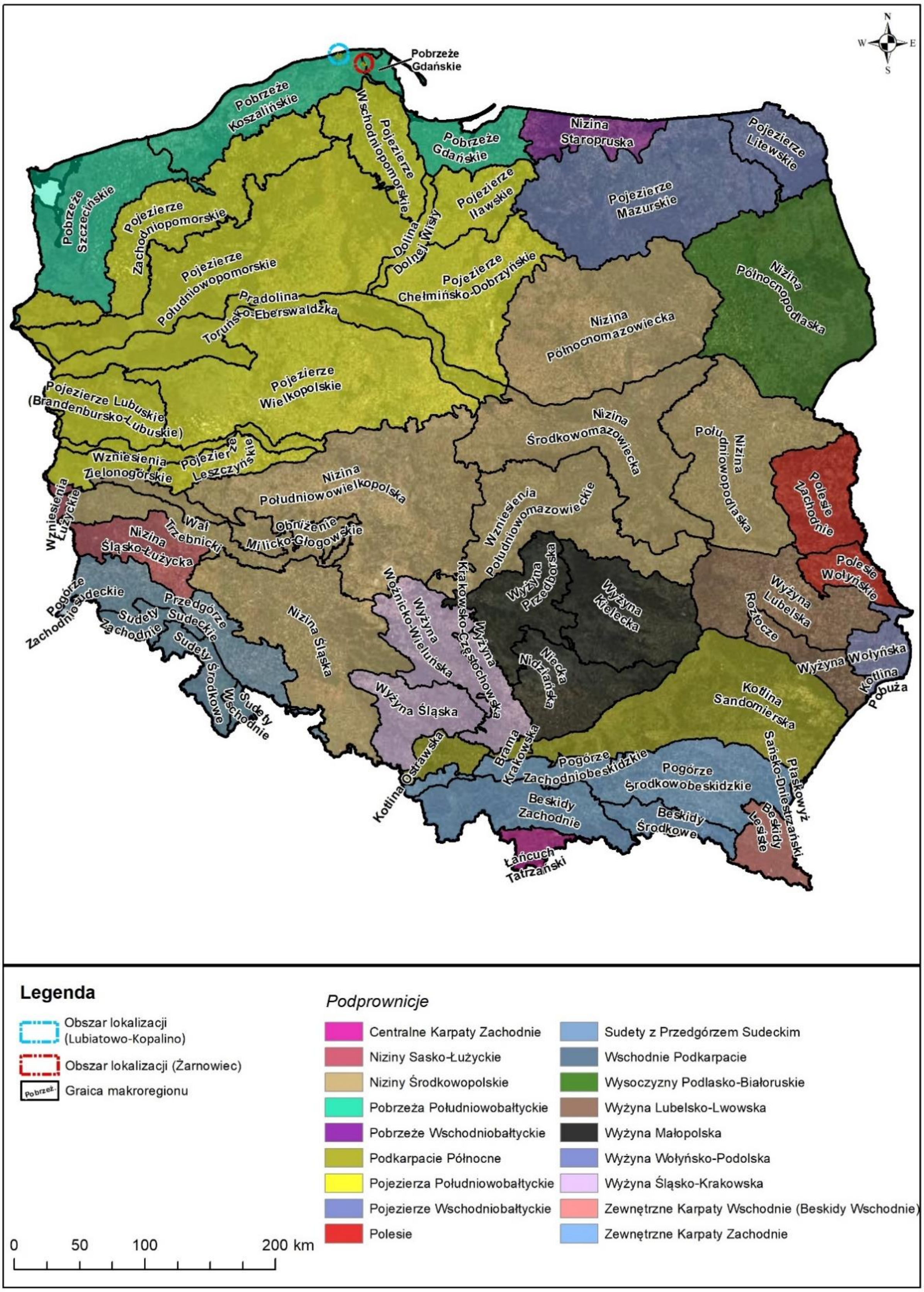
According to the physical-geographical regionalisation of Poland, both site variants are located in the megaregion of Extra-Alpine Central Europe, in the province of the Central European Lowland [Figure VI.3.3.1- 1]. The site variants are entirely located in the subprovince of the South Baltic Coast, with Variant 1 – Lubiatowo - Kopalino site is located within the boundaries of the Macroregion of the Koszalin Coast, and Variant 2 – Żarnowiec site – within the boundaries of two macroregions: the Koszalin Coast and the Gdańsk Coastal Area [Figure VI.3.3.1- 2].



Niż Wschodniobałtycko-Białoruski	Eastern Baltic-Belarusian Lowlands
Niż Środkowoeuropejski	North European Plain
Niż Wschodnio-Białoruski	Eastern Belarusian Lowlands
Wyżyny Ukraińskie	Ukrainian Upland
Wyżyny Polskie	Polish Upland
Masyw Czeski	Bohemian Massif
Karpaty Zachodnie z Podkarpaciem Zachodnim i Północnym	Western Carpathians with Western and Northern Subcarpathia
Karpaty Wschodnie z Podkarpaciem Wschodnim	Eastern Carpathians with Eastern Subcarpathia
Legenda	Legend
Obszar lokalizacji (Lubiatowo - Kopalino)	Site Area (Lubiatowo - Kopalino)
Obszar lokalizacji (Żarnowiec)	Site Area (Żarnowiec)
Granica prownicji	Province boundary
Megaregiony	Megaregions
Karpaty, Podkarpackie i Nizina Panońska	Carpathians, Subcarpathia and Pannonian Plain
Niż Wschodnioeuropejski	East European Plain
Pozaalpejska Europa Środkowa	Non-Alpine Central Europe

Figure VI.3.3.1- 1 Site variant against the background of megaregions and provinces of physical-geographical division of Poland

Source: In-house study



Pobrzeże Gdańskie	Gdańsk Coastal Region
Pobrzeże Koszalińskie	Koszalin Coastal Region
Pobrzeże Szczecińskie	Szczecin Coastal Region
Pojezierze Zachodniopomorskie	West Pomeranian Lake District
Pojezierze Wschodniopomorskie	East Pomeranian Lake District

Pojezierze Południowopomorskie	South Pomeranian Lake District
Pojezierze Iławskie	Iława Lake District
Pojezierze Chełmińsko-Dobrzyńskie	Chełmno-Dobrzyń Lake District
Pradolina Toruńsko-Eberswaldzka	Toruń-Eberswalde Ice-marginal Valley
Pojezierze Lubuskie (Brandenbursko-Lubuskie)	Lubuskie (Brandenburg-Lebus) Lake District
Pojezierze Wielkopolskie	Greater Poland Lake District
Pojezierze Leszczyńskie	Leszno Lake District
Wzniesienia Zielonogórskie	Zielona Góra Highlands
Nizina Staropruska	Old Prussian Plain
Pojezierze Litewskie	Lithuanian Lake District
Pojezierze Mazurskie	Masurian Lake District
Nizina Północnomazowiecka	North Masovian Lowland
Nizina Północnopodlaska	North Podlasie Lowland
Nizina Południowopodlaska	South Podlasie Lowland
Nizina Środkowomazowiecka	Central Masovian Lowland
Nizina Południowowielkopolska	South Greater Poland Lowland
Wzniesienia Południowomazowieckie	South Masovian Highlands
Nizina Śląska	Silesian Lowlands
Wzniesienia Łużyckie	Lusatian Highlands
Nizina Śląsko-Łużycka	Silesian-Lusatian Lowlands
Wyżyna Woźnicko-Wieluńska	Woźnik-Wieluń Upland
Wyżyna Krakowsko-Częstochowska	Kraków-Częstochowa Upland
Wyżyna Śląska	Silesian Upland
Wyżyna Przedborska	Przedbórz Upland
Wyżyna Kielecka	Kielce Upland
Nizina Nidziańska	Nida Lowland
Wyżyna Lubelska	Lublin Upland
Roztocze	Roztocze
Wyżyna Wołyńska	Volhynian Upland
Kotlina Pobuża	Pobuża Basin
Podlesie Zachodnie	Western Polesie
Podlesie Wołyńskie	Volhynian Polesie
Kotlina Sandomierska	Sandomierz Basin
Kotlina Ostrawska	Ostrava Basin
Brama Krakowska	Kraków Gate
Podgórze Zachodniobeskidzkie	Western Beskidian Foothills
Podgórze Środkowobeskidzkie	Central Beskidian Piedmont
Beskidy Zachodnie	Western Beskids
Beskidy Środkowe	Central Beskids
Beskidy Lesiste	Wooded Beskids
Płaskowyż Sańsko-Dniestrzański	San-Dniester Plateau
Łańcuch Tatrzański	Tatra Chain
Podgórze Zachodniosudeckie	West Sudetes Foothills
Podgórze Sudeckie	Sudetes Foothills
Sudety Zachodnie	Western Sudetes
Sudety Środkowe	Central Sudetes
Sudety Wschodnie	Eastern Sudetes
Legenda	Legend
Obszar lokalizacji (Lubiatowo - Kopalino)	Site Area (Lubiatowo - Kopalino)
Obszar lokalizacji (Żarnowiec)	Site Area (Żarnowiec)
Granica makroregionu	Macroregion boundary
Podprownicje	Sub-provinces
Pobrzeż.	Coastal Region
Centralne Karpaty Zachodnie	Central Western Carpathians
Niziny Sasko-Łużyckie	Saxon-Lusatian Lowlands
Niziny Środkowopolskie	Central Polish Lowlands
Pobrzeża Południowobałtyckie	South Baltic Coastal Regions
Pobrzeże Wschodniobałtyckie	East Baltic Coastal Region
Podkarpacie Północne	Northern Subcarpathia
Pojezierza Południowobałtyckie	South Baltic Lake Districts

Pojezierze Wschodniobałtyckie	East Baltic Lake District
Polesie	Polesie
Sudety z Przedgórzem Sudeckim	Sudetes with the Sudetes Foothills
Wschodnie Podkarpacie	Eastern Subcarpathia
Wysoczyzny Podlasko-Białoruskie	Podlasie-Belarusian Uplands
wyżyna Lubelsko-Lwowska	Lublin-Lviv Upland
Wyżyna Małopolska	Małopolska Upland
Wyżyna Wołyńsko-Podolska	Volhynian-Podolian Upland
Wyżyna Śląsko-Krakowska	Silesian-Kraków Upland
Zewnętrzne Karpaty Wschodnie (Beskidy Wschodnie)	Outer Eastern Carpathians (Eastern Beskids)
Zewnętrzne Karpaty Zachodnie	Outer Western Carpathians

Figure VI.3.3.1- 2 Site variant against the background of subprovinces and macroregions of physical-geographical division of Poland

Source: In-house study

VI.3.3.1.1 Variant 1 — Lubiatowo - Kopalino site

Variant 1 – Lubiatowo - Kopalino site is entirely located within the boundaries of the Słowińskie Coast mesoregion, while the Site Area also covers the mesoregion of the Choczewska Upland. The Słowińskie Coast mesoregion (313.41) covers an area of approximately 1,123 km^2 and is the northernmost coastal part of the Koszalin Coast. The topography of the above-mentioned mesoregion was largely shaped by a glacier, as evidenced by the presence e.g. of hills and coastal lakes: Gardno (charged by Łupawa) and Łebsko (charged by Łeba) formed from sea bays gradually cut off from the sea by sandy spits. A typical element of the landscape of the mesoregion are extensive sandy beaches and dunes, while the characteristic plant community are the Baltic dune Scots pine woods, i.e. pine forests with one-sided crowns and twisted branches, growing on weak, sandy soils, and swamp forests with the cross-leaved heath, and the bog-myrtle - plants typical of the oceanic climate of Western Europe. The climate is characterised by sea and land breezes and winters warmer than inland, as well as colder summer months.

VI.3.3.1.2 Variant 2 — Żarnowiec site

Variant 2 – Żarnowiec site is located on the border of three mesoregions: Choczewska Upland, Kashubian Coast and Słowińskie Coast. The Choczewska Upland (313.45) is a well-distinguished physico-geographical mesoregion covering an area of approximately 870 km^2. The area, the height of which exceeds locally 100 m above sea level, was formed from moraine formations and is strongly fragmented. It is shaped by moraine mounds: Gniewinowska, Osiecka, Salińska, Tawęcińska, Łebienicka and Radowicka. The mesoregion is dominated by forested glacial outwash plains. A characteristic element of the landscape are tunnel valley lakes, the largest of which - Lake Żarnowieckie - covers an area of approximately 14 km^2. The climate of the mesoregion is characterised by mild winters (warmer than inland) and colder summers. A typical plant community found in this area are Pomeranian beech trees.

Pobrzeże Kaszubskie (313.51) is a mesoregion with an area of approximately 400 km^2, comprising two types of landscape: moraine mounds and separating them parts of ice-marginal valleys from the period of recession of the Pomeranian glacial phase. Mounds from the sea side fall down more or less with high cliffs. In the western part of this upland, with hills locally exceeding the height of 100 m above sea level, there is a large forest area called the Darżlubska Forest, in which the "Darżlubskie Buki" reserve was created in the vicinity of Mechów.

VI.3.3.2 Climate

The climate (average weather condition in a given place) in Variant 1 – Lubiatowo - Kopalino site and in Variant 2 – Żarnowiec site is characteristic of the Pomeranian region. It results from its location in the central part of Europe and is shaped by air masses flowing from the centre of the continent and from the Atlantic Ocean. It is distinguished from the rest of the country by a higher frequency of strong wind and greater precipitation. The location within the range of the Baltic Sea contributes to the mitigation of thermal extremes – winters are milder and warmer and summers are cooler.

The climatological conditions in the studied region were characterised using data from meteorological stations in Łeba (seaside station) and Lębork (land station about 26 km away from the sea) and rainfall stations in the village of Wierzchucino, the village of Żelazno and in Wejherowo, for the years 1981–2018. The average annual temperature in Łeba is 8.2°C, and in Lębork it is higher by 0.3°C. The coldest month is January with an average temperature of just under 0°C, and the warmest month is July with an average temperature of 18.0°C in Lębork and 17.3°C in Łeba. During the year in Łeba there occur on average about 14 hot days and 2 torrid days and 21 frosty days. The average annual fluctuations in air temperature in Łeba amount to 17.4°C and 18.5°C in Lębork. The difference found indicates that the impact of the Baltic Sea on the thermal conditions is weakening further away from the sea.

The average annual amount of atmospheric precipitation in the survey area was diverse: 663.6 mm in Łeba, 722.4 mm in Lębork, 710.4 mm in Wierzchucino, 813.1 mm in Żelazno and 807.0 mm in Wejherowo. The differences found result e.g. from the location of the station above sea level (stations located higher above sea level, e.g. Żelazno, have more rainfall due to forced precipitation on the slopes of hills). In Łeba, rainfall occurs for 179 days a year, and in Lębork for 10 days more. The snow cover in Łeba occurs from October to May. On average, 45 days with snow cover were identified here during the year. Its average thickness is the highest in January (approximately 10 cm), and the maximum thickness found was 61 cm.

The average long-term wind velocity in Łeba is 5.0 m/s, and in Lębork it is lower and amounts to 3.2 m/s. The established regularity results from the location of both stations. Coastal stations, unlike those located inland, are characterised by a higher wind speed, resulting e.g. from less surface roughness. In Łeba, there occur on average about 102 days during the year with strong wind (≥10 m/s) and about 13 days with very strong wind (≥15 m/s). They are more common in the cooler than in the warmer half of the year. The strong winds occur for more than a third of all days in December and January.

The Lubiatowo - Kopalino and Żarnowiec site may similarly differ from each other in the course of weather conditions. The differences result from different local conditions, primarily the location in relation to the sea, topography and land use.

The atmospheric, hydrological and marine conditions in which the nuclear power plant will operate, as well as the emerging extreme phenomena, have an impact on the design process of a nuclear facility, and also determine the impact that the project may have on the environment during its construction, operation and even decommissioning. Progressing climate change can also lead to a change in the environmental conditions in which the NPP will operate. For this reason, they will be taken into account, both in the design process and during planning of the future operation of the NPP.

Information on future climate change is provided by climate scenarios. They are a reliable forecast of the course of meteorological parameters in the future, taking into account human-induced impacts. They take into account various factors which foster climate change, such as social and economic, technological, demographic and environmental developments, including changes in land use and greenhouse gas concentrations. Climate scenarios are developed by the Intergovernmental Panel on Climate Change (IPCC) and are used to improve the decision-making process. In its last, fifth report (AR5), the IPCC presented 4 scenarios for the concentration of greenhouse gases in the 21st century: RCP 2.6, RCP 4.5, RCP 6.0 and RCP 8.5. RCP 8.5 is a scenario with a very high concentration of greenhouse gases in the year 2100, while RCP 2.6 scenario assumes a global radical reduction in emissions. RCP 4.5 and RCP 6.0 correspond to "intermediate stabilisation paths".

There is no "proper" RCP scenario which would predict future climatic conditions, as what the future climate will actually be dependent on many social and economic and environmental factors. RCP 8.5 is based on the assumption that in the twenty-first century emissions will continue to increase due to increased dependence on coal-fired power generation. This corresponds to the most extreme baseline scenarios assuming the absence of a climate policy. Global electricity production from coal is not growing at a rate proportional to that of the RCP 8.5 scenario. This is the result of global mitigation of climate change and the fall in alternative energy prices since the scenarios were developed. This means that RCP 8.5 is an appropriate "reliable maximum", but does not present realistic project assumptions. Also, the world is not currently moving towards the climate change mitigation scenarios compliant with the objectives of the Paris Agreement, making reliance on RCP 2.6 too optimistic. Therefore, the two intermediate RCP scenarios (4.5 and 6.0) are the most in line with current policy and are suitable for use as project assumptions.

For the purposes of the project, it is recommended to use RCP 4.5 to characterise the future climatic conditions in which the project (together with the associated infrastructure) will operate. This applies to the "reasonably predictable" scenario for the design assumptions and the basic assumption of the environmental impact assessment. In addition, RCP 8.5 should be used as a "plausible maximum" scenario. It should be used to understand the sensitivity assessment of environmental impact. In RCP scenario 8.5 consideration should be given to the possibility of modifying the project or applying mitigation measures based on the scale of impact (e.g. in terms of safety, cost, environmental degradation, etc.).

Where possible, measures to prevent or mitigate the effects of future climate change will be developed already at the initial design stage of the NPP, and in other cases adaptive risk management approaches can be introduced to respond to a hazard that may arise only during the operational phase of a nuclear plant.

VI.3.3.3 Geological structure

The general characteristics of the structure and geological conditions were prepared on the basis of the Detailed Geological Map of Poland, as well as studies, designs, documentation and results of survey carried out as part of the Environmental and Location Survey Programme for the Project. As part of the above-mentioned research carried out in the years 2015 – 2019, a number of geological works were carried out, including: geological and geomorphological mapping, geological drilling up to a maximum depth of 200 m b.g.l. (including hydrogeological and geological-engineering boreholes) and static and dynamic exploration, as well as geophysical surveys.

VI.3.3.3.1 Variant 1 — Lubiatowo - Kopalino site

Geological conditions

<u>Older substrate</u>

The oldest substrate, within the Site Region of Variant 1 – Lubiatowo - Kopalino site, is located below the depth of 3000 m and is composed of igneous and metamorphic rocks (e.g. granitoids and gneisses). Above them there are mainly sedimentary rocks formed in marine and terrestrial environments (e.g. limestones and sandstones). Sediments of individual geological periods are characterised by a profile with different thicknesses, which is caused by uneven sedimentation, its absence or erosion.

<u>Paleogene-Neogene</u>

Paleogene-Neogene (Tertiary) formations in the Site Region of Variant 1 are characterised by high variability resulting from their sedimentation and subsequent activity of the ice sheet (e.g. different thicknesses, lack of sediments, disturbances inside the formations). In total, Paleogene-Neogene sediments have thicknesses of 100–300 m, these are e.g. sands, clays, silt and small numbers of lignite.

<u>The Quaternary</u>

Quaternary sediments occur on almost the entire surface of the Site Region of Variant 1, are characterised by very variable thickness and high complexity of construction (e.g. displacements inside the formations). In the Site Region, their thickness usually varies between 0–160 m, significantly exceeding it only locally, e.g. in the Choczewo region it reaches 274 m, and in Dębki up to 324 m. Quaternary sediments are represented by the formations of the following glaciations: South Polish, Middle Polish and North Polish glaciation. These mainly include: sands, gravels, silts and clays. Large differences in the thickness of sediments result from the action of strong erosion.

The youngest sediments (Holocene) are represented by dune and beach sands, lake-sea sands and silts and organic sediments (e.g. peats and allochthonous silt). These formations build the surface of the coastal lowland and occur in the bottoms of river valleys, where they build low alluvial terraces.

In the marine part of the Site Region and the Project Area, the thickness of Quaternary sediments is quite diverse. It ranges on average from 10 to 60 m, sometimes reaching over 100 m (within Płycizna Czołpińska). On the seabed, two types of sediments were found: sands and cohesive sediments (e.g. clays), peat is exposed locally. The thickness of the sands reaches up to several metres. Below the sediments deposited on the seabed, there are stagnant sediments (e.g. clays) and glacial sediments (mainly clays).

Tectonic and seismic conditions

Tectonic and seismic conditions for seismic hazard assessment analyses have been developed for the Macroregion of Variant 1 (an area with a radius of 300 km around the boundaries of the planned site of a nuclear plant – determined in accordance with PAA and IAEA guidelines). The modern distribution of tectonic forces in the area of the Macroregion of Variant 1 began to stabilise at the end of the Paleogene-Neogene (Tertiary period), faults recognised in older formations do not show traces of subsequent reactivation. In the Quaternary, an additional geodynamic factor appears in Poland in the form of glaciations. Several glaciations in the area of Poland caused significant deflections of the lithosphere.

The Macroregion of Variant 1 is characterised by low natural seismicity, and the Site Region is characterised by very low natural seismicity. No catastrophic earthquakes have been recorded in the Macroregion, the Site Region and the Project Area since the fourteenth century, i.e. in the period including available archival materials on earthquakes.

Geomorphological conditions

The Site Region of Variant 1 is located in the land part within two moraine uplands (built of glacial sediments, mainly clay): the Kashubian Lake District in the south and the Żarnowiec Upland in the north. The moraine plateaus are separated by the Reda-Łeba ice-marginal valley with kames and kettle lakes. The northernmost part of the Site Region includes a strip of coastal lowlands with peat bogs, wetlands and strips of dunes and the beach – these are the Gardzieńsko-Łebska Lowland and the Karwieńska Lowland.

The Baltic Sea is divided into a deep-water part and a shallow-water part, which is separated by a slope – the rapids of the Słupska Bank. The marine part of the Site Region of Variant 1 location region is located in the shallow-water area, which stretches from the coastline to a depth of about 60 m. The maximum sea depth in the Site Region of Variant 1 does not exceed 40 m. A characteristic feature of this part of the Baltic Sea is the presence of shoals and shallow waters built of sand and gravel sediments. Within the Project Area, three types of bottom, different in terms of construction and topography, were distinguished, including: the shoal zone, the coastal slope and the bottom of the open sea.

Morphology and dynamics of the seashore

The beaches of the entire Site Region of Variant 1 – Lubiatowo - Kopalino site, are directly preceded by dunes. Along the seashore there is a beach with a width of 15 to 100 m. The beach is an area of active erosion and accumulation processes. An important role is played by the wind, which is a source of energy for waves and currents, which controls the aeolian processes on the dunes and beaches. The main source of material supply is the bed erosion. Sediments are subject to further processing during transport; accumulation occurs, shoals, beaches and dunes are formed. The coastal zone of Site Region of Variant 1 — Lubiatowo - Kopalino site — should be considered dynamic. The zone includes: the shoal zone and coastal slope of a different nature of dynamic processes, which are under the influence of waves. There is a continuous movement of material lying on the bottom and continuous rebuilding of the bottom, especially intensively during storms, when a significant blurring of sediments occurs, and then re-accumulation.

Deposits of raw materials

In the Site Region of Variant 1, there are many different types of natural resource deposits (approximately 80 deposits). These are e.g. oil, natural gas, rock and potassium salts, chalk, peat and deposits of common minerals (stones, natural aggregates, clay materials). Four oil deposits exploited by PGNiG SA are located here: Żarnowiec, Dębki, Żarnowiec-W and Białogóra. In the Site Region and the Project Area, concessions for the exploration, identification and extraction of oil and natural gas are located - Żarnowiec and Wejherowo. There are also recognised and documented deposits of rock salt (Bay of Puck deposit) and potassium-magnesium salt deposits (Puck region).

In the marine part of the Site Region and the Project Area, there are no identified deposits of raw materials or active concessions.

VI.3.3.3.2 Variant 2 — Żarnowiec site

Geological conditions

Older substrate

The oldest substrate, within the Site Region of Variant 2 – Żarnowiec site, is located below the depth of 3000 m and is composed of igneous and metamorphic rocks (e.g. granitoids and gneisses). Above them there are mainly sedimentary rocks formed in marine and terrestrial environments (e.g. sandstones and limestones). Sediments of individual geological periods are characterised by a profile with different thicknesses, which is caused by uneven sedimentation, its absence or erosion.

Paleogene-Neogene

Paleogene-Neogene (Tertiary) formations in the Site Region of Variant 2 form a complex arrangement of layers. This is due to the genesis of sediments and accumulation and erosion processes (mainly activity of continental glacier). The most developed sediment profile occurs in the moraine upland region, while in the area of the Lake Żarnowieckie valley, the sediments were eroded in the Quaternary period. In total, Paleogene-Neogene sediments have thicknesses of 100–300 m. These are e.g. marls, gaizes, sands, clays and mudstones and small occurrences of lignite.

The Quaternary

Quaternary sediments occur in almost the entire area of the Site Region of Variant 2. They are characterised by very variable thickness and high complexity of structure (e.g. displacement inside the formations), their thickness usually varies between 0 and 170 m, significantly exceeding it only locally, e.g. in the Dębki region it reaches about 324 m. Quaternary sediments are represented by the formations of the following glaciations: South Polish, Middle Polish and North Polish glaciation. These mainly include: sands, gravels, silts and glacial tills. Large differences in the thickness of sediments result from the action of strong erosion, which led, among others, to the creation of the Lake Żarnowieckie Valley. The youngest sediments are represented by dune and beach sands, lake-sea sands and silts and organic sediments (e.g. peats and allochthonous silt). These formations build the surface of the coastal lowland and occur in the bottoms of river valleys, where they build low alluvial terraces.

In the marine part of the Site Region of Variant 2, the thickness of Quaternary sediments is quite diverse. It ranges on average from 10 to 60 m, locally reaching up to 200 m (east of the mouth of the Piaśnica River). On the seabed, two types of sediments were found: sands and cohesive sediments (e.g. clays), peat is exposed locally. The thickness of the sands reaches up to several metres. Below the sediments deposited on the seabed, there are stagnant sediments (e.g. clays) and glacial sediments (mainly clays).

Tectonic and seismic conditions

Tectonic and seismic conditions for seismic hazard assessment analyses have been developed for the Macroregion of Variant 2 (an area with a radius of 300 km around the boundaries of the planned site of a nuclear plant – determined in accordance with the guidelines of the National Atomic Energy Agency and the International Atomic Energy Agency). The modern distribution of tectonic forces in the area of the Macroregion of Variant

2 began to stabilise at the end of the Paleogene-Neogene (Tertiary period), faults recognised in older formations do not show traces of subsequent reactivation. In the Quaternary, an additional geodynamic factor appears in Poland in the form of glaciations. Several glaciations in the area of Poland caused significant deflections of the lithosphere.

In the Site Region of Variant 2, the most distinctive form is the Żarnowiec Gully. It is a structure of a water-glacial genesis. It is assumed that the lowering of the land caused by faults in the older substrate may have facilitated the ice sheet's indentation into the ground and was used by glacial waters as the preferred flow directions.

The Macroregion of Variant 2 is characterised by low natural seismicity, and the Site Region is characterised by very low natural seismicity. No catastrophic earthquakes have been recorded in the Macroregion, the Site Region and the Project Area since the fourteenth century, i.e. in the period including available archival materials on earthquakes.

Geomorphological conditions

The Site Region of Variant 2 — Żarnowiec site is located in the land part within two moraine uplands (built of glacial sediments, mainly clay): the Kashubian Lake District in the south and the Żarnowiec Upland in the north. The moraine plateaus are separated by the Reda-Łeba ice-marginal valley with kames and kettle lakes. The largest part of Site Region of Variant 2 is occupied by the Żarnowiec Upland, within which there is the most distinctive topography – the Lake Żarnowieckie Gully. The northern part of the Site Region includes a coastal lowland with peat bogs, wetlands, strips of dunes and a beach. The eastern part of the Site Region includes a fragment of the Hel Spit (Hel Peninsula) and the Kashubian ice-marginal valley.

The Baltic Sea is divided into a deep-water part and a shallow-water part, which is separated by a slope – the rapids of the Słupska Bank. The shallow-water area stretches from the coastline to a depth of about 60 m. Site Region of Variant 2 - Żarnowiec site is located in the shallow-water part. A characteristic feature of this part of the Baltic Sea is the presence of shoals and shallow waters built of sand and gravel sediments. Within the coastal zone, three types of bottom, different in terms of construction and topography, were distinguished, including: the shoal zone, the coastal slope and the bottom of the open sea.

Morphology and dynamics of the seashore

In the Site Region of Variant 2 – Żarnowiec site, the beaches are directly surrounded by dunes. The seashore in the entire Site Region of Variant 2 includes beach with a width of several to 100 m. The beach is an area of active erosion and accumulation processes. There is an active cliff in the eastern part of the Site Region of Variant 2 between Jastrzębia Góra and Chłapów. An important role is played by the wind, which is a source of energy for waves and currents, which controls the aeolian processes on the dunes and beaches. The main source of material supply is the bed erosion. Sediments are subject to further processing during transport; accumulation occurs, shoals, beaches and dunes are formed. The coastal zone of Site Region of Variant 2 should be considered dynamic. The zone includes: the shoal zone and coastal slope of a different nature of dynamic processes, which are under the influence of waves. There is a continuous movement of material lying on the bottom and continuous rebuilding of the bottom, especially intensively during storms, when a significant blurring of sediments occurs, and then re-accumulation.

Deposits of raw materials

In the Site Region of Variant 2, there are many different types of natural resource deposits (approximately 100 deposits). These are e.g. oil, natural gas, rock and potassium salts, chalk, peat and deposits of common minerals (stones, natural aggregates, clayey materials). Four oil deposits exploited by PGNiG SA are located here: Żarnowiec, Dębki, Żarnowiec-W and Białogóra. In the Site Region and the Project Area, concessions for the exploration, identification and extraction of oil and natural gas are located - Żarnowiec and Wejherowo. There are also recognised and documented deposits of rock salt (Bay of Puck deposit) and potassium-magnesium salt deposits (Puck region). The "Kosakowo" gas storage facility was created in the Mechelinka deposit and was covered by the licence for underground tankless storage of natural gas. The Project Area includes deposits of common minerals, such as natural sand and gravel aggregates, some of which are currently being exploited.

In the marine part of the Site Region and the Project Area, there are no identified deposits of raw materials or active concessions.

VI.3.3.4 Soils

VI.3.3.4.1 Variant 1 — Lubiatowo - Kopalino site

Land use

The area located within the boundaries of the Area for Variant 1 – Lubiatowo - Kopalino site, is mainly occupied by forests (approximately 54% of its area) and agricultural land (approximately 42%), among which permanent grassland predominates. Built-up areas (including built-up agricultural land), as well as ecological land and land under water constitute about 4% of its total area.

Typology of soils (arable land and permanent grassland)

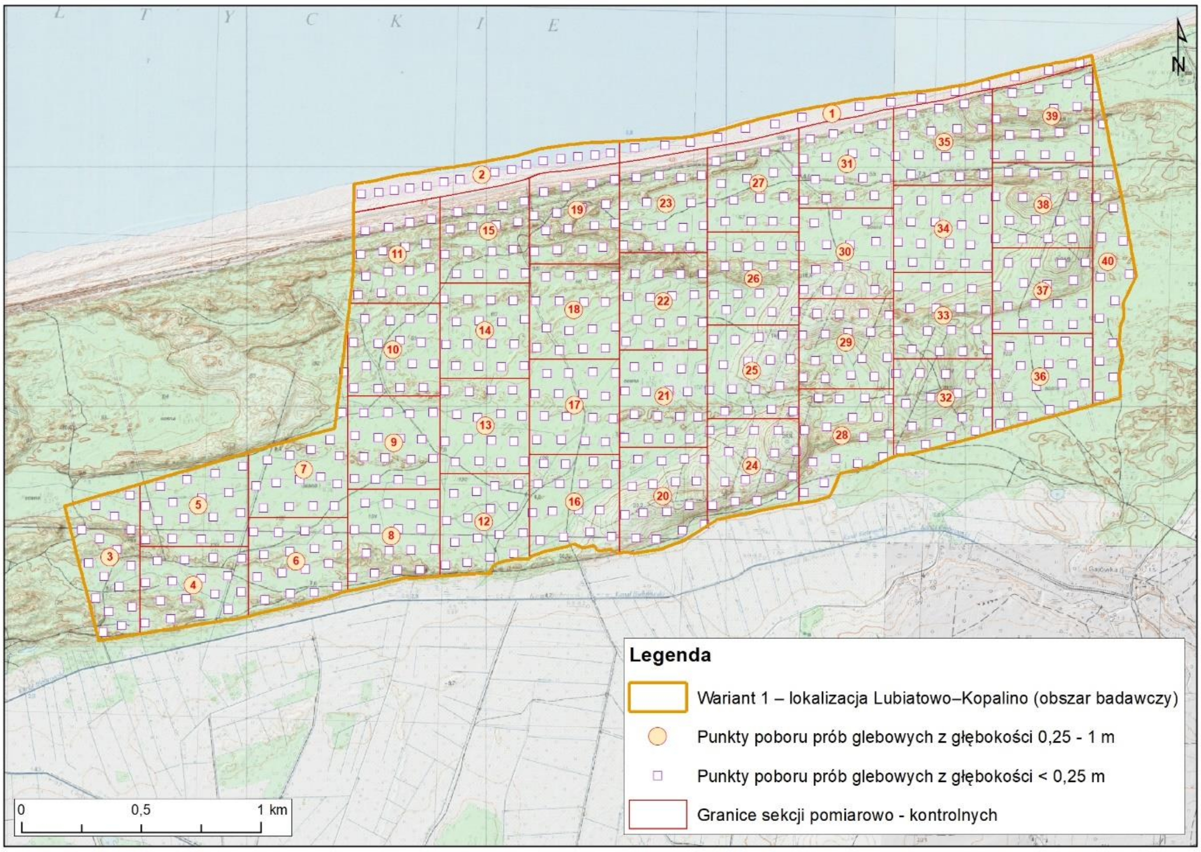
The types of soils occurring under arable land and permanent grassland located within the boundaries of the Site Area were determined on the basis of soil and agricultural maps made available by the Soil Science and Plant Cultivation – State Research Institute. Their analysis shows that arable land and permanent grassland are located predominantly on leached and acidic brown soils (approximately 45% of the area occupied by the above-mentioned agricultural land), peat and muck-peat soils (approximately 17%) and on muck-mineral and muck soils (also about 17%). Other types of soil (podzolic and pseudopodzolic soils, black surface soils, black deluvial soils, black degraded lands and grey soils, alluvial soils, mud-peat and peat-silt soils, brown surface soils, black degraded soils and grey deluvial soils) occupy approximately 21% of the Site Area.

Valuation classification of soils

Arable land and permanent grassland occurring in the Site Area are mostly located on soils of class IV (approximately 44% of the total area occupied by the above-mentioned agricultural land) and on class V soils (approximately 23%) and III – including IIIa and IIIb (approximately 22%). The remaining part consists of arable land and permanent grassland of class VI, as well as class II (approximately 0.4%). About 11% is the soil valuation class VI (the weakest arable soils, mainly meadows and pastures). The agricultural land referred to above, located on soils of class II or III, constitutes agricultural land particularly protected on the basis of the Act of 3 February 1995 on the Protection of Agricultural and Forest Land.

Soil quality – current pollution

In order to assess soil contamination, physicochemical analyses were performed in soil samples taken from the designated research area [according to the Regulation of the Minister of the Environment of 1 September 2016 on the method of assessment of the land surface contamination), initially divided into 40 research sections in a regular shape grid [Figure VI.3.3.4- 1]. The individual sections were designated based on the classification of the land and their uniform distribution over the surveyed area.



Legenda	Legend
Wariant 1 - lokalizacja Lubiatowo - Kopalino (obszar badawczy)	Variant 1 – Lubiatowo - Kopalino site (survey area)
Punkty poboru prób glebowych z głębokości 0,25 - 1 m	Soil sampling points from a depth of 0.25 - 1 m
Punkty poboru prób glebowych z głębokości < 0,25 m	Soil sampling points from a depth of < 0.25 m
Granice sekcji pomiarowo - kontrolnych	Boundaries of measurement and control sections

Figure VI.3.3.4- 1 Boundaries of designated sections including soil sampling points. Variant 1 — Lubiatowo - Kopalino site

Source: Reports on Environmental Characteristics and Valorisation for the purposes of the EIA Report on the chemism of the land environment for the Lubiatowo - Kopalino site and for the Żarnowiec site; Ośrodek Badań i Kontroli Środowiska Sp. z o.o., Warsaw, 2020

Soil sampling sites are designated at depths of up to 0.25 m and from 0.25 to 1 m in each measurement and control section. A total of 100 soil samples were taken (a sum for two depths), including samples at additional sites where groundwater survey results suggested potentially contaminated sites. Each sample was tested for substances from the following groups: metals and metalloids, inorganic impurities, hydrocarbons, chlorinated hydrocarbons, plant protection products and other impurities. A total of 57 determinations of chemical substances were carried out and all analyses were performed in accredited laboratories and based on reference methodologies (in accordance with the Regulation of the Minister of the Environment of 1 September 2016 on the method of assessment of the land surface contamination) for research on the properties and contamination of soil and land.

The results of physicochemical analyses of the collected soil samples indicate that the permitted concentration limits of the analysed chemicals have not been exceeded in soils located within the limits of the research area. No exceedances of the pollution indicators for the surveyed soils applies to both the near-surface layers of the soil, as well as the layers forming the deeper parts of the studied soil profile.

VI.3.3.4.2 Variant 2 — Żarnowiec site

Land use

The structure of use of land located within the boundaries of the Site Area is dominated by agricultural land (approximately 47% of its area) and forest land (approximately 35%), as well as land under water (approximately 11%). As for Variant 1, there is the smallest share of built-up areas, including built-up agricultural land (approximately 7%). The research area of cooling water corridors is also dominated by agricultural land (approximately 73%) and forest land (approximately 20%), but there is little land covered with water (approximately 1%). The remaining approximately 6% includes built-up and urbanised areas, land under water and various areas.

Typology of soils (arable land and permanent grassland)

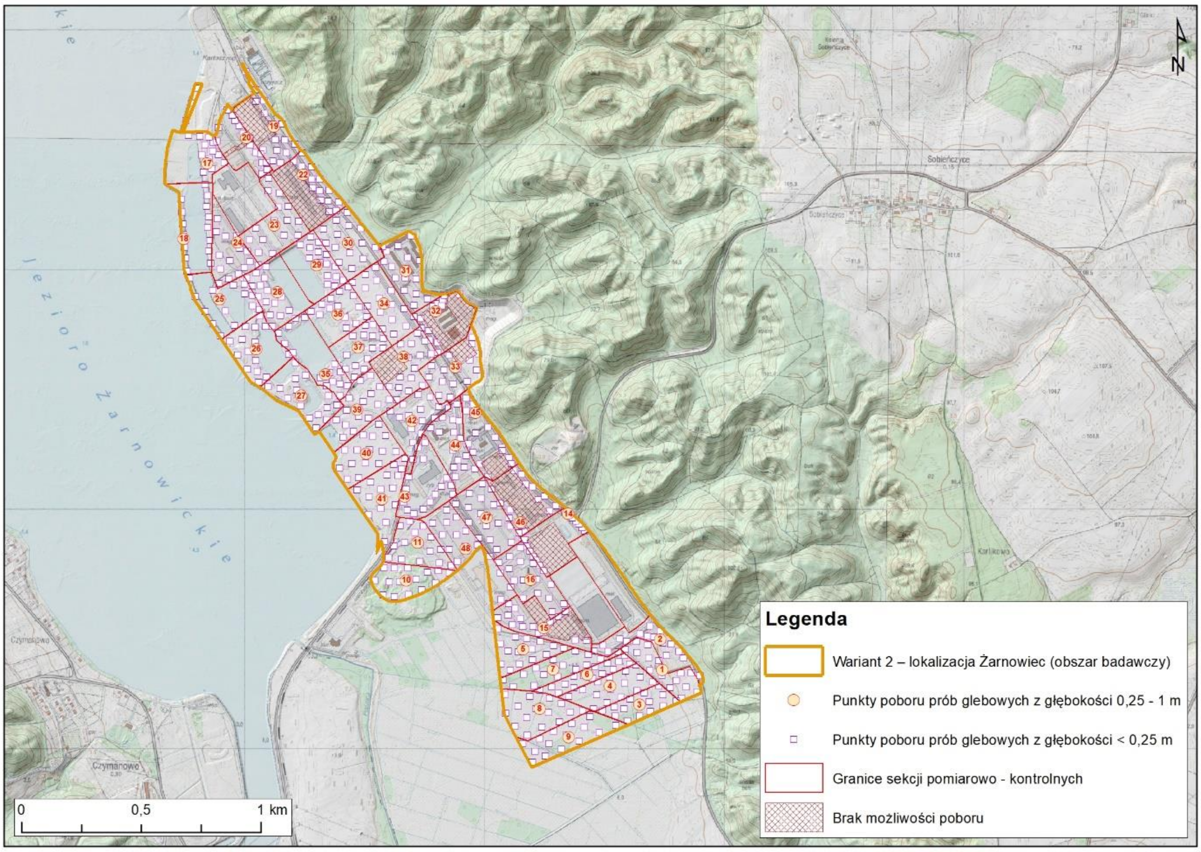
Information on soil types was taken from the same sources as for Variant 1 (i.e. from the Institute of Soil Science and Plant Cultivation – State Research Institute). Their analysis shows that arable land and permanent grassland are occurring within the boundaries of the Site Area are located predominantly on leached and acidic brown soils (approximately 76% of the area occupied by the above-mentioned agricultural land) and on peat and muck-peat soils (approximately 11%). Other types of soil (podzolic and pseudopodzolic soils, brown surface soils, brown deluvial soils, leached brown deluvial soils, black surface soils, black deluvial soils, black degraded lands and grey soils, black deluvial degraded lands and grey deluvial soils, mud-peat and peat-silt soils, gley soils, muck-mineral and muck soils) occupy approximately 13% of the Site Area. However, in the research area for corridors of water making up the cooling system, the largest area is occupied by peat and muck-peat soils (66%) and muck-mineral and muck soils (32%). The others are: podzolic and pseudopodzolic soils, deluvial brown soils, leached and acidic brown soils, deluvial black soils and mud-peat and peat-silt soils.

Soil quality classification

Arable land and permanent grassland occurring in the Site Area are mostly located on soils of class IV and III (approximately 47% and approximately 29% of the total area occupied by agricultural land, respectively). Successively, a significant part in arable land and permanent grassland is occupied by soils of classes V and VI (a total of about 23%), while less than 1% are class II soils. Arable land and permanent grassland occurring in the Research area for the corridors of water making up the cooling system are mostly located on soils of class IV and V (approximately 57% and approximately 30% of the total area occupied by agricultural land, respectively) and to a lesser extent on class III and class VI soils (5% and 8%, respectively). The agricultural land occurring within the boundaries of the Site Area and within the boundaries of the research area for water corridors making up the cooling system, located on soils of class II or III, constitutes agricultural land particularly protected (in accordance with the Act of 3 February 1995 on the Protection of Agricultural and Forest Land).

Soil quality – current pollution

To assess the quality of soils, a physicochemical analysis of soil samples taken from the designated research area of Variant 2 – Żarnowiec site was performed similar to that of Variant 1 [Figure VI.3.3.4- 2]. The land located in this area is for the most part classified as industrial areas, the rest are meadows, agricultural land and land under ditches, and small areas of plots are classified as wastelands and forests. According to the provisions of the local development plan, most of the research area consists of areas of production, industrial and warehouse development as well as areas of technical infrastructure. Taking into account the above, the research area was divided into 48 sections with consideration of the course land classification boundary and terrain obstacles preventing sampling (buildings, areas paved with asphalt or concrete, building structures flooded with water). Systematic sampling was used on the basis of a regular-shaped grid. The single sampling points were established in the centre of the grid area, as shown in Figure [Figure VI.3.3.4- 2].



Wariant 2 - lokalizacja Żarnowiec (obszar badawczy)	Variant 2 – Żarnowiec site (survey area)
Punkty poboru prób glebowych z głębokości 0,25 - 1 m	Soil sampling points from a depth of 0.25 - 1 m
Punkty poboru prób glebowych z głębokości < 0,25 m	Soil sampling points from a depth of < 0.25 m
Granice sekcji pomiarowo - kontrolnych	Boundaries of measurement and control sections
Brak możliwości poboru	Sampling impossible
Legenda	Legend

Figure VI.3.3.4- 2 Boundaries of designated sections including soil sampling points. Variant 2 — Żarnowiec site

Source: Report on Environmental Characteristics and Valorisation for the purposes of the EIA Report on the chemism of the terrestrial environment for the Lubiatowo - Kopalino site and for the Żarnowiec site; Ośrodek Badań i Kontroli Środowiska Sp. z o.o., Warsaw, 2020

During field work in the research area, a total of 102 soil samples were taken. Laboratory tests included the same components as for Variant 1.

The results of the physicochemical analyses of the samples taken indicate that the permissible concentration limits of the analysed chemicals have not been exceeded in the soils located within the research area. No exceedances of pollution indicators specified for the land of the group occurring there. This applies to both the near-surface layers of the soil, as well as the layers forming the deeper parts of the studied soil profile.

VI.3.3.5 Groundwater (hydrogeology)

VI.3.3.5.1 Variant 1 — Lubiatowo - Kopalino site

Hydrogeological conditions in the Site area

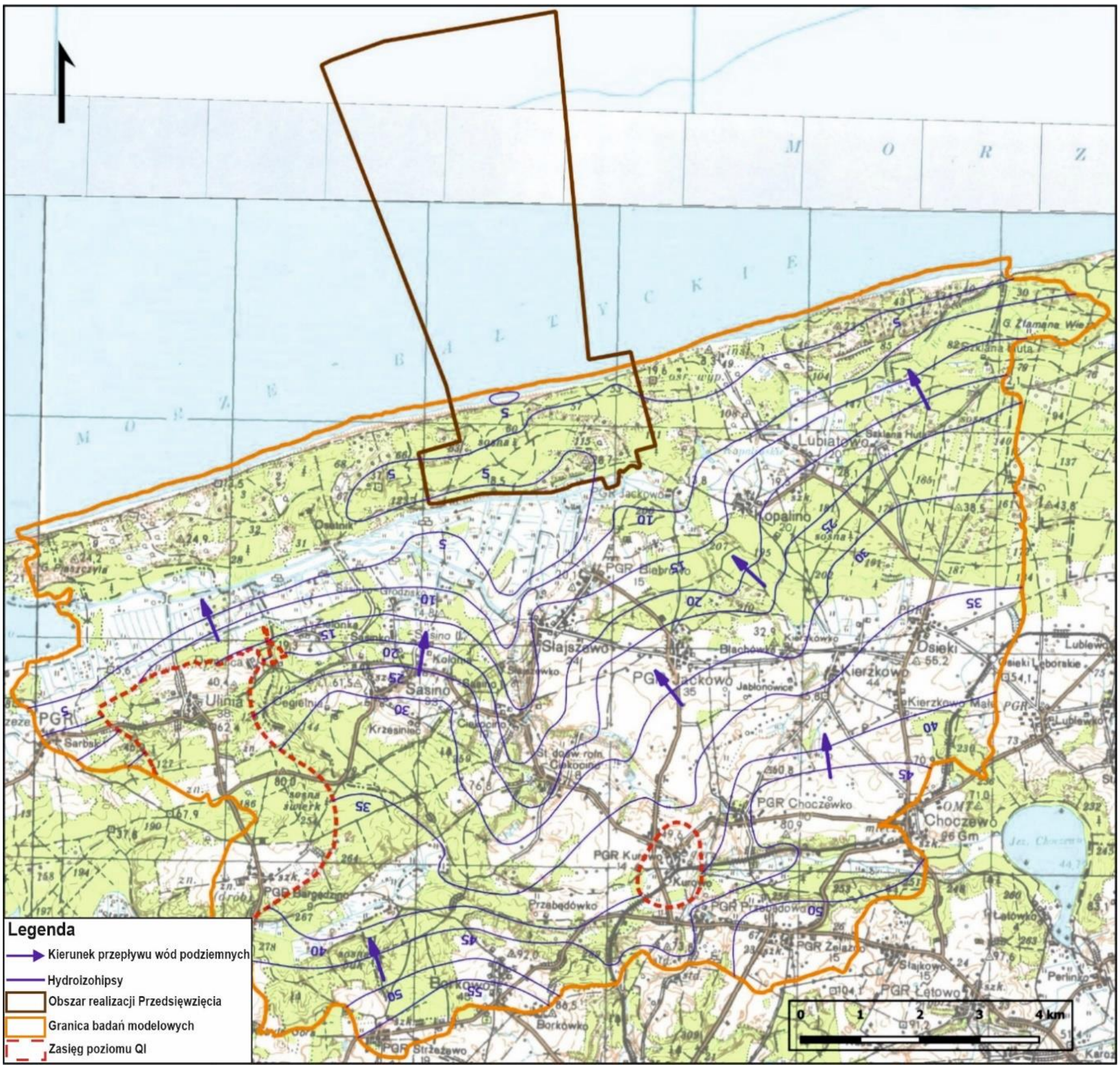
The site area is characterised by varied hydrogeological conditions, different in the upland zones, in relation to the coastal plains and the coastal zone of the sea. It is divided into the coastal zone and coastal plains within the strip of dunes (Project Area), as well as the upland zone and river valleys (Chełst and Choczewka rivers). The aquifers from which water is drawn are mainly associated with the Quaternary system – the inter-till aquifer associated with the North Polish and Middle Polish glaciation formations. Due to the water circulation system and the depth of the Quaternary aquifers, the first aquifer (PPW) and the deep levels: inter-till and sub-till. There are two aquifer zones in the Paleogene-Neogene aquifer system. The aquifer systems of the Quaternary and the

Paleogene and Neogene show considerable variation. Aquifers differ in the regime of water flow, the properties and composition of aquifers and their parameters, as well as the type of structures within which they occur. Groundwater hydrodynamics is shaped by the Chełst River valley along with the tributaries of Choczewka and the Biebrowski Kanał and by the Baltic Sea, which are the main drainage base for the aquifers occurring here. Most of the documented area is drained by the Chełst River, which together with its tributaries discharges water towards the west – to Lake Sarbsko. The Biebrowski Kanał is supplied mainly from the east. It flows westwards, draining, using a network of drainage ditches, vast meadows and pastures and then flows into the Chełst River. The conditions of occurrence and hydrodynamics of the waters of the first aquifer in the area of the coastal lowlands, Chełst River and the Biebrowski Kanał, were changed by the construction of canals and drainage ditches. Their task is to regulate the water level in wetlands.

In the Lubiatowo - Kopalino site area, the following aquifers have been identified:

- the Oligocene aquifer Pg – locally in contact with QIII,
- the Neogene aquifer Ng – occurring locally in contact with QII or QIII,
- the Quaternary aquifer QIII – including the sub-till level, which is locally in contact with the level QII, Ng and Pg,
- the Quaternary aquifer QII - including the lower or upper inter-till aquifer, locally in contact with the Aquifer QI and Ng,
- the Quaternary Aquifer QI – including the first aquifer in the coastal plains and the upper inter-silt aquifer in the uplands.

The first aquifer, which occurs within the Holocene sands of various granulations with a predominance of fine-grained sands of coastal plains along with a small fragment of the Chełst river valley seems the most important from the point of view of the planned Project. In the surveyed area, the coverage of the first aquifer covers the entire area of the coast and coastal plains. The first aquifer is characterised by a free water table and is arranged on the elevation from below 5 m above sea level to about 10 m above sea level. The upper surface occurs at a depth of about 1 m to 15 m. The width of the first aquifer is variable and can range from less than 5 m to over 20 m. Charging of the aquifer occurs mainly through the inflow of precipitation from the surface of the ground and the side inflow from the upland. The directions of water flow of the first aquifer clearly indicate the draining nature of surface watercourses [Figure VI.3.3.5- 1].



Legenda	Legend
Kierunek przepływu wód podziemnych	Direction of groundwater flow
Hydroizohipsy	Hydroisohypses
Obszar realizacji Przedsięwzięcia	Project Area
Granica badań modelowych	Boundaries of model studies
Zasięg poziomu QI	Range of QI level

Figure VI.3.3.5- 1 Map of the hydroisohypses of the first aquifer QI

Source: In-house study

This aquifer is in direct contact with surface waters. Numerous wetlands are characteristic. The first aquifer in the water circulation system by free flow usually charges the upper inter-till aquifer. The aquifer is formed by sands of different granulation with a predominance of fine-grained sands. The filtration parameters of the first aquifer are spatially diverse on the scale of the documented area depending on the type and formation of permeable sediments (coastal plains, valleys). The filtration coefficient determined on the basis of the results of the test pumping ranges from approximately 5 m/d to approximately 26 m/d. The average value of the filtration coefficient for the area of coastal plains is about 10 m/d.

The natural resistance of the waters of the first aquifer to pollution is a property of the aquifer system which determines the risk of migration of pollutants from the surface of the site to groundwater. In the area of the Żarnowiec upland, the areas have a very low and low degree of susceptibility to pollution. In areas of coastal lowlands and in areas of larger river valleys cutting moraine upland (valleys of the Chełst and Choczewka rivers), i.e. in areas where the migration time of pollutants is less than 5 years, and the depth to the first aquifer is less than 5 m, the degree of susceptibility was defined to be very high. Places where the water table of the first aquifer is deposited at depths of 5–10 m or the near-surface zone are occupied by peats. The time for the pollutants to reach the aquifer may be longer than 5 years, and the degree of susceptibility to pollution in these places has been determined to be high (5-25 years) or medium (25-50 years).

Results of observation of groundwater table fluctuations

As part of the monitoring of groundwater table fluctuations in observation piezometers located in the Project Area, carried out from August 2016 to November 2020, measurements of the depth of occurrence of the static water level were carried out. During this period of time, it was conducted on a variable number of observation points, depending on the number of subsequent observation boreholes. The measurements were carried out using automatic water pressure sensors or manually using a hydrogeological whistle. The sensors measured the pressure of the water column once a day, while manual measurements were carried out once a month. It should be noted that the maximum value of the depth to the water table was 9.2 m, while the minimum value was 0.9 m. The maximum value of the amplitude of fluctuations of the water table was 1.6 m, and the minimum value was 0.3 m.

Groundwater quality

Qualitative groundwater surveys were carried out from March 2017 to August 2020 with a quarterly frequency of water sampling.

Quaternary aquifer QI and QII

The main factors shaping the chemical composition of the waters of both aquifers are the short time of water circulation in the aquifer, the recharge of the level through atmospheric precipitation and the dominant share of pore formations in the saturation zone. The results of work and research have shown that the waters of the Quaternary aquifers QI and QII have a diverse chemical composition, most often with a predominance of bicarbonate and sulphate anion and calcium, less often magnesium and sodium cation. In general, groundwater of aquifers QI and QII belong to water quality classes II and III and are characterised by good chemical status.

Quaternary sub-till aquifer QIII

Chemical analyses of water samples have shown that the sub-till aquifer is dominated by bi-ionic waters of the bicarbonate-calcium type. These are fresh waters with a total mineralisation in the range of 290–350 mg/L, a poorly alkaline reaction, on the edge of soft and medium hard waters, with a specific electrolytic conductivity (PEW) in the range of 295–353 µS / cm.

Neogene aquifer Ng

Analyses showed different hydrochemical types of waters at the examined points. There are both bicarbonate-calcium bi-ionic waters, bicarbonate-calcium-magnesium tri-ionic waters, bicarbonate-sulphate-calcium bi-ionic waters, as well as bicarbonate-sulphate-calcium-magnesium four-ionic waters. These are fresh, weakly alkaline waters, with electrolytic conductivity in the range of 250–400 µS/cm. Most of the surveyed parameters were characterised by concentrations within the limits of the natural background for groundwater. Neogene waters at all monitoring points are characterised by good chemical status corresponding to waters of quality class II and III.

Paleogene aquifer Pg

Chemical analyses have shown that the Oligocene aquifer is dominated by bi-ionic waters of the bicarbonate-calcium type. The determined concentrations, ionic proportions and hydrogeochemical type of the surveyed waters indicate mainly the natural formation of their chemical composition. The distinguishing feature of the water of this aquifer is the relatively small variability of individual physicochemical parameters noticeable on a time scale, which is the result of both good isolation of the aquifer and the result of slow water exchange. The total mineralisation was in the range of 200–240 mg/l. The pH determined in the laboratory and in the field was

7.6–7.7, and the value of specific electrolytic conductivity was 314–346 μS/cm. These waters are characterised by good chemical status.

The above results of laboratory analyses testify to the natural processes taking place in the aquifers, which shape the chemistry of the described groundwater. Elevated concentrations of such components as iron, manganese, ammonium ion, total organic carbon or aluminium are associated with the mineral composition of aquifers. The presence of ammonium ions, and increased values of total organic carbon (TOC), are associated with the ingress of dead organic matter into groundwater along with precipitation, and then with its decomposition under anaerobic conditions.

Assessment of condition of GWB

The Site Area is located in the area of three Groundwater Bodies (GWB) – PLGW200011, PLGW200012 and PLGW200013. According to the 2016 Vistula River Basin Management Plan pursuant to Article 4(1)(b) of 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 (Water Framework Directive, WFD) and in accordance with Article 59 of the Water Law, the following main environmental objectives are envisaged for groundwater:

- preventing or limiting the inflow of pollutants into groundwater,
- preventing deterioration of the status of all groundwater bodies (subject to the reservations set out in the WFD),
- ensuring a balance between intake and recharge of groundwater,
- implementation of measures necessary to reverse the significant and sustained increasing trend in the concentration of each pollutant resulting from human activities.

According to the definitions in Article 2 of the WFD, good groundwater status is determined by both good quantitative and chemical status.

According to the methodology for setting environmental targets in the years 2012 – 2013, the environmental goal for GWB is good chemical and quantitative status.

Assessment of groundwater condition and analysis of pressures and impacts on groundwater in GWB areas as part of the tasks of the National Hydrogeological Service, is performed by the Polish Geological Institute – National Research Institute (PIG-PIB). To characterise the chemical status of GWB no. 11, 12 and 13, the most up-to-date Report on the assessment of the status of groundwater bodies in river basins – as of 2019 was used.

Assessment of the general condition of the GWB consists of an assessment of the chemical and quantitative status:

- assessment of chemical status:
  - general assessment of the chemical status,
  - assessment of the impact of salt water ingress and ascension,
  - protection of terrestrial ecosystems dependent on groundwater,
  - protection of surface waters,
  - protection of groundwater intended for human consumption,
- assessment of the quantitative status:
  - water balance including the analysis of changes in the position of the water table,
  - assessment of the impact of salt water ingress and ascension,
  - protection of terrestrial ecosystems dependent on groundwater,
  - protection of surface waters.

Qualification tests carried out in accordance with the qualification methodology based on the above criteria, showed good water quality status for Variant 1 – Lubiatowo - Kopalino site.

VI.3.3.5.2 Variant 2 — Żarnowiec site

Hydrogeological conditions in the Site area

In the Żarnowiec site area, the following aquifers have been identified:

- the Oligocene aquifer Pg – locally in contact with QIII,
- the Neogene aquifer Ng – occurring locally in contact with QII or QIII,
- the Quaternary aquifer QIII – including the sub-till level, which is locally in contact with the level QII, Ng and Pg,
- the Quaternary aquifer QII - including the lower or upper inter-till aquifer, locally in contact with the Aquifer QI and Ng,
- the Quaternary Aquifer QI – including the first aquifer in the coastal plains and the upper inter-till aquifer in the uplands.

The spread of individual levels varies. In most areas of coastal plains and the erosion gully of Lake Żarnowieckie, the first aquifer is identical to the main exploitable aquifer (GUPW), locally it is a subordinate aquifer to GUPW. Of the inter-till aquifers, the most common aquifer is the lower inter-till aquifer. The number, thickness of aquifers and their spatial range are related to the range of subsequent glaciations. In the research area, the Quaternary aquifer has been quite accurately identified by numerous hydrogeological boreholes. The first aquifer, which occurs within the Holocene sands, fine-grained sands and silty sand of coastal plains and the gully of Lake Żarnowieckie along with a small fragment of the Piaśnica river valley seems the most important from the point of view of the planned Project. Within the gutter of Lake Żarnowieckie, the first aquifer is the main useful aquifer. The first aquifer is characterised by a free water table, locally confined. Depending on the terrain, the top of aquifer within the coastal plains separating the Baltic coast from the moraine uplands lies at a depth of about 2 m below ground level, in inter-dune zones up to approximately 10 m below ground level on dune hills, stabilising at an altitude of 0.14 m below sea level (the region of Białogórskie Marshes) to 5 m above sea level. In the areas of the erosion gully, the free water table lies at a depth of about 1 m below ground level in the immediate vicinity of Lake Żarnowieckie to 5–10 m below ground level in the vicinity of Nadole (south-western coastal zone of Lake Żarnowieckie) and stabilises at an altitude of about 10 to 20 m above sea level. The first aquifer layer is variable and can range in coastal plain areas from less than 1 m to 60 m, in upland zones up to 45 m, and in the gully regions it reaches higher values from over 20 m to 95 m. The recharging of the aquifer occurs mainly through precipitation and lateral inflow from the plateau. The directions of water flow of the first aquifer clearly indicate the draining nature of the Lake Żarnowieckie surface watercourses [Figure VI.3.3.5- 2]. The drainage base in the central part of the documented area is the gully of Lake Żarnowieckie. This aquifer is in direct contact with surface waters. Numerous wetlands are characteristic. The first aquifer in the water circulation system by free flow usually charges the upper inter-till aquifer. The filtration coefficient determined on the basis of the results of the test pumping ranges from approximately 2.2 m/d to approximately 36.8 m/d. The average value of the filtration coefficient for the area of coastal plains is about 12.3 m/d. Within Lake Żarnowieckie, the conductivity of the first aquifer in question is from 20 to 40 m^2/h, and the average filtration coefficient is 19 m/d.

Legenda	Legend
Kierunek przepływu wód podziemnych	Direction of groundwater flow
Hydroizohipsy	Hydroisohypses
Obszar realizacji Przedsięwzięcia	Project Area
Granica badań modelowych	Boundaries of model studies
Zasięg poziomu QI	Range of QI level

Figure VI.3.3.5- 2 Map of the hydroisohypses of the first QI aquifer

Source: In-house study

The natural resistance of the waters of the first aquifer to pollution is a property of the aquifer system which determines the risk of migration of pollutants from the surface of the site to groundwater. In the uplands, the first aquifer usually occurs at depths of 20–50 m below ground level, and in part of the area also above 50 m below ground level. The zone between the free groundwater table and the surface of the site consists mainly of a layer of sands, often separated by well-insulating complexes of glacial clays. Hence, these areas have a very low and low degree of susceptibility to pollution. Edge zones of the uplands, where the time of vertical migration of pollutants was determined at 25–50 years, were classified as areas with a medium degree of susceptibility. In areas of coastal plains and in the area covering the structure of Lake Żarnowieckie gully, i.e. in areas where the migration time of pollutants is less than 5 years, and the depth to the first aquifer is less than 5 m, the degree of susceptibility was defined to be high. Only in places with peat surfaces, the time for the contaminants to reach the aquifer can be longer than 5 years.

Results of observation of groundwater table fluctuations

As part of the monitoring of groundwater table fluctuations in observation piezometers located in the Project Area, carried out from August 2016 to November 2020, measurements of the depth of occurrence of the static water level were carried out. During this period of time, the monitoring was conducted on a variable number of observation points, depending on the number of subsequent observation boreholes. The measurements were carried out using automatic water pressure sensors or manually using a hydrogeological whistle. The sensors measured the pressure of the water column once a day, while manual measurements were carried out once a month. The maximum value of the depth to the water table in the Project Area was 5.8 m for the QI level, while the minimum value was 0.5 m. The maximum value of the amplitude of fluctuations of the water table was 1.5 m and the minimum value was 0.3 m.

Groundwater quality

<u>Chemism of groundwaters in the Site Area</u>

Qualitative groundwater surveys were carried out from March 2017 to August 2020 with a quarterly frequency of water sampling.

According to the classification by Prikłoński and Szczukariew, the Quaternary aquifer in the **gully zone of Lake Żarnowieckie** is characterised by bi-ionic waters of the bicarbonate-calcium type. These waters belong to ordinary, low-mineralised waters, with specific electrolytic conductivity on average in the range of approximately 320–600 µS/cm. They are characterised by a weakly alkaline reaction with an average pH value of 7.4 and calcium hardness usually in the range of 2.8–5.1 mval/dm^3, which classifies water mainly as medium hard. The waters of the Quaternary aquifer in the area of Lake Żarnowieckie gully were classified at most measuring points into quality classes I, II and III as waters of good chemical status.

The waters in the upland area mostly belong to the two-ionic waters of the hydrochemical bicarbonate-calcium type. Waters at the edge part of the upland, at the edge of Lake Żarnowieckie are of chloride-bicarbonate-sodium-calcium and chloride-sodium-calcium types. Waters on the upland are mainly ordinary, low-mineralised waters, with conductivity on average in the range of approximately 300 – 600 µS/cm. In the area of the moraine upland, mineral waters were tested at two measurement and control points, whose specific electrolytic conductivity was determined in the range of 3280–7370 µS/cm. In general, fresh waters in this area have a weakly alkaline reaction with an average pH value of 7.4, and calcium hardness in the range of 2.2–4.3 mval/dm^3, which allows them to be classified as soft and medium hard waters, saline waters are usually hard or very hard. The waters at all points were classified into quality classes I, II and III as waters of good chemical status. Only at one point groundwater was classified as waters of Class V, waters of poor quality and poor chemical status.

The waters of the coastal lowlands are characterised by various hydrogeochemical types. There are bi-ionic waters of the bicarbonate-calcium type, tri-ionic waters of the chloride-sodium-calcium and bicarbonate-sulphate-calcium type and four-ionic of the bicarbonate-chloride-sodium-calcium type. The waters of the Quaternary aquifer in the region of the coastal lowlands are, according to the division, both freshwater, acratopegae and mineral waters. Fresh waters are characterised by an average value of minerals in the range of

316–406 mg/l, acratopegae have a value of 514–687 mg/l, and mineral waters reach up to 2599 mg/l – 5341 mg/l (recorded at two measurement and control points). In general, waters at all measuring points had a weakly acidic reaction (average pH = 6.7). The waters of the coastal lowlands were mostly characterised by high values of dissolved organic carbon. The highest concentrations in the range of 10 to 74.9 mg/l indicating the presence of organic substances were shown in each series by water samples taken in areas of wetlands and peatlands from which humic substances penetrate into the waters. The results of monitoring studies of the Quaternary aquifer in the area of coastal lowlands in the vast majority of measurement and control points classified the waters as waters of good chemical status. A weak chemical status of groundwater has been determined only in a few boreholes.

Assessment of condition of GWB

The Site Area and the Project Area are located in the area of the Groundwater Body – PLGW200013. According to the 2016 Vistula River Basin Management Plan, pursuant to Article 4(1)(b) of the WFD and Article 59 of the Water Law, the following main environmental objectives are foreseen for groundwater:

- preventing or limiting the inflow of pollutants into groundwater,
- preventing deterioration of the status of all groundwater bodies (subject to the reservations set out in the WFD),
- ensuring a balance between intake and recharge of groundwater,
- implementation of measures necessary to reverse the significant and sustained increasing trend in the concentration of each pollutant resulting from human activities.

According to the definitions in Article 2 of the WFD, good groundwater status is determined by both good quantitative and chemical status.

According to the methodology for setting environmental targets in the years 2012 – 2013, the environmental goal for GWB is good chemical and quantitative status.

Assessment of groundwater status and analysis of pressures and impacts on groundwater in GWB areas is carried out by the Polish Geological Institute - National Research Institute as part of the tasks of the Polish Hydrogeological Survey. To characterise the chemical status of GWB no. 13, the most up-to-date Report on the assessment of the status of groundwater bodies in river basins – as of 2019 was used.

Assessment of the general condition of the GWB consists of an assessment of the chemical and quantitative status:

- assessment of chemical status:
  - general assessment of the chemical status,
  - assessment of the impact of salt water ingress and ascension,
  - protection of terrestrial ecosystems dependent on groundwater,
  - protection of surface waters,
  - protection of groundwater intended for human consumption,
- assessment of the quantitative status:
  - water balance including the analysis of changes in the position of the water table,
  - assessment of the impact of salt water ingress and ascension,
  - protection of terrestrial ecosystems dependent on groundwater,
  - protection of surface waters.

Qualification tests carried out in accordance with the qualification methodology based on the above criteria, showed good water quality status for Variant 2 – Żarnowiec site.

VI.3.3.6 Surface waters (land part)

The Chapter presents the general characteristics of inland surface waters occurring within the considered site variants. The existing condition of inland surface waters is described by their quantitative and qualitative status. The Chapter presents hydrography, hydrological conditions, qualitative characteristics of the properties of flowing and standing waters and characteristics of bottom sediments for both site variants, as well as information on areas of particular flood risk within the meaning of Article 16(34) of the Water Law. Description of hydrographic network focused on the hydrography of the Site Area from the basin perspective. In the case of the Site Regions, only the main watercourses and water bodies located in it have been identified. The hydrographic network was described on the basis of publicly available cartographic and literature data, such as the Atlas of Hydrographic Division of Poland and the Map of Hydrographic Division of Poland, which are commonly used in hydrological studies, as well as on the basis of own field research – hydrological mapping.

In addition to providing the hydrometric characteristics of waters, the magnitudes and variability of their resources were determined and the status of water quality was assessed. The above information was based on literature data, available archival data, as well as the results of hydrological mapping and own hydrochemical monitoring of surface waters obtained as part of environmental survey. In addition, the results of own hydrological monitoring of inland waters carried out since April 2017 were used during preparation of this chapter.

VI.3.3.6.1 Variant 1 — Lubiatowo - Kopalino site

Hydrography

The Site Area in Variant 1 – Lubiatowo - Kopalino site is located in two catchments: of the Chełst River and the direct catchment area of the Baltic Sea. The largest river flowing through this area is Chełst (length of 32.14 km) – a right tributary of the Łeba River. The main tributaries of the Chełst River are: Biebrowski Kanał (length: 12.16 km, catchment area: 46.08 km^2) together with its right-bank tributary from Kierzków (5.94 km, 11.68 km^2) and Choczewka (9.88 km, 16.58 km^2) constituting the second largest, also right-bank tributary of the Chełst after the Biebrowski Kanał. Other important watercourses of the site area are flowing directly into the Baltic Sea – Lubiatówka and Bezimienna (length of 3.66 km and 4.04 km, respectively, catchment area – 8.64 km^2 and 8.71 km^2). The Site Area also includes one lake located in the Chełst catchment, with an area of about 3 ha – Kopalińskie Lake.

According to the Atlas of Hydrographic Division of Poland, the following river basins are located within the Site Region: Łeba, Przymorze from Łeba to Reda and Reda. 41 lakes with an area of more than 1 ha were found in the Site Region. These are mostly small lakes with an area not exceeding 5 ha (33 lakes out of 41 identified).

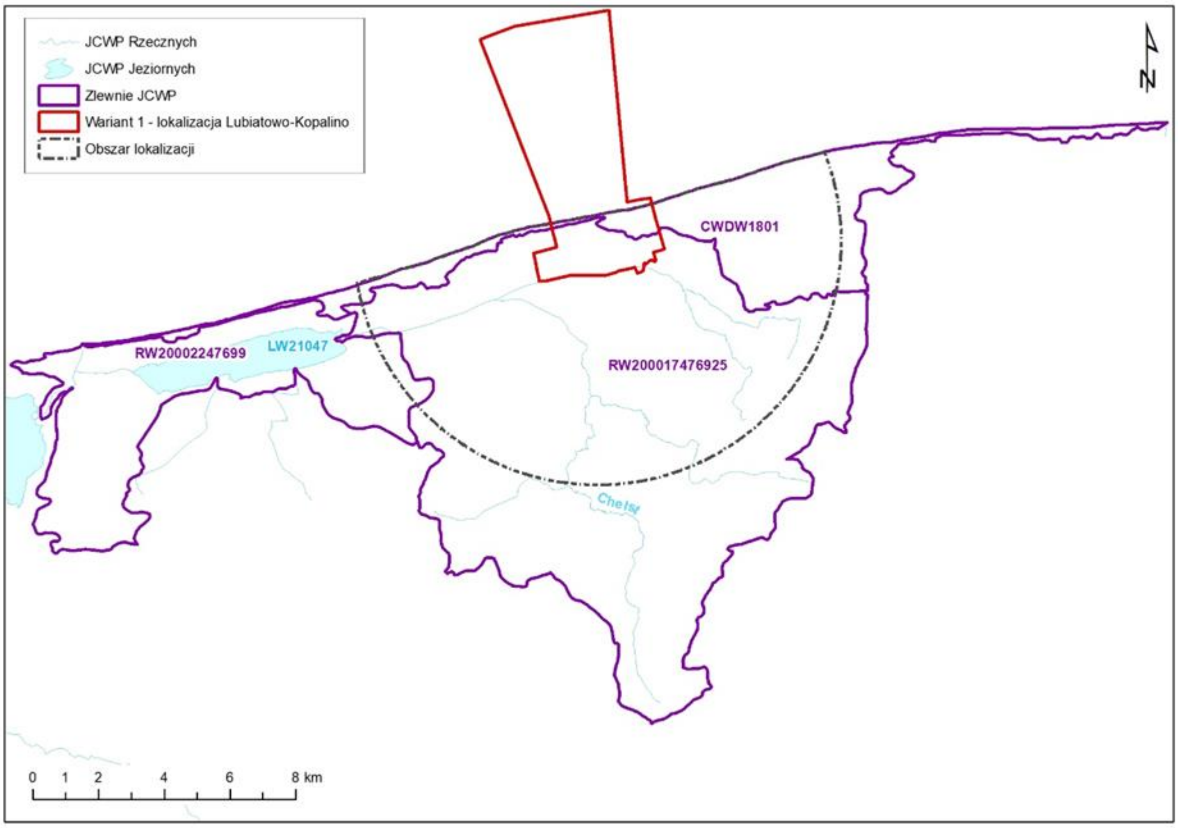
There are low and high peat bogs as well as silt deposits, alluvial deposits and wetlands within the Site Area. They are located mainly along the Biebrowski Kanał and along the Chełst River just before its mouth to Lake Sarbsko.

Surface water bodies (SWB) in the Site Area

The site area is located within:

- PLCWDW1801 — Direct sea catchment area;
- PLRW200017476925 — Chełst to the inflow to Lake Sarbsko;
- PLRW20002247699 – Łeba from Lake Łebsko with Chełst River from the inflow to Lake Sarbsko, where SWB of Lake Sarbsko with number PLLW21047 is located.

The boundaries of the SWB catchment of the Site Area are shown in the figure below [Figure VI.3.3.6- 1].



JCWP Rzecznych	River SWB
JCWP Jeziornych	Lake SWB
Zlewnie JCWP	SWB catchments
Wariant 1 - lokalizacja Lubiatowo - Kopalino	Variant 1 – Lubiatowo - Kopalino site
Obszar lokalizacji	Site Area

Figure VI.3.3.6- 1 Site area against the background of surface water bodies. Variant 1 — Lubiatowo - Kopalino site

Source: In-house studies based on the Update of water management plans - National Water Management Authority, https://www.apgw.gov.pl/

Quantitative characteristics

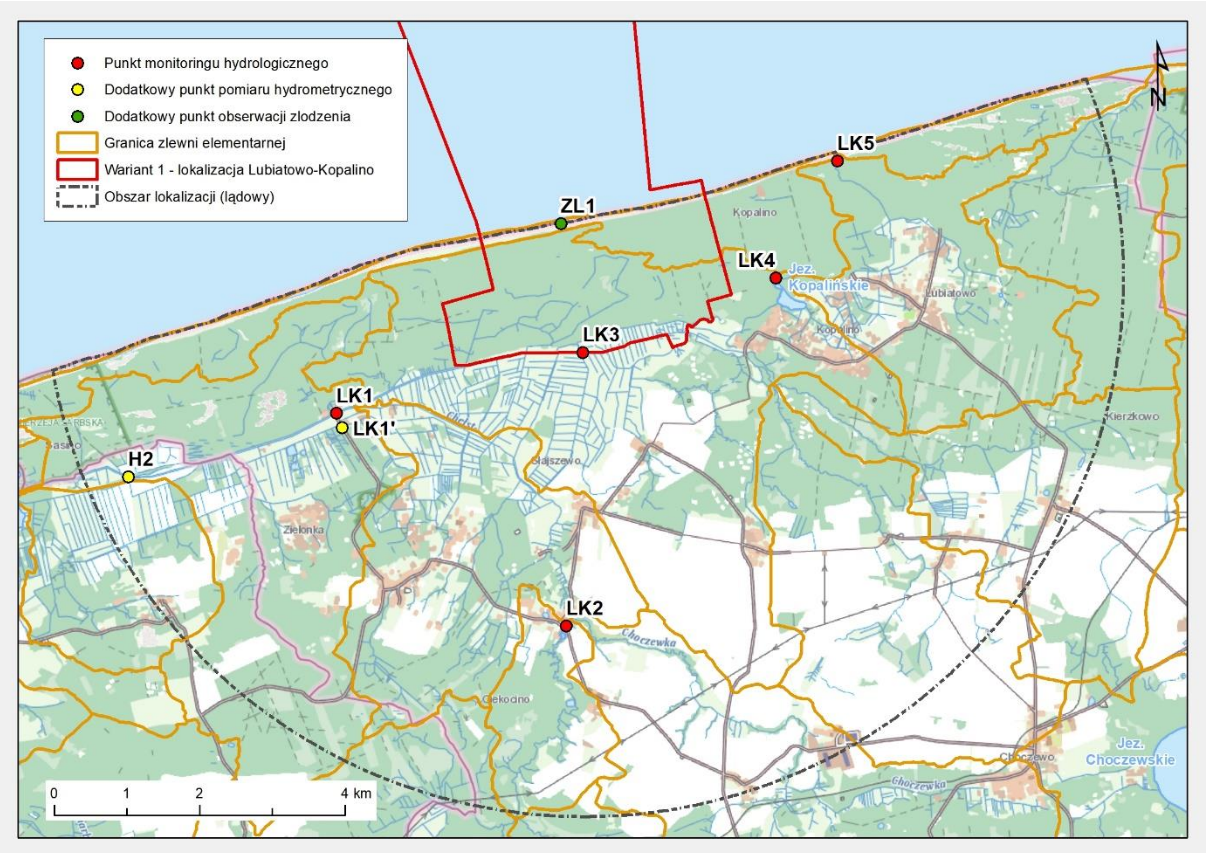
There are no stations of the National Hydrological and Meteorological Service (CPMŚ) recording the physical state and thermal conditions, e.g. temperature and water flow rate. Therefore, the quantitative characterisation of the surface water in the area could only be based on the results from in-house monitoring. The duration of the survey covered the period from April 1, 2017 to October 31, 2019.

As part of in-house study, field measurements of the level of water, its flow rate, temperature and the volume of transport of river debris were carried out on selected measurement profiles for Variant 1 – Lubiatowo - Kopalino site. In addition, as part of the monitoring, observation of the occurrence of ice phenomena was also carried out on the profiles. Below is a list of measuring stations:

- LK1 – Chełst River in Osetnik – measurement of water level, flow, temperature and sum of transported debris, along with observation of ice phenomena;
- LK1' – a channel parallel to the Chełst River in Osetnik – included in the biweekly measurements of the flow rate and the volume of the transported debris on December 20, 2017, along with the observation of ice phenomena;
- LK2 – Chełst River in Ciekocin – measurement of water level, flow, temperature and sum of transported debris, along with observation of ice phenomena;

- LK3 – Biebrowski Kanał – measurement of water level, flow, temperature and sum of transported debris, along with observation of ice phenomena;
- LK4 – Kopalińskie Lake – measurements of water level and temperature;
- LK5 – Lubiatówka River at the mouth of the Baltic Sea – measurement of water level, flow, temperature and sum of transported debris, along with observation of ice phenomena;
- H2 – Chełst River north of Ulinia – monthly measurements of water flow rate, started on 20.12.2017, combined with the reading of water levels;
- LKZL1 – observation of the occurrence of ice phenomena in 167.2 km of the Baltic coastline, north of the LK3 profile.

The location of measuring stations and observation points against the background of elementary catchments is shown in the following Figure [Figure VI.3.3.6- 2].



Punkt monitoringu hydrologicznego	Hydrological monitoring point
Dodatkowy punkt pomiaru hydrometrycznego	Additional hydrometric measurement point
Dodatkowy punkt obserwacji zlodzenia	Additional icing observation point
Granica zlewni elementarnej	Boundary of the sub-catchment
Wariant 1 - lokalizacja Lubiatowo - Kopalino	Variant 1 – Lubiatowo - Kopalino site
Obszar lokalizacji (lądowy)	Site Area (land)

Figure VI.3.3.6- 2 Location of measuring stations and observation points against the background of elementary catchments. Variant 1 — Lubiatowo - Kopalino site

Source: In-house study

The average unit outflow of most rivers in the Site Region (based on measurements gauging stations of the Institute of Meteorology and Water Management) ranges from 2.6 dm^3/s·km^2 to 11.4 dm^3/s·km^2, while for rivers under own monitoring (estimation based on measurements from 1 April 2017 to 31 October 2019) from 3.5 dm^3/s·km^2 to 10.65 dm^3/s·km^2. For most watercourses, the average unit ebb tide is higher than the average from the area of Poland, where the unit ebb tide is 5.4 dm^3/s·km^2.

Areas of particular risk of flooding

The following areas of particular flood risk in the Project Area have been identified in the Site Area:

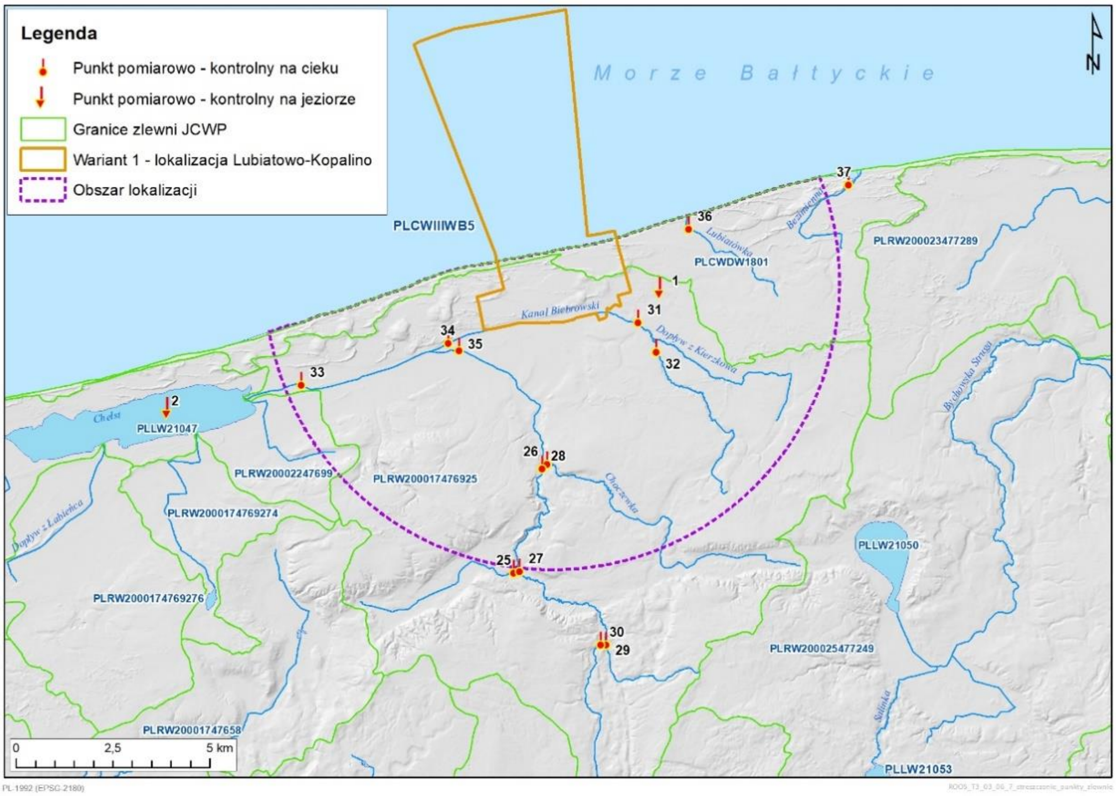
- a strip in the beach zone identified as an area at risk of flooding from the sea side with a probability of occurrence of 1%,
- service strip.

Qualitative characteristics of flowing and standing waters

The qualitative assessment of the status of the existing inland surface waters was carried out in a division in accordance with the SWB completely included in the Site area, or at the border of the circle delimiting the Area. This approach is in line with the Water Framework Directive, where the assessment of surface water status is set at the level of the SWB. The assessment of the existing state was carried out taking into account biological, physicochemical, hydromorphological and chemical elements. On the basis of the results obtained from in-house studies, a final assessment of the existing status of water quality was made.

Firstly, the identification of the SWB state in the Area was carried out on the basis of data obtained from annual reports on the state of the environment in the Pomorskie Voivodeship. The water status was assessed on the basis of measurements carried out under National Environmental Monitoring at two measurement and control points. According to the results of the research of the State Environmental Monitoring on the Chełst River in 2018, biological elements were assigned to class III (out of 5 classes), physicochemical elements were not assessed, and the chemical status of the water body was classified below good. However, for Lake Sarbsko (in 2016), biological elements were assigned to class IV (oversized values for the phytoplankton index), physicochemical elements were assigned to a class greater than II (total nitrogen, transparency), and the chemical status of the water body was not assessed.

In the next step, in order to verify and clarify the results of the assessment of the existing state of the SWB covered by the potential impact of the Project for Variant 1 – Lubiatowo - Kopalino site, annual surveys of all elements of water quality at the selected 15 measurement and control points (ppk) were carried out. The points were located on rivers (13 ppk points) and lakes (2 ppk points) [Figure VI.3.3.6-3]. The scope of in-house studies and its frequency have been developed on the basis of regulations current at the time of research, in the field of water monitoring (in accordance with the Regulation of the Minister of the Environment of 19 July 2016 on the forms and method of monitoring of uniform bodies of surface and groundwater).



Legenda	Legend
Punkt pomiarowo - kontrolny na cieku	Measurement and control point on the watercourse
Punkt pomiarowo - kontrolny na jeziorze	Measurement and control point on the lake
Granice zlewni JCWP	Boundaries of the SWB catchment
Wariant 1 - lokalizacja Lubiatowo - Kopalino	Variant 1 – Lubiatowo - Kopalino site
Obszar lokalizacji	Site Area

Figure VI.3.3.6-3 measurement and control points in the area of Variant 1 — Lubiatowo - Kopalino site

Source: Report on Environmental Characteristics and Valorisation for the EIA Report on the chemism of terrestrial environment. Ośrodek Badań i Kontroli Środowiska Sp. z o.o., Warsaw, 2020

The assessment of the state of river and lake SWB and Lake Kopalińskie, for which no SWB was designated, and yet was included in the assessment due to its close location in relation to Variant 1 – Lubiatowo - Kopalino site, is presented in the table [Table VI.3.3.6- 1].

Table VI.3.3.6- 1 Results of the SWB evaluation. Variant 1 – Lubiatowo - Kopalino site

No.	SWB	Status/ecological potential	Chemical status	Status evaluation
1	Chełst to the inflow to Lake Sarbsko	moderate	below good	bad
2	direct sea catchment area	moderate	below good	bad
3	Lake Sarbsko	bad	below good	bad
4	Lake Kopalińskie	moderate	below good	bad

Source: Report on Environmental Characteristics and Valorisation for the EIA Report on the chemism of the terrestrial environment. Ośrodek Badań i Kontroli Środowiska Sp. z o.o., Warsaw, 2020

The work has shown that the overall status of surface water bodies, both in rivers and lakes, is bad.

Quality characteristics of bottom sediment

Qualitative characterisation and assessment of the condition of bottom sediments were carried out according to the principles used within the National Environmental Monitoring at points coinciding with the location of measurement and control points for rivers and lakes [Figure VI.3.3.6-3]. The following two criteria were adopted:

- a geochemical criterion, enabling the degree of contamination of bottom sediments to be assessed in relation to the content of elements present in sediments under natural conditions. The assessment distinguishes (taking into account the decrease in quality): first the background, class I, class II, class III and non-class items,
- an ecotoxicological criterion to assess the degree of impact of contaminated sediments on aquatic organisms. The assessment distinguishes four levels, of which level IV indicates heavily contaminated sediment.

The results of the assessment of bottom sediments for rivers and lakes did not indicate contamination of sediments with heavy metals, which means that the geochemical criterion did not exceed class I. With regard to organic pollutants, in 4 out of 15 surveyed points, sediments were found to be slightly contaminated (level II according to the ecotoxicological criterion) and in 1 measurement and control point sediments contaminated to a medium degree (level III according to the ecotoxicological criterion) were found.

VI.3.3.6.2 Variant 2 — Żarnowiec site

Hydrography

The site area designated for Variant 2 – Żarnowiec site covers several catchment areas:

- Piaśnica catchment (river length of 31.3 km, catchment area of 317 km^2) together with Lake Żarnowiec, crossing the Site area from south-east to north-west,
- Reda catchment (river length of 52.2 km, catchment area of 486 km^2), and more precisely its left-bank tributary – Kostkowo Kanał (10.7 km),
- Czarna Woda catchment (river length of 20.5 km, catchment area of 87.3 km^2), together with its upper section, including springs,
- from the north-east the Site area includes a part of the Karwianki catchment (length of 10.6 km, catchment area of 60.9 km^2) with its upper section and almost its entire largest, left-bank tributary near Goszczno (5.1 km).

In the north-western part of the Site area, there is an estuary section of the Bychowska Struga River located in the Piaśnica catchment. The Bychowska Struga River with a length of 22.5 km (catchment area of 117.6 km^2) flows into Lake Żarnowieckie and is also the left-bank, largest tributary of the Piaśnica. In addition to the above-mentioned watercourses, in the Site area there are numerous drainage channels concentrated in the gully of Lake Żarnowieckie – in the catchment area of Piaśnica and Bychowska Struga, as well as in the valleys of Czarna Woda and Karwianka. There are 3 lakes in the Site Area. The largest is Lake Żarnowieckie with an area of 1,425 ha and a maximum depth of 19.4 m. The other lakes are Lake Dobre (18.5 ha) and Lake Witalicz (4.2 ha). A reservoir important in terms of surface in the Site area, albeit artificial, is the upper reservoir of the Żarnowiec pumped-storage power plant (95.3 ha).

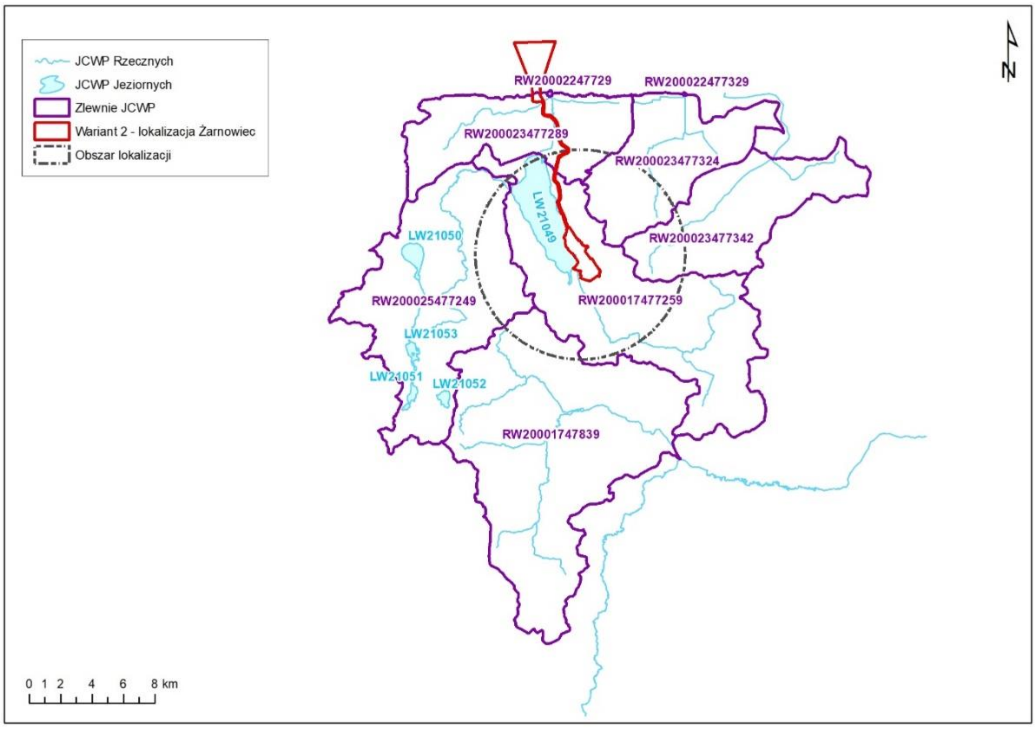
According to the Atlas of Hydrographic Division of Poland, the following river basins are located within the Site Region: Łeba, Przymorze from Łeba to Reda and Reda and the northern part of Przymorze from Reda to Martwa Wisła. 65 lakes with an area of more than 1 ha were found in the Site Region. These are mostly small lakes with an area not exceeding 5 ha (43 lakes out of 65 identified).

There are low peat bogs within the Site Area associated with the Piaśnica valley. Silt deposits, alluvial deposits and wetlands were identified in the valleys of Bychowska Struga, Karwianka and Czarna Woda rivers. Locally, there are also high and transitional peat bogs in the Site Area.

Surface water bodies

With regard to the division into SWB, the majority of the Site area is located within the river SWB PLRW200017477259 – the Piaśnica river to the outflow from Lake Żarnowieckie, together with the lake SWB LW21049 – Lake Żarnowieckie. The Site area also partially covers the river SWB: PLRW20001747839 – Reda to

Bolszewka, PLRW200025477249 – Bychowska Struga, PLRW200023477289 – Piaśnica from the outflow from Lake Żarnowieckie to Białogórska Struga, PLRW200023477324 – Karwianka Kanał to the tributary from the Karwia polder from the tributary from the Karwia polder, PLRW200023477342 – Czarna Woda to Struga (inclusive). The boundaries of the SWB catchment are shown in the figure below [Figure VI.3.3.6- 4].



JCWP Rzecznych	River SWB
JCWP Jeziornych	Lake SWB
Zlewnie JCWP	SWB catchments
Wariant 2 - lokalizacja Żarnowiec	Variant 2 — Żarnowiec site
Obszar lokalizacji	Site Area

Figure VI.3.3.6- 4 Site area against the background of surface water bodies. Variant 2 — Żarnowiec site

Source: In-house studies based on the Update of water management plans - National Water Management Authority, https://www.apgw.gov.pl/

Quantitative characteristics

In connection with the surface water system, there are four inactive and one active water gauging station of the National Hydrological and Meteorological Service in the Site Area and in its close vicinity. These are: Wierzchucino on Bychowska Struga, Nadole on Lake Żarnowieckie, Żarnowiec and Dębki on Piaśnica below Lake Żarnowieckie (inactive stations), as well as Warszkowski Młyn on the upper section of Piaśnica (active station). The station locations are shown in the figure [Figure VI.3.3.6- 5].

As part of the research on the identification of the quantitative status of inland surface waters, hydrological monitoring has been carried out by the Investor since 1 April 2017. For the purposes of this Chapter, data from the period from 1 April 2017 to 31 October 2019 was used.

As part of in-house study, field measurements of the level of water, its flow rate, temperature and the volume of transport of river debris were carried out on selected measurement profiles for Variant 2 – Żarnowiec site. In addition, as part of the monitoring, observation of the occurrence of ice phenomena was also carried out on the profiles. Below is a list of gauging stations, measurement profiles and observation points:

- Za1 – Bychowska Struga in Wierzchucin – measurement of water level, flow, temperature and sum of transported debris, along with observation of ice phenomena;

- Za2 – Piaśnica at outflow from Lake Żarnowieckie – measurement of water level, flow, temperature and sum of transported debris, along with observation of ice phenomena;
- Za3 – Piaśnica River at the mouth of the Baltic Sea in Dębki – measurement of water level, flow, temperature and sum of transported debris, along with observation of ice phenomena;
- Za4 – Lake Żarnowieckie in Kartoszyno – measurement of water level, flow, temperature and sum of transported debris, along with observation of ice phenomena;
- Za5 – Piaśnica above Lake Żarnowieckie – measurement of the level and temperature of water, flow, sum of transported debris, along with observation of ice phenomena;
- Za6 – Karwianka River at the mouth of the Baltic Sea in Karwia – measurement of water level, flow, temperature and sum of transported debris, along with observation of ice phenomena;
- ZaZL1 – a place of observation of ice phenomena on a water reservoir (pond) in the area after the construction of the former nuclear power plant in Kartoszyno;
- ZaZL2 – a place of observation of ice phenomena in the Baltic Sea, between points Za3 and Za6, north of Karwieńskie Błota Drugie.

The location of measurement profiles and points against the background of elementary catchments is shown in the following Figure [Figure VI.3.3.6- 5].

Punkt monitoringu hydrologicznego	Hydrological monitoring point
Dodatkowy punkt obserwacji zlodzenia	Additional icing observation point
Stacja wodowskazowa	Gauging station
czynna	active
nieczynna	inactive
Granica zlewni elementarnej	Boundary of the sub-catchment
Wariant 2 - lokalizacja Żarnowiec	Variant 2 — Żarnowiec site
Obszar lokalizacji	Site Area

Figure VI.3.3.6- 5 Location of measuring profiles and points against the background of elementary catchments. Variant 2 — Żarnowiec site

Source: In-house study

The average unit outflow of most rivers in the Site Region (based on measurements gauging stations of the Institute of Meteorology and Water Management) ranges from 2.6 $dm^3/s \cdot km^2$ to 11.4 $dm^3/s \cdot km^2$, while for rivers under own monitoring (estimation based on measurements from 1 April 2017 to 31 October 2019) from 5.82 $dm^3/s \cdot km^2$ to 7.45 $dm^3/s \cdot km^2$. For most watercourses, the average unit ebb tide is higher than the average from the area of Poland, where the unit ebb tide is 5.4 $dm^3/s \cdot km^2$.

Areas of particular risk of flooding

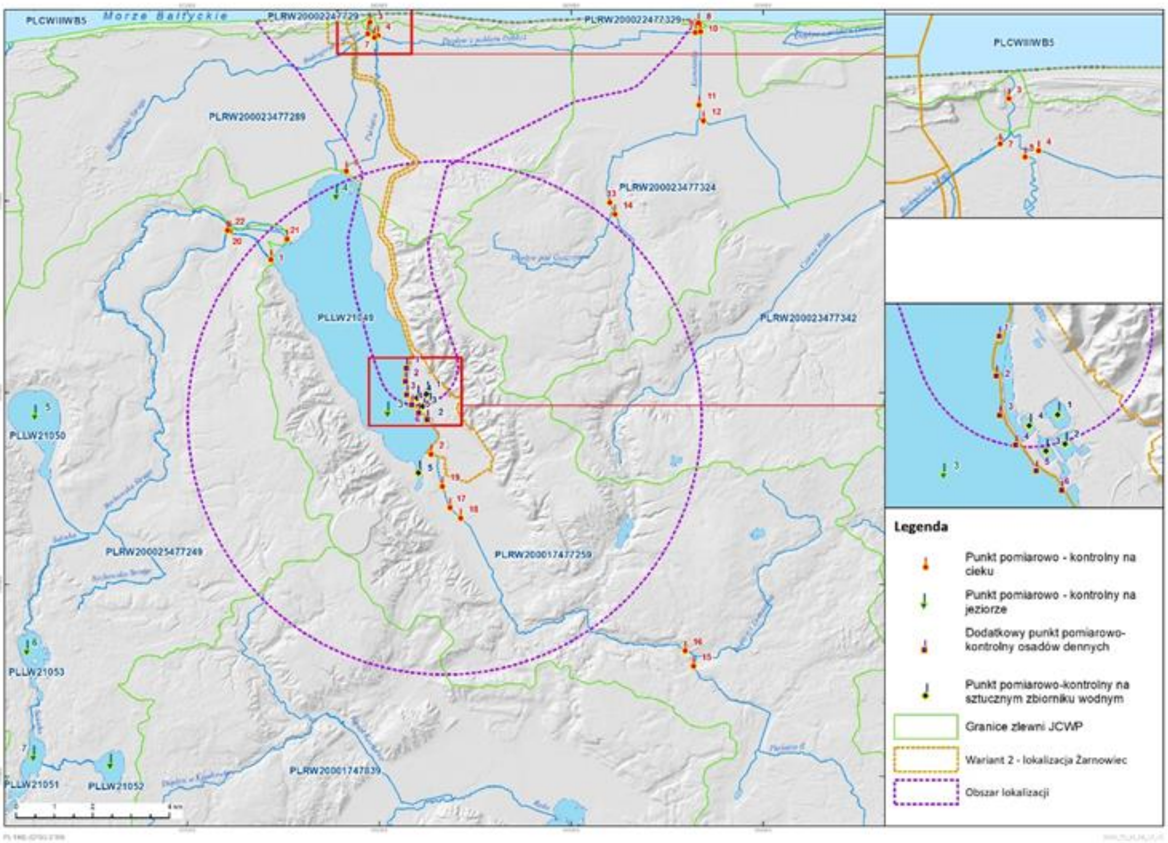
Using the approach and requirements analogous to those in the case of Variant 1 – Lubiatowo - Kopalino site, areas of particular flood risk for land use within the scope of the Project Area for Variant 2 – Żarnowiec site were identified.

The analysis shows that:

- within the boundaries of the main area of the NPP and in the area of the pipeline route for cooling systems to the northern ends of Lake Żarnowieckie, no areas particularly at risk of flooding have been identified,
- in the further course of the infrastructure related to the cooling system, a passage through areas particularly at risk of flooding is conducted: first along the Piaśnica River on its right bank, then crossing the river and continuing along the left-bank levee. Technical solutions aimed at eliminating the risk of flooding, and at least maintaining the flood protection function of the existing embankment, to be taken into account at the design stage,
- in the coastal zone, between the pumping station and the seashore, along the route of the planned pipelines for cooling systems, the area particularly at risk of flooding shall be the technical strip and the 1% flood risk strip from the side of the sea; without affecting the functioning of the NPP.

Qualitative characteristics of flowing and standing waters

The qualitative characteristics of surface waters in SWB, whose surface range included the Site Area of Variant 2 – Żarnowiec site, were carried out in the same way as for Variant 1 – Lubiatowo - Kopalino site. The location of 33 measurement and control points (for rivers, lakes and artificial reservoirs) of the annual monitoring of surface water quality is shown in the Figure [Figure VI.3.3.6-6]. For comparison, the State Environmental Monitoring was carried out, taking into account the considered SWB, at 3 points located on rivers and on 3 lakes. To sum up the results – the chemical status of the water body of the Piaśnica River was classified as good (2018). In the case of the Bychowska Struga River, the physicochemical elements were assigned with class II, other elements were not assessed (2016). For the Karwianka Kanał biological elements were assigned with class I, and physicochemical elements were assigned with class II (2016). However, the chemical status of all three surveyed lakes (Choczewskie, Czarne and Dąbrze) was classified as good (2015 and 2016).



Legenda	Legend
Punkt pomiarowo - kontrolny na cieku	Measurement and control point on the watercourse
Punkt pomiarowo - kontrolny na jeziorze	Measurement and control point on the lake
Dodatkowy punkt pomiarowo-kontrolny osadów dennych	Additional measurement and control point for bottom sediments
Punkt pomiarowo-kontrolny na sztucznym zbiorniku wodnym	Measurement and control point on an artificial water reservoir
Granice zlewni JCWP	Boundaries of the SWB catchment
Wariant 2 - lokalizacja Żarnowiec	Variant 2 — Żarnowiec site
Obszar lokalizacji	Site Area

Figure VI.3.3.6-6 measurement and control points in the area of Variant 2 — Żarnowiec site

Source: Reports on Environmental Characteristics and Valorisation for the purposes of the EIA Report on the chemism of terrestrial environment. Ośrodek Badań i Kontroli Środowiska Sp. z o.o., Warsaw, 2020

Own monitoring research of surface waters has shown that the overall status of surface water bodies (11 points), both in rivers and lakes, is bad. The water chemical status of all surveyed SWBs is below good, while the ecological status/potential is characterised by 3 classes – from moderate to bad. The overall status of surface water bodies, both in rivers and lakes, is bad, which was presented in the table [Table VI.3.3.6- 2].

Table VI.3.3.6- 2 Results of the SWB evaluation. Variant 2 – Żarnowiec site

No.	SWB	Status/ecological potential	Chemical status	Status evaluation
1	Piaśnica to distributary from Lake Żarnowieckie	moderate	below good	bad
2	Piaśnica from distributary from Lake Żarnowieckie to Białogórska Struga	moderate	below good	bad
3	Piaśnica from tributary from the Dębki polder to the mouth	poor	below good	bad
4	Karwianka Kanał to the tributary from the Karwia polder	bad	below good	bad
5	Karwianka Kanał from tributary from the Karwia polder to the mouth	bad	below good	bad
6	Bychowska Struga	poor	below good	bad
7	Lake Żarnowiec	bad	below good	bad
8	Lake Choczewskie	bad	below good	bad
9	Lake Salińskie	poor	below good	bad
10	Lake Czarne	poor	below good	bad
11	Lake Dąbrze	poor	below good	bad

Source: In-house studies based on the Report on Environmental Characteristics and Valorisation for the EIA Report on the chemism of the terrestrial environment. Ośrodek Badań i Kontroli Środowiska Sp. z o.o., Warsaw, 2020

Quality characteristics of bottom sediment

The qualitative characterisation and assessment of the condition of bottom sediments were carried out, similarly as for Variant 1 – Lubiatowo - Kopalino site.

The results of the assessment of bottom sediments for rivers and lakes did not indicate contamination of bottom sediments with heavy metals. The final assessment of bottom sediments surveyed in tanks in 3 (Tank 1, Tank 2 and Tank 4) indicated sludges not contaminated with heavy metals and organic compounds (geochemical background values according to the geochemical criterion and level I according to the ecotoxicological criterion). The final assessment of sediments in Reservoir 3 according to the geochemical criterion is class II, and according to the ecotoxicological criterion – level III. For organic pollutants in 15 out of 22 river points, the final assessment indicated low-level sediments (ecotoxicological level II). In 1 point bottom sediments are classified as highly contaminated sediments (level IV of the ecotoxicological criterion). In turn, surveys of bottom sediments in 4 lakes (Choczewskie, Salińskie, Czarne and Dąbrze) did not indicate heavy metal pollution, only in Lake Żarnowiec silver values corresponding to class II according to the geochemical criterion were found, i.e. contaminated to a small extent. With regard to organic pollutants, in 4 out of 6 surveyed points sediments were found to be slightly contaminated (level II according to the ecotoxicological criterion). In the supply channel, the sediments were classified as heavily contaminated (level IV).

In order to meet the requirements of the GDOŚ Decision in Variant 2 – Żarnowiec site, the scope of bottom sediment survey has been extended to include the following issues: qualitative characteristics of bottom sediments (lithology, chemical composition, including heavy metals), quality of sediment in the place of planned protection of the wharf against flood and erosion, and the method of dealing with possible spoil according to the Regulation of the Minister of the Environment of 11 May 2015 on the recovery of waste outside plants and devices.

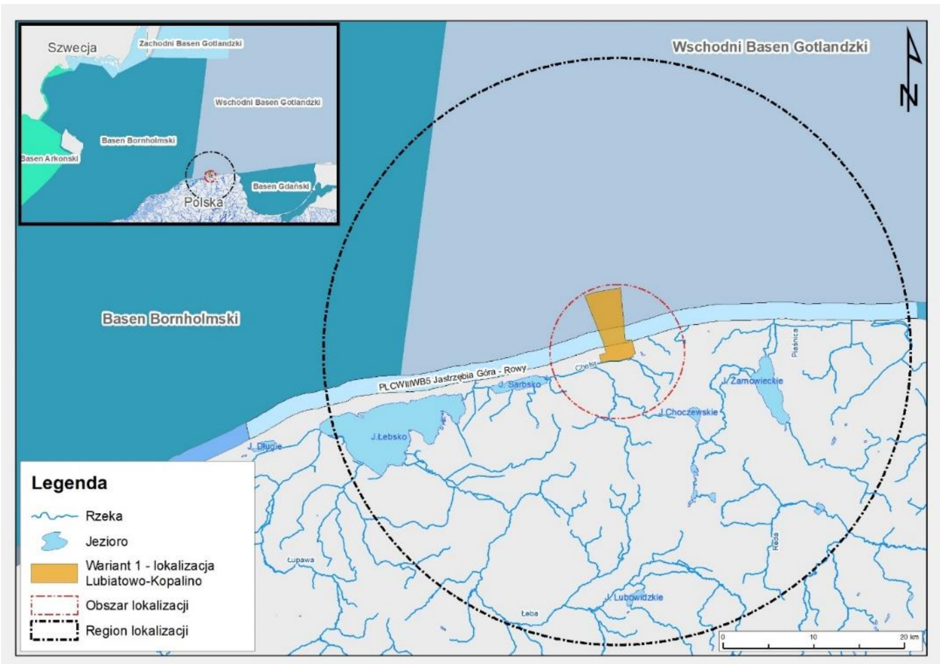
In addition, the scope of bottom sediment survey showed that the tested sediments and possible spoil resulting from the possible dredging of Lake Żarnowieckie could be used as waste in the recovery process, because the sediments meets the requirements contained in the Regulation of the Minister of the Environment of 11 May 2015 on the recovery of waste outside plants and devices.

VI.3.3.7 Surface waters (marine part)

VI.3.3.7.1 Variant 1 — Lubiatowo - Kopalino site

Hydrogeography

The site region of the analysed site variant is located in the southern part of the Baltic Proper, in the shallow-water zone, where the depth reaches a maximum of 38 m. In accordance with the Act of 21 March 1991 on the maritime areas of the Republic of Poland and maritime administration, the Site Region is administratively located within the Polish territorial sea, i.e. in the area of sea waters with a width of 12 nautical miles (i.e. 22,224 m) from the baseline of the sea and covers part of the area of the adjacent exclusive economic zone. According to the latest guidelines on the division of the sea (results of the work of the Baltic Marine Environment Protection Commission - HELCOM), the site region is located in the south-western part of the eastern Gotland Basin, which is the largest unit of the Baltic Proper, and in a small part in the south-eastern part of the Bornholm Basin. Before the 2014 update of the division of water regions in accordance with HELCOM, this part of the Baltic Sea was referred to as Polish coastal waters and open waters of the eastern part of the Baltic Proper, so different terms often exist in the literature. According to the division of coastal waters resulting from the transposition of the Water Framework Directive, coastal SWB no. PLCWIIIWB5 Jastrzębia Góra-Rowy [Figure VI.3.3.7- 1] is located within the Site Region. The environmental objectives for the above-mentioned SWB are presented in the table below [Table VI.3.3.7- 1].



Szwecja	Sweden
Zachodni Basen Gotlandzki	West Gotland Basin
Basen Arkonski	Arkona Basin
Wschodni Basen Gotlandzki	Eastern Gotland Basin
Basen Bornholmski	Bornholm Basin
Polska	Poland
Legenda	Legend
Rzeka	River
Jezioro	Lake
Wariant 1 - lokalizacja Lubiatowo - Kopalino	Variant 1 – Lubiatowo - Kopalino site
Obszar lokalizacji	Site Area
Region lokalizacji	Site Region
PLCWIIIWB5 Jastrzębia Góra - Rowy	PLCWIIIWB5 Jastrzębia Góra - Rowy

Figure VI.3.3.7- 1 Site region against the background of the HELCOM division of southern Baltic Sea and coastal and transitional SWB designated under the transposition of the Water Framework Directive applicable at the time of preparation of the Report. Variant 1 — Lubiatowo - Kopalino site

Source: In-house studies based on HELCOM Map And Data Service. http://maps.helcom.fi/website/mapservice/

Table VI.3.3.7- 1 SWB of the Site Region Variant 1 — Lubiatowo - Kopalino site (valid from 2021)

No.	Name	SWB code / Type	Status	General status	Environmental objective - status or ecological potential	Environmental objective — chemical status	Assessment of risk of failure to achieve environmental goals
1.	Jastrzębia Góra – Rowy	PLCWIIIWB5 / coastal	NAT	BAD	good ecological status	good chemical status	at risk

**NAT – natural*

Source: In-house studies based on the Update of water management plans - National Water Management Authority, https://www.apgw.gov.pl/

The above information applies to the SWB developed in the planning cycle applicable at the time of preparation of this Report. From 2022, another planning cycle will be implemented, under which environmental objectives, as well as the names and scopes of the SWB are under change. As part of the new planning cycle, Variant 1 – Lubiatowo - Kopalino site will be located within the SWB with the number PLCW20001WB2 under the name Polskie wody przybrzeżne Basenu Gotlandzkiego [Table VI.3.3.7- 2].

Table VI.3.3.7- 2 SWB of the Site Region. Variant 1 — Lubiatowo - Kopalino site (valid from 2022)

No.	Name	SWB code / Type	Status	General status	Environmental objective - status or ecological potential	Environmental objective — chemical status	Assessment of risk of failure to achieve environmental goals
1.	Polskie wody przybrzeżne Basenu Gotlandzkiego	PLCW20001WB2 / coastal	NAT	BAD	moderate ecological status (mitigated indicators - chlorophyll, Index B (class III), other indicators - quality class II)	good chemical status	at risk

Source: In-house studies based on the Update of water management plans - National Water Management Authority, https://www.apgw.gov.pl/

Bearing in mind the coastal nature of the above-mentioned SWB, it should be emphasised that the assessment as part of the implementation of the provisions of the Water Framework Directive was carried out taking into account the relevant environmental objectives set at the water bodies. However, when carrying out an assessment under 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, MSFD), a descriptive and professional judgement approach is used for other marine waters. 11 descriptive indicators (characteristics) are used, for which criteria which constitute good environmental status have been established. According to the MSFD, a Good Environmental Status (GES) within European marine waters it is required to be achieved by 2020. A set of environmental objectives set for Polish maritime areas defined at the level of individual characteristics and criteria has been presented in the Regulation of the Minister of Infrastructure of 25 February 2021 on the adoption of an update of the set of environmental objectives for marine waters.

Hydrological conditions

The preparation of the report on the assessment of the environmental impact for the first Polish nuclear power plant was preceded by a number of marine water surveys, e.g. hydrological monitoring, which was carried out continuously in the period from 30 April 2017 to 31 August 2019. The marine hydrological monitoring system for Variant 1 – Lubiatowo - Kopalino site consisted of two permanently anchored measuring buoys: MHM_LK1 and MHM_LK2, located in a straight line perpendicular to the shore. The MHM_LK1 was located 1.5 km from the shore at a depth of about 13 m, in the eastern Gotland Basin within the coastal SWB no. PLCWIIIWB5 Jastrzębia

Góra – Rowy (from 2022 it will be SWB PLCW20001WB2 Polish coastal waters of the Gotland Basin). The MHM_LK2 buoy was located at a distance of 3.0 km from the shore at a depth of about 18 m, in the open waters of the eastern Gotland Basin. The choice of the location of monitoring points (buoys MHM_LK1 and MHM_LK2) was closely related to the potential location of infrastructure related to the collection and discharge of cooling water and is included in the area of comprehensive marine surveys in the field of qualitative research of sea waters and bottom sediments, research on the biotic environment of marine waters, seabed morphology and bathymetry. The measurement sets continuously recorded the hydrodynamic parameters and basic hydrophysical parameters of seawater. Below is basic information about the recorded parameters.

Waves

Waves on the free surface of the sea within Variant 1 – Lubiatowo - Kopalino site was clearly characterised by differentiation depending on the season – the highest waves were recorded in autumn and winter periods, and the lowest in spring and summer. The strongest storm was recorded in the first week of January 2019. The average wave height and the average significant wave height for the MHM_LK1 station were 0.44 m and 0.75 m, respectively, and for the MHM_LK2 station – 0.48 m and 0.81 m. The highest wave for the MHM_LK1 station reached a height of 6.98 m (January 2, 2019), and for the MHM_LK2 station it was 7.78 m high (January 2, 2019). The sea level most often remained from the second to the fifth on the ten-point Douglas scale. In both cases, waves from the west prevailed with a slight share of waves from the north, north-east and north-west directions. However, there was no waving from the south at all.

Sea level

Changes in the free sea surface were typical for this part of the Baltic Sea – in the spring the sea level was usually lower, rising in the summer; strong storms occurred in the autumn and early winter periods. The maximum sea levels recorded as part of the monitoring of Variant 1 – Lubiatowo - Kopalino site — are for the stations MHM_LK1 – 635 cm and MHM_LK2 – 629 cm (January 2, 2018), and the minimum of 408 cm for the MHM_LK1 station and 407 cm for the MHM_LK2 station, respectively (November 30, 2018).

Direction and velocity of flow

Recordings of the directions and speeds of water flows covered the entire vertical profile of the depths in 4 m layers of water. The highest current velocities that occurred at the MHM_LK1 station are 0.92 m/s (at a depth of 1–4 m), and 0.81 m/s at the MHM_LK2 station (at a depth of 2–6 m). The average speed of water movement in the entire profile of body of water for both stations was about 0.11 m/s, at the same time it was observed that the average speeds of water movement decreased towards the bottom.

For the entire period at both stations, a definite predominance of water flows towards the east and north-east is visible. The same direction of water flows occurs throughout the body of water profile. This nature of flows results from the location of the measurement stations in places at relatively short distances from the shore with the prevailing longitudinal currents directed mainly from west to east.

Ice conditions

Observations of ice phenomena were carried out within Variant 1 – Lubiatowo - Kopalino site on the measurement station on the 167.2 km of the Baltic Sea coastline. In the measurement period from 30 April 2017 to 31 August 2019 (i.e. 2 full ice seasons), no ice phenomena were recorded.

Water temperature

The results of the water temperature surveys reflected the intensity of solar radiation, which changes depending on the season, and the mixing of water. At the MHM_LK1 station, the temperature was measured above the bottom, where the average temperature for the entire measurement period was 10.36°C, while extreme values ranged from -0.13°C to 24.13°C. At the MHM_LK2 station, the temperature was measured at 3 depths, where the average temperature in the entire body of water's profile was close to 10.0°C and extreme values were in the range of -0.27°C (at a depth of 1 m) to 24.51°C (at a depth of 1 m).

Electrolytic conductivity

The electrolytic conductivity of water was measured at three depths in the waters at the measuring station MHM_LK2. The analysis of the electrolytic conductivity of water throughout the survey period, i.e. from 30 April 2017 to 31 August 2019, showed the seasonality of the parameter associated with the change in water temperature. The variability of this parameter ranged from 0.68 S/m at depths of 1 and 9 m to 1.26 S/m at a depth of 1 m.

Salinity

Water salinity was calculated using data on water temperature, depth and electrolytic conductivity. The maximum, average and minimum values were similar in the entire vertical profile. Salinity was measured at the MHM_LK2 station – the variability of this parameter ranged from 6,668.5 ppm to 8,112.7 ppm (in both cases at the measurement point above the bottom).

Turbidity

The measured turbidity values (measurements were carried out only at the MHM_LK2 station) ranged from 0 NTU to 153.4 NTU above the bottom. In general, more turbidity was observed in the body of water than above the bottom – which is most likely due to the large mixing of seawater throughout its depth, where the type of bottom is susceptible to detachment and transport.

Quality characteristics of waters

The assessment of the water quality status was carried out on the basis of the obtained results of surveys in the marine survey area for Variant 1 – Lubiatowo - Kopalino site in accordance with Annexes 7, 10, 11 and 12 of the Regulation of the Minister of the Environment of 21 July 2016 on the method of classification of the status of uniform bodies of surface water and environmental quality standards for priority substances.

Based on phytoplankton surveys carried out in the marine survey area for Variant 1 – Lubiatowo - Kopalino site in 2020, sea waters were assigned to class IV, i.e. waters with a poor ecological status. In similar studies carried out for this area in 2017, only 3 sites could be classified as waters of class IV, and the condition of the entire area was assessed as bad at that time. This suggests that over the last three years the ecological status of the area in question has improved by one class, which is also confirmed by monitoring studies conducted by the National Environmental Monitoring.

The chemical status of waters from the marine research area for Variant 1 – Lubiatowo - Kopalino site was classified as below good. This result of the classification of the chemical status of the waters of the surveyed area was influenced by brominated diphenylethers and mercury in the fish tissue.

On the basis of in-house study carried out in the field of diagnostic research, the condition of the monitored coastal waters and marine waters was assessed as poor.

The overall assessment of the water status of the surveyed area indicates poor ecological status, poor chemical status and poor water status, which is confirmed by the results of the National Environmental Monitoring in the years 2016–2019.

The conducted surveys were consistent with the National Environmental Monitoring in terms of assigning V class to biological elements in 2017/2018 (due to the content of chlorophyll *a*) and IV class to biological elements in 2020, below the good status of physicochemical elements supporting biological elements (transparency and content of biogenic substances). On the other hand, the chemical status of the discussed SWB in the National Environmental Monitoring was determined to be good in 2016 (no biological tissue studies were performed) and therefore the assessment made during the surveys of waters from the marine research area for Variant 1 – Lubiatowo - Kopalino site carried out under this project differs from the results of the National Environmental Monitoring. However, there was no difference in the assessment for the results of the National Environmental Monitoring in 2019.

Quality characteristics of bottom sediment

The frequency of sampling and the frequency of surveys of physicochemical indicators were consistent with the frequency and scope set out for diagnostic monitoring of water bodies specified in Annex 4 to the Regulation of the Minister of the Environment of 19 July 2016 on the forms and manner of monitoring of uniform bodies of surface and groundwater for coastal waters, including heavily modified water bodies. Reference methods or equivalent methods were used for the surveys in accordance with the above-mentioned regulation.

The values of the physicochemical parameters of bottom sediments collected in the marine survey area for the Lubiatowo - Kopalino site did not differ significantly from the typical content for sediments in the Baltic Sea. These sediments were characterised by a low content of organic matter, total organic carbon and biogenic substances represented by total phosphorus. Also, the content of metals and other organic pollutants, including pesticides, did not differ significantly from the literature data for sandy bottom sediments of the South Baltic and was at a low level. On the other hand, the content of dioxins and furans in the surveyed sediments, expressed by an equivalent toxicity index, did not exceed the limit value for 'ecologically clean' sites.

The concentrations of most of the determined indicators were low and were below the defined limits of quantification and detection of the analytical methods used for the studies.

As a result of comparing the obtained concentration values of labile form of metals, polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs) in the studied sediments with the normative values given in the Regulation of the Minister of the Environment of 11 May 2015 on the recovery of waste outside plants and devices, which allows to classify the sediment as pure in the context of practical applications, it can be concluded that for standardised groups of compounds their content is low, and the sediments are not contaminated with compounds from these groups.

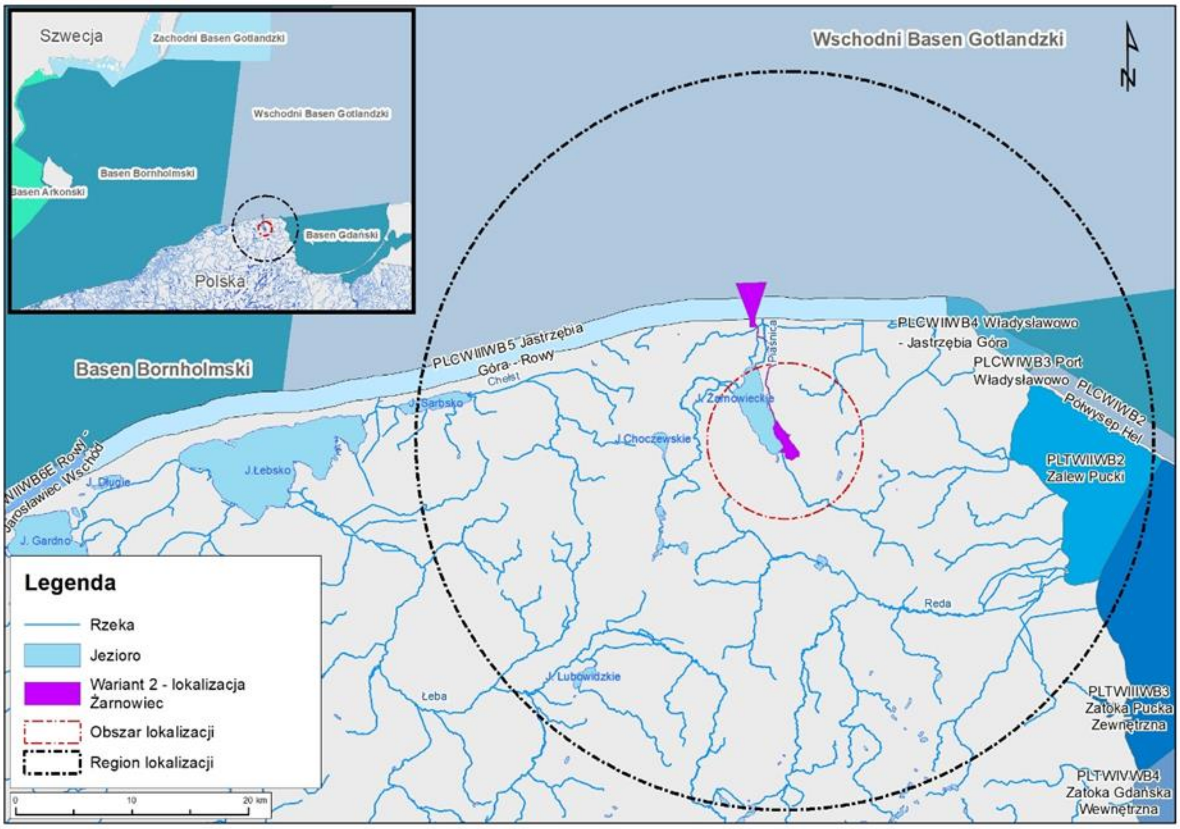
All concentration results obtained during the 2017 surveys of priority substances and substances particularly harmful to the aquatic environment are in line with the downward trend forecast by HELCOM.

VI.3.3.7.2 Variant 2 — Żarnowiec site

Hydrogeography

The Site Region of Variant 2 – Żarnowiec site, similarly to the Site Region of Variant 1 – Lubiatowo - Kopalino site, is located in the south-western part of the eastern Gotland Basin, and also partly in the east – in the Gdańsk Basin[Figure VI.3.3.7- 2]. Both units belong to the Baltic Proper. In accordance with the Act of 21 March 1991 on the maritime areas of the Republic of Poland and maritime administration, the Site Region of Variant 2 – Żarnowiec site, is administratively located within the Polish territorial sea, i.e. in the area of sea waters and covers a part of territorial waters.

According to the division of coastal waters resulting from the transposition of the Water Framework Directive, there are coastal SWB no. PLCWIIIWB5 Jastrzębia Góra – Rowy, no. PLCWIIWB4 Władysławowo – Jastrzębia Góra, no. PLCWIWB3 Port Władysławowo, no. PLCWIWB2 Peninsula Hel and transitional SWB no. PLTWIIWB2 Bay of Puck and no. PLTWIIIWB3 Outer Bay of Puck [Figure VI.3.3.7- 2]. The environmental objectives for the above-mentioned SWB are presented in the table below [Table VI.3.3.7- 3].



Szwecja	Sweden
Zachodni Basen Gotlandzki	West Gotland Basin
Basen Arkonski	Arkona Basin
Wschodni Basen Gotlandzki	Eastern Gotland Basin
Basen Bornholmski	Bornholm Basin
Polska	Poland
Legenda	Legend
Rzeka	River
Jezioro	Lake
Wariant 1 - lokalizacja Lubiatowo - Kopalino	Variant 1 – Lubiatowo - Kopalino site
Obszar lokalizacji	Site Area
Region lokalizacji	Site Region
PLCWIIWB6E /Rowy - Jarosławiec Wschód	PLCWIIWB6E /Rowy - Jarosławiec Wschód
PLCWIIIWB5 Jastrzębia Góra - Rowy	PLCWIIIWB5 Jastrzębia Góra - Rowy
PLCWIIWB4 Władysławowo - Jastrzębia Góra	PLCWIIWB4 Władysławowo - Jastrzębia Góra
PLCWIWB3 Port Władysławowo	PLCWIWB3 Port Władysławowo
PLCWIWB2 Półwysep Helski	PLCWIWB2 Półwysep Helski
PLTWIIWB2 Zalew Pucki	PLTWIIWB2 Zalew Pucki
PLTWIIIWB3 Zatoka Pucka Zewnętrzna	PLTWIIIWB3 Zatoka Pucka Zewnętrzna
PLTWIVWB4 Zatoka Gdańska Wewnętrzna	PLTWIVWB4 Zatoka Gdańska Wewnętrzna

Figure VI.3.3.7- 2 Site region against the background of the HELCOM division of southern Baltic Sea and coastal and transitional SWB. Variant 2 — Żarnowiec site

Source: In-house studies based on HELCOM Map And Data Service. http://maps.helcom.fi/website/mapservice/

Table VI.3.3.7- 3 SWB of the Site Region. Variant 2 — Żarnowiec site (valid from 2021)

No.	Name	SWB code	Type	Status	General status	Environmental objective - ecological status or potential	Environmental objective — chemical status	Assessment of risk of failure to achieve environmental goals
1.	Jastrzębia Góra – Rowy	PLCWIIIWB5	coastal	NAT	BAD	good ecological status	good chemical status	at risk
2.	Władysławowo -Jastrzębia Góra	PLCWIIWB4	coastal	NAT	BAD	good ecological status	good chemical status	at risk
3.	Port of Władysławowo	PLCWIWB3	coastal	SZCW	BAD	less stringent environmental target	good chemical status	at risk
4.	Hel Peninsula	PLCWIWB2	coastal	NAT	BAD	good ecological status	good chemical status	at risk
5.	Puck Lagoon	PLTWIIWB2	transient	NAT	BAD	good ecological status	good chemical status	at risk
6.	Outer Puck Bay	PLTWIIIWB3	transient	NAT	BAD	good ecological status	good chemical status	at risk

**NAT- natural, SZCW – heavily modified water body*

Source: In-house studies based on the Update of water management plans - National Water Management Authority, https://www.apgw.gov.pl/

From 2022, another planning cycle will be implemented, under which environmental objectives, as well as the names and scopes of the SWB are under change. Below is a list of SWBs where the Site Region will be located from the new planning cycle [Table VI.3.3.7- 4].

Table VI.3.3.7- 4 SWB of the Site Region. Variant 2 — Żarnowiec site (valid from 2022)

No.	Name	SWB code / Type	Status	General status	Environmental objective - ecological status or potential	Environmental objective — chemical status	Assessment of risk of failure to achieve environmental goals
1.	Polskie wody przybrzeżne Gotland Basin	PLCW20001WB2 / coastal	NAT	BAD	moderate ecological status (mitigated indicators - chlorophyll, Index B (class III), other indicators - quality class II)	good chemical status	at risk
2.	Hel Peninsula	PLCW20001WB1 / coastal	NAT	BAD	good ecological status	good chemical status	at risk
3.	Puck Lagoon	PLTW20002WB4 / coastal	NAT	BAD	good ecological status	good chemical status	at risk
4.	Outer Puck Bay	PLTW20003WB5 / coastal	NAT	BAD	good ecological status	good chemical status	at risk

Source: In-house studies based on the Update of water management plans - National Water Management Authority, https://www.apgw.gov.pl/

Information on environmental objectives for open sea waters is included in the section devoted to Variant 1 – Lubiatowo - Kopalino site.

Hydrological conditions

The marine hydrological monitoring system for Variant 2 – Żarnowiec site consisted of two permanently anchored measuring buoys: MHM_Z1 and MHM_Z2. The MHM_Z1 buoy was located 2.9 km from the sea shore, and the MHM_Z2 buoy – 3.0 km from the shore, at a distance of about 5 km from each other, in the open waters of the eastern Gotland Basin. Both buoys are anchored at a depth of about 17 m. Continuous measurement kits recorded hydrodynamic parameters and basic hydrophysical parameters of seawater. Below is basic information about the recorded parameters.

Waves

Waves on the free surface of the sea within Variant 2 – Żarnowiec site was clearly characterised by differentiation depending on the season – the highest waves were recorded in autumn and winter periods, and the lowest in spring and summer. The strongest storm was recorded in the first week of January 2019. The average wave height and the average significant wave height for the MHM_Z1 station were 0.48 m and 0.81 m, respectively, and for the MHM_Z2 station – 0.48 m and 0.82 m. The highest wave for the MHM_Z1 station reached a height of 9.20 m (January 2, 2019), and for the MHM_Z2 station it was 9.64 m high (January 2, 2019). In both stations, waves from the west prevailed with a slight share of waves from the north, north-east and north-west directions. However, there was no waving from the south at all. The sea level most often remained from the second to the fifth on the Douglas scale.

Sea level

The maximum sea levels recorded as part of the monitoring of Variant 2 – Żarnowiec site — are for the stations MHM_Z1 – 638 cm and MHM_Z2 – 631 cm (January 2, 2018), and the minimum of 411 cm for the MHM_Z1 station and 410 cm for the MHM_Z2 station, respectively (November 30, 2018).

Direction and velocity of flow

Recordings of the directions and speeds of water flows covered the entire vertical profile of the depths in 4 m layers of water. At both monitoring stations, water flows towards the east and north-east prevailed. The average speed of water movement in the entire profile of the water body at the stations is about 0.12 m/s. The highest current velocities that occurred at the MHM_Z1 station are 0.67 m/s (at a depth of 1–4 m), and 0.64 m/s at the MHM_Z2 station (at a depth of 1–8 m). For both stations, the average speeds of water movement decreased when moving towards the bottom.

Ice conditions

Observations of ice phenomena were carried out within Variant 2 – Żarnowiec site on the measurement station on the 143.8 km of the Baltic Sea coastline. In the measurement period from 30 April 2017 to 31 August 2019 (i.e. 2 full ice seasons), no ice phenomena were recorded.

Water temperature

At the measuring stations, MHM_Z1 and MHM_Z2, temperature was measured at three depths of water. The average values at both measuring stations were similar. The minimum water temperature values were 0.37°C (28 February 2018) for MHM_Z1 station and 0.47°C (9 March 2018) for MHM_Z2 station, respectively. The maximum water temperature was 24.35°C (4 August 2018) for the MHM_Z1 measuring station and 24.18°C (4 August 2018) for the MHM_Z2 station.

Electrolytic conductivity

Electrolytic conductivity was measured at three depths at the measurement stations of Variant 2 – Żarnowiec site. At the station MHM_Z1, the parameter ranged from 0.48 S/m above the bottom to 1.25 S/m at depths of 1 and 9 m, at the station MHM_Z2 electrolytic conductivity ranged from 0.70 S/m to 1.24 S/m at depths of 1 and 9 m.

Salinity

Water salinity was calculated using data on water temperature, depth and electrolytic conductivity. At the monitoring stations of Variant 2 – Żarnowiec site, salinity ranged from 4,877.4 ppm to 8,696.4 ppm – at the MHM_Z1 station from 4,877.4 ppm to 8,453.0 ppm above the bottom, while at the MHM_Z2 station from 6,442.2 ppm at a depth of 1 m to 8,696.4 ppm above the bottom.

Turbidity

At the MHM_Z1 station, values were recorded from 0 NTU both in the body of water and at the bottom to 451.6 NTU at the bottom, at the MHM_Z2 station from 0.2 NTU in the body of water to 980.3 NTU at the bottom. At both stations, greater turbidity was observed above the bottom, and less in the depth – most likely this is related to the type of bottom at the site of the survey.

Quality characteristics of waters

The assessment of water quality status was carried out in the same way as in the case of Variant 1.

Based on phytoplankton surveys carried out in the marine survey area for Variant 2 – Żarnowiec site in 2020, sea waters were classified according to the principles of the WFD as class IV waters, i.e. waters with a poor ecological status. In similar studies carried out for this area in 2017, only 3 sites could be classified as waters of class IV, and the condition of the entire area was assessed as bad at that time. This suggests that over the last three years the ecological status of the area in question has improved by one class, which is also confirmed by monitoring studies conducted by the National Environmental Monitoring.

Chemical status of waters from the marine survey area for Variant 2 – Żarnowiec site is classified as below good. This result of the classification of the chemical status of the waters of the surveyed area was influenced by brominated diphenylethers and mercury in the fish tissue.

The overall assessment of the water status of the surveyed area indicates poor ecological status, poor chemical status and poor water status, which is confirmed by the results of the National Environmental Monitoring in the years 2016–2019.

The conducted surveys were consistent with the National Environmental Monitoring in terms of assigning V class to biological elements (due to the content of chlorophyll *a*) and IV class to biological elements in 2020, below the good status of physicochemical elements supporting biological elements (transparency and content of biogenic substances) within the area of SWB Jastrzębia Góra – Rowy and were confirmed within the area of SWB Władysławowo – Jastrzębia Góra, where the National Environmental Monitoring in 2019 indicated class IV in terms of the contents of chlorophyll *a*. The chemical status of SWB Władysławowo – Jastrzębia Góra was designated to be below the good state due to the results of biological tissue surveys. On the other hand, the chemical status of the SWB Jastrzębia Góra – Rowy in the National Environmental Monitoring was determined to be good (no biological tissue studies were performed) and therefore the assessment made during the surveys of waters from the marine survey area for Variant 2 – Żarnowiec site carried out under this project differs from the results of the National Environmental Monitoring. However, there was no difference in the assessment for the results of the National Environmental Monitoring in 2019.

Quality characteristics of bottom sediment

The frequency of sampling and the frequency of surveys of physicochemical indicators were consistent with the frequency and scope set out for diagnostic monitoring of water bodies specified in Annex 4 to the Regulation of the Minister of the Environment of 19 July 2016 on the forms and manner of monitoring of uniform bodies of surface and groundwater for coastal waters, including heavily modified water bodies. Reference methods or equivalent methods were used for the surveys in accordance with the above-mentioned regulation.

The values of the physicochemical parameters of bottom sediments collected in the marine survey area for Variant 2 — Żarnowiec site did not differ significantly from the typical content for sediments in the Baltic Sea. These sediments were characterised by a low content of organic matter, total organic carbon and biogenic substances represented by total phosphorus. Also, the content of metals and other organic pollutants, including pesticides, did not differ significantly from the literature data for sandy bottom sediments of the South Baltic.

All concentration results obtained during the 2017 surveys of the above-discussed priority substances and substances particularly harmful to the aquatic environment are in line with the downward trend forecast by HELCOM and were at a very low level. On the other hand, the content of dioxins and furans in the surveyed sediments, expressed by an equivalent toxicity index, did not exceed the limit value for 'ecologically clean' sites.

The concentrations of most of the determined indicators were low and were below the defined limits of quantification and detection of the analytical methods used for the studies.

As a result of comparing the obtained concentration values of labile form of metals, PAHs and PCBs in the studied sediments with the normative values given in the Regulation of the Minister of the Environment of 11 May 2015 on the recovery of waste outside plants and devices, which allows to classify the sediment as pure in the context of practical applications, it can be concluded that for standardised groups of compounds their content is low, and the sediments are not contaminated with compounds from these groups.

All concentration results obtained during the 2017 surveys of priority substances and substances particularly harmful to the aquatic environment are in line with the downward trend forecast by HELCOM.

VI.3.3.8 Current ambient air quality

The state of air quality in both site variants was analysed in terms of historical data on pollution and on the basis of in-house study (measurements and calculations) aimed at identifying the current state of air pollution in Site Regions.

Air quality monitoring as part of the measurement network of the national Environmental Monitoring included measurements of benzene, nitrogen oxide and dioxide, sulphur dioxide, carbon monoxide, ozone, concentration of PM10 and PM2.5 particulate matter, chemical composition of dust and deposition, i.e. the mass of pollutants which enter the atmosphere to the surface with precipitation (wet deposition) and as a result of dry settlement (dry deposition). In Poland, air quality is assessed annually in the so-called zones, i.e. areas in each voivodeship. During the years, the range of individual zones has changed, now the zone is:

- an agglomeration with a population of more than 250,000,
- a city with a population of more than 100,000,
- the remaining area of the voivodeship, not included in cities with more than 100,000 inhabitants and agglomerations (in accordance with the EPL Act).

The results of the classification of zones (data from long-term measurements of concentrations of selected gaseous and particulate pollutants, carried out in the network of the National Environmental Monitoring of the Pomorskie Voivodeship), due to the short distance between the two Site Regions were summarised jointly in the Table [Table VI.3.3.8- 1].

Table VI.3.3.8- 1 Results of the classification of zones in both Site Regions as part of the air quality assessment for the years 2002-2018 (according to the National Environmental Monitoring)

Substance	Years	Zone name	Classification result
Benzene	2002-2018	All zones	A
Nitrogen dioxide and nitrogen oxides	2002-2018	All zones	A
Sulphur dioxide	2002-2018	All zones	A
Carbon monoxide	2002-2018	All zones	A
Ozone – health protection	2002-2006	All zones	A

Substance	Years	Zone name	Classification result
	2010-2018	Pomeranian Zone*	A, D2
Ozone – plant protection	2007-2008	Pomeranian Zone*	A, C
	2009-2018	Pomeranian Zone*	A, D2
Suspended dust PM10	2002-2003	Districts: Lębork, Słupsk county district, Wejherowo	A
		Districts: Puck, Słupsk township district	B, B/C
	2004	All zones	A
	2005-2006	Districts: Lębork, Puck, Słupsk township district, Słupsk county district	A
		Wejherowo poviat	C
	2007-2009	All zones	A
	2010-2014	All zones	C
	2015	All zones	A
	2016-2018	All zones	C
Suspended dust PM2.5	2010-2011	Pomeranian Zone*	A
	2012	Pomeranian Zone*	B
	2013-2014	Pomeranian Zone*	C
	2015-2018	Pomeranian Zone*	A
Arsenic, cadmium and nickel in PM10 particulate matter	2007-2009	City of Słupsk, Puck-Wejherowo Zone**	C
		Lębork-Słupsk Zone***	A
	2010-2018	Pomeranian Zone*	A
Lead (Pb) in PM10 particulate matter	2002-2018	All zones	A
Benzo(a)pyrene (B(a)P) in PM10 particulate matter	2007-2009	Lębork-Słupsk Zone***	A
		City of Słupsk, Puck-Wejherowo Zone**	C
	2010-2018	Pomeranian Zone*	C

where: A - not exceeding the permissible level, not exceeding the target level; B - above the permissible level but not exceeding the permissible level plus the margin of tolerance; C - above the permissible level or above the permissible level plus the margin of tolerance; D2 - above the level of the long-term goal
** covering the Pomorskie Voivodeship without the Tri-City Agglomeration; ** including the following poviats: Puck and Wejherowo; covering the following poviats: Lębork and Słupsk.*

Source: In-house study

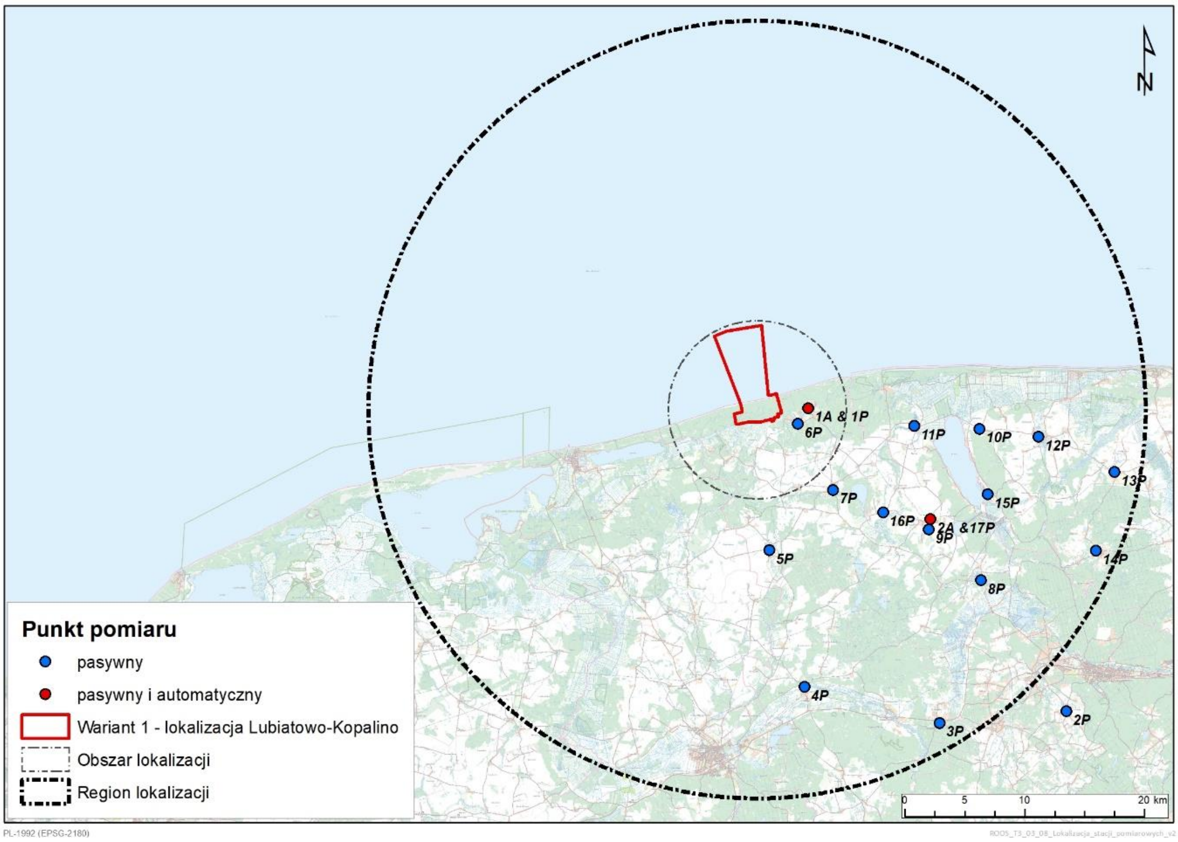
By analysing the above historic data, it can be concluded that, with the exception of PM10 particulate matter, benzo(a)pyrene in PM10 particulate matter and ozone, no exceedances of air quality standards were recorded in both Site Regions.

VI.3.3.8.1 Variant 1 — Lubiatowo - Kopalino site

<u>Own measurements of air quality</u>

As part of our in-house study in the annual measurement period (June 2017 – June 2018), automatic measurements of gas substances in 1-hour cycle and of particulate matter pollutions – in a daily cycle were carried out and passive measurements in measurements of depositions in 4-week cycles at measuring points located in the Site Region [Figure VI.3.3.8- 1] were conducted. The following compounds present in the air were tested: benzene, toluene, ethylbenzene, m-xylene, p-xylene, o-xylene, nitrogen oxides, sulphur dioxide, carbon monoxide, ozone, acid gases, concentration and chemical composition of PM10 and PM2.5 particulate matter and the process of deposition of pollutants. The location of stations and monitoring points, the scope of measurements and the method of averaging the results have been determined in accordance with the requirements of relevant legal acts regarding the assessment of air quality (Regulation of the Minister of the Environment of 24 August 2012 on the levels of certain substances in the air; Regulation of the Minister of the Environment of 8 June 2018 on the assessment of levels of substances in the air).

The factor determining the adopted scope and methodology of research was to ensure the comparability of results with available data obtained from measurements carried out both in the national air quality monitoring network, within the framework of the National Environmental Monitoring, as well as in other European Union countries, within the framework of legal requirements in force in the EU.



Punkt pomiaru	Measurement point
pasywny	passive
pasywny i automatyczny	passive and automatic
Wariant 1 - lokalizacja Lubiatowo - Kopalino	Variant 1 – Lubiatowo - Kopalino site
Obszar lokalizacji	Site Area
Region lokalizacji	Site Region

Figure VI.3.3.8- 1 Location of passive and automatic measuring points

Source: In-house studies based on the Report on Environmental Characteristics and Valorisation for the purposes of the EIA Report in the field of air pollution for the Lubiatowo - Kopalino site, IPIŚ PAN, 2019

Analysis of the results of in-house study from the annual measurement period as part of air quality monitoring related to the applicable air quality standards (Regulation of the Minister of the Environment of 24 August 2012 on the levels of certain substances in the air showed that with the exception of B(a)P concentrations in PM10 particulate matter, no exceedances of the normative values for the measured pollutants were recorded. For all analysed substances, the condition regarding the required annual time coverage for the results of continuous and periodic measurements (the minimum of 90%) was met.

Periodically occurring episodes of elevated concentrations of PM10 particulate matters were observed, which is characteristic of climatic conditions of Poland and in cases of the so-called large smog episodes, their range also included areas with low density of build-up areas. Elevated levels of ozone concentrations were observed during the summer season. The relatively high concentration of B(a)P in PM10 matter in the research area primarily due to low air temperatures and the associated significant increase in the intensity of burning fossil fuels.

Model calculations of air quality

The air quality characteristics also take into account the results of calculations covering the years 2017-2018 for substances included in the applicable legal regulations, such as: ozone, dioxide and nitrogen oxides, sulphur dioxide, PM10 particulate matter, PM2.5 particulate matter, carbon monoxide and B(a)P and heavy metals in PM10. The calculation was made using the pollution spread model based on specific annual emissions of sources located in the Site Region such as: energy, industrial, road transport, individual heating, emissions from agriculture and emissions coming from the rest of the country and from outside the borders of Poland. Meteorological data from 2017–2018, data on the relief and topography were also used.

The results of the modelling showed that:

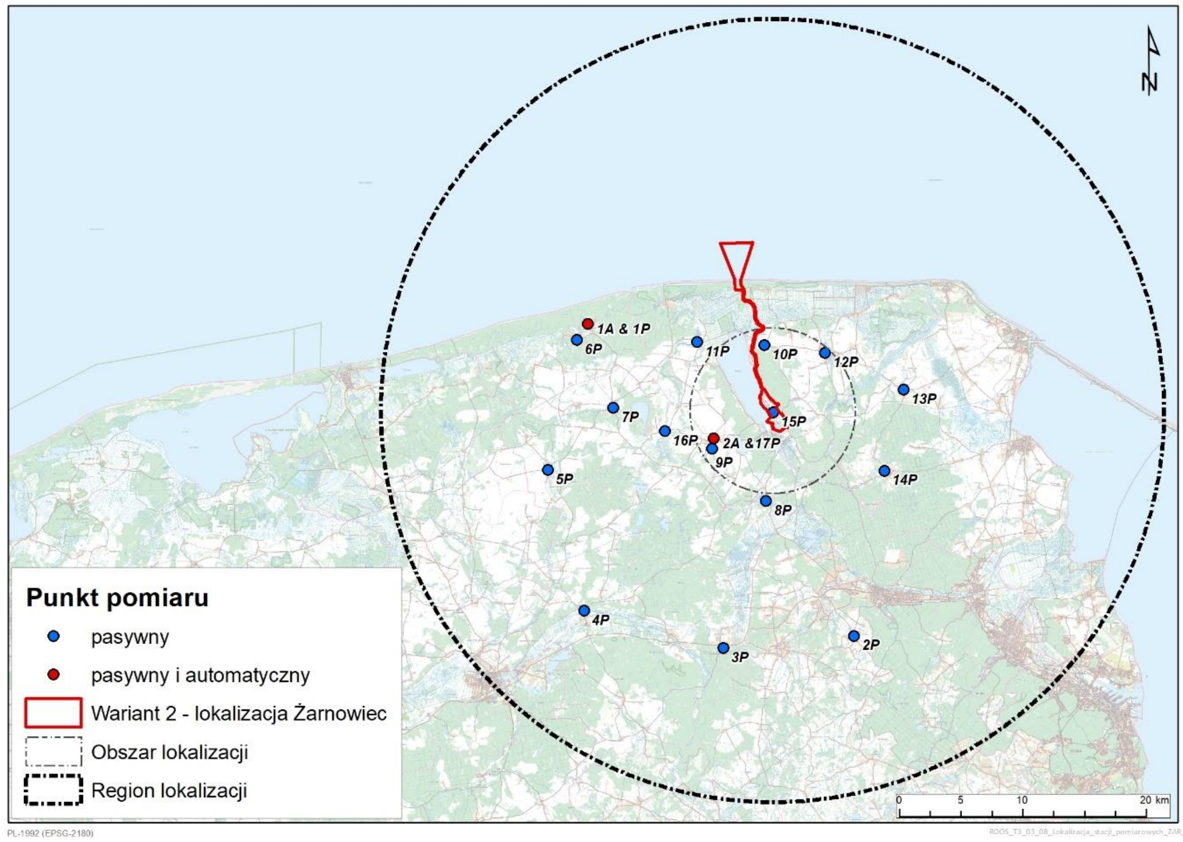
- the dominant impact on air pollution with this benzene was exerted by emissions related to road transport (linear emission), at the same time the highest values of nitrogen dioxide concentrations occurred along roads with high traffic,
- sulphur dioxide concentrations in the Site Area were very low, and the average 8-hour concentrations of carbon monoxide throughout the Site Region were low and reached a maximum of 7.5% of the permissible level,
- the average 8-hour ozone concentrations in the Site Area were relatively high and reached 95% of the target level,
- PM10 concentrations in the Site Area were relatively low – its average daily concentrations reached a maximum of 42% of the permissible level, and the average annual concentrations up to 40% of the permissible level. In the Site Area, PM2.5 concentrations reached a maximum of 44% of the permissible level,
- B(a)P concentrations in the Site Area were relatively low, with maximum values reaching 50% of the target level. However, taking into account the Site Region, concentrations of B(a)P in built-up areas significantly exceeded the target value 3 times, reaching up to 3 ng·m^3 in Lębork,
- the concentrations of all determined heavy metals in the Site Area were negligibly small. They reached the values well below 10% of the relevant target or acceptable levels.

To sum up the above, Variant 1 – Lubiatowo - Kopalino site, is distinguished by a large carrying capacity of the environment, very good air quality and low population density. Despite the fact that the Pomeranian zone – due to exceeding the limit value for the average daily concentration of PM10 matter and the target value for the average annual concentration of B(a)P – was given class C in 2018, the Site Area is outside the area of exceeded normative values for the above-mentioned substances.

VI.3.3.8.2 Variant 2 — Żarnowiec site

Own measurements of air quality

As part of our in-house study in the annual measurement period (June 2017 – June 2018), the same measurements were carried out as for Variant 1 – Lubiatowo - Kopalino site, at measuring points located in the Site Region [Figure VI.3.3.8- 2]. The same substances as for Variant 1 were also surveyed. The location of stations and monitoring points, the scope of measurements and the method of averaging the results have been determined in accordance with the requirements of relevant legal acts regarding the assessment of air quality.



Punkt pomiaru	Measurement point
pasywny	passive
pasywny i automatyczny	passive and automatic
Wariant 2 - lokalizacja Żarnowiec	Variant 2 — Żarnowiec site
Obszar lokalizacji	Site Area
Region lokalizacji	Site Region

Figure VI.3.3.8- 2 Location of passive and automatic measuring points

Source: In-house studies based on the Report on Environmental Characteristics and Valorisation for the purposes of the EIA Report in the field of air pollution for the Żarnowiec site, IPIŚ PAN, 2019

The basic factor determining the adopted scope and methodology of research was to ensure the comparability of results with available data obtained from measurements carried out both in the national air quality monitoring network, within the framework of the National Environmental Monitoring, as well as in other European Union countries, within the framework of legal requirements in force in the EU.

Analysis of the results of in-house study from the annual measurement period related to the applicable air quality standards showed that with the exception of B(a)P concentrations in PM10 particulate matter, no exceedances of the normative values for the measured pollutants were recorded. For all analysed substances, the condition regarding the required annual time coverage for the results of continuous and periodic measurements (the minimum of 90%) was met.

Periodically occurring episodes of elevated concentrations of PM10 matter were characteristic of climatic conditions of Poland and in cases of the so-called large smog episodes, their range also included areas with low density of build-up areas. The increased level of ozone concentrations observed in the summer season was typical for areas with a high level of ultraviolet (UV) radiation which occurs in uncontaminated areas with the occurrence of sources of natural ozone precursors, whose impact is additionally intensified by the influx of the above-mentioned precursors from neighbouring areas. The relatively high concentration of B(a)P in PM10 matter in the research area was due to low air temperatures and the associated significant increase in the intensity of burning fossil fuels.

Model calculations of air quality

The air quality characteristics also take into account the results of calculations, covering the years 2017 – 2018, for substances covered by legal regulations (adequately to the calculations in Variant 1).

The results of the modelling showed that:

- the highest concentrations of benzene in the Site Region occurred along the main traffic routes. The dominant impact on air pollution with this substance was exerted by emissions related to road transport (linear emission), at the same time the values of nitrogen dioxide concentrations occurred along roads with high traffic,
- concentrations of sulphur dioxide in the Site Area were very low. Taking into account the Site Region, the lowest concentrations of sulphur dioxide occurred in the western part of the coastal strip of the Baltic Sea, while the highest occurred in Lębork and in the coastal strip of the Gulf of Gdańsk,
- the average 8-hour ozone concentrations in the Site Area were relatively high and reached 95% of the target level. The lowest concentrations of ozone in the Site Region occurred in the vicinity of the Small Tri-City (Wejherowo, Reda and Rumia), and the highest, exceeding the target level, in the northern part of the Site Region – at the Baltic Sea,
- PM10 concentrations in the Site Area were relatively low – the average daily concentrations of PM10 reached a maximum of 50% of the permissible level, and the average annual concentrations up to 47.5% of the permissible level. In the Site Region, in the strip on the Gulf of Gdansk, PM10 concentrations were significantly higher due to the high industrialisation and dense development of this area, but did not exceed the appropriate permissible levels,
- in the Site Area, PM2.5 concentrations were relatively low and reached a maximum of 52% of the permissible level, In the Site Region, in the strip on the Gulf of Gdansk, PM2.5 concentrations were significantly higher (16–24 $\mu g \cdot m^{-3}$),
- concentrations of B(a)P in the Site Area were relatively low, with maximum values reaching 0.7 $ng \cdot m^{-3}$ (70% of the target level). However, taking into account the Site Region, B(a)P concentrations in built-up areas significantly exceeded the target value (more than four times – reaching 4.4 ng·m-3 in Rumia and Kosaków).

To sum up the above, the Żarnowiec Site Region is distinguished by a large carrying capacity of the environment, very good air quality and low population density. Despite the fact that the Pomeranian zone – due to exceeding the limit value for the average daily concentration of PM10 matter and the target value for the average annual concentration of B(a)P – was given class C, the Site Area is outside the area of exceeded normative values for the above-mentioned substances (the Regulation of the Minister of Environment of 24 August 2012 on the levels of certain substances in the air; Regulation of the Minister of the Environment of 8 June 2018 on the assessment of levels of substances in the air).

To sum up, it should be stated that both site variants do not differ from each other in terms of the background of ambient air quality. This is mainly due to the short distance between them, and their location in areas with low population density. The state of identification of the issue of air pollution by substances analysed as part of the conducted survey is sufficient for the purpose of performing a correct assessment of the effects of the Project.

VI.3.3.9 Condition of acoustic environment

The description of the state of the existing acoustic climate is based on data from planning and strategic documents on the current state of the acoustic environment and the results of in-house monitoring of the background noise on land and sea carried out for two site variants.

VI.3.3.9.1 Land area

The legal basis for acoustic protection is the Regulation of the Minister of the Environment of 14 June 2007 on permissible noise levels in the environment. The values of the permissible noise levels vary depending on the type of source, the method of land use and the noise assessment rate. The purpose of determining the permissible noise levels in a given area is to determine the appropriate acoustic classification of the site based on its management method. According to the EPL Act, this classification is made on the basis of local development plans or, in the absence thereof, on the basis of the position of administratively competent public administration bodies (usually commune offices). Due to the fact that some of the analysed areas are not covered by the local development plan, pursuant to Article 115 of the EPL Act, information on the method of development of the areas being the subject of the analyses was obtained from the competent commune offices. On the basis of information on the applicable local development plan and acoustic classification based on the current method of development, the nearest acoustically protected areas within the scope of the Project and associated investments were taken into account. The permissible noise levels of the analysed types of land were defined, expressed in short-term indicators (equivalent continuous sound level for the daytime (LAeqD) and night (LAeqN), in accordance with the Regulation of the Minister of the Environment of 14 June 2007 on permissible noise levels in the environment). The Planned Project qualifies under two groups of this Regulation:

- 'roads or railways' means associated infrastructure for which the limit values for the equivalent continuous sound level A relate to: daytime (6:00 a.m. to 10:00 p.m.— reference time interval of 16 hours) and the nighttime (10:00 p.m. to 6:00 a.m.— reference time interval of 8 hours), and
- 'other noise-producing facilities and activities' – the planned NPP together with associated infrastructure for which the limit values for the equivalent sound level A concern: the time of day (6:00 a.m. to 10:00 p.m.– reference time interval equal to 8 least favourable hours of the day, consecutively) and time of night (10:00 p.m. to 6:00 a.m.– reference time interval equal to 1 least favourable hour of night).

During the construction phase, the source of noise emissions into the environment are construction plants, equipment and machinery, therefore, the assessment of compliance with the legal requirements regarding the scale of acoustic impact at this stage is also carried out in relation to the limit values set for "other facilities and activities being the source of noise".

Applicable programmes for the environment protection against noise and for communes

In order to obtain additional information (in addition to noise monitoring) on the noise sources existing in the surveyed area, the scale of their impact on the nearest areas subject to acoustic protection and the adopted strategies and anti-noise measures, appropriate environmental protection programmes were analysed. In addition, due to the importance of the document, which is the Programme for the Environment Protection against Noise constituting an act of local law, the current schedule of corrective actions determined on the basis of appropriate strategic acoustic maps was analysed.

Programmes for the environment protection against noise

Programmes for the environment protection against noise are in force within the potential impact of the Project, together with the accompanying road and rail infrastructure. Their provisions indicate, in particular, corrective actions towards noise reduction under the adopted programme.

In the above-mentioned programmes, the maximum values of exceedances of the permissible noise level values are expressed in the following indicators: L_{DWN} – long-term average equivalent A- weighted sound level expressed in [dB], determined during all days of the year, taking into account the time of day (6:00 a.m. – 18:00p.m.), the time of the evening (6:00 p.m.– 10:00 p.m.), the time of night (10:00 p.m. – 6:00 a.m.) and L_N – the long-term equivalent A- weighted sound level expressed in dB determined during all nights of the year (10:00 p.m. – 6:00 a.m.).

For Variant 1 – Lubiatowo - Kopalino site, 2 programmes for protection of environment against noise are in force: Programme for protection of environment against noise for the years 2019–2023 with a perspective for the following years for areas outside agglomerations in the Pomorskie Voivodeship located along sections of national and expressway roads of 25 April 2019 (Resolution no. 89/VIII/19 of the Council of Pomorskie Voivodeship of April 25, 2019) and the Programme for the environment protection against noise for the years 2019–2023 with a perspective for the following years for areas outside agglomerations in the Pomorskie Voivodeship located along sections of provincial roads of 25 April 2019. (Resolution no. 92/VIII/19 of the Council of Pomorskie Voivodeship of 25 April 2019).

- The area covered by the programme for the environment protection against noise for the years 2019–2023 with a perspective for the following years for areas outside agglomerations in the Pomorskie Voivodeship located along sections of national and expressway roads includes the national road DK6 running in close proximity to the railway line no. 229 planned for retrofitting (as part of the associated infrastructure) and the planned access road to the NPP at the height of Strzebielino and Bożejewo. In these areas, the maximum values of exceedance of permissible L_{DWN} noise level are 15 dB and 10 dB for L_N. Therefore, part of the land along the DK6 sections has been classified as high priority areas for the implementation of corrective actions under the adopted programme. The railway line no. 230, not far from DK6, is planned for retrofitting. The maximum values for exceeding the permissible values of noise level from DK6 road near this railway section were 15 dB for L_{DWN} and L_N, which indicates that some protected areas have been classified as areas with a high priority of implementation of corrective actions;
- The area covered by the programme for the environment protection against noise for the years 2019–2023 with a perspective for the following years for areas outside agglomerations in the Pomorskie Voivodeship located along sections of provincial roads includes the provincial road DW 214 running in close proximity to the railway line no. 230 planned for retrofitting. The maximum values for exceedance of the permissible values of noise level on a section of this road expressed in L_{DWN} indicators are up to 5 to 10 dB and in L_N are 5 dB. Calculations showed that part of the areas along the section of Lębork (city border) – Lębork (DK6) was classified as areas with a high priority of implementation of corrective actions. In the case of the Lębork (DK6) – Lębork (city border) section, all areas where exceedances were demonstrated, were classified as areas with a low priority of corrective actions.

For Variant 2 – Żarnowiec site, 1 programme is in force: Programme for the environment protection against noise for the years 2019–2023 with a perspective for the following years for areas outside agglomerations in the Pomorskie Voivodeship located along sections of national and expressway roads of 25 April 2019.

- The area covered by the above programme includes the national road DK6 running in close proximity from the planned access road to the NPP at the height of Strzebielino and Bożejewo. On sections of the DK6 road near the indicated associated infrastructure, the maximum values for exceeded permissible values of the L_{DWN} noise level amount to 15 dB, and in the case of L_N – 10 dB. The calculations indicated that parts of the area along the sections of DK 6 in question were classified as areas with a high priority of implementation of corrective actions under the adopted Programme. In addition, the railway line no. 230 is planned for retrofitting within the DK6 range. The maximum values for exceedance of the permissible values of noise level from this road section were 15 dB for L_{DWN} and L_N, therefore, those areas have been classified as areas with a high priority of implementation of corrective actions;

According to the provisions of the above-mentioned programmes, the managers of individual road sections are supervised by the Marshal's Office of the Pomorskie Voivodeship in the form of monitoring and control activities. Depending on the area of e.g. the proposed corrective actions indicate the construction of the S6 expressway, the construction of the Eastern Bypass of Lębork, the enforcement of speed limits (e.g. using a speed camera) and local surface replacements.

<u>Environmental protection programme for communes</u>

Information on the current acoustic status can be found in the commune’s environmental protection programmes. For the needs of the Project, appropriate programmes of communes (communes of Choczewo, Gniewino, Krokowa, Lębork, Luzino, Łęczyce, Nowa Wieś Lęborska, Wicko, the city of Wejherowo – for Variant

1 – Lubiatowo - Kopalino and communes of Gniewino, Krokowa, Luzino, Łęczyce, the city of Wejherowo – for Variant 2 Żarnowiec site) were analysed, which result in similar acoustic problems and methods of minimising them.

In most communes, the most important problem is traffic noise from road infrastructure e.g. DK6 and DW213, 215, 218, 224 and the network of poviat and local roads. The main reasons for the high noise emissions from roads include an increase in the number of vehicles involved in traffic, high volume of vehicle traffic on local roads during the tourist season, lack of by-passes, a large share of heavy goods vehicles in traffic, high vehicle speeds, poor technical condition of vehicles, poor technical condition of road surfaces, inefficient urban planning and the lack of unambiguous provisions in spatial planning regulations taking into account the criterion of noise emission, lack of care for planting of buffer vegetation. As another problem of noise nuisance in communes, service companies are indicated, located in residential areas (however, their impact on the general acoustic climate of the commune is not significant). The causes of excessive noise emission from industrial facilities include: lack of proper acoustic protection of noise sources operating outside production buildings (ventilation and airconditioning systems), insufficient acoustic insulation of the walls of production buildings, improper organisation of production activities carried out with the participation of noisy technical means. An important type of noise in tourist communes is the so-called municipal noise coming from recreation, entertainment and sports facilities. The main areas exposed to an increase in municipal noise emissions are coastal towns during the summer season. At the moment, the recreational infrastructure in most coastal towns is very extensive, so periods of increased tourist traffic can cause considerable acoustic discomfort for residents and visitors. It is even estimated that in summer the noise associated with the operation of recreation and leisure areas is definitely higher than the noise coming from communication and industrial sources. The point noise sources include numerous wind turbines in some communes, whose scale of impact on the acoustic environment depends strictly on temporary weather conditions.

The environmental protection programmes for communes, depending on the needs in a given commune, indicate the scope of short-term and long-term tasks aimed at reducing noise at least to acceptable levels. These are e.g. proper spatial planning and adaptation of the local development plan to the provisions of the Regulation of the Minister of the Environment of 14 June 2007 on permissible noise levels in the environment, reconstruction and upgrading of roads (optimisation of the course of transport routes and traffic flow, improvement of the surface of existing road networks), introduction and promotion of the combined transport system (bicycle with other means of transport), creation of acoustic protection, introduction of buffer vegetation along transport routes, taking steps to measure the noise level at points with a high probability of exceeding noise standards, inspections of industrial plants in terms of noise level, use of appropriate technical, technological and organisational solutions in plants, modification of existing buildings (e.g. by replacing window joinery). The above-mentioned programmes also referred to the provisions of the adopted Programmes for environment protection against noise of the Pomorskie Voivodeship and the corrective actions indicated therein, which will be implemented.

Measurement methodology

<u>Acoustic analysis area</u>

The acoustic analysis area was defined for areas covering the maximum range of predicted acoustic impacts, which was determined redundantly taking into account the precautionary principle. Depending on the type of facilities and individual phases/stages of the Project, the following areas of analysis (buffers) were adopted:

- construction works at the location of the Project – 1 km,
- road traffic related to construction – 600 m (300 m from the axis of the roadway in each direction),
- road traffic related to operation – 600 m (300 m from the axis of the roadway in each direction),
- railway traffic related to construction – 600 m (300 m from the axis of the roadway in each direction),

- railway traffic related to operation – 600 m (300 m from the axis of the roadway in each direction),
- industrial noise related to operation – 1.5 km from the border of the Project Area,
- the course of the corridor of 400 kV line – 400 m (200 m from the axis of the line in each direction).

For the purposes of further stages of work, the method of land development within the boundaries of previously established buffers was determined, including the areas requiring acoustic protection and the limit values for the level of noise in the environment were established.

Methodology of traffic and industrial noise monitoring

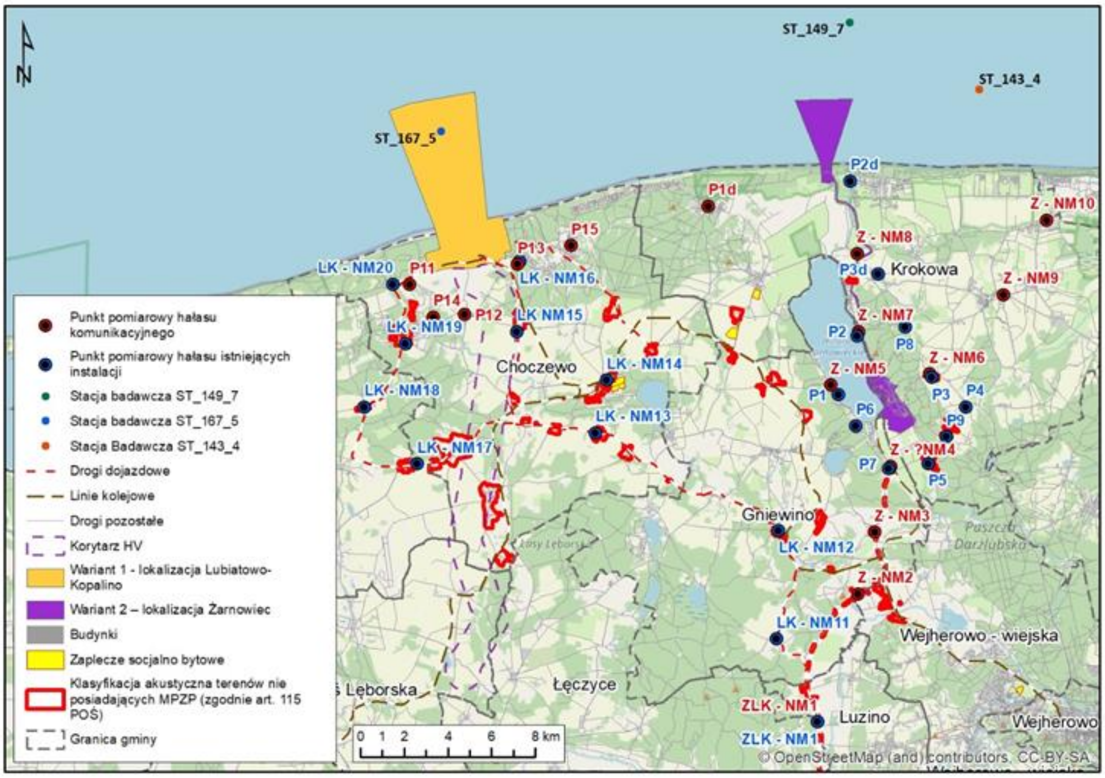
The main element of the description of the current state of acoustic environment is the analysis and interpretation of monitoring results from noise measurements of traffic and existing plants. Noise measurements for the current condition were performed according to national reference methodologies specified in the regulations of the Minister of the Environment of 16 June 2011 on the requirements for conducting measurements of the levels of substances or energy in the environment by administrator of road, railway, tram line, airport or port and of 30 October 2014 on the requirements for measurements of emission levels and measurements of amounts of water consumed. These methodologies regulate the location of the measurement points, the requirements for the measurement sets, the meteorological conditions appropriate for carrying out the measurements, the noise sampling methods, the procedures for the processing and treatment of the measurement data and the data recorded in the measurement reports and presented in the test reports. On the basis of the measurements carried out, noise assessment indicators for the daytime and nighttime, L_{AeqD} and L_{AeqN} together with the measurement uncertainty U_{95} were determined for each metering point. The results of noise measurements were related to the permissible values of the noise level in the environment (according to the Regulation of the Minister of the Environment of 14 June 2007 on permissible environmental noise levels). Accredited reports were drawn up from the measurements of traffic and industrial noise for each measurement point.

Noise measurements for road infrastructure were made for public roads within the buffer range described above. Due to significant changes in the structure and volume of traffic in the analysis areas due to tourist traffic, the measurements were conducted in 2020 in two measurement series:

- in the summer vacation season peak characterised by increased traffic intensity in the Pomorskie voivodeship -- in the period from 26.06 June and 1.09 September 2020,
- in the period outside the peak holiday season – on the dates between 22.06 and 25.06 and between 15.09 and 16.09.

The traffic noise survey included a total of 20 measuring points representative of the transport corridors planned for Variant 1 – Lubiatowo - Kopalino site and Variant 2 – Żarnowiec site, as shown in the figure [Figure VI.3.3.9-1]. A 24-hour noise measurements were performed twice at each of them. Each measurement session covered a time interval between 6:00 a.m. and 10:00 p.m. on one day (16 hours of the daytime) and 8 consecutive hours of one nighttime, between 10:00 p.m. and 6:00 a.m. on the next day, during which vehicle speeds and traffic intensity and structure were recorded. In accordance with the reference methodology entitled "Reference methodology for periodic measurements of noise levels introduced into the environment in connection with the operation of roads, railway lines and tram lines and criteria for the location of measurement points" from Annex 3 to the Regulation of the Minister of the Environment of 16 June 2011 on the requirements for measuring the levels of substances or energy in the environment by the road operator, railway line, by tram line, airport or port, measurements points were located in a built-up area, near the source of noise (roads) on designated roads, which will be representative of the transport system planned to serve the two considered locations of the Project.

Noise of existing plants means total noise composed of sounds from all existing plants, equipment and factories, hence it is treated as noise of industrial plants. Measurements, in accordance with the reference methodology entitled "Reference methodology for periodic measurements of environmental noise from plants or devices, with the exception of impulse noise" from Annex 7 to the Regulation of the Minister of the Environment of 30 October 2014 on requirements for measurements of emissions and measurements of the amount of water taken, were performed at 17 points in one measurement series, as shown in the figure below [Figure VI.3.3.9- 1]. Noise monitoring points of existing plants were designated according to the criterion of distance to the Project site, selecting the nearest inhabited areas in a given direction, which should give a picture of the current state of acoustic conditions in the vicinity of the planned Project sites in both variants. The locations of the monitoring points were indicated on the basis of a site inspection, selecting inhabited properties representative in terms of the way the area is developed for a given local community, which at the same time are not exposed to other sources of disturbing noise (e.g. ventilation / air conditioning units of shops, restaurants, etc.). Noise measurements were carried out continuously for 24 hours. On this basis, at the stage of analysis of the collected measurement data, reference time intervals were determined (the worst consecutive 8 hours of the day in the whole daytime and 1 worst hour of the night from the entire night time), for each measurement point separately.



Punkt pomiarowy hałasu komunikacyjnego	Traffic noise measurement point
Punkt pomiarowy hałasu istniejących instalacji	Ambient noise measurement point
Stacja badawcza ST_149_7	ST_149_7 Research Station
Stacja badawcza ST_167_5	ST_167_5 Research Station
Stacja Badawcza ST_143_4	ST_143_4 Research Station
Drogi dojazdowe	Access roads
Linie kolejowe	Railways
Drogi pozostałe	Other roads
Korytarz HV	HV corridor
Wariant 1 - lokalizacja Lubiatowo - Kopalino	Variant 1 – Lubiatowo - Kopalino site
Wariant 2 - lokalizacja Żarnowiec	Variant 2 — Żarnowiec site
Budynki	Buildings
Zaplecze socjalno bytowe	Staff facilities
Klasyfikacja akustyczna terenów nie posiadających MPZP (zgodnie art. 115 POŚ)	Acoustic classification of areas without spatial development plans (in accordance with Article 115 of the Environmental Protection Law)
Granica gminy	Commune boundary

Figure VI.3.3.9- 1 Background noise monitoring points in the land and marine area for Variant 1 Lubiatowo - Kopalino site and Variant 2 – Żarnowiec site

Source: In-house study based on Noise and Vibration Assessment. Jacobs Clean Energy Limited, 2020

Results of traffic noise monitoring: Variant 1 — Lubiatowo - Kopalino site and Variant 2— Żarnowiec site

Traffic noise

The table below [Table VI.3.3.9- 1] summarises the results of traffic noise measurements from 11 monitoring points for Variant 1 and 10 monitoring points for Variant 2, divided into measurements from two sessions characterising traffic in the holiday season (sw) and traffic outside the holiday season (psw).

Table VI.3.3.9- 1 Results of traffic noise monitoring for Variant 1 — Lubiatowo - Kopalino site and Variant 2— Żarnowiec site

No.	Measurement period	Variant 1 – Lubiatowo - Kopalino site			Variant 2 — Żarnowiec			Acceptable levels	
		Monitoring point number	$L_{Aeq,D}$ [dB]	$L_{Aeq,N}$ [dB]	Monitoring point number	$L_{Aeq,D}$ [dB]	$L_{Aeq,N}$ [dB]	Daytime [dB]	Nighttime [dB]
1	sw	ZLK-NM1	42.4	26.9	ZLK-NM1	42.4	26.9	65	56
2	psw		44.2	30.8		44.2	30.8		
3	sw	LK-NM11	50.9	42.1	Z-NM2	40.5	30.0	65	56
4	psw		49.5	42.1		44.7	28.5		
5	sw	LK-NM12	**65.2** (prz. 4.2)	55.9	Z-NM3	**65.5** (prz. 4.5)	**56.5** (prz. 0.5)	61	56
6	psw		**63.2** (prz. 2.2)	55.1		**64.7** (prz. 3.7)	56.0		
7	sw	LK-NM13	**61.1** (prz. 0.1)	52.5	Z-NM4	**64.5** (prz. 3.5)	**59.4** (prz. 3.4)	61	56
8	psw		58.2	50.9		**62.8** (prz. 1.8)	55.0		
9	sw	LK-NM14	63.3	52.9	Z-NM5	58.0	49.3	65	56
10	psw		62.7	51.7		59.0	50.3		
11	sw	LK-NM15	52.3	45.2	Z-NM6	58.0	50.1	65	56
12	psw		51.8	44.3		57.2	50.1		
13	sw	LK-NM16	47.3	33.8	Z-NM7	**64.4** (prz. 3.4	**56.3** (prz. 0.3)	65-L-K 61-Z	56
14	psw		42.4	25.4		**64.5** (prz. 3.5)	**57.3** (prz. 1.3)		
15	sw	LK-NM17	61.2	51.5	ZNM8	49.7	33.4	65	56
16	psw		58.6	49.4		46.3	32.7		
17	sw	LK-NM18	57.6	47.0	Z-NM9	64.0	54.6	65	56
18	psw		57.0	45.9		63.4	54.7		
19	sw	LK-NM19	47.3	35.3	Z-NM10	**64.2** (prz. 3.2)	55.8	65-L-K 61-Z	56
20	psw		44.0	32.2		**62.3** (prz. 1.3)	54.4		
21	sw	LK-NM20	42.4	33.6	-	-	-	-	-
22	psw		37.4	-					

** L_{AeqD} — Equivalent A-weighted sound level for daytime; L_{AeqN} — Equivalent A-weighted sound level for nighttime.*
prz. – exceeding of the permissible noise level in dB; sw – holiday season; psw – non-holiday season

Source: In-house study based on Noise and Vibration Impact Assessment. Jacobs Clean Energy Limited, 2020

Variant 1 — Lubiatowo - Kopalino site

To sum up the results from 11 measurement points, in most protected areas in the vicinity of road infrastructure, road noise does not exceed the permissible levels. The exceptions are the measurement points LK-NM12 (Tadzino, district road 1438G), where exceedances of limit values were recorded regardless of the period of measurements, and LK-NM13 (Słajkowo, district road 1438G), where in the holiday season an exceedance of 0.1 dB was recorded. At the above two measuring points, exceedances of the noise limit values occurred only during the day. At the same time, it should be noted that all measuring points, where exceedances of the noise limit value occurred, were located with caution – i.e. on the premises of single-family residential development, for which lower limit values apply during the daytime. The largest increase in traffic during the holiday season (above 50%) was observed at the following points: LK-NM13, LK-NM16, LK-NM17, LK-NM19, LK-NM20. A clear increase in traffic intensity concerned the number of light vehicles during the day and at night. The measurement points where the largest increase in the number of vehicles during the holiday period was recorded are the LK-

NM13 and LK-NM19 points, while the smallest increase in the number of vehicles during the holiday period was observed at the LK-NM11 point.

Variant 2 — Żarnowiec site

To sum up the results from 10 measurement points, the obtained results of traffic noise measurements in the vicinity of road infrastructure indicate exceeded permissible noise levels at four points: Z-NM3 (Rybno, district road 1446G), Z-NM4 (Opalino, Lipowa street), Z-NM7 (Lubkowo, Długa street) and Z-NM10 (Karwieńskie Błoto Pierwsze, Kwiatowa street). In all the above 4 points, exceedances of the limit values during the day occur regardless of the measurement period. Exceedances of the limit values at night, regardless of the date of the survey, were observed only at point Z-NM7, and in 2 points Z-NM3 and Z-ZNM4 noise exceedances during the night occurred only during the holiday season. At the Z-NM10 point, no noise exceedances were observed during the night. At the same time, it should be noted that all measuring points, where exceedances of the noise limit value occurred, were located with caution – i.e. on the premises of single-family residential development, for which lower limit values apply during the daytime. At the same time, the results of the measurements indicate that exceedances during the day occur at more points than at night. The largest increase in traffic during the holiday season (above 50%) was observed at the following points: Z-NM4, Z-NM8, Z-NM 10. The measurement point where the largest increase in the number of vehicles during the holiday period was recorded is the Z-NM8 point, and the smallest increase in the number of vehicles during the holiday period was recorded at the Z-NM6 point.

Results of noise monitoring from the existing plants: Variant 1 — Lubiatowo - Kopalino site and Variant 2— Żarnowiec site

The table below [Table VI.3.3.9- 2] summarises the results of noise measurements of existing plants from 6 monitoring points for Variant 1 and 11 monitoring points for Variant 2.

Table VI.3.3.9- 2 Results of monitoring of noise from existing plants for Variant 1 — Lubiatowo - Kopalino site and Variant 2— Żarnowiec site

No.	Monitoring point number	Measurement results [dB]								
		$L_{Aeq,D}$ 16 h	$L_{Aeq,D}$ 8 h MAX.	$L_{Aeq,D}$ 1 h MAX.	$L_{Aeq,D}$ 1 h MIN.	$L_{Aeq,N}$ 8 h	$L_{Aeq,N}$ 1 h MAX.	$L_{Aeq,N}$ 1 h MIN.	Difference $L_{Aeq,D}$ (1 h MAX. 1 h MIN.)	Difference $L_{Aeq,N}$ 1 h MAX. - 1 h MIN.
Variant 1 — Lubiatowo - Kopalino site										
1	P1d	41.8	43.2	45.3	39.2	39.3	40.9	35.8	6.1	5.1
2	P11	31.8	32.8	35.3	22.3	22.5	27.8	19.7	13.0	8.1
3	P12	55.2	58.0	64.5	39.8	27.4	31.2	24.2	24.7	7.0
4	P13	42.3	44.3	47.5	33.2	37.2	41.4	29.8	14.3	11.6
5	P14	37.7	39.5	41.9	31.3	23.8	29.4	19.3	10.6	10.1
6	P15	41.7	43.3	48.0	33.8	32.1	33.1	31.3	14.2	1.8
Variant 2 — Żarnowiec site										
1	P1	44.1	45.6	47.8	39.0	39.0	42.7	36.8	8.8	5.9
2	P2	38.4	39.2	41.6	34.2	32.0	36.6	27.7	7.4	8.9
3	P2d	42.8	43.9	46.4	38.6	40.3	43.8	34.8	7.8	9.0
4	P3	38.2	38.7	41.1	34.7	29.5	32.4	25.9	6.4	6.5
5	P3d	42.9	44.7	46.4	34.7	39.1	40.6	38.4	11.7	2.2
6	P4	39.0	39.7	42.1	30.5	30.0	34.2	25.9	11.6	8.3
7	P5	41.8	42.1	44.5	36.2	34.8	39.5	31.0	8.3	8.5
8	P6	43.0	44.2	46.5	38.8	38.1	42.3	33.8	7.7	8.5
9	P7	46.4	48.4	52.1	39.5	35.8	40.0	33.0	12.6	7.0
10	P8	31.9	33.1	36.5	25.0	27.2	32.1	20.1	11.5	12.0
11	P9	39.9	40.6	42.5	35.4	34.9	40.9	27.6	7.1	13.3

**L_{AeqD} — Equivalent A-weighted sound level for daytime; L_{AeqN} — Equivalent A-weighted sound level for nighttime.*
$L_{Aeq,D}$ 16 h – from 16 hours during the day; $L_{Aeq,D}$ 8 h MAX – from 8 least favourable hours of the daytime, $L_{Aeq,N}$ 8 h – from 8 hours during the night, $L_{Aeq,N}$ 1 h MAX – from 1 least favourable hour of the night; $L_{Aeq,D}$ 1 h MAX – from 1 least favourable hour of the day, $L_{Aeq,D}$ 1h MIN – from 1 most favourable hour of the day, $L_{Aeq,N}$ 1h MIN – from 1 most favourable hour of the night

Source: In-house study based on Noise and Vibration Impact Assessment. Jacobs Clean Energy Limited, 2020

Variant 1 — Lubiatowo - Kopalino site

To sum up, the results of noise measurements of the existing plants at 6 measurement points in places of potential impact of the Project and auxiliary infrastructure from the period of 8 least favourable hours of the day are (rounded to 5 dB) in the range of 60–30 dB. In the case of the nighttime, the results of measurements from the period of 1 least favourable hour are in the range of 45–25 dB. At the same time, it should be noted that at most measurement points, sources of industrial noise that have a decisive impact on the state of the acoustic climate at a given point have not been identified. This is due to the low degree of industrialisation of the region in which the measurements were performed, as well as the method of spatial development bringing together large production plants away from residential areas.

Variant 2 — Żarnowiec site

To sum up, the results of noise measurements of the existing plants at 11 measurement points in places of potential impact of the Project and auxiliary infrastructure from the period of 8 least favourable hours of the day are (rounded to 5 dB) in the range of 50–30 dB. In the case of the nighttime, the results of measurements from the period of 1 least favourable hour are in the range of 45–30 dB. At the same time, it should be noted that at the measurement points: P1, P2, P3, P4, P5, P6, P7, P8 located in the surroundings of the PSEZ, there were found no levels significantly higher than in the case of other points located outside the immediate vicinity of the industrial zone.

VI.3.3.9.2 Marine area

Measurement methodology

Research at sea as part of background noise monitoring was carried out simultaneously in both variants in the annual period – from 30 March 2017 to 4 April 2018. The most up-to-date German standards available (BSH Standard Investigation of the Impact of Offshore Wind Turbines on the Marine Environment) were used for the analysis, which specify that it is sufficient to perform tests and documentation once before the start of the investment. According to these standards, the background noise measurements will include three hours of recordings for three classes of wind speed, resulting in a total of 9 hours of underwater noise recordings collected during the entire year of research. For this reason, the measurements included periodic recordings (3 hours per wind class at any time of the year) throughout the annual cycle. The recordings were continuous, while the classification of data according to wind speed classes took place at the stage of data analysis by an expert, based on meteorological data collected during the project by a measuring buoy placed in the research area. A total of three devices reporting noise background were deployed in remote locations of the marine survey area as shown in the figure [Figure VI.3.3.9- 1]:

- at the height of Variant 1 — Lubiatowo - Kopalino site, research station no. ST_167_5 at a depth of 12 m, acoustic recorder of type SM2M,
- at the height between the two variants – research station no. ST_149_7 at a depth of 16 m, acoustic recorder of type SM2M,
- at the height of Variant 2 – Żarnowiec site, research station ST_143_4 at a depth of 17 m, SM3M acoustic recorder from Wildlife Acoustics.

Acoustic recorders record all underwater sounds with frequencies from 2 Hz to 192 kHz. They have a length of 80 cm, a diameter of 17 cm and weigh 10 kg. The recorder has a built-in underwater microphone that recorded sounds in the selected frequency band from 2 Hz to 22 kHz. The guidelines of BSH Standard – Investigation of the Impact of Offshore Wind Turbines on the Marine Environment, together with their updates, indicate that only one measurement campaign should be carried out before the start of construction works, but also indicate the need to examine seasonal differences in the level of background noise intensity. However, this does not mean the need for continuous monitoring of the background noise, because the purpose of monitoring is to obtain data from different seasons (3 hours of recordings for each surveyed season), at different wind speeds (sea level).

The recorder detects sounds from nearby sources, such as passing ships, and low-frequency sounds from very distant sources, because low-frequency sounds can travel very long distances underwater, so the recordings contain information from the research station and a vast surrounding area. Accurate designation of the range is very difficult, because sounds from distant sources overlap and are not distinguishable. Acoustic recorders record sounds with frequencies and time intervals set at each immersion. The frequency band is between 2 Hz and 22 kHz and this range is sufficient to record most sounds of unnatural origin at low and medium frequencies in the range from 10 Hz to 10 kHz. The processing of acoustic data was performed using appropriate filters to separate the signals for the selected band using American standards (American National Standards Institute ANSI - Specification for Octave-Band and Fractional-Octave-Band Analog and Digital Filters).

Results of noise monitoring: Variant 1 — Lubiatowo - Kopalino site and Variant 2— Żarnowiec site

The following are the results of background noise measurements, where the summary of the results shows the average value of broadband sound pressure level (SPL) for 63 Hz and for 125 Hz covering 1/3 of an octave from the frequency range of 63 Hz to 10 kHz. Measurements were obtained for each of the three stations at any time of the year, indicating the exact date of measurement [Table VI.3.3.9- 3].

Table VI.3.3.9- 3 Results of measurements of background noise in the marine area for Variant 1 Lubiatowo - Kopalino site and Variant 2 – Żarnowiec site

Station name	Location	Measurement date	Mean broadband sound pressure SPL (1/3 octave in the frequency range 63 Hz to 10 kHz) [dB re 1 µPa]			
			63 Hz		125 Hz	
Measurement in spring 2017/2018			spring 2017	spring 2018	spring 2017	spring 2018
ST_167_5	Lubiatowo - Kopalino	30.03 – 18.05.2017 25 – 31.05.2017 1.03 – 4.04.2018	76	97	84	99
ST_149_7	Lubiatowo - Kopalino, and Żarnowiec	19 – 31.05.2017 1.03 – 4.04.2018	105	106	101	106
ST_143_4	Żarnowiec	30.03 – 3.04.2017, 19 – 31.05.2017 1.03 – 4.04.2018	80	103	84	102
Measurement in summer 2017			**63 Hz**		**125 Hz**	
ST_167_5	Lubiatowo - Kopalino	1.06 – 31.08.2017	72		81	
ST_149_7	Lubiatowo - Kopalino, and Żarnowiec	1.06 – 31.08.2017	103		101	
ST_143_4	Żarnowiec	1 – 20.06.2017 10 – 11.08.2017 17 – 31.08.2017	70		77	
Measurement in autumn 2017			**63 Hz**		**125 Hz**	
ST_167_5	Lubiatowo - Kopalino	1.09 – 30.11.2017	73		83	
ST_149_7	Lubiatowo - Kopalino, and Żarnowiec	1.09 – 30.11.2017	104		103	
ST_143_4	Żarnowiec	1.09 – 30.11.2017	73		80	
Measurement in the winter period 2017/2018			**63 Hz**		**125 Hz**	
ST_167_5	Lubiatowo - Kopalino	20.01 – 28.02.2018	97		100	
ST_149_7	Lubiatowo - Kopalino, and Żarnowiec	1.12.2017 – 28.02.2018	106		106	
ST_143_4	Żarnowiec	1.12.2017 – 20.01.2018; 2 – 28.02.2018	85		90	

Source: In-house studies of the Final Report with research results for the EIA Report and the Location Report in the field of marine mammal survey in the period from March 2017 to April 2018, Maritime Institute in Gdańsk, MEWO sp. z o.o. S.K.A., National Marine Fisheries Research Institute

The results of the background noise analysis in the marine area for both variants were consistent with those obtained from other larger-scale projects, such as the Baltic Sea Information on the Acoustic Soundscape (BIAS). The Baltic Sea area is considered noisy due to the very intense movement of ships. In particular, the ST_149_7 station is located in the research area subjected to high noise of unnatural origin, as shown by the results of the entire monitoring period. These levels are comparable to the noise level, e.g. in the Great Belt in Denmark and the Gulf of Finland, which is characterised by high volume of vessel traffic.

Analysis of the background noise data did not reveal any significant differences between the marine survey areas for Variant 1 – Lubiatowo - Kopalino site and for Variant 2 – Żarnowiec site. Both of these areas are characterised by the consistency of the results with those obtained by the BIAS research project.

VI.3.3.10 Electromagnetic field

The chapter presents the analysis of electromagnetic radiation sources (EMF) in the Power Plant Site Region and the current status of EMF background (currently occurring EMF) in the area designated separately for both site variants.

The permissible levels of electromagnetic fields in the environment are specified in the Regulation of the Minister of Health of 17 December 2019 on the permissible levels of electromagnetic fields in the environment.

In order to assess the current level of the electromagnetic field background for both site variants, its measurements were performed, which were then compared with the limit values specified in the above-mentioned regulation.

The measurements were made using methods and equipment in accordance with the guidelines contained in the Regulation of the Minister of Climate of 17 February 2020 on methods of verification of compliance with the permissible levels of electromagnetic fields in the environment. EMF background measurements were performed at representative border points and covered the full frequency range for identified military and civilian communication devices.

VI.3.3.10.1 Variant 1 — Lubiatowo - Kopalino site

In the Site Region of Variant 1, the following types of military and civilian devices and facilities emitting electromagnetic fields have been identified:

- radar equipment and communication devices from the area of military complexes,
- civil equipment such as UKF FM radio broadcasting stations, TV stations, radio link stations, VHF and UHF systems (very and ultra high frequency) and mobile telephony base stations.

The analysis of the measurements carried out allows for concluding that the background noise of the electromagnetic field within the limits of the survey area designated for Variant 1 does not exceed the permissible values specified in the Regulation of the Minister of Climate of 17 February 2020 on the methods of verification compliance with the permissible levels of electromagnetic fields in the environment.

VI.3.3.10.2 Variant 2 — Żarnowiec site

In the Site Region of Variant 2, the following types of military and civilian devices and facilities emitting electromagnetic fields have been identified:

- radar equipment and communication devices from the area of military complexes,
- civil equipment such as UKF FM radio broadcasting stations, TV stations, radio link stations, VHF and UHF systems (very and ultra high frequency), one meteorological device and mobile telephony base stations.

The analysis of the measurements carried out allows for concluding that the background noise of the electromagnetic field within the limits of the survey area designated for Variant 2 does not exceed the permissible values specified in the Regulation of the Minister of Climate of 17 February 2020 on the methods of verification compliance with the permissible levels of electromagnetic fields in the environment.

VI.3.3.11 Ionising radiation background

The assessment of the current condition of the ionising radiation background in the Site Regions for both site variants was carried out both on the basis of existing data and in-house study. These measurements are important due to the need to determine the "zero state" of the ionising radiation background, and the need to properly plan the radiation monitoring of the NPP area and its surroundings before commissioning, and then at the commissioning stage and during the operational phase of the power plant. The need for monitoring of ionising radiation in the environment is determined by a number of legal regulations, both national (such as the Atomic Law Act and the EPL Act together with the relevant regulations) and European (Euratom Treaty), as well as in relevant publications of the International Atomic Energy Agency.

Radiation background measurements have been carried out in Poland for several decades. Initially, they were carried out as part of dedicated and irregular scientific research. Regular measurements began in 1957. In 1975, the Central Laboratory of Radiological Protection (CLOR) carried out thorough measurements of the radiation background around Lake Żarnowieckie, where the construction of the first Polish NPP was planned. After the Chernobyl accident in 1986 (which fundamentally changed the image of the radiation background in Europe), the data on these measurements became obsolete. In the years 1993–1994 the National Geological Institute published Radioecological maps of Poland, and in 1995 – the Geochemical Atlas of Poland. These maps are accurate enough to be used to assess the background radiation in the Site Regions considered as part of the Project. Newer maps, published in 2005 in the Radiological Atlas of Poland and in 2011 in the Radiological Atlas of Poland by CLOR and the Chief Inspectorate for Environmental Protection (GIOŚ) are more general, making it impossible to determine the value of radioisotope concentrations/dose rate separately for each of the Site Regions, and only for the entire Pomorskie Voivodeship.

Regardless of the existing data, the Investor conducted its own research in this area. In-house study was carried out with a division into individual components of the environment: air and total atmospheric precipitation of radionuclides, land environment, aquatic environment of inland waters and marine environment. As part of the measurements, the background of gamma radiation and the concentration of radioactive isotopes in the air (including radon concentration in buildings), precipitation, vegetation from various types of areas (urban, forest, agricultural land), food products of plant and animal origin and in waters, bottom sediments and aquatic organisms of inland, coastal and marine waters were examined.

The above studies allow for conclusion that the values of the tested parameters are slightly lower than the average values for the entire territory of Poland. These conclusions are consistent with the information contained in the Radiological Atlas of Poland, where the northern part of Poland is characterised by a slightly lower background level of ionising radiation than the south. There were no anomalies, places with an increased radiation background, or radioactive contamination in any of the surveyed locations. This means that the studied radiation background in these areas is a good reference point – the so-called zero state – for future radiation monitoring. The conducted surveys did not show significant differences between the analysed site variants.

VI.3.3.12 Characteristics of current landscape and visual conditions

In order to characterise the landscape and subsequently assess the impact of the Project on this element of the environment, the so-called landscape survey was first carried out. It included both the process of office studies (i.e. research consisting in the review of available scientific publications, graphic studies or photographic documentation) and field research. The concept of landscape can be described in different ways, but for the purposes of the EIA Report it was assumed that landscape is an area perceived by people, the character of which is the result of the action and interaction of natural and/or human factors. A landscape can be a collection of different elements that form a common ensemble described e.g. as a seascape or a dune landscape, forest landscape, etc. However, in order to describe this collection, it is first necessary to know in detail its components, which include, e.g. natural and cultural elements of the landscape, protected areas (in particular landscape protection), lookout points, light pollution zones and others.

The collection of data on the current state of the environment (landscape) was primarily based on the guidelines presented in the official British guidelines contained in the document entitled "Guidelines for Landscape and Visual Impact Assessment (GLVIA3)", while in the case of land landscape surveys, Polish regulations governing the preparation of the so-called Landscape Audits, i.e. the Regulation of the Council of Ministers of 11 January 2019 on the preparation of landscape audits, have been additionally taken into account.

During the field research, photos from lookout points were taken in such a way that they present the "worst possible scenario" for a selected group of recipients of visual elements.

Groups of recipients of visual elements have been divided into:

- recipients of visual elements living in a specific area (e.g. residents of a town),
- recipients spending free time (e.g. recreational recipients using various forms of active recreation) or
- recipients moving by means of transport, using both their own and public transport.

Places related to these categories of recipients, e.g. towns, walking and cycling paths, tourist attractions (e.g.: lighthouses, beaches, observation towers, navigable lakes and water sports centres) and nature reserves accessible to visitors are described in detail. The most popular routes for the movement of groups of recipients are also indicated.

Summarising the results of the above-mentioned research, it was found that:

1. In the case of the terrestrial landscape in the entire research area (for Variant 1 – Lubiatowo - Kopalino site and Variant 2 – Żarnowiec site), 53 landscape complexes were finally designated, representing, for example, dominant forms of land cover and land use and common features in terms of hypsometric, hydrological, lithological conditions, etc.;
2. In the case of the seascape, the analyses identified eight Seascape Character Types (SCTs) and twelve Seascape Character Areas (SCAs);
3. Natural landscape elements in the Project Area and in its surroundings:
    - in the case of Variant 1 – Lubiatowo - Kopalino site: diverse ecosystems, some of which are protected under the European Ecological Network Natura 2000, and the cultural value of this area is mainly related to intensive afforestation and new towns created in the twentieth century;
    - in the case of Variant 2 – Żarnowiec site, the situation is quite different, at least when it comes to the Project Area. It consists mainly of industrial areas, overgrown with ruderal vegetation, and research has shown a low value of natural landscape elements. More valuable elements are recently developed aquatic habitats and regenerating forests and trees as well as the ecosystem of Lake Żarnowieckie. From the point of view of cultural elements, this area is significantly disturbed by new industrial elements, although it has a high recreational potential due to the surrounding high slopes and the presence of a lake.

A number of research methods were used to designate the environment at night, e.g.

- office studies to determine the brightness levels and any designated areas of dark sky which may occur in the landscape research area,
- field research in order to conduct research in the dark and obtain a night photographic record from selected viewpoints,
- measurements of illuminance, with the designation of the so-called Light Pollution Zones.

The obtained results indicate that the lowest brightness levels (category 0.00 – 0.15) occur in the Słowiński National Park and along the Baltic Coast between the eastern side of Łeba and Dębki, interrupted only by a higher level of brightness around Białogóra. Other fragments with the lowest brightness levels are located along the Łeba Valley south of the Słowiński National Park and in the forest area between Wicko on the western edge of the survey area for Variant 2 – Żarnowiec site, and Choczewo south of the Project Area for Variant 1 – Lubiatowo - Kopalino site. Moderate brightness levels (categories 0.25 – 0.50, 0.50 – 1.50 and 1.50 – 10.0) can be observed within smaller settlements located within the combined research area, which is associated with a higher level of domestic and roadside lighting in these localities. The highest levels of brightness within the combined research area (category of 10.0–50.0) coincide with larger towns, including Łeba, Lębork and the cities lying in an almost continuous line: Bolszewo, Wejherowo, Reda, Rumia and Gdynia-Chylonia, which stretch along the Reda Valley to the northwest of Gdynia. This category of light intensity also includes the coastal towns of Władysławowo and Puck. However, no areas falling within the two highest brightness level categories (50.0 – 75.0 and >75.0) were observed.

VI.3.3.13 Description of cultural monuments, protected pursuant to the regulations on monuments protection and care, existing in the vicinity or within the immediate range of impact of the proposed project

The description of existing architectural monuments, culturally protected areas and archaeological sites was created on the basis of the results of the archaeological survey carried out in 2017 – 2019 as part of environmental survey conducted for the purposes of the EIA Report for the planned Project. The type of cultural heritage present in the studied areas is reflected in the history of the following districts: Wejherowo, Lębork and Puck, which is associated e.g. with the migration of peoples, the establishment of settlements, trade routes and war periods.

The legal basis for the protection of cultural heritage resources is the Act of 23 July 2003 on the Protection of Monuments and Care of Monuments, according to which the forms of monument protection are: entry in the register of monuments, recognition as a monument of history, creation of a cultural park, determination of protection in the local development plan or in the decision on the site location of a public-purpose line-investment project, a decision on development conditions, a decision on permission to carry out a road investment, a decision on determining the location of a railway line or a decision on allowing for the implementation of investments in the field of an airport for public use. Due to the degree of protection, cultural heritage is divided into those entered in the Registry of Monuments (with the highest degree of protection) and in the Register of Monuments (with a lower degree of protection), which in turn is divided into the National Register of Monuments, the Voivodeship Register of Monuments (WEZ) and the Communal Register of Monuments (GEZ).

VI.3.3.13.1 Methodology

Archaeological inventory areas

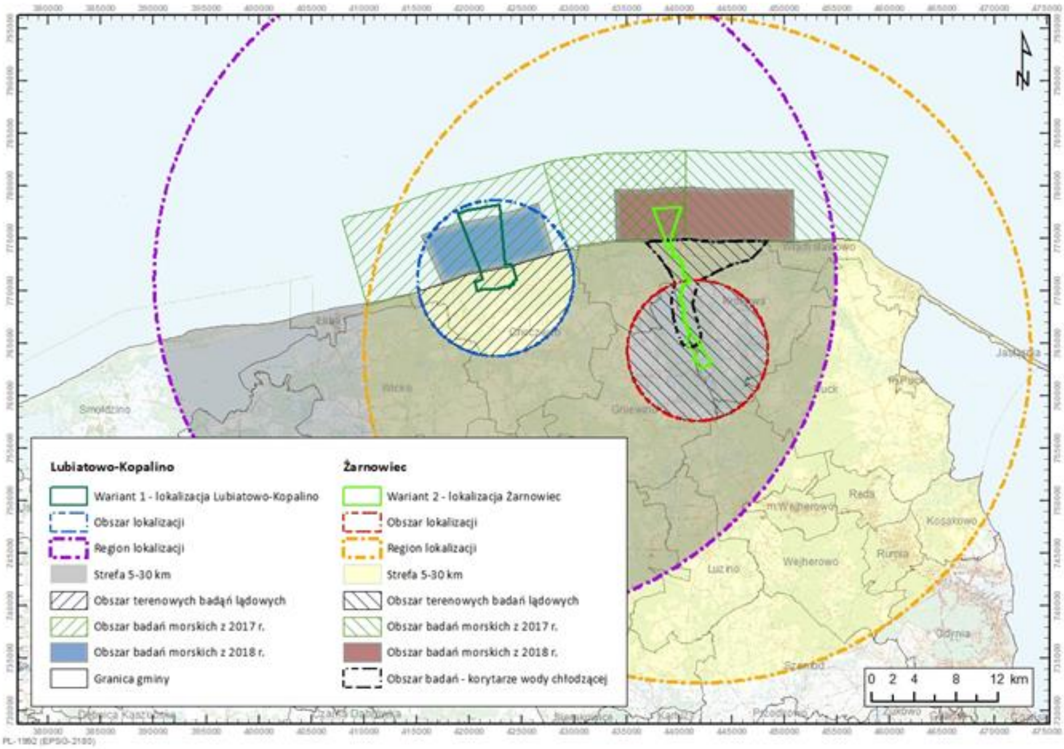
The analysis of archival documentation in terms of the presence of monuments and archaeological sites was carried out in the following areas [Figure VI.3.3.13- 1]:

- Site area;
- Zone 5 km – 30 km – area of the Site Region on land excluding the Site Area;
- Marine survey area – the area of the seabed strip of the territorial sea parallel to the shore at a distance of approximately 8.5 km from the coastline: for Variant 1 – an area with a length of approximately 31 km and surface area of approximately 274 km^2, and for Variant 2 – an area with a length of approximately 27.5 km and surface area of approximately 257 km^2.

Field reconnaissance consisting in surface surveys of archaeological sites, identification of architectural monuments and culturally protected areas and identification of sites/wrecks lying on the bottom of the Baltic Sea using an echo sounder and sonar were carried out in the following survey areas indicated below:

- Area of land field research – Site area on land, including the Project Area in Variant 1 — Lubiatowo - Kopalino site and Variant 2 — Żarnowiec site;
- The corridors of cooling/make-up water – land area in Variant 2 planned for cooling/make-up water corridors with technical infrastructure and a buffer with a width of 1 km;

- Marine survey area – areas of the strip of territorial sea bed for both site variants parallel to the shore at a distance of approximately 8.5 km from the coastline in the case of series 1 of surveys and 5 km in the case of series 2 of surveys, descending to a depth of bottom of approximately 30 m:
  - Series 1 of survey in 2017 – for both site variants covered a strip of the Polish territorial sea with a width of approximately 47.5 km contained between sections of the coastline from 132 km to 179.5 km. For Variant 1 it was an area about 31 km wide (from 148.5 km of the shore to 179.5 km), and for Variant 2 - with a width of about 27.5 km (from 132 km of the shore to 159.5 km). Variants 1 and 2 have a common part – it is a strip with a width of about 11 km (148.5 km from the shore to 159.5 km);
  - Series 2 of surveys in 2018 – for both site variants the areas in the 2nd series were reduced compared to series 1 of surveys to approach the boundaries of the variants: Variant 1 from 161 km to 172 km of the shore; Variant 2 from 138 km to km 155 km of the shore.



Lubiatowo - Kopalino	Lubiatowo - Kopalino
Wariant 1 - lokalizacja Lubiatowo - Kopalino	Variant 1 – Lubiatowo - Kopalino site
Obszar lokalizacji	Site Area
Region lokalizacji	Site Region
Strefa 5-30 km	Zone 5-30 km
Obszar terenowych badań lądowych	Area of land field surveys
Obszar badań morskich z 2017 r.	2017 Marine survey area
Obszar badań morskich z 2018 r.	2018 Marine survey area
Granica gminy	Commune boundary
Żarnowiec	Żarnowiec
Wariant 2 - lokalizacja Żarnowiec	Variant 2 — Żarnowiec site
Obszar badań - korytarze wody chłodzącej	Research area - cooling water corridors

Figure VI.3.3.13- 1 Archaeological research area in the land and marine parts

Source: In-house study

Types of archaeological surveys

As part of the archaeological survey, the so-called "desk reconnaissance" was first carried out, consisting in the analysis of available archival materials. In the next step, the collected materials were twice subjected to field reconnaissance during archaeological surface surveys.

- Desk reconnaissance

For the land area of the Site Region, an analysis of archival documents of archaeological sites and architectural monuments located in the resources of the following registers was carried out: in the Register of Monuments and Records for the Pomorskie Voivodeship (Voivodeship Office for the Protection of Monuments in Gdańsk and its Representative Office in Słupsk), the Register of Archaeological Monuments, the National Register of Monuments, the Voivodeship Register of Monuments, the Archive of the Archaeological Museum in Gdańsk and in Lębork, National Heritage Institute in Warsaw, Municipal registers of archaeological monuments. Source data e.g. of the Communal Programmes for the Care of Monuments, Studies of conditions and directions of spatial development of communes – in particular, from parts of studies on the Study of Cultural Heritage and Landscape, address cards of immovable monuments in communes, Archaeological Cards of Communal Register of Monuments, list of immovable monuments located in the commune and Local Development Plans of communes located in the Site Area and Site Region were also used.

The analysis of the archives of underwater cultural heritage was made on the basis of the Register of Underwater Archaeological Sites and maps and materials from the Underwater Archaeology Department of the National Maritime Museum in Gdańsk, Maritime Offices in Gdynia and Słupsk.

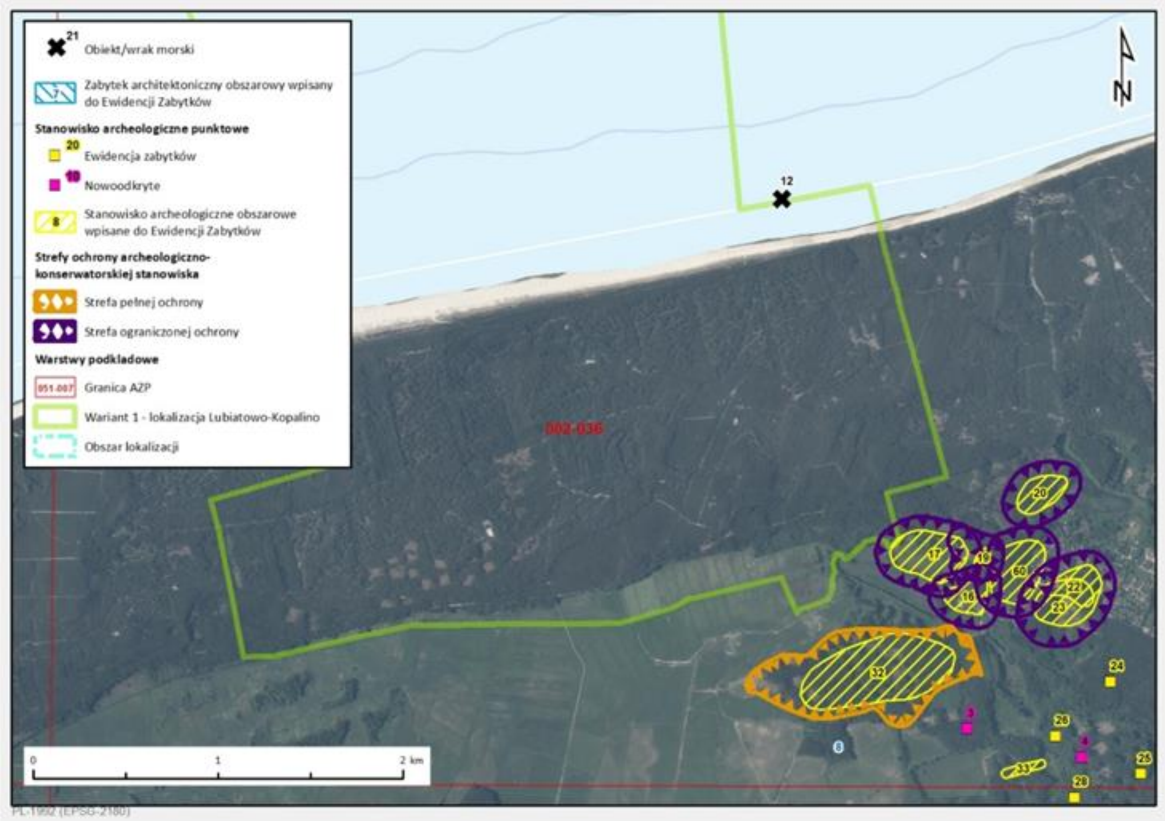
- Field reconnaissance

In the area of field land surveys, the area of cooling water corridors and in the marine survey area, field verification of the obtained archival documents was carried out by:

- surface surveys of archaeological sites consisting in penetrating the surface of the earth – in order to find and locate the relics of settlement and determine on this basis the range of archaeological sites and obtain data on the settlement sites forming them. As part of the research, the Methodology of archaeological surface surveys was used, and the documentation of archaeological sites was created according to the guidelines of the National Heritage Institute. Field research consisted in passing the area linearly in dispersion with appropriate distances towards previously known archival sites and with simultaneous observation of the area between these sites in search of new relics of settlement. As far as possible, the so-called field interview with owners or users of land, employees of the State Forests and residents of towns located in the research site was also carried out. As a result of two rounds of archaeological surface surveys in the area of field land research, previously unknown archaeological sites were also identified,
- field reconnaissance of architectural monuments and culturally protected areas consisting of a touring visit – in order to identify, confirm the location using GPS, visually inspect and photograph the existing state of individual architectural monuments and culturally protected areas. In some cases, basic measurements and verifications of a historical and architectural nature were also carried out and interviews with the owners or users of monuments were carried out, as far as possible.
- field reconnaissance of objects on the seabed consisting in echo sounder and sonar testing, whose main task is to recognise the detailed topography of the bottom and changes in bathymetry in the period of one year between 2017 and 2018. The selected objects were then verified using a remote underwater vehicle (ROV).

VI.3.3.13.2 Variant 1 — Lubiatowo - Kopalino site

Current condition of cultural heritage in the vicinity of the Project in Variant 1 – Lubiatowo - Kopalino site is presented in the figure below [Figure VI.3.3.13- 2].



Obiekt/wrak morski	Object/sea wreck
Zabytek architektoniczny obszarowy wpisany do Ewidencji Zabytków	Area architectural monument entered in the Record of monuments
Stanowisko archeologiczne punktowe	Point archaeological site
Ewidencja zabytków	Record of monuments
Nowoodkryte	Newly discovered
Stanowisko archeologiczne obszarowe wpisane do Ewidencji Zabytków	Area archaeological site entered in the Record of Monuments
Strefy ochrony archeologiczno-konserwatorskiej stanowiska	Archaeological and conservation protection zones of the site
Strefa pełnej ochrony	Full protection zone
Strefa ograniczonej ochrony	Limited protection zone
Warstwy podkładowe	Base map layers
Granica AZP	Polish Archaeological Record Boundary
Wariant 1 - lokalizacja Lubiatowo - Kopalino	Variant 1 – Lubiatowo - Kopalino site
Obszar lokalizacji	Site Area

Figure VI.3.3.13- 2 Current condition of cultural heritage in the vicinity of the Project in Variant 1 – Lubiatowo - Kopalino site.

Source: In-house study

Archaeological sites

At the stage of office reconnaissance in the area of field land research, information was collected on 117 archaeological sites entered into the Polish Archaeological Record, of which 89 were located in the field, while 28 of them were considered to be archival sites with an undetermined location. Two archaeological sites (burial mounds) located about 3.5–4 km from the eastern border of the Project Area are entered in the Register of Monuments. On the other hand, 1 area site belonging to the Voivodeship Register of Monuments (WEZ) – a burial mound called "Gajówka" in Jackowo (no. 32), located about 300 m from the southern border of the Project Area, has a full archaeological and conservation zone of the site, where all investment activities resulting in the transformation of the area are excluded. Currently, the site is awaiting supplementary archaeological research to confirm the intention of its entry in the Register of Monuments. In addition, during the surface surveys, 10 new archaeological sites were discovered, which gives a total of 99 archaeological sites identified in field, entered into the Polish Archaeological Record.

The land part of the south-eastern border of the Project Area, in the contact zone of the site in the village of Jackowo, Choczewo commune, includes 1 field archaeological site (no. 17) with a total area of approximately 8.53 ha (in the Project Area it occurs in a fragment on the area of approximately 0.08 ha). Protection measures cover an open settlement from the early and late Middle Ages. The site is entered in the Register of Monuments and is covered by the zone of limited archaeological and conservation protection.

In the zone of 5–30 km, on the basis of the analysis of archival documentation, a total of 2,739 archaeological sites have been identified, of which 33 are entered in the Register of Monuments. At the same time, no archaeological sites were found in the communes of Cewice and Potęgowo.

Architectural monuments and culturally protected areas

At the stage of analysis of archival documentation, information on 97 architectural monuments and culturally protected areas entered in the Polish Archaeological Record was collected in the area of field land research. 93 of them were located in the field and additionally 3 new architectural monuments were revealed. 3 monuments entered in the Register of Monuments were destroyed (considered no longer existent) and 1 monument, entered into the Register of Monuments, was not identified in the area. Among the 96 architectural monuments and culturally protected areas identified in the area, 48 are entered in the Register of Monuments of the Pomorskie Voivodeship. The remainder of the architectural monuments and culturally protected areas (48) appear in the lower-order registers recorded in the Voivodeship Register of Monuments (WEZ) and Communal Register of Monuments (GEZ). Architectural monuments and culturally protected areas are located mainly in the historical centres of towns, in the immediate vicinity or a short distance from the historical and modern road network. They were created in the late Middle Ages in towns founded as a result of the so-called "internal colonisation".

There are no architectural monuments in the land part of the Project Area.

In the zone of 5–30 km, on the basis of the analysis of archival documentation, a total of 1,340 archaeological sites and culturally protected areas have been identified, of which 167 are entered in the Register of Monuments. At the same time, no architectural monuments and culturally protected areas were found in the municipalities of Cewice and Potęgowo, as well as in the city of Wejherowo.

Cultural heritage at sea

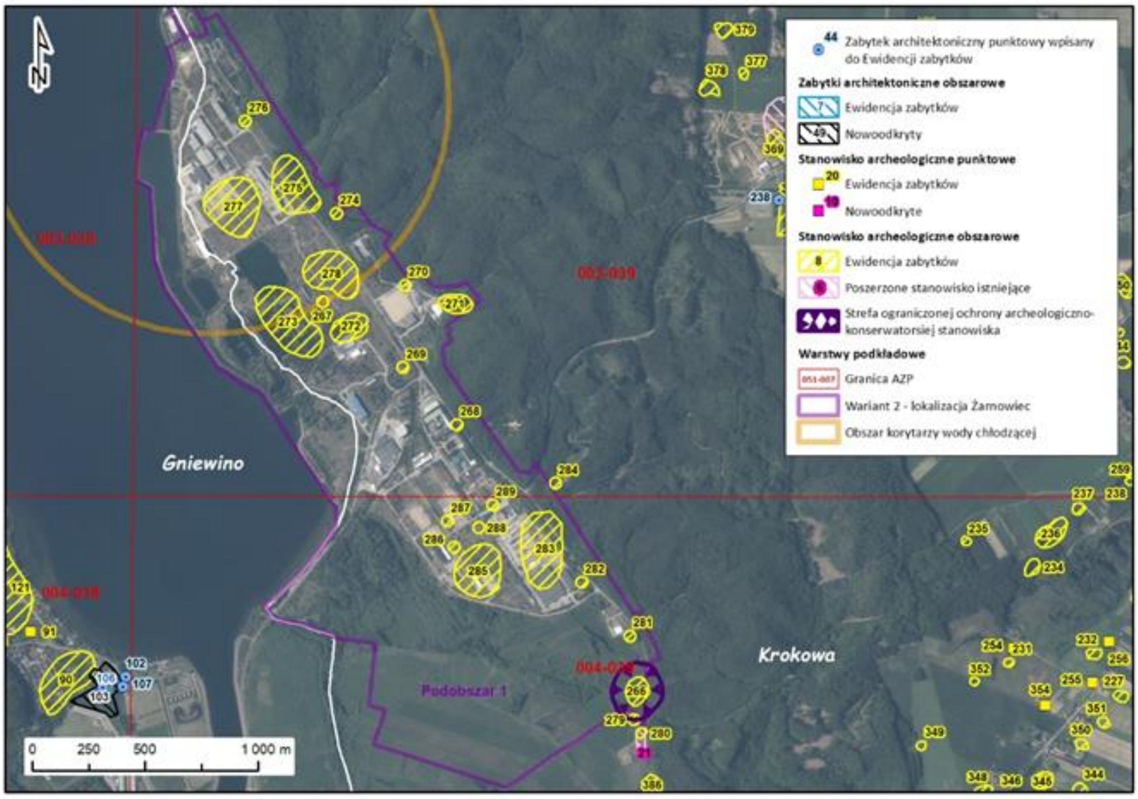
Based on the analysis of archival data, 24 objects were located in the marine research area, including 4 wrecks considered to be marine archaeological sites, 3 wrecks with a modern metric, 5 objects designated for verification in the future, as well as 12 navigational obstacles reported by fishermen or sailors.

After analysing the sonar profiles from the Series 1 surveys (2017) and analysing the recordings from the ROV, it turned out that 9 wrecks were newly discovered objects ("Galuna", "Kadlu", "Lucki", "Somi", "Nomis", "Nusiada", "Boiz", "Cetnik", "Marcelina") which are probably wooden or metal ships and the remains of cargo from the wrecks that may have historical value. These objects were reported to the Voivodeship Conservator of Monuments in Gdańsk, the Hydrographic Office of the Navy and the Maritime Office in Słupsk and Gdynia. As part of the series 2 (2018) surveys, another additional wreck, the "Haben", was identified, which was also subject to notification. A total of 23 wrecks were identified as part of the seabed analyses after archival data analysis and newly discovered wrecks identified during sonar surveys after verification by an ROV, including 2 wrecks/objects (E19.4 and GUM 66) from archival data analysis not confirmed during sonar research.

There are no underwater historic objects in the marine part of the Project Area. At a distance of approximately 0.2 km from the coastline and approximately 15 m from the eastern border of the Project Area, there is a wooden wreck "Centik" at the depth of 4 m (no. 12) with the following dimensions: length 4 m, height 0.5 m, width 0.2 m.

VI.3.3.13.3 Variant 2 — Żarnowiec site

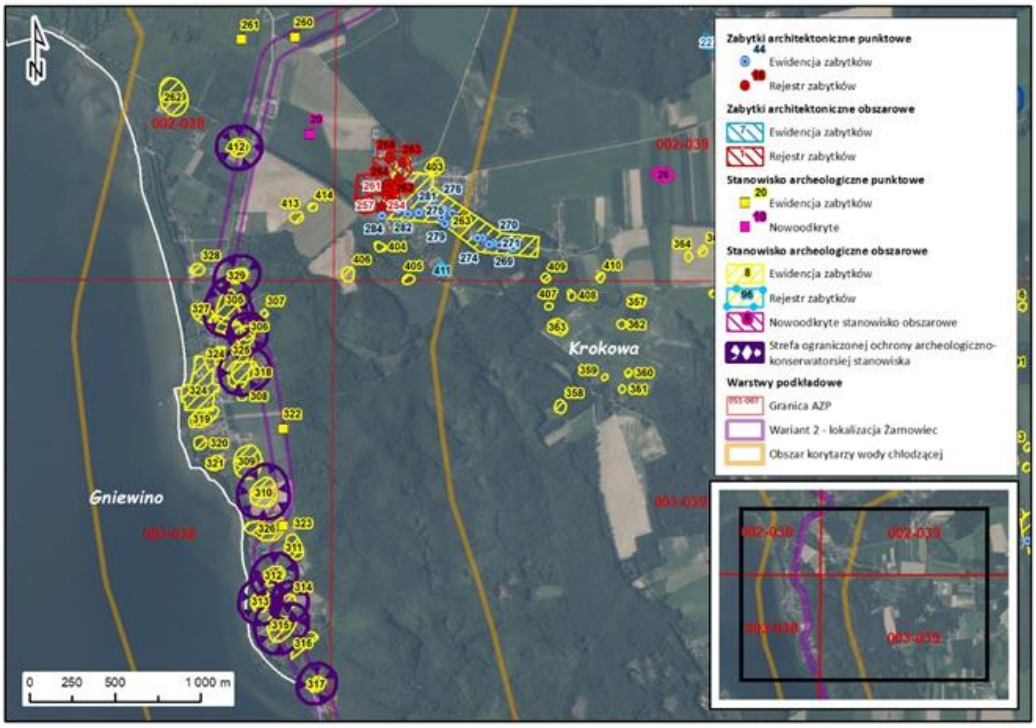
The current state of cultural heritage in the surroundings of the Project in Variant 2 – Żarnowiec site in Subareas 1 and 2 is presented in the following figures [Figure VI.3.3.13- 3] and [Figure VI.3.3.13- 4]. In Subareas 3 and 4, no archaeological sites or architectural monuments have been identified.



Zabytek architektoniczny punktowy wpisany do ewidencji zabytków	Point architectural monument entered in the Record of monuments
Zabytki architektoniczne obszarowe	Architectural monuments of the area
Ewidencja zabytków	Record of monuments
Nowoodkryty	Newly discovered
Stanowisko archeologiczne punktowe	Point archaeological site
Stanowisko archeologiczne obszarowe	Area archaeological site
Poszerzone stanowisko istniejące	Extended existing site
Strefa ograniczonej ochrony archeologiczno-konserwatorskiej stanowiska	Zone of limited archaeological and conservation protection of the site
Warstwy podkładowe	Base map layers
Granica AZP	Polish Archaeological Record Boundary
Wariant 2 - lokalizacja Żarnowiec	Variant 2 — Żarnowiec site
Obszar korytarzy wody chłodzącej	Cooling water corridor area

Figure VI.3.3.13- 3 Current condition of cultural heritage in the vicinity of the Project in Variant 2 – Żarnowiec site (Sub-area 1).

Source: In-house study



Zabytki architektoniczne punktowe	Point architectural monuments
Ewidencja zabytków	Record of monuments
Rejestr zabytków	Register of monuments
Zabytki architektoniczne obszarowe	Architectural monuments of the area
Stanowisko archeologiczne punktowe	Point archaeological site
Nowoodkryte	Newly discovered
Stanowisko archeologiczne obszarowe	Area archaeological site
Nowoodkryte stanowisko obszarowe	Newly discovered area site
Strefa ograniczonej ochrony archeologiczno-konserwatorskiej stanowiska	Zone of limited archaeological and conservation protection of the site
Warstwy podkładowe	Base map layers
Granica AZP	Polish Archaeological Record Boundary
Wariant 2 - lokalizacja Żarnowiec	Variant 2 — Żarnowiec site
Obszar korytarzy wody chłodzącej	Cooling water corridor area

Figure VI.3.3.13- 4 Current condition of cultural heritage in the vicinity of the Project in Variant 2 – Żarnowiec site (Sub-area 2).

Source: In-house study

Archaeological sites

At the stage of a desk study in the area of field land research, information was collected on 384 archaeological sites entered into the Polish Archaeological Record, of which 325 were located in the field. 10 archaeological sites are entered in the Register of Monuments, and the nearest of them entered in the Register (no. 264) being a medieval hillfort, is located about 330 m from the boundaries of the Subarea 2 of the Project Area, i.e. the area of the route of complimentary water pipelines for cooling systems [Figure VI.3.3.13- 4]. 59 sites were considered to be archival sites with an undetermined location. During the course of surface surveys, 11 new archaeological sites were discovered.

In the Area of cooling water corridors, which is a separate survey area as part of the archaeological survey, with the exception of the Area of field land research in Variant 2 – Żarnowiec site, information was collected on 13 archaeological sites entered in the Register of Monuments of the Polish Archaeological Record, where 6 of them were identified in the field. 7 sites are marked as archival with an indeterminable location. There are no sites belonging to the Register of Monuments. None of the identified sites are covered by any conservation protection zone. Most of the identified archaeological sites are found in cultivated fields. Particularly noteworthy are: the peat mine site in Białogóra (however, this site is partially destroyed by drainage works), the water mill of the eighteenth to twentieth centuries in Żarnowiec, an extensive site constituting the historical village of Karwieńskie Błota and the historical site of Dębki (the last 2 sites are partially built-up, hence the hazard of continuous use and stay of people in the area of the site).

The Project Implementation Area in Sub-Area 1 (main NPP area) [Figure VI.3.3.13- 3] includes 22 archaeological sites located within the area of the existing Pomorskie Voivodeship Special Economic Zone in Kartoszyno, Krokowa Commune (sites no. 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 281, 282, 283, 285, 286, 287, 288, 289). All the sites are entered in the Register of Monuments. The protection of the sites situated in this area covers mostly settlements and traces of settlements from the Middle Ages (early Iron Age, Roman influence period). Site 267 is a barrow cemetery/settlement, and site 278 is a Lusatian Culture encampment (Neolithic period). Sites occurring within the area of the former Żarnowiec NPP construction site are mostly in an unsatisfactory technical condition, partially or completely destroyed. These sites are located in typical industrial or wasteland areas, where the land is largely covered with concrete, water, tress or fences, or is part of private property that is inaccessible for archaeological investigation. Only two sites (sites 266 and 279) near the south-eastern border of the Project Area, but outside the industrial area of the unfinished Żarnowiec NPP, are in very good technical condition and have preserved their proper form. These sites occur in an area covered with dense vegetation (grassy area, wet meadow, pasture). In addition, site no. 266 has a zone of limited archaeological protection. If earthworks are carried out within its boundaries, it is obligatory to conduct advance archaeological investigation or archaeological supervision within the scope indicated by the WKZ. Works may commence provided an appropriate permit is obtained from the Voivodeship Monuments Protection Office in Gdańsk.

The Project Area in Sub-area 2 (the area of cooling system make-up water pipelines together with technical infrastructure) [Figure VI.3.3.13- 4] includes 16 archaeological sites, including 14 area sites and 2 point sites (no. 305, 306, 310, 312, 313, 314, 315, 316, 317, 318, 325, 326, 329 and 412 — area sites and no. 260 and 322 — point sites). Most of them are located in the Krokowa commune: in the town of Lubkowo, besides two that are situated in Żarnowiec. All the sites are entered in the Register of Monuments. The protection of the sites covers mostly settlements and traces of settlements from the Middle Ages (Stone Age, Early Bronze Age — Neolithic period, Early Iron Age — Roman influence period). In addition, 11 sites (no. 305, 306, 310, 312, 313, 314, 315, 317, 318, 329 and 412) are covered by a zone of limited archaeological protection. Most of the sites in Subarea 2 are in good or very good technical condition and have retained their proper field form – they do not require conservation treatments, and only 6 sites are partially destroyed. The described sites are located in cultivated areas (fields, meadows) and on recreational plots partly developed by summer houses (fenced and inaccessible areas). In Subareas 3 and 4, no archaeological sites or architectural monuments have been identified.

In Zone 5 – 30 km, 3,760 archaeological sites were identified on the basis of an archival query. Out of this number, 98 are entered in the Register of Monuments. There are no archaeological sites in the communes of Cewice and Łeba.

Architectural monuments and culturally protected areas

At the stage of archival query in the area of field land research, information was collected on 190 architectural monuments and culturally protected areas entered into the Polish Archaeological Record, of which 185 were located in the field. In addition, as part of the field work, additional 3 new architectural monuments were revealed, which gives a total of 188 architectural monuments identified in the field, of which 26 architectural monuments and culturally protected areas are entered in the Register of Monuments of the Pomorskie Voivodeship, while 159 are recorded in lower-order registers (WEZ and GEZ). Architectural monuments and culturally protected areas are located mainly in the historical centre towns, in the immediate vicinity or a short distance from the historical and modern road network. They were created in towns with medieval metric.

In the area of cooling water/make-up water corridors with technical infrastructure, which is a separate research area as part of the archaeological survey, with the exception of the Area of field land survey in Variant 2 – Żarnowiec site, 8 archaeological sites entered in the Register of Monuments of the Polish Archaeological Record were identified and could be confirmed in the field. 3 of them are entered in the Register of Monuments (Fisherman's Cottage in Dębki, the Our Lady of Częstochowa Chapel of the Resurrectionist Priests in Dębki and the Ruralistic System of the village of Karwieńskie Błoto Pierwsze and Karwieńskie Błoto Drugie). The rest of the architectural monuments are entered in the Register of Monuments of the Polish Archaeological Record AZP.

There are no architectural monuments in any of sub-areas (1, 2, 3 and 4) of the Project Area.

In Zone 5–30 km, a total of 2,954 architectural monuments and culturally protected areas were identified on the basis of archival data analysis. Out of this number there are 271 architectural monuments and culturally protected areas entered in the Register of Monuments. There are no architectural monuments and culturally protected areas in the area of the communes: Cewice, Łeba and Szemud.

Cultural heritage at sea

Based on the analysis of archival data, 27 objects were located in the marine research area, including 3 wrecks considered to be marine archaeological sites, 6 wrecks with a modern metric, 5 objects designated for verification in the future, as well as 13 navigational obstacles reported by fishermen or sailors.

The results of series 1 of sonar surveys (2017) partially coincided with the area for Variant 1 – Lubiatowo - Kopalino site, while the analysed sonar profiles as part of series 2 of surveys (2018) identified e.g. 4 wrecks ("General Carleton", "Sleipner-stem", "Sleipner-stern", "Julka").

A total of 17 wrecks were identified as part of the seabed analyses (after the analysis of archival data), identified during sonar surveys after ROV verification – 3 newly discovered wrecks ("Marcelina", "Julka" and Karwik" – probably elements of wooden/metal ships and cargo residues from wrecks/anthropogenic objects) and 1 remnant of cargo or stone ballast of the wreck ("Carg"). 3 wrecks were considered archaeological sites, 5 wrecks/objects (GUM 66, F11.1, GUM 63, GUM 64, GUM 65) from the archival query were not confirmed during sonar survey.

There are no underwater historic objects in the marine section of the Project Area. The nearest is the wreck of the British cargo ship, currently in the rank of the archaeological site, the so-called "General Carleton" coal vessel marked as "Wreck W-32" with the following dimensions: length 14.1 m, height: 2.4 m, width: 5.2 m, located between the Project Site boundary and the planned sewage pipeline, at a distance of about 0.5 from the Project Site boundary and 0.5 km from the beach border.

VI.3.4 Social and economic conditions

VI.3.4.1 Spatial development

Area of analyses

For the purpose of assessing the impact of the planned Project on spatial development and land use, as well as determining the expected transformations of the settlement network and infrastructure, several areas were adopted to determine the level of detail of the analyses carried out. Since the cadastral data on spatial development and land use are collected at the level of territorial division units (poviat– commune – locality) or geodetic division (poviat – cadastral unit – geodetic precinct – cadastral plot), the so-called Administrative Site Region (ASR) was established – the communes associated with the site region – the area up to 30 km from the border of the site of the nuclear facility – and the Administrative Site Area (ASA) – communes related to the area of the site – the area up to 5 km from the border of the site of the nuclear facility. The analyses for the maritime area in both site variants were carried out in the area designated by the border of the site region.

Spatial development (planning documents)

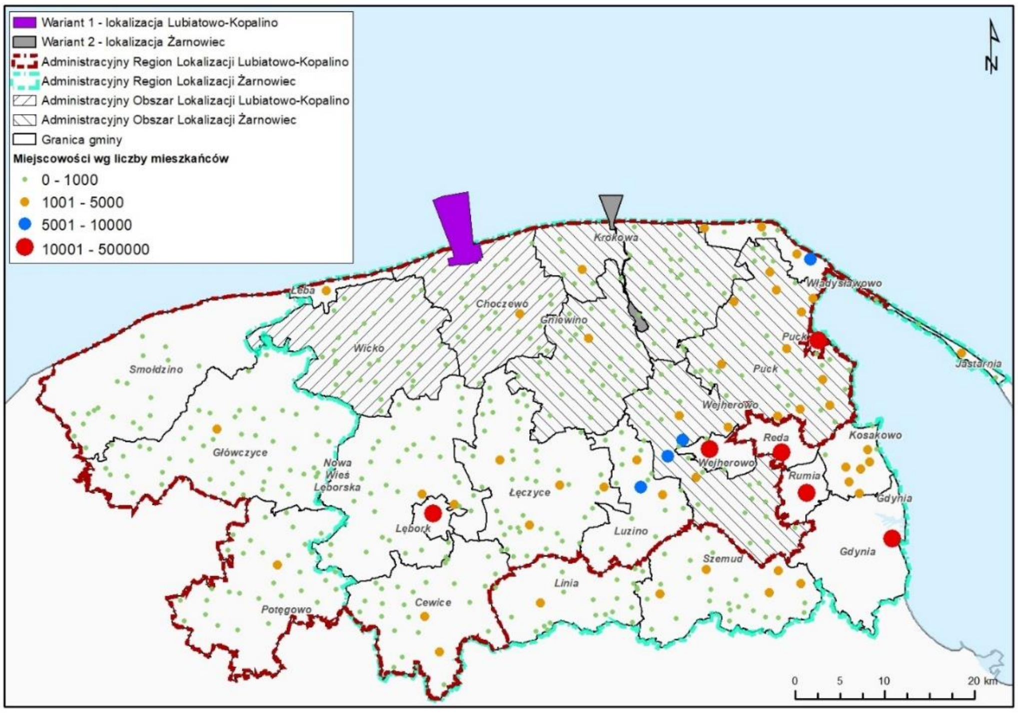
The study of conditions and directions of spatial development of the site commune of Choczewo (site commune Variant 1 - Lubiatowo - Kopalino) does not contain provisions referring to the planned Investment. Most of the areas in which the Project is planned to be implemented are not covered by the provisions of local development plans (MPZP). The local development plan within the geodetic precinct of Słajszewo, in the area of the village of

Biebrowo applies only to a small fragment (about 7 ha). This area is intended mostly for sports and recreation areas (just over 6 ha), and for green areas (less than a hectare).

In the context of the site communes of Variant 2 (communes of Gniewino and Krokowa), the studies of conditions and directions of spatial development of these communes include provisions specifying the possible location of the Project, as well as probable actions that will have to be taken in connection with the implementation of the investment (e.g. restoration of the Wejherowo-Gniewino-Choczewo-Lębork railway line). The boundaries of the area directly related to the implementation of the NPP are covered by the provisions of local development plans. The main purposes resulting from these plans are: production and service development areas (near the village of Kartoszyno), residential and service development areas, and recreational development areas (south-eastern shore of Lake Żarnowieckie), residential and summer development areas, protected areas in the northern part of the area related to the implementation of the Project).

Spatial development at sea for both investment site variants is specified by the Maritime Spatial Plan of the Polish Internal seawaters, Territorial Sea and Exclusive Economic Zone. In detailed arrangements of the plan in the northern part of the NPP Variant 1 - Lubiatowo - Kopalino, a dedicated body of water POM.39a.I was separated (section of the coast between Osetnik and Lubiatowo) with the basic function of Technical infrastructure intended for the construction of technical infrastructure for the needs of the NPP. For Variant 2 - Żarnowiec site, the POM.39b.I water region was established (on the section of the coast between Białogóra and Karwia) for the implementation of technical infrastructure for the needs of the NPP.

Settlement network layout and types of buildings



Wariant 1 - lokalizacja Lubiatowo - Kopalino	Variant 1 – Lubiatowo - Kopalino site
Wariant 2 - lokalizacja Żarnowiec	Variant 2 — Żarnowiec site
Administracyjny Region Lokalizacji Lubiatowo - Kopalino	Lubiatowo - Kopalino Administrative Site Region
Administracyjny Region Lokalizacji Żarnowiec	Żarnowiec Administrative Site Region
Administracyjny Obszar Lokalizacji Lubiatowo - Kopalino	Lubiatowo - Kopalino Administrative Site Area
Administracyjny Obszar Lokalizacji Żarnowiec	Żarnowiec Administrative Site Area
Granica gminy	Commune boundary
Miejscowości wg liczby mieszkańców	Towns/Cities by population

Figure VI.3.4.1- 1 Arrangement of the settlement network in ASA and ASR of both site variants. Variant 1 — Lubiatowo - Kopalino site and Variant 2— Żarnowiec site

Source: In-house studies on the basis of the Spatial Development Analysis — Current status for the purposes of the EIA Report in the Żarnowiec Site, part Va. INPLUS Energetyka Sp. z o.o., July 2021 and on the basis of the Spatial Development Analysis — Current status for the purposes of the EIA Report in the Żarnowiec Site, part I. INPLUS Energetyka Sp. z o.o., July 2021

The settlement structure of both sites [Figure VI.3.4.1- 1] is largely shaped by the close location of multifunctional urban centres of the Pomorskie Voivodeship, which include: Gdańsk, Sopot, Gdynia, and from the west – Słupsk.

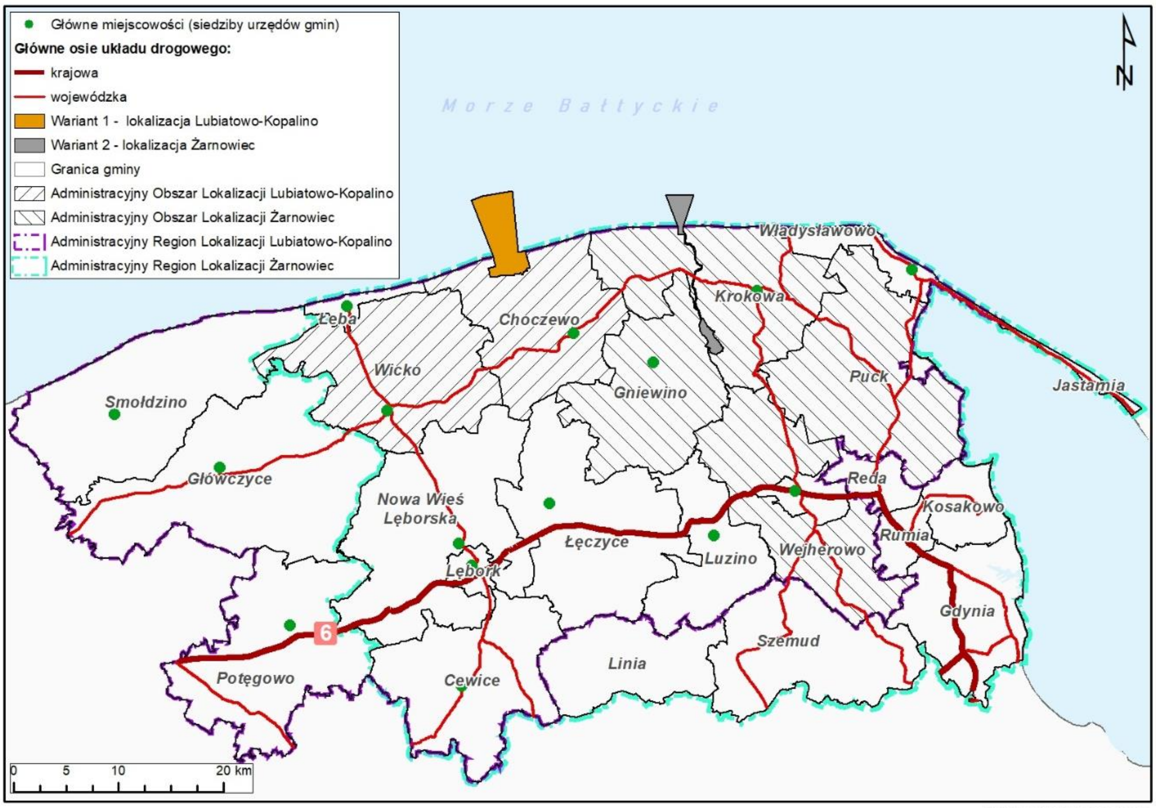
The site commune of Choczewo (Variant 1 – Lubiatowo - Kopalino site) is a rural commune. Thanks to its 17- kilometre sea coastline, extensive forest areas, and presence of Lake Choczewskie, the commune is not only agricultural in character but also attractive for tourists. Individual recreation development (mainly summer houses) prevails in the commune – approximately 55% of the total buildings, and single-family housing (approximately 37%).

The site commune of Krokowa (Variant 2 – Żarnowiec site) has access to the Baltic Sea and Lake Żarnowieckie, and is adjacent to the rural commune of Gniewino (the second site commune in Variant 2, apart from the Krokowa commune). It is very diverse in nature. The coastal strip is dominated by tourism, and the main towns located in this part of the Krokowa commune are Dębki, Białogóra and Karwieńskie Błota. In the remaining part, the commune maintains its rural nature. It is dominated by single-family housing (approximately 47%), and buildings for individual recreation (approximately 42%).

The site commune of Gniewino, the administrative boundaries of which include Lake Żarnowieckie, is also a rural commune, with several towns of tourist and cultural importance situated near several lakes located in the commune and directly adjacent to it (e.g. Lake Choczewskie). The commune of Gniewino is also dominated by single-family housing (approximately 63%), and buildings for individual recreation (approximately 26%).

Transport infrastructure

Road transport infrastructure



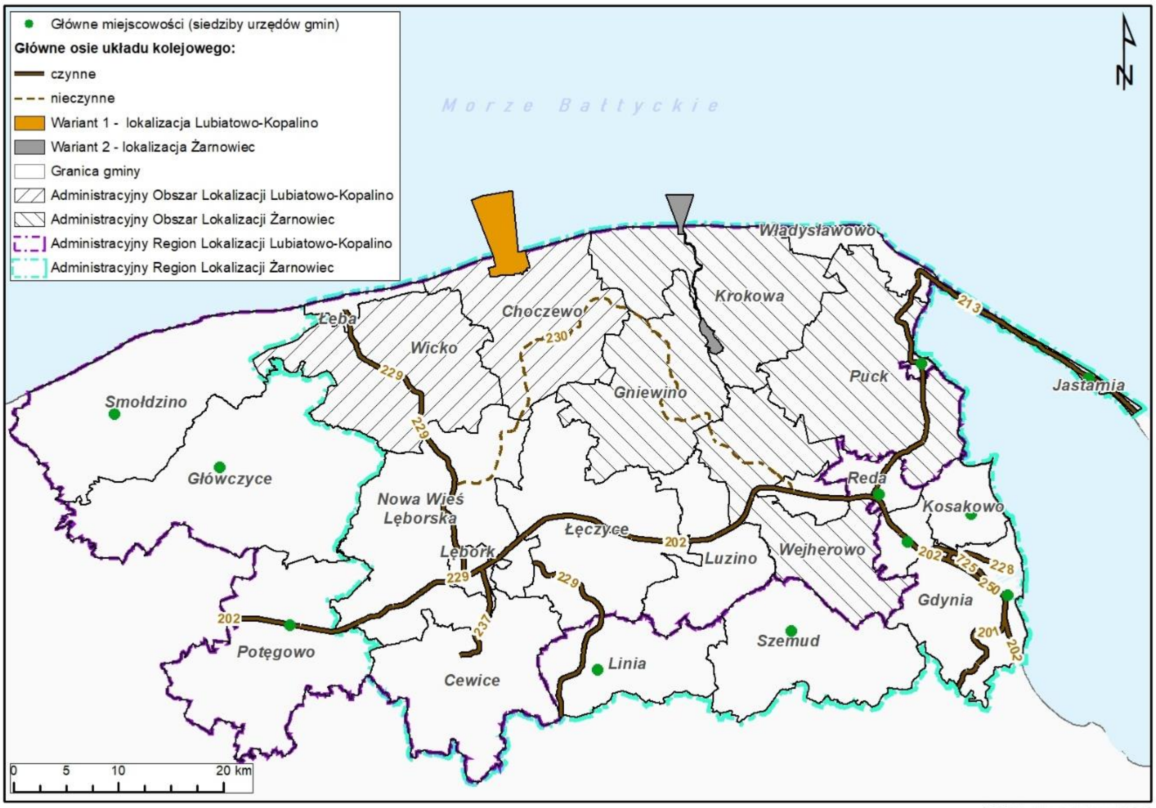
Główne miejscowości (siedziby urzędów gmin)	Main towns/cities (seats of municipal offices)
Główne osie układu drogowego:	Main axes of the road system:
krajowa	national
wojewódzka	voivodeship
Wariant 1 - lokalizacja Lubiatowo - Kopalino	Variant 1 – Lubiatowo - Kopalino site
Wariant 2 - lokalizacja Żarnowiec	Variant 2 — Żarnowiec site
Granica gminy	Commune boundary
Administracyjny Obszar Lokalizacji Lubiatowo - Kopalino	Lubiatowo - Kopalino Administrative Site Area
Administracyjny Obszar Lokalizacji Żarnowiec	Żarnowiec Administrative Site Area
Administracyjny Region Lokalizacji Lubiatowo - Kopalino	Lubiatowo - Kopalino Administrative Site Region
Administracyjny Region Lokalizacji Żarnowiec	Żarnowiec Administrative Site Region

Figure VI.3.4.1- 2 main axes of the road system in ASA and ASR of both site variants. Variant 1 — Lubiatowo - Kopalino site and Variant 2— Żarnowiec site

Source: In-house studies on the basis of the Spatial Development Analysis — Current status for the purposes of the EIA Report in the Żarnowiec Site, part Va. INPLUS Energetyka Sp. z o.o., July 2021 and on the basis of the Spatial Development Analysis — Current status for the purposes of the EIA Report in the Żarnowiec Site, part I. INPLUS Energetyka Sp. z o.o., July 2021

The main axes of the road system of the Pomorskie Voivodeship [Figure VI.3.4.1- 2] inscribed in the boundaries of the Administrative Site Region of both variants run latitudinally – these are routes of national and international importance. The main axis is marked by the east-west national road no. 6 connecting the two most important centres of northern Poland: the Tri-City agglomeration and Szczecin, which ends at the state border, where the border crossing in Kołbaskowo is located. National road 6 is also part of the corridor of the EU's Trans-European Transport Networks (*TEN-T*). The remaining roads constituting the main axes of the transportation system of the Pomorskie Voivodeship are voivodeship roads of the main or collective design standard, connecting important centres in the settlement network of the voivodeship and strategic points in terms of functionality – tourist centres or airports.

Railway transport infrastructure



Główne miejscowości (siedziby urzędów gmin)	Main towns/cities (seats of commune offices)
Główne osie układu Kolejowego:	Main axes of the Railway system:
czynne	active
nieczynne	inactive
Wariant 1 - lokalizacja Lubiatowo - Kopalino	Variant 1 – Lubiatowo - Kopalino site
Wariant 2 - lokalizacja Żarnowiec	Variant 2 — Żarnowiec site
Granica gminy	Commune boundary
Administracyjny Obszar Lokalizacji Lubiatowo - Kopalino	Lubiatowo - Kopalino Administrative Site Area
Administracyjny Obszar Lokalizacji Żarnowiec	Żarnowiec Administrative Site Area
Administracyjny Region Lokalizacji Lubiatowo - Kopalino	Lubiatowo - Kopalino Administrative Site Region
Administracyjny Region Lokalizacji Żarnowiec	Żarnowiec Administrative Site Region

Figure VI.3.4.1- 3 main axes of the railroad system in ASA and ASR of both site variants. Variant 1 — Lubiatowo - Kopalino site and Variant 2— Żarnowiec site

Source: In-house studieson the basis of the Spatial Development Analysis — Current status for the purposes of the EIA Report in the Żarnowiec Site, part Va. INPLUS Energetyka Sp. z o.o., July 2021 and on the basis of the Spatial Development Analysis — Current status for the purposes of the EIA Report in the Żarnowiec Site, part I. INPLUS Energetyka Sp. z o.o., July 2021

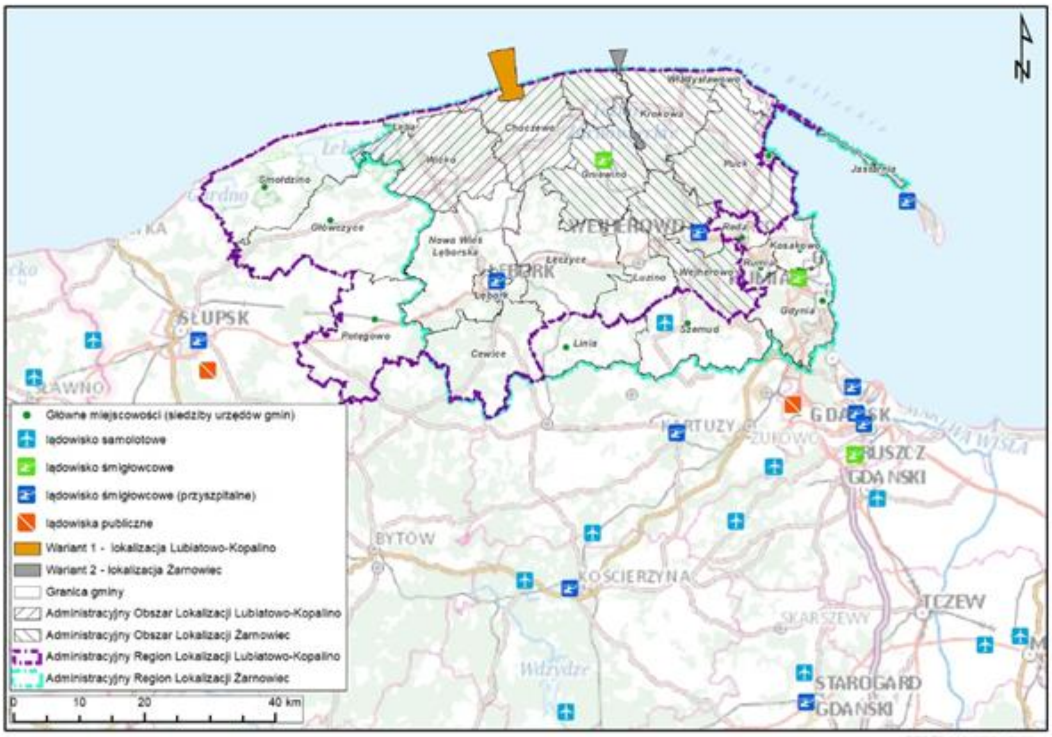
The main axis of the railway system of the Pomorskie Voivodeship [Figure VI.3.4.1- 3] inscribed in the boundaries of the Administrative Site Region of both variants runs in the east-west relation. The most important railway line is line no. 202 between Gdańsk Główny and Stargard – it is a route of national importance, which is part of the TEN-T corridor. It is an electrified line, on which passenger and freight traffic takes place. Two other important lines in the railway system of the Pomorskie Voivodeship are line no. 213 – running along the coastline, serving seasonally intensified tourist traffic and line no. 229 operating on the Lębork – Łeba section. The remaining railway lines are lines intended for freight traffic or are inactive lines. There are also remains of railway lines within the boundaries of the above-mentioned regions, which have been partially or completely dismantled.

Civil air transport infrastructure

In Variant 1 - Lubiatowo - Kopalino there are 2 airports and 24 airstrips within a radius of 100 km from the planned Project. The nearest civil airport is the airport of the Pomeranian Aeroclub in Krępa near Słupsk (60 km in a straight line from the planned investment). In the case of Variant 2 - Żarnowiec site within a radius of 100 km from the planned investment, 2 airports and 26 airstrips are located. The nearest civil airport is the Lech Wałęsa Airport in Gdańsk, 45 km in a straight line from the planned location.

There are 3 landing fields in Lubiatowo - Kopalino ASR, and 5 landing fields in Żarnowiec ASR. In both cases, there are no civil airports in this group, but only airstrips.

Civil air transport infrastructure in ASA and ASR of both site variants. Variant 1 — Lubiatowo - Kopalino site and Variant 2— Żarnowiec site is shown in the figure below [Figure VI.3.4.1- 4].



Główne miejscowości (siedziby urzędów gmin)	Main towns/cities (seats of municipal offices)
lądowisko samolotowe	airstrip
lądowisko śmigłowcowe	helipad
lądowisko śmigłowcowe (przyszpitalne)	helipad (hospital)
lądowiska publiczne	public airstrips
Wariant 1 - lokalizacja Lubiatowo - Kopalino	Variant 1 – Lubiatowo - Kopalino site
Wariant 2 - lokalizacja Żarnowiec	Variant 2 — Żarnowiec site
Granica gminy	Commune boundary
Administracyjny Obszar Lokalizacji Lubiatowo - Kopalino	Lubiatowo - Kopalino Administrative Site Area
Administracyjny Obszar Lokalizacji Żarnowiec	Żarnowiec Administrative Site Area
Administracyjny Region Lokalizacji Lubiatowo - Kopalino	Lubiatowo - Kopalino Administrative Site Region
Administracyjny Region Lokalizacji Żarnowiec	Żarnowiec Administrative Site Region

Figure VI.3.4.1- 4 Civil air transport infrastructure in ASA and ASR of both site variants. Variant 1 — Lubiatowo - Kopalino site and Variant 2— Żarnowiec site

Source: In-house studies on the basis of the Spatial Development Analysis — Current status for the purposes of the EIA Report in the Żarnowiec Site, part Va. INPLUS Energetyka Sp. z o.o., July 2021 and on the basis of the Spatial Development Analysis — Current status for the purposes of the EIA Report in the Żarnowiec Site, part I. INPLUS Energetyka Sp. z o.o., July 2021

Municipal infrastructure

The water and sewage infrastructure (including e.g. water supply networks, water intakes and treatment plants, sewage networks and sewage treatment plants)

Choczewo and Wicko located in Lubiatowo - Kopalino ASA have a similar length (about 77 km) and density of the water supply network (approximately 0.40 km/km^2). Within the boundaries of Lubiatowo - Kopalino ASA, 12 water treatment plants have been identified. The nearest surface water intake is about 4 km away (Ciekocino), and underground water about 1.5 km (Osetnik) from the potential location of the NPP.

The rural communes of Wejherowo, Krokowa, Gniewino and Puck located in Żarnowiec ASA have a longer water and sewage network than the average for Żarnowiec ASR. 31 water treatment plants have been identified within the boundaries of Żarnowiec ASA. The nearest surface water intake is about 2.5 km away (between Dębki and Odargów), and the underground water intake is about 0.5 km (Lubkowo) of the potential location of the NPP.

Municipal plants for waste treatment and landfills

There are 3 municipal waste treatment plants in Lubiatowo - Kopalino ASR entered on the official list kept by the Marshal of the Voivodeship, and 2 such plants in Żarnowiec ASR.

There are also 3 landfills in Lubiatowo - Kopalino ASR in the process of recultivation and 7 closed landfills. There are also 3 landfills in Żarnowiec ASR in the process of recultivation and 3 closed landfills.

There is an uncontrolled landfill of municipal and construction waste in the Choczewo commune within Zwartówko in Lubiatowo - Kopalino and Żarnowiec ASAs. In Żarnowiec ASA, another such landfill was identified in the commune of Szemud. No landfills for hazardous waste, landfills for inert waste and underground landfills were identified both in Lubiatowo - Kopalino and Żarnowiec ASA and ASR.

Gas and district heating networks

In Lubiatowo - Kopalino ASR, 12 out of 17 communes are provided with a gas network, and 4 communes with a heating network. In Żarnowiec ASR, 18 out of 22 communes are provided with a gas network, and 9 communes with a heating network.

Transmission and distribution grids

In Lubiatowo - Kopalino ASR, the largest number of power lines is located in the commune of Puck (327 km), while the least in the commune of Łeba (almost 13 km). The highest density of power grids occurs in the commune of Lębork (approximately 3 km per 1 km^2 of the commune's area), while the lowest in the commune of Smołdzino (0.4 km per 1 km^2 of the commune's area). In Lubiatowo - Kopalino ASA, the longest network of overhead power infrastructure is owned by the commune of Wicko (over 180 km).

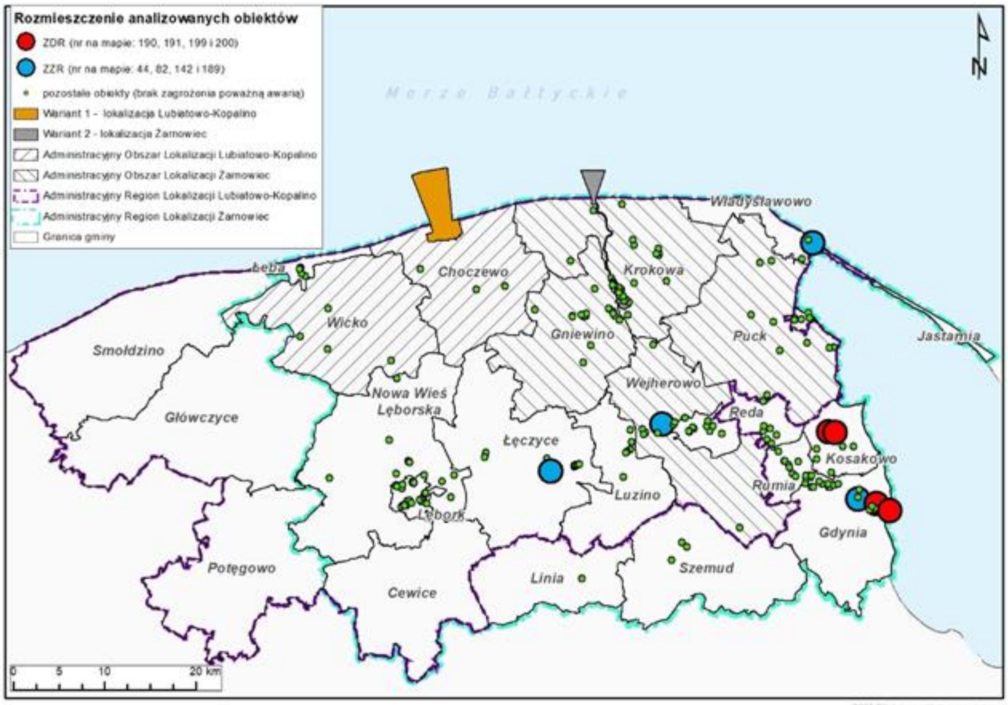
In Żarnowiec ASR, the largest number of power lines is located in the commune of Szemud (420 km), while the least in the commune of Łeba (almost 13 km). The highest density of power grids occurs in the commune of Rumia (4 km per 1 km^2 of the commune's area), while the lowest in the commune of Łeba (0.8 km per 1 km^2 of the commune's area). The longest network of overhead power infrastructure in Żarnowiec ASA is owned by the rural commune of Puck (over 320 km).

Industrial plants

For the purposes of the study facilities in the fuel-energy, electromechanical, mineral, chemical, light, food, electronic, metallurgical, wood, paper, printing, feed and shipbuilding sectors were identified [Figure VI.3.4.1-5].

In Lubiatowo - Kopalino ASR, 144 industrial facilities were found, including 3 plants with an increased risk of a major industrial accident (ZZR). In Lubiatowo - Kopalino ASA, 7 industrial facilities were identified and no plants with an increased risk of a serious industrial accident were found.

In Żarnowiec ASR, 202 industrial facilities were found, including 4 plants with high risk of a major industrial accident and 4 plants with an increased risk of a major industrial accident. In Żarnowiec ASA, 67 industrial facilities were identified, including one plant with an increased risk of a serious industrial accident (chemical raw materials warehouse).



Rozmieszczanie analizowanych obiektów	Distribution of analysed facilities
ZDR (nr na mapie 190.191 1991200)	ZDR – upper-tier establishment (number on the map 190.191 1991200)
ZZR (nr na mapie 44, 82, 142 1189)	ZZR – lower-tier establishment (number on map 44, 82, 142 1189)
pozostałe obiekty (brak zagrożenia poważną awarią)	other facilities (no threat of a severe industrial accident)
Wariant 1 lokalizacja Lubiatowo - Kopalino	Variant 1 Lubiatowo - Kopalino site
Wariant 2 - lokalizacja Żarnowiec	Variant 2 — Żarnowiec site
Administracyjny Obszar Lokalizacji Lubiatowo - Kopalino	Lubiatowo - Kopalino Administrative Site Area
Administracyjny Obszar Lokalizacji Żarnowiec	Żarnowiec Administrative Site Area
Administracyjny Region Lokalizacji Lubiatowo - Kopalino	Lubiatowo - Kopalino Administrative Site Region
Administracyjny Region Lokalizacji Żarnowiec	Żarnowiec Administrative Site Region
Granica gminy	Commune boundary

Figure VI.3.4.1- 5 Industrial plants with potential chemical, biological or mechanical impact in ASA and ASR of both site variants. Variant 1 — Lubiatowo - Kopalino site and Variant 2— Żarnowiec site

Source: In-house studies on the basis of the Spatial Development Analysis — Current status for the purposes of the EIA Report in the Żarnowiec Site, part Va. INPLUS Energetyka Sp. z o.o., July 2021 and on the basis of the Spatial Development Analysis — Current status for the purposes of the EIA Report in the Żarnowiec Site, part I. INPLUS Energetyka Sp. z o.o., July 2021

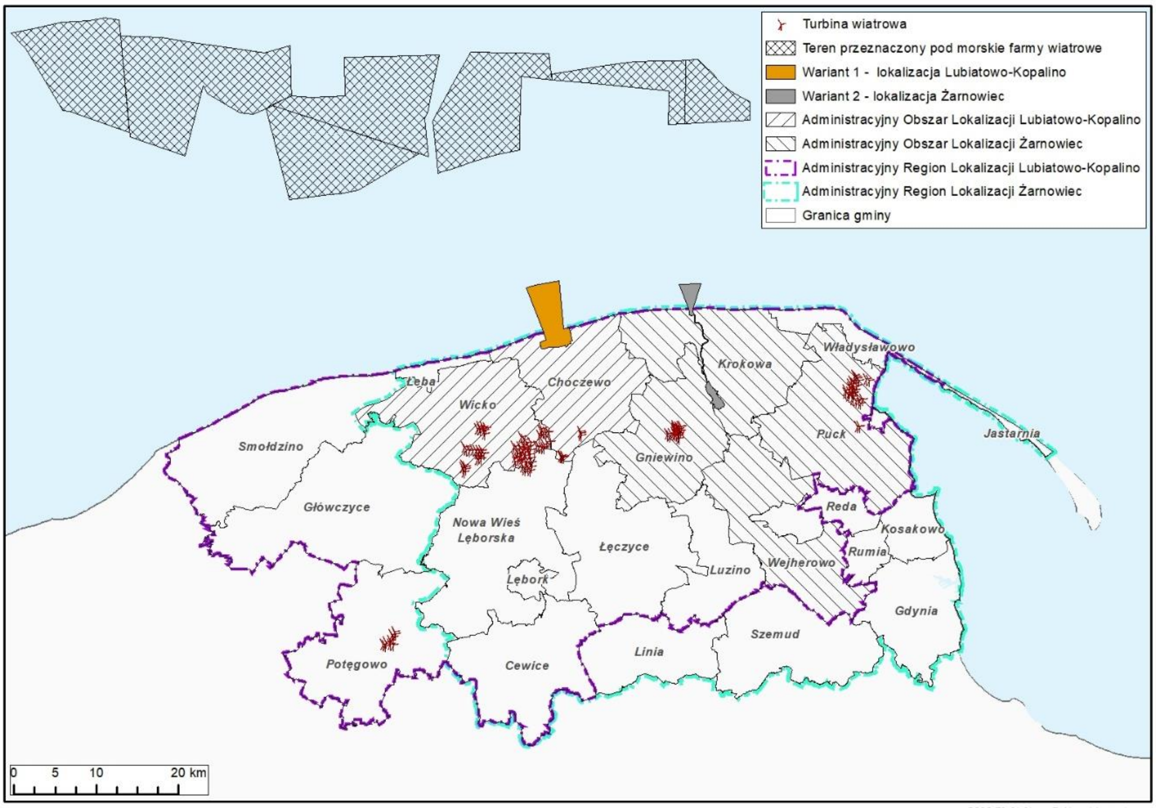
Wind farms

Using data from the Open Street Map resource and information from local development plans and a review of orthophotomaps, the presence of wind turbines in ASR was identified.

134 such facilities were located within the boundaries of Lubiatowo - Kopalino ASR, of which 76 were within the boundaries of the ASA. The wind farms closest to the planned NPP are in the vicinity of Strzeszewo, at a distance of about 10 km. There are no offshore wind farms in the maritime area within the boundaries of the Site Region. Nevertheless, projects related to their implementation are in the development phase and should be expected to be implemented in the 2nd half of the third decade of the 21st century.

126 facilities were identified within the boundaries of Żarnowiec ASR, of which 48 were within the boundaries of the ASA. The wind farms closest to the planned NPP are in the vicinity of Jęczewo at a distance of about 5 km. There are no offshore wind farms in the maritime area within the boundaries of the Site Region and no such are planned.

Farms in ASA, ASR and the Site Region for both site variants are shown in the figure below [Figure VI.3.4.1- 6].



Turbina wiatrowa	Wind turbine
Teren przeznaczony pod morskie farmy wiatrowe	Land intended for offshore wind farms
Wariant 1 - lokalizacja Lubiatowo - Kopalino	Variant 1 – Lubiatowo - Kopalino site
Wariant 2 - lokalizacja Żarnowiec	Variant 2 — Żarnowiec site
Administracyjny Obszar Lokalizacji Lubiatowo - Kopalino	Lubiatowo - Kopalino Administrative Site Area
Administracyjny Obszar Lokalizacji Żarnowiec	Żarnowiec Administrative Site Area
Administracyjny Region Lokalizacji Lubiatowo - Kopalino	Lubiatowo - Kopalino Administrative Site Region
Administracyjny Region Lokalizacji Żarnowiec	Żarnowiec Administrative Site Region
Granica gminy	Commune boundary

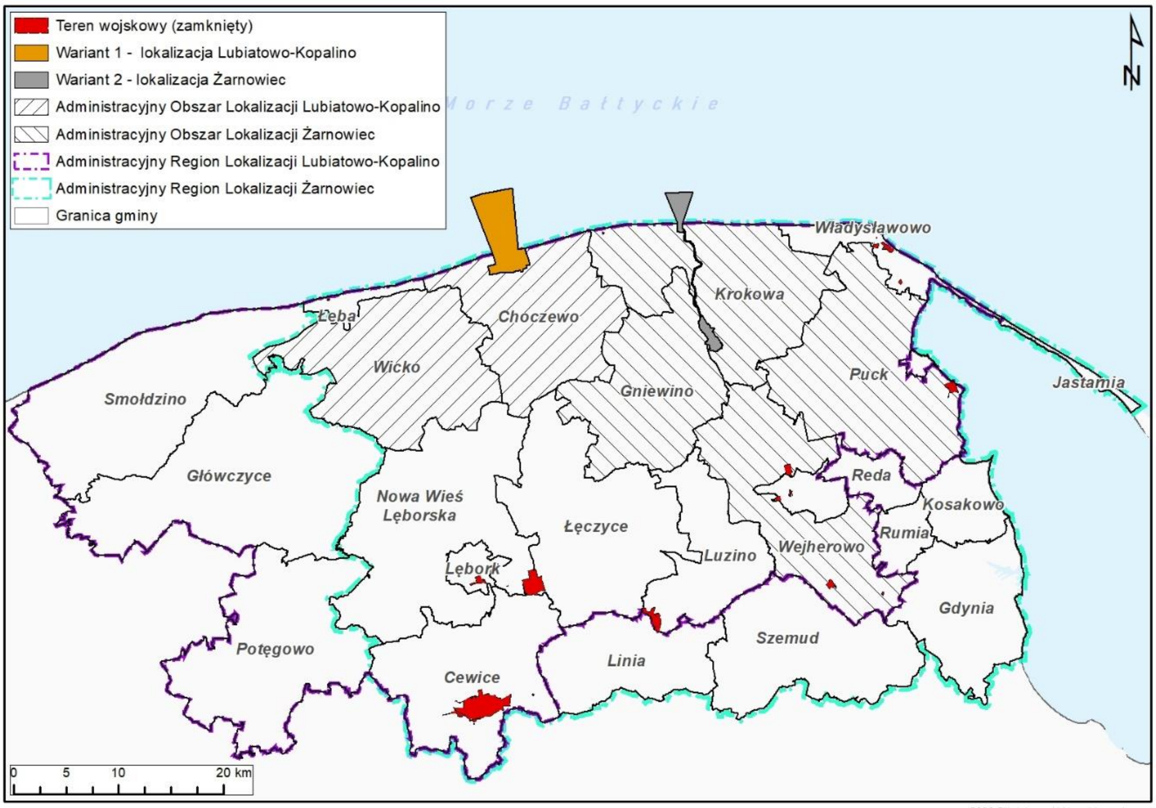
Figure VI.3.4.1- 6 Farms in ASA, ASR and the Site Region for both site variants. Variant 1 — Lubiatowo - Kopalino site and Variant 2— Żarnowiec site

Source: In-house studies on the basis of the Spatial Development Analysis — Current status for the purposes of the EIA Report in the Żarnowiec Site, part Va. INPLUS Energetyka Sp. z o.o., July 2021 and on the basis of the Spatial Development Analysis — Current status for the purposes of the EIA Report in the Żarnowiec Site, part I. INPLUS Energetyka Sp. z o.o., July 2021

Military facilities and military air transport infrastructure

Restricted military areas with a protected zone of the restricted area

Military facilities and military air transport infrastructure in ASA and ASR of both site variants are presented in the following figure [Figure VI.3.4.1- 7].



Teren wojskowy (zamknięty)	Military area (closed)
Wariant 1 - lokalizacja Lubiatowo - Kopalino	Variant 1 – Lubiatowo - Kopalino site
Wariant 2 - lokalizacja Żarnowiec	Variant 2 — Żarnowiec site
Administracyjny Obszar Lokalizacji Lubiatowo - Kopalino	Lubiatowo - Kopalino Administrative Site Area
Administracyjny Obszar Lokalizacji Żarnowiec	Żarnowiec Administrative Site Area
Administracyjny Region Lokalizacji Lubiatowo - Kopalino	Lubiatowo - Kopalino Administrative Site Region
Administracyjny Region Lokalizacji Żarnowiec	Żarnowiec Administrative Site Region
Granica gminy	Commune boundary

Figure VI.3.4.1- 7 Military facilities and military air transport infrastructure in ASA and ASR of both site variants. Variant 1 — Lubiatowo - Kopalino site and Variant 2— Żarnowiec site

Source: In-house studies on the basis of the Spatial Development Analysis — Current status for the purposes of the EIA Report in the Żarnowiec Site, part Va. INPLUS Energetyka Sp. z o.o., July 2021 and on the basis of the Spatial Development Analysis — Current status for the purposes of the EIA Report in the Żarnowiec Site, part I. INPLUS Energetyka Sp. z o.o., July 2021

The analysis of closed areas within the boundaries of the ASR was carried out on the basis of the list at Decision no. 68/MON of the Minister of National Defence of 21 May 2020 amending the decision on the determination of closed areas in the Ministry of National Defence.

Within the boundaries of Lubiatowo - Kopalino ASR, there are 22 military complexes, and no restricted areas occur in the ASA. The nearest military area closed to the planned NPP is the complex no. 4121 in the Krokowa commune, which is located at a distance of about 7 km (to the east).

Within the boundaries of Lubiatowo - Kopalino ASR, there are 50 military complexes, of which 7 in the ASA. The nearest military area closed to the planned NPP is complex no. 4121, which is located at a distance of about 6.5 km.

Military training grounds

In Lubiatowo - Kopalino and Żarnowiec ASR, 4 complexes of military training grounds have been identified, one of which is located in the complex of military restricted areas described above.

Ammunition depots

There are no military infrastructure facilities within a radius of 30 km of boundaries of the planned NPP, in which propellants or propellants and lubricants (other hazardous materials) are stored in quantities whose potential detonation would exceed 100 mbar.

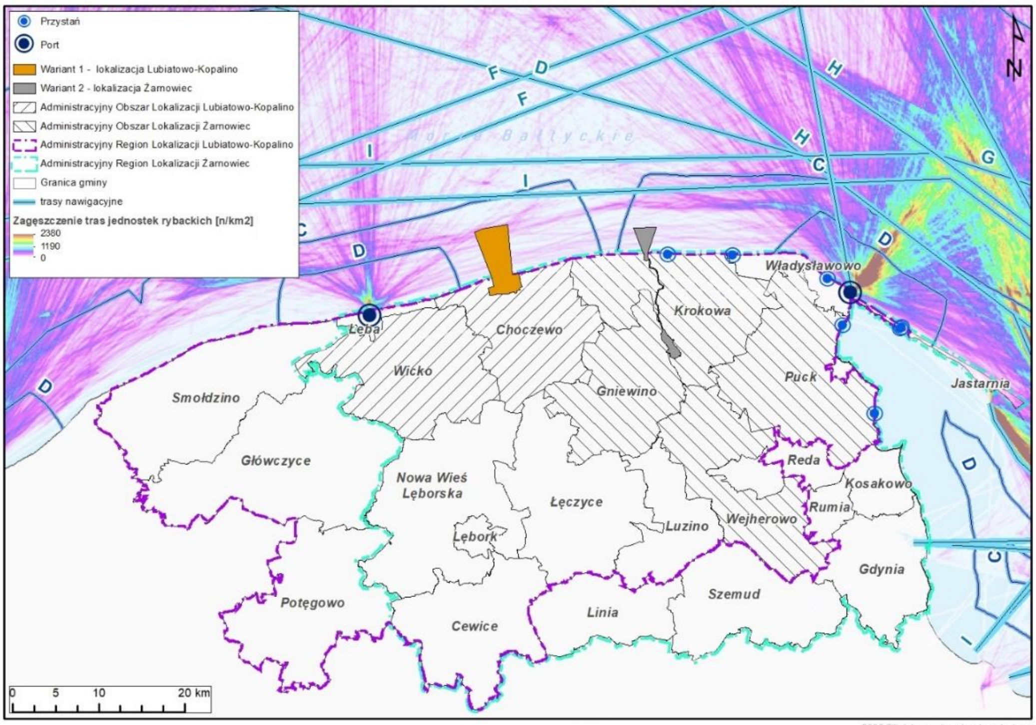
Military air transport infrastructure

In the field of military air transport infrastructure, the study covered military airports and airstrips listed in the register of the Minister of National Defence of 28 August 2019. There is only one facility within the boundaries of Lubiatowo - Kopalino ASR – the airport in Cewice, located about 41 km south of the potential location of the NPP. There are 5 facilities within the boundaries of Żarnowiec ASR. The nearest is the airport in Oksywie, about 31 km away from the planned NPP (in the south-east direction).

Maritime infrastructure

Maritime transport

Ports and harbours in ASA, ASR and density of fishing vessel routes in both site variants are presented in the following figure [Figure VI.3.4.1- 8].



Przystań	Harbour
Port	Port
Wariant 1 - lokalizacja Lubiatowo - Kopalino	Variant 1 – Lubiatowo - Kopalino site
Wariant 2 - lokalizacja Żarnowiec	Variant 2 — Żarnowiec site
Administracyjny Obszar Lokalizacji Lubiatowo - Kopalino	Lubiatowo - Kopalino Administrative Site Area
Administracyjny Obszar Lokalizacji Żarnowiec	Żarnowiec Administrative Site Area
Administracyjny Region Lokalizacji Lubiatowo - Kopalino	Lubiatowo - Kopalino Administrative Site Region
Administracyjny Region Lokalizacji Żarnowiec	Żarnowiec Administrative Site Region
Granica gminy	Commune boundary
trasy nawigacyjne	navigation routes
Zagęszczenie tras jednostek rybackich [n/km2]	Density of routes of fishing vessels [n/km^2]

Figure VI.3.4.1- 8 Ports and harbours in ASA, ASR and density of fishing vessel routes in both site variants. Variant 1 — Lubiatowo - Kopalino site and Variant 2— Żarnowiec site

Source: In-house studies on the basis of the Spatial Development Analysis — Current status for the purposes of the EIA Report in the Żarnowiec Site, part Va. INPLUS Energetyka Sp. z o.o., July 2021 and on the basis of the Spatial Development Analysis — Current status for the purposes of the EIA Report in the Żarnowiec Site, part I. INPLUS Energetyka Sp. z o.o., July 2021

In areas of crossing or convergence of the routes on which ships navigate, the volume of traffic is regulated in accordance with the provisions of the International Maritime Organisation in London (IMO).https://en.wikipedia.org/wiki/International_Maritime_Organization In agreement with the IMO, local maritime administration offices (Maritime Offices in Poland) establish Traffic Separation Systems (TSS), zones subject to special technical supervision (Vessel Traffic Service, VTS). There is a fragment of the TSS Route, the so-called TSS Słupska Bank East) in the western part of the maritime Site Region of the Lubiatowo - Kopalino site. In the case of the Żarnowiec Site Region, no such routes were found.

The Site Region of Lubiatowo - Kopalino and Żarnowiec includes the following navigation routes: the main route "I" and the usual routes "D", "F" and in the case of the Żarnowiec site also the "H" route. In addition to the above-mentioned routes, the maritime site region includes passenger shipping routes and routes of fishing vessels.

Ports and marinas

9 such facilities have been identified in Lubiatowo - Kopalino ASR, including 2 ports in Władysławowo (the main Polish fishing port, which handles bulk cargo, and contains a shipyard producing fishing vessels) and in Łeba (the port has mainly fishing and tourist functions).

26 such facilities have been identified in Żarnowiec ASR, including 9 ports: Gdynia (a universal modern port specialising in handling general cargo, mainly cargo transported in containers), Władysławowo, Puck (fishing and tourist port), Łeba, Jastarnia (fishing and tourist port), Gdynia (war port).

Water equipment

The following objects are located along the sea borders of Lubiatowo - Kopalino and Żarnowiec ASRs: hydrotechnical structures (retaining wall, breakwater, wharf, pier, groin, seawall, causeway, storm embankment, slip) navigation aids, piers, jetties. All of them are located at a distance of more than 10 km from each of the site variants. Only in the Choczewo commune (Variant 1 – Lubiatowo - Kopalino site) there are two navigational aids at a distance of about 1.5 km from the Project.

Technical infrastructure

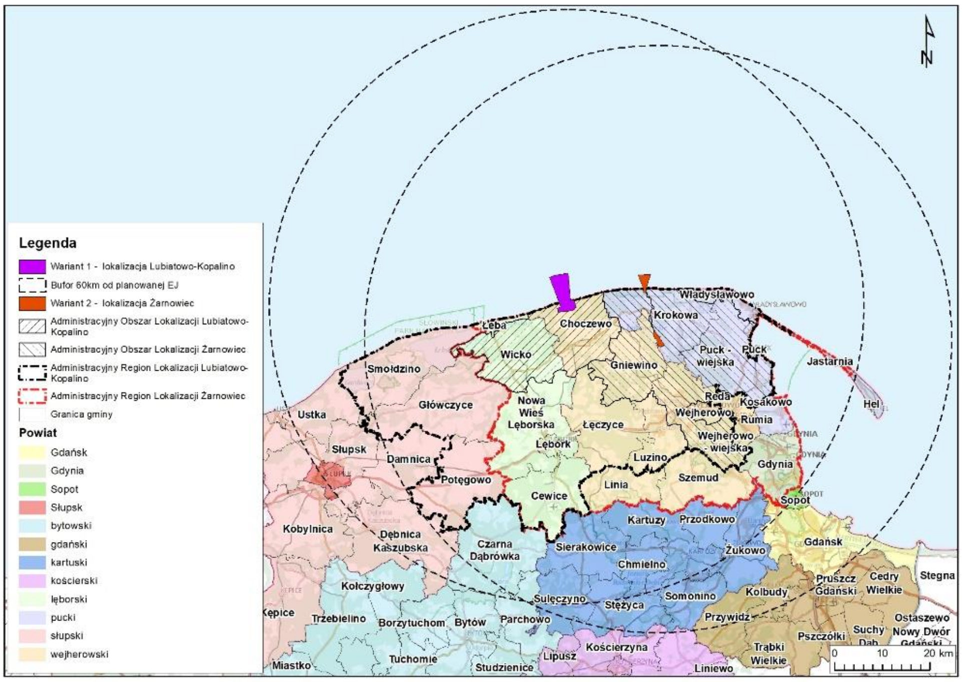
Within the boundaries of Lubiatowo - Kopalino and Żarnowiec ASR, the nearest facility of maritime technical infrastructure for which a location permit has been issued is the corridor of the submarine power cable from the area of offshore wind farms. It is located about 0.7 km from the planned NPP in the Lubiatowo - Kopalino site and about 13 km from the planned NPP in the Żarnowiec site.

VI.3.4.2 Social and economic conditions

Area of analyses

The implementation of NPP is being considered for two site variants, the so-called Variant 1 – Lubiatowo - Kopalino site in the Choczewo commune and Variant 2 – Żarnowiec site in the rural communes of Krokowa and Gniewino.

Therefore, for the purposes of analysis of socio-economic conditions, data on the Pomorskie Voivodeship and districts and communes located in the Administrative Site Region and in the Administrative Site Area were used, and in some cases also those located at a distance of 30 km to 60 km from the planned location of the NPP, if it was considered necessary for a comprehensive presentation of the issue. This issue is addressed individually in the description of each aspect. Some of the issues have also been illustrated from the level of national data, which mainly serves as a reference for analyses.



Legenda	Legend
Wariant 1 - lokalizacja Lubiatowo - Kopalino	Variant 1 – Lubiatowo - Kopalino site
Bufor 60km od planowane, EJ	Buffer of 60 km from the planned NPP
Wariant 2 - lokalizacja Żarnowiec	Variant 2 — Żarnowiec site
Administracyjny Obszar lokalizacji Żarnowiec	Żarnowiec Administrative Site Area
Administracyjny Region Lokalizacji Lubiatowo - Kopalino	Lubiatowo - Kopalino Administrative Site Region
Administracyjny Region Lokalizacji Żarnowiec	Żarnowiec Administrative Site Region
Granica gminy	Commune boundary
Powiat	Poviat
Gdańsk	Gdańsk
Gdynia	Gdynia
Sopot	Sopot
Stupsk	Słupsk
bytowski	Bytów
gdański	Gdańsk
kartuski	Kartuzy
kościerski	Kościerzyna
lęborski	Lębork
pucki	Puck
słupski	Słupsk
wejherowski	Wejherowo

Figure VI.3.4.2- 1 Areas of analysis designated for social and economic determinants for both site variants

Source: In-house studies based on the Analysis of social and economic conditions and impact. Jacobs Clean Energy Limited, 2021

In the figure above [Figure VI.3.4.2- 1] it can be noted that part of the territorial area of both site variants for the Administrative Site Regions (up to 30 km from the NPP) is common, i.e. 14 municipalities with a total number of inhabitants (approximately 326,600) is located within the limits of the analysis of both site variants. In addition to Variant 1 – Lubiatowo - Kopalino site, there are 7 communes (over 130,700 inhabitants) and the city of Gdynia (approximately 246,300). There are 3 communes with a total population of 19,200 inhabitants outside Variant 2 – Żarnowiec site.

The territorial range of the analysed area in Variant 1 – Lubiatowo - Kopalino site includes communes of 4 country districts of the Pomorskie Voivodeship: Puck, Wejherowo, Lębork and Słupsk poviats, of which 17 communes located within a radius of 30 km from the NPP site (13 communes are rural communes, 1 rural-urban commune and 3 urban communes). Two communes are located in the ASA, i.e. the rural commune of Choczewo

(Wejherowo district), in which the implementation of the Project is planned, and the rural commune of Wicko (Lębork district), part of which is located at a distance of approximately 5 km from the planned Investment. The remaining 15 communes are located within a radius of 5 to approximately 30 km from the planned Project. The territorial range of the analysed area in Variant 2 – Żarnowiec site includes communes located in 3 country poviats of the Pomorskie Voivodeship: in Puck, Wejherowo, Lębork poviats and the city with poviat rights - Gdynia. Four communes are located in the ASA, i.e. the rural commune of Krokowa (Puck poviat) and the rural commune of Gniewino (Wejherowo poviat) in which the implementation of the Project is planned, as well as the rural commune of Wejherowo (Wejherowo poviat) and the rural commune of Puck (Puck poviat), part of whose area is located at a distance of up to approximately 5 km from the planned Project. The remaining 18 communes are located within a radius of 5 to approximately 30 km from the planned Project.

The analyses were carried out in 2020, therefore data and trend analyses were collected for the period covering primarily the years 2010-2019 (or 2010-2018 in the case when data for 2019 were not available). It was considered that the adopted time range is sufficient to assess the state of the analysed conditions for the needs of EIA due to the fact that the socio-economic situation in Poland in this time frame was relatively homogeneous and stable (2009 was the year of slowdown in economic development of Poland resulting from the global crisis). In some respects reference was made to 2018 due to the availability of data (due to the period of the Covid 19 pandemic, some data were available later than usual).

Historical and cultural outline

The area covered by the analyses, currently located in the northern and central part of Pomorskie Voivodeship, belonged in the past to various state authorities and was subjected to the influence of various political, cultural, economic and civilisational centres (German, Polish, periodically also Danish, Swedish, Russian). This area was located for hundreds of years on the border of two parts of Pomerania (eastern and western) and state authorities, within which they functioned. Lubiatowo - Kopalino, the area for the planned implementation of the NPP in Variant 1, is located within the boundaries of the Lębork poviat, which until 1939 was located in the territory of the German state, while the area of the planned implementation of the NPP in Variant 2, Żarnowiec, is located within the boundaries of the Wejherowo poviat, which before 1939 was located in Poland. The distance between them is barely 20 km, but both the past and the recent history of these places was different, which also results in a completely different structure of the population living in the analysed area today.

The contemporary national structure in the Pomorskie Voivodeship can be inferred on the basis of the 2011 census. Kartuzy, Puck or Wejherowo poviats have the highest share of declarations other than Polish both in absolute numbers and in per cents. The cultural specificity of the Pomorskie Voivodeship is determined primarily by the Kashubian population. The most commonly spoken language in Pomorskie Voivodeship other than Polish is Kashubian. According to the 2011 census, a total of over 232,000 people declared Kashubian ethnic identification on a national scale, and 108,000 people declared the use of the Kashubian language. The list of the Statistical Office in Poland (GUS) shows that the core of Kashubian is primarily the Kartuzy poviat (47,000 Kashubian speakers), Wejherowo (over 14,000) and Puck (over 12,000), as well as partly Bytów (over 5,000) and Kościerzyna (over 2,000).

Demographic structure

In 2019, the Pomorskie Voivodeship was inhabited by 2,343,928 people, of which 51% were women and 49% men. In terms of population, the Pomorskie Voivodeship places seventh in the country. In the period 2015-2019, there was a slight increase in the number of births (from 24,500 to 26,400, i.e. by 7.3% compared to the national average of 1.5%). The largest increase took place in the years 2015-2017 (11.7% - voivodeship; 8.8% - Poland). According to the study "*Demographic situation of the Pomorskie Voivodeship in 2019*", the median age of the population of the Pomorskie Voivodeship was 40 years in 2019. This is primarily due to the high birth rate compared to the national average.

Population of Pomorskie Voivodeship by biological age groups and median age in 2019 is presented in the following table [Table VI.3.4.2- 1].

Table VI.3.4.2- 1 Population of Pomorskie Voivodeship by biological age groups and median age in 2019

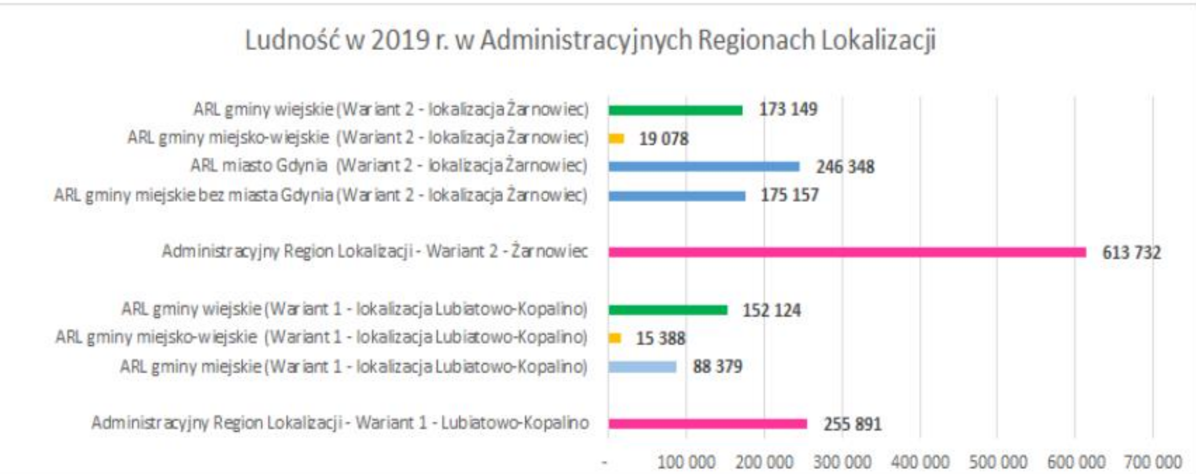
Specification	Total	Towns	Village	Men	Women
In absolute numbers					
Total	2,343,928	1,488,127	855,801	1,141,225	1,202,703
0-14 years	394,205	228,795	165,410	202,630	191,575
15-64 years	1,553,247	966,616	586,631	775,741	777,506
65 years and more	396,476	292,716	103,760	162,854	233,622
including 85 years and older	43,718	33,389	10,329	12,884	30,874
in %					
Total	100.0	100.0	100.0	100.0	100.0
0-14 years	16.8	15.4	19.3	17.8	15.9
15-64 years	66.3	65.0	68.5	68.0	64.6
65 years and more	16.9	19.7	12.1	14.3	19.4
including 85 years and older	1.9	2.2	1.2	1.1	2.6
Median age					
Total	40.0	41.8	36.7	38.7	41.3

Source: In-house studies based on the Analysis of social and economic conditions and impact. Jacobs Clean Energy Limited, 2021, and Bank of Local Data of Statistics Poland (BDL GUS), http://bdl.stat.gov.pl/BDL/start and the Demographic Situation of the Pomorskie Voivodeship in 2019. Statistical Office in Gdańsk, 2020

Data from Statistics Poland should be treated only as approximate, because they do not include people who live in a given commune, but are not registered in it. Lack of registration is a common phenomenon, especially in large cities, resulting in a higher number of actual residents. On the other hand, the data from Statistics Poland does not include people who are still registered in the communes, but do not live in them. For this reason, the actual number of inhabitants in some communes may turn out to be lower.

In the Pomorskie Voivodeship, a minimal, systematic increase in the ruralisation rate is observed. Rural communes located near large cities are gaining. Taking into account the age of migrants, people between 25 and 39 years of age were the most likely to move. In 2019, nearly 800 cases of de-registering abroad were recorded in the Pomorskie Voivodeship, mainly to Germany and the United Kingdom. Among the people who went abroad, most were previously registered in Gdańsk – nearly every fourth of them.

The number of inhabitants of the Administrative Site Region in Variant 1 – Lubiatowo - Kopalino, is about 11% of all inhabitants of the Pomorskie Voivodeship (255,900), and in Variant 2 – Żarnowiec site, it is about 26% (about 613,700 together with the city of Gdynia), without the city of Gdynia – about 16% (367,300) [Figure VI.3.4.2- 2].



Ludność w 2019 r. w Administracyjnych Regionach Lokalizacji	Population in 2019 in Administrative Site Regions
ARL gminy wiejskie (Wariant 2 - lokalizacja Żarnowiec)	ASR rural communes (Variant 2 - Żarnowiec site)
ARL gminy miejsko-wiejskie (Wariant 2 - lokalizacja Żarnowiec)	ASR urban-rural communess (Variant 2 – Żarnowiec site)
ARL miasto Gdynia (Wariant 2 - lokalizacja Żarnowiec)	ASR city of Gdynia (Variant 2 – Żarnowiec site)

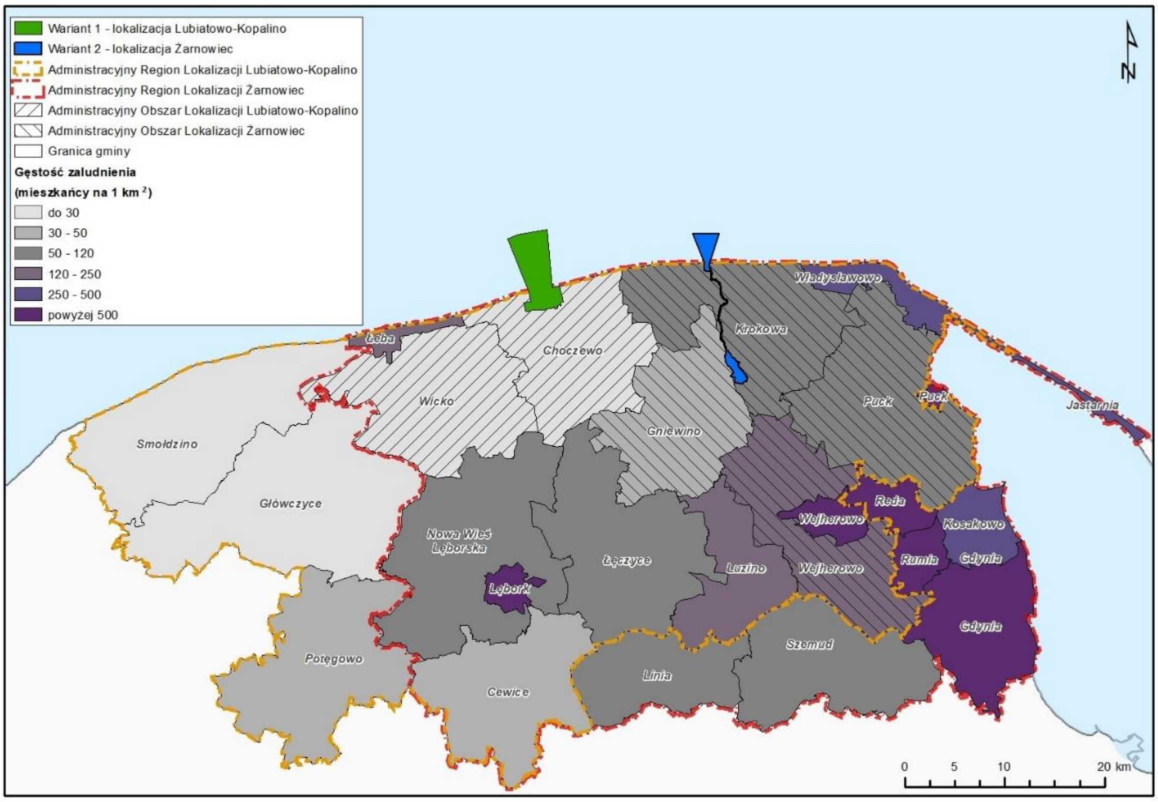
ARL gminy miejskie bez miasta Gdynia (Wariant 2 - lokalizacja Żarnowiec)	ASR urban communes without the city of Gdynia (Variant 2 – Żarnowiec site)
Administracyjny Region Lokalizacji- Wariant 2 -Żarnowiec	Administrative Site Region – Variant 2 – Żarnowiec site
ARL gminy wiejskie (Wariant 1 - lokalizacja Lubiatowo - Kopalino)	ASR rural communes (Variant 1 - Lubiatowo - Kopalino site)
ARL gminy miejsko-wiejskie (Wariant 1 - lokalizacja Lubiatowo - Kopalino)	ASR urban-rural communes (Variant 1 - Lubiatowo - Kopalino site)
ARL gminy miejskie (Wariant 1 - lokalizacja Lubiatowo - Kopalino)	ASL urban communes (Variant 1 - Lubiatowo - Kopalino site)
Administracyjny Region Lokalizacji - Wariant 1 - Lubiatowo - Kopalino)	Administrative Site Region – Variant 1 - Lubiatowo - Kopalino site

Figure VI.3.4.2- 2 Population in 2019 in Administrative Site Regions – for both site variants

Source: In-house study

In 2019, the Administrative Site Area for Variant 1 was inhabited by 11,500 people, including about 5,500 in the commune of Choczewo, while in Variant 2 the number of inhabitants according to Statistics Poland was much higher, i.e. about 71,500 inhabitants, of which 18,300 in the commune of Krokowa and the commune of Gniewino.

Population density in ASR and ASA in both site variants is presented in the figure below [Figure VI.3.4.2- 3].



Wariant 1 - lokalizacja Lubiatowo - Kopalino	Variant 1 – Lubiatowo - Kopalino site
Wariant 2 - lokalizacja Żarnowiec	Variant 2 — Żarnowiec site
Administracyjny Region Lokalizacji Lubiatowo - Kopalino	Lubiatowo - Kopalino Administrative Site Region
Administracyjny Region Lokalizacji Żarnowiec	Żarnowiec Administrative Site Region
Administracyjny Obszar Lokalizacji Lubiatowo - Kopalino	Lubiatowo - Kopalino Administrative Site Area
Administracyjny Obszar Lokalizacji Żarnowiec	Żarnowiec Administrative Site Area
Granica gminy	Commune boundary
Gęstość zaludnienia (mieszkańcy na 1 km2)	Population density (inhabitants per 1 km^2)
powyżej 500	above 500

Figure VI.3.4.2- 3 Population density in ASR and ASA. Variant 2 — Żarnowiec site

Source: In-house studies based on the Analysis of social and economic conditions and impact. Jacobs Clean Energy Limited, 2021, and Bank of Local Data of Statistics Poland (BDL GUS), http://bdl.stat.gov.pl/BDL/start

Administrative Site Areas and Regions in both site variants are characterised by different population density. The population density in the Choczewo commune is about 30 people/km^2, while in the Krokowa commune – about 50 people/km^2, and in the Gniewino commune – 42 people/km^2. The average population density in the Administrative Site Region in Variant 1 is much lower than in Variant 2, i.e. 87 people/km^2 compared to 228 people/km^2, which indicates a much smaller number of cities and towns in the area. In Variant 2 – Żarnowiec site, high population density is characterised primarily by the cities of Puck, Wejherowo, Lębork, Rumia and Gdynia.

The structure of the population against the background of the Pomorskie Voivodeship according to economic groups is favourable. The share of the working-age population in both site variants was over 60% in the Administrative Site Regions.

The vast majority of net migration is shaped by internal traffic (over 90% of the total number of registrations and de-registrations). The highest net migration was characterised by the Wejherowo and Puck poviats (about 1,100 and 800 people, respectively), and the Lębork poviat was the only one to record negative net migration (about 200 people migrated). Taking into account the site communes of the NPP, a negative net migration was observed in each of them in 2019: in the Choczewo commune, the population decreased by 22 people, in the Krokowa commune by 29 people, and in the Gniewino commune by 18 people.

Structure of the economy

The basis for the economic growth of the Pomorskie Voivodeship are strong urban centres concentrating human capital. According to data from Statistics Poland, there were over 307,000 entities of the national economy in 2019, operating in the Voivodeship, of which over 40% were located in the Tri-City. The Voivodeship is one of the top five most attractive areas in Poland in terms of foreign investments. According to data from Statistics Poland, in its area there were over 1,300 out of nearly 28,000 entities with foreign capital registered in Poland. The largest percentage of them was located in the Tri-City (903 entities). By analysing the index of entities entered in the register for 1,000 people, the highest values of the index were obtained by the following communes: Łeba (355), Jastarnia (309) and Władysławowo (260), which is related to the development of the tourism services sector in this area. This indicator in the Administrative Site Area for Variant 1 amounted to: in Choczewo commune – 100, in Wicko commune – 121, and for Variant 2: in Krokowa commune – 107, in Gniewino commune – 78, and in rural communes of Puck and Wejherowo the indicator was at the level of 93 and 120, respectively. For comparison, the indicators for the Pomorskie Voivodeship were 131 entities for the voivodeship and 117 entities per 1,000 people for Poland.

There were also 38 foreign entities operating in the Wejherowo poviat, and their capital reached the value of 179.5 million, which translates into PLN 1,400 thousand per 1 inhabitant of working age. The total number of enterprises in the years 2010-2019 increased, and the largest increase was recorded in the Wejherowo and Puck poviats. The exception was the Lębork poviat, where the number of entities has not changed.

Services market

By analysing the professional activity of the population by sector (data available only at the level of the Pomorskie Voivodeship), it should be stated that the most active people work in the service sector (649,000 in 2019). Significantly lower figures were recorded in the industrial sector (321,000), and the lowest in agriculture (59,000). The largest increase in employment in the years 2010-2019 was recorded in the service and industrial sectors - 156,000 people employed in services and 66,000 in industry. The situation is different for agriculture – after an increase in 2011, the level of activity in 2019 returned to its initial situation in 2010.

Labour market

In the Pomorskie Voivodeship in the years 2010-2019, an increase in employment was recorded in all analysed groups of the Polish Classification of Activity, with the most dynamic increase in the case of the group including trade, repair of motor vehicles, transport and warehouse management, accommodation and catering, information and communication (increase by 28%) and the group including other services (increase by 24%). In

2019, the number of business entities in Pomorskie Voivodeship per 10,000 inhabitants was higher than in Poland in general (2,200 vs. 1,900). The development of potential was facilitated by a high share of innovative enterprises in the service sector and a high degree of entrepreneurship. In 2019, nearly 587,000 people worked in the Pomorskie Voivodeship, of which a slightly larger percentage were women.

In 2019, a record low level of unemployment in the voivodeship was achieved (4.5%), which is a positive phenomenon, while it should be remembered that the labour market is still struggling with a growing staff deficit in some industries. The unemployment rate recorded in 2019 is close to natural unemployment, i.e. one in which the labour market remains in a state of equilibrium.

In the area up to approximately 60 km from the NPP location, the lowest level of unemployment occurred in the Tri-City and poviats directly adjacent to it (Kartuzy – 4% and Wejherowo – 7.1%). In turn, a slightly higher one characterised poviats located further away (the exception is the Puck poviat – despite the nearby location in relation to the Tri-City, high unemployment is recorded in its area). A positive trend of decreasing the disproportion of the unemployment level between individual poviats of the analysed area (up to approximately 60 km from the NPP site) was also observed.

By analysing the site variants, in the ASR in Variant 1 – Lubiatowo - Kopalino, the number of working people in 2019 was about 42,000, of which 915 working people were in the ASA, including 460 people in the Choczewo commune. It should be noted, however, that the Choczewo commune is characterised by an increasing number of working people, while in the commune of Wicko the number of working people has decreased by more than 43% since 2010.

In the ASR in Variant 2 – Żarnowiec site, the number of working people is also higher due to the much larger population and amounted to over 133,000, of which 13,200 people were working in the Administrative Site Area.

The highest rate of employment per 1,000 people was recorded in the case of the Krokowa commune (225), and the lowest – the Puck commune (159). In the analysed poviats there was an increase in the rate of employed per 1,000 people compared to 2010, with the provision that these data do not include all employees.

Material status of the population

The average monthly gross salary in 2019 in the Pomorskie Voivodeship was at the level of PLN 5,140 and was close to the national average (PLN 5,180). By analysing the average gross salary of the inhabitants of the Pomorskie Voivodeship due to the section of the Polish Classification of Activity, it should be pointed out that the largest remuneration can be offered to employees employed in the information and communication section (PLN 8,600) and the financial and insurance activity section (PLN 7,000). Earnings above average were also observed e.g. in the professional, scientific and technical activity section (PLN 5,700) and the public administration and national defence and mandatory social security section (PLN 5,900). On the other hand, the lowest salaries were recorded in activities related to accommodation and catering services (PLN 3,100), followed by administration and support activities (PLN 3,500). The salary was also much lower than the average in the case of people employed in other service activities (PLN 3,600) and in construction (PLN 3,900). In the case of the remaining sections, earnings were between PLN 4,200 in the section covering wholesale and retail trade, repair of motor vehicles, including motorcycles, and PLN 4,900 in agriculture, forestry, hunting and fishing. The amount of the average monthly salary in individual sections in the Pomorskie Voivodeship is generally consistent with the national trend.

Level and scope of social security

Transfers of funds through the commune budget under the "500+ Programme" have meant that social care is usually the second position in communes (after education) in terms of the amount of expenditure. Social assistance per capita in the area of the Administrative Site Area for Variant 1 – Lubiatowo - Kopalino site, decreased from PLN 984 in 2015 to PLN 445, and Variant 2 - Żarnowiec site, from PLN 585 in 2015 to PLN 199, which is in line with the general trend observed in the Pomorskie Voivodeship (decrease from PLN 609 to PLN 305). It should be pointed out that in 2019, in the case of both site variants, expenditure on social assistance per capita in the above-mentioned area was lower than the average for the voivodeship, while at the same time expenses in the family section were higher. The large scale of the reduction in this category of expenditure is particularly noticeable in rural communes. It should be assumed that this reduction is related to significant financial transfers under the 500+ social programme and other aid programmes.

Housing conditions

The data on the housing stock includes the public number of dwellings in communes (including newly commissioned dwellings), as well as the number of rooms and floor space in these dwellings located in residential and non-residential buildings. On the basis of the balance sheet of the housing stock in [Table VI.3.4.2- 2], the housing resources in both analysed site variants are presented, with particular emphasis on communes located up to 5 km from the location of the NPP.

Table VI.3.4.2- 2 Housing resources in both site variants in the years 2010–2019

No.	Area	Average floor space of a flat [m²]		Average floor space of a flat per 1 person		Flats per 1,000 inhabitants		Average number of people per 1 flat		Average number of people per 1 room	
		2010	**2019**	**2010**	**2019**	**2010**	**2019**	**2010**	**2019**	**2010**	**2019**
	Variant 1 — Lubiatowo - Kopalino site										
1.	Wicko (w)	84	88	24	27	286	309	3.50	3.24	0.82	0.75
2.	Choczewo (w)	77	80	22	26	289	325	3.46	3.08	0.86	0.75
3.	**ASA**	**81**	**84**	**23**	**27**	**287**	**316**	**3.48**	**3.16**	**0.84**	**0.75**
4.	**ASR**	**87**	**90**	**25**	**28**	**303**	**323**	**3.56**	**3.30**	**0.83**	**0.76**
	Variant 2 — Żarnowiec site										
5.	Krokowa (w)	102	103	26	31	255	300	3.92	3.33	0.80	0.67
6.	Puck (w)	106	113	26	29	242	255	4.14	3.93	0.86	0.79
7.	Gniewino (w)	75	78	18	20	242	255	4.14	3.92	1.06	0.99
8.	Wejherowo (w)	105	104	26	28	246	267	4.06	3.74	0.87	0.82
9.	**ASA**	**97**	**99**	**24**	**27**	**245**	**266**	**4.07**	**3.73**	**0.90**	**0.82**
10	**ASR**	**89**	**91**	**27**	**30**	**360**	**390**	**3.39**	**3.14**	**0.78**	**0.73**
11	**Pomorskie Voivodeship**										
12	Pomorskie Voivodeship	**71**	**72**	**24**	**28**	**343**	**383**	**2.91**	**2.61**	**0.77**	**0.69**

Source: In-house studies based on the Analysis of social and economic conditions and impact. Jacobs Clean Energy Limited, 2021, and Bank of Local Data of Statistics Poland (BDL GUS), http://bdl.stat.gov.pl/BDL/start

27 m^2 of living space falls on average per statistical inhabitant of the Administrative Site Areas of both site variants, and in the Administrative Site Regions this value is a bit higher, i.e. 28-30 m^2. The largest available floor space of flats was recorded in the commune of Władysławowo – 5-6 m^2 and the commune of Łeba – 52.4 m^2. This may be due to the fact that the owners of the flats offer rooms for rent to tourists. The smallest floor space of flats was recorded in the commune of Gniewino with 19.9 m^2 per inhabitant and in the commune of Główczyce with 20.8 m^2 per person. The largest increase in the number of premises put into use was recorded in the Puck poviat with the number of approximately 14 flats per 1,000 inhabitants (this is undoubtedly related to the development of tourism) and in the Wejherowo poviat with the number of 6 flats per 1,000 people (the effect of strong urban and rural development in the area of the suburban Tri-City metropolis). The lowest growth is observed in the Lębork poviat with an average of 4.6 flats per 1,000 inhabitants. Analyses of the standard, technical condition and equipment in key utilities show that there are differences both between the city and the countryside, between individual districts, as well as between individual elements of equipment.

Crime

The number of crimes in the Pomorskie Voivodeship per 1,000 inhabitants decreased from 28.7 in 2013 to 20.7 crimes in 2019. The value of this indicator higher than the average for Pomerania, was characterised only by cities forming the core of the Gdańsk-Gdynia-Sopot Metropolitan Area. In country poviats, values lower than the average for the Pomorskie Voivodeship were recorded. The lowest values were recorded in the Słupsk (15.4) and Wejherowo (15.1) poviats.

Finances of local governments

In 2010, the sum of budget revenues of municipalities in the Administrative Site Area of Variant 1 – Lubiatowo - Kopalino, amounted to PLN 39 million and increased by 67% to PLN 65 million in 2019, which accounted for approximately 0.4% of budget revenues of all urban communes of the Pomorskie Voivodeship in 2019. In the Choczewo commune, property tax accounted for 14% of total budget revenues, and in the Wicko commune it amounted to 18% (in 2019).

In 2010, the sum of budget revenues of communes of the Administrative Site Area of Variant 2 – Żarnowiec site, amounted to PLN 215 million, and over time increased by 100% to PLN 433.5 million in 2019. Gniewino Commune has the strongest tax base, which is reflected in high budget revenues per 1 inhabitant, of which 51% are own revenues (local taxes, mainly property tax and share in PIT). The commune of Krokowa is placed next (45% of own revenues in the total value of budget revenues). However, the largest value of the PIT share per capita was recorded in the Administrative Site Area in 2019 by the rural commune of Wejherowo, followed by the rural communes of Puck, Krokowa and Gniewino. About 1/3 of the share in the total budget revenues of the four analysed communes in 2019 fell to the rural communes of Puck and Wejherowo.

Infrastructure and social services

Courts, prisons, police facilities

There are no courts, prisons, commands and police stations in the rural communes of Choczewo and Wicko (ASA – Variant 1 – Lubiatowo - Kopalino site) and Krokowa, Gniewino, Puck, Wejherowo (ASA Variant 2 – Żarnowiec site). These institutions are located in the ASR area of both site variants. Police stations are located in the rural communes of Luzino, Łęczyce, Smołdzino, Cewice and Potęgowo. The Poviat Police Headquarters is located in the cities of Lębork, Puck, Wejherowo and Gdynia. On the other hand, there are Police Stations in the commune of Gniewino, the commune of Reda, the commune of Rumia, the commune of Szemud and the commune of Krokowa, the commune of Władysławowo, the commune of Kosakowo (within the Poviat Police Headquarters in Wejherowo and the Poviat Police Headquarters in Puck, respectively). The district court is located in Lębork, Wejherowo and Gdynia.

Education

The number of facilities in the field of pre-school education in Pomorskie Voivodeship in 2019 increased by approximately 35%. There were 10 pre-school education institutions in the Administrative Site Area in Variant 1 – Lubiatowo - Kopalino site, of which 5 were located in the Choczewo commune. There were 5 primary schools in the analysed area, two of them in the Choczewo commune. There were 51 pre-school facilities, 28 primary schools, 2 vocational schools and a general secondary school in ASA in Variant 2 – Żarnowiec site. There were 9 preschool education institutions and 5 primary schools in the Krokowa commune, and 5 kindergartens and 2 primary schools in the Gniewino commune, respectively. Vocational and secondary schools are located outside the commune of Choczewo and the commune of Wicko (ASA Variant 1), but they are found in ASA Variant 2. Post-secondary and art schools in both site variants are located outside the Administrative Site Regions. Universities are located mainly in Gdynia (ASR Variant 2).

Cultural institutions

The Pomorskie Voivodeship has a very rich cultural offer, although it is undoubtedly not equally available to all residents. The largest number of cultural centres and offers for residents is recorded in urban communes. The Choczewo commune is home to the Stefan Żeromski Communal Cultural Centre and Library, in Krokowa there is the Commune Public Library with branches in Wierzchucino and Żarnowiec and the Regional Museum in Krokowa, and the Gniewino commune includes the Centre for Culture, Sport, Tourism and a Library in Gniewino. The Wejherowo poviat runs two local government cultural institutions: the Museum of Kashubian and

Pomeranian Literature and Music in Wejherowo (since 2002) and the Poviat Public Library in Wejherowo (since 2014). The poviat has the largest number of senior clubs, art and technical circles and music and dance sections. This is related to the cultivation of Kashubian culture and the type of artistic activity. In addition, the Cultural Centre is located in Wejherowo, where the Kashubian Philharmonic has been operating since 2000.

Social welfare infrastructure

With the increase in the number of people of post-working age, the number of stationary social welfare institutions has increased. On the scale of the entire Pomorskie Voivodeship, this increase amounted to approximately 33.7%. In Variant 1 – Lubiatowo - Kopalino site, these facilities are located in the rural communes of Puck, Krokowa, Wejherowo, Gniewino, Luzino, as well as in the cities of Wejherowo and Władysławowo. In Variant 2 – Żarnowiec site, these facilities are located in the rural communes of Puck, Krokowa, Wejherowo, Gniewino, as well as in the ASR: Luzino, Szemud, Rumia, the city of Wejherowo, Puck, Władysławowo, Lębork and Gdynia. There are no such facilities both in the commune of Wicko and the commune of Choczewo.

Sports infrastructure and public space (bicycle paths)

In the communes belonging to the Administrative Site Areas, there are sports facilities in both site variants, i.e. sports fields, stadiums, gymnasiums and gyms. However, there are no swimming pools, which are present in cities such as Lębork, Władysławowo, Rumia and Gdynia. In the Pomorskie Voivodeship in 2018, there were 6.8 km of bicycle paths per 100 km^2, of which the Tri-City and Słupsk have the most bicycle paths per 100 km^2. This indicator in the Puck poviat is 19.5 km, which is associated with increased tourist traffic and the existing bicycle path through the entire Hel Peninsula. The results for other counties are at the level of 2.0-5.9 km per 100 km^2 (Wejherowo poviat – 5.4 km). There are bicycle paths in the communes of Choczewo, Krokowa, Gniewino which are an important part of the tourist offer.

Transport services

The main directions of travel of the population of the Choczewo commune are: the city of Wejherowo, Gdynia, Gniewino and Gdańsk. On this basis, it can be assumed that the inhabitants of the Choczewo commune (outside the region of their own commune) work mainly in the above-mentioned communes and cities. In Gniewino, Czymanowo, Krokowa and Tyłowo, there are regular bus lines to Wejherowo, operated by PKS Gdynia. There are also long-distance and regional trains from Wejherowo in the direction of Gdynia, Sopot and Gdańsk. The network of regular connections is complemented by public school lines reaching most of the towns.

Water supply, water consumption and sewage disposal

In the period from 2010 to 2019, the average unit water consumption in the Pomorskie Voivodeship showed a decreasing trend. In the commune of Wicko in the Administrative Site Area, an increase of 47.5% was recorded, while in the commune of Choczewo, unit water consumption decreased by 3.2%. In the commune of Krokowa, unit water consumption decreased significantly, and slightly in the commune of Gniewino. The highest annual consumption occurs in tourist municipalities (mainly coastal) and is associated with an increased influx of holidaymakers. The number of people using the water supply network has increased in the ASR in both site variants. The data refer to the use of water for the needs of the national economy and population during the year. These data also include water used for irrigation of agricultural and forest land and for filling fish ponds.

The average water consumption per capita and average household water consumption per capita in ASR and ASA in 2010 and 2019 in both site variants is presented in the below table [Table VI.3.4.2- 3].

Table VI.3.4.2- 3 Average water consumption per capita and average household water consumption per capita in ASR and ASA in 2010 and 2019 in both site variants

No.	Area	Average water consumption [m³/person]		Average water consumption in households per capita [m³/person]	
		2010	2019	2010	2019
	Variant 1 — Lubiatowo - Kopalino site				
1	**Administrative Site Area**	**41**	**48**	**29**	**34**
a)	*Wicko (w)*	31	45	29	36
b)	*Choczewo (w)*	53	51	29	31
2	**Administrative Site Region**	**70**	**49**	**32**	**33**
	Variant 2 — Żarnowiec site				
1	**Administrative Site Area**	**133**	**44**	**30**	**32**
• *a)*	*Krokowa (w)*	*389*	67	40	39
• *b)*	*Puck (w)*	137	42	28	34
• *c)*	*Gniewino (w)*	59	*53*	33	28
d)	*Wejherowo (w)*	*31*	*35*	28	29
2	**Administrative Site Region**	**59**	**49**	**34**	**35**
3	**Pomorskie Voivodeship**	**89**	**79**	**33**	**35**

Source: In-house studies based on the Analysis of social and economic conditions and impact. Jacobs Clean Energy Limited, 2021, and Bank of Local Data of Statistics Poland (BDL GUS), http://bdl.stat.gov.pl/BDL/start

In addition to the residents, industry is a very important recipient of water. This share in the analysed area, Variant 1 – Lubiatowo - Kopalino in 2019, amounted to 13% and 9% in the ASA and ASR area, respectively, while in the ASA and ASR this share was 3% and 7%, respectively, in 2019. These values are lower compared to the average for the entire voivodeship (43%). In all districts covered by the analysis, an increase in the number of flats connected to sewage treatment plants was recorded. A reduction in the amount of wastewater directly discharged into the waters or into the ground is observed. Wastewater containing substances particularly harmful to the aquatic environment has been eliminated. In the areas of analysis, an increase in tourist traffic was observed, characterised by large seasonal fluctuations. In the summer months, the number of people staying in given towns increases significantly (in the case of Łeba even several times). This results in large monthly fluctuations in water demand and the need to drain and treat significant amounts of wastewater. For this reason, although the main reason for expanding the water supply and sewage network for communes are the needs of residents, they are trying to ensure adequate sanitary conditions also for tourists. The water supply and sewage network is constantly being developed, which leads to an increase in the number of recipients.

Waste management

In recent years, the total amount of waste generated in the Pomorskie Voivodeship, including industrial waste, has decreased. In 2019, it amounted to 1,024,300 tonnes. In the years 2017-2019, the largest decrease was recorded in the Lębork (10,600 tonnes) and Wejherowo (7,700 tonnes) poviats. In the Puck and Słupsk poviats in 2017-2019, an increase of waste by 400 tonnes and 13,000 tonnes was recorded, and in the city of Gdynia by 31,200 tonnes of waste. By analysing the stream of municipal waste, the average amount of municipal waste generated in the Pomorskie Voivodeship amounted to 372 kg/person (a total of about 870,000 tonnes). In ASA for Variant 1 – Lubiatowo - Kopalino site, residents of the Choczewo commune generated 342 kg (total of 1,879 tonnes) per capita, and of the Wicko commune 251 kg (total of 1,517 tonnes). In Variant 2 – Żarnowiec site, the amount of waste generated in the Gniewino commune amounted to 349 kg (a total of 2,596 tonnes), the Krokowa commune - 448 kg (a total of 4,851 tonnes), the rural commune of Puck - 297 kg (a total of 7,885 tonnes) and the rural commune of Wejherowo - 343 kg (a total of 8,953 Mg).

Telecommunications networks and services (mobile network, Internet)

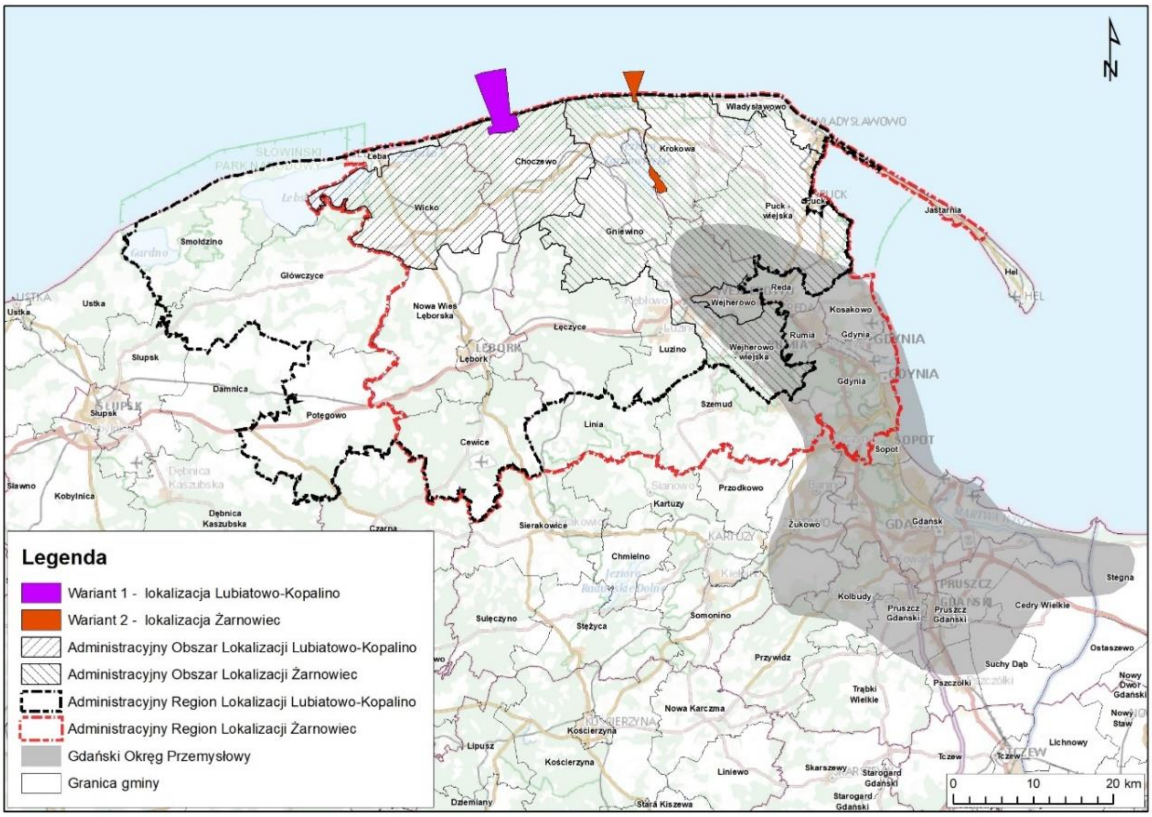
In terms of development of telecommunications infrastructure, the Pomorskie Voivodeship places 7th in the country. The infrastructure density index (km/km^2) in 2019 was 1.46. Therefore, it is included in the group of voivodeships with well-developed infrastructure. In the Choczewo commune and in the Wicko commune, the density of linear infrastructure is small, well below the national average and the average for the voivodeship. Whereas, in the communes of the Administrative Site Area in Variant 2 – Żarnowiec site, the density of linear infrastructure is high, above the national average and at the level of the average for the voivodeship. In the Adminsitrative Site Region, the telecommunications infrastructure density index is close to the average for the entire voivodeship or in Variant 2 well above the average. Communes are characterised by average coverage of LTE technology. However, it can be seen that fixed-line Internet is a technology users are slowly resigning from.

VI.3.4.3 Industry

Industry

The Pomorskie Voivodeship is home to some of the country's main ports, the seaport of Gdansk and the seaport of Gdynia, as well as traditional industries such as shipbuilding and refining. The Gdańsk Industrial District is located in the Pomorskie Voivodeship, whose main industrial centres are cities included in the Tri-City agglomeration (Gdańsk, Gdynia, Sopot), but also Elbląg, Starogard Gdański and Malbork, and industries related to maritime transport and broadly understood maritime economy are developed, including shipbuilding, electrotechnical industry and petrochemical industry. Traditional industries in the Pomorskie Voivodeship also include the food, machine, furniture and tourism industries. The Tri-City together with access roads in the form of the A1 motorway, the S7, S6 expressways and railway lines no. 9, 201, 202 and the Gdańsk Lech Wałęsa International Airport is a logistics centre for the whole country and creates favourable conditions for the development of industry.

The Gdańsk Industrial District in the background of ASA and ASR of both site variants is presented in the following figure [Figure VI.3.4.3- 1].



Legenda	Legend
Wariant 1 - lokalizacja Lubiatowo - Kopalino	Variant 1 – Lubiatowo - Kopalino site
Wariant 2 - lokalizacja Żarnowiec	Variant 2 — Żarnowiec site
Administracyjny Obszar Lokalizacji Lubiatowo - Kopalino	Lubiatowo - Kopalino Administrative Site Area
Administracyjny Obszar Lokalizacji Żarnowiec	Żarnowiec Administrative Site Area
Administracyjny Region Lokalizacji Lubiatowo - Kopalino	Lubiatowo - Kopalino Administrative Site Region
Administracyjny Region Lokalizacji Żarnowiec	Żarnowiec Administrative Site Region
Gdański Okręg Przemysłowy	Gdańsk Industrial District
Granica gminy	Commune boundary

Figure VI.3.4.3- 1 The Gdańsk Industrial District in the background of ASA and ASR of both site variants

Source: In-house studies based on the Analysis of social and economic conditions and impact. Jacobs Clean Energy Limited, 2021

In the Pomorskie Voivodeship, 71 of the 100 largest Pomeranian companies (according to the volume of sales revenues) are located in the Tri-City. There are 5 such entities in Variant 1 ASR, and 29 in Variant 2 ASR, of which 3 in ASA (1 in the commune of Krokowa, and 2 in the rural commune of Wejherowo). There are no such business entities in the communes of Choczewo and Wicko in the area of Variant 1 ASA.

The implementation of the Project is primarily related to the industrial and construction sectors, therefore the number of industrial and construction enterprises in both site variants was analysed. There are also two special economic zones (SEZ): Pomeranian SEZ (PSEZ) and Słupsk SEZ in the analysed area

Entities of the industrial and construction sectors in 2019 for both site variants are presented in the table below [Table VI.3.4.3- 1].

Table VI.3.4.3- 1 Entities of the industrial and construction sector in 2019 (number of entities) in the analysed site areas

	Area	Number of entities in 2019	Share (%) in Pomorskie Voivodeship in 2019
1	Pomorskie Voivodeship	75,159	
	Variant 1 — Lubiatowo - Kopalino site		
2	**Administrative Site Region**	**9,270**	**12.33%**
3	**Administrative Site Area**	**422**	**0.56%**
3a	Commune of Wicko (in)	218	0.29%
3b	Commune of Choczewo (w)	204	0.27%
	Variant 2 — Żarnowiec site		
4	**Administrative Site Region**	**19,405**	**25.82%**
5	**Administrative Site Area**	**2,768**	**3.68%**
5a	commune of Wicko (w)	341	0.45%
5b	Commune of Wicko (w)	938	1.25%
5c	commune of Wicko (w)	241	0.32%
5d	Commune of Wejherowo (w)	1,248	1.66%

(w) rural commune

Source: In-house studies based on the Analysis of social and economic conditions and impact. Jacobs Clean Energy Limited, 2021, Bank of Local Data of Statistics Poland (BDL GUS), http://bdl.stat.gov.pl/BDL/start

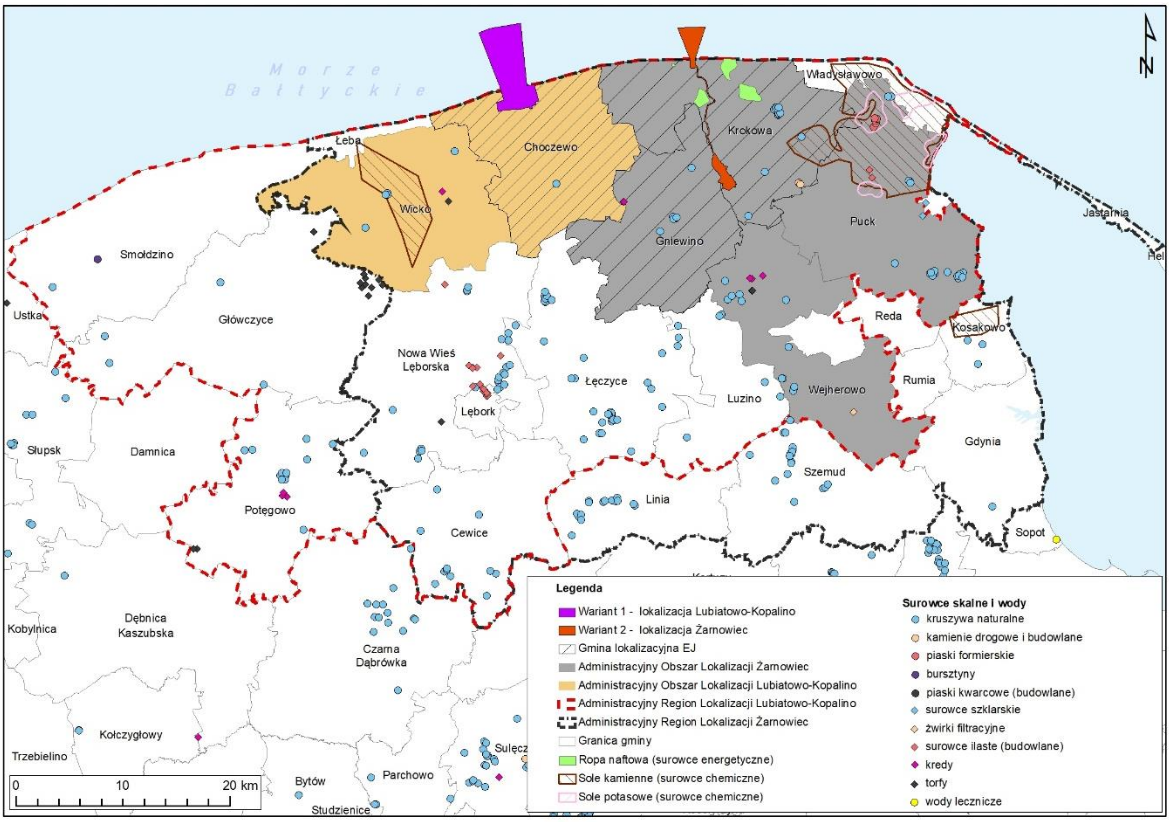
The results of the analysis show that the number of entities located in ASR in Variant 2 is twice as high as in Variant 1. Companies operating in the PSEZ, which includes, among others, the communes of Gniewino and Krokowa, are an important element of the region's economic potential.

Mineral deposits

In districts located in the area of both site variants, there are deposits of natural minerals classified in total in three groups of raw materials: energy and chemical raw materials (classified as basic minerals), waters classified as minerals (common minerals) and rock raw materials. Deposits of metallic raw materials (metal ores) have not yet been documented. The basic minerals in the group of energy resources include deposits of crude oil (all in the Puck poviat) and deposits of chemical raw materials (rock salts in the Puck and Lębork poviats), as well as deposits of potassium-magnesium salts (all in the Puck poviat). There are also amber deposits in the analysed area (Słupsk poviat). Rock raw materials are dominated by deposits of natural aggregate (sands and gravels). One of the largest resources of these raw materials occurs in the Wejherowo poviat.

There are 8 documented mineral deposits belonging to the category of rock materials in the Administrative Site Area for Variant 1, of which only two: "Łebieniec II" and "Roszczyce II" are currently exploited [Figure VI.3.4.3-2]. Both are classified as small deposits. The Administrative Site Area also includes a rock salt deposit "Łeba". The largest part of the deposit is located in the commune of Wicko, and a small northern part is located in the neighbouring commune of Łeba (outside the area). The resources of this deposit can be considered quite important from the point of view of the possibility of their economic use. This deposit has not been exploited so far and its availability and extraction of rock salt resources is not expected.

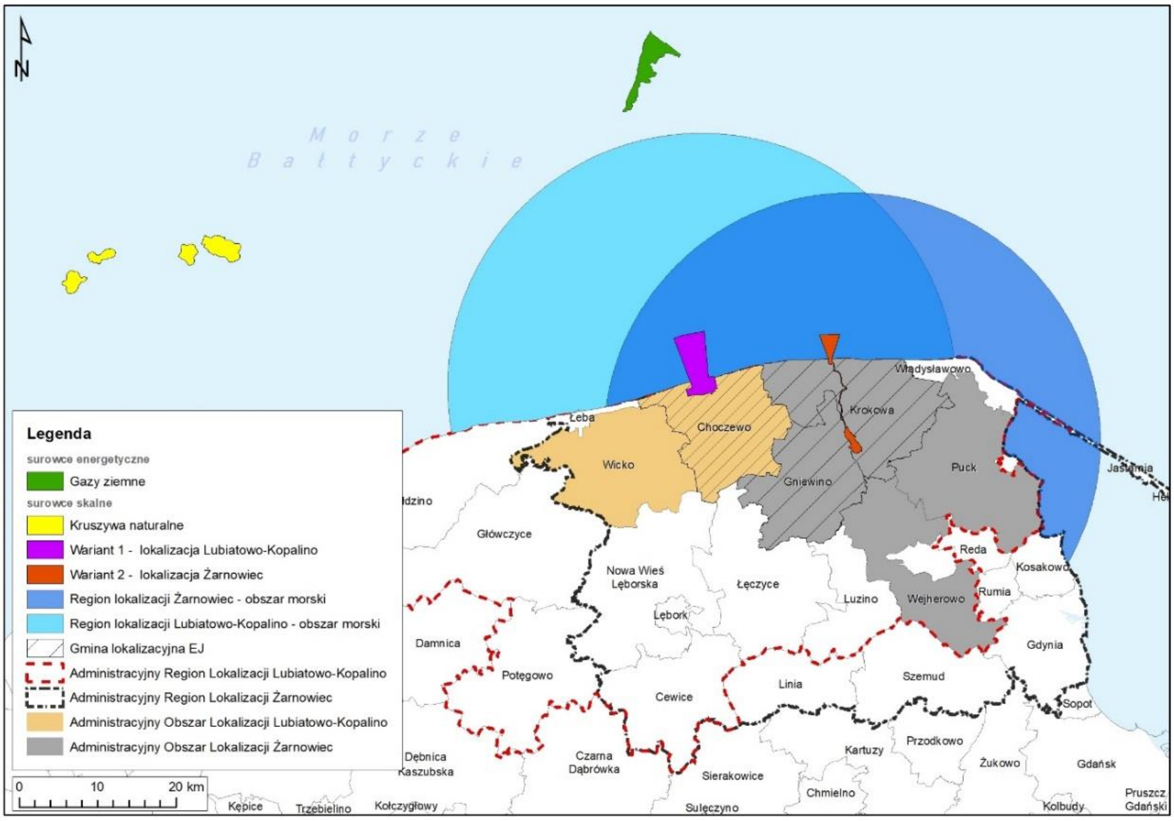
There are 5 documented mineral deposits in ASA for Variant 2, which are included in the group of rock raw materials [Figure VI.3.4.3- 3]. Apart from the Karlikowo deposit, all the others are currently under development. There is a small fragment of the "Żarnowiec W" oil deposit (MIDAS system number 5322) within the boundaries of the Żarnowiec site area. The vast majority of the area of this deposit is located outside the site area. It is a small deposit with resources of 17,620 tonnes, which currently does not have a valid mining licence (the licence deadline expired on 31 May 2020). There are no mineral, medicinal or thermal water resources in the analysed area of both sites classified as minerals.



Legenda	Legend
Wariant 1 - lokalizacja Lubiatowo - Kopalino	Variant 1 – Lubiatowo - Kopalino site
Wariant 2 - lokalizacja Żarnowiec	Variant 2 — Żarnowiec site
Gmina lokalizacyjna EJ	NPP site commune
Administracyjny Obszar Lokalizacji Żarnowiec	Żarnowiec Administrative Site Area
Administracyjny Obszar Lokalizacji Lubiatowo - Kopalino	Lubiatowo - Kopalino Administrative Site Area
Administracyjny Region Lokalizacji Lubiatowo - Kopalino	Lubiatowo - Kopalino Administrative Site Region
Administracyjny Region Lokalizacji Żarnowiec	Żarnowiec Administrative Site Region
Granica gminy	Commune boundary
Ropa naftowa (surowce energetyczne)	Crude oil (energy raw materials)
Sole kamienne (surowce chemiczne)	Rock salts (chemical raw materials)
Sole potasowe (surowce chemiczne)	Potassium salts (chemical raw materials)
Surowce skalne i wody	Rock raw materials and waters
kruszywa naturalne	natural aggregates
kamienie drogowe i budowlane	road and construction stones
piaski formierskie	moulding sands
bursztyny	amber
piaski kwarcowe (budowlane)	quartz sands (construction)
surowce szklarskie	glass raw materials
żwirki filtracyjne	filter gravels
surowce ilaste (budowlane)	clay raw materials (construction)
kredy	chalks
torfy	peat
wody lecznicze	therapeutic waters

Figure VI.3.4.3- 2 Distribution of mineral deposits (land area) against the background of site variants

*Source: **In-house study** based on the Analysis of social and economic conditions and impact. Jacobs Clean Energy Limited, 2021 and Data from the National Geological Institute on documented mineral deposits together with information from the MIDAS database kept for registered mineral deposits,* ***http://geoportal.pgi.gov.pl/midas-web***



Legenda	Legend
surowce energetyczne	energy raw materials
Gazy ziemne	Natural gases
surowe skalne	rock raw materials
Kruszywa naturalne	Natural aggregates
Wariant 1 - lokalizacja Lubiatowo - Kopalino	Variant 1 – Lubiatowo - Kopalino site
Wariant 2 - lokalizacja Żarnowiec	Variant 2 — Żarnowiec site
Region lokalizacji Żarnowiec - obszar morski	Żarnowiec site region — marine area
Region lokalizacji Lubiatowo - Kopalino- obszar morski	Lubiatowo - Kopalino site region – marine area
Gmina lokalizacyjna EJ	NPP site commune
Administracyjny Region Lokalizacji Lubiatowo - Kopalino	Lubiatowo - Kopalino Administrative Site Region
Administracyjny Region Lokalizacji Żarnowiec	Żarnowiec Administrative Site Region
Administracyjny Obszar Lokalizacji Lubiatowo - Kopalino	Lubiatowo - Kopalino Administrative Site Area
Administracyjny Obszar Lokalizacji Żarnowiec	Żarnowiec Administrative Site Area

Figure VI.3.4.3- 3 Distribution of mineral deposits (marine area) against the background of site variants

Source: In-house study based on the Analysis of social and economic conditions and impact. Jacobs Clean Energy Limited, 2021 and Data from the National Geological Institute on documented mineral deposits together with information from the MIDAS database kept for registered mineral deposits, http://geoportal.pgi.gov.pl/midas-web

In the marine part of both site variants, deposits at sea are located outside the analysed Site Region. They occur at a distance of more than 30 km from the location of the NPP and will be: 1 natural gas deposit (energy raw material) - designated as B21 and 4 deposits of common minerals - natural aggregates (rock raw materials) in the area of the so-called Słupska Bank and including 4 deposit fields numbered 2, 3, 7 and 8 included in the extensive aggregate deposit "Słupska Bank - Baltic S".

VI.3.4.4 Tourism

The Pomorskie Voivodeship is one of the three voivodeships in Poland with the highest level of development and exceptional attractiveness for tourists. Tourism is considered to be one of the key factors in the development of the regional self-government of the voivodeship, which has a significant impact on the economic development and social wellbeing of many communes. In the case of both site variants, the analysed area is primarily the coast, the lake district and the Tri-City. There are sandy beaches, dunes and a strip of about 25-30 km of moraine terrain along the coast. There are the following towns/cities from the west along the coast as well as areas and facilities important from the point of view of tourist attractiveness: Łeba (tourist centre), Mierzeja Sarbska reserve, Stilo Cape (lighthouse), Lubiatowo and Kopalino (Lubiatowska Dune), Białogóra (dunes overgrown with forest and Babnica and Białogóra Reserves), Dębki and Karwia (tourist destinations) and Jastrzębia Góra. The eastern part of the South Baltic Coast is the Gdańsk Coastal Region. There is also the Pobrzeże Kaszubskie, where from the north-west there are Cape Rozewie, Władysławowo (a local fishing port and an important tourist centre), the Hel Peninsula (extremely attractive directions of summer tourism), Kępa Swarzewska, Puck, Kępa Pucka, the south-eastern part of the Żarnowiecka Upland and Kępa Oksywska, the Tri-City Landscape Park and Kępa Redłowska lying in the Tri-City area. It should also be mentioned that the Kashubian Region is an area inhabited in part by indigenous Kashubians.

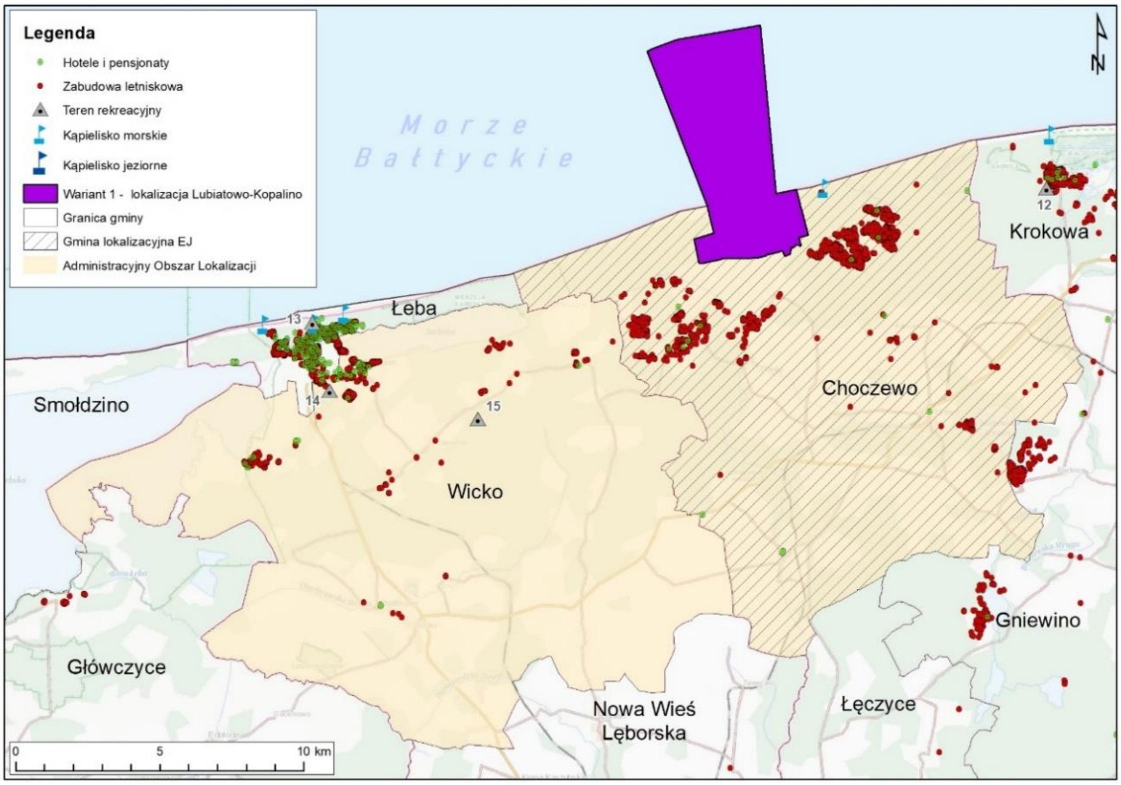
According to data from Statistics Poland, the Pomorskie Voivodeship had the largest accommodation base in Poland in 2019, amounting to 1637 accommodation facilities in total (almost 15% of all accommodation facilities in Poland). The largest accommodation base (hotels, guesthouses, campsites and youth hostels) in the Pomorskie Voivodeship in 2019 was present in Gdańsk (63), Władysławowo (25), Sopot (23), Gdynia (15), Łeba (13), Słupsk (10) and Jastarnia (9).

Most of the accommodation places are located in the Tri-City and Władysławowo, with the fact that Władysławowo mainly includes holiday centres, guest rooms and campsites mainly of a seasonal nature. A relatively large accommodation base is also characterised by Łeba with Wicko, Ustka and the Hel Peninsula (Jastarnia and Hel communes). Year-round facilities in the total number of accommodation facilities in the Pomorskie Voivodeship in 2019 accounted for approximately 55%. Nevertheless, the variation in the share of year-round facilities in their total number is large and corresponds to the nature of tourist attractions. The fewer attractions other than the beach, the share of year-round accommodation facilities decreases.

The Pomorskie Voivodeship as a coastal area is characterised by high tourist traffic. In the summer season, this traffic is exceptionally large throughout the Pomorskie Voivodeship and is associated with rest by the sea and lakes. In the off-season, tourist traffic is associated with the largest cities of the voivodeship – i.e. the Tri-City, as well as the most important historical attractions of the region, such as the Teutonic Castle in Malbork. In the summer season, tourist traffic is concentrated in the Tri-City and coastal towns of the Puck poviat. Slightly smaller is found in large coastal towns, such as Ustka, Łeba and Słupsk. The Kashubian Lake District and other areas of the Pomorskie Voivodeship are characterised by smaller, strongly dispersed tourist traffic.

When analysing both site variants in terms of tourist attractions, it should be noted that the Choczewo commune (Variant 1) consists mainly of beaches and dunes and large forest spaces, as well as small and wild lakes, the main attractions of the Krokowa and Gniewino communes (Variant 2) include sandy beaches and dunes in the Krokowa commune, Lake Żarnowieckie in the Gniewino commune and Darżlubska Forest in the Wejherowo commune and Puck commune.

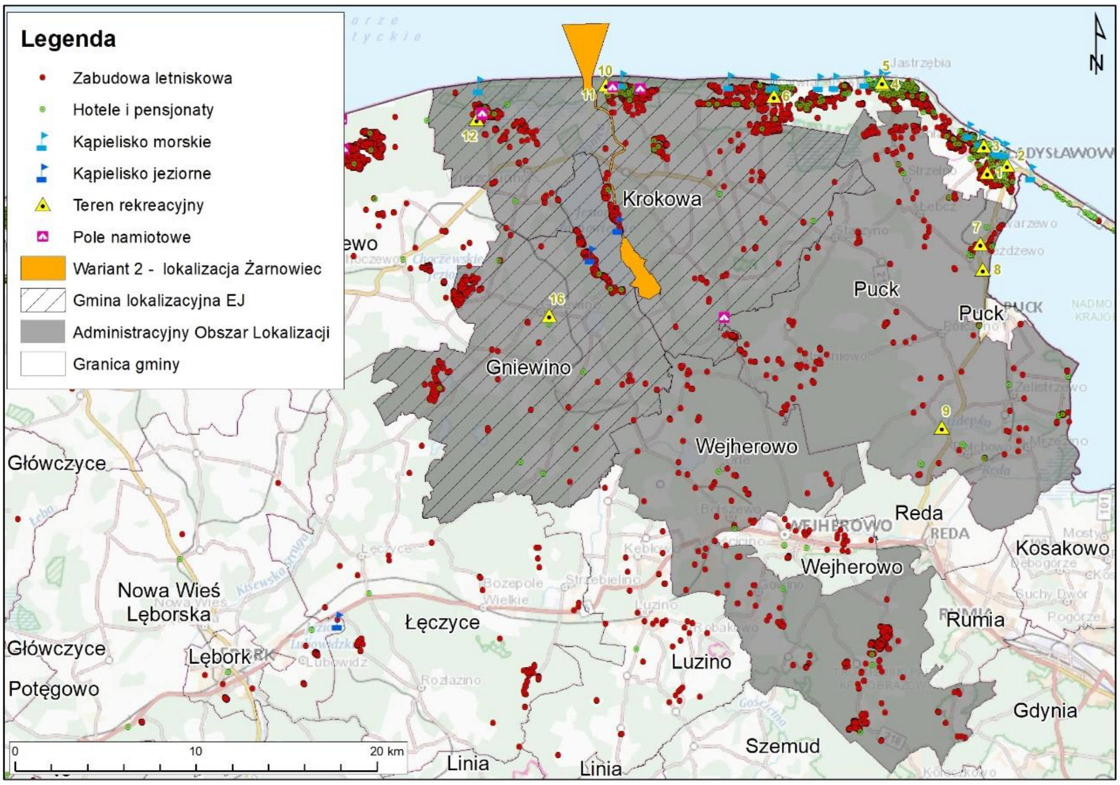
The key coastal towns in the Choczewo commune (Variant 1) are towns located in the commune itself, i.e. Lubiatowo and Kopalino. There are also the following places located nearby: Białogóra, Dębki, Karwieńskie Błota in the commune of Krokowa (Variant 2). Additionally, Karwia is located in a close distance in the commune of Władysławowo. These are typical coastal towns, where tourists come primarily in the summer season and during spring and autumn weekends. Outside these periods, these areas attract little tourist traffic from the Pomorskie Voivodeship. These are especially one-day walking trips on the Lubiatowska Dune and on sandy beaches. These are relatively small towns with accommodation in the form of private accommodation, summer homes, agritourism farms, campsites and tents. The commune of Gniewino (Variant 2) includes a Kashubian summer village Nadole on the western shore of Lake Żarnowieckie. The figures below present accommodation (hotels and guesthouses and summer buildings) and facilities related to tourism and recreation in the area of communes of the Administrative Site Area near the planned NPP in Variant 1 [Figure VI.3.4.4- 1] and in Variant 2 – Żarnowiec site [Figure VI.3.4.4- 2].



Legenda	Legend
Hotele i pensjonaty	Hotels and guest houses
Zabudowa letniskowa	Holiday homes
Teren rekreacyjny	Recreation area
Kąpielisko morskie	Sea bathing area
Kąpielisko jeziorne	Lake bathing area
Wariant 1 - lokalizacja Lubiatowo - Kopalino	Variant 1 – Lubiatowo - Kopalino site
Granica gminy	Commune boundary
Gmina lokalizacyjna EJ	NPP site commune
Administracyjny Obszar Lokalizacji	Administrative Site Area

Figure VI.3.4.4- 1 Accommodation (hotels and guesthouses and summer resorts) and tourism and recreation facilities within the ASA. Variant 1 — Lubiatowo - Kopalino site

Source: In-house studies based on the Analysis of social and economic conditions and impact. Jacobs Clean Energy Limited, 2021 and Spatial Development Analysis — Current status for the purposes of the EIA Report in the Lubiatowo - Kopalino Site, part I. INPLUS Energetyka Sp. z o.o., July 2021



Legenda	Legend
Zabudowa letniskowa	Holiday homes
Hotele i pensjonaty	Hotels and guest houses
Kąpielisko morskie	Sea bathing area
Kąpielisko jeziorne	Lake bathing area
Teren rekreacyjny	Recreation area
Wariant 2 - lokalizacja Żarnowiec	Variant 2 — Żarnowiec site
Gmina lokalizacyjna EJ	NPP site commune
Administracyjny Obszar Lokalizacji	Administrative Site Area
Granica gminy	Commune boundary

Figure VI.3.4.4- 2 Accommodation (hotels and guesthouses and summer resorts) and tourism and recreation facilities within the ASA. Variant 2 — Żarnowiec site

Source: In-house study based on the Spatial Development Analysis — Current status for the purposes of the EIA Report in the Żarnowiec Site, part Va. INPLUS Energetyka Sp. z o.o., July 2021

The coast of the Pomorskie Voivodeship is an attractive region for sailors, and in the area of both site variants, there are several yacht ports offering berths along the Baltic Coast, including Łeba, Władysławowo, Jastarnia, Hel, Puck, Gdynia, Sopot, Gdańsk and Ustka. These marinas offer a total of about 1,000 berths. The waters are also used for other recreational purposes, such as canoeing, Canadian canoeing or riding watercrafts. There are over 30 sea bathing sites, as well as 4 lake bathing areas in the analysed area of both site variants.

The closest to the planned location of the nuclear power plant in Variant 1 – Lubiatowo - Kopalino site (approximately 14 km) there is the port of Łeba, which offers berths for boats and small yachts. The nearest bathing area is the Lubiatowo Sea Bath (between the entrances to the beach no. 43 and 44). In Variant 2 – Żarnowiec site, the closest to the planned location of the nuclear power plant (Subarea 1 - the main part of the NPP) is the port of Władysławowo and Puck (approximately 20 km). Counting from the maritime border of the Project, the Dębki marina is located about 2.3 km, and the port of Puck about 19.7 km to the east. The commune of Krokowa includes a lake swimming area on Lake Żarnowiec (in Lubków), and there are also marinas in Gniewino in Nadole.

In the analysed area of both site options, tourism plays an important role in the local economy, especially in communes with a less diverse labour market. In the period between 2010 and 2019, the number of entities of the national economy entered in the REGON register in almost all districts of the analysed area (the sum of the section "economic activity related to accommodation and catering services" and section N, division 79 "activities of tour operators, intermediaries and travel agents and other service activities in the field of reservations and activities related to it") increased, although the scale of growth showed a strong differentiation.

In the period 2010– 2019, the largest increase in the number of business entities occurred in the Wejherowo poviat (by over 50%). The second poviat in terms of the increase in the number of entities with tourist activities was the Kartuzy poviat (48%). The increase also occurred in the Słupsk poviat (28%), a slightly lower increase took place in the Puck and Bytów poviats (12% each). Growth also occurred in Gdańsk (39%), Gdynia and Sopot (32% each). The relatively small increase in the number of entities on the Hel Peninsula (about 12% in Puck poviat) results from the fairly strong development of the tourist market in that area in 2010. (3,986 in the Puck poviat). The number of entities in the city of Słupsk increased by only 2%. A decrease in the number of tourism enterprises by about 6% occurred in the Lębork poviat. In the commune of Choczewo (Variant 1) there was almost a twofold increase in the number of entities involved in tourism, while the increase in the communes of Krokowa and Gniewino (Variant 2) was slight (about 17%).

VI.3.4.5 Agriculture and fishing

Agriculture

In the Pomorskie Voivodeship, agricultural land occupies about 50% of the area, of which arable land occupies about 38.1%, meadows and pastures about 20%, orchards 0.5%, and the remaining built-up land of the farmstead, land under ponds and ditches accounts for about 3.5%. In districts located in an area up to approximately 60 km from the location of the NPP, the poviats of Lębork and Puck are characterised by a low percentage of arable land (approximately 63%), which is due to the higher share of meadows and pastures. The highest share of arable land in the total agricultural land was recorded in the following poviats: Bytów (about 78%), Słupsk and Kartuzy (approximately 74%) and Wejherowo (approximately 71%).

In Variant 1 – Lubiatowo - Kopalino site, the structure of agricultural land use in the Choczewo commune is very similar to the average in the Wejherowo poviat (approximately 71% of arable land in relation to agricultural land) and does not differ significantly from the average values for the Pomorskie Voivodeship (approximately 76%). Orchards and gardens (0.3%) play a marginal role. In the Wicko commune, the share of arable land was much lower than in the Choczewo commune (approximately 53%), while a significant share was characterised by meadows and pastures (approximately 42%). In Variant 2 – Żarnowiec site, the structure of agricultural land use in the Krokowa and Gniewino communes also indicated a predominance of arable land, while it was higher in the Gniewino commune (about 75%) than in the Krokowa commune (approximately 55%).

In both site variants, cereals dominated the sown area:

a) in ASA in Variant 1 – Lubiatowo - Kopalino site:
   - wheat, barley, triticale and oats (Choczewo commune),
   - wheat, rye and barley (Wicko commune),

b) in ASA in Variant 2 – Żarnowiec site:
   - rye, wheat, triticale (Gniewino commune),
   - wheat, barley, triticale, rye (Krokowa commune),
   - wheat, triticale, barley (Puck rural commune),
   - rye, grain mixture, and triticale (Wejherowo rural commune).

In 2019, there were 350 farms in the Administrative Site Area in Variant 1, of which 138 farms were situated in the Choczewo commune. Among them, 35% were small farms (1 ha - 5 ha), and about 34% - large farms (over 15 ha). There were about 1,400 farms in the Administrative Site Area in Variant 2 – Żarnowiec site, of which the

Gniewino commune accounted for 132 farms, and the Krokowa commune for 342. Among them, as in Variant 1, small farms (33%) and large farms (25%) prevailed.

In the years 2010 - 2019, the total pig population in the Administrative Site Area in Variant 1 decreased significantly. In the Choczewo commune by 79%, and in the Wicko commune by as much as 89%. In total, in seventeen communes belonging to the Administrative Site Region, the decrease was 62%. A similar situation occurred with the cattle herd, which in the years 2010-2019 decreased in the Choczewo commune by 43%, and in the Wicko commune by 11%, but the Administrative Site Region recorded an increase in the cattle herd by about 15%, which is mainly related to the increase observed in the Wejherowo poviat.

In the area of the Krokowa and Gniewino communes, as in the case of Variant 1, the pig population more than halved in the years 2010-2019, although in individual communes the rate of decline varied, that is, in the Gniewino commune it amounted to approximately 53%, and in the Krokowa commune as much as 82%. By analysing the four communes of the Administrative Site Area of Variant 2, this decrease was 58%, and in the entire Administrative Site Region (22 communes) - 54%. In the Administrative Site Region, the cattle herd increased by 20%, with the most in the Wejherowo poviat (by approximately 43%). In the communes of Gniewino and Krokowa, however, a decrease in the cattle population was recorded (by approximately 4%).

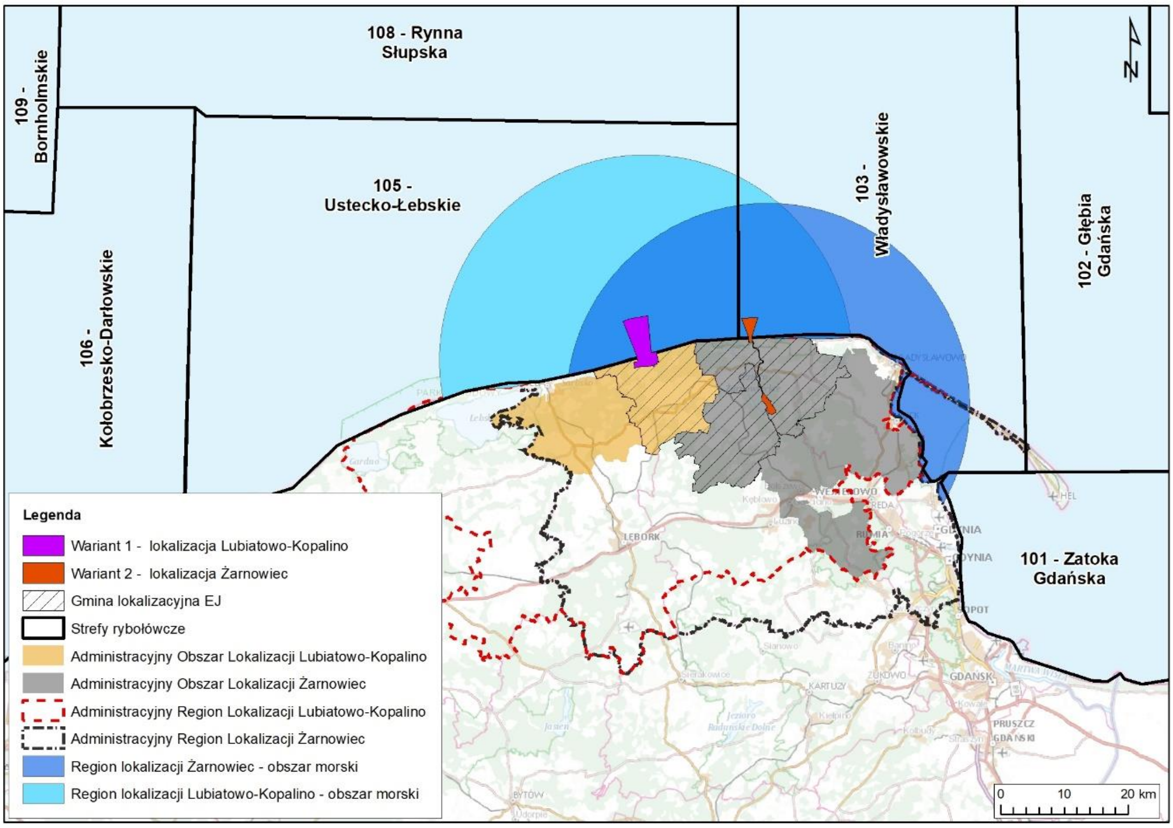
In Variant 1 – Lubiatowo - Kopalino site, no sheep breeding was recorded in the Choczewo commune, while in the Wicko commune the sheep population in 2019 amounted to 765 sheep. In the case of Variant 2, the number of sheep in the Administrative Site Area was 188.

In 2019, goat breeding in Variant 1 ASA was of marginal importance, in Variant 2 ASA about 90 goats were bred.

Fishery

The Polish Baltic fishery sector is subject to catch registration supervised by the Fishing Monitoring Centre (CMR), and the registration of catches in sea fishing is divided into regions known as fishing squares. The following squares: BM6, BM7, BN6, BN7, BO6, BO7, BP6, BP7, BR5, BR5GD, and BR6 are of the greatest importance for fishing in the country, and they are outside the site areas of either site variant. In both site variants, fishing in marine waters is part of the region's local economy.

Fishing zones against the site variants are presented in the following figure [Figure VI.3.4.5- 1].



Legenda	Legend
Wariant 1 - lokalizacja Lubiatowo - Kopalino	Variant 1 – Lubiatowo - Kopalino site
Wariant 2 - lokalizacja Żarnowiec	Variant 2 — Żarnowiec site
Gmina lokalizacyjna EJ	NPP site commune
Strefy rybołówcze	Fishing zones
Administracyjny Obszar Lokalizacji Lubiatowo - Kopalino	Lubiatowo - Kopalino Administrative Site Area
Administracyjny Obszar Lokalizacji Żarnowiec	Żarnowiec Administrative Site Area
Administracyjny Region Lokalizacji Lubiatowo - Kopalino	Lubiatowo - Kopalino Administrative Site Region
Administracyjny Region Lokalizacji Żarnowiec	Żarnowiec Administrative Site Region
Region lokalizacji Żarnowiec - obszar morski	Żarnowiec site region — marine area
Region lokalizacji Lubiatowo - Kopalino - obszar morski	Lubiatowo - Kopalino site region – marine area

Figure VI.3.4.5- 1 Fishing zone against the site variants

Source: In-house studies based on Dynamika populacji ważniejszych ryb użytkowych w świetle czynników środowiskowych wraz z implikacjami dotyczącymi racjonalnego gospodarowania zasobami [Population dynamics of major productive fish in the light of environmental factors along with implications for rational management of resources] (Horbowy, J.). Department of Fisheries Resources. Website of the National Marine Fisheries Research Institute, https://mir.gdynia.pl/dot16zasoby/

There are 51 fishing boats (≤12 m) and 50 cutters (> 12 m) registered in 5 fishing ports (marinas) in the Administrative Site Region of the Lubiatowo - Kopalino site. There are no fishing ports (marinas) or fishing harbours in the area of Wicko and Choczewo communes. There are 10 fishing ports (marinas) in the Administrative Site Region of the Żarnowiec site, including one of them located in the Administrative Site Area in Dębki. There are 143 fishing boats (≤12 m) and 63 cutters (> 12 m) registered in the ports. Larger fishing boats are registered in Łeba, Władysławowo and Jastarnia.

In 2018-2020, the Polish fishing fleet operating in the Baltic Sea waters caught an average of 141,5tonnes of fish (excluding salmonid fish) and 40,700 salmonid fish. However, a downward trend is noticeable, which has several reasons. One of them is the introduction of restrictions on catches of individual fish species, particularly as regards cod, as well as the reduction of fishing effort by payment of compensation for temporary cessation of fishing. In the area analysed (for both sites), an overall decrease in catches of almost 45% was also observed. However, in the case of salmonids there was no downward trend, and catches in 2020 were practically the same as in 2018. In terms of the weight of catches from the area in question, the annual catch is about 3% of the total

Polish Baltic catches. However, for salmonids this percentage is much higher: in 2019, it even exceeded 20% of the total number of salmonids caught. The basic species are sprat, herring, European flounder and cod. In coastal areas, and especially in the waters of the Bay of Puck, freshwater fish dominate in fishing, with a predominance of perch, eel, zander and roach.

The market price of fish depends on many factors, including the volume of the catch, season, availability on the market or even the volume of tourist traffic. Taking into account these factors, it can be noted that large vessels usually catch fish with a low unit value – these are usually pelagic fish, such as sprat or herring, occurring in large quantities. On the other hand, small vessels usually focus on more valuable fish, but caught in much smaller quantities (for example, sea trout or eel, which in particular is caught by small fishing boats). Most of ventures in the fishing boat segment are small, family businesses that generate additional income and usually are not the only source of income for their owners. This type of activity is often combined with services in the catering industry (fryers, smokehouses, etc.) or in the hotel and agritourism industry.

As of today, there is no industrial breeding of marine organisms (fish, molluscs, algae, etc.) in Polish marine areas (POM). Only small and usually time-limited experimental cultures are carried out.

In the analysed area, the breeding of rainbow trout is very strongly developed. About 60 trout farms were identified. In addition, there are carp production facilities and farms involved in the production of edible snail (although snails are not fish, according to the law they are aquaculture, that is, fishing facilities). There are several farms engaged in fish farming (mainly trout) in the Choczewo commune. There are 14 fisheries in the Wejherowo poviat and in the Krokowa commune (Puck poviat) with an area of approximately 680 ha. All fisheries belong to the Gdańsk District of the Polish Angling Association. In the village of Kartoszyno on Lake Żarnowieckie (Krokowa commune), on the former site of the construction of the Żarnowiec nuclear power plant started in the 1980s but not completed, there is a large fish processing plant – Polinord belonging to Graal S.A. (producer of canned fish). Fishing in marine waters is part of the region's local economy. The Krokowa commune and its coast belong entirely to subarea 26. There are no ports or fishing harbours in this area. Similarly as in Variant 1, the nearest important fishing ports are Łeba and Władysławowo.

VI.3.4.6 Forestry

The area of forest land in the Pomorskie Voivodeship in 2019 amounted to over 684,000 ha and has not changed fundamentally compared to 2010. The afforestation rate in 2019 was about 36%. The ownership structure is dominated by public forests (approximately 88%), of which about 97% are managed by the State Forests National Forest Holding, while the share of private forests is small and amounts to approximately 12%. About 1,768 ha in the Pomorskie Voivodeship are protected forests, of which 8% are present on private forest land.

The areas of communes in the Administrative Site Area are located within the boundaries of the following forest districts: Choczewo Forest District, Gdańsk Forest District, Strzebielino Forest District and Wejherowo Forest District.

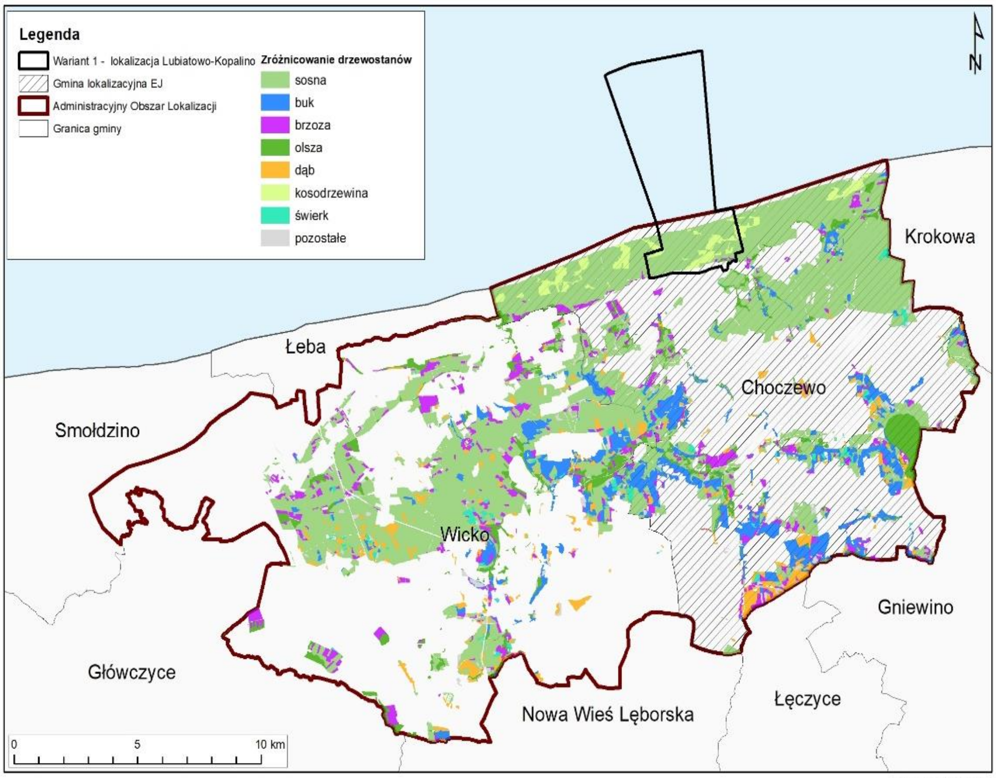
Forests present within the boundaries of the Administrative Site Area of Variant 1 – Lubiatowo - Kopalino site are mostly state forests (97%) in the management of PGL State Forests, and the remaining 3% are private forests. In the ASA of Variant 2 – Żarnowiec site, it is 93% and 7%, respectively.

In both site variants, the afforestation rate is high. In the Administrative Site Area in Variant 1 it is approximately 40%, while in Variant 2 - approximately 41%. However, taking into account the site communes, afforestation in the Choczewo commune is over 44%, the Gniewino commune - 42%, and in the Krokowa commune - 33%.

In the areas analysed, both Variant 1 and Variant 2 are dominated by habitats with high and medium productivity. The largest percentage of the area are habitats of fresh mixed deciduous forest and fresh mixed coniferous forest (approximately 30% and 24% for Variant 1, and approximately 48% and 18% for Variant 2).

The basic forest-forming species in the Administrative Site Region in both variants is pine – in Variant 1 it is about 64% of the forest area and about 55% in Variant 2.

Within the boundaries of the Administrative Site Area (Choczewo and Wicko communes), pine is also the prevailing species (approximately 63%). A characteristic feature of Variant 1 – Lubiatowo - Kopalino site is a noticeable share of tree stands with dwarf pine (creeping pine) planted artificially to stabilise dunes in the coastal strip (approximately 2% of forests).



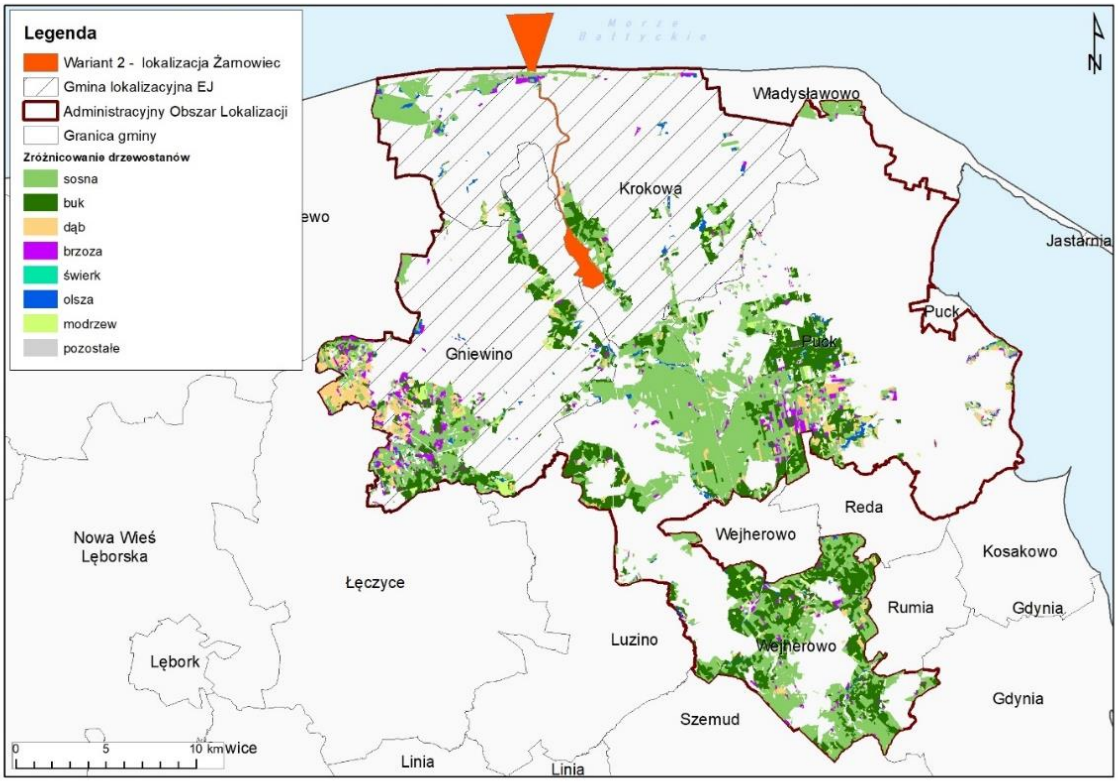
Legenda	Legend
Wariant 1 - lokalizacja Lubiatowo - Kopalino	Variant 1 – Lubiatowo - Kopalino site
Gmina lokalizacyjna EJ	NPP site commune
Administracyjny Obszar Lokalizacji	Administrative Site Area
Granica gminy	Commune boundary
Zróżnicowania drzewostanów	Diversification of tree stands
sosna	pine
buk	beech
brzoza	birch
olsza	alder
dąb	oak
kosodrzewina	dwarf mountain pine
świerk	spruce
pozostałe	other

Figure VI.3.4.6- 1 Variety of tree stands in the Administrative Site Area. Variant 1 — Lubiatowo - Kopalino site

Source: In-house studies based on the Analysis of social and economic conditions and impact. Jacobs Clean Energy Limited, 2021, and Forest Data Bank, https://www.bdl.lasy.gov.pl/portal/

Within the boundaries of the Krokowa, Gniewino, Puck, and Wejherowo communes (Administrative Site Area), the prevailing species in the wider environment is also pine (approximately 52%), while deciduous species, that is, beech, birch, alder and oak, together account for about 40% of the area of tree stands.

The variety of tree stands in ASA for each variant is shown in the figures [Figure VI.3.4.6- 1], [Figure VI.3.4.6- 2].

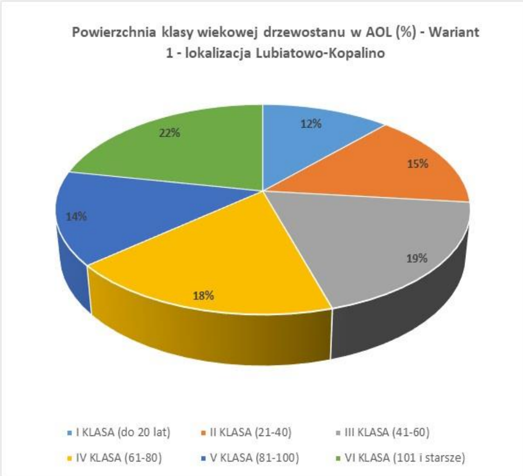


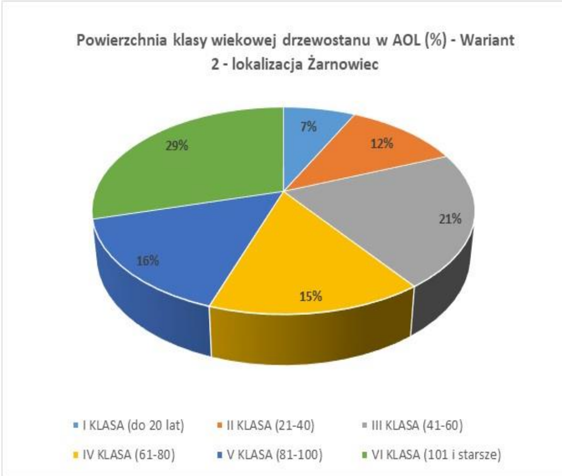
Legenda	Legend
Wariant 2 - lokalizacja Żarnowiec	Variant 2 — Żarnowiec site
Gmina lokalizacyjna EJ	NPP site commune
Administracyjny Obszar Lokalizacji Granica gminy	Administrative Site Area Commune boundary
Zróżnicowanie drzewostanów	Diversification of tree stands
sosna	pine
buk	beech
dąb	oak
brzoza	birch
świerk	spruce
olsza	alder
modrzew	larch
pozostałe	other

Figure VI.3.4.6- 2 Variety of tree stands in the Administrative Site Area. Variant 2 — Żarnowiec site

Source: In-house studies based on the Analysis of social and economic conditions and impact. Jacobs Clean Energy Limited, 2021, and Forest Data Bank, https://www.bdl.lasy.gov.pl/portal/

The age structure of forest stands (PGL State Forests) situated within the boundaries of ASA of both site variants is presented below [Figure VI.3.4.6- 3].





Powierzchnia klasy wiekowej drzewostanu w AOL (%) - Wariant 1 - lokalizacja Lubiatowo - Kopalino	Age class area of the stand in ASA (%) - Variant 1 – Lubiatowo - Kopalino site
Powierzchnia klasy wiekowej drzewostanu w AOL (%) - Wariant 2 - lokalizacja Żarnowiec	Age class area of the stand in ASA (%) - Variant 2 – Żarnowiec site
I KLASA (do 20 lat)	CLASS I (up to 20 years)
IV KLASA (61-80)	CLASS IV (61-80)
II KLASA (21-40)	CLASS II (21-40)
V KLASA (81-100)	CLASS V (81-100)
III KLASA (41-60)	CLASS III (41-60)
VI KLASA (101 i starsze)	CLASS VI (101 and older)

Figure VI.3.4.6- 3 Age structure of forest stands (PGL State Forests) present within the boundaries of ASA of both site variants

Source: In-house studies based on the Analysis of social and economic conditions and impact. Jacobs Clean Energy Limited, 2021, and Forest Data Bank, https://www.bdl.lasy.gov.pl/portal/

Within the boundaries of the Choczewo and Lębork Forest Districts, a total area of approximately 1,461 ha was allocated for felling, which is approximately 10% of the total area of stands in the ASA in Variant 1.

However, for the Krokowa, Gniewino, Puck, and Wejherowo communes (forest administration within the boundaries of the Choczewo, Gdańsk, Strzebielino and Wejherowo forest districts), a total area of about 4,287 ha was allocated, which is about 14% of the total area of tree stands in the ASA in Variant 2.

In the years 2010-2019, logging in the Pomorskie Voivodeship remained at a similar level (approximately 3.4 million m^3/year). The exceptions were the years 2017 and 2018, when logging was significantly higher than in other years (it amounted to approximately 4.9 – 5.8 million m^3). Increased logging in the above-mentioned years resulted from the need to manage fallen and damaged trees after a storm passed through a part of the Pomorskie Voivodeship in August 2017.

The value of logging performed by the State Forests in the Choczewo and Wicko communes (ASA for Variant 1) in 2019 amounted to approximately PLN 14 million. The value of trees logged by the State Forests in the rural communes of Krokowa, Gniewino, Puck, and Wejherowo (ASA for Variant 2) in 2019 amounted to approximately PLN 33 million. Logging has not changed much in the last 10 years in the above-mentioned communes of the ASA, while it has increased by over 12% in the area of communes located in the Administrative Site Region of both site variants.

The area up to approximately 60km from the NPP area (in both sites) includes protective forests, which exclusively or additionally play an ecosystemic (or non-productive) function related to the protection of land, water, infrastructure and areas inhabited by man and threatened by the effects of natural phenomena. In the ASA in Variant 1, water-protective forests prevail, followed by soil-protective forests. The share of forests protecting valuable fragments of the native natural environment is also noted. In the ASA of Variant 2, also forests with the soil-protective function prevail, which grow primarily on the steep slopes of the edge of Lake

Żarnowieckie. There are also forests in the southern part of the ASA, which are considered protective due to their location around cities (the city of Wejherowo).

The economic use of the forest also includes the collection of forest fruit and mushrooms, as well as hunting. Data available from the level of the Pomorskie Voivodeship show that in 2019, 698 tonnes of forest fruits worth over PLN 7.4 million and 1,523 tonnes of mushrooms worth over PLN 19.9 million were collected in the forests of the Pomorskie Voivodeship. The purchase of wild game in the Pomorskie Voivodeship in 2019 amounted to 1,080 tonnes worth over PLN 7.7 million, in which the largest share was the purchase of deer.

VI.3.4.7 Health

Environmental health determinants are aimed at presenting the state of health of residents and the condition of health care system together with the spatial diversity of the occurrence of various diseases, especially diseases that may result from exposure to ionising radiation (in particular neoplastic diseases), in order to determine the baseline situation in this respect.

The analysis used a very wide range of issues, including birth, mortality, hospitalisation and data on health infrastructure and medical potential: figures for medical staff, outpatient and hospital care, facilities with the ability to treat radiation injuries, and emergency medical and maritime emergency services.

For the purposes of analysis of the situation in terms of neoplastic disease (for both sites), 15 basic types of neoplasms were selected. A specific case of diseases are the diseases which may be related to the exposure to ionising radiation. For this purpose, the following cases were analysed in detail: a) all types of leukaemias; b) laryngeal neoplasms; c) neoplasms of the bones and articular cartilage of the limbs; d) skin neoplasms (other than melanomas); e) other types of neoplasms, including within lungs or the thyroid gland.

Data on cardiovascular diseases and cardiovascular problems, diabetes, eye diseases, infectious diseases, thyroid problems, Lyme disease and tick-borne encephalitis, as well as a rare metabolic disease specific to the Pomeranian region associated with LCHAD enzyme deficiency, which is commonly called the "Kashubian gene", were also analysed. It was also found that there is a rare disease in the voivodeship, called the nephrotic syndrome. The work also analysed data on mental illness and psychiatric care, stimulants and the impact of accidents at work and pollution on human health and life.

The analyses carried out in the chapter showed similar results for both sites. It should be noted that infant mortality in the years 2010–2019 in the Pomorskie Voivodeship is slightly lower than in the whole country (4 cases per 1,000 live births). The level of mortality in the entire Pomorskie Voivodeship has been increasing for several years, both among men and women. A similar trend can be seen in the poviats and communes analysed. The most common cause of death is a cardiovascular disease (even more than 40% of all cases), followed by neoplastic diseases. The highest number of cases of lung cancer in Poland was recorded in Pomorskie Voivodeship.

It is worth noting that compared to the national average, leukaemia is more common among women from the Pomorskie Voivodeship. Cases of various types of leukaemia in both the Administrative Site Region of Lubiatowo - Kopalino and Żarnowiec are annually recorded at most in double-digit numbers.

The incidence of other diseases is not specific to the surveyed region, including site communes.

VI.3.4.8 Quality of human life

The quality of life of people, according to the WHO definition is understood as "an individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns." According to the above definition and those adopted by Eurostat, Statistics Poland, and the Pan-European Survey on the Quality of Life, the level and quality of life is determined by eight indicators of an objective nature: material living conditions (income, consumption and material conditions), activity, health, education, leisure and social relations, economic security and physical security, governance and civil rights, local environment and living environment and one subjective indicator concerning the sense of well-being (generalised experience of quality of life).

The situation regarding the quality of life in the Pomorskie Voivodeship is relatively favourable compared to other voivodeships. This is reflected in the general attitudes of the residents – their satisfaction with life, with their own financial and material situation, and especially with their place of residence. Analysis of data in five poviats of the Administrative Site Region in both Variant 1 and Variant 2 showed that there are differences in both objective and subjective indicators between the voivodeship and the analysed poviats of the Administrative Site Regions indicated. The analyses carried out in the chapter showed similar results for both sites.

The quality of life in economic terms in the analysed poviats and communes (the exception is the city of Gdynia - Variant 2) is lower compared to the average for the entire voivodeship. This is mainly due to lower household incomes and higher unemployment rates. Compared to the average for the Pomorskie Voivodeship, in 2019 ASR was characterised by an average monthly gross salary lower by 13-17%, while the differences in the amount of remuneration between the poviats were not significant. Only Gdynia was characterised by a higher level of average monthly gross salary (by 10%) compared to the average for the voivodeship. The highest unemployment rates occurred in the Lębork (8.7%), Puck (6.8%) and Słupsk (6.4%) poviats. The Wejherowo poviat is characterised by the lowest rate of 5.4% with the average for the voivodeship at 4.5%. The share of the long-term unemployed (over one year) for the Wejherowo and Lębork poviats was at 30%-34% and was close to the voivodeship average (32%). The level of poverty in part of the analysed area measured by the amount of expenditure on social assistance was higher than the average in the voivodeship. In terms of expenditure on social assistance per capita, the area is diverse, because in the Puck and Wejherowo poviats, expenditure on social assistance was lower by 30% compared to the average for the voivodeship.

The state of social capital and social relations varies in the area analysed. The Puck poviat indicates a better quality of interpersonal relations compared to other poviats (low divorce rate, high attendance in local elections, high level of education, the largest number of participants in organised events).

The condition of the local environment, on the other hand, shapes the quality of life by creating living conditions, and the possibility of participation in the socio-cultural sphere. It is also associated with pollution of individual components of the environment, which have a direct impact on health.

The area analysed (ASR of both site variants) is diverse in terms of quality of life in the area of the local environment. In terms of housing, when analysing the ratio of the number of people per flat, it did not show significant deviations. Only the Puck poviat showed a clearly higher average floor space of flats. There are also visible disproportions in the area of culture, when it comes to access to cultural institutions. The same applies to the condition of the environment, where the area of particular natural value per capita more than doubles the average for the voivodeship, with the exception of Gdynia. It can be stated that the region analysed offers favourable natural living conditions against the Pomorskie Voivodeship both in terms of the availability of areas of special natural value, as well as the low air pollution.

VI.3.4.9 Real estate market

The presentation of the land property and building real estate market is aimed at presenting key information in the rural communes of Choczewo and Wicko (Variant 1 ASA - Lubiatowo - Kopalino) and in the rural communes of Gniewino, Krokowa, Wejherowo and Puck (Variant 2 ASA - Żarnowiec site). Due to the fact that the real possibility of changes in the real estate market may occur especially in coastal areas, two additional communes were also analysed, that is, for Variant 1 - Łeba urban commune, which is adjacent to the communes of Wicko and Choczewo, and for Variant 2 - the urban-rural commune of Władysławowo, adjacent to the communes of Krokowa and Puck.

For the purposes of the real estate market, transaction data from available public sources were used.

It should be borne in mind, however, that determination of the value of the real estate groups separated in the course of the research is not equivalent to determination of the market value of specific properties, but is only intended to illustrate the general trends in the real estate market.

In the case of Variant 1, almost 1,400 real estate purchase/sale transactions were concluded between 2017 and the first half of 2020 inthe analysed area (ASA – Variant 1 - Lubiatowo - Kopalino site and the Łeba commune), with the largest number of transactions recorded in the Choczewo commune (over 44%). However, in the case of Variant 2, the number of transactions referred to above, concluded in the analysed area (ASA – Variant 2 – Żarnowiec site and Władysławowo commune) amounted to approximately 6,600, with the largest real estate turnover recorded in the Wejherowo commune (over 31%), and the smallest - in the Gniewino commune (8.5%). In both site variants, transactions of purchase/sale of undeveloped land properties prevailed among the transactions concluded.

The analyses carried out for Variant 1 showed that high unit values in all categories of facilities were achieved by properties located in the Łeba commune. It is an urban area with a developed road infrastructure, highly attractive to tourists not only on the local market, but also on a national scale. Thanks to the location on the shores of the Baltic Sea, vicinity of two large lakes: Łebsko and Sarbsko, and high environmental values, the tourism industry has been developing here for decades. It is also an attractive place to live. Of all the buildings identified, about 90% are single-family housing and tourist facilities such as hotels, guesthouses or holiday resorts. As in most coastal towns, also in Łeba, the residential function is often combined with activities related to rental of places for leisure and tourism. Some such facilities operate year-round and hosts receive guests regardless of the season. Relatively high values, especially when it comes to residential development and land for such development, were also recorded in the rural commune of Choczewo (Variant 1). The average unit price for a structure built up with a single-family residential building was at approximately PLN 3,231/m^2, while for comparison, it amounted to approximately PLN 3,523/m^2 in the city of Łeba. The main factors influencing such a price level in the Choczewo commune were primarily high transaction prices for such facilities in coastal towns. The estimated values of real estate located in the commune of Wicko were at a lower level, which is characteristic of rural areas.

In Variant 2, it is noted that the highest unit values in all categories of facilities were achieved by properties located in the urban-rural commune of Władysławowo. The average unit price for a structure built up with a single-family residential building was at approximately PLN 3,159/m^2. It is an area of the commune with a very high tourist attractiveness on a national scale. Władysławowo itself, but also towns belonging to the commune, such as Jastrzębia Góra or Karwia, have been the most popular national holiday resorts for years. Of all the buildings identified in the Władysławowo commune, nearly 94% are single-family houses, including pension and housing facilities and tourist facilities such as hotels, guesthouses or holiday resorts. As in most coastal towns, also here the residential function is often combined with activities related to rental of places for leisure and tourism. Some such facilities operate year-round and hosts receive guests regardless of the season. In the Krokowa commune, analyses showed high transaction prices for land intended for commercial development, which translated into a high estimation of the value of such facilities (PLN 150/m^2). This is mainly related to the commercial services area near Lake Żarnowieckie and the Special Economic Zone which operates there. The relatively high level of average values of agricultural land in the commune of Krokowa (PLN 38/m^2) may result from the fact that there are quite large areas in the coastal strip, where local plans do not apply, and the land marked in the Study of conditions and directions of spatial development as agricultural is used as, for example, camping or tent fields or facilities for tourist attractions, which significantly increases transaction prices implemented on this market, and thus the value of such real estate.

VI.4 Impact assessment

VI.4.1 Impacts on protected areas and objects (land and sea)

Under the Environmental Protection Act (EPA), impacts on nature protection sites were assessed and compared, including for the purpose of and with a view to protecting Natura 2000 sites and ecological corridors that connect them. The assessment was conducted both for the land and marine area of Project impacts for both site variants: Variant 1 — Lubiatowo - Kopalino site, and Variant 2 — Żarnowiec site.

The assessment of impacts on protected sites and objects is based on desk research and results of wildlife inventories. A major source of information was also provided by the outcomes of abiotic surveys conducted for the purpose of this Project and numerical modelling (for example, a distribution of thermal waters and sediments), defining the ranges of impacts of particular activities.

VI.4.1.1 Impacts on protected areas and objects – land environment. Variant 1 — Lubiatowo - Kopalino site

The land part of the Project Area in Variant 1 is situated both within national nature protection sites and Natura 2000 sites. The assessment of impacts on national nature protection sites was conducted within the radius of 5km of the Project Area, and on Natura 2000 sites - within the 14km zone. The following nature protection sites were selected for further analysis and assessment:

- **Natura 2000 sites**: Białogóra (PLH220003), Mierzeja Sarbska (PLH220018), Lasy Lęborskie (PLB220006);
- **Nature reserves**: Choczewskie Cisy, Mierzeja Sarbska;
- **Ecological sites**: Osoczne Oczko, Torfowisko w Szklanej Hucie, Źródliska Bezimiennej, Gajówka.

Threats for the following sites: Białogóra, Mierzeja Sarbska i Lasy Lęborskie contained in Standard Data Forms (SDF) were analysed, as were environmental objectives under the Water Framework Directive (WFD). For any of the sites, neither any impacts from the proposed Project nor any contradiction with WFD environmental objectives were identified.

Impacts on natural habitats from the Natura 2000 network sites identified in the Project Area were assessed. Direct intrusion would take place in the Mierzeja Sarbska Natura 2000 site, for the following habitats:

- 2120 – shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes”) (intrusion at approximately 5%);
- 2130 – fixed coastal dunes with herbaceous vegetation ("grey dunes”) (intrusion at approximately 2%);
- 2170 – Dunes with Salix repens ssp. argentea (*Salicion arenariae*) (intrusion at approximately 12%);
- 2180 Wooded dunes of the Atlantic, Continental and Boreal region (intrusion at approximately 0.4%);

Impacts are calculated based on comparing the area of the habitat under potential impacts to its area provided in the SDF. The importance of each of the above-mentioned impacts has been found insignificant due to their low magnitude. Nevertheless, for Site 2170 – Dunes with Salix repens ssp. argentea (*Salicion arenariae*), certain minimisation measures are proposed.

The impact assessment also covered species of flora and fauna protected in Natura 2000 sites.

Mierzeja Sarbska (PLH220018)

None of the species of flora protected for the Mierzeja Sarbska site was found during the inventory in the area where there will be an intrusion in the site during the Project implementation. A fauna species protected and occurring in the Mierzeja Sarbska site is lesser ramshorn snail (*Anisus vorticulus*). However, no potential impacts on that species have been identified. In the Project Area, there is an auxiliary species – European adder (*Vipera berus*), for which possible impacts have been found, but minimisation measures are provided for.

Lasy Lęborskie (PLB220006)

No flora protected features are identified in the SDF. Also, no impacts are anticipated for the protected fauna features.

Białogóra (PLH220003)

For the Białogóra site, SDF does not identify flora species subject to protection, therefore, there are no impacts. No fauna species described in the SDF have been identified in the Project Area, therefore, no impacts on fauna species at the site are anticipated.

For other (national) nature protection sites, that is, Choczewskie Cisy nature reserve, Mierzeja Sarbska nature reserve , and Osoczne Oczko, Torfowisko w Szklanej Hucie, Źródliska Bezimiennej and Gajówka ecological sites, no adverse impacts from the Project, or impacts on environmental objectives under the Water Framework Directive, were identified.

This chapter also reviews Project impacts on ecological corridors. It should be recognised that, already at development stage, an ecological barrier would be created and a fragment of the Coastal Environmental Corridor would be disturbed.

The impact of disturbances in continuity of environmental corridors was assessed for all natural components under analysis: macroscopic and lichenised fungi, bryophytes, vascular plants, natural habitats, terrestrial and freshwater invertebrates, herpetofauna (amphibians and reptiles), avifauna, chiropterofauna and mammals except the Chiroptera order. The scale of those impacts is difficult to predict, but measures are anticipated to restore the environmental corridor upon the completion of the NPP construction phase.

In addition, potential impacts on biodiversity are addressed. The Project impacts on particular groups of organisms has been found to be insignificant.

VI.4.1.2 Impacts on protected areas and objects – land environment. Variant 2 - Żarnowiec site

The land part of the Project Area in Variant 2 – Żarnowiec site – is situated both within national nature protection sites and Natura 2000 sites. The assessment of impacts on national nature protection sites was conducted within the radius of 5km of the Project Area, and on Natura 2000 sites - within the 14km zone. The following nature protection sites were selected for further analysis and assessment:

- **Natura 2000 sites**: Piaśnickie Łąki (PLH220021), Opalińskie Buczyny (PLH220099), Widowo (PLH220054), Trzy Młyny (PLH220029), Lasy Lęborskie (PLB220006), Puszcza Darżlubska (PLB220007), Bielawskie Błota (PLB220010);
- **Nature reserves**: Piaśnickie Łąki, Widowo, Długosz Królewski w Wierzchucinie, Źródliska Czarnej Wody, Białogóra, Zielone;
- **Ecological sites:** Porąbski Moczar, Świecińska Topiel, Jezioro Witalicz, Księża Łąka.

Threats for the following sites: Piaśnickie Łąki, Opalińskie Buczyny, Widowo, Trzy Młyny, Lasy Lęborskie, Puszcza Darżlubska and Bielawskie Błota contained in Standard Data Forms (SDF) were analysed, as were the environmental objectives under the WFD. Impacts from the proposed Project were identified for Piaśnickie Łąki site, and, in addition, non-conformances with WFD environmental objectives were identified.

Impacts on natural habitats from the Natura 2000 network sites identified in the Project Area were assessed. Direct influence will take place in the Piaśnickie Łąki Natura 2000 site, for the following habitats:

- 2180 – Wooded dunes of the Atlantic, Continental and Boreal region (intrusion at approximately 8%);
- 6410 – *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) (intrusion at approximately 7%);
- 9190 – Old acidophilous oak woods with *Quercus robur* on sandy plains (intrusion at approximately 11%);

Impacts are calculated based on comparing the area of the habitat under potential impacts to its area provided in the SDF. The importance of each of the above-mentioned impacts has been found insignificant due to their low magnitude. Nevertheless, for the site: 6410 – *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*), mitigation measures are proposed.

The impact assessment also covered species of flora and fauna protected in Natura 2000 sites.

Piaśnickie Łąki (PLH220021)

For the Piaśnickie Łąki site, impacts from the Project identified in the SDF for this site as threats – this impact is related to modified water regime in Subarea 2 of the Variant considered. In addition, a non-conformance with WFD objectives was identified. Protected flora exposed to the threats from the Project include a species considered “biocenotic” according to the SDF, that is, other important and rare flora species – meadow gladiolus (*Gladiolus imbricatus*). For *Gladiolus imbricatus* specimens found in the Project Area, minimisation measures such as metaplantation to other sites are provided for. No protected fauna species were found in the SDF, hence no Project impacts are found in this respect.

Lasy Lęborskie (PLB220006)

No impacts from the proposed Project on the protected item: Boreal owl (*Aegolius funereus*) are anticipated (the species breeds in the area), due to a significant distance of the protected site analysed from the zone of Project works.

Puszcza Darżlubska (PLB220007)

No impacts from the proposed Project on the protected item: boreal owl (*Aegolius funereus*) and red-breasted flycatcher (*Ficedula parva*) are anticipated (the species breed in the area), due to a significant distance of the protected site from the works zone.

Bielawskie Błota (PLB220010)

Possible impacts on the protected common crane (*Grus grus*) have been identified, but the magnitude of impacts would be insignificant. Minimisation measures are possible, consisting in improved visibility of overhead lines. The Project would pose no threat to protected species: wood sandpiper (*Tringa glareola*) (a species breeding in the Natura 2000 site) found during inventory surveys, due to a significant distance of the Project Area from the Natura 2000 site.

For the following Natura 2000 sites: Opalińskie Buczyny, Widowo, Trzy Młyny, no protected flora or fauna species were identified in the SDF. Hence, no Project impacts are found in this respect.

A direct intrusion into the area of approximately 2.3 ha has been found for the Piaśnickie Łąki nature reserve, which is approximately 4% of its overall area. In addition to a direct destruction of Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*), including meadow gladiolus *Gladiolus imbricatus* or Siberian iris (*Iris sibirica*), water regime will also change due to excavations.

For other (national) nature protection sites, that is, nature reserves Widowo, Długosz Królewski w Wierzchucinie, Źródliska Czarnej Wody, Białogóra, and Zielone; and ecological sites: Porąbski Moczar, Świecińska Topiel, Jezioro Witalicz and Księża Łąka, no adverse impacts from the Project were identified, or impacts on environmental objectives under the Water Framework Directive.

This chapter also reviews Project impacts on ecological corridors. It should be recognised that, already at the development stage, there would be impacts on the environmental corridor. The infrastructure related to the water regime of the Project situated in the coastal zone would establish a small-footprint ecological barrier, and would not excessively disturb the functioning of the fragment of the Coastal Environmental Corridor in that area.

The effect of the disturbed continuity of ecological corridors on natural components is assessed similarly as for Variant 1.

In addition, potential impacts on biodiversity are addressed. The Project impacts on particular groups of organisms has been found to be insignificant.

VI.4.1.3 Impacts on protected areas and objects – marine environment. Variant 1 — Lubiatowo - Kopalino site

Due to the fact that both the Project Area, the marine survey area and the area of Project impacts would be outside of the national nature protection sites, the assessment in this chapter will focus primarily on Natura 2000 sites, sites of Community importance, integrity of those areas, and natural habitats.

Impact on marine protected sites and objects was assessed using the assessment under habitat regulations (habitat assessment). The first stage of habitat assessment was to determine potential Project impacts on European sites. However, if likely significant effects (LSEs) on the site could not be ruled out, full assessment is conducted in the next step.

Potential environmental changes that can occur at the development and construction stages, and in the operational phase have been assessed to establish whether, based on objective information, LSEs can be ruled out in the European sites.

The Project is not directly related or necessary to manage any of the European sites, and it cannot be ruled out, based on objective scientific inputs upon screening, that it would, individually or in combination with other plans or projects, have a likely significant effect on particular protected features of the following European sites:

- Przybrzeżne wody Bałtyku: common scoter, long-tailed duck, velvet scoter, razorbill, common gull, European herring gull;
- Mierzeja Sarbska: grey seal
- Ostoja Słowińska: grey seal, harbour porpoise, habitats: 1150: Coastal lagoons; 1170: Reefs;
- Pobrzeże Słowińskie SPA: grey seal, great cormorant;
- Słowiński Park Narodowy / Ramsar site: grey seal, harbour porpoise;
- Zatoka Pucka SPA: European herring gull;
- Zatoka Pucka i Półwysep Helski: grey seal, harbour porpoise;
- Kaszubskie Klify: grey seal, harbour porpoise;
- Hoburgs bank och Midsjöbankarna: harbour porpoise;
- Zalew Wiślany i Mierzeja Wiślana: grey seal;
- Ostoja w Ujściu Wisły: grey seal;
- Pommersche Bucht: harbour porpoise;
- Ostoja na Zatoce Pomorskiej: harbour porpoise;
- Wolin i Uznam: harbour porpoise;
- Adler Grund og Rønne Banke: harbour porpoise,
- Sydvästskånes utsjövatten: harbour porpoise;

- Greifswalder Boddenrandschwelle und Teile der Pommerschen Bucht SAC: harbour porpoise;
- Darßer Schwelle: harbour porpoise;
- Kadetrinne: harbour porpoise;
- Plantagenetgrund: harbour porpoise;
- Westrügensche Boddenlandschaft mit Hiddensee: harbour porpoise;
- Erweiterung Libben, Steilküste und Blockgründe Wittow und Arkona: harbour porpoise;
- Greifswalder Bodden, Teile des Strelasundes und Nordspitze Usedom: harbour porpoise;
- Greifswalder Boddenrandschwelle und Teile der Pommerschen Bucht: harbour porpoise;
- Greifswalder Bodden, Teile des Strelasundes und Nordspitze Usedom: harbour porpoise;
- Greifswalder Boddenrandschwelle und Teile der Pommerschen Bucht: harbour porpoise.

For the above-mentioned qualifying features, the following LSEs have been identified, that is:

- indirect effects through potential changes in prey availability as a result of introduction of invasive and non-native species,
- indirect effects through impacts on prey availability – benthic species,
- indirect effects through impacts on prey availability – fish species,
- indirect impacts on habitats – changes in water quality,
- indirect effects through impacts on food availability – changes in water quality,
- direct impact caused by the construction activity – underwater noise,
- direct impacts caused by the construction activity – airborne noise, light and visual impacts,
- direct disturbances caused by construction activity – increased marine vessel traffic,
- direct impacts due to the MOLF construction.

If detailed objectives of protection are not available for the given European site, the following protection objectives were applied in accordance with the Nature Conservation Act:

- non-deteriorated status of natural habitats or habitats of plant and animal species for which the Natura 2000 site has been designated; and
- non-deteriorated integrity of the Natura 2000 site or its links to other sites.

Impact assessment for Sub-variant 1A with the open cooling system and Sub-variants 1B and 1C with the closed cooling system at the development and construction stages, and in the operational phase was conducted in terms of LSE for species habitats of European sites through water quality, plankton, benthic habitats, fish predators, and invasive and non-native species. LSE assessments found that no adverse impacts on the integrity of any of the European sites for the identified:

- indirect effects through potential changes in prey availability as a result of introduction of invasive and non-native species,
- indirect effects through impacts on prey availability – benthic species,
- indirect effects through impacts on prey availability – fish species,
- indirect effects through impacts on prey availability – changes in water quality,
- direct effects caused by the construction activity – underwater noise.

In addition, the assessment has found that there would be no adverse impacts on the integrity of any European site of sea mammal protection for Variant 1 – Lubiatowo - Kopalino site in the development or construction stages, or in the operational phase.

Other LSEs related to the construction and operational phases, applicable to all three Sub-variants, that could potentially have an adverse impact on the integrity of European sites are the following:

- direct impact from the construction activity through airborne noise, light and visual impacts (NPP development and construction stages),
- direct impact from the construction activity through increased marine vessel traffic (NPP development and construction stages),
- direct impact through the MOLF operation (NPP construction stage).

The above-mentioned LSEs were significant for the following protected objects in European sites, for which further assessments were conducted:

- Przybrzeżne wody Bałtyku: common scoter, long-tailed duck, velvet scoter, razorbill,
- Pobrzeże Słowińskie SPA: great cormorant.

The assessment identified potential adverse effects on Przybrzeżne wody Bałtyku special protection area (SPA) (Common scoter, long-tailed duck, razorbill and velvet scoter) due to impacts from increased marine vessel traffic at the NPP development and construction stages. Mitigation measures are recommended to minimise those effects and avoid adverse impacts on site integrity.

Mitigation measures to minimise any disturbances from the marine vessel traffic indicated the need to establish a marine traffic zone (MTZ). All activities related to ship approaches would be limited to the MTZ to take the shortest route through Przybrzeżne wody Bałtyku SPA, that is, perpendicular to the coastline and extend 1km from the centre line of the NPP site. To ensure effective mitigation of disturbances by the MTZ, an adaptive monitoring and effect mitigation strategy would be developed and implemented prior to the commencement of the Project development stage. Such a strategy couples documentation research and information on habitats, and distribution and population sizes of species to make the location, scope of and rationale for MTZ more specific.

The established MTZ is found to have a minor impact on common scoter, long-tailed duck, velvet scoter, and razorbill resulting from increased marine vessel traffic at the development stage.

According to the LSE assessment, upon the implementation of recommended mitigation measures, there would be no adverse effects for the integrity of Przybrzeżne wody Bałtyku SPA. These mitigation measures should ensure:

- non-deteriorated status of habitats of protected species which will ensure keeping the integrity of the site,
- keeping the population of the protected species as a permanent component of the site, and maintaining it in a long term,
- maintaining the species habitats in a long term,
- preserving the structure, functions and processes that support habitats, and maintaining them in the long term.

No adverse impacts are anticipated for the protected features and habitats of species related to Przybrzeżne wody Bałtyku SPA. Therefore, the Project would not have adverse impacts on the integrity of the site.

For SPA Pobrzeże Słowińskie, the LSE assessment found that upon the implementation of recommended minimisation measures, there would be no adverse effects on the integrity of that site, either.

The in-combination assessment concluded that a significant increase in disturbance to wild animals as a result of the construction of the marine infrastructure under the Project as well as in combination with investment projects for the construction of cable connections to offshore wind farms is unlikely, thus the in-combination impacts are found not to affect the integrity of any European site.

This environmental impact assessment takes into account all European sites in the Baltic area within potential impacts from the Project. No adverse impacts have been identified for any of the European sites, therefore, transboundary impacts of the Project itself or in combination with other projects are excluded.

VI.4.1.4 Impacts on protected areas and objects – marine environment. Variant 2 - Żarnowiec site

Due to the fact that both the Project Area, marine survey area, and the extent of impacts from the Project are outside of national nature protection sites, and the range and magnitude of marine environmental impacts under Variant 2 would be lower than for Variant 1 – Lubiatowo - Kopalino site, the Project in its Variant 2 Żarnowiec site would have no adverse effects on the integrity of protected sites, including transboundary impacts.

VI.4.2 Impacts on natural (biotic) elements

The purpose of this chapter is to present the results of the assessment of the impact from the Project consisting in the construction of the Nuclear Power Plant (hereinafter: "NPP) on terrestrial and marine biological receptors in Variant 1 (Lubiatowo - Kopalino site) and in Variant 2 (Żarnowiec site).

The assessments presented in this report are based on a number of sources, including the outcomes the computer modelling. The assessments were carried out in accordance with industry standards, methodologies, applicable law, and the requirements set out in the GDOŚ Decision setting out the scope of the report.

VI.4.2.1 Impacts on natural elements – land environment. Variant 1 – Lubiatowo - Kopalino site

The assessment was conducted on groups of ecological receptors based on the outcomes of wildlife inventories.

The assessment of potential impacts on land environment due to the proposed NPP construction in its Variant 1 was conducted in terms of the analysis of the effect of a number of abiotic factors (impact factors) at each stage of the Project on natural components (receptors) of the vegetation cover: vascular plants, bryophytes, fungi and lichens, and of fauna: freshwater and land invertebrates, ichthyofauna, herpetofauna, amphibians and reptiles, avifauna, Chiroptera and other mammal species.

The following impact factors were identified for the Project, by phase and stage or works at which they occur:

<u>Project construction phase – development stage:</u>

- transformation of the terrain and change of use and management – (removal of the vegetation cover),
- change of hydrological conditions,
- emissions of non-radioactive pollutants to the air,
- emission of light (light pollution),
- emission of non-radioactive wastewater,
- emission of vibrations,
- emission of noise,
- conventional waste generation.

<u>Project construction phase – construction stage:</u>

- factors the same as at the development stage, and

- emission of radioactive substances,
- emission of heat.

Project operational phase:

- emissions of non-radioactive pollutants to the air,
- emission of light (light pollution),
- emission of non-radioactive wastewater,
- emission of vibrations,
- emission of noise,
- production of conventional waste,
- emission of radioactive substances,
- production of radioactive waste and spent nuclear fuel,
- emission of electromagnetic field,
- emission of steam, and salinity.

Project decommissioning phase:

- emissions of non-radioactive pollutants to the air,
- emission of light (light pollution),
- emission of non-radioactive wastewater,
- emission of vibrations,
- emission of noise,
- production of conventional waste,
- emission of radioactive substances,
- production and processing of radioactive waste

Due to the fact that the same impact factors apply to each of the considered sub-variants, that is, 1A, 1B, 1C, and the magnitude of their impacts is identical, the adopted main assumption for the in-combination assessment for the factor analysed on biotic components of the environment is the same for all sub-variants. The only impact factor that significantly varies by sub-variant is transformation of the surface of the area and change of its use and management (removal of the vegetation cover). Depending on the adopted sub-variant, the scale of loss of valuable natural areas, habitats or sites of the fauna and flora would be different.

The analysis also takes into account the exception due to differences in the "emission of water vapour and salinity" factor which would take place only in Sub-variants 1B and 1C (related to cooling towers).

Potential impacts of the construction of the Project's land infrastructure on receptors in the land environment were assessed by receptor group and Project stage.

As regards the components specific for the fauna (i.e. terrestrial and freshwater invertebrates, ichthyofauna, amphibians, reptiles, avifauna and mammals), the characteristics of particular sub-variants are considered to be the same as the characteristics identified for the Project Area, which is due to the mobility of the above-mentioned groups of organisms, which precludes their "fixed" spatial assignment to the areas of particular sub-variants.

With respect to certain impact factors (primarily for the terrain transformation), minimisation measures are proposed for particular natural components.

Sub-Variant 1A – open cooling system

Project construction phase – development stage

The development stage would involve the most important impact factor on land, namely the terrain transformation and change of use and management (including complete removal of the vegetation cover). The maximum area of clearance would be 356 ha. Significant factors with an adverse effect on some of the receptors would be also emissions of non-radioactive pollutants and the emission of light.

Project construction phase – construction stage

During the works, the factor with the most significant effect on the receptors of the flora would be a change of hydrological conditions, emission of non-radioactive pollutants to the air, and emission of light. For the fauna, the impacts with greatest adverse effects would be the emission of noise, emission of vibrations, and light pollution. This is coupled with a change in hydrological conditions which would entail direct adverse effects for the receptors, that is, terrestrial invertebrates.

Project operational phase

A potential impact on each group of receptors for Sub-variant 1A is in principle negligible in the Project operational phase. The only factor of significance would be light pollution which would adversely affect most receptors of the flora and fauna throughout the entire Project operation.

Project decommissioning phase

In terms of impact factors and their intensity, the Project decommissioning phase is comparable to the construction phase, nevertheless, less impact factors are anticipated here. The effect of each impact factor in the decommissioning phase on all natural components considered here should be interpreted based on the analysis conducted for the construction phase.

Sub-Variant 1B – closed cooling system using seawater

In the construction phase (development stage and construction stage) in Sub-variant 1B, the impact factors are no different from the ones described under Sub-variant 1A.

Project operational phase

A potential impact on each group of receptors for Sub-variant 1B is in principle negligible and insignificant in the Project operational phase.

Nevertheless, this Sub-variant involves cooling towers which would emit the salty water vapour to the air. This factor would have an adverse effect primarily on lichens.

In addition, a significant factor would be light pollution to the extent identical to Sub-variant 1A.

Project decommissioning phase

In terms of impact factors and their intensity, the Project decommissioning phase is comparable to the construction phase, nevertheless, less impact factors are anticipated here. The effect of each impact factor in the decommissioning phase on all natural components considered here should be interpreted based on the analysis conducted for the construction phase.

Sub-Variant 1C – closed cooling system using desalinated seawater

Project construction phase – development stage

In Sub-variant 1C, the maximum area of clearance is estimated to be 410 ha. This Sub-variant would involve the largest scale of loss of environmentally valuable species of the vegetation cover and fungi. The remaining impact factors at this stage are no different from the ones described under Sub-variant 1A.

At the construction stage and in the Project operational and decommissioning phases, potential impacts on each group of receptors for Sub-variant 1C is the same as for Sub-variant 1B.

VI.4.2.2 Impacts on natural items – land environment Variant 2 — Żarnowiec site

The assessment was split into two site variants and examination of all sub-variants for cooling water, that is, 2A and 2B, and then by group of ecological receptors, based on the outcomes of wildlife inventories.

The assessment of potential impacts on the land environment due to the proposed NPP construction in its Variant 2 – Żarnowiec site involved the analysis of the effect of a number of abiotic factors (hereinafter: impact factors) at each stage of the Project on natural components (receptors) of the vegetation cover: vascular plants, bryophytes, and natural habitats, macroscopic and lichenised fungi biota, and of fauna: freshwater and land invertebrates, ichthyofauna, herpetofauna, amphibians and reptiles, avifauna, Chiroptera and other mammal species.

Project impact factors for its Variant 2 – Żarnowiec site are identical to those highlighted for Variant 1 – Lubiatowo – Kopalino site.

Due to the fact that the same impact factors occur for each of the sub-variants considered, that is, 2A and 2B, and the magnitude of their impacts is identical, the main assumption was adopted for the in-combination assessment for the factor analysed on biotic components of the environment for each Sub-variant. The only impact factor that significantly varies by Sub-variant is transformation of the terrain and change of land use and management (removal of the vegetation cover). Depending on the Sub-variant adopted, the scale of loss of valuable natural areas, habitats or sites of the fauna and flora would be different.

Potential impacts of the construction of the Project's land infrastructure on receptors in the land environment were assessed by receptor group and Project stage.

Regarding the components specific for the fauna (i.e. terrestrial and freshwater invertebrates, ichthyofauna, amphibians, reptiles, avifauna and mammals), the characteristics of particular sub-variants are considered to be the same as the characteristics identified for the Project Area, which is due to the mobility of the above-mentioned groups of organisms, which precludes their "fixed" spatial assignment to the areas of particular sub-variants.

With respect to certain impact factors (primarily for the terrain transformation), minimisation measures are proposed for particular natural components.

Sub-variant 2A – closed cooling system using seawater

Project construction phase – development stage

The development stage would involve the most important impact factor on land, namely the terrain transformation and change of use and management (including complete removal of the vegetation cover). The maximum area of clearance is estimated to be 70 ha. Significant factors with an adverse effect on some of the receptors would be also emissions of non-radioactive pollutants and the emission of light.

Project construction phase – construction stage

During the principal works, the factor with the most significant effect on the receptors of the flora would be a change of hydrological conditions, emission of non-radioactive pollutants to the air, and emission of light. For the fauna, the impacts with greatest adverse effects would be the emission of noise, emission of vibrations, and light pollution.

Project operational phase

A potential impact on each group of receptors for Sub-variant 2A is in principle negligible and insignificant in the Project operational phase. The only factor of significance would be light pollution which would adversely affect most receptors of the flora and fauna throughout the entire Project operation. In addition, the water vapour emission factor would have an adverse effect primarily on lichens.

Project decommissioning phase

In terms of impact factors and their intensity, the Project decommissioning phase is comparable to the construction phase, nevertheless, less impact factors are anticipated here.

Sub-variant 2B – closed cooling system using desalinated seawater

In the construction, operational and decommissioning phases of the Project, potential impacts on each group of receptors for Sub-variant 2B are the same as for Sub-variant 2A.

VI.4.2.3 Impact on natural components – marine environment. Variant 1 — Lubiatowo - Kopalino site

The analysis of potential impacts on the marine environment due to the proposed NPP construction in its Variant 1 – Lubiatowo – Kopalino site was conducted in keeping with the requirements of the applicable national and European regulations, as well as Poland's obligations under applicable international treaties.

The assessment methodology is presented in a six-level approach:

- **Level 1**: Exposed environmental components (receptors);
- **Level 2**: Key measures;
- **Level 3**: Types of key impacts by stage;
- **Level 4**: Values that determine impact directions and types;
- **Level 5**: Environmental vulnerability;
- **Level 6**: Significance of impacts.

The assessment was split by Sub-variant, that is, 1A, 1B and 1C, and then by groups of ecological receptors, focusing on key receptor groups for which appropriate environmental studies and analyses specific for the site were conducted. For the purposes of this assessment, all works and infrastructure are considered to be part of the same Project, including the infrastructure related to the water intake/discharge, marine off-loading facility (MOLF) and sewage treatment works at the construction stage.

Sub-Variant 1A – open cooling system

The assessment of potential impacts related to the construction of marine infrastructure for the Project in the marine environment was conducted by receptor group and Project stage.

A potential impact on each group of receptors for Sub-variant 1A is in principle negligible at the Project construction stage and in its operational phase, except for three cases.

- In the operational phase, the effects of combined effluent discharges might result in moderate (potentially significant) effect on the plankton, if no additional mitigation measures are implemented. This is due to potential toxic effect of biocides which can affect the plankton throughout the Project operation (several dozens of years);
- The disturbances resulting from the watercraft traffic might bring potentially major (significant) effect on the most vulnerable wintering bird species present in the area of neighbouring SPAs, namely on the velvet scoter;
- Similarly, for less vulnerable wintering bird species (common scoter, long-tailed duck and razorbill), the potential effect of the disturbances caused by marine vessels was assessed to be medium (potentially significant).

Application of additional mitigation measures would make it possible to reduce medium (potentially significant) effects for the plankton and medium/high (significant) effects for birds to minor (insignificant) effects.

Sub-variants 1B and 1C – closed cooling system

The impacts related to the construction of a closed cooling system are similar, but of a lower magnitude than the construction of an open cooling system in Sub-variant 1A; most impacts on the marine environment in Sub-variants 1B and 1C would also be lower.

VI.4.2.4 Impact on natural components – marine environment. Variant 2 - Żarnowiec site

The assessment of potential impacts on the marine environment due to the proposed NPP construction in its Variant 2 – Żarnowiec site was conducted in a similar way as for Variant 1 Lubiatowo - Kopalino site. The assessment was split into two sub-variants, that is, 2A and 2B, and then by groups of ecological receptors, focusing on key receptor groups for which appropriate environmental studies and analyses specific for the site were conducted.

Sub-variant 2A – closed cooling system using seawater

The assessment of potential impacts related to the construction of marine infrastructure for the Project for receptors in the marine environment was conducted by a receptor group and Project stage.

The assessment of potential impacts of the Project shows that in most cases, the effects will be negligible or low if mitigation measures are provided for.

- For the operational stage under Sub-variant 2A, the effects of release of nutrients in process effluent discharged from the cooling water system were found to be medium (potentially significant) due to effects on the phytoplankton and the related eutrophication. However, if additional mitigation measures are implemented, these effects could be reduced to minor (insignificant) effects;
- Similarly, concentrations of certain chemicals in discharged process effluent, including biocides, might potentially affect plankton communities, whereas the effects are considered to be medium (potentially significant). Also in this case, implementation of the above-mentioned additional mitigation measures would make it possible to decrease them to a minor (insignificant) level;
- For the avifauna, and in particular the species covered by the SPA, the disturbances caused by the increased marine vessel traffic, were found to have medium to high significance, and therefore they are significant for some bird species, including the wintering velvet scoter, common scoter, long-tailed duck, and razorbill. However, if mitigation measures are implemented, these effects could be reduced to minor (insignificant) effects.

To sum up, the analysis of Sub-variant 2A identified no significant adverse environmental effects of the impacts on the receptor groups in the marine environment.

Sub-variant 2B – closed cooling system using desalinated water

The assessment of potential effects related to the construction of marine infrastructure components of the Project on receptors in the marine environment was conducted by a receptor group and Project stage.

Potential impacts on each group of receptors for Sub-variant 2B are assessed as in principle negligible and minor (insignificant) at the Project development and construction stages and in the operational phase, except for three cases.

- In the operational phase, the effects of process effluent discharges might result in a medium (potentially significant) effect on the plankton, if no additional mitigation measures are implemented. This is due to biocides and nutrients in the discharged process effluent, and the related potential for an effect on plankton communities over several dozens of years;
- The disturbances resulting from the marine vessel traffic might bring potentially major (significant) effect on velvet scoters, the most sensitive wintering bird species occurring in the area of neighbouring SPAs;

- For less vulnerable wintering bird species (common scoter, long-tailed duck and razorbill), the potential effect of the disturbances caused by marine vessels was assessed to be medium (potentially significant).

Additional measures to mitigate potentially significant impacts would make it possible to reduce medium (potentially significant) effects for the plankton and medium/major (significant) effects for birds to minor (insignificant) effects.

VI.4.3 Impact of the Project on climate, and impact of climatic factors on the Project

Project impacts on climate were examined in two aspects. Impacts on the global climate by assessing greenhouse gas emissions and impacts on the local climate (microclimate) by assessing changes in meteorological parameters.

Estimation of greenhouse gas emissions was conducted for all phases of the Project life cycle. Greenhouse gas (GHG) emissions from all sources and in all processes were taken into account, for example emissions related to the production of steel, concrete, equipment, and transport emissions. If the life cycle of an alternative technology is less than 60 years, estimates of carbon footprint have taken into account the need to replace the installations. For this purpose, data from a literature review concerning various environmental declarations for the existing NPPs and data from environmental surveys of the nuclear industry were used. In addition, the results obtained were compared to greenhouse gas emissions from alternative technologies of the electricity generation. The final outcome of the analysis of the Project life cycle and alternative technologies is the total amount of the carbon dioxide released during the generation of electricity, expressed in gCO_2e/kWh (carbon dioxide equivalent per unit of electricity).

The outcomes indicate that the AP1000 reactor would be a low-emission variant for Poland which would emits greenhouse gases at a level comparable to or lower than alternative renewable energy technologies, even taking into account conservative assumptions of Life Cycle Assessment (LCA) of nuclear technology [Table VI.4.3- 1].

Table VI.4.3- 1 Outcome of the comparative analysis of carbon footprint of nuclear technology contemplated by the Investor versus alternative technologies

Energy technology	**$C0_2$ emissions from power generation [gCO_2e/kWh]**
Biomass	106.0
Hydroelectric power	4.49
Wind	28.50
Solar power	81.70
Natural gas	402.0
Coal	764.0
NPP - Sub-Variant 1A: open cooling system	6.01
NPP - Sub-variant 1B: closed cooling system (seawater)	6.46
NPP - Sub-variant 1C: closed cooling system (desalinated seawater)	6.60
NPP - Sub-variant 2A: closed cooling system (seawater)	6.46
NPP - Sub-variant 2B: closed cooling system (desalinated seawater)	6.60

Source: Life Cycle and Carbon Footprint. Jacobs Clean Energy Limited, 2020

All five sub-variants would generate electric power with carbon dioxide emission rates much lower than the expected average carbon dioxide emission rates accompanying overall generation mix of electric power supplying the power grid throughout the designed 60-year Project life. This significant favourable effect means each kWh generated in this scenario would bring net savings in terms of carbon dioxide emissions, by replacing a emission-intensive generation source. In the first full year of operation, that is, in 2034, the Project would contribute emission savings at approximately 13 million tonnes of CO_2, which is equivalent to (annual) emission of CO_2 from about 3 million cars.

As at the date of analysis, the emission reduction commitments do not extend beyond 2045. Poland is likely to undertake further actions to cut emissions after 2045. Based on Poland's commitments to reduce emissions as at the date of this report, the Project is expected to save approximately 380 million tonnes of CO_2 emissions, which is equivalent to almost 1 billion of oil barrels.

The largest CO_2 emissions come from the initial phase of the NPP life cycle and constitute about 37% of its total greenhouse gas emissions. The life cycle phase that contributes the second-largest CO_2 emissions (34% of total emissions), is construction. The lowest GHG emissions (about 3%) are in the operational phase.

The process of extraction and processing of uranium is the main part of the general GHG emission of the initial phase, and the amounts of GHG emissions depend on the energy mix of the country from which the material is sourced.

The largest contribution to the emissions related to the construction is the production of cement and steel for the NPP purposes. A significant part of the GHG emission in the construction phase is due to electric power necessary at commissioning. The analysis was conservative, therefore, the currently applicable carbon footprint of the Polish energy mix was adopted, although it is very likely to be much lower by the commissioning time.

The operational phase is responsible for only 3% of total GHG emissions. Most of the emissions related to the NPP operation come from its initial stage related to the fuel production process.

Greenhouse gas emissions in the Project life cycle would be, therefore, two orders of magnitude (10^{-2}) smaller than life cycle emissions of an analogous project using gas or coal. The only stable source of electric power in the decarbonisation analysis with life cycle GHG emissions comparable to nuclear power is hydropower, but the available analyses indicate that the development of hydropower in Poland on a larger scale is impossible.

The Project would undoubtedly contribute to significant emission savings, with favourable outcomes for the climate, but, in addition, a broader context of Project impacts on the climate should be emphasised:

- Polish energy policy has set out the objectives of energy independence and increased competitiveness, which points to an additional strategic dimension related to the Project, in addition to targets for emission cuts in the power sector,
- technical guidelines of reputable institutions, which set out technology pathways leading to deep decarbonisation, support the significance of the Project in the process of achievement of CO_2 emission reduction objectives by Poland in the future,
- the experience of the European Union Member States which support the view that implementation of nuclear projects contribute to reduced greenhouse gas emissions.

Urban and industrial areas have strongly reshaped the land surfaces; as a consequence, the original meteorological conditions have been modified. The greater the transformation, the bigger modification is observed. The desk research shows that changes to meteorological parameters can be expected regarding the development of urban heat islands, change of thermal precipitation conditions, and modifications of the wind direction and speed. In addition, cooling towers can affect local climate by emitting water vapour with varying degrees of salinity.

In assessing the impact of the Project on the local climate, a similarity method has been used, and determination of a difference between meteorological parameters before the Project implementation and in its particular phases.

Changes in land management and the construction of Project facilities are expected to involve a modification of basic meteorological elements in the area surveyed. However, the modelling and estimation of changes in microclimate conditions in all phases of the Project life cycle demonstrated that this impact would be negligible.

The parts of infrastructure that can affect the microclimate apply to two principal Project intrusions into the baseline environmental status: changes in land use and operation of cooling towers.

Due to the nature of the phenomena observed, their largest impacts (except for the effects of the water vapour rising from cooling towers) take place in the direct vicinity of the cooling towers in the Project Area. In addition, the impact of the cooling towers on the environment is found to decrease sharply with the distance from the cooling towers.

A major factor that may expose the area around the cooling towers to the effects of the water vapour emitted by the cooling towers is the direction and velocity of wind which carries the vapour plume. This results in relatively small areas where this effect can be significantly stronger than in other areas situated at the same distance from the cooling towers. The visibility of vapour plumes emitted from the cooling towers (their length and frequency of observation) has only aesthetic values, and the calculations conducted show that, in both site variants, the plumes shading the Baltic Sea area have a larger share, and their effect on the local climate and microclimate is insignificant.

The deposition of salt around the cooling towers has no effect on the local climate and microclimate. Potentially, it could affect salinity of soils. However, our modelling shows that for the Żarnowiec site deposition of salt on land would be mainly in spring and summer, and in the Lubiatowo - Kopalino site – in summer, and this applies to small surface area of land. Potential effects of deposition of salt would be mitigated by leaching due to atmospheric precipitation.

For the shading and the related modification of solar radiation balance and the quantity of solar energy absorbed in the environment, the effect on the local climate and microclimate is insignificant. The effect of shading is also negligible, even for the most exposed areas closest to the Project site. At the Lubiatowo - Kopalino site, the plume shading the Baltic Sea area are found to have much larger share. Consequently, the shading caused by emission of the water vapour from cooling towers would not affect local climate and microclimate in the entire Site Region.

The change of land use has secondary importance, although it would affect a relatively large number of meteorological parameters (air temperature, wind direction and speed, evapotranspiration, atmospheric precipitation). Interpretation of changes of average values for each of the meteorological parameters measured in the Project Area relative to the surrounding area shows a similar spatial distribution for each phase of the Project. However, the most visible changes are more concentrated in the area of high-density building facilities on the site. Changes to metrological parameters that are most unfavourable for the environment are due to the development of a heat island in the Project Area site (primarily at summer nights). This can result in a (local) rise in temperature. For the environment, it can result in disturbances in plant vegetation, shorter periods of snow cover, and disturbances in local air circulation. However, these changes would be limited to the NPP site, and the forecast intensity of the heat island would not be high.

Construction of any project of strategic importance requires that environmental conditions be assessed for the region where the project is to be situated. A major item of the environment subject to assessment are meteorological and climate conditions. Therefore, using the guidelines of the International Atomic Energy Agency, extreme weather events, including extreme values of meteorological parameters, occurrence of extreme meteorological phenomena, and extremely rare meteorological phenomena in the area of the Project site were analysed. The modelling also determined their likelihood. For a facility such as the NPP, these include likelihood of occurrence once per 100 years and once per 10,000 years. The modelling outcomes would be taken into account at the stage of preparation of the building permit design, when selecting measures of adaptation to climate changes.

The analysis was complemented with a projection of climate changes under climate scenarios developed by the Intergovernmental Panel on Climate Change in: RCP 4.5 – reasonable and moderate scenario, and RCP 8.5 – pessimistic scenario. Then, there was an exercise to link it to the calculated values of particular meteorological elements. Climate change scenarios (RCP 4.5 and RCP 8.5) available as part of the project entitled, "Baza wiedzy o zmianach klimatu i adaptacji do ich skutków oraz kanałów jej upowszechniania w kontekście zwiększania odporności gospodarki, środowiska i społeczeństwa na zmiany klimatu oraz przeciwdziałania i minimalizowania skutków nadzwyczajnych zagrożeń” [*Database on climate changes and adaptation to its effects and the channels of its dissemination in the context of improved resilience of the economy, environment and society to climate change, and prevention and mitigation of the consequences of extraordinary threats*] (KLIMADA), in principle confirm the trend based on observational data, and the calculated probabilities of frequency in 100 years demonstrate the values of extreme phenomena similar to those established for climate change scenarios (for the components, for which such scenarios were established). A significant conclusion is that, in almost all cases, the meteorological station in Łeba (coastal station) was characterised by the influence of a large body of water. The climate of that location, defined by the analysis of extreme phenomena, was milder and free from strong contrasts.

VI.4.4 Impacts related to changes in geological structures

VI.4.4.1 Variant 1 - Lubiatowo - Kopalino site

Construction phase

Development stage

Regardless of the Sub-variant, works conducted at the Project development stage would consist in the development of the construction site, including: forest clearing and grubbing-up, stripping of the topsoil layer, dismantling or transfer of the existing technical infrastructure (for example, ICT cables, power cables), development of infrastructural network (electrical installations, water and sewerage installations, telecommunications and teletechnical installations), construction of internal roads, temporary yards, parking lots and helipad, construction of a temporary drainage system for the construction site (yards, roads, parking lots and excavations) with water reservoirs, treatment and pumping system, construction of fire protection facilities and system, and land levelling.

These works would change the soil profile, transform the near-surface geological layers or transform the landscape features that are permanent but local, such as dunes.

Construction stage

At the construction stage, the following works would be conducted that can affect geological structures: fills (up to 9.5m AMSL), excavations (up to 20m below the target ground ordinate), and drainage of the site.

The facilities of the Nuclear Power Plant and its auxiliary facilities would be supported on foundations 1.0 to 20 m below the target ground level, supported by foundation piles 10-20m long where needed. Depending on the adopted foundation technology, and ground and water conditions found at the site, soil under engineering structures might be replaced.

Foundation works would disturb the continuity of geological layers, which could lead to local changes in the direction of flow of groundwater, and would modify its depth. Construction site drainage, excavations, fills and engineering structures may result in changes to the features and properties of the ground within the range of the works, for example replacement of high load bearing capacity soil with low bearing capacity soil. Construction works may trigger or exacerbate unfavourable geological phenomena (e.g. landslides).

In the marine area, channels/pipelines of cooling water or channels/pipelines of make-up water would be laid at approximately 3m below the average dune slack, and would be 1.5km to 6.7km long. The construction of channels/pipelines would disturb the setup of sediments on the seabed and in geological layers (up to the depth of laying). However, interference with the seabed would bring only temporary and local changes to the transport of sediments (change in erosion and accumulation processes).

Construction works would be designed in such a way as to minimise changes to geological structures, and to ensure that any changes are only local, and do not affect the safety of the nuclear facility and the areas adjacent to the Project Area.

Commissioning stage

At the commissioning stage for Units 1, 2 and 3, the effect on changes in geological structures is the same as in the Project operational phase.

Operational phase

In the operational phase of the Project, the completed engineering structures would result in changes to geological structures. The load of engineering structures affects the ground, causing settling, which could also occur due to lower groundwater table, for example due to drainage facilities. The use of the structure would affect the geological substrate (for example, by vibrations from equipment), as well as by groundwater whose natural flow patterns can be disturbed by the foundations, which might lead to its accumulation around the foundations in a longer term. These phenomena can lead to local changes to ground properties, which would be accounted for in the design of foundations for the structures.

Structures situated on the seabed (for the intake and discharge of cooling/make-up water) might disturb local movement of sediments. The intensity of this would depend mainly on the size of the obstacle, and the intensity of movement of the load on the seabed. However, this is assumed to have a negligible effect on the geological structure of the seabed.

Decommissioning phase of the Project

Regardless of a sub-variant, the Power Plant would be decommissioned after approximately 70 years at the earliest, taking into account the construction and operational phases of the Project. The impact on geological structures in the decommissioning phase of the Project would be similar as at the construction stage. Upon the completion of the decommissioning, the former NPP site would be restored to the conditions similar to those existing before the commencement of the construction.

VI.4.4.2 Variant 2 — Żarnowiec site

Construction phase

Development stage

Regardless of a sub-variant, the Project development stage would involve works similar to those for Variant 1 – Lubiatowo - Kopalino site.

In Variant 2 – Żarnowiec site, dismantling works would be performed. All structures erected during the abandoned construction of nuclear power plant in Żarnowiec and the current infrastructure of the “Pomeranian Special Economic Zone” are designed to be decommissioned.

The demolition works would involve various activities affecting geological structures, including: removal of the existing foundations, dismantling of the above- and below-ground infrastructures, excavations and backfilling, and drainage. These works can result in changed ground and water conditions, but their extent would be limited to the necessary minimum.

Construction stage

At the construction stage, the following works would be conducted: fills (up to 9.0m AMSL), excavations (up to 20m below the target ground ordinate), and drainage of the site.

The facilities of the Nuclear Power Plant and its auxiliary facilities would be supported on foundations 1 to 20m below the target ground level, supported by foundation piles 10-20m long where needed. Depending on the adopted foundation technology, and ground and water conditions found at the site, soil under engineering structures might be replaced.

In the marine area, channels/pipelines of make-up water would be laid at approximately 3m below the average dune slack and would be 1.5km to 2.5km long. Due to the fact that the main facilities of the Nuclear Power Plant are approximately 10km away from the coastline, the pipelines of make-up water would be laid along the service road intended for oversized transports, in trenches (up to 3m below the ground level) or fills (up to 5m above the ground level). Near to the shore, a make-up water pumping station would be built on a fill whose surface would be approximately 5m AMSL.

The impact of construction works would be similar as for Variant 1 – Lubiatowo - Kopalino site. One major difference is the fact that the slopes of the Plateau in the Lake Żarnowieckie area are susceptible to mass movements, hence a modification of ground and water regime might lead, in extreme cases, to landslides, which would be accounted for at the facility foundation design stage.

Commissioning stage

At the commissioning stage for Units 1, 2 and 3, the effect on geological structures would be similar as in the Project operational phase.

Operational phase

At the operational stage of the Project, geological structures can be affected by the already existing facilities. Regardless of the variant and sub-variant, changes in geological structures at the operational stage of the Project are the same – a description is provided in the part for Variant 1 – Lubiatowo - Kopalino site.

Decommissioning phase

The time, method, conditions, requirements, purposes of decommissioning are common for each of the described site variants. Description for Variant 1 — Lubiatowo - Kopalino site is, therefore, wholly the same as for Variant 2 – Żarnowiec site.

VI.4.5 Vibration impacts

This chapter presents potential impacts from mechanical vibrations which might arise as a result of the Project implementation. In addition, sources of vibrations related to the Associated Infrastructure are also discussed.

VI.4.5.1 Methodology

To assess vibration impacts, the following activities were completed:

- verification of the presence of environmental components sensitive to impacts (in the NPP impact area), determination of their sensitivity to impacts and relationships between them,
- development of the NPP technical envelope – technical concept involving a set of maximum and minimum parameters of various components of the Project,
- identification of the sources of emissions and disturbances that can be caused by the NPP, and verification of Project parameters affecting the occurrence and scale of impacts in identified environmental conditions,
- analysis of potential scale of NPP impacts, and verification of whether impacts on particular environmental components can exceed the level of significance, under various contemplated sub-variants:
  - for individual impacts of various components of the Project,
  - for cumulative impacts throughout the Project,
  - for cumulative impacts together with other plans or projects,
- analysis of available minimisation methods and their effect on the impact magnitude reduction.

The effects of noise and vibration were assessed based on Polish legal requirements, EU Directives and standards (used for assessing vibration impacts).

Forecasting vibrations is particularly difficult due to high uncertainty related to vibrations originating from the source and propagated through the ground to the receptor. Forecasts of railway vibrations will be prepared under a separate procedure of environmental impact assessment for the contemplated new railway.

Forecast propagation of vibrations related to piling is affected by, among others: ground conditions or the acquaintance with building design, which are not yet completely recognised at this stage. Detailed information to enable detailed modelling of the Project will be known only at the stage of building permit design.

Vibration impact assessment was conducted based on qualification criteria for various types of measures, and the number of the real estate exposed.

The areas identified as having potential for high vibration impacts will be considered as part of examination of the condition of real estate and/or monitoring of vibrations in order to identify the actual level of vibration impacts.

VI.4.5.2 Assessment of the Project vibration impacts

Construction phase

At the **development stage** for the Project, no receptor susceptible to vibrations was identified for any of the considered sub-variants (1A, 1B, 1C) of Variant 1 Lubiatowo – Kopalino site, or sub-variants (2A, 2B) of Variant 2 – Żarnowiec site, using the qualification criteria for soil compaction or spalling of concrete/reinforced-concrete structures (distance of 50m was adopted) in the Project Area.

At the Project **construction stage**, taking into account the qualification criteria (for soil compaction, the qualification distance is 50m, for piling it is 100m, for railway traffic it is 200m from the boundary of the railway corridor), the main source of vibrations that can result in impacts is impact pile driving for the construction of the railway and 400 kV lines for associated infrastructure, and then railway (cargo) traffic related to transportation of construction materials for the NPP implementation purposes. These linear facilities were qualified to further analyses due to their location.

For each sub-variant considered here (1A, 1B, 1C) of Variant 1 – Lubiatowo – Kopalino site, for the receptors of moderate sensitivity to vibrations from railway traffic, the intensity of impacts in the Lębork poviat is high in most cases, whereas in the Wejherowo poviat it is usually medium. It means that for residential buildings in the Lębork poviat, a larger number of monitoring and real estate surveys might be required. For the receptors of high sensitivity to vibrations from railway traffic where the intensity of impacts is high, the three identified receptors are hospitals – two in the Wejherowo poviat and one in the Lębork poviat. The vibrations caused by piling for the purpose of the construction of the 400 kV line may potentially affect three receptors: two in the Lębork poviat and one in the Wejherowo poviat, therefore the intensity of impacts is low.

For each sub-variant considered here (2A, 2B) of Variant 2 – Żarnowiec site, for the receptors of moderate sensitivity to vibrations from railway traffic, the intensity of impacts in the Lębork poviat is high in most cases, whereas in the Wejherowo Powiat – it is medium. For this reason, for residential buildings in the Lębork poviat, a larger number of monitoring and real estate surveys might be required. For the receptors of high sensitivity to vibrations from railway traffic where the intensity of impacts is high, the three identified receptors are hospitals – two in the Wejherowo poviat and one in the Lębork poviat.

Additional measures identified as causing potential impacts include impact pile driving in the construction of the 400 kV line, and the construction of pumping station on the coastline (Subarea 3). However, if shielding is applied for those two activities, no receptors sensitive to vibrations and subject to impacts have been identified.

At the Project **commissioning stage**, taking into account qualification criteria, no additional activities (in addition to those which are applied at the construction stage) have been identified in any of the site variants considered, that would result in vibrations that could have an effect on the receptors sensitive to vibrations.

Operational phase

The main source of vibrations in the NPP operational phase are devices with rotating elements (such as fans, pumps, and turbines) which might potentially result in perceptible vibrations. To ensure their safe and efficient operation, vibrations of those devices should be reduced to the minimum at the design stage and the commissioning stage, and on a continuous basis during operation by monitoring their condition and maintenance. Due to a large distance between machines with rotating parts and susceptible receptors, these impacts are considered to be negligible.

Therefore, in the operational phase, in each of the site variants and sub-variants considered (1A, 1B, 1C, 2A and 2B), impacts are reduced to the traffic of passenger and cargo trains. The related vibrations are not caused by activities in the Project Area.

Decommissioning phase

In the Project decommissioning phase, in each site variant considered here, the sources of vibration are assumed to be demolition works as well as traffic of people and goods, but the related impacts and effects will be subject to a separate procedure of environmental impact assessment. As for today, it is difficult to anticipate what technology will be applied in the process of dismantling construction facilities, however, taking into account the constant development of technology, impacts of vibrations on the environment should not be greater than during dismantling works for Variant 2 – Żarnowiec site, conducted at the development stage of the Project.

VI.4.6 Impacts on soils and ground surface

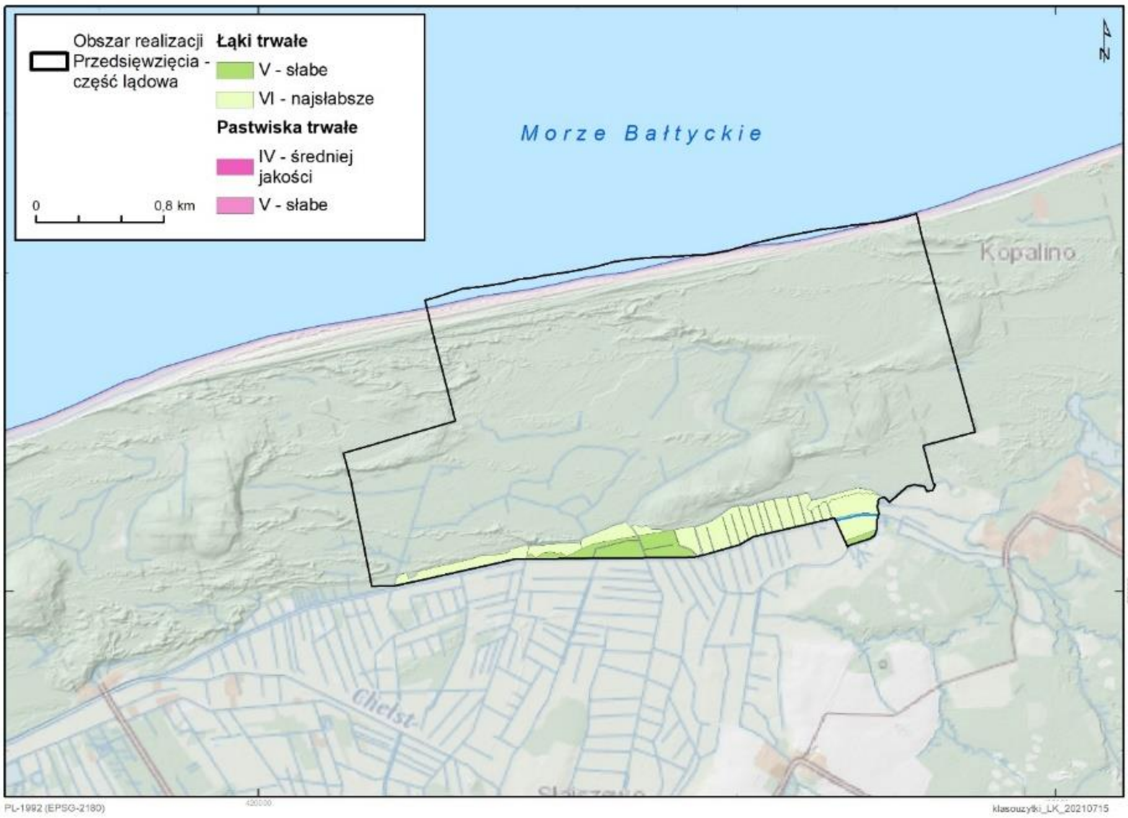
As part of analysis of the Project impacts on soils and ground surface, impacts on the management and use, and the quantity and quality of soils in the Project Area were estimated. For this purpose, changes in land management and use were analysed, as were the terrain features, especially during the development and construction works conducted. The method of waste storage, wastewater handling, and the effect of potential sources of contamination, including the handling of chemicals under the Project, were also assessed.

VI.4.6.1 Analysis of changes in land management and use

Development works are to prepare the site for the construction of nuclear power facilities, therefore, the use of land would change at this stage already. The target land management manner, category – built-up and urban areas, is assumed to be permanent.

In Variant 1 – Lubiatowo – Kopalino site (in all Sub-variants: 1A, 1B, 1C) upon clearing trees and shrubs and transformation of agricultural and forest lands, the land necessary for the completion of the Project would be turned to built-up and urban areas. Consequently, the Project would change the existing use of land to industrial function.

Taking into account the classification of agricultural land quality, in the Project Area there are only bad and medium quality soils (classes IV, V and VI out of six quality classes), which is presented in the figure [Figure VI.4.6 - 1]. As regards the soils covered by soil quality classification, the largest share have the least fertile permanent meadows and less fertile permanent meadows. Therefore, the loss of the above-mentioned agricultural land would not be significant.



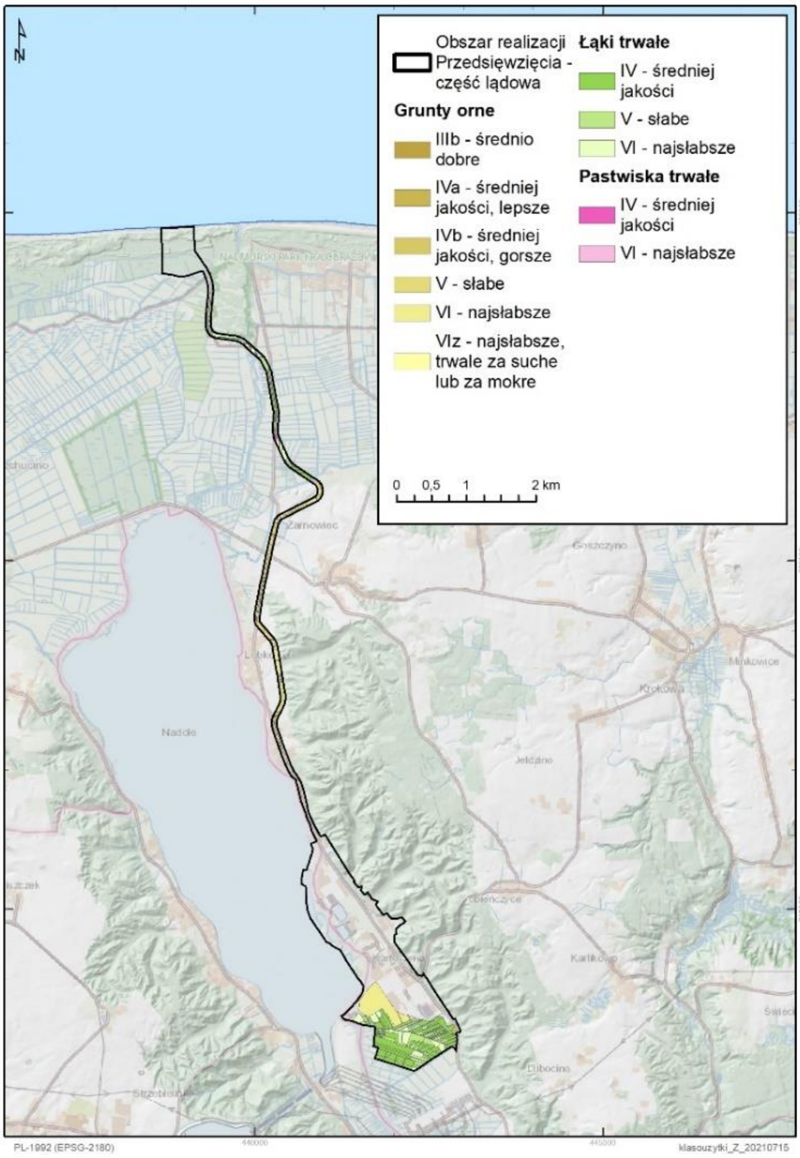
Obszar realizacji Przedsięwzięcia -część lądowa	Project Area - land part
Łąki trwałe	Permanent meadows
V - słabe	V - weak
VI - najsłabsze	VI - the weakest
Pastwiska trwałe	Permanent pastures
IV - średniej jakości	IV - medium quality
V - słabe	V - weak

Figure VI.4.6 - 1 Quality classification of agricultural land inside the Project Area in its land part. Variant 1 — Lubiatowo - Kopalino site

Source: In-house study on the basis of the data from the Land and Building Register provided by the poviat authorities for Wejherowo

On the other hand, in Variant 2 – Żarnowiec site (in all of its sub-variants: 2A and 2B), the Project would largely not change the existing function and industrial nature of the development, as the Project is situated in the Pomeranian Special Economic Zone (PSEZ) Żarnowiec. The land part of the Project Area consists of built-up and urban land, agricultural land and forest land (approximately 47%, 36% and 15% of its area, respectively), the rest is miscellaneous land and land under water.

Taking into account the classification of agricultural land quality, in Subarea 1 of the project Area there are only soils with quality classes IV, V and VI (that is, bad and medium quality) out of six soil quality classes, which is presented in the figure [Figure VI.4.6 - 2]. The largest share of the land covered by the agricultural quality classification are permanent meadows (of medium, bad and the worst quality) and the worst arable land. Similarly, in Subareas 2, 3 and 4 there is only land of quality class IIIb, IV, V and VI, whereas class IIIb constitutes only 0.2% of the land included in soil quality classification in all three Subareas. The largest shares have the following (in a descending order): bad arable land, permanent meadows of medium and bad quality, and the worst arable land.



Obszar realizacji Przedsięwzięcia -część lądowa	Project Area - land part
Grunty orne	Arable land
IIIb - średnio dobre	IIIb - medium good
IVa - średniej jakości, lepsze	IVa - medium quality, better
IVb - średniej jakości, gorsze	IVb - medium quality, worse
V - słabe	V - weak
VI - najsłabsze	VI - the weakest
Vlz - najsłabsze, trwale za suche lub za mokre	Vlz - the weakest, permanently too dry or too wet
Łąki trwałe	Permanent meadows
IV - średniej jakości	IV - medium quality
Pastwiska trwałe	Permanent pasture
IV - średniej jakości	IV - medium quality
VI - najsłabsze	VI - the weakest

Figure VI.4.6 - 2 Quality classification of agricultural land inside the Project Area in its land part. Variant 2 — Żarnowiec site

Source: In-house study on the basis of the data from the Land and Building Register provided by the poviat authorities for Puck and Wejherowo

VI.4.6.2 Assessment of the Project impacts on soils

Project impacts on soils were analysed in terms of the effect of adaptation of land topography to the design requirements of the Project, the manner of waste storage, method of handling wastewater, and the effect of potential sources of contamination, including chemicals handling methods.

Construction phase

At the stage of Project development, the process of physical degradation (transformation) of soil would begin, consisting in a change of land relief and forms. Changes in the land surface would be due to, primarily: removal of trees and shrubs, soil levelling, storage of soil masses, development of the construction site facilities, adaptation of land to concrete batching plants with technical infrastructure, excavations for the buildings of the reactors and other structures, as well as structural fill under the nuclear island facilities, and for Variant 2 – Żarnowiec site, also due to dismantling and demolition of the existing facilities and infrastructure in the area of the abandoned construction of the nuclear power plant in Żarnowiec. They would result in a modified structure of particular soil levels and a sequence of those levels that would stretch to the boundary of the Project Area. It would result in the process of a physical degradation (transformation) of soil, consisting in a change of land relief and forms. It would be an irreversible change due to the long-term process of soil formation. Consequently, an important aspect will be to ensure the storage of the topsoil and its reuse for green areas.

The estimates show that the development and construction stages in the Project Area would bring a positive balance of cut and fill (Variant 1), which means that new allocation should be found for excess excavated material (soil, sand). On the other hand, the total balance of cut and fill for Variant 2 would be negative, which means that various construction aggregate materials would need to be brought in to the Project Area. Based on the conducted soil and ground quality examinations, it is highly likely that the excavated soil will not be contaminated and its use for the formation of the surface would be easier, provided that its consistency with design requirements. Uncontaminated soil excavated during construction works and used for construction purposes will not be waste.

Storage of waste is arranged in such a way as to preclude its spread by minimising the effect of atmospheric factors (temperature, precipitation). Hazardous waste would be stored in sealed containers, and the equipment and agents for the removal of the consequences of any leakage will be provided in the places of storage. Thus, waste management should not result in adverse impacts on soils.

The management of wastewater generated in the construction phase in both site variants would be arranged in such a way as to mitigate the risk of impacts on the environment, including soils. Ultimately, domestic and process effluent from the construction site would be transferred to a newly established sewage treatment works.

Another important aspect in the context of impacts on soils is a potential contamination from leaking fuel containers of construction machinery and equipment, and vehicles moving in the Project Area. Maintenance of equipment and machinery in good state of repair and prevention of incidents involving leaks of liquids/hazardous substances is assumed to be standard practice. Parking lots would be equipped with stormwater drainage system that collects precipitation water and potential pollutants. In addition, the area of storage of hazardous substances would be paved, equipped with drainage system and kits for immediate removal of consequences of potential leaks. This also applies to the filling station for refuelling vehicles, machinery and equipment. Thus, the risk of adverse effects on soils would be limited to the minimum.

In conclusion, all preliminary design solutions for the Project regarding water and wastewater management, waste and chemicals management in all site variants, as well as the control of potential and unintended leaks of hazardous substances mitigate the risk of adverse impacts on soils and earth.

Operational phase

For both site variants, physical degradation of soil, consisting in a change of the land relief, would have ceased in the operational phase. The Project Area would have been already built-up, developed and structured. Throughout all the years of the Project operation, the soil would constitute the substrate for engineering structures. At the same time, the method of handling all types of wastewater and waste management would ensure that Project operation would not result in impacts on soils. Places particularly exposed to soil contamination (storehouses of chemicals, parking lots, containers for heating or fuel oil) would be paved, some of them even equipped with tight safety trays, thus limiting the risk of soil contamination.

Decommissioning phase

For both site variants, the final use of land in the terminal phase of decommissioning of the Project and the target topography in the terminal phase of decommissioning of the Project would be adapted to the general pattern of soil reclamation and strategy of NPP decommissioning, and the anticipated use of the nuclear site upon decommissioning. No impacts on soils are foreseen upon the completion of the decommissioning phase.

VI.4.7 Impacts on groundwater

The groundwater environment in the Project Areas considered here is particularly exposed to potential adverse impacts of the Project. Due to hydrogeological conditions and the exposure of groundwater to contamination, it should be protected against adverse effects of the proposed Project. The level of exposure of groundwater of the first aquifer level (FAL) to potential contamination is very high and high for both site variants. It means that the first aquifer level from the land surface does not have natural confinement in the form of layers with low hydraulic conductivity. Each stage of the Project (regardless of Variant or site) would involve potential adverse impacts on ground waters. These include development, construction or demolition works, and in particular any drainage. Transformation of land relief, digging for deep foundations, piling and drainage might lead to a modification of hydrogeological conditions in the Project Area. These works can have an adverse effect on both the quantity and quality of groundwater. Therefore, all possible remediation measures should be taken during these works to limit adverse impacts to the necessary minimum. All works should be conducted in a robust and correct manner, in compliance with the applicable standards, legislation and industry guidelines. The concrete mixes used for the construction of foundations must be made of materials resistant to the activity of groundwater that do not come into chemical reactions with groundwater.

Variant 1 — Lubiatowo - Kopalino site

Modelling conducted with dedicated software (Groundwater Vistas) for the Lubiatowo - Kopalino site, with predefined assumptions, shows that the largest impacts on groundwater of the first aquifer level would be in the area of the excavations (for layer QI), and the maximum surface area of the depression cone would be approximately 500m x 900m (in layer QII). Drainage would not result in salty seawaters infiltrating the terrestrial area.

No adverse impacts on the Main Groundwater Basins are anticipated at this stage of works. The boundary of Main Groundwater Basin No. 108 “Zbiornik międzymorenowy Salino” is approximately 5.6km away from the area where the contemplated works would take place.

The development and construction works would be confined to the Project Area. In that area, there are no existing wells intended for drawing groundwater on which the construction works would have an impact.

No significant impacts from the Project on environmental objectives are anticipated for Groundwater Bodies (GWBs). For all three GWBs (no. 11, 12 and 13), environmental objectives under the Water Management Plan in the Vistula River basin area consist in achieving a good chemical condition accompanied by satisfactory quantities. These objectives are not at risk in any phase of the Project, and any adverse impacts that could bring about changes within the GWBs would be limited to the necessary minimum by applying appropriate technologies (e.g. diaphragm walls, jet grouting, etc.).

Any wastewater and solid waste, both conventional and containing radioactive substances, would not harm the groundwater environment. The same applies to chemicals stored at the NPP and used in the process of power generation.

Variant 2 - Żarnowiec site

Modelling conducted with dedicated software (Groundwater Vistas) for Variant 2 – Żarnowiec site, with specific assumptions, shows that the depression cone caused by the drainage of construction excavations under reactors would have a significant size, despite applying technical measures such as anti-filtration vertical diaphragms founded in the upper surface of the first low hydraulic conductivity layer. Drainage would impact on all identified groundwater layers due to the presence of hydrogeological windows in the area. The inflow of groundwater to the drainage system would be significant and reach approximately 7,288 $m^3/d \approx 304$ m^3/h. In addition, drainage for Reactor 3 would result in an inflow of surface water from Lake Żarnowieckie.

The site under Variant 2 (mainly Subarea 1) is completely confined within the boundaries of the Main Groundwater Basin (GZWP) 109 – Dolina Kopalna Żarnowiec. Drainage of excavations can be equivalent to temporary exploitation of reservoir water at a rate of approximately 4,020 to 7,288 m^3/d (depending on the contemplated drainage technology), which would lower the groundwater table. Given that the forced inflow to the excavations would be also determined by the water seeping from Lake Żarnowieckie, one can indicate that the drainage of the excavation would draw approximately 18-30% of the available resources of GZWP No. 109.

No adverse impacts from the Project are expected for the operation of intakes of groundwater situated close to the area of works. Only in Lubkowo, about 1.1km to the north-west from the boundary of the Project Area, directly at the route of the channels of make-up water for the NPP cooling system (Variant 2), there are two wells unused for many years now, at the premises of the Nursing Home; these wells would need to be decommissioned.

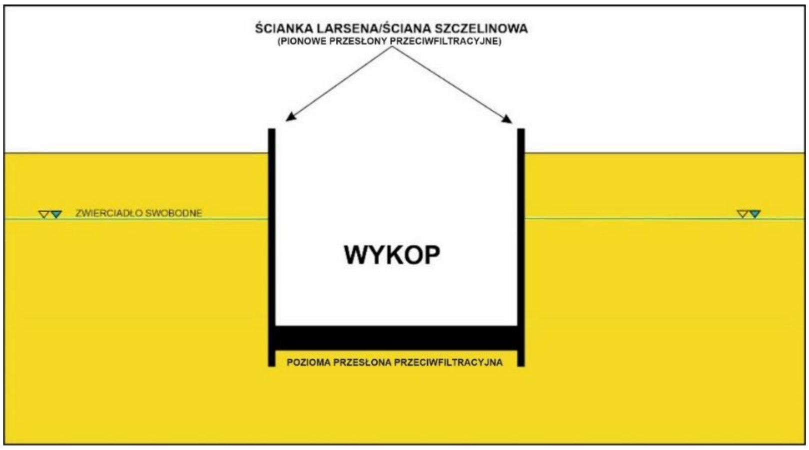
No significant Project impact is expected for the environmental objectives of GWB No. 13 where the Project would be located. Under the “Water management plan for the Vistula River basin”, the environmental objectives are to achieve good chemical and quantitative status. In no phase of the Project would these objectives be threatened, and any adverse impacts on the GWB would be limited to the necessary minimum by using appropriate technologies, such as for Variant 1.

Any wastewater and solid waste, both conventional and containing radioactive substances, would not harm the soil and water environment. The same applies to chemicals stored at the NPP and used in the process of power generation.

Considering the above, it should be emphasised that drainage of construction excavations under Variant 1 – Lubiatowo - Kopalino site might prove to be both easier in engineering terms and more cost effective. It would also bring less impact on groundwater. The geological construction of the area makes it possible to execute diaphragm walls and found them in a low hydraulic conductivity layer. Thus, the inflow of groundwater to the excavations would be small.

The situation is different in Variant 2 – Żarnowiec site. There is no thick and shallow low hydraulic conductivity layer there. Cutting off groundwater inflow using sheet piling may prove to be difficult in engineering terms due to the depth of the low hydraulic conductivity layer that could provide a natural barrier to the inflowing groundwater. In such case, sheet piling up to the depth of approximately 70 – 80m below ground level should be made, which is technically possible, but very expensive.

The best engineering solution to be applied when making deep excavations in both contemplated site variants would be to use vertical diaphragms (diaphragm walls) and make a horizontal anti-filtration diaphragm under the bottom of the pit [Figure VI.4.7- 1]. By this, the pit would be completely isolated from the inflowing groundwater, and the impact would be restricted to the cubic capacity of the pit. Thus, the choice of the preferred Variant in terms of groundwater would be determined by the choice of technology of construction and drainage methods.



ŚCIANKA LARSENA/ŚCIANA SZCZELINOWA	LARSSEN SHEET PILING/DIAPHRAGM WALL
(PIONOWE PRZESŁONY PRZECIWFILTRACYJNE)	(VERTICAL ANTI-FILTRATION BARRIERS)
ŹWIERCIADŁO SWOBODNE	FREE WATER TABLE
WYKOP	EXCAVATION
POZIOMA PRZESŁONA PRZECIWFILTRACYJNA	VERTICAL ANTI-FILTRATION BARRIER

Figure VI.4.7- 1 Schematic view of how to cut off groundwater inflows to the excavation pit
Source: In-house study

Prior to executing deep excavations, their locations would be additionally surveyed (for example, geological drilling, probing), to identify detailed geological and hydrogeological conditions. Thus, the technology of excavations and pit drainage would be determined in the building permit design. Any impacts of the proposed construction works on the ground and water environment – in this case – the groundwater, would be limited to the strict minimum.

The only potential water contamination can occur in the event of a major accident. All installations at the NPP would be executed correctly and meet high environmental protection standards, thus no contamination of the groundwater environment would take place at normal operation.

VI.4.8 Impacts on surface waters

VI.4.8.1 Impacts on surface inland water

This chapter presents the assessment of potential impacts on inland water environment – flowing and standing bodies of water in connection with the implementation of the Project planned.

For significant impacts identified at particular phases and stages of the Project for which mitigation measures would be required (avoidance, minimisation, compensation), to meet the limits that are sanctioned, where appropriate, by legislation, their kinds, types are presented, as are the possibilities of application and feasibility assessment.

Transitional areas which are specific for the hydrogeological model, such as saturation zone, are also addressed in this chapter, due to the methodological requirements used for quantitative analysis of the assessment of Project impacts on hydrologic regime as an indicator of quality for hydromorphological elements.

The scope of assessment of the impacts from the proposed Project on the environment of inland surface waters is defined by:

- provisions of the Water Law Act, and
- provisions of Article 68 of the EIA Act,
- specific requirements in this scope are in GDOŚ Decision of 25 May 2016.

This assessment takes into account the provisions of II PGW/II (Water Management Plan) in accordance with Regulation of the Council of Ministers of 18 October 2016 on the Vistula River Basin Management Plan and the provisions, where appropriate (more conservative) of II aPGW.

Elements subject to this assessment are:

- physical and chemical elements,
- hydrologic elements (regime, continuity, morphology),
- biological elements.

Purpose of the assessment of impacts on inland flowing and standing surface waters in connection with the proposed Project on the status of waters.

The purpose of the impact assessment conducted in this chapter is to:

- identify the receptors situated in the zone of potential impacts of the proposed Project related to the scope of this assessment, exposed to changes in status due to modification of the magnitude and speed of flows, quality of physical and chemical indices, environmental quality standards, and biotic components,
- present the magnitude (significance) of the expected future change relative to the existing status, of the water status in terms of basic characteristics that determine the quality status/qualification status, taking into account the components of the proposed Project, in particular execution phases,
- assess impacts in all Project execution phases on the identified biological, hydrological, physical, chemical and morphological receptors,
- present a list of contemplated mitigation measures, verified in terms of feasibility and cost effectiveness, necessary to protect the identified vulnerable receptors,
- assess residual impacts, where appropriate, with a list of recommended further steps as necessary prerequisites for the Project if implemented – possible necessity to apply for derogation under Article 68(1) to (4) of the Water Law Act.

VI.4.8.1.1 Methodology of the assessment of impacts on inland surface waters

The methodology of the assessment of impacts on inland surface waters applied in this chapter is a modified procedure for WFD conformity assessment

The modification mentioned above applies to (1) conducting environmental physical studies to collect information on its status, (2) application of numerical tools already at the screening stage, and (3) in-depth analysis in step three, conducted with deep learning models to transform expert assessment into numerical values.

The outcomes allow us to answer the following questions:

- how significant the impacts are, and
- what scope of mitigation measures should be used.

A part of the modified methodology is to use a scaling procedure to determine the significance of impacts – determination of the magnitude and significance of impacts in accordance with the requirements of EIA Act (Article 66(1)(8)) and industry guidance in this regard.

Methodology of the assessment of impacts on inland surface waters in terms of EIA Act requirements

The basic assumptions made in conducting the Project environmental impact assessment are as follows:

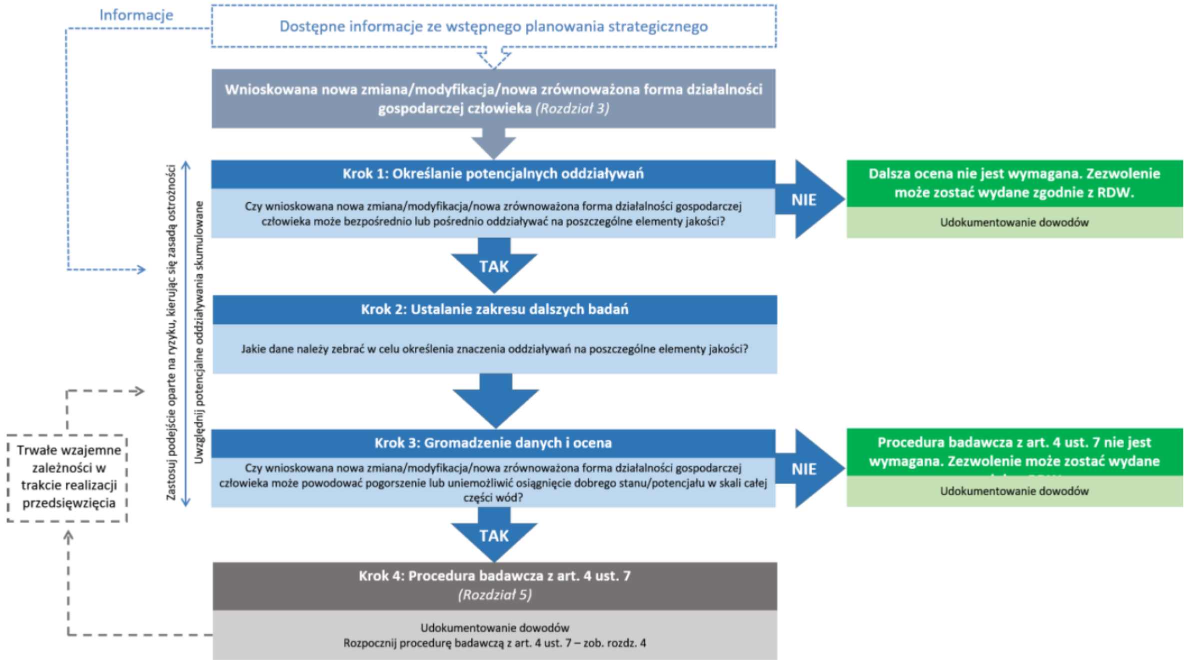
- Impact zone/Area scope of impacts;
- Vulnerability of a receptor/Importance of a receptor.

Methodology of the assessment of impacts on inland surface waters with regard to the Water Law Act and EIA Act requirements

Methodology of the assessment of impacts on inland surface waters with regard to the Water Law Act requirements

The assessment of impacts of the proposed Project on the components covered by the Water Framework Directive and the Water Law Act was based on a modified conformity assessment. The modification consisted in taking into account direct requirements of the surface waters assessment procedure, and broader aspects, such as interpretation divergences across particular regulations, and their interpretation and the prevailing approach used in the consulting industry.

The WFD conformity assessment applied in this assessment is a two-stage process including the qualification stage – called “applicability assessment” and in-depth analysis stage – called “test procedure” [Figure VI.4.8- 1].



Informacje	Information
Dostępne informacje ze wstępnego planowania strategicznego	Available information from initial strategic planning
Wnioskowana nowa zmiana/modyfikacja/nowa zrównoważona forma działalności gospodarczej człowieka (Rozdział 3)	Proposed new change/modification/new sustainable form of human economic activity (Chapter 3)
Krok 1: Określanie potencjalnych oddziaływań	Step 1: Identification of potential impacts
Czy wnioskowana nowa zmiana/modyfikacja/nowa zrównoważona forma działalności gospodarczej człowieka może bezpośrednio lub pośrednio oddziaływać na poszczególne elementy jakości?	Can the proposed new change/modification/new sustainable form of human economic activity directly or indirectly affect the individual quality elements?
TAK	YES
NIE	NO
Krok 2: Ustalanie zakresu dalszych badań	Step 2: Determination of the scope of further research
Jakie dane należy zebrać w celu określenia znaczenia oddziaływań na poszczególne elementy jakości?	What data should be collected to determine the significance of the impacts on the individual quality elements?
Krok 3: Gromadzenie danych i ocena	Step 3: Data collection and evaluation
Czy wnioskowana nowa zmiana/modyfikacja/nowa zrównoważona forma działalności gospodarczej człowieka może powodować pogorszenie lub uniemożliwić osiągnięcie dobrego stanu/potencjału w skali całej części wód?	Can the proposed new change/modification/new sustainable form of human economic activity cause deterioration or prevent the achievement of good status/potential across the body of water?

Krok 4: Procedura badawcza z art. 4 ust. 7 (Rozdział 5)	Step 4: Research procedure under Article 4(7) (Chapter 5)
Udokumentowanie dowodów Rozpocznij procedurę badawczą z art. 4 ust. 7 - zob. rozdz. 4	Evidence documentation Start the examination procedure under Article 4(7) - see Chapter 4
Procedura badawcza z art. 4 ust. 7 nie jest wymagana. Zezwolenie może zostać wydane	Research procedure under Article 4(7) is not required. The permit may be issued
Udokumentowanie dowodów	Evidence documentation
Dalsza ocena nie jest wymagana. Zezwolenie może zostać wydane zgodnie z RDW.	No further assessment is required. The permit may be issued in accordance with the WFD.
Udokumentowanie dowodów	Evidence documentation
Trwałe wzajemne zależności w trakcie realizacji przedsięwzięcia	Permanent interdependence during the implementation of the project
Zastosuj podejście oparte na ryzyku, kierując się zasadą ostrożności	Apply a risk-based approach following the precautionary principle
Uwzględnij potencjalne oddziaływania skumulowane	Consider potential cumulative impacts

Figure VI.4.8- 1 Algorithm of iterative approach to the assessment of effects on the water status as part of applicability assessment and test procedure

Source: Guidance Document no. 36 Exemptions to the Environmental Objectives according to Article 4(7) Common Implementation Strategy for the Water Framework Directive and Floods Directive,Technical Report - 2017

The initial three steps consist is determination of the impacts on the aquatic environment in the event of the application of remediation measures if found necessary to keep the water status unchanged.

If, upon the application of all available technical solutions, it is not possible to keep all the parameters on the existing level, we move to step four which consists in determination of how the parameters would deteriorate, in order to obtain derogations from the applicable laws.

VI.4.8.1.2 Identification of activities that can affect the status of water bodies as a result of the proposed Project

Determination of the range of impact

In determination of the range of impacts, all aspects, in principle related to the changes in the banks and bed, and changes in water status as assessed by quality indices set out for physical and chemical elements (in particular, includes in suspended matter, nutrients, and reduction of oxidation conditions, and the amount of oxygen dissolved in water) were taken into account.

The direct impact criterion is defined as the possibility for a project to have a physical effect, in one or all its execution phases, irrespective of the time of the impact, on the water quality indices and/or conditions of entering wastewater/discharging precipitation water into the waters.

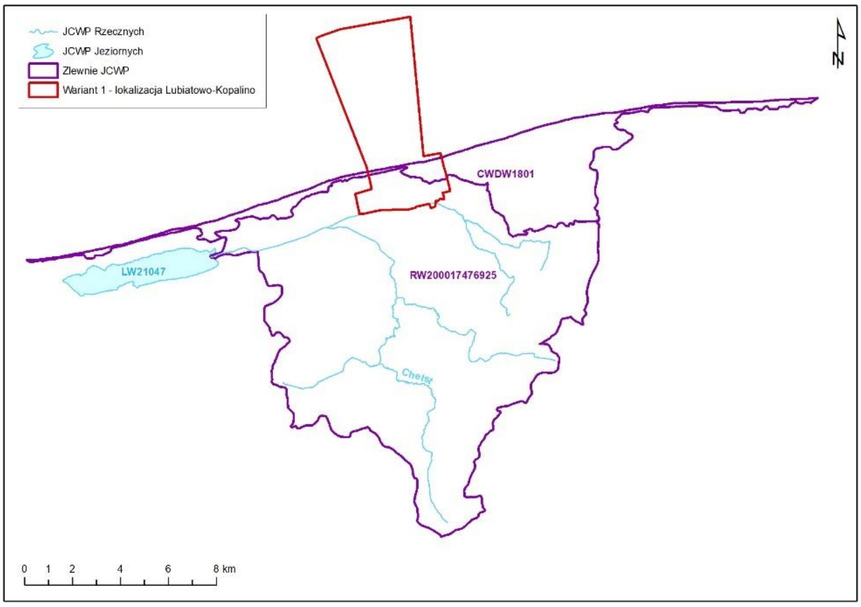
The indirect impact criterion is defined as the lack of possibility for the project to have a physical effect, in one or all its execution phases, irrespective of the time of the impact, on the water quality indices and/or conditions of entering wastewater/discharging precipitation water into the waters.

Variant 1 - Lubiatowo - Kopalino site

For the classification of surface water bodies (SWB), the land part of the Project Area is within the boundaries of the “Direct sea catchment area” and river SWB of “Chełst river to the inflow to Lake Sarbsko”. Both areas are adjacent to the coastal SWB “Jastrzębia Góra – Rowy”.

In the south-western part of Variant 1 – Lubiatowo - Kopalino site, water bodies connect with the catchment area of “the Łeba river from Lake Łebsko with the Chełst River from the inflow to Lake Sarbsko”, which also includes Lake Sarbsko.

The figure below [Figure VI.4.8- 2] presents the direct impact zone (DIZ) of the Project.



JCWP Rzecznych	River SWB
JCWP Jeziornych	Lake SWB
Zlewnie JCWP	SWB catchments
Wariant 1 - lokalizacja Lubiatowo - Kopalino	Variant 1 – Lubiatowo - Kopalino site

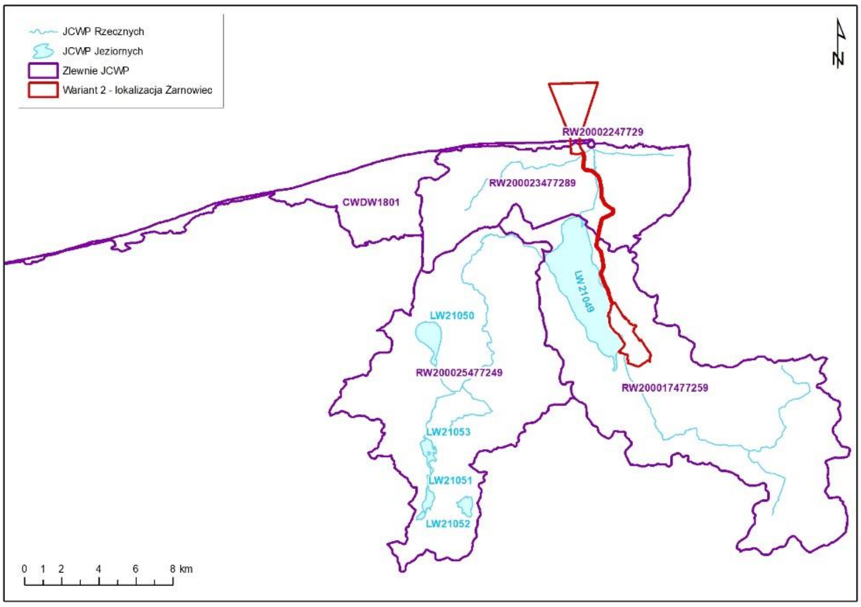
Figure VI.4.8- 2 Variant 1 – Lubiatowo - Kopalino site against the DIZ and IIZ, by river and lake SWBs

Source: In-house study

Variant 2 - Żarnowiec site

With respect to the division into SWBs, the land part of the Project Area is in principle within the “Piaśnica river upstream the outflow from Lake Żarnowieckie” and “Lake Żarnowieckie” SWBs. In addition – technical corridor includes linear sections: “Piaśnica river downstream the outflow from Lake Żarnowieckie to Białogórska Struga” and “Direct Sea Catchment Area”.

Schematic view of the site of the planned Project and the routing of linear infrastructure – technical corridor against the background of river and lake SWBs and the sea catchment area is presented in the figure below [Figure VI.4.8- 3].



JCWP Rzecznych	River SWB
JCWP Jeziornych	Lake SWB
Zlewnie JCWP	SWB catchments
Wariant 2 - lokalizacja Żarnowiec	Variant 2 — Żarnowiec site

Figure VI.4.8- 3Variant 2 – Żarnowiec site against surface water bodies
Source: In-house study

VI.4.8.1.3 Summary of measures related to the implementation of the proposed Project

As a result of the qualification process conducted - stage I or Variant 1 – Lubiatowo - Kopalino site, an absolute necessity to carry out an impact assessment due to the possibility of impacts on water quality indices in connection with the implementation of the planned Project, has been identified for the following SWBs:

- CWDW1801 Direct catchment of the Baltic Sea;
- RW200017476925 the Chełst river to the inflow into Lake Sarbsko;
- LW21047 Lake Sarbsko.

Additionally, it should be clarified that from the point of view of the parameterisation of the computational model used for the qualitative-quantitative impact assessment of the LW21047 Sarbsko status assessment, the catchment areas of the tributaries to LW21047 Sarbsko are taken into account:

- RW20002247699 the Łeba river from Lake Łebsko with the Chełst river from the inflow to Lake Sarbsko (direct catchment LW21047 Sarbsko - aPGW, and in II aPGW the direct basin of the lake belongs to the lake LW21047 Sarbsko),
- RW2000174769274 Tributary from Lake Czarne (tributary to Lake Sarbsko);
- RW2000174769276 Tributary from Łabieniec (tributary to Lake Sarbsko).

As a result of qualification process – stage I for Variant 2 – Żarnowiec site, impact assessment was conducted for the following SWBs:

- RW200017477259 The Piaśnica river upstream the outflow from Lake Żarnowieckie;
- LW21049 Lake Żarnowieckie;
- RW200023477289 The Piaśnica river downstream Lake Żarnowieckie to Białogórska Struga;
- RW20002247729 The Piaśnica river from tributary from Dębki polder to the river mouth.

In addition, for the model parametrisation and/or methodological considerations, e.g. hydraulic connections, or incorporation of adjacent catchment areas, the following surface water bodies are taken into account:

- RW200025477249 Bychowska Struga;
- LW21053 Lake Salińskie (Salino);
- LW21051 Lake Czarne;
- LW21052 Lake Dąbrze;
- LW21050 Lake Choczewskie;
- RW20001947891 The Reda river from Bolszewka to tributary from Rekowo polder;
- RW200023477324 Karwianka Channel to the tributary from Karwia polder; with the tributary from Karwia polder;
- PLRW200022477329 Karwianka Channel from tributary from Karwia polder to the river mouth;
- RW200023477342 Czarna Woda to Struga;
- RW200022477349 Czarna Woda from Struga to the river mouth.

VI.4.8.1.4 Determination of forecast effect of the proposed Project on the condition of SWBs

The principal purpose of this impact assessment is to determine the potential of impacts on the condition or ecological potential, including biological elements of water quality, in connection with the implementation of the proposed Project.

It should be emphasised that biological components of the assessment of the condition or ecological potential of surface water bodies has an overriding significance in relation to hydromorphological and physicochemical elements which are to enable the ecosystem to operate on such a level as to ensure the conditions for existence of biotic components assigned to the given class. The result of the classification of ecological status or potential is determined by the biological element that was assigned to the lowest class.

Variant 1 - Lubiatowo - Kopalino site

<u>Construction phase</u>

- Hydromorphological elements – morphological indices

The principal scope of the proposed Project is situated in RW200017476925 – the total surface area of that water body under the proposed Project is 473 ha, which is 4% of the overall occupancy of the SWB. The remaining 145 ha out of 619 ha of the Project Area are situated in CWDW1801, which is 5% of the overall occupancy of the SWB.

As a result of analysis conducted it was found that as regards the impact on quality indicators for the element in question, there would be no significant impacts on any water body located in the direct impact zone (DIZ).

- Hydromorphological elements - hydrological regime

The impact on the water balance was calculated using the SWAT (*Soil and Water Assessment Tool*) model. The outcomes of the modelling show that the construction of the NPP as proposed would affect the flows of inland waters in the following SWBs only: RW200017476925, CWDW1801, and LW21047.

As a result of analysis conducted it was found that as regards the impact on quality indicators for the hydrological regime, taking into account the minimum biological flow, there would be no significant impacts on any water body located in the DIZ.

- Physicochemical and chemical elements

The assessment of impacts on water quality and potential changes related to the Project was conducted for a series of selected indices mentioned in the literature as primary causes of changes with regard to the overall classification of the status of water bodies.

Although the reduction of sediments brought into the receiving waters would be 15.893 and 18.756, respectively, concentrations within class II would still not be achieved, and the impact of the Project on the indicator assessed here should be considered insignificant.

The impacts of the planned Project in terms of physicochemical elements, including synthetic and non-synthetic pollutants, will be related to an insignificant impact on inland surface waters.

With respect to the assessment of the chemical status, the impact of the Project planned on the inland surface waters in the construction phase, would not be related to the emission of the pollutants specified in Table 1 of substances particularly harmful to the aquatic environment. Consequently, the implementation of the Project would involve impacts insignificant for the water quality indices in this regard.

- Biological elements

Finally, the modelling involves the following biological quality elements:

  - Macrophyte Index for Rivers (MIR);
  - (Phytobethos) Diatom Index (IO);
  - (Macroinvertebrates) Polish Multimetric Index (MMI_PL).

Biological and physicochemical input data for the modelling are based on the results of monitoring activities.

All changes to biological indices based on artificial neural network (ANN) modelling were assessed at 30% below the reference level. Such range is clearly below the uncertainty of the reference level of the assessment of the ecological status and ecological potential defined based on the error analysis conducted by the GIOŚ in accordance with the measurement uncertainty estimation methodology for the purpose of the National Environmental Monitoring.

Given the overall uncertainty level being a natural part of any assessment system based on measurements of physical values (41%) and small changes of the indices for biological elements obtained from ANN (a computational tool), the level of uncertainty found by ANN calculations is significantly lower than that allowed by the regulatory authority (GIOŚ).

Hence, the implementation of the Project, in the construction phase under any of the proposed variants – LC1 scenario, was found not to bring with it any significant impacts on biological and related elements, including the risk of failure to achieve and/or risk of deterioration of a good condition of surface water bodies subject to the impacts.

<u>Operational phase</u>

- Hydromorphological elements – morphological indices

As a result of analysis conducted it was found that as regards the impact on quality indicators for the element in question, there would be no significant impacts on any water body located in the DIZ.

- Hydromorphological elements - hydrological regime

The impact on the water balance was calculated using the SWAT (*Soil and Water Assessment Tool*) model. The outcomes of the modelling show that the construction of the NPP as proposed would affect the flows of inland waters in the following SWBs only: RW200017476925, CWDW1801, and LW21047. Consequently, the results show that the proposed Project would not bring with it any significant impacts on the environment for all sub-variants, in terms of the magnitude and dynamics of flows – hydrologic regime.

- Physicochemical and chemical elements

The assessment of impacts on physical and chemical elements supporting the biological elements was conducted using hydrological modelling. The analysis covered the following set of indices: total suspended solids, organic N, total N, organic P, total P, $N\text{-}NO_3$, $N\text{-}NH_4$, $P\text{-}PO_4$, O_2 and petroleum hydrocarbons.

The results show that the changes involved in the implementation of the Project planned in any sub-variant 1A, 1B or 1C would not result in a changed quality class of selected indices describing the status and condition of waters. All physical and chemical changes calculated for the design status were identified as being below the quantification limit.

Consequently, the implementation of the Project would involve impacts insignificant for the water quality indices for chemical elements.

- Biological elements

Impacts of the Project were assessed using a forecasting ANN model which incorporated the following indices of the quality of biological elements:

- Macrophyte Index for Rivers (MIR);
- (Phytobethos) Diatom Index (IO);
- (Macroinvertebrates) Polish Multimetric Index (MMI_PL).

With respect to the compliance with environmental quality standards in the receiving waters, based on the elements underlying the qualification of the ecological potential, impacts for sub-variants 1A, 1B and 1C in the operational phase are found to be insignificant.

<u>Decommissioning phase</u>

In terms of types and significance of impacts, the decommissioning phase brings with it impacts similar to those of the construction phase of the Project planned.

The assumed similarity of Project phases also applies to recommended mitigation measures whose effectiveness in the construction phase also justifies their application in the decommissioning phase. The mitigation measures need to be applied at least where above-standard impacts on the indices or conditions of entering/discharging wastewater/water to the receiving waters are identified.

Variant 2 - Żarnowiec site

Similarly as for Variant 1, Variant 2 also incorporates a conservative approach, while the construction phase in Variant 2, including the development works, takes into account demolition of the remains of the unfinished construction of nuclear power plant in Żarnowiec. Particular phases of the NPP are not confined to separate time intervals. If development works are conducted in one place of the Project area, construction works might take place in another one, and operational phase might begin in still another one, at the same time.

<u>Construction phase</u>

Due to specific features of the works involved in the implementation of the Project on this site, including: works at Lake Żarnowieckie and construction of a technical corridor (service road, channels/pipelines of make-up water/treated wastewater, including blowdown from the cooling system), about 10km long, connecting the site with the coastline, the impacts are split into two scopes: for LW21049, and RW200017477259, RW200023477289 and CWDW1801.

- Hydromorphological elements

<u>Lake Żarnowieckie (LW21049) – morphological conditions</u>

The Project would not involve any additional points in the assessment of the hydromorphological status, therefore, it would not change the hydromorphological components in terms of changed depth and width, structure and composition of the substrate, including the structure of the coastal zone.

Lake Żarnowieckie (LW21049) – hydrologic regime

The impacts on hydromorphological elements in relation to the works performed, taking into account proposed measures to minimise impacts on morphological conditions, were found not to be significant.

River SWBs

In the course of the analysis it was established that when it comes to the impact on the hydrological regime quality indicators, taking into account the minimum biological flow, there would be no significant impact on any of the WBs located in the DIZ, the significance of which would be manifested by the possibility of a change in quality indicator of the hydromorphological element by one class – insignificant impact.

- Physicochemical and chemical elements

Lake Żarnowieckie (LW21049) – hydrologic regime

Impact on concentration of nitrogen (N) and phosphorus (P).

Short-term forecasts show that:

- Concentration of the total nitrogen at Measurement and Control Point (PPK) 3 (in the southern part of the lake) does not increase in the construction involving scenarios in comparison to Scenario "0" with low and moderate flows. For high flows (SWQ) lasting more than six days, there is a perceptible difference of almost 0.01mg total N/litre;
- At PPK 4 (northern part of the lake), the calculations indicate similar relationships, whereas for SWQ, the activities related to the Project would result in a significantly lower increase in concentration. It should be stressed at this point that inflows to the lake sustained for several days on a level equal to SWQ are rare, and the effect of such inflows in the form of increased concentrations should be considered incidental and difficult to reflect in the assessment of the SWB condition;
- Changes in total phosphorus concentrations as a result of the activities performed in the lake catchment area in connection with the construction is of the same nature as the anticipated change in nitrogen concentrations. At both measurement points (PPK 3 and 4), a change of concentration is only perceptible for SWQ flows. For PPK 3, after three days of inflows, concentration growth is estimated to be 0.00025 mg P/litre. For PPK 4, no change has been found;
- Similar magnitudes of change as described in the two foregoing items are forecast for the eastern part of the cross-section which runs latitudinally from the western boundary of the lake to its eastern boundary where that cross-section reaches the boundary of the NPP site. The concentrations of the total nitrogen and phosphorus increase due to planned activities only for SWQ flows, and the increase does not exceed 0.02 mg N/litre and 0.001 mg P/litre.

Forecasts based on annual actual hydrological and meteorological conditions in the long term in which Project impacts were analysed, with actual daily intensity of inflows to the lake (Scenario "0") and daily inflows taking into account planned changes in the patterns of use of the catchment area, show the absence of any impact of the Project on concentrations of those substances in the lake water. It means that changed topography of the shoreline and changed intensity of surface water inflows due to changed use of the catchment area would not have significant impacts on the concentrations observed in PPK 3 and 4.

Impact on electrolytic conductivity

Given that the observed conductivity (about 320 µS/cm at both PPKs) is less than a half of the value admissible for water quality class II (800 µS/cm), and changes in concentrations of dissolved substances and changes in temperature are assessed to be insignificant, the impact of the Project on electrolytic conductivity can be also considered insignificant in terms of assessment of ecological potential.

Impact on transparency

With respect to physical and chemical components, the impact of the proposed Project on lake surface waters would be insignificant.

River SWBs

With respect to physical and chemical components, including synthetic and non-synthetic pollutants, the impact of the planned Project on inland surface waters would be insignificant.

Regarding the assessment of the chemical status, no causal relationships between receptors and stressors has been found. When it comes to the impact on inland surface waters, the planned Project will not be associated with emissions of pollutants listed in Table 1 of substances particularly harmful for the aquatic environment during the construction phase – Appendix 4, Regulation of the Minister of Maritime Economy and Inland Navigation of 12 July 2019.

Consequently, the implementation of the Project would involve impacts insignificant for the water quality indices for chemical elements.

- Biological elements

Lake Żarnowieckie (LW21049)

Phytoplankton

Impacts of the Project on phytoplankton were found to be insignificant.

Macrophytes

In terms of the Project impact on the indicator of phytocoenotic diversity, the status of hydro- and halophytes as representatives of the groups indicative of changes in hydrologic regime and physical and chemical changes, respectively, no significant impacts can be identified – insignificant impact.

Phytobenthos

Project impacts on phytobenthos are assumed to be insignificant and posing no risks of reduced water quality class. An additional argument for such a conclusion is the outcome of monitoring that indicates that the lake is dominated by diatom species characteristic for waters with moderate and high trophic status or a broad spectrum of trophic levels.

Benthic macro-invertebrates

Impacts on this index were found to be insignificant in the construction phase of the Project planned.

Ichtyofauna

Except for cases of water poisoning, the composition and structure of the ichthyofauna are characteristic of a fisheries lake, and the abundance of fish depends usually on the availability of food, structure of fry stocking, and fisheries and angling exploitation rather than the level of anthropogenic disturbances of the system. Fisheries operations are conducted on Lake Żarnowieckie, with relatively high fry stocking levels and angling pressure. For that reason, no significant connection between the LFI-EN index and changes in the environment analysed using a lake model, or changes in the flows of waters, retention time and concentration of substances dissolved in water as a result of intentional activity is assumed – insignificant impact.

River SWBs

Forecast changes in biological indices of water condition are presented below. Results are provided only for those SWBs for which the forecast based on the application of neural networks yielded any change.

- Results

Due to the fact that deteriorated MMI_PL class was demonstrated to be uncorrelated to Project impacts and activities involved in the construction phase, the Project impacts were found to be insignificant.

Operational phase

- Hydromorphological elements – morphological indices

Similarly as for Variant 1 – Lubiatowo – Kopalino site, the impact assessment for the construction phase regarding morphological indices of hydromorphological elements for flowing waters was based on the HIR methodology. In the course of the analysis it was established that when it comes to the impact on quality indicators of the element discussed, there would be no significant impact on any of the WBs located in the DIZ, the significance of which would be manifested by the potential for a change in quality indicator of the hydromorphological element leading to the class change – insignificant impact.

- Hydromorphological elements - hydrological regime

The impact on the flowing water balance was calculated using the SWAT (*Soil and Water Assessment Tool*) model. The outcomes of the modelling show that the construction of the NPP would affect the flows of inland waters in the following SWBs only: RW200017477259 and RW200023477289. Calculations of the magnitude and dynamics of flows – hydrological regime show that the Project planned would not have any significant impacts on the environment regardless of the sub-variant (2A or 2B).

- Physicochemical and chemical elements

Like for Variant 1, the assessment of impacts on physical and chemical elements supporting the biological elements was conducted using hydrological modelling. The analysis covered the following set of indices: total suspended solids, organic N, total N, organic P, total P, N-NO3, $N\text{-}NH_4$, $P\text{-}PO_4$, O_2 and petroleum hydrocarbons. The basis for determining the impacts was the correlation between environmental changes related to the Project and factors vulnerable to changes in time. The results show that the changes involved in the implementation of the Project planned in Variant 2 would not result in a changed quality class of selected indices describing the status and condition of waters. All physical and chemical changes calculated for the design status were identified as being below the quantification limit. Consequently, the implementation of the Project would involve impacts insignificant for the water quality indices for chemical elements.

- Biological elements

Impacts of the Project were assessed using a forecasting ANN model which incorporated the following indices of the quality of biological elements:

  - Macrophyte Index for Rivers (MIR);
  - (Phytobethos) Diatom Index (IO);
  - (Macroinvertebrates) Polish Multimetric Index (MMI_PL).

ANN modelling demonstrated that the Project would not involve impacts on selected indicators of biological elements. The calculations show that, for a set of analysed indices in PPK 33 – the catchment exit, the indicators have improved as a result of the Project implementation. Regarding impacts on surface waters, the operational phase of the Project would involve only the drainage of precipitation water to a watercourse at an unchanged outflow rate, similarly as for undisturbed conditions of the catchment area. An improvement in indices might result from the response of aquatic biology to small changes (below the quantification limit) due to introduction of nutrients whose availability in absorbable forms might catalyse changes leading to the improvement recorded in calculations.

The only reduction in the index was recorded at PPK 34 for IO. However, it is not significant; change of – 0.60 relative to the baseline level. As already mentioned, total suspended solids is the parameter that determines the biggest changes in the biological elements from among the physical and chemical indices identified for the Project operational phase. Hence, it should be stated that impacts for Variant 2 in the operational phase regarding the conformance with environmental quality standards would be **insignificant**. Biological and physicochemical input data for the modelling are based on the results of monitoring conducted by the Investor.

Decommissioning phase

In terms of types and significance of impacts, the decommissioning phase brings with it impacts similar to those of the construction phase of the Project planned.

The assumed similarity of Project phases also applies to recommended mitigation measures whose effectiveness in the construction phase also justifies their application in the decommissioning phase. The mitigation measures need to be applied at least where above-standard impacts on the indices or conditions of entering/discharging wastewater/water to the receiving waters are identified.

VI.4.8.1.5 Summary of the impact assessment of the Project planned on SWB

The assessment was carried out separately for Variants 1 and 2. The principal impact on inland surface water involved in the implementation of the Project is transformation of the catchment areas of water bodies where the Project would be located. The conservative approach applied in this assessment enabled us to identify the point of time in the Project life cycle involving transformation of land in the Project Area accompanied by the largest range of impacts on waters.

The identified maximum impact is a common set of phases and stages for three generating units, implemented in accordance with the Timetable under which particular units would be put in operation one year after another. The change of character of the catchment area from natural to urban one (industrial land) in the construction phase would involve the largest impacts in this scope.

The operational phase would de facto involve net supplies of water in WB catchment areas, taking into account the minimum ecological flow. The intentional division of flows of precipitation water from sites of particular Project Variant to the corresponding reservoirs of the catchment area in undisturbed conditions is preventive rather than operational in nature. The reason is the nature of the flowing water bodies that drain the area, which take most of their supply from groundwater. Situations involving a change of nature to infiltration – following heavy rain, or in long periods of draught, are sporadic. However, due to the above and the fact that calculations using the SWAT model demonstrated a change in flow rates, albeit small, precipitation water would be discharged to appropriate receiving waters in keeping with retention rates as for undisturbed catchment area.

The modelling demonstrated quantitatively the effect (significance of impacts) the proposed Project would have on the environment. For the operational stage, both in Variant 1 and in Variant 2, the Project was found not to involve extraordinary impacts on any of the physical and chemical indices analysed here.

A similar situation is for biological components. However, regarding biological elements underlying the qualification of water condition, for Variant 2, PPK 6, a result was obtained that indicates a change in class of the MMI_Pl index from II to III. The root cause were suspended solids (as demonstrated by sensitivity analysis conducted using the ANN model, which, when excluded from calculations, brings the indicator to the desirable level), which has slightly increased. In accordance with Regulation 2021.1475 and further to the explanations contained in communication No. 3695 of the Sejm, suspended solids, as an indicator of the physical condition of waters in terms of physical and chemical elements, ceases to be valid as of the effective date of that Regulation, which means that, without suspended solids, the MMI_PL index would not change. Due to the fact that synergistic, indirect or secondary effect of suspended solids, despite being excluded as an indicator of water quality, might manifest itself by reduced indices of biological elements, it is recommended to apply mitigation measures.

The assessment of impacts of the Project planned, in its particular variants and sub-variants, has found no significant adverse impacts on inland surface waters in any phase of the Project.

VI.4.8.2 Impacts on marine surface waters

This chapter presents potential impacts on marine environment within the boundaries of Lubiatowo – Kopalino Site Area and Żarnowiec Site Area which can take place as a result of implementation of the Project with its associated investment. This chapter presents primarily impacts on physical characteristics of the coastal marine environment and coastline directly adjacent to Variant 1 – Lubiatowo – Kopalino site. For Variant 2 – Żarnowiec site, these impacts would be mainly related to works in Subareas 3 and 4 and the construction of make-up water channels/pipelines for the NPP cooling system and discharge channels/pipelines.

The analysis of potential impacts at all stages of the Project was based on environmental observation and surveys in the coastal zone of the Baltic Sea. The environmental surveys included physical and chemical surveys of marine waters, surveys of marine flora and fauna, bathymetric surveys, hydrodynamics surveys, sea tide surveys, meteorological surveys, identification of sea currents, and geomorphology of the coastal region.

Assessments of potential impacts are based primarily on numerical models and interpretation of their results. The assessments were carried out in accordance with industry standards, methodologies, applicable law, and the requirements set out in the GDOŚ Decision. The construction of the MOLF, treated wastewater discharge system (domestic wastewater and process effluent) and construction of channels of cooling and make-up water were considered to be the main sources that might generate adverse effects for the marine environment.

Construction phase

Development stage

The effect of works conducted at the development stage is identical in both Project sites in all of their sub-variants (1A, 1B, 1C, 2A and 2B).

Most works in the marine areas at the development stage would involve supporting projects such as the construction of the MOLF. However, the effects of the construction of the MOLF are considered to be confined in space and limited in time, therefore, they are considered to be negligible and insignificant. Since the completion of the MOLF, it would be operated throughout the life cycle of the NPP, but due to its braced frame structure the impact is considered not to affect the geomorphology of the coast. The biggest potential effects of the construction of the MOLF on marine ecosystem would arise from generation of underwater noise and vibrations when executing the piling on which the structure would be founded. To minimise the effect of construction works on the environment, appropriate preventive measures would be applied, such as: use of best available technology to reduce noise during the works, presence of observers of sea mammals who would inform the contractor of the presence of the animals on the site, as a result of which the works would be suspended, and would continue when the animals move out of the region, use of acoustic repelling devices or avoidance of piling in the nighttime.

The precipitation and melt water from the construction site would be pre-treated and then tested for quality to meet appropriate environmental standards.

To sum up, impacts of works at the development stage that might affect the marine environment are considered negligible and insignificant.

Construction stage

The impacts identified for the construction stage would be identical in all of sub-variants (1A, 1B, 1C, 2A and 2B). Any difference would only arise from the scale of the Project. For Sub-variant 1A, channels/pipelines of cooling water and the channel/pipeline of post-cooling water and treated industrial effluent would be routed separately, and, what is more, they would be much longer than for the remaining Sub-variants (1B, 1C, 2A and 2B).

For works conducted at the construction stage, modelling addressed the most invasive environmental scenario of the construction of supply and discharge channels/pipelines (by what is known as the “submersion method”) – using an open pit method involving the installation of channels made of prefabricated reinforced-concrete parts. It would require temporary sheet piling and dredging along the route of those channels/pipelines.

The design and tightness of sheet piling, construction works, and earth removal, may affect the coastal geomorphology by disturbing coastal hydrodynamics and movement of the bedload which might lead to differences in sediments and erosion of the sea bottom or the coast in direct neighbourhood of the structure. It may also affect the stability of the coastline and exert a locally limited, direct impact on the system of dunes. The modelling covering the construction of the above-mentioned channels/pipelines using temporary sheet piling and the presence of the MOLF structure in marine areas demonstrated that their impact on coastal bathymetry and the location of the coastline would be temporary and locally confined. The modelling also demonstrated that return to the baseline status should begin within one year from the completion of construction works related to execution of the above-mentioned channels/pipelines. The changes were also demonstrated to be within the range of normal variability of the coastline in the Marine Survey Area for both Site Variants.

The effects on hydromorphology of the coastal waters are considered to be negligible due to their small scale and short duration of the impacts forecast. However, there is some uncertainty related to the outcome of modelling related to the impact of sheet piling on the stability of the coastline. Despite that the effects of such impacts would be probably negligible, it is recommended to launch a monitoring programme at the stage of construction works and upon their completion, and implement methods to ensure restoration of the baseline morphology of the coastline if the impacts prove to be more pronounced and longer than anticipated in the modelling exercise.

Analysis of baseline levels of pollutants present in seabed sediments demonstrated that the sediments are not contaminated, so they would not provide a source of contamination when disturbed during submarine works. The modelling also shows that increased water turbidity as a result of sediment disturbed from the seabed due to the works would slightly exceed environmental quality standards. However, it would take place in a small area only, in direct vicinity of the works, therefore, those effects are considered to be negligible and insignificant.

At the Project construction stage, treated domestic waste water would be discharged directly to the Baltic Sea. Due to the fact that they would meet demanding environmental standards, our modelling demonstrated that they would have no adverse effect on the quality of marine waters and would not affect their eutrophication.

<u>Commissioning stage</u>

At the commissioning stage, for Sub-variant 1A, the abstraction of marine waters for cooling the first nuclear unit and discharge of heated cooling water back to the Baltic Sea would begin, while for the remaining Sub-variants 1B, 1C, 2A and 2B, water abstraction as a make-up water for the cooling system and blowdown discharge would start, relative to the operational phase, which is described in the next chapter – Project operational phase. This stage would also involve discharge of treated industrial effluent to the sea. As described for the construction stage, the said discharge would not affect the quality of Baltic waters and would not increase their eutrophication.

Operational phase

The largest impacts on the marine environment at the Project operational stage would come from the discharge of heated cooling water used in technological processes. Their impact would apply mainly to the quality of the discharge water and the receiving water body (the sea) and their relative temperatures. Modelling of an increase in temperature near the outlet of the cooling water system demonstrated potential moderate impacts on the marine environment. However, due to a small sensitivity and large extent of the habitats in the area, the overall effect on marine living organisms is considered to be insignificant. The discharge of industrial effluent, upon its adequate treatment, to the Baltic waters was assessed to be insignificant. No construction or assembling works would be conducted in the Baltic Sea in the operational phase of the Project. The only works that could be conducted would be related to the removal of potential failures and defects of the NPP infrastructure. Permanent items in the marine area related to the Project would be water intakes and water discharge diffusers, and the MOLF structure. Adverse impacts related to their presence might involve disturbance of hydrodynamics of the seabed or the load, which might lead to differences in accumulation of bottom sediments and erosion in the direct vicinity of those structures. However, these impacts would occur only close to the NPP infrastructure components mentioned above. Modelling analyses show that these changes would be negligible and insignificant.

The main ecological effects related to the implementation of Sub-variant 1A would come from the accumulation of biogenic substances from discharged treated industrial effluent and the risk of fish entrapment when pumping water through the cooling system. A comparison of forecast quantities of organic substances to the actual levels of those substances in the Baltic Sea shows that the impacts would be negligible and insignificant. Their impact on eutrophication would be also insignificant. Medium and potentially significant impact would apply to the ecosystem in the region of the cooling water intake. Probably, due to construction of the structure and forced inflow of marine water to the cooling system, the fish currently living in the area would move to other feeding grounds.

The main differences between Sub-variants 1A on the one hand and 1B, 1C, 2A and 2B on the other in the Project operational phase consist in the quantities of seawater intake and discharge, and the chemical composition and temperature of the discharged water. The quantities of discharged cooling water in Sub-variants 1B, 1C, 2A and 2B would be much smaller (than in Sub-variant 1A), but the by-product of evaporation of water in cooling towers would be primarily concentrated brine which would be brought back to the sea. However, it is worthwhile to note that the outcomes of modelling of the mixing, salination and temperature show that the effects on the quality of seawater would be negligible and insignificant. Impacts related to the discharge of treated industrial effluent were considered to be insignificant. Effects on the marine ecology were assessed to be insignificant. The problem of the impacts of the intakes of cooling water on fish, held significant for Sub-variant 1A, is considered to be negligible and insignificant in Subvariants 1B, 1C, 2A and 2B due to lower intake of seawater.

Decommissioning phase

As of today, it is difficult to predict what technologies would be applied to remove the structural components built into the seabed. However, having regard to technological progress that should happen throughout the 60 years, one can assume that potential impacts at the Project decommissioning stage would be lower than the impacts at the construction stage. Consequently, potential impacts on marine environment in the Project decommissioning phase should be also considered insignificant.

VI.4.9 Impacts on ambient air quality

As part of analysis of Project impacts on the quality of ambient air, the magnitude of emissions of pollutants to the air was assessed for all phases of the Project, modelling of the spread of pollutants in the air was conducted, and impacts on people and the environment were assessed. The analysis covered the Site Region, including both its land and marine parts, to take into account the overall range of Project impacts.

VI.4.9.1 Assumptions and methodology

To assess the quantity of emissions, it was necessary to identify the sources of emission and types of substances released to the ambient air. To correctly estimate the size of emissions, commonly used and verified emission indicators were applied in the calculations.

The sources of emissions were identified based on the description of and information on the Project and on the associated infrastructure, and the following types were taken into account:

- power generation and industrial sources,
- road, railway, marine, and air transport,
- construction and demolition works, and non-road mobile machinery, known as the fugitive emission.

An additional group were the sources of emissions related to changes in other requirements, for example due to the adoption of local legislation, changes in emission trends for particular types of sources, introduction of national policies, and so on. To forecast this type of emissions, the following was taken into account:

- effect of the anti-smog resolution adopted for the Pomorskie Voivodeship (change of fuel mix used for domestic heating),
- increased road traffic,
- effect of new industrial projects unrelated to the Project.

The assessment of impacts on the quality of ambient air was conducted using mathematical modelling methods – the CALMET/CALPUFF model was used for the analysis of dispersion of pollutants. To determine spatial distribution of pollutant concentrations, in addition to a detailed database of emissions, it was necessary to properly prepare, first and foremost:

- multiannual meteorological data,
- information on the area (land relief and use, roughness, albedo, plant cover),
- meteorological parameters in the adopted computational matrix, such as temperature, wind speed and direction, humidity, pressure, precipitation, and cloud cover.

To assess Project impacts on the quality of air and thus on people and the environment, the main regulations on air quality were applied, as defined in:

- Regulation of the Minister of the Environment of 24 August 2012 on levels of certain substances in the air, which defines "permissible levels" (PL);
- Regulation of the Minister of Environment of 26 January 2010 on reference values for certain substances in the air, which defines "reference values" (RV).

The standards laid down by those Regulations are aimed at protecting human health, and some of them at protecting plants and ecosystems, which is demonstrated on the example of permissible levels in the table [Table VI.9.1- 1].

Table VI.9.1- 1 Permissible levels of substances in the air

No.	Substance name	Period of averaging	Level of substance in the air [μg/m³]	Permissible frequency of excess in a calendar year	Purpose
1	Sulphur dioxide	1 hour	350	18 times	PoH
2		24 hours	125	four times	PoH
3		calendar year and winter season (1 October - 31 March)	20	-	PoP
4	Nitrogen dioxide	1 hour	200	18 times	PoH
5		calendar year	40	-	PoH
6	Nitrogen oxides 1)	calendar year	30	-	PoP
7	Particulate matter PM10	24 hours	50	35 times	PoH
8		calendar year	40	-	PoH
9	Particulate matter PM2.5	calendar year	20 2)	-	PoH
10	Carbon monoxide	8 hours 3)	10,000	-	PoH
11	Benzene	calendar year	5	-	PoH
12	Lead 4)	calendar year	0.5	-	PoH

PoH - protection of health, PoP – protection of plants,
1) – The sum of nitrogen dioxide and nitric oxide; 2) – Permissible level for particulate matter PM2.5 to be achieved by 1 January 2020 (Phase II), 3) – Maximum eight-hour average from among moving averages calculated every hour from eight hourly averages per day. Each such calculated eight-hour average is assigned to the 24-hour span in which the average ends; the first computational period for each 24-hour span is the period from 5:00 p.m. of the preceding day to 01:00 a.m. of the given day; the last computational period for each 24-hour span is the period from 4:00 p.m. to 12:00 a.m. (midnight) of that day, Central European Time (CET); 4) – total level of that pollutant in particulate matter PM10.

Source: Rozporządzenie Ministra Środowiska z dnia 24 sierpnia 2012 r. w sprawie poziomów niektórych substancji w powietrzu [Regulation of the Minister of the Environment of 24 August 2012 on levels of certain substances in the air], Journal of Laws of 2012, item 1031

The normative values of the above-mentioned Regulations are defined for averaged values, depending on a substance. The following average values are analysed:

- 1h – hourly average;
- 8h – eight-hour average from among moving averages calculated every hour based on eight hourly averages per day;

- 24h – daily average;
- winter – average for winter season from 1 October to 31 March;
- year – annual average.

Concentrations of particular pollutants were classified as: insignificant, moderate, significant, at risk of non-conformance with the standard, or non-conformance with the standard. Non-conformance with the standard for permissible levels is tantamount to non-conformance with environmental quality standards. The table below [Table VI.9.1- 2] shows, on the example of particulate matter PM10, the numerical scale for concentrations of particular pollutants and the corresponding magnitude of impact.

Table VI.9.1- 2 Scale of concentrations and impacts for particulate matter PM10

Impact	Colour	PM10 1h (for RV)	PM10 24h (for PL)	PM10 year*
		[μg/m³]		
Insignificant		<3	<0.6	<0.5
Insignificant		3.1-5.0	0.7-1.5	0.6-1.0
Insignificant		5.1-10.0	1.6-2.0	1.1-1.5
Insignificant		10.1-14.0	2.1-2.5	1.6-2.0
Moderate		14.1-20.0	2.6-5.0	2.1-4.0
Moderate		20.1-40.0	5.1-7.5	4.1-6.0
Moderate		40.1-50.0	7.6-10.0	6.1-8.0
Moderate		50.1-70.0	10.1-12.5	8.1-10.0
Significant		70.1-100.0	12.6-18.5	10.1-15.0
Significant		100.1-140.0	18.6-25.0	15.1-20.0
Risk of non-conformance with the standard		140.1-200.0	25.1-37.5	20.1-30.0
Risk of non-conformance with the standard		200.1-280.0	37.6-50.0	30.1-40.0
Non-conformance with standards		>280.0	>50.0	>40.0

** permissible level (PL) is the same as reference value (RV)*
Source: Study based on: E. Krajny, L. Ośródka. Opracowanie w zakresie oddziaływania Przedsięwzięcia na powietrze atmosferyczne, Tom I – Lubiatowo - Kopalino, Tom II – Żarnowiec, [Study of Project impacts on ambient air, Vol. I – Lubiatowo - Kopalino, Vol. II – Żarnowiec],

VI.4.9.2 Input data for impact analysis

Background air pollution forecasts

The outcomes of modelling of air pollutants from Variant 1 - Lubiatowo – Kopalino site, and Variant 2 – Żarnowiec site, obtained under the inventory of emission sources and pollution dispersion modelling from emission sources existing in 2018, were used as the pollution background. In addition, as part of the pollution background, changes due to investment projects contemplated in the Site Region were assumed. Both the construction of new projects unrelated to the NPP and the expansion of the existing projects in the years 2022-2030 were taken into account. The information was received from environmental protection authorities based on licences for the release of gases and dusts to the air, integrated permits, and environmental scoping reports of projects, prepared in order to obtain decisions on environmental conditions. The forecast background also takes into account a significant reduction in emissions from the municipal sector under provisions of anti-smog resolutions for the Pomorskie Voivodeship. At the same time, increasing road traffic and changes to emission indicators due to anticipated changes in the structure of the fleet of vehicles in road traffic (increasing share of vehicles that meet stricter exhaust emission standards) were taken into account.

Forecast of meteorological conditions

Pollutant dispersion calculations were based on a single year. The representative year was chosen based on analysis of probability between historical data for 2012-2019 and the available climate projection data (IPCC)

RCP 4.5 (Representative Concentration Pathways 4.5 W/m^2) scenario in the 2021 – 2040 time horizon. Having analysed the similarities, 2018 was chosen as the representative year for both site variants.

Sources of anticipated emissions to ambient air

Depending on the category of impact, the sources of anticipated emissions to the air are grouped into direct sources – related to direct impacts of the Project inside the Project Area, and indirect sources – related to direct impacts of the Project outside of the Project Area.

The next step was to estimate the magnitude of emissions for each contemplated Sub-variant (1A, 1B, 1C, 2A, 2B), separately for the construction phase (development stage, construction and commissioning stages), operational phase, and decommissioning phase. In calculating emissions for particular stages, the assumptions presented in the Project Implementation Schedule (duration of particular stages, equipment and personnel involved), compliant with the Polish Nuclear Power Programme updated in October 2020, were used. Given the need to address the zero variant and the worst-case scenario – or the case that potentially generates the biggest emissions and has the potential of bringing adverse impacts on air quality, the analyses covered the following periods:

- 1^{st} – 3^{rd} year or Project life: development works;
- 6^{th} – 10^{th} year of the Project life: implementation and construction – three units (maximum 8^{th} – 9^{th} year of Project life);
- 13^{th} – 70^{th} year of Project life: operation – three units in operation;
- 73^{rd} – 92^{nd} year of Project life: decommissioning – demolition of three units.

The methodology of calculation of fugitive and non-fugitive emissions is proposed based on information from international guidance on the estimation of emissions, and in particular:

- EMEP/EEA air pollutant emission inventory guidebook 2019. Technical guidance to prepare national emission inventories;
- AP-42 Fifth Edition January 1995. Compilation of air pollutant emission factors.

The analysis of Project impacts on ambient air took into account the substances which, according to the most recent and best knowledge, would be released in the processes of a nuclear power plant (except for radioactive substances and greenhouse gases). Selected from among those were substances for which air quality standards are applicable in view of the protection of human health and protection of plants, defined by the law as permissible levels.

The annual emission was calculated with the assumption of erection and operation of three units of nuclear power plant, for the year representing the worst possible scenario, taking into account the above-mentioned Project stages. Impacts of the following emission sources were considered:

- emission sources located on the NPP premises, whose impact can be characterised as a direct impact of the Project planned on air quality, such as: auxiliary boiler house, medium and low voltage emergency generators, mobile generator unit, heating oil tanks, fuel oil tanks, ventilation stacks of reactors, steam generators, cooling towers, concrete batching plants, and miscellaneous sources related to fugitive emissions,
- emission sources located outside of the NPP premises, whose operation is directly related to the operation of the Project, and their impacts can be characterised as “indirect impact” of the Project planned on the air quality. These include the following: road transport, railway transport, sea transport, premises heating (personnel living quarters), as well as emission sources related to activities involved in the development of the associated infrastructure: construction of the MOLF and service road, extra high, high and medium voltage transmission networks, expansion and upgrade of road and railway transport

infrastructure, construction of water supply and wastewater infrastructure, as well as ITC networks, and Local Information Centre,

- the emission sources included in the air pollution background, including: emissions from local transport, heating of the existing buildings, farming emissions, and industrial emissions from miscellaneous sources, including from other investment projects for which environmental permits are issued.

In addition to standard impacts of the facility, impacts related to potential emergency states were reviewed, namely, those resulting from emergency operation of the boiler room and power generator sets.

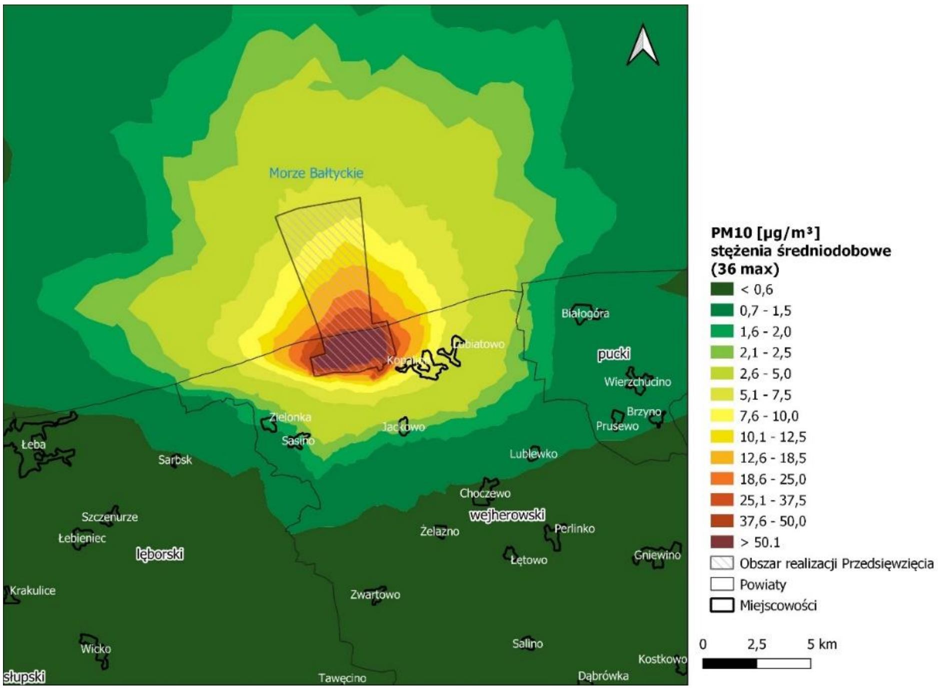
VI.4.9.3 Assessment of Project impacts on air quality

The background forecast for the year of commencement of development of the proposed Project for all pollutants would be low: from 1% of the permissible level for carbon oxides, benzene and lead to slightly more than 28% of the permissible level for average daily particulate matter PM10.

Construction phase

At the Project development stage, in each contemplated Sub-variant (1A, 1B, 1C) of Variant 1 – Lubiatowo – Kopalino site, concentrations of sulphur dioxide, carbon monoxide and benzene would be negligibly low, and average annual and hourly concentrations of nitrogen dioxide would be low (5 – 6% of the permissible level). Only the concentrations of particulate matter PM10 and PM2.5 would be high, but only at the boundary of the Project Area (average daily concentrations of PM10 may approach approximately 74% of the permissible level). However, they would not exceed the permissible levels, and would sharply drop with the distance from the project development site [Figure VI.9.3- 1].

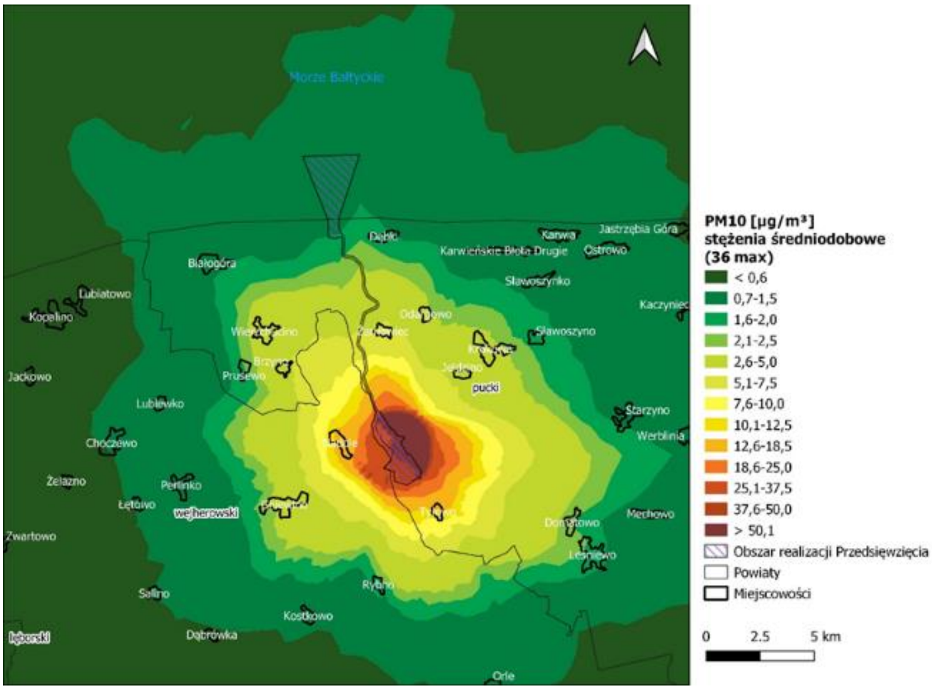
Similarly, for all Sub-variants (2A, 2B) of Variant 2 – Lubiatowo – Żarnowiec site, concentrations of sulphur dioxide, carbon monoxide and benzene would be negligibly low. Average annual and hourly concentrations of nitrogen dioxide would be low and may reach maximum concentrations outside of the Project Area approaching 1.5% of the permissible level. Only concentrations of particulate matter PM10 and PM2.5 would be high just on the boundary of the Project Area. Average annual concentration of PM2.5 may be increased, but the maximum would reach 27% of the permissible level. Average daily concentrations of PM10 may exceed the permissible level and approach up to approximately 220% of the permissible level, and average annual concentrations up to 134% of the permissible level. Such high concentrations of particulate matter would be short-term and located in a woodland, just at the boundary of the Project Area (up to 1.2 km of the boundary of the Area. They would drop sharply with the distance from the Project site. Excessive levels would not extend to any residential area [Figure VI.9.3- 1] and [Figure VI.9.3- 2].



PM10 [µg/m^3] stężenia średniodobowe (36 max)	PM10 [µg/m^3] average daily concentrations (max. 36)
Obszar realizacji Przedsięwzięcia	Project Area
Powiaty	Poviats
Miejscowości	Towns/Cities

Figure VI.9.3- 1 Distribution of PM10 24h concentrations (36 maximum value), at the development stage (permissible level = 50 µg/m^3), Variant 1 – Lubiatowo – Kopalino site

Source: Krajny E., Ośródka L., IMGW – PIB, BSiPP Ekometria Sp. z o. o., IPIŚ PAN. Opracowanie w zakresie oddziaływania Przedsięwzięcia na powietrze atmosferyczne, Tom I – Lubiatowo - Kopalino, Tom II – Żarnowiec, 2021 [Study of Project impacts on ambient air, Vol. I – Lubiatowo - Kopalino, Vol. II – Żarnowiec]



PM10 [µg/m³] stężenia średniodobowe (36 max)	PM10 [µg/m³] average daily concentrations (max. 36)
Obszar realizacji Przedsięwzięcia	Project Area
Powiaty	Poviats
Miejscowości	Towns/Cities

Figure VI.9.3- 2 Distribution of PM10 24h concentrations (36 maximum value), at the development stage (permissible level = 50 µg/m³), Variant 2 – Żarnowiec site

Source: Krajny E., Ośródka L., IMGW – PIB, BSiPP Ekometria Sp. z o. o., IPIŚ PAN. Opracowanie w zakresie oddziaływania Przedsięwzięcia na powietrze atmosferyczne, Tom I – Lubiatowo - Kopalino, Tom II – Żarnowiec, 2021 [Study of Project impacts on ambient air, Vol. I – Lubiatowo - Kopalino, Vol. II – Żarnowiec]

The concentrations of sulphur dioxide, carbon oxide, benzene and lead for the stage of construction and commissioning of Variant 1 would be low or negligibly low (less than 1% of permissible levels). Average annual concentrations of nitrogen dioxide and PM2.5 would be slightly higher (more than 19% and almost 16% of the permissible level, respectively). Hourly concentrations of nitrogen dioxide may maximally approach 65% of the permissible level in Sub-variant 1A, and 47% in Sub-variants 1B and 1C. Concentrations of particulate matter PM10 would be high just on the boundary of the Project Area (average daily concentrations of PM10) and may approach approximately 91% of the permissible level, however, PM10 concentration would drop sharply with the distance from the Project Area.

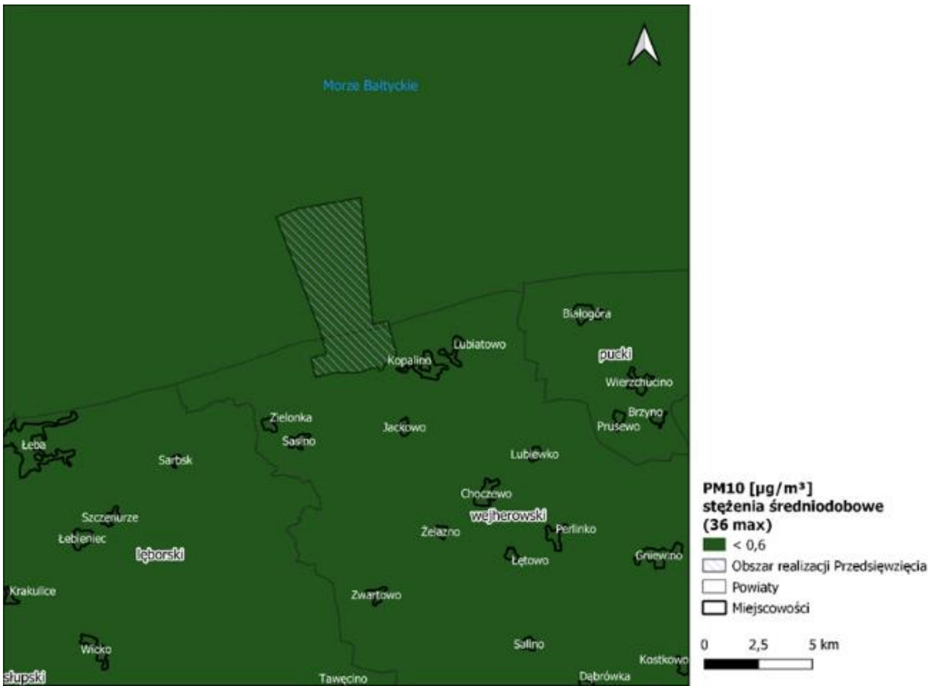
For Variant 2 – Żarnowiec site, concentrations of sulphur dioxide, carbon oxide, benzene and lead for both Sub-variants would be low or negligibly low (less than 1% of the permissible level), and low for CO – up to 2.5% of the permissible level. Concentrations of sulphur dioxide, nitrogen dioxide and PM2.5 in both Sub-variants would be higher – from 18% to 54% of the corresponding permissible levels. Hourly NO_2 concentrations may reach a maximum of 67% of the permissible level outside of the Project Area. Concentrations of particulate matter PM10 would be high at the boundary of the Project Area, with average daily concentrations of PM10 potentially exceeding the permissible level and approach a maximum of approximately 222% of the permissible level, and for hourly concentrations they would approach 243% of the permissible level, which is due to high fugitive emissions from the construction site. The location and extent of area of exceeded levels would be the same as for the development stage and would also not extend to the nearby residential areas.

Operational phase

For Variant 1 – Lubiatowo – Kopalino site, both average annual and short-term concentrations of pollutants in the air, resulting from normal operation of the NPP for all of its Sub-variants (1A, 1B, 1C) would be negligibly low.

Maximum concentrations of sulphur dioxide, nitrogen dioxide, particulate matter, benzene, carbon oxide and lead would not exceed 1% of the permissible levels beyond the Project Area. It should be also noted that despite an increased emission of particulate matter for Sub-variant 1B, the concentrations remain low, which is due to engineering parameters of the emitter, especially its height. Also, total fall-out particulate matter and lead would be negligibly low – less than 1% of the reference level. Hence, the impact of the facility on air quality at the operational stage would be insignificant [Figure VI.9.3- 2].

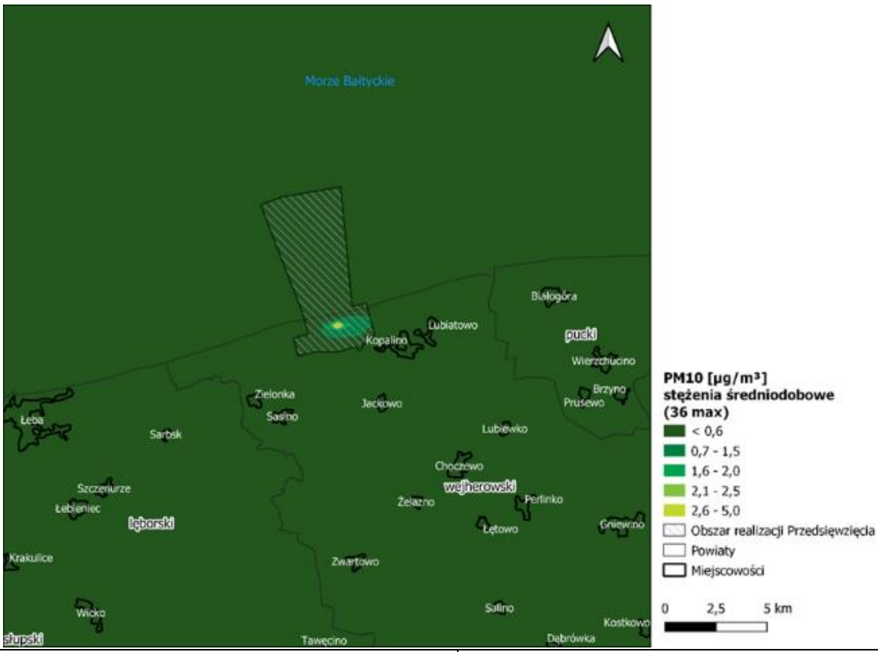
For Variant 2 – Żarnowiec site, both average annual and short-term concentrations of pollutants in the air, resulting from normal operation of the NPP for the two contemplated Sub-variants (2A, 2B) would be negligibly low. Maximum concentrations of sulphur dioxide, nitrogen dioxide, average annual particulate matter PM10 and PM2.5, benzene, carbon oxide and lead would not exceed 1.5% of the permissible levels beyond the Project Area. It should be also noted that despite increased emission of the particulate matter, the concentrations remain low, which is due to engineering parameters of the emitter, especially its height. Concentration of PM10 on the eastern boundary of the Project Area may approach 8% of the permissible levels for maximum levels, and approximately 3% of the permissible levels for average annual levels. Also, total fall-out particulate matter and lead would be negligibly low – less than 1% of the permissible level. Hence, the impact of the planned Project on air quality at the operational stage would be insignificant in both Sub-variants considered. In addition, for Sub-variant 2A, also the maximum range of impact related to drift from cooling towers was identified, which almost reaches the reference value and occurs at a distance of up to 200m from the boundary of the Project Area. The distribution of concentrations of PM10 (component of pollutants with the largest range of impacts), and thus the ranges of impacts on the quality of ambient air in the operational phase for all Sub-variants are negligibly low, as presented in the figures below [Figure VI.9.3- 3].



PM10 [µg/m^3] stężenia średniodobowe (36 max)	PM10 [µg/m^3] average daily concentrations (max. 36)
Obszar realizacji Przedsięwzięcia	Project Area
Powiaty	Poviats
Miejscowości	Towns/Cities

Figure VI.9.3- 3 Distribution of PM10 24h concentrations (36 maximum value), operational phase (PL = 50 µg/m^3), Variant 1 – Lubiatowo – Kopalino site – Sub-variant 1A

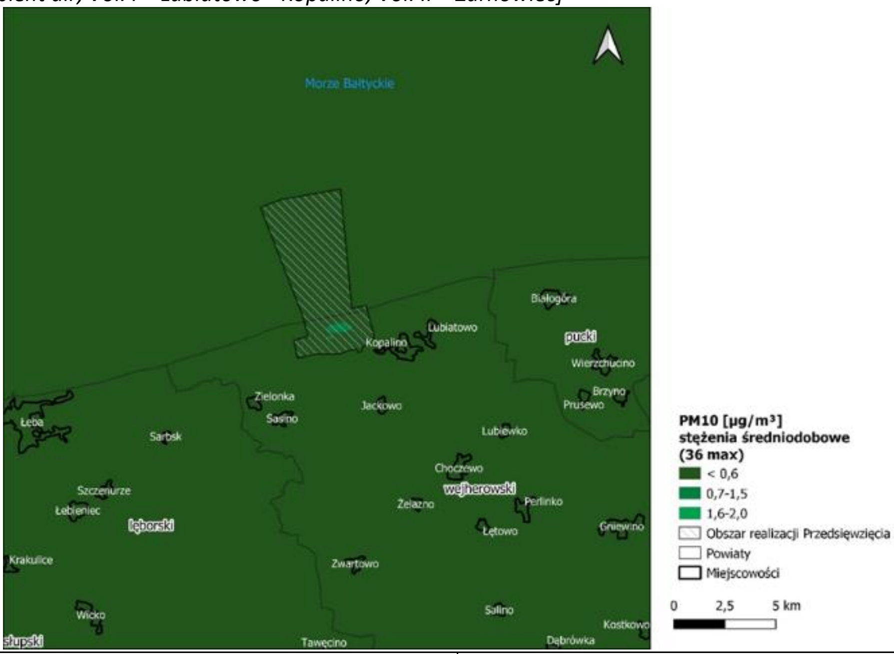
Source: Krajny E., Ośródka L., IMGW – PIB, BSiPP Ekometria Sp. z o. o., IPIŚ PAN. Opracowanie w zakresie oddziaływania Przedsięwzięcia na powietrze atmosferyczneTom I – Lubiatowo - Kopalino, Tom II – Żarnowiec, 2021 [Study of Project impacts on ambient air, Vol. I – Lubiatowo - Kopalino, Vol. II – Żarnowiec]



PM10 [µg/m³] stężenia średniodobowe (36 max)	PM10 [µg/m³] average daily concentrations (max. 36)
Obszar realizacji Przedsięwzięcia	Project Area
Powiaty	Poviats
Miejscowości	Towns/Cities

Figure VI.9.3- 4 Distribution of PM10 24h concentrations (36 maximum value), operational phase (PL = 50 µg/m³), Variant 1 – Lubiatowo – Kopalino site – Sub-variant 1B

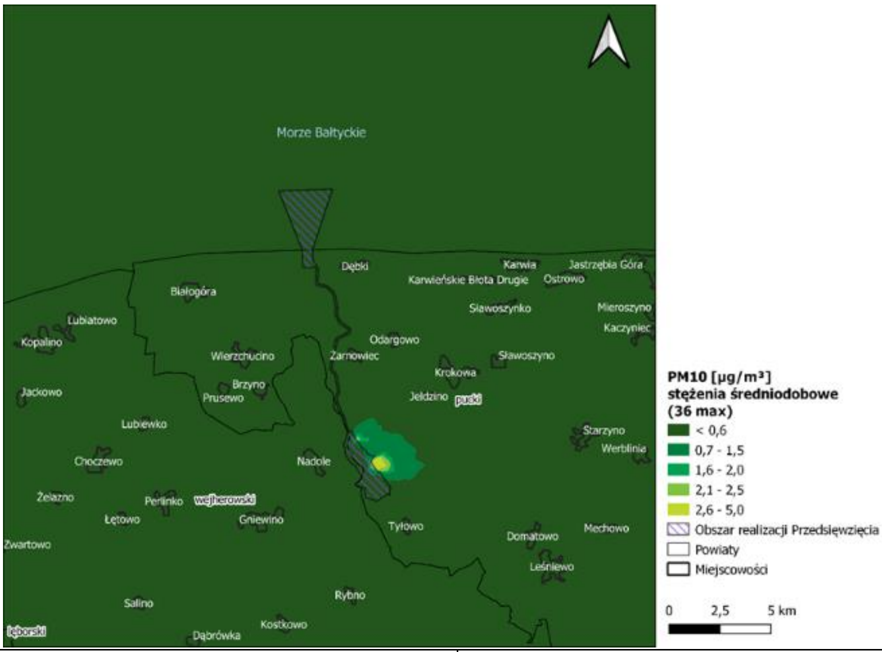
Source: Krajny E., Ośródka L., IMGW – PIB, BSiPP Ekometria Sp. z o. o., IPIŚ PAN. Opracowanie w zakresie oddziaływania Przedsięwzięcia na powietrze atmosferyczneTom I – Lubiatowo - Kopalino, Tom II – Żarnowiec, 2021 [Study of Project impacts on ambient air, Vol. I – Lubiatowo - Kopalino, Vol. II – Żarnowiec]



PM10 [µg/m³] stężenia średniodobowe (36 max)	PM10 [µg/m³] average daily concentrations (max. 36)
Obszar realizacji Przedsięwzięcia	Project Area
Powiaty	Poviats
Miejscowości	Towns/Cities

Figure VI.9.3- 5 Distribution of PM10 24h concentrations (36 maximum value), operational phase (PL = 50 µg/m³), Variant 1 – Lubiatowo – Kopalino site – Sub-variant 1C

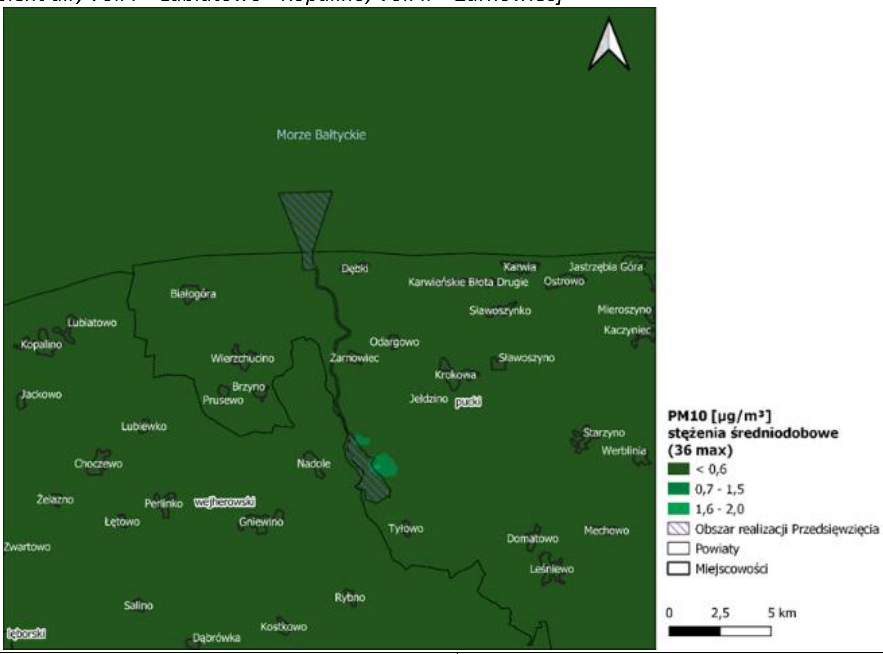
Source: Krajny E., Ośródka L., IMGW – PIB, BSiPP Ekometria Sp. z o. o., IPIŚ PAN. Opracowanie w zakresie oddziaływania Przedsięwzięcia na powietrze atmosferyczneTom I – Lubiatowo - Kopalino, Tom II – Żarnowiec, 2021 [Study of Project impacts on ambient air, Vol. I – Lubiatowo - Kopalino, Vol. II – Żarnowiec]



PM10 [µg/m³] stężenia średniodobowe (36 max)	PM10 [µg/m³] average daily concentrations (max. 36)
Obszar realizacji Przedsięwzięcia	Project Area
Powiaty	Poviats
Miejscowości	Towns/Cities

Figure VI.9.3- 6 Distribution of PM10 24h concentrations (36 maximum value), operational phase (permissible level = 50 µg/m³), Variant 2 – Żarnowiec site – Sub-variant 2A

Source: Krajny E., Ośródka L., IMGW – PIB, BSiPP Ekometria Sp. z o. o., IPIŚ PAN. Opracowanie w zakresie oddziaływania Przedsięwzięcia na powietrze atmosferyczneTom I – Lubiatowo - Kopalino, Tom II – Żarnowiec, 2021 [Study of Project impacts on ambient air, Vol. I – Lubiatowo - Kopalino, Vol. II – Żarnowiec]



PM10 [µg/m³] stężenia średniodobowe (36 max)	PM10 [µg/m³] average daily concentrations (max. 36)
Obszar realizacji Przedsięwzięcia	Project Area
Powiaty	Poviats
Miejscowości	Towns/Cities

Figure VI.9.3- 7 Distribution of PM10 24h concentrations (36 maximum value), operational phase (permissible level = 50 µg/m³), Variant 2 – Żarnowiec site – Sub-variant 2B

Source: Krajny E., Ośródka L., IMGW – PIB, BSiPP Ekometria Sp. z o. o., IPIŚ PAN. Opracowanie w zakresie oddziaływania Przedsięwzięcia na powietrze atmosferyczneTom I – Lubiatowo - Kopalino, Tom II – Żarnowiec, 2021 [Study of Project impacts on ambient air, Vol. I – Lubiatowo - Kopalino, Vol. II – Żarnowiec]

Decommissioning phase

The process of decommissioning of the nuclear power plant is subject to separate environmental impact assessment and subject to a separate decision on environmental conditions. It is assumed that, in the NPP decommissioning phase, for all Sub-variants, environmental load would not be higher than in the construction phase, and the primary sources of impacts on the air would be: emission of pollutants into the air caused by operation of combustion engines of construction machinery and transport vehicles, and emission of dust generated during demolition works and vehicle traffic.

VI.4.9.4 Transboundary impacts

Due to the fact that the closest country neighbouring Poland – Russia (Kaliningrad Oblast) is more than 100km away, the impact of the planned Project on air quality would not be transboundary in nature. Air quality in the Countries neighbouring Poland would not deteriorate in connection with the construction and operation of the planned Project.

VI.4.10 Impacts on acoustic climate

VI.4.10.1 Land area

This chapter presents an assessment of impacts of the planned Project on acoustic climate in the land part, taking into account two Site variants: Variant 1 – Lubiatowo - Kopalino site, and Variant 2 – Żarnowiec site, and three or two, respectively, Sub-variants for each of them. The analysis was conducted for all phases/stages of the Project, also taking into account two options for the construction of channels/pipelines of cooling/make-up water.

VI.4.10.1.1 Assessment methodology

Basic analytical approach

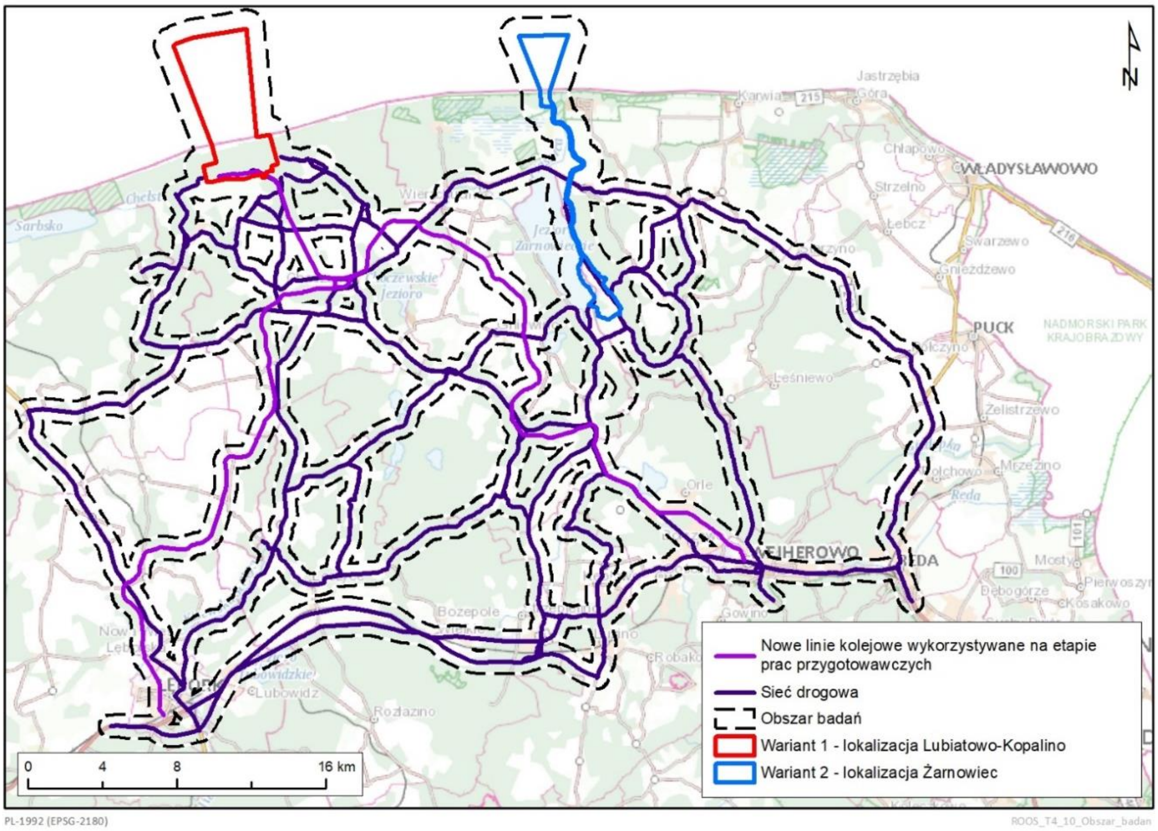
Noise assessment was conducted for particular phases of the Project, with quantitative analysis for the construction and operational phases (for construction works at the Project premises, and for road and railway traffic related to transportation for Project purposes). Qualitative assessment was conducted for the Project decommissioning phase and for the implementation of components of the associated infrastructure (regarding the noise involved in the NPP decommissioning, and the noise related to the construction of roads and railways). There are direct impacts (of the NPP main facilities and NPP auxiliary facilities within the Project scope) and indirect impacts (of roads and railways outside of the Project scope, but which are associated investments).

Due to high uncertainty as to the level of noise involved in most of the factors, the analysis was conducted taking into account an “envelope of boundary conditions”, which means an approach based on the worst-case scenario that could happen as part of the given works for particular stages of the Project implementation. Consequently, no impact would be greater than the one within the envelope.

First, environmental items vulnerable to noise impacts were identified and the NPP technical envelope was developed that contains a set of maximum and minimum parameters of various components of the Project. Emission sources and Project technical parameters were identified, the magnitude of impacts and possible non-conformance with noise standards were analysed. Then, mitigation methods were analysed, and impacts as minimised by mitigation measures were forecast.

Scope of the analysis

The survey area was delineated as 1km from the boundary of Site variants and 600m from the transportation network for the construction works. The figure below [Figure VI.4.10- 1] presents the area of analysis taken into account in assessing impacts on the acoustic climate.



Nowe linie kolejowe wykorzystywane na etapie prac przygotowawczych	New railway lines used at the development stage
Sieć drogowa	Road network
Obszar badań	Survey area
Wariant 1 - lokalizacja Lubiatowo - Kopalino	Variant 1 – Lubiatowo - Kopalino site
Wariant 2 - lokalizacja Żarnowiec	Variant 2 — Żarnowiec site

Figure VI.4.10- 1 Area of analysis taken into account in assessing impacts on acoustic climate

Source: Ocena oddziaływania hałasu i wibracji [Noise and Vibration Impact Assessment], Jacobs Clean Energy Limited. 2021.

In vulnerable zones of acoustic protection (residential buildings, hospitals and social welfare buildings, public buildings where children and young people stay temporarily or permanently, community health care centres, recreational areas, residential and services areas), permissible levels of noise are applicable for the daytime (6:00 a.m. – 10:00 p.m.) and the nighttime (10:00 p.m. – 6:00 a.m.) defined in the Regulation of the Minister of Environment of 14 June 2007 on permissible levels of noise in the environment. Noise was forecasts for particular receptors, each being assigned a number. The method of noise assessment depended on the receptor type. For noise emissions in the planned Variant 1 – Lubiatowo – Kopalino site, and in Variant 2 – Żarnowiec site (both in the construction and operational phases), particular receptors were identified based on their proximity and vulnerability, and then forecasts for those site variants were conducted.

Impacts occur when the noise emission from a source exceeds the permissible levels for a specific impact receptor. The magnitude of impacts incorporates the difference between noise levels generated by the Project and the baseline noise levels (the existing acoustic background). The methodology of analysis was based on the criteria presented in the table below [Figure VI.4.10- 1].

Table VI.4.10- 1 Criteria for the assessment of noise on land

<table>
<tr><th>Impact intensity</th><th>Impact duration</th><th>Impact magnitude</th><th>Significance of effects</th></tr>
<tr><td><u>Negligible</u>
Noise levels involved in the construction of the NPP are more than 10dB lower than the permissible levels.</td><td>any</td><td>negligible</td><td>insignificant</td></tr>
<tr><td rowspan="4"><u>Low</u>
Noise levels involved in the construction of the NPP are below the permissible levels, but within 10dB from them, thus increasing the likelihood of cumulative adverse effects in the future.</td><td>momentary</td><td rowspan="7">low</td><td rowspan="7">minor (insignificant)</td></tr>
<tr><td>short-term</td></tr>
<tr><td>medium-term</td></tr>
<tr><td>long-term</td></tr>
<tr><td rowspan="4"><u>Moderate</u>
Noise levels involved in the NPP exceed the permissible levels, but are not higher than the existing noise in the environment.</td><td>momentary</td></tr>
<tr><td>short-term</td></tr>
<tr><td>medium-term</td></tr>
<tr><td>long-term</td><td>medium</td><td>moderate</td></tr>
<tr><td rowspan="4"><u>High</u>
Noise levels involved in the NPP exceed the permissible levels and are higher than the existing noise in the environment, which also means that permissible levels have been exceeded.</td><td>momentary</td><td rowspan="2">low</td><td rowspan="2">minor (insignificant)</td></tr>
<tr><td>short-term</td></tr>
<tr><td>medium-term</td><td rowspan="2">medium</td><td rowspan="2">moderate</td></tr>
<tr><td>long-term</td></tr>
<tr><td rowspan="4"><u>Very high</u>
Noise levels involved in NPP construction exceed the permissible levels, but the existing noise in the environment does not exceed them.</td><td>momentary</td><td>low</td><td>minor (insignificant)</td></tr>
<tr><td>short-term</td><td rowspan="2">medium</td><td rowspan="2">moderate</td></tr>
<tr><td>medium-term</td></tr>
<tr><td>long-term</td><td>high</td><td>major (significant)</td></tr>
</table>

Source: Ocena oddziaływania hałasu i wibracji [Noise and Vibration Impacts Assessment], Jacobs Clean Energy Limited, 2021

VI.4.10.1.2 Noise forecasting methodology

The basis for the noise model was the 3D terrain model, and the source of data for the land cover layer used in the model was the CORINE Land Cover (CLC) 2018 dataset. All noise modelling and calculations of anticipated noise levels were conducted using SoundPLAN software (Version 8.2).

Results of noise forecasts are presented in tabular format and as a noise isoline for the noise generated by the NPP at the commissioning stage and in the operational phase, from road traffic at the construction stage and in the operational phase, and railway traffic at the NPP construction stage. The isoline for the noise generated at the NPP construction stage is not presented, because it would imply a scale of uncertainty and lack of coherence of noise emission levels, which would be unrealistic due to discontinuous operation of the source. Also, noise for railway traffic in the operational phase is not presented, because in that phase it would not bring significant impacts related to the NPP operations. All forecast noise levels in key identified receptor points were established at the height of 4m above ground level, 2m away from the outer wall of the vulnerable building, except for situations where the vulnerable receptor points are situated in an open space where the receptors were modelled at 1.5m above the ground level.

Noise modelling related to the Project

<u>Construction phase</u>

Noise levels in the construction phase were forecast in key points of the receptors in order to compare noise levels to permissible levels.

The development and construction stages – modelling of development works and the construction stage was divided into particular components: construction of the NPP and the cooling system components, including channels/pipelines of cooling or make-up water, and construction of roads and railways, while for Variant 2 – Żarnowiec site, additionally: construction of a pumping station, service road (between the MOLF and the NPP) and traffic of construction site vehicles on the service road. For each activity, two points of noise emission were established: one 2.5m above the ground level, and the other one at 4m above the ground level (cranes, concrete batching plant, etc.). Actual sources of noise may be on different heights, but such an assumption presents the worst-case noise levels anticipated.

Commissioning stage – due to noise levels, modelling of noise involved in the commissioning stage covered the footprint of the reactor and the cooling tower of the unit which would be under construction at the same time. If the permissible levels are found to be exceeded at the commissioning stage, analysis is conducted to establish the share of particular sources, to be able to determine preferred effective minimisation measures.

<u>Operational phase</u>

The anticipated industrial noise generated by the NPP was assessed for a situation where all noise sources operate at the same time. Operational noise was compared to the sources of industrial noise present in the existing environment. The operation of the NPP facilities would result in constant, continuous, broadband levels of noise, with little variations between the daytime and nighttime. The receptors closest to the proposed NPP sites were identified and modelled as point receptors. Forecast noise isolines were prepared to show how the noise from the NPP operation under the respective Sub-variant spreads to farther-away areas. Where permissible levels are found to be exceeded, detailed isolines of noise levels are presented. All sources where modelled as point, linear or area sources, as appropriate.

<u>Decommissioning phase</u>

The decommissioning phase is comparable to the construction stage in terms of impacts and overall noise emissions. Consequently, in this case, reference to the results of assessment for the construction stage without detailed forecasts or assessment process was considered to be sufficient, and only qualitative analyses were conducted for the decommissioning phase.

Noise modelling related to the road and railway traffic

- Road traffic

Modelling was conducted for the construction stage and for the operational phase of the Project. Similarly as for construction works, the most disadvantageous option of traffic intensity was assessed for each road connection. The impact of the Project planned was assessed without cumulative impacts, so the site traffic, both on roads and railway, was assessed independently from the existing traffic, by a comparison to both the permissible noise levels and the existing levels of traffic noise.

The Project is situated close to the coast and several tourist attractions, with an increased traffic in summer months (from June to August). For this reason, scenarios for the peak and non-peak times were defined to establish seasonal variations in traffic. Key data for analyses was Raport z Generalnego Pomiaru Ruchu [*The Polish General Traffic Survey*], conducted in 2015 regarding the intensity of road traffic in national and voivodeship roads in the regions of the proposed NPP sites.

- Railway traffic

Due to the magnitude of impacts, the analysis of noise coming from railway infrastructure takes into account only models of railway traffic at the construction stage. Railway analyses referred to daytime only, and involves four train passages. For Variant 1, models of noise generated by railway traffic related to the construction of the Project were established. In addition, passenger trains were taken into account. For Variant 2, only the traffic of cargo trains was incorporated.

Minimisation measures

For locations where permissible noise levels were found to be exceeded, measures to minimise their consequences were determined. These involved various techniques for the reduction of noise, as appropriate for the type of works: a selection of quieter machinery, shorter duration of machinery operation, and provision of local screening. In some cases, the list of machinery included items whose use on all sub-stages of construction works was considered less probable. Then an adequately lower number of particular machinery items were proposed to be used. Where operational noise levels were identified to exceed permissible levels, the shares of particular sources were analysed to select preferred and effective mitigation measures.

Sources of noise emission

The modelling adopted all possible sources of noise in all phases of the Project implementation, with particular attention to primary construction activities and the involved equipment and machinery, as per the Project Characteristics. Specifications of the sources of noise for all Sub-variants were presented, with indication of their parameters and sound power.

- Road traffic

The model of road traffic regarding the transportation of personnel incorporated commuter traffic between the Accommodation Base and the respective NPP Site variant. The model of cargo transportation incorporated cargo which is not transported to the destination by railway or sea. The worst-case scenario accepts that most cargo would be transported by sea to Gdańsk and Gdynia and from there by road to the destination. Hence, at the stage of construction works, a total of approximately 600 heavy vehicles per day (in both directions) would move on the main access route. In addition, Variant 1 anticipates the traffic of up to 3,500, and Variant 2 up to 5,000 passenger cars per day, due to no possibility of using a railroad connection to the accommodation facilities. The passengers in those vehicles would commute from nearby places, with potential equal distribution between Gdańsk, Lębork and Wejherowo. In each case, modelling of traffic from the sites contemplated would be based on the faster route to the NPP, that is, by the main roads. For Variant 2 – Żarnowiec site, the entire passenger traffic from Choczewo is assumed to be by Road No. 213.

In the operational phase, passage of up to five heavy vehicles per day is forecast.

- Railway traffic

For the construction stage, four cargo trains per day are assumed to run. With respect to Variant 1, these trains were modelled on Railway 230 between Lębork and Wejherowo and on the railway leading to the site. For Variant 2, train traffic was modelled on Railway 230 from Wejherowo to Rybno, where the line would join the new railway leading to the NPP site.

Analysis of the noise baseline

The analysis assessed trends in data on road traffic in the areas of NPP impacts, by analysing changes in traffic intensity, class of vehicles, and differences between the holiday season (important for the region) and non-holiday time. The Sustainable Transport Development Strategy until 2030, adopted by the Council of Ministers, was adopted to review probable changes in noise generated by road traffic. According to the document, the number of cars in Poland in 2030 would be similar as in 2022, with an anticipated larger share of hybrid and electric vehicles in the total number of vehicles. Growing demand for transport in rural areas will intensify traffic by about 30 - 40% on national roads and by about 3 - 12% on voivodeship roads. This will increase the intensity of noise by 2dB on national roads and by 1dB on voivodeship roads.

The figures from report: "Badania i pomiary istniejącego ruchu drogowego" [*The existing road traffic tests and measurements*] of 2016 were compared to the results of traffic measurements made for the EIA Report in 2020 accompanying the monitoring of baseline noise on regional (voivodeship), poviat and local roads close to the Project Site. Initial measurements were taken in October 2015, whereas the measurements for the EIA Report were carried out between June and September 2020. A very high increase in traffic intensity and noise in the years 2016 – 2020 was observed. Hence, the baseline level is expected to grow further, regardless of whether the Project is completed or not.

For Variant 1, noise baseline status was studied for receptors established along the roads. The results show that the locations of receptors in Tadzino and Słajkowo region were exposed to road noise exceeding the permissible levels for the daytime. As discussed above, the extent to which the limits are exceeded will most likely increase irrespective of the Project. The study identified no significant sources of industrial noise. No other large infrastructural projects are anticipated to increase industrial noise in the area.

For Variant 2, the study demonstrated that all receptor locations in Rybno, Opalino, Lubkowo, Kwiatowa and Tadzino are characterised by levels in excess of permissible levels of road traffic noise in the daytime in the summer peak season. In Rybno, Opalino and Lubkowo, the permissible levels were exceeded beyond the summer peak season and in the nighttime. The extent to which the limits are exceeded will most likely increase irrespective of the Project. Noise levels measured in Nadole, Sobieńczyce, Czymanowo and Lubocino were determined as higher than the lowest permissible level for noise with an industrial component. The observations made during the study indicate that the situations where the limits were exceeded are most likely caused in part by the existing noise from the Pomeranian Special Economic Zone. It is anticipated that these noise level would still be exceeded regardless of the Project implementation. Other industrial facilities in this area are the "Żarnowiec" hydropower plant and Żarnowiec 400 kV power station. Noise levels in these places would be similar to measurements in other points, but were not identified as significant sources of noise in this area.

Upon review of available data, both in Variant 1 and in Variant 2, the overall background noise is expected to increase due to increased road traffic regardless of whether the Project is implemented or not. In addition, the variety of vehicles indicates growing numbers of passenger cars, vans and trucks, and certain locations are already exposed to noise that exceeds the permissible levels.

VI.4.10.1.3 Assessment of impacts on acoustic climate

Construction phase

Development stage on NPP site

All activities related to development works are assumed to take place in the daytime only. However, a nighttime scenario, or potential noise emissions caused by the use of lighting powered from a generator set, was also assessed.

The forecast levels of noise generated in connection with development work for Variant 1 do not exceed the permissible levels, and also 10dB below the permissible level. Therefore, impacts on acoustic climate for all activities at the development stage are negligible for all receptors and no mitigation measures are required.

For Variant 2, the expected noise levels in the daytime in connection with the development stage are at least 10dB below the permissible noise levels for a significant majority of receptors. In turn, in the nighttime, the intensity of all impacts is negligible, and the effects are insignificant.

Construction stage

The analyses assumed that construction work would be restricted to the daytime, with some exceptions (such as concrete work, work of generators powering the lights near the site boundary, or other that require continuous operation).

The expected noise levels in connection with the construction stage for Variant 1 – Lubiatowo – Kopalino site – Sub-variant 1A, are at least 10dB below the permissible noise levels for a majority of receptors. During the construction of civil engineering structures, the expected noise levels exceed the 10dB threshold below the permissible noise level for all receptors. For the Słajszewo receptor, minimisation measures are anticipated, in order to not exceed permissible noise levels. For sub-variants 1B and 1C during the construction of the facilities, the expected noise levels exceed the 10dB threshold below the permissible noise level for all receptors.

For Variant 2 – Żarnowiec site – sub-variants 2A and 2B, the expected noise levels at the construction stage are at least 10dB below the permissible noise levels in about a half of the receptors assessed. Only for two receptors, the 10dB threshold below the permissible noise level was exceeded. The expected noise levels during the construction of foundations are close to the permissible noise levels, or exceed those levels for all receptors in the nighttime. The permissible levels of noise that are anticipated to be exceeded at various stages for six receptors would trigger impacts of a very high intensity, which would require minimisation measures.

- Construction of channels/pipelines of the cooling system

For sub-variant 1A for the construction of cooling water channels at sea and on land by an open-pit method, the works are assumed to be conducted in the daytime. However, the option of using a tunnel boring machine (TBM) requires continuous operation, so the assessment of the TBM option also covers permissible noise levels in the nighttime. In the daytime, the forecast levels of noise generated in connection with the construction of cooling system channels do not exceed the permissible levels and do not cross the threshold of 10dB below the permissible noise levels in any receptor location. In the nighttime, levels of noise related to the construction work reach 10dB below the permissible level, which results in low-intensity impacts.

In sub-variants 1B and 1C, the forecast levels of noise generated in connection with the construction of cooling system channels do not exceed the permissible levels and do not cross the threshold of 10dB below the permissible noise levels in any receptor location.

The construction of pipelines of make-up water in sub-variants 2A and 2B at sea would be conducted in the daytime only. However, the anticipated levels of noise from the construction of pipelines of make-up water and pumping station exceed the permissible noise levels, which results in impacts of a very high intensity. Since it is unlikely that noise emissions representative for that impact are sustained for more than one year, this shall be considered a short-term impact. Therefore, such direct adverse but reversible impact would have a medium magnitude and moderate effect.

- Traffic on the service road between the NPP and MOLF

For Variant 1, the service road is situated in the Project Area, away from any receptors, which, coupled with low intensity of traffic and speed of cargo transport, would not generate significant noise levels.

For Variant 2, the service corridor comprises pipelines of make-up water and a service road. The service road is intended for oversized transports between the MOLF and the NPP site, with the maximum speed of 30 km/h. Low intensity of traffic and travelling speed of oversized transports would not generate significant noise levels. The construction works for the service road and the construction of the pipelines of make-up water would be conducted at the same time to minimise any disruptions.

The expected levels of noise related to the construction of the service road and pipelines of make-up water are expected to exceed by 26dB the permissible noise levels in the nearest receptor. Consequently, it would be a very high intensity impact.

- Road traffic

In Variant 1, for road traffic at the construction stage, the scenario of peak and non-peak traffic intensity, or, respectively, for the holiday and non-holiday seasons are assumed. In the daytime, 149 receptors are expected to experience noise above the permissible levels, generated by road traffic at the construction stage in the summer holiday season, whereas 32 receptors would be new. In turn, in the nighttime, 659 receptors are expected to experience noise in excess of permissible levels, of which 90 receptors would be new.

In the non-holiday season, 151 receptors are expected to experience noise above the permissible levels in the daytime, generated by road traffic at the construction stage, whereas 15 receptors would be new. In turn, in the nighttime, 657 receptors are expected to experience noise in excess of permissible levels, of which 76 receptors would be new. With respect to the current status, a large number of receptors have already experienced noise levels generated by road traffic above the permissible levels both in the daytime and in the nighttime. Considering the trends in the road traffic, this impact would intensify regardless of whether the project is proceeded with or not.

For Variant 2, in the non-holiday season, 159 receptors are expected to experience noise levels above the permissible levels in the daytime, whereas 44 would be new exposures. On the other hand, 721 receptors are expected to experience noise in the nighttime above the permissible levels, whereas 189 would be new exposures. In the peak season, 160 receptors are expected to experience noise above the permissible levels in the daytime, whereas 44 would be new exposures. For the nighttime, 723 receptors would experience noise exceeding permissible levels, with 171 new exposures.

- Railway traffic

For Variant 1, 318 receptors are expected to experience noise below permissible levels but within the boundaries of 10dB from the permissible levels, in connection with railway traffic, of which 25 receptors would experience noise in excess of permissible levels in the daytime. These receptors are situated between Lębork, Tawęcino, Choczewo, Kostkowo, Paradyż, Bolszewo, and Wejherowo. For these receptors, forecast noise levels at the construction stage would be very high (in excess of permissible levels), and the intensity of impacts would correspond to indirect, adverse, but reversible, impacts of medium magnitude and moderate effects.

For Variant 2, 344 receptors are expected to experience noise below permissible levels but within the boundaries of 10dB, of which 24 receptors would experience noise levels in excess of permissible levels in the daytime, and this applies to receptors situated in the same places as mentioned for Variant 1.

<u>Commissioning stage</u>

For sub-variant 1A of Variant 1, the assessed commissioning scenario involves the start-up of two reactors and installations related to cooling systems and simultaneous construction of the third unit. All construction works are assumed to be performed in the daytime only. The assessment of the commissioning stage incorporates the identified potential impacts resulting from combined emissions of noise from the operation of the power plant (including minimisation) and construction activities without minimisation measures. The results show that the expected noise levels at the commissioning stage would not exceed the permissible noise levels. Consequently, it would be a low intensity impact. On the other hand, for Sub-variants 1B and 1C, the assessed commissioning scenario takes into account the operation of two reactors and two natural draft cooling towers with installations related to the cooling water systems. One reactor and one natural draft cooling tower are still at the construction stage. All construction works are assumed to be performed in the daytime only. The results show that the expected noise levels at the commissioning stage would exceed the 10dB threshold below the permissible noise level for all receptors, but would not exceed the permissible noise levels. Consequently, it would be a low intensity impact.

For Variant 2, the assessed commissioning scenario includes one reactor in operation and one natural draft cooling tower in operation. Two reactors and two natural draft cooling towers are under construction. All construction works are assumed to be performed in the daytime only. The results show that the expected noise levels at the commissioning stage would exceed the 10dB threshold below the permissible noise level for most of the receptors, and exceed the permissible noise levels for two receptors. Where the anticipated noise levels exceed the permissible levels, it would be a very high intensity impact. These short-term, direct adverse but reversible impacts would have a medium magnitude and moderate effect.

Operational phase

- Operation at NPP site

Noise generated by road traffic on the site is not taken into account in the assessment, because the intensity of traffic in the operational phase would be low, and light vehicles would be prevalent. Therefore, such an impact would be negligible. The most significant sources of noise in the operational phase under sub-variant 1A at the NPP site would be the buildings and facilities involved in the generation of power: transformers and turbine building, reactor auxiliary buildings and a power evacuation switchyard. The results of modelling show that transformers would be the prevailing source of noise affecting the receptors. Combined emissions from the remaining sources are expected to be 11 - 15dB less than emissions from transformers.

In sub-variants 1B and 1C, an additional source of noise would be natural draft cooling towers and a desalination plant. The emission of noise from the desalination plant in sub-variant 1C would be greater due to significantly larger amounts of desalinated water, therefore this process would also involve a much larger magnitude and sound power.

In Variant 2, the impact would be similar to that of sub-variants 1B and 1C of Variant 1. The results of modelling show that transformers and natural draft cooling towers would be the prevailing source of noise affecting the receptors.

A review of detailed noise forecasts has shown that the noise generated mainly by transformers would be clearly perceptible in the receptors closest to the transformers. The anticipated noise level in the operational phase includes additional 6dB on top of the sound power level from transformers, and it constitutes the worst-case scenario that could have happened upon commissioning of the plant.

The results show that in the daytime, the expected noise levels for Variant 1 in the operational phase would exceed the 10dB threshold below the permissible noise levels for one receptor, but do not exceed the permissible noise levels for any other receptors. At night, expected noise levels in the operational phase exceed the 10dB threshold below the permissible noise levels for six receptor locations, and also exceed the permissible noise level in one receptor (Słajszewo). Where expected noise levels in the operational phase exceed the 10dB threshold below the permissible noise levels, this results in impacts of low intensity. Noise levels exceeded in one receptor in the operational phase, in the nighttime, results in impacts of a very high intensity.

In Variant 2, in the daytime, the expected noise levels in the operational phase would exceed the 10dB threshold below the permissible level of noise for four receptors, but would not exceed permissible noise levels for any other receptor. In the nighttime, the expected noise levels in the operational phase would exceed the 10dB threshold below the permissible level of noise for two receptor locations and would exceed permissible noise levels for four receptors.

- Road traffic

For Variant 1 in the operational phase in the non-holiday season, in the daytime, five receptors are expected to experience noise in excess of permissible levels, generated by road traffic, whereas noise above permissible levels has been already recorded at all receptors. In the nighttime, 23 receptors are expected to experience noise above permissible levels, whereas only one would be a new receptor exposed to excessive levels.

In the operational phase in the peak season, in the daytime, five receptors are expected to experience noise in excess of permissible levels, whereas noise above permissible levels has been already recorded at all receptors. In the nighttime, 23 receptors are expected to experience noise above permissible levels, generated by traffic in the operational phase, whereas only one would be a new receptor.

For Variant 2, two receptors are expected to experience noise levels above the permissible levels in the daytime, generated by traffic in the operational phase in the non-holiday season. Both receptors are currently exposed to noise in excess of permissible levels. In the nighttime, 17 receptors are expected to experience noise above permissible levels, generated by traffic in the operational phase, whereas only one receptor would be exposed to noise levels significantly above the permissible level. The receptors are situated near the new roads related to the Project implementation.

For traffic in the holiday season, two receptors are expected to experience noise above permissible levels in the daytime. Both receptors are currently exposed to noise in excess of permissible levels. The receptors are situated near the new roads related to the Project implementation. In the nighttime, 17 receptors are expected to experience noise above permissible levels, whereas only one receptor would be newly exposed to noise in excess of the permissible level. Traffic intensity reflects commuter traffic of the NPP personnel in the long term.

Decommissioning phase

Decommissioning of the NPP would result mainly in low-intensity impacts in the short term and of little significance. Without minimisation measures, effects of moderate significance can arise in Variant 1 and in Variant 2 for all their sub-variants. The decommissioning phase is comparable to the construction stage in terms of impacts and overall noise emissions. Consequently, in this case, reference to the results of assessment for the construction stage without detailed forecasts or assessment process was considered to be sufficient, and the decommissioning phase was assessed qualitatively. The minimisation measures described for the construction stage are considered to be sufficient to remove significant effects in the decommissioning phase.

Minimisation measures

Significant environmental impacts are expected in the Project Area during construction works, construction of the pumping station, increased railway and road traffic. Thus, minimisation measures are recommended, including the use of construction equipment of lower sound power, using screening methods, and proper management of machine operation times. For the operational phase, minimisation measures are proposed to reduce noise emissions from transformers and cooling towers, bringing the levels down to permissible levels at the points of impact. These measures include installation of local screens, using noise-absorbing enclosures and other barriers that would limit noise propagation and reduce its level.

Summary

Almost all comparative and quantitative analyses bring worse impact assessments for the Project in its Variant 2 – Żarnowiec site versus Variant 1 – Lubiatowo – Kopalino site, except for one receptor exposed to noise emissions generated by railway traffic during Project construction works in Variants 1, and six receptors exposed to adverse impacts from noise emissions from road traffic in Variant 1, in the nighttime (as the worst-case scenario).

For Variant 2, the size of residential areas exposed to noise emitted at the construction stage without minimisation measures would be much larger than in Variant 1, and minimisation measures to limit those impacts for Variant 2 would have to be more extensive. In addition, the proposed minimisation measures for the Project operational phase in Variant 2 would have to include more items than in Variant 1, including methods to limit noise emission from natural draft cooling towers.

As regards cumulative impacts, overlapping noise emissions related to the Project and the associated infrastructure are expected to occur in both sites considered. In Variant 2, cumulative impacts would occur in a bigger number of cases/locations of noise receptors (five noise receptor areas exposed) than in Variant 1 (two noise receptor areas exposed).

In conclusion, having considered the cost and complexity of required minimisation measures, even if their application would bring noise levels down to permissible levels, and due to the proximity of receptors vulnerable to noise emission, Variant 2 – Żarnowiec site is considered to be much less suitable for the NPP construction than Variant 1 – Lubiatowo – Kopalino site, in terms of noise emissions.

VI.4.10.2 Marine area

The main purpose of this chapter is to assess the probability of impact of noise and vibrations propagated by water to aquatic mammals and fish (including larvae and roe) during the construction, operation and decommissioning of the Project. The analysis uses guidelines of the Instytut Zarządzania Środowiskiem i Oceny Środowiskowej *[Institute of Environmental Management and Assessments]* concerning noise impacts, which present best-practice approaches to the scope, content and methodology of noise impact assessment. The assessment of impacts is based on comparing the magnitude of impacts and vulnerability of receptors. Measurements of ambient noise in the Marine Survey Area for Variant 1 and Variant 2 were conducted between 30 March 2017 and 4 April 2018. The analysis of acoustic data demonstrated ambient noise levels characteristic of the littoral zone of the Baltic Sea. During acoustic surveys conducted in the region, the following marine and freshwater receptors vulnerable to noise were identified and taken into account in the assessment:

- harbour porpoise (high-frequency cetaceans),
- seals (phocid pinnipeds),
- fish, larvae and roe (species with or without a swim bladder).

The probability of impacts of noise and vibrations propagated in water to the above-mentioned receptors vulnerable to noise was assessed for the construction, operation and decommissioning of the Project and its associated infrastructure.

Natura 2000 sites with porpoise and grey seal are: Ostoja Słowińska Site of Community Importance (SCI) situated approximately 14.5 km to the west of the boundary of Variant 1, and Zatoka Pucka and Półwysep Helski SCI situated approximately 21 km to the east of Variant 2.

VI.4.10.2.1 Variant 1 — Lubiatowo - Kopalino site

Construction phase

The works comprise the construction of the cooling system components, including channels or pipelines with intake and discharge diffusers, as well as the construction of MOLF, fish recovery and return system (FRRS), and temporary items, that is, sheet piling (in the littoral zone and in the sea) or caissons (in the sea) around the cooling system infrastructure. The construction of underwater infrastructure would generate impulsive noise propagated by water, related to pile driving, and non-impulsive noise, related to vibration driving of sheet piles, dredging, making stone backfills, or operation of watercraft.

The analysis shows that the levels of underwater noise due to construction works in Variant 1 would be below the vulnerability threshold for high-frequency cetaceans and fish (with a swim bladder), except for the following scopes:

- impact pile driving – marine mammals vulnerable to noise:
  - Permanent Threshold Shift – up to 2.5km,
  - temporary, reversible trauma and hearing threshold shift – up to 20km,
- impact pile driving – species with a swim bladder:
  - temporary, reversible trauma and hearing threshold shift – up to 50m,
- dredging and stone backfilling – marine mammals:
  - behavioural disturbance – up to 1.8km (dredging),
  - behavioural disturbance – up to 50m (stone backfilling),
- vibration-driven sheet piles – the threshold of behavioural disturbances was not reached for marine mammals, but the threshold of temporary, reversible trauma and elevated hearing threshold was reached for fish. The distance from the source was not provided, but this is due to the fact that the works involving pile driving would have to be conducted for 12 hours without interruption, and fish, as receptors, would need to have stayed in the same place all the time.

Modelling of underwater noise caused by other construction works did not reveal any values above assessment thresholds.

Operational phase

In the operational phase, the only noise propagated by water may be generated by watercraft docking to the MOLF structure. However, due to the fact that such situations could happen very rarely, they would not have any significant impact on the marine acoustic climate.

Decommissioning phase

Decommissioning of underwater infrastructure would generate non-impulsive noise propagated by water, related to the extraction of piling (vibration driving of sheet piles), mechanical removal of piling and infrastructure from the seabed, and works conducted by watercraft and the traffic of this watercraft. Therefore, the noise is considered to be of nature similar to that adopted for the construction stage.

However, it should be noted that a separate environmental impact assessment would be prepared for that phase of the Project.

VI.4.10.2.2 Variant 2 - Żarnowiec site

Construction phase

The scope of works at sea for Variant 2 is similar to that of Variant 1, but due to a smaller range of those works, noise-related impacts would also be lower.

The analysis shows that the levels of underwater noise due to construction works in Variant 2 would be below the vulnerability threshold for high-frequency cetaceans and fish (with a swim bladder), except for the following scopes:

- dredging and stone backfilling – marine mammals:
  - behavioural disturbance – up to 1.8km (dredging),
  - behavioural disturbance – up to 50m (stone backfilling),
- vibration-driven sheet piles – for vibration-driven sheet piles, the threshold of behavioural disturbances was not reached for marine mammals, but the threshold of temporary, reversible trauma and elevated hearing threshold was reached for fish. The distance from the source was not provided, but this is due to the fact that the works involving pile driving would need to be conducted for 12 hours without interruption, and fish, as receptors, would need to have stayed in the same place all the time.

To sum up, it should be emphasised that the analyses assume that the selected receptors, that is, marine mammals and fish, would be present in the described areas throughout the entire duration of construction/decommissioning works. This is highly unlikely, since these animals would migrate outside of the area already after the commencement of works. These animals can be assumed to return to the regions of the contemplated Project sites upon the completion of construction works that generate noise.

Operational phase

In the operational phase, the only noise propagated by water may be generated by watercraft docking to the MOLF structure. However, due to the fact that such situations could happen very rarely, they would not have any significant impact on the marine acoustic climate.

Decommissioning phase

Noise impacts on marine environment in the decommissioning phase for Variant 2 would be similar to that of Variant 1.

VI.4.11 Impact on monuments and archaeological sites (land and sea)

To describe the existing architectural monuments and archaeological sites subject to the impact of the Project, the results of archaeological survey conducted in the years 2017 – 2019 were used. The outcomes of those surveys were compiled in two studies: Raport końcowy z wynikami badań w zakresie inwentaryzacji archeologicznej *[Final report with outcomes of archaeological surveys]* and Raport z charakterystyki i waloryzacji środowiska *[Environment specification and valuation report]* regarding tangible and intangible cultural heritage.

VI.4.11.1 Methodology for assessing impacts on cultural heritage

The NPP impact on cultural heritage was forecast using an expert method, by analysing particular phases/stages of the Project and the scope of works, taking into account the location, object and level of protection, and the condition of the object. Impact assessment based on the above collected data extended to architectural monuments and culturally protected areas, and archaeological sites on land and at sea, in the region of the direct and indirect impacts of the Project. The following assumptions were adopted:

- direct impacts would occur within the boundary of the Project Area on archaeological sites where, due to the construction, the entire area would be transformed, and all items of cultural heritage would be at risk of significant impacts such as exposure, degradation or destruction,
- indirect impacts would occur outside of the boundary of the Project Area in all of its phases/stage on architectural monument in buffer zones at roads and railways with traffic of vehicles carrying construction materials, and the personnel employed, to the NPP. Traffic would result in vibrations, which might potentially affect the historic resources.

To protect buildings against vibrations (if adverse impacts are confirmed), measures should be taken to minimise the impact of the vibration source on buildings. However, the effectiveness of these measures depends on factors including the type of vehicles, local geotechnical conditions, and the design of the buildings that receive the vibrations. In the current, early stage of the Project (and EIA Report), there are uncertainties whether the source of vibration, being in this case passages of transport vehicles and construction machinery on roads and railroads, would be in the quantities forecast for this Project; whether the location of the Associated Infrastructure of roads and railways would be finally adopted in the footprint considered; and whether the indicated specification would be maintained. Consequently, due to the too early stage now, detailed measurements and analyses of the effect of vibrations on architectural monuments are recommended to be conducted at the stage of developing design documentation for the transport infrastructure.

For the purpose of the assessment of potential impacts of vibrations elicited by road and railway traffic, the area of indirect impacts was narrowed down to the buffers of roads and railways included in the associated infrastructure, on which vehicles and trains would move to and from the NPP. To determine indirect impacts, the analysis covered:

- road transport – roads of the associated infrastructure: main access road from S6 (Strzebielino junction) to the NPP and reserve access roads to the NPP under both site variants; service road leading from the marine off-load facility to the NPP. The buffer for analysis of historic monuments and archaeological sites on both sides of the above-mentioned roads was determined as follows: for sections of voivodeship roads, a buffer of 100m was assumed due to a larger number of vehicles and higher average travelling speeds, and for commune and poviat roads – a buffer of 50m was assumed due to a smaller number of vehicles and lower average travelling speed;
- railroad transport – railway no. 230 to be reconstructed, and a new railway to the NPP site. For railway, a buffer of 100m was assumed on both sides of the external tracks.

The results of archival query and field surveys of archaeological sites and architectural monuments for both site variants were entered into tables of results and to the spatial database using a geographic information system (GIS). Then, cultural heritage was analysed in terms of any existing impacts. The archaeological sites and historic buildings exposed to indirect and direct impacts are shown on the orthophotomap.

VI.4.11.2 Methods for protection of cultural heritage before the start of the Project

Conservator's permit

Archaeological sites, architectural monuments and culturally protected areas are cultural resources, and are subject to protection under the Historic Monument Protection and Care Act of 23 July 2003. All construction works must take into account maximum protection of cultural resources. Construction works, archaeological and architectural surveys, and other activities that might compromise the substance or change the appearance of a historic monument require conservational permit prior to the commencement of works. The permit lays down the method of archaeological surveys, in the form of exploratory archaeological excavation or archaeological oversight (observation and recording of events during earthworks for construction projects); a method of conducting construction works near the historic monument may also be ordered. The permit shall be obtained prior to construction permit for the Project.

If construction works need to be conducted close to a historic monument or archaeological site, the scope of works within the area of historic resource should be consulted with the Pomorskie Voivodeship Monument Conservator (PWKZ) at the design stage and prior to the commencement of the Project construction.

Archaeological and architectural surveys

In the light of the Historic Monument Protection and Care Act, archaeological surveys are activities aimed at exposing, identifying, documenting and preserving an archaeological monument. Archaeological surveys include: exploratory archaeological surveys, archaeological excavations, recording of survey outcomes. Special type of archaeological survey are surveys of underwater cultural heritage. In Polish marine areas, permits for activities aimed at search for hidden or abandoned movable historic monuments, including archaeological monuments, using all kinds of electronic and engineering devices and diving equipment, are issued by the Director of the Maritime Office (DMO) in consultation with Voivodeship Monument Conservator competent for the site of the Maritime Office.

VI.4.11.3 Assessment of impacts on historic monuments and archaeological sites

VI.4.11.3.1 Variant 1 — Lubiatowo - Kopalino site

The outcomes of impacts on historic monuments and archaeological sites would be the same regardless of the sub-variant: 1A, 1B or 1C.

Construction phase

Development stage

Figure VI.3.3-(1) shows one area archaeological site, marked with No. 17, in the land part of the south-eastern boundary of the Project Area, in the village of Jackowo, the Choczewo commune. The protected object is an open settlement from the early and late Middle Ages. The site is entered to the Records of Monuments and designated for protection in the Study of Development Conditions and Directions of Spatial Planning (zoning study) of the Choczewo Commune.

In the current phase of the Project/assessment, there are no specific guidelines as to the scope of development in the area of that site, because the area is considered to be a reserve area that might turn out to be necessary for the NPP construction. However, using this area as site facilities cannot be ruled out. Consequently, potential earthworks at the Project development stage might adversely affect that archaeological site. For a fragment of site no. 17 that is in woodland area, hazards would be brought primarily by the grubbing of trees and bushes and any earthworks, including levelling of terrain, excavations or construction of a network of the technical infrastructure.

Within the boundary of the Project Area, there are no architectural monuments, culturally protected areas or shipwrecks/archaeological sites in the sea. Hence, no impact of the Project on cultural heritage is expected to arise at the development stage. At that stage, neither construction work would take place in the marine part nor there would be any transport of materials by sea. Most sections of roads and all railways would be under construction, therefore, no NPP impacts on historic buildings are expected arising from transportation by these communication routes.

Construction stage

It is assumed that, already at the development stage, Archaeological Site No. 17 would be surveyed, the historic material from it would be properly exposed, secured and sent to the museum (provided that any construction work is contemplated that could deteriorate its condition). However, due to the fact that the area is assigned as a reserve area, there may be no need to interfere in that site. During the above deep earthworks, deeply lying, known or unknown and unexposed archaeological sites might be degraded or destroyed. In such cases, all work that might damage or destroy a historic object would be suspended (on the spot of the archaeological site and in its direct vicinity), the object and place of discovery would be properly secured, and the PWKZ would be immediately notified.

Within the boundary of the Project Area, there are no architectural monuments or culturally protected areas. Hence, no impact of the Project is expected to arise in this regard.

The Project implementation at the construction stage would not have a direct effect on underwater cultural heritage, because of absence of any underwater cultural heritage identified within the boundaries of the marine part of the Project Area. The closest object to the site is a wrecked “Centik” ship near Variant 1 – Lubiatowo – Kopalino site, at about 15m from the boundary of the Project Area in its marine part and at a distance of approximately 215m from the coastline. That is why construction works related to the construction of the cooling system components in the marine area would be conducted under strict supervision, in keeping with safe distance from the above-mentioned shipwreck.

In the buffer zones around roads and railways included in Associated Infrastructure, 31 architectural monuments and one culturally protected area were identified, that might be potentially at risk of damage due to vibrations during the passage of heavy vehicles, machinery and rolling stock carrying construction materials. That impact at the construction stage is indirect, it would be limited in time until the completion of construction works and commissioning of the Project.

<u>Commissioning stage</u>

No earthworks would be conducted at the NPP commissioning stage, and road traffic on transportation routes would be characterised by lower intensity. Therefore, no significant impact on archaeological sites and architectural monuments is forecast at that stage.

Operational phase

In the operational phase, within the boundary of the Project Area, no impact on archaeological sites is expected to arise. No construction works are anticipated in the marine part, either. Transports by sea of materials necessary in the operational phase of the Project would not intrude into the seabed.

The impact of vibrations on 31 architectural monuments and one culturally protected area along the roads and the railway would be less intensive than in the Project construction phase, but it would be long-term one and would spread over time. Therefore, the objects and areas which undergo impacts from the Project operation and are covered by the conservator’s protection, would be subject to a periodic inspection.

Decommissioning phase

In the decommissioning phase, within the boundary of the Project, no impact on archaeological sites is expected to arise. There would be also no impact on underwater cultural heritage.

Only indirect impacts might occur, such as impact of vibration on architectural monuments situated along the roads and railway transporting the dismantled structural elements of the NPP facility, or impact of mobile heavy machinery levelling the ground. Such works in the decommissioning phase are expected to have a similar nature and intensity of impacts as those assumed for the construction stage.

VI.4.11.3.2 Variant 2 - Żarnowiec site

Construction phase

<u>Development stage</u>

- Subarea 1 (main NPP site)

In Sub-Area 1, there are 22 archaeological sites in Kartoszyno, the Krokowa commune. All the sites are entered in the Records of Monuments. Site No. 266 is designated for protection in the Study of Development Conditions and Directions of Spatial Planning (zoning study) of the Krokowa Commune, by including it in a zone of the limited archaeological protection. The protection of the sites situated in this area covers mostly a settlement and traces of settlements from the Middle Ages (early Iron Age, Roman influence sub-period).

Intensive development work is expected in Subarea 1, necessary for the NPP construction, that would pose a risk to the above-mentioned archaeological sites situated there. The works that could result in adverse impacts on archaeological resources include, among others: demolition works (removal of the existing facilities implemented during the construction of NPP Żarnowiec in the 1980s) and works to prepare the site for the construction of NPP facilities, that is, clearing and grubbing of trees and bushes, ground levelling, making reservoirs of drainage water, and building the construction site facilities and infrastructure (including roads, technical and telecom installations, office or welfare facilities, etc.). As demonstrated by the field surveys of the surface, most sites are in unsatisfactory condition. They have been probably partially or completely destroyed during the construction of the NPP Żarnowiec in the 1980s. In Subarea 1, there are no architectural monuments or culturally protected areas. Hence, no impact of the Project on cultural heritage is expected to arise at the development stage.

- Subarea 2 (area of make-up water pipelines for the NPP cooling system together with technical infrastructure)

Subarea 2 includes 16 archaeological sites entered to the Records of Monuments, including 14 area sites and two point sites. Most of them are located in Lubkowo, and two are situated in Żarnowiec, in the Krokowa commune. The protection of the sites covers mostly a settlement and traces of settlements from the Middle Ages (Stone Age, Early Bronze Age — Neolithic period, Early Iron Age — Roman influence subperiod). Eleven sites are designated for protection in the Study of Development Conditions and Directions of Spatial Planning (zoning study) of the Krokowa Commune, by including them in a zone of the limited archaeological protection.

During development work, there may be adverse impacts on buried archaeological sites as a result of demolition works of the facilities built during the construction of the former NPP Żarnowiec, resolutions of conflicts with the infrastructure existing on the anticipated routing of pipelines supplying make-up water to the cooling system, with technical infrastructure, and grubbing trees and bushes, stripping of topsoil, and land levelling.

- Subarea 3 – pumping station and Subarea 4 – area of make-up water pipelines for the cooling system together with technical infrastructure

In these Subareas, no Project impacts are anticipated on archaeological sites, historic buildings and culturally protected areas in any phase of the Project due to their absence from the Project Area.

No impacts on underwater cultural heritage are anticipated due to the lack of construction works in the marine part at that stage. In addition, there is no shipwreck/archaeological site within the boundaries of the Project Area in its marine part in Variant 2 – Żarnowiec site. At the development stage, most sections of roads and all proposed railways would not have been constructed yet. Such infrastructure would begin to be used mainly from the Project construction stage, and cleared trees and bushes and earth/excavated material at the development stage would be transported by the existing roads. Therefore, no adverse impacts on archaeological monuments are expected in the buffer zones of that infrastructure.

<u>Construction stage</u>

In Subarea 1, the types of facilities and the scope of works for the NPP facilities are similar to those of Sub-variants 1B and 1C of Variant 1 – Lubiatowo – Kopalino site, the only difference being a change in the arrangement of specific facilities due to the shape of boundaries of the Project Area in Variant 2 – Żarnowiec site.

The works conducted at the construction stage would have an adverse impact on archaeological sites, leading to their exposure/degradation, including due to making deep excavations for NPP facilities, piling, drainage of excavations, securing deep excavations, and foundation works. Subarea 2 (area of make-up water pipelines for the cooling system together with technical infrastructure).

Earthworks, digging for make-up water pipelines for the cooling system with its technical infrastructure and the construction of service road would lead to adverse impacts in their footprint that could degrade or destroy archaeological sites. In Subarea 2 and in close vicinity of its boundary, there are no architectural monuments or culturally protected areas. Hence, no impact on them is anticipated.

The Project implementation would have no effect on underwater cultural heritage, because of their absence within the boundaries of the marine part of the Project Area, for Variant 2 – Żarnowiec site. The closest shipwreck having the status of an archaeological site (British cargo ship, also known as a collier, “General Carleton”) is more than 0.5km away from the boundary of the Project. Therefore, if particular care is exercised when navigating watercraft, construction works at sea should not bring any adverse impacts on the condition of that historic monument.

Four historic buildings were identified, situated in the buffers along transport routes to the NPP site, that could be potentially at risk of damage due to vibrations. This impact at the construction stage, previously defined as indirect, will be limited in time until the completion of construction works.

Recommendations for preventive archaeological investigations and rescue studies in the case of uncovering of a site in Sub-areas 1, 2, 3 and 4 at the construction stage remain the same as for Variant 1 - Lubiatowo - Kopalino site.

<u>Commissioning stage</u>

As described for Variant 1 – Lubiatowo – Kopalino site, this stage would not involve any particularly noticeable traffic of vehicles and machinery that would impact on the surroundings. Consequently, no impact on archaeological sites and historic buildings is expected at that stage.

Operational phase

In the Operational phase, no impact on archaeological sites is expected within the boundary of the Project Area. Also, no construction works are expected in the marine part, and transports of necessary materials by sea in the operational phase of the Project will not interfere with the seabed.

The impact of vibrations on four historic buildings along the roads and the railway will be less intensive than at the Project construction stage, but it will be long-term one and will be spread over time. Therefore, the objects and areas under conservator’s protection and experiencing impacts from Project operation, would be subject to periodic inspection.

Decommissioning phase

No impact on archaeological sites is expected to arise in the Project decommissioning phase. There would be also no impact on underwater cultural heritage.

There may only be an indirect impact in the form of vibrations on architectural monuments located along the roads from vehicles and machines transporting dismantled structural components of the nuclear power plant building and heavy driving machines levelling the terrain. It is expected that these works in the decommissioning phase will bring about a similar nature and intensity of impacts as those that occur at the construction stage.

VI.4.11.4 Summary

The construction of the NPP would involve intervention in the ground at places covered by conservator’s protection, hence, it would potentially constitute a threat for the preservation of archaeological relics, the documentation and preservation of which is in public interest. In addition, there would be indirect impact, in the form of vibrations, on historic buildings situated in the vicinity of roads and railways with traffic of vehicles supporting the Project. For all site Variants, impacts on archaeological sites would be most pronounced at the development and construction stages due to extensive earthworks and construction works. Project impacts on historic buildings/architectural monuments may be most pronounced at the construction stage and in decommissioning phase due to the intensity of using transportation routes (roads and railways) situated in the vicinity of monuments. It is assumed that already in the construction phase archaeological sites will be discovered, properly excavated, extracted, secured, examined and sent to the museum. Consequently, the investment activities would take into account maximum protection of cultural assets in each phase of the Project, and all works within or in the vicinity of Sites or historic buildings and culturally protected areas would be conducted in consultation with the Pomorskie Voivodeship Conservator of Monuments.

Regardless of Sub-variant, completion of the Project in its Variant 2 – Żarnowiec site would be least favourable for cultural heritage, since, in the Project construction phase in the Project Area, a much larger number of archaeological sites could be lost (38 sites) than in the case of Project implemented in Variant 1 – Lubiatowo – Kopalino site (one site). The indirect impact on architectural monuments on roads and railway lines has in this case a secondary importance since it is not possible at this stage of the Project to definitively confirm whether the architectural monuments indicated in the above analysis will be subject to gradual degradation or be exposed [to it]. This can be resolved based on field measurements only in during the operation of roads and the railway.

To sum up, Variant 1 – Lubiatowo – Kopalino site, preferred by the Investor regardless of the Sub-variant, is also a more favourable variant in environmental terms.

VI.4.12 Landscape and Visual Impact Assessment

Based on the assessment of Project impacts on landscape, Sub-variants 1B and 1C with closed cooling systems (in Variant 1 – Lubiatowo – Kopalino site) and 2A and 2B (in Variant 2 – Żarnowiec site) proved to be most unfavourable in terms of landscape impacts. This is due to the fact that closed cooling systems require the construction of cooling towers which constitute an adverse landmark feature, which is absent from Sub-variant 1A with open cooling system.

Please note here the following important aspect. Landscape studies are based on elements difficult to model, i.e. feeling, reception, perception, since such words are usually used, in the space in front of an observer, potentially every human being. This, obviously, makes it harder to provide objective assessments, since the same landscape or landscape item can be evaluated differently by different observers. An excellent example here are wind farms – for many, they are "alien" items that are difficult to accept in an idyllic rural landscape, while others associate them with generation of clean energy and this fact allows them to accept a "new" view.

For the purpose of impact assessment, the "points of view" of many potential observers on the same items of landscape should be standardised, and this has been conducted within the chapter on landscape impact assessment.

For both site Variants, representative lookout points of particular landscape sensitivity from which the Project would or could be visible were identified. All permanent and temporary structures of the NPP, taking into account the topography, existing building structures (development) and natural obstacles obscuring the view (high vegetation), and then the exposure of Project components in the landscape were assessed.

Such simplified approach allows us to standardise both the assessment and its outcomes.

Construction phase

In the construction phase, items not yet present in the survey area: tall structures and equipment (e.g. scaffolding, tower cranes, etc.), a large number of construction machinery (excavators, bulldozers, trucks, etc.) and workers, with constant activity and lights of the construction site visible from many kilometres away, constitute a foreign element that disturbs the hitherto positive perception of the coastal landscape, and will be the most intrusive element in terms of landscape regardless of the sub-variant analysed. However, due to terrain features of both Site variants, Variant 2 – Żarnowiec site seems to be more favourable. Project site in the existing industrial area situated between high hills is less prominent as a landscape feature than in Variant 1 – Lubiatowo – Kopalino site.

Operational phase

However, the situation would change when construction activities are completed and the NPP begins regular operation. After the auxiliary structures (scaffolding, tower cranes, etc.) are dismantled, construction equipment is demobilised, building façades are finished, and the construction site is tidied up, the only sub-variant under consideration without cooling towers in Variant 1 – Lubiatowo – Kopalino site, will be the least perceptible in terms of human impact on the landscape. The remaining sub-variants (1B, 1C, 2A, 2B) with cooling towers would for many years significantly and adversely dominate the close, and sometimes quite distant surroundings of the NPP.

Decommissioning phase

In the Decommissioning phase, subject to the method and technology of demolition works, the landscape impacts that are similar to the construction phase, albeit less intensive, should be anticipated.

Summary

In landscape terms, the final choice proved to be quite clear. The analysis therefore shows that it was the duration of the impact that became the key element in the assessment, whereby the decades-long dominant visual impact of the cooling towers shifted the result of the assessment in favour of technical sub-variant 1A (without cooling towers) in Variant 1 - Lubiatowo - Kopalino site.

VI.4.13 Impacts related to exceeding the permissible values of the electromagnetic field

In the case of the planned Project the phenomenon of electromagnetic field's impact on the environment, including on the human organism is not connected to NPP's location or the cooling system applied, hence it is not dependent on the selected location variant or sub-variant.

Among NPP facilities that will constitute electromagnetic radiation sources will be power lines and power stations (in the 50 Hz frequency range), and radio communication and safety systems equipment (in the 100 MHz—60 GHz frequency range).

Irrespective of the Site variant or phase of the Project, the nuclear facility would not exceed the permissible levels of emission of electromagnetic fields as defined in Regulation of the Minister of Health of 17 December 2019 on the permissible levels of electromagnetic fields in the environment, in locations where human presence is allowed.

In the vicinity of electrical power equipment (transformers, rotating machinery, and electrical devices) and radio communication equipment (transmitting and receiving antennas) there will be local fencing, with access to the said equipment limited only to authorised maintenance personnel, with the equipment de-energised.

Under 400 kV power lines and in the vicinity of power substation, and within the impact range of telecommunication transmitting and receiving equipment on the NPP premises, at locations where exceedance of permissible electromagnetic field level values for buildings with rooms designated for permanent occupancy by humans could potentially occur, a prohibited zone will be designated, banning the construction of such buildings.

The range of environmental impacts of electromagnetic field generated by devices installed on NPP premises would be confined to the boundaries of the Project.

VI.4.14 Impact related to ionising radiation

Anticipated emissions of radiative isotopes to the atmosphere and surface waters (Baltic Sea) are presented for Variants 1 and 2. Total annual effective doses from individual exposure pathways and annual thyroid dose, for various age groups (adults, children and infants) was assessed. In addition, possible accumulation of radioactive substances in components of the environment (flora, fauna and human organisms: bones and thyroid) were analysed.

These assessments and analyses were conducted for two phases of the Project: construction phase (covering development, construction, and commissioning stages) and operational phase. The assessment of radiological impacts on the environment for the decommissioning phase will be conducted in a separate safety report dedicated to the decommissioning phase, taking into account the actual status of nuclear and radioactive materials accumulated and stored on NPP premises. However, radiological impacts on the surroundings in the NPP decommissioning phase are expected to be much less than in the operational phase.

During the construction phase, the first radioactive emissions will occur at the commissioning stage, once the first criticality of the reactor has been reached. It is estimated that they will not to exceed half of the average emissions from a single NPP unit in the operational phase.

The outcomes of calculations and analyses of NPP radiological impacts in operational states in Project operational phase demonstrated that the limit of annual effective dose (0.3 mSv/year) adopted as the criterion for analysis – in accordance with the “Atomic Law” Act and EU requirements (EUR) will not be exceeded in any case in NPP surroundings.

The calculated maximum annual effective doses related to operational emissions of radioactive substances from the NPP into the environment (i.e. into the atmosphere and seawaters) for both locations are 4.8x10-3 mSv/year and are more than one order of magnitude less than the limit mentioned above.

In addition, the assessment of doses related to emissions of liquid radioactive substances to the sea demonstrated that radiological impacts related to these emissions are insignificant, since they contribute less than 1% to the cumulative effective dose.

The maximum annual (equivalent) doses of iodine to thyroid in both proposed sites are also insignificant and cannot have any adverse impact on human health. The analysis of potential accumulation of radioactive substances in environmental components shows that the effect of radionuclides released into the environment on their natural concentration in particular environmental components is also negligible (at 4.45x10-4 mSv/year).

VI.4.15 Impacts on human health and life

Conventional emissions would be the potential sources of the impact on human health and life (emissions of pollutants into the air, noise emissions, water pollution, or wastewater) that could physically affect human health. On the other hand, the radiological impact of the NPP in operational states on the environment will be negligibly low (maximum additional annual effective doses from those impacts are only 0.2% of the ionising radiation background) which would not have any adverse impact on human health.

The analyses show that conventional emissions would be within the limits of relevant standards and the related nuisance would occur mainly in the construction phase, i.e. for approximately 12 years (Variant 1 – Lubiatowo - Kopalino site) and for approximately 17 years (Variant 2 – Żarnowiec site). This nuisance can be experienced by people staying or living near the NPP implementation site. There may be a risk of exposure to harmful impacts related to air pollution, especially for people living near the sources of air pollution, principally along main transport routes. For Variant 1 – Lubiatowo - Kopalino site, it would be e.g. residents of Choczewo and nearby locations such as Kopalino, Lubiatowo, Biebrowo and Słajszewo.

No significant noise and vibration, or pollutant emissions into the atmosphere are expected to occur outside of the NPP site during Project operation. The entity operating the NPP would conduct surveys and measurements of physical and chemical factors, including noise, to which workers at the workplace could be exposed, and introduce measures to minimise such impacts. During the operation, there may only be a local increase in noise levels due to the transport of materials and personnel on public roads. It could be experienced by people living near the network of public roads, mainly residents of Choczewo (Variant 1 – Lubiatowo - Kopalino site).

No impacts related to waterborne diseases in either of the site variants should occur during the NPP construction or operational phases. The Project provides for a water treatment and supply system, as well as wastewater treatment and discharge system.

Liquid radioactive substances would not be generated during the construction phase. At its final stage, i.e. during active (nuclear) commissioning, the first liquid emissions might occur. However, their volume would be less than at the operational phase.

In the operational phase, liquid radioactive substances would be routinely discharged into the Baltic Sea. However, their volumes, concentrations, and the methods for controlling and discharging (several kilometres into the sea) would be selected in such a way as to ensure that the impact on water quality is negligible, taking into account the half-life. Similarly as for the cooling water discharge, in the commissioning phase and throughout the operational phase, discharge of liquid chemicals or radioactive elements into the sea would be kept under strict control, and their impact on health and quality of life would be constantly monitored.

Radiological impacts on power plant personnel would not exceed the limit dose set out in regulations. Even in the worst case scenario, the doses received by general population in the NPP surroundings are several orders of magnitude lower than the average radiation background in Poland, and therefore, they pose no risks to people.

Initially, the Project might raise many concerns and doubts in local communities, which may result in increased stress and anxiety, due to potential misconceptions about negative impacts of the NPP on health. The fear of change or the need to adapt to new circumstance may also result in additional stress. It is estimated that the negative impact in this respect will gradually give way to a positive impact - perception of opportunities generated by the Project, development of the commune's potential, new employment prospects or business opportunities. This should be facilitated, in particular, by educational activity and full openness of the NPP operator in providing information to the local community on NPP impacts on the surroundings, based on objective data and analyses resulting from environmental monitoring.

VI.4.16 Impacts related to waste management

Waste treatment was analysed in the context of both Project sites with their Sub-variants (1A, 1B, 1C – Variant 1 – Lubiatowo – Kopalino site, and 2A and 2B – Variant 2 – Żarnowiec site).

Generation and treatment of conventional waste, radioactive waste (RW) and spent [nuclear] fuel (SNF) are presented in relation to individual Project phases.

Direct impacts related to conventional waste are assumed to occur primarily in the construction and decommissioning phases. It would be mainly construction waste, most of which could be recycled and recovered, thus its quantities would be effectively minimised. Under the applicable regulations, all waste would be sent for management to licensed entities only. In connection with the need of demolishing/dismantling of the facilities existing at the Variant 2 – Żarnowiec site, that site would generate significantly more construction waste, whereas in Variant 1 – Lubiatowo – Kopalino site the key issue would be optimisation of earth mass management.

Conventional waste generated in the Project operational phase would be processed in compliance with the applicable procedures in such a way as to ensure that they are not contaminated with radioactive substances.

With reference to radioactive waste and spent nuclear fuel, NW processing, packaging and transport to the designated waste repository (New [Surface] Radioactive Waste Repository – NSRWR). Also, doses for general population from RW transport were assessed, as were maximum emissions of radioactive substances beyond the NPP site, and the doses involved in the processing and storage of RW, and storage of SNF at NPP premises. The above analyses show that the estimated doses are negligible in comparison with the ionising radiation background in Poland, hence they have no adverse impact on human health or the environment.

In addition, the carbon footprint involved in RW and SNF treatment in the operational phase and in the decommissioning phase was assessed (RW and SNF are not generated in the construction phase). The values are among the lowest from among alternative energy sources and in this aspect NPPs are second best only to hydroelectric power stations.

VI.4.17 Determining the projected environmental impact in the event of a severe accident

The notion of severe accident (in nuclear terms) could be considered only in the context of random events during the use of nuclear fuel in nuclear reactor, i.e. in the operational phase and, to a much smaller extent, in the construction phase (commissioning stage) or in the Project decommissioning phase.

The radiological consequences outside of NPP in the event of severe accident were analysed for two cases: accident without core melt, and severe accident with core melt, which is also a representative accident for emergency planning. Based on applicable regulations, requirements and recommendations, both national and international, the criteria for defining NPP surrounding zones and areas where, in particular, specific protective measures (so called intervention measures) may be planned, with the aim of minimising any adverse impacts of an accident on human health in the NPP surroundings. The extent of those zones and areas is estimated based on calculation results and analyses of the radiological consequences of the above-mentioned events. The outcomes of analyses of Project impacts resulting from a severe accident at a distance of more than 30 km show that, even for cities and voivodeships located closest to the NPP (for both site variants), effective doses and dose rates would be at low levels. For dose rate, it means that they are lower than the average ionising radiation background in Poland. For doses, it means that lifetime doses (in periods of: 70 years – for children, 50 years – for adults) received as a result of an accident would not exceed annual limits for planned exposure situations, i.e. NPP operational states.

To sum up, even in the event of a severe accident, the measures needed for the protection of human health would be limited in space (no need for permanent resettlement or temporary relocation of the population outside of the immediate surroundings of the power plant) and in time (that is, there would be sufficient time for the implementation of necessary protective measures). Therefore, it is consistent with recommendations of the West European Nuclear Regulators' Association (WENRA) for next generation of reactors.

VI.4.18 Impacts on socio-economic aspects

VI.4.18.1 Assumptions

The Project impact has been analysed separately for both site variants: Variant 1 – Lubiatowo - Kopalino site, and Variant 2 – Żarnowiec site, without a detailed differentiation for sub-variants, unless the impact is associated with a differentiation factor which constitutes a material component that can affect the extent and magnitude of the impact. The impacts analysed relate to the impact of the NPP under normal operating conditions.

The NPP implementation will have an impact on socio-economic aspects, and consequently there will be changes in land development forms and land use, settlement network and infrastructure (transformations), spatial planning in communes, especially in communes in the vicinity of the NPP, development of marine and coastal areas, services, economy, industry, agriculture, fisheries, forestry, tourism, living standards and quality of life.

VI.4.18.1.1 Projected number of employees

Construction phase

<u>Development stage</u>

The table below [Table VI.4.18.1- 1] presents the estimated number of employees. At the development stage for both site variants it is assumed that the workforce will be sourced primarily in the local and regional markets and there will be no need to build new accommodation facilities. The potential incoming workforce will be accommodated (short-term rent) in the existing base (hotels, guest houses, privately owned accommodation).

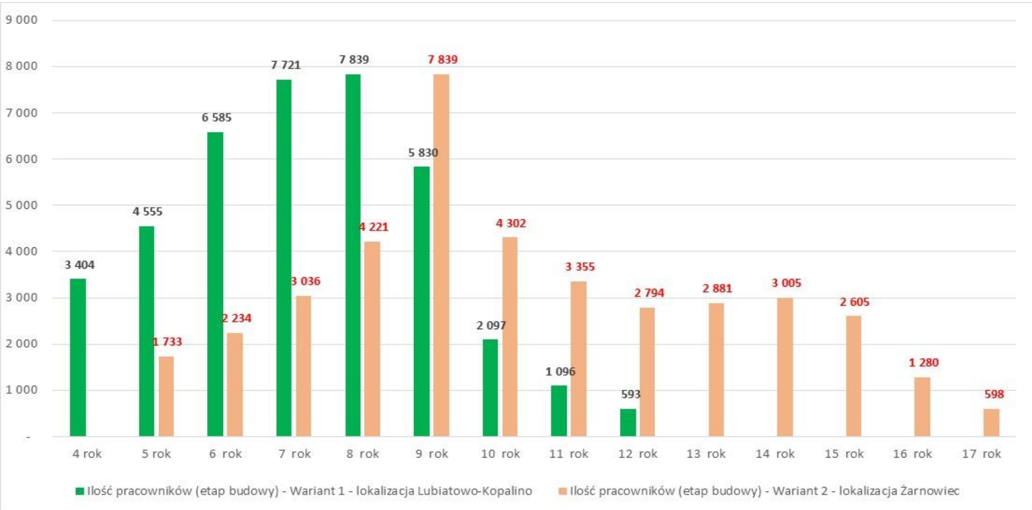
Table VI.4.18.1- 1 Projected number of the full-time employees at the development stage

Employees	Variant 1 Lubiatowo - Kopalino site		Variant 2 – Żarnowiec site		Number of people to be accommodated in the area analysed
	Demolition works	Development stage (approx. 3 years)	Demolition works (approx. 2 years)	Development stage (approx. 3 years)	
Total number of employees	not applicable	1750	1017	1750	Potential short-term hiring of a certain group of workers outside the region
Management / engineering staff	not applicable	*120*	*117*	*120*	
Skilled and unskilled workers	not applicable	*1630*	*900*	*1630*	

Source: In-house study

<u>Construction stage</u>

The estimated duration of the construction stage is approximately 9 years for Variant 1 - Lubiatowo - Kopalino site, and approximately 13 years for Variant 2 - The Żarnowiec site. The number of employees during that time will vary [Figure VI.4.18.1- 1].



rok	year
Ilość pracowników (etap budowy) - Wariant 1 - lokalizacja Lubiatowo - Kopalino	Number of employees (construction stage) - Variant 1 – Lubiatowo - Kopalino site
Ilość pracowników (etap budowy) - Wariant 2 - lokalizacja Żarnowiec	Number of employees (construction stage) - Variant 2 – Żarnowiec site

Figure VI.4.18.1- 1 Projected number of employees required during the construction stage for both site variants
Source: In-house study

It is assumed for the analyses that the employees will live in the region for a certain period, and the majority of them will not be accompanied by their family members.

For both site variants, it is assumed that in the construction stage a maximum of about 8,000 workers will be employed. It is assumed that some workers can be sourced locally and regionally. For the analyses that are to present the impact of the number of the incoming workforce, a scenario is assumed according to which approximately 15% will be acquired from the local market, and such employees will not use either the existing or planned accommodation base. For the remaining 85% of the total workforce, it is assumed that a significant part of them will be able to live in the planned workforce accommodation base in Choczewo and in the container base located near the construction site. The remaining workforce will be accommodated in existing accommodation base (hotels, boarding houses, private lodgings etc.).

For the purposes of analyses, a two-step approach was adopted to determine the ability of workers to take advantage of the currently available tourist accommodation base. Accommodation of workers in 12 communes (in 42 different towns and villages) was presented.

Commissioning stage

It is expected that 150 workers will work at the peak time during the commissioning stage of one nuclear unit. They will be accommodated at the container base or Accommodation Base in Choczewo commune.

Operational phase

Approximately 860 full-time employees will work during the NPP operation. To a large extent they will be specialists, qualified to work at the NPP. Most of these are forecast to be incoming workers. Nevertheless, it is assumed that some of the staff will be employees acquired from the local/regional market. For the analysis, the maximum impact was assumed, namely that 860 people will be the incoming workforce.. It was assumed that approximately 75% of these workers would live with their family members. It was anticipated that the average family size would be 3.35 persons, which implies the estimated number of permanent workers with their families will total approximated 2376 people. It is assumed that a part of the employees will choose as place of residence one of the nearby towns, that is Łeba, Puck, Wejherowo, Władysławowo, Reda. They will prefer locations with access to more amenities, services, and infrastructure than in rural communities, including, for the sake of children, accessibility to schools, kindergartens and nurseries, and medical care.

Approximately 1,000 additional workers are expected to come over to the site to perform tasks related to refuelling and repairs during the unit outage. The duration of routine repairs will be one month, that is, the routine repairs will be performed immediately before the refuelling. It has been assumed that interim repairs will last two months, while overhauls which take place every ten years - three months. It is assumed that some temporary staff may also be sourced locally or regionally. Incoming workers are likely to be accommodated in the tourist accommodation facilities in the vicinity of the NPP or in a dedicated accommodation base in Choczewo.

Decommissioning phase

At present, it is not possible to provide an accurate estimate of the number of employees required for the decommissioning phase, as this will only take place approximately 60 years after the NPP commissioning, and by then technological advances in nuclear decommissioning will occur. However, for the analysis purposes, it is assumed that approximately 1,000 full-time employees will be required during the decommissioning phase. The estimated duration of the decommissioning phase will be 20 to 25 years.

VI.4.18.2 Project impact on the land development

VI.4.18.2.1 Variant 1 — Lubiatowo - Kopalino site

Under all technical sub-variants, both 1A, 1B and 1C, the Investor will have to acquire the land for the Project implementation - the Project Area. The designated boundaries of the Project Area are the same for each of the sub-variants and provide for all requirements for construction site development and future operations.

Construction phase

Development stage

In connection with the Project implementation, there will be changes in land use and development on the Project Area during the development stage. They will primarily involve the exclusion of land from agricultural and forestry production, as well as the felling of trees and changing the nature of the site to industrial.

Workforce requirements concerning basic services (retail, food service, finance, or health care) will already at this stage influence the development of utility infrastructure and these services. The Project will also have an impact on the local transport network including public transport due to the enhanced traffic of vehicles preparing the site for construction.

Construction and commissioning stages

Similarly as in the development stage, in the vicinity of the Project Area, due to the expected growth of investment areas, changes consisting in the development of new functions in undeveloped areas (conversion of agricultural land into service areas) can be expected. Due to the planned number of incoming workers and demand for new services, new investments may turn up with regard to the commercial and industrial facilities, outside the borders of Choczewo commune.

The Project implementation will also affect the land use from the perspective of landscape views. The Project will modify the landscape not only in the immediate vicinity of the NPP but owing to the land relief and type of sub-variant, it may be visible from several kilometres away from the Project Area. This may change the attractiveness of areas previously used as recreational grounds. However, on the other hand, some land may be activated as a result of better accessibility to both road and rail transport routes, which will be established to give access to the NPP site and accommodation base for the NPP construction workers.

Changes in land development will restrict access to beach areas and sea waters within the reach of the Project Area. In the marine part of the Project Area, within the boundaries of the dedicated body of water 39a.I, it will not be possible to implement new elements of the harbour and sea infrastructure unrelated to the Project implementation, including new bathing areas. However, the Project implementation of an unprecedented scale in Poland, may attract a different kind of tourism, namely scientific and cognitive, for which the natural values will not be a priority.

Operational phase

No direct changes to land use patterns are anticipated during the operational phase of the Project. This phase will be a period of relative stabilisation of spatial management processes. It can be expected that with each successive year of the NPP operations, its social acceptance will grow and the neighbourhood will become part of the landscape, becoming its at least neutral element. Due to the increase of tax revenues in the communes associated with the Project implementation, it is expected that there will be an improvement in the availability and quality of technical and communications infrastructure, which may translate into the commune development towards urbanisation of new areas.

In the marine part of the site, changes and restrictions related to water use will continue as an extension of restrictions existing in the construction and commissioning stages. Activities related to the directions of spatial management in maritime sub-bodies will be carried out following the principles defined in the Maritime Spatial Plan of the Polish Internal Sea Waters, Territorial Sea and Exclusive Economic Zone and its more detailed version - the currently processed draft of the spatial management plan for the waters adjacent to the sea shore at the Władysławowo-Łeba section.

Decommissioning phase

It is currently difficult to predict the course of the Project decommissioning phase. The direction of land use after NPP decommissioning will be determined towards the end of the operational phase. At this stage, it is assumed that the preferred direction of development of the Project Area may be restoration of its original function, that is, reforestation. However, associated infrastructure components (for example, transportation network, water and sewage system, accommodation base, and MOLF structure) will not be decommissioned. Instead they can form the basis for the land development to deliver services for tourism and recreation.

Considering the disassembly and decommissioning works related to specific components of the Project, a part of the marine area will be periodically occupied.

VI.4.18.2.2 Variant 2 - Żarnowiec site

The Project Area in Variant 2 - Żarnowiec site is situated within the administrative borders of two communes (Gniewino and Krokowa), and the main part of the Project (Subarea 1) significantly differs from the area referred to in Variant 1. It covers a significant part of the Pomeranian Special Economic Zone, where several large industrial plants are currently operating.

Construction phase

Development stage

Development of the Project site will involve much more intensive work at this stage (compared to Variant 1 - Lubiatowo - Kopalino site) mainly due to the necessity to demolish the existing buildings. The structures earmarked for demolition are located both in the main part of the Project (Subarea 1) and along the assumed route of the NPP cooling water pipelines and pumping station (Subareas 2, 3, and 4).

At the development stage, the impact on land use will also be visible due to the necessity to perform levelling works and works related to tree and shrub felling within the borders of the Project Area.

Similarly as in Variant 1, development of the local public infrastructure is anticipated due to the workforce needs for access to services. The Project will also impact the local transport network due to the traffic of vehicles preparing the site for construction activities and hauling away demolition debris. It is assumed that there may be an increase in manufacturing, storage, and industrial land in the vicinity of the Project Area.

Within the boundaries of the Project Area, there are surface waters, that is, the Piaśnica river, inflow from Dębki II polder, Białogórska Struga and Lake Żarnowieckie. The water facilities include: canals, drainage ditches, damming and controlling devices, pumping station, culverts, and flood banks. Potential changes will consist in the removal or reconstruction of some water facilities located within the boundaries of the Project Area.

Enhanced traffic volumes will translate into an environmental nuisance such as increased noise, vibration and air pollution. Because the works will spread along all four Project subareas, the environmental nuisance may not be merely local.

Construction and commissioning stages

Land impacts in Variant 1 - Lubiatowo - Kopalino site will occur in all four Project subareas.

Operational phase

The impact will be the same as for Variant 1 – Lubiatowo – Kopalino site.

Decommissioning phase

The impact will be the same as for Variant 1 – Lubiatowo – Kopalino site, however demolition works will take place in all four Project subareas.

VI.4.18.3 Project impact on social aspects as well as on the quality of life and living conditions of the population

The Project implementation will result in both temporary and permanent population growth characterised by significant variations and changes with respect to various NPP phases. As a result, there will be changes in the fabric of the local community and the emergence of new infrastructure and service needs. Population growth will also cause increased vulnerability for certain groups in society. The impact extent will depend, *inter alia*, on such drivers as the location of worker accommodation (in and outside of the dedicated worker accommodation base in Choczewo) and age and gender, as these will affect changes as well as the rate of change. It is anticipated that the Project may result in population growth that will affect, to varying degrees, the communes in the Administrative Site Areas and Site Regions of both site variants.

VI.4.18.3.1 Variant 1 — Lubiatowo - Kopalino site

When analysing the range of impacts for Sub-variants 1A, 1B, 1C, it was concluded that they do not cause significant differences in impacts on social aspects. Therefore, the Project impact analysis was carried out for three Sub-variants (1A, 1B, 1C) together.

Construction phase

Demographic changes – The project is located in the rural commune of Choczewo (the site commune). The construction phase will see a significant influx of workers in connection with the NPP Project execution. In the development phase there will be about 1,700 workers (from the local market), while at the peak of the NPP construction phase this figure will reach about 8,000 (85% incoming workers and 15% local ones). They will be accommodated at the accommodation base in Choczewo (approximately 4,000 people), an on-site container workforce housing (approx. 1,000 people) and in the surrounding hotels, guesthouses, and private lodgings. The above actions will result in changes to the local population size and structure. In the long term, however, it is projected that the workers hired to work in construction stage will not reside permanently in the region. It is a typical arrangement for this type of projects.

Changes in the housing sector - During the Project implementation, there will be a need for both short-term and long-term housing for workers, primarily within the site communes, in the ASA and ASR. The criterion for selection of accommodation will primarily be the availability of housing infrastructure provided by the Investor (container accommodation base at the construction site, accommodation base in Choczewo and available space in the existing tourist base (hotels, boarding houses, apartments/houses for rent, recreational buildings for rent, etc.), as well as travel time to the site, rent, standard of accommodation, and access to commercial, sports, and recreational facilities, etc. The availability of accommodation may increase as much as access to tourism services may decrease. Tourists may gradually give way to workers, which may change the type of accommodation services provided by the local market.

Changes in the education sector - It is assumed that most workers will not be accompanied by their families, so the demand for school places in the ASA and/or ASR will not change significantly from the projected baseline. In the development stage and then construction stage, it is planned to implement a training program in order to enable some of the workers to adapt their qualifications for employment in the operational phase of the Project.

Impact on culture, sports and recreation – The influx of workers due to the NPP construction is likely to contribute to increasing the level of using sports, recreational, or cultural facilities. This can lead to inconvenience to the local community regarding the accessibility of these facilities and the opportunity to use them. Nevertheless, the demand for such facilities may attract new investments in the area.

Impact on unemployment and exclusion - Approximately 1,700 workers will be employed during the development stage, mainly from the local and regional market. This is expected to have a positive impact on the local community and improve the livelihood of many people. It is also possible that some of the workers will continue to work during the construction stage, or in the operational phase of the NPP, after acquiring appropriate qualifications, or in the sector of external services for the NPP.

Impact on water and sewer infrastructure due to incoming workforce - Due to the significant number of incoming workers - approximately 8,000 people (an increase of about 3.3% of Ark's water users compared to 2019), there will be an increase in demand for water and wastewater services. At the development stage, in the Project Area, own infrastructure of water supply, and sewage collection, treatment and disposal will be developed, which in the operational phase can be used by the inhabitants of the commune. For the workforce accommodation base in Choczewo, infrastructure will be used to meet the increased demand requirements.

Operational phase

Demographic changes - in comparison to the construction phase, the number of workers in the operational phase will decrease significantly (approximately 860 people). It is expected that some of the workforce will be recruited from the local market, but a significant portion will be visitors who will settle permanently in the vicinity of the NPP. A long-term population growth in the surrounding communes is likely to happen. It is estimated that about 75% of full-time workers would come with their families, which should contribute to an increase in the surrounding population of about 2,400 people. If these individuals were to settle in Choczewo commune, this would represent approximately 45% of the projected baseline population in Choczewo in 2030 (approximately 5,300 people). However, it is expected that housing will be scattered and impacts will be spread throughout the surrounding communities. It is forecast that the Choczewo commune can accommodate maximum approximately 2,000 people.

Changes in the housing sector - During the Project implementation, there will be a need for long-term accommodation. The criterion for the selection of housing places for employees will be primarily issues such as availability of housing facilities, time of commuting to the place of work, rent, standard of accommodation, as well as convenient access to recreational and cultural facilities, health care and elementary school. The accommodation base (built as part of the associated infrastructure) will be convertible into housing for workforce, or residents of the commune. However, it is projected that there will be an increase in demand for medium and long-term housing (apartments/homes within the region) for rent or for purchase.

Changes in the education sector - During the operational phase, particularly in the first years of operation, there would be the highest impact related to the demand for educational units. It was assumed that about 75% of the total number of full-time NPP employees (that is, about 650 employees) would settle with their families. It should be noted that this also represents the "highest impact" case. Thus, there will be approximately 870 "additional" children in the area, and their age profile will likely hover around children attending primary and secondary school. Given the above, it may be necessary to increase the capacity of schools in the ASA and/or ASR. During the NPP operation, efforts will be taken to engage schools, universities, and colleges in collaboration aimed at development of the future workforce for the NPP.

Impact on culture, sports and recreation - The total number of workers will decrease during the operational phase (compared to the construction phase), but a large proportion of them will be accompanied by their families. Impacts will be similar to those in the construction phase; however, due to families with children, there may be an increase in demand for recreational and leisure facilities and cultural and entertainment events.

Impact on unemployment and exclusion - The number of the NPP employees will be about 860. They will have a stable financial position and good working conditions. It is expected that the workforce and their families will participate in the local community life. The NPP will also create indirect jobs associated with the delivery of services to the NPP itself and new members of the local community. The emergence of new markets, long-term employment, and opportunities to learn new skills will have a positive impact on the overall quality of life for the current and future residents.

Impact on water and sewer infrastructure due to incoming workforce - It is assumed that once the NPP has been constructed, the water and sewer infrastructure used so far to provide for construction purposes will be connected to the municipal water supply and sewerage system. This should contribute to an increase in the efficiency of municipal water and wastewater utilities, which should translate into an improved quality of life for residents, resulting in the development of surrounding areas for residential development.

Decommissioning phase

Demographic changes - A small percentage of the full-time workforce at the NPP is projected to work during the decommissioning phase. They will be largely replaced by the workers of third party companies (about 1,000 people). These individuals will arrive to perform the work, after which they will be replaced by other workers.

Changes in the housing sector - In connection with the NPP decommissioning, the sales of apartments and houses by the NPP workers is probable. On the basis of experience in the NPP sector it is concluded that a small percentage of full-time NPP operational staff would remain to carry out the NPP decommissioning work. However, during the decommissioning phase, similarly as in the construction phase, there will be a demand for the short-term accommodation market (local market).

Changes in the education sector - During the decommissioning phase, the workforce structure will change, in part into temporary workers. At this stage, it is difficult to forecast the changes that will occur in the education sector.

Impact on culture, sports and leisure - During the decommissioning phase, there will be an exodus of workers from the NPP while there will be an influx of workers to carry out the activities planned in this phase. Sports, leisure and cultural facilities, etc. are projected to continue to operate. No major changes in access to and use of sports, recreation and cultural facilities are projected, but their availability might tend to be greater.

Impact on unemployment and exclusion - NPP decommissioning experience shows that prior to the decommissioning, workers often move to other nuclear plants and do not seek any alternative employment in the region. External workforce will be obtained for decommissioning phase. Similarly as in the construction and operational phases, there will be a demand for materials and services related to the works performed, which can also generate other jobs.

Impact on water and sewer infrastructure due to incoming workforce - During the decommissioning phase, the supply of water and sewer services is not projected to change significantly, except that it may gradually decrease.

VI.4.18.3.2 Variant 2 - Żarnowiec site

When analysing the range of impacts for sub-variants 2A and 2B, they were found to result in no significant differences in impacts on social aspects. Therefore, the Project impact analysis was conducted for two sub-variants (2A and 2B) together.

Construction phase

Demographic changes - The Project is located within two Site Communes, namely the rural commune of Krokowa and rural commune of Choczewo. As the accommodation base is located in Choczewo, the main impact associated with the incoming workforce will focus on the Choczewo commune (see Variant 1 - Lubiatowo - Kopalino site).

Changes in the housing sector - Impacts in Variant 2 - Żarnowiec site will be similar to those described for Variant 1 - Lubiatowo - Kopalino site.

Changes in the education sector - Impact in Variant 2 - Żarnowiec site will be similar to those described for Variant 1 - Lubiatowo - Kopalino site.

Impact on culture, sports and recreation - Impacts in Variant 2 - Żarnowiec site will be similar to those described for Variant 1 - Lubiatowo - Kopalino site.

Impact on unemployment and exclusion - Impacts in Variant 2 - Żarnowiec site will be similar to those described for Variant 1 - Lubiatowo - Kopalino site.

Impact on water and sewerage infrastructure due to incoming workforce - There will be additional demand for water and sewer services generated by the Project. Similarly as in Variant 1, during the development stage, own infrastructure for water supply, and sewage collection, treatment and disposal will be developed. As some workers will live in the accommodation base in Choczewo, the water supply and sewerage system will be organised within the existing water and sewage infrastructure of the Choczewo commune. Both of these infrastructure elements are part of the associated infrastructure not covered in this EIA Report. The impact will be associated with approximately 1,700 workers who will be housed in the existing accommodation base (hotels, boarding houses, private lodgings). This increment will not significantly affect the existing utilisation rate of commune water supply and sewerage infrastructure.

Operational phase

Demographic changes - During the operational phase, many of the impacts will be of the same nature as those described for Variant 1 - Lubiatowo - Kopalino site. The same number of employees at the NPP is projected (approximately 860) and, therefore, the population growth in each locality will be long term. It is anticipated that similarly to Variant 1 - Lubiatowo - Kopalino site, the places of residence of the NPP personnel will be more scattered than at the construction stage and therefore impacts will be spread over a wider area.

Changes in the housing sector - Impacts in Variant 2 will be similar to those described for Variant 1 - Lubiatowo - Kopalino site.

Changes in the education sector - Impacts in Variant 2 will be similar to those described for Variant 1 - Lubiatowo - Kopalino site.

Impact on culture, sports and recreation - Impact in Variant 2 will be similar to those described for Variant 1 - Lubiatowo - Kopalino site.

Impact on unemployment and exclusion - Impacts in Variant 2 will be similar to those described for Variant 1 - Lubiatowo - Kopalino site.

Impact on water supply and sewerage infrastructure - Impact in Variant 2 will be similar to those described for Variant 1 - Lubiatowo - Kopalino site.

Decommissioning phase

The impact will be the same as for Variant 1 – Lubiatowo – Kopalino site.

VI.4.18.4 Project impact on socio-economic aspects

The implementation of the NPP under both site variants involves a large number of workers, especially in the construction and industrial sectors. It is assumed that the planned Project will result in a significant increase in the employment rate (direct and indirect impacts). The Project will have a significant impact on the Site commune (Variant 1) / Site communes (Variant 2) and their neighbouring communes due to the fact that the implementation of the NPP is associated with the generation of tax revenues: PIT, CIT and property tax. In addition, there will be impacts associated with the economic sector within the Pomorskie Voivodeship and nationwide, with the highest magnitude of impact on the ASA and ASR in both site variants.

VI.4.18.4.1 Variant 1 - Lubiatowo - Kopalino site

Construction phase

Labour market changes - Implementation of the NPP is likely to have a direct, significant impact on the size and structure of employment in the local labour market. Impacts and effects at the development stage will be similar to those noted at the construction stage, but on a smaller scale due to fewer workers involved (approximately 1,700 people). Considering that in the peak construction period (year 8 of the Project) some 8,000 construction workers will be employed, with the annual average employment of approximately 4,400 people at the construction stage, it would mean a significant change in the labour market. It was assumed that about 15% of the workers needed at the construction stage (that is, approximately 1,200 people) would be local workers and the remainder would be incoming workforce. The majority of these will be workers employed in the construction and industrial sectors. Overall, an increase in labour rates is possible throughout the entire Pomorskie voivodeship, since additional demand attracts workers to the area. It is likely that labour rates will increase in all sectors of the economy, although the labour rates are expected to be highest in the construction and industrial sectors. As both direct and indirect employment increases, the overall unemployment rate is expected to decline. In addition to the direct impact on worker employment, the construction of a nuclear power plant will be associated with a number of indirect impacts. Construction work will also create demand for goods and services from local and regional businesses supplying materials and services, and this can also contribute to the creation of additional jobs.

Changes in taxes - During the construction phase, tax impacts on the Project are not expected to be significant and are limited to personal income tax (PIT) receipts. Throughout the construction period, payroll tax revenues will be generated for a total employment of approximately 40,000 people. A portion of the PIT proceeds will belong to the revenues of the communes where the tax residents will be employed during the construction and commissioning stages.

Impact on the economy - Impacts on the economy will result from activities planned for the development stage (site development for the NPP construction). The work implementation costs and personnel costs will be incurred. The size of impacts associated with the construction stage i.e. in year 9 of the Project will be significant when compared to the projected changes in population and employment levels, which will reflect the economic performance of the region. The Project implementation is likely to have a positive impact on economic sectors, including nuclear research and development on a nationwide basis. There will be an increased demand for nuclear scientists and engineers, as well as for related educational programs.

Impact on the construction sector - A large stream of materials and equipment for the Project is projected to be sourced from the manufacturers throughout Poland. Where domestic production is not possible, the international market will be used. The major supply chain will primarily include materials, namely cement, aggregates, steel, as well as electrical and electronic equipment (standard supplies), but also specialised materials and equipment produced as part of the international nuclear power supply chain (they do not form a part of standard supplies for the construction sector).

Operational phase

Labour market changes - The NPP operation will have a direct, significant impact on the labour sector - approximately 860 workers will be employed directly. As was the case during the construction phase, local and regional business as well as nationwide enterprises, will gain an opportunity to supply materials and services due to the arrival of the NPP in Poland (indirect and secondary effects), which may affect the number of people employed by them. Consequently, an increase in employment rate of three to four times the direct employment can be expected. This will be boosted by the hiring of temporary workers for periodic maintenance. It is estimated that temporary workers will generate about 3,500 jobs, of which about 2,500 jobs may occur within a radius of up to about 60km from the planned NPP.

Changes in taxes - PIT, CIT, and property tax revenues are expected during the operational phase. Property tax including tax on land (currently 0.90 PLN/m^2), tax on buildings (currently 23.13 PLN/m^2), and tax on structures at 2% of the structure value, will have the biggest impact on finances of the site commune of Choczewo and the immediately neighbouring communes. In addition to the property tax, additional revenues for the communes will be generated by PIT returns on those directly employed by the NPP during the operational phase and indirect and induced jobs associated with the Project implementation.

Impact on the economy - the main economic impacts during the NPP operational phase will result from financial flows from the sale of electricity and expenditures on the NPP operations. At the regional level, the most significant flows will be tax revenues and employee remuneration. The broader economic impact will concern the purchase of nuclear fuel and related specialised services, and additional transactions of a purely financial nature. Due to the nature of the NPP, it will also be possible to develop more specialised industrial enterprises.

Impact on the construction sector - The NPP is not expected to have a significant impact on the construction sector during the operational phase.

Decommissioning phase

The current experience of the NPP decommissioning shows that before decommissioning, workers often move to other nuclear plants and do not seek alternative employment in the region. For this reason, a small percentage of the full-time NPP operating staff is expected to work in the decommissioning phase. However, external staff will be recruited for the NPP decommissioning (approximately 1,000 people). No tax revenue will be generated after the NPP is decommissioned. Impacts on the construction sector are not expected, either.

VI.4.18.4.2 Variant 2 - Żarnowiec site

Construction phase

Impacts under Variant 2 - Żarnowiec site will be similar to those described for Variant 1 - Lubiatowo - Kopalino site under the proviso that in Variant 2, demolition works will take place at the development stage, which are not present in Variant 1. In addition, the Project is located in the territory of two communes. Impacts and effects of a similar nature will occur at the development stage, but on a smaller scale than those described for the construction stage due to a smaller number of staff involved (approximately 1,700 workers). Similarly to Variant 1 - Lubiatowo - Kopalino site, the impact of taxes on the Project is not expected to be significant during the development stage. The PIT revenue assumptions for the construction and commissioning stages are the same as those for Variant 1 - Lubiatowo - Kopalino site. Economic and construction impacts of Variant 2 - Żarnowiec site will be similar to those described for Variant 1 - Lubiatowo - Kopalino site.

Operational phase

The NPP operation will have a direct significant impact on the labour sector - approximately 860 workers will be employed directly in the NPP site in Żarnowiec. The impacts will be similar to those referred to in Variant 1 - Lubiatowo - Kopalino site. Similarly to Variant 1, there will be PIT, CIT, and property tax revenues during the operational phase.

Decommissioning phase

Impacts in Variant 2 - Żarnowiec site will be similar to those referred to in Variant 1 - Lubiatowo - Kopalino site.

VI.4.18.5 Project impact on tourism

Tourism is considered to be one of the crucial factors in the regional development of the Pomorskie Voivodeship. The overall tourism sector, including domestic and foreign tourists, owners of tourist facilities, businesses associated with the sector (providers of products and services), as well as employees working in the sector, will be exposed to impacts generated by the Project. The changes that will occur as a result of the Project implementation will affect the tourist offer, the level of services, as well as access to recreational and tourist areas. The direct and indirect impacts on the tourism sector were analysed taking into account the Project phasing, the characteristics of nuclear power and concerns about it, as well as the demographic changes caused mainly by the incoming workforce required by the NPP.

VI.4.18.5.1 Variant 1 - Lubiatowo - Kopalino site

Impacts have been analysed for Variant 1 - Lubiatowo - Kopalino site without detailing the sub-variants (1A, 1B, 1C).

Changes in accessibility to recreational tourist areas and their impact on visitors to the area

Construction phase

The tourist offer of the Choczewo site commune and the surrounding communes and towns is mainly focused on opportunities to spend time in nature, in the natural environment, usually by the surrounding lakes and/or the sea. These communes generate a significant portion of their local tourist traffic also thanks to tourists from the Tricity agglomeration (for example, one-day city breaks regardless of the season). The Project will result in the loss of both some land (the Project Area) and access to some land that currently performs recreational functions and is attractive for tourists. The Project will have impact on the activities such as hiking, walking, sunbathing on the beach, biking, and horseback riding, particularly on any existing hiking trails that run in the immediate vicinity. A part of the PTTK (Polish Tourist and Sightseeing Society) tourist trail called the "Baltic Seaside Trail", which is a section of the European Long Distance Trail E9, as well as the EuroVelo bicycle trail and other local trails designated by the commune, run through the Project Area. The target running of the aforementioned trails/routes will have to be aligned with the new land development plan. The nearest bathing area (guarded) and public beach are located at a distance of approximately 700m from the borders of the Project Area (Lubiatowo marine bathing area). It is quite probable that due to the construction activities under the Project, some tourists may refrain from sunbathing on the beach, swimming and water sports in this bathing area. During the construction phase of the Project, the surrounding roads will be more congested due to the transport of workers, equipment, and materials to the NPP construction site. It is assumed that at the development stage the workers will operate in two shifts from 7:00 a.m. to 10:00 p.m. for 6 days a week, similarly as at the construction stage, under the proviso that the works which cannot be interrupted due to the construction/manufacturing technology will be carried out on a round-the-clock basis. It is projected that some tourists will avoid the area situated in the vicinity of the Project Area. Most likely, the tourist facilities located in the immediate vicinity of the contemplated Project will be occupied by workers, which will result in a lack of available accommodation for tourists and forcing them to look for accommodation in other, more remote locations. Therefore, it is predicted that during the construction phase there will be a change in the number of tourists visiting the region under study in favour of the NPP construction workers, primarily in the coastal villages of the Choczewo commune. Undoubtedly, the implementation of the Project on such a scale will attract tourists interested in the construction of the first Polish nuclear power plant. Similar interest will be aroused by the investment project among students and lecturers of technical universities all over Poland, especially of the energy, construction, mechanical, and similar faculties. Additionally, new investment projects (associated infrastructure) will appear in the area, including the Local Information Centre, which will also serve as a hotel and conference facility and will foster the development of the “scientific and cognitive tourism" sector. In addition to its primary informational role, the Local Information Centre will host numerous training sessions, conferences, and workshops, including international ones, devoted to nuclear energy and the construction of this unique investment project.

Operational phase

It is assumed that during the operational phase of the nuclear power plant the existing (guarded) bathing area and public beach will be available for tourists. During the operational phase of the NPP, there will be restrictions on the location of new port-related and marine infrastructure components. This includes the creation of new bathing areas. The area of the cooling water intake and discharge diffusers will be closed to all navigation and non-nuclear power plant operations. Some of the local trails that is, hiking trails, horseback riding trails, etc. will have to be adapted by the Choczewo commune to the new land development requirements for the period of the NPP operation. International experience with nuclear power plants indicates that there was no negative correlation between the number of tourists and the nuclear power plant site, which suggested that tourists did not pay much attention to this issue. In reality, it has been observed that some of the power plants have had a positive impact on tourism, and the scientific tours organised by the power plant authorities have attracted a new category of people who later come as tourists visiting the region. Thus, it is possible that during operation there will be an increase in the number of tourists visiting the NPP site, including foreign tourists who would like to learn more about the Project, but would also spend time in the area. In addition, new investments will be made in the area, including investments into the associated infrastructure, namely road network, railway system, which will make the area more accessible. Consequently, this may lead to greater interest from potential investors who would like to invest in the area.

Decommissioning phase

During the decommissioning phase of the NPP, the impact of demolition activities is expected to be similar to that of the NPP construction.

<u>Changes in the availability of tourist accommodation</u>

Construction phase

The direct impact of the Project on accommodation availability will come from the number of workers required for each NPP construction phase, but also from the desire of tourists to visit areas located in close proximity to the Project site.

<u>Development stage</u>

Approximately 1,700 employees are expected to perform tasks at the development stage. It is assumed that they will come primarily from the local/regional market. Given the above, no significant impact is projected on the tourist accommodation base due to the incoming workforce.

<u>Construction and commissioning stages</u>

At the construction stage, the workers will stay at the accommodation facilities on the construction site (container base), at the accommodation base in Choczewo and at the existing tourist base in the surrounding localities. It is anticipated that the greatest impact on the tourist accommodation base would occur during the peak construction employment period (that is, in year 8, when there would be approximately 8,000 staff working on the site). The use of selected tourist accommodation facilities to house some of the workers will benefit the owners of the facilities, including businesses and individuals in the tourism industry. The accommodation they have offered so far will be able to be occupied all year round, rather than mainly during the peak tourist season. Additional revenues from tourist lodging services will have indirect impacts on the local and regional economy due to additional demand for services and products, as well as increased employment in other industries related to increased demand for lodging. At the peak tourist season (summer months), the local tourist base may be used by both tourists and construction workers. This could lead to higher rental prices. In the peak tourist season, there may also be a situation where there is no plenty of available, convenient accommodation for tourists. Due to limited accessibility, accommodation prices are likely to increase, which may cause tourists to activate areas further away from the site under study.

Operational phase

During the operational phase, approximately 1,000 workers will also come to perform tasks related with periodic maintenance. They will be housed in the accommodation base in Choczewo or in tourist facilities around the NPP. This is expected to benefit the service and commercial sectors, and potentially the owners of private lodgings, hotels, bed and breakfasts and other accommodation facilities.

Decommissioning phase

During the decommissioning phase of the NPP, impacts from ongoing demolition activities are expected to continue over a long period of time (approximately 24 years) with around 1,000 workers involved in the works, who will likely live in the surrounding tourist facilities designated for rent.

VI.4.18.5.2 Variant 2 - Żarnowiec site

The impact of the Project on tourism was analysed from the angle of a site variant without differentiating between sub-variants 2A and 2B.

<u>Changes in accessibility to recreational tourist areas and their impact on visitors to the area</u>

Construction phase

The tourist offer of Krokowa and Gniewino communes is mainly focused on offering natural environment by the neighbouring lakes and/or the sea to spend one's leisure time. These communes generate a significant portion of their local tourist traffic also thanks to tourists from the Tricity agglomeration (for example, one-day city breaks regardless of the season). The Project will result in the loss of both some land (the Project Area) and access to some land that currently performs recreational functions and is attractive for tourists. The Project will have impact on the activities such as hiking, walking, sunbathing on the beach, cycling, and horseback riding, particularly on any existing hiking trails that run in the immediate vicinity.

The main part of the NPP will be located on the southeastern shore of Lake Żarnowieckie. The lake is a well-known destination for water-based tourism. The construction of the make-up water pipeline along the technical road may have a negative impact on touristic and leisure activities in the immediate vicinity of this infrastructure. Restriction of access to some areas (for example in Lubkowo) will mean that the providers in the tourism sector will not be able to deliver services, or provide them to the extent that they did before the Project start date. This will primarily apply to businesses offering lodging, catering, and water equipment rentals. The Lubkowo marina will be closed for the duration of the construction of the makeup water pipeline supplying the cooling system and the technical infrastructure. There is also a bathing area near the marina. Some individual recreation facilities or facilities providing such services in this area will be demolished. In addition, attention should be paid to the areas located in the vicinity of the Piaśnica River, which flows through Lake Żarnowieckie, and its fragment between the lake and the Baltic Sea is a busy canoeing route. The Project Area (subareas 2 and 3) is also crossed by a part of the tourist route called “The Baltic Seaside Trail", which is a section of European Long Distance Route E9, as well as EuroVelo cycling route and other local routes (pedestrian, cycling and equestrian trails), whose routes will have to be modified. Implementation of work at the construction stage will result in enhanced vehicular transportation (workers, equipment, and construction materials). This in turn will affect access to towns in the close proximity to the Project Area. In addition, the potential inconvenience associated with traffic congestion, noise, and air pollution, may provide tourists with grounds to choose alternative holiday destinations. Therefore, it is anticipated that during the construction phase there will be a change in the number of tourists visiting the region analysed, primarily in the Krokowa and Gniewino communes owing to the difficult access to the sea and Lake Żarnowieckie (both the sea area and the Lake Żarnowieckie area), and the Gniewino commune primarily in the vicinity of Lake Żarnowieckie.

On the other hand, there may also be tourists interested in the Project and its construction, which may also change the type of tourists visiting the region so far, as described for Variant 1 - Lubiatowo - Kopalino site.

Operational phase

During the operational phase, there will be a permanent loss of some land and reduced access to the shoreline of Lake Żarnowieckie. In addition, during the operational phase of the NPP, the marine area in the vicinity of cooling water intake and discharge points will be excluded from use. At the stretch of coastline between Białogóra and Karwia, restrictions will be imposed on the location of new elements of the harbour and maritime infrastructure unrelated to the Project execution, including the restriction of setting up new bathing areas. It is assumed that during the operational phase of the nuclear power plant, the beach in the area of the cooling water pumping station will be taken out of service only as a result of failure of the NPP's cooling system infrastructure or repair works of MOLF structure.

Other types of impact will be similar to those described for Variant 1 - Lubiatowo - Kopalino site.

Decommissioning phase

During the decommissioning phase, the impact of the ongoing demolition activities of the NPP decommissioning are expected to be similar in nature to those during the construction phase, but in a lower magnitude.

Changes in the availability of tourist accommodation

Impact on the availability of tourist accommodation during all phases of the Project under Variant 1 - The Żarnowiec site will be similar to those described for Variant 1 - The Lubiatowo - Kopalino site.

VI.4.18.6 Project impact on agriculture

As part of the agricultural impact assessment, an analysis of the impact of changes in agricultural land use and development to prepare the construction site for the nuclear power facilities was performed.

VI.4.18.6.1 Variant 1 - Lubiatowo - Kopalino site

Impact was analysed for Variant 1 - the Lubiatowo - Kopalino site without detailing the sub-variants (1A, 1B, 1C).

Construction phase

Development stage

In the Project Area, there are approximately 47 ha (about 14%) of permanent meadows, that is, land of IV, V and VI quality class, that is, bad and medium quality. Ultimately, it is assumed that after conversion, the land will be developed and urban (the current form of land use will be changed into industrial land). The loss of agricultural land, that is, a possible reduction of the area of agricultural production land by approximately 47 hectares, will not be significant considering its value in use.

Construction and commissioning stages

During the construction phase, access to agricultural land may be impeded due to increased traffic (local impacts); however, these impacts are expected to be short-term due to transport of materials, equipment, as well as increased passenger vehicle traffic (workers). There will also be an increased demand for food products at the construction stage due to the incoming workforce (approximately 8,000 people). This demand will also be able to be met with locally made products, particularly in the communes where the workers will be housed. In connection with the NPP construction, there may also be a partial transfer of agricultural workers who choose to work on the Project or to perform works concerning the associated infrastructure.

Operational phase

In the operational phase, there will be public concern about crops or livestock located in the vicinity of the NPP, even though agricultural activities will not be affected by the NPP operation. Nevertheless, farmers may be concerned about the quality and economic value of the crop and livestock products made, given that there is no negative impact in this regard.

Decommissioning phase

Impact during the decommissioning phase will be similar in nature to those during the construction phase but will be much less intense.

VI.4.18.6.2 Variant 2 - Żarnowiec site

Construction phase

<u>Development stage</u>

In connection with the implementation of the Project it will be necessary to change the current form of use of the aforementioned agricultural land into land with an industrial function. Allocation of agricultural production land for the Project will not be significant in terms of land value in use. Agricultural area in the land part of the site accounts for approximately 36% (about 168 ha). In subarea 1, there is soil of IV, V and VI quality class, that is, bad and medium quality, and the largest share is of medium quality permanent grassland (47%), bad and the worst permanent grassland (26% in total) and the worst arable land (20%). The situation is similar in subareas 2, 3 and 4, where there is soil of IIIb (0.2%), IV, V and VI quality class, and the largest share is occupied by bad arable land (38%), permanent meadows of medium and bad quality (28%) and the worst arable land (12%).

<u>Construction and commissioning stages</u>

Same as for Variant 1.

Operational phase

Same as for Variant 1.

Decommissioning phase

Same as for Variant 1.

VI.4.18.7 Project impact on fisheries

This chapter assesses the impact of the Project on the fisheries sector, with respect to marine and inland fisheries as well as aquaculture (marine and inland), within the framework of socio-economic conditions.

VI.4.18.7.1 Variant 1 - Lubiatowo - Kopalino site

Impact was analysed for Variant 1 - Lubiatowo - Kopalino site without detailed differentiation of sub-variants (1A, 1B, 1C), unless the impact was related to a differentiating factor, that is, the cooling system in sub-variant 1A - open cooling system, and in sub-variants 1B and 1C - closed cooling system.

Construction phase

<u>Development stage</u>

At the development stage, the construction of the MOLF (associated infrastructure) will be launched. However, due to its relatively small range (up to approximately 1.1 km from the shoreline) and local nature, it will not have a significant impact on fisheries.

Construction and commissioning stages

Because the Project will create an exclusion zone (Project Area/construction site), there will be a disruption of fishing activities near the littoral zone. Due to the fact that there are no fishing ports in the Choczewo commune and the fishing intensity is low, the Project implementation should not have an insignificant impact on this area of economy. The greatest impact will occur in Sub-variant 1A due to the routing of the cooling system pipelines up to approximately 5 - 6 km away from the coastline. The incoming workforce in large numbers (about 8,000 people) may increase the demand for food products, including fish, so there may be a demand for them in the communes that offer accommodation to the workers.

Operational phase

During the operational phase, the fishing industry could be affected by the Project due to restricted access to parts of the marine area. For sub-variant 1A, cooling water intake/discharge points will be located up to approximately 6km from the coastline, and for sub-variants 1B and 1C, at a distance of approximately 1.2 - 2.3 km counting from the coastline. In view of this, sub-variant 1A is less favourable in terms of fisheries, due to the location of potential fishing grounds on the high seas. Restrictions on vessel traffic will be implemented in the water body adjacent to the nuclear power plant whereas the area around the intake and discharge points /diffusers will be closed to all navigation. Only maintenance vessels performing work for the NPP, rescue and coastal protection vessels will be allowed to operate. In the operational phase, public concerns will be monitored with regard to the fish being caught, even though the quality and safety of fish consumption will not be affected by the NPP operation. However, fishermen, fish processing plant owners, vendors, etc., may be concerned about the quality and economic value of marine products due to the fact that there are no negative impacts in this regard.

Decommissioning phase

No significant impact on the fisheries and aquaculture industry are anticipated during the decommissioning phase. For the decommissioning of the NPP, assumptions related to the dismantling of the marine infrastructure will be developed taking into account all aspects regarding the risk of impact on marine waters, including the fishing industry.

VI.4.18.7.2 Variant 2 - Żarnowiec site

The analysis of impact of the Project for Variant 2 - Żarnowiec site was performed without detailed differentiation of sub-variants (2A and 2B).

Construction phase

Development stage

At the development stage demolition works will be carried out first, including the part of Lake Żarnowieckie adjacent to Subarea 1, as well as to the Subarea 2. Demolition works will require the establishment of temporary exclusion zones. Noise and air pollution nuisance may also occur, which will have a direct impact on users of Lake Żarnowieckie, including anglers (inland fishing). In Subareas 3 and 4, on the other hand, works will be launched with little impact on the marine fisheries sector. The construction of the MOLF (up to approximately 0.7 km from the coastline) (associated infrastructure) will also commence at the development stage.

Construction and commissioning stages

Due to construction activities, access to Lake Żarnowieckie waters will be restricted from the fenced area of the construction site. Lake Żarnowieckie is a popular area for both water recreation and angling activities, so the Project implementation and limited access to the lake shore (access to the fisheries) may have a negative public perception. In this case, potential impacts would also include possible reduced financial income from the sales of angling permits in the District. Other construction-related impacts, including those in the marine area, will be similar to those described for Variant 1 - Lubiatowo - Kopalino site. No significant impact on the fisheries sector (including fishing vessels) are forecast, although in the case of sectioning-off the marine use restriction zone some of the existing routes of fishing boats and other vessels to the marina in Dębki or along the coast may be slightly extended. No nuisance (in terms of navigation or transport) is forecast for the Władysławowo sea port.

Operational phase

During the operational phase, the marine and inland fisheries and aquaculture sectors may be affected by the Project. Impacts associated with public concerns will be similar to those described for Variant 1 - Lubiatowo - Kopalino site, under the proviso that they will affect both marine (Subareas 3 and 4) and Lake Żarnowieckie fishing activities (Subarea 1). In the marine area, the likelihood of disturbance with the fishing industry is low. Pipelines placed close to shore and under the seabed will not cause any impacts to the location of potential marine fisheries. During the operation of the Project, the area where the intake and discharge points for cooling water will be located along with the discharge of treated industrial effluent, will be taken out of service. However, the location of the NPP on Lake Żarnowieckie shores may fuel the concerns about the quality and safety of fish caught in the lake.

Decommissioning phase

No significant impacts to the marine fisheries sector are anticipated during the decommissioning phase. Impact will occur during demolition activities, with potential impact to the inland fisheries sector anticipated for the land portion (Subarea 1).

VI.4.18.8 Project impact on forestry

This chapter assesses the Project impact on forestry under socioeconomic considerations. Forests provide a range of resources and perform productive, environmental, and social functions, as well as protective functions in the area of both site variants. The Project implementation under both variants will lead to unavoidable and permanent transformation of space, including clearing of some forest areas located in the area intended for the NPP construction. Impact on tree species, forest habitat types and protective forests as well as impact on stand age class are referred to the Project Area rather than to the total deforestation zone as this will be precisely indicated at the Project construction stage. The chapter presents the impacts that the construction and subsequent operation and decommissioning of the NPP will have on forest management, including, in particular, the required forest clearing.

VI.4.18.8.1 Variant 1 - Lubiatowo - Kopalino site

Construction phase

Development stage

In the development stage of the construction phase, there will be an unavoidable permanent transformation of forest land in the Project Area, i.e. up to approximately 542 ha. The deforestation area will result from the selected option of building channels/pipelines for the intake and discharge of cooling water and treated industrial effluent in the marine area, that is, in Option 1 using tunnel boring machines (TBM), or in Option 2 using an open trench method (in the land part). In the case of Variant 1 - Lubiatowo - Kopalino site the greatest impact will occur under sub-variant 1C (with Variant 2), where the forest area subject to deforestation is estimated at approximately 410 ha, which accounts for about 76% of the forested land situated in the Project Area. Sub-variants 1A and 1B (with Option 1) have the lowest impact - about 335 ha, which means that the area under deforestation is about 15% lower. Permanent loss of forest land resulting from development of a nuclear power plant site, in the context of current availability and use of forests in the Choczewo commune, level of natural variability and wide availability of alternative forest land, will not represent a significant impact. Under Variant 1 - Lubiatowo - Kopalino site, the maximum loss of forest land in the Choczewo commune may account for approximately 5.5%. However, it should be noted that this is a maximum impact, which should be limited to the zone of permanent deforestation.

As a result of deforestation - the species that will be lost as a result of tree clearance is primarily pine, the share of which in other forest-forming species in the Project Area accounts for approximately 80%. There will also be a loss of a dwarf mountain pine (about 18%), which was often planted artificially to stabilise dunes in the coastal strip. With regard to the age structure, these will be predominantly tree stands which account for the greatest share in the surface area, that is, tree stands of age class V (81-100 years old) and VI (older than 100 years old). However, when analysing habitat types, moist coniferous forest, fresh coniferous forest, and dry coniferous forest will be lost. In connection with the Project implementation, plantings are planned outside the NPP permanent deforestation zone, which will reduce the Project impact. Measures will also be taken to minimise clearing of coastal pine forests (*Empetro Nigri-Pinetum*) to the north from the Project Area.

Construction and commissioning stages

No additional forest area is planned to be cleared during the construction and commissioning phases, but this option is not excluded due to safety analyses performed as part of the building permit design. Forestry operators will be impacted by the construction activities on the nuclear power plant site, but these impacts are expected to be short lasting.

Operational phase

Impacts in the operational phase will be a continuation of long-term effects from the development stage and the construction phase. During the operational phase, there will be no restrictions on picking forest fruits or mushrooms outside the Project Area due to the lack of impact of the Project on their quality.

Decommissioning phase

In the decommissioning phase, impacts from ongoing demolition activities are expected to occur on the NPP site, and potential reforestation of the Project Area may occur after decommissioning.

VI.4.18.8.2 Variant 2 - Żarnowiec site

When analysing the range of impact of Sub-variants 2A and 2B, they were found to result in no significant differences in forestry impacts. From a forestry perspective, the Project impact analysis was carried out for two Sub-variants (2A, 2B) jointly.

Construction phase

Development stage

There will be a permanent loss of forest resources in the Project Area at the development stage, i.e, up to about 70 ha. The area to be deforested is about 60 ha in both sub-variants 2A and 2B when selecting Option 1 (using tunnel boring machines (TBM)), or about 70 ha when selecting Option 2 (using the open excavation method in the land part) in relation to the total forest land area of the Project Area, which is approximately 70 ha. The implementation of Option 2 will result in a complete loss of forest land in the Project Area. However, the permanent loss of forest land will not be a significant impact because such loss will account maximum for 0.5% of the total forest area in the Krokowa and Gniewino communes. The species that will be lost as a result of tree clearance is primarily pine, the share of which in other forest-forming species in the Project Area will account for approximately 61%. The remaining prevailing species intended for felling will be the European white birch (*Betula Pendula Roth*) and black alder (*Alnus Glutinosa*) with a total share of approximately 27%. With regard to the age structure, these will be predominantly tree stands which account for the greatest share in the surface area, that is, tree stands of age class IV (61-80 years old) and V (81-100 years old). However, when analysing habitat types, moist mixed coniferous forest, fresh mixed coniferous forest, fresh mixed broadleaved forest, and boggy mixed broadleaved forest will be lost.

Construction and commissioning stages

No additional forest area is planned to be cleared during the construction and commissioning phases, but this option is not excluded due to safety analyses performed as part of the building permit design. The forestry operators will experience short-term impacts as a consequence of activities at the nuclear power plant construction site.

Operational phase

Impacts in the operational phase will be a continuation of long-term effects from the development stage and the construction phase.

Decommissioning phase

In the decommissioning phase, it is assumed that the impacts of the demolition activities will result from the decisions made on the direction of land development in individual subareas (Subareas 1, 2, 3, 4), and possible decision on plantings.

VI.4.18.9 Project impact on the real estate market

This chapter assesses the Project impact on the real estate market within the framework of socio-economic considerations.

VI.4.18.9.1 Variant 1 - Lubiatowo - Kopalino site

VI.4.18.9.2 VI.4.19.9.1 Variant 1 – Lubiatowo – Kopalino site

The Project impact analysis was carried out jointly for the three sub-variants (1A, 1B and 1C) owing to the fact that they do not lead to significant differences in the impact on the real estate markets. The differences between the Sub-variants will be the presence (Sub-variants 1B and 1C) or absence (Sub-variant 1A) of cooling towers.

Construction phase

Development stage

In order to implement the Project it will be required to obtain the rights to use the land. No demolition of buildings will be required in the Project Area. The land designated for the Project will not be traded on the market from the moment rights to the real estate are acquired till the process of liquidation of the Project is completed. Given the current ownership structure of the Project Area, the acquisition of land for the Project will not result in a change in demand for real estate in the local market. It is expected that there will be public concerns about nuisance caused by works at the development stage.

Construction and commissioning stages

At the construction stage, the concerns of some of the public will not be dismissed, but their impact on the real estate market should remain at a similar level as at the development stage, or show a downward trend. At the construction stage, there will be the biggest changes due to the incoming workforce (approximately 8,000 people). The number of workers and the need to accommodate them (as well as the enhanced demand for services) will drive up demand for housing and tourist properties (which are going to be used for housing purposes later). It is also likely that there will be investors who will want to increase the supply through development of new tourist facilities. Growing demand will most likely drive prices up, especially rental prices for lodging and/or floor area. It should be noted that some workers will be accommodated at the Choczewo accommodation base (approximately 4,000 people) and in on-site container workforce housing (approx. 1,000 people). A change of the status and/or potential of the land adjacent to the Project Area will also be reflected in real estate market trends. It is assumed that in the initial period the Project execution may translate into price (offer) hike expectations, however, it will not necessarily translate immediately into the level of actual transaction prices.

At the construction stage, Project-related nuisance is expected, including primarily the nuisance caused by enhanced heavy vehicle transport, which may result in a temporary decline of attractiveness of certain types of properties (particularly those purchased for recreational purposes). Note also the issue of differences between sub-variants. Sub-variant 1A lacks cooling towers, which are present in Sub-variants 1B and 1C. These facilities, due to their dimensions, may affect the attractiveness of residential and tourist properties located in the close vicinity to the NPP. If Sub-variant 1A (without cooling towers) is implemented, the impact of the Project on property attractiveness will be smaller.

Operational phase

It is forecast that during the initial years of the NPP operation, the concerns of some members of the general public about the NPP operation may affect the structure and size of demand in the real estate market, which, however, should show a declining trend. The real estate market will respond and adjust to new operational conditions resulting from the emergence of the NPP in the area. Nevertheless, due to the expected development of the Choczewo site commune, as well as neighbouring communes, the development of the real estate market is also expected.

The changes will be most intense during the initial few years of the plant operation. The socio-economic development, including the impact of the NPP construction on the residential, tourism, and commercial sectors, can help a rural commune with a moderately developed tourism sector become a thriving and much more urban area than it is today.

Decommissioning phase

During the decommissioning phase, the public concerns will include the NPP shutdown and the associated impact on the municipal budget, followed by the demolition of the NPP facilities and their impact on the lives of the local community. The NPP decommissioning may affect the employment rate in the territory of the communes under study. Since economic indicators, including the unemployment rate, affect real estate markets, changes in this respect are expected. A periodic stagnation in the site commune and neighbouring communes may also take place. At this stage, however, it is difficult to forecast what impact this will have on the real estate market.

VI.4.18.9.3 Variant 2 - Żarnowiec site

The Project impact analysis was carried out jointly for the two Sub-variants (2A and 2B) because they do not lead to significant differences in the impact on the real estate market.

Construction phase

Development stage

In order to implement the Project it will be required to obtain the rights to use the land. In the areas covered by the Project Area, demolition of buildings (maximum about 180 buildings) will be required. The land designated for the Project will not be traded on the market from the moment rights to the real estate are acquired till the process of liquidation of the Project is completed. Given the current ownership structure of the Project Area and the need to demolish some structures, land acquisition for the Project purposes may trigger changes in demand for real estate in the local market.

The development stage will take one year longer compared to Variant 1 due to the need to demolish the existing facilities. There will be more workers in the area (approximately 1,000 for the demolition period and 1,700 for development phase).

Construction and commissioning stages

Impacts will be similar to those for Variant 1 - Lubiatowo - Kopalino site with the difference that in the construction stage, the on-site container workforce housing (for approximately 1,000 workers) will be located on the NPP construction site in the Krokowa commune. Approximately 4,000 workers (as in Variant 1 - Lubiatowo - Kopalino site) would be lodged at the accommodation base in Choczewo (the Choczewo commune). The remaining workers would probably use the existing hotel base and guesthouses or residential space for rent in the Gniewino and Krokowa communes. As a result of the construction of cooling towers (Sub-variants 2A and 2B), the attractiveness of residential and tourist properties located in the close vicinity to the NPP is likely to decline.

Operational phase

The impact is similar to that for Variant 1 - Lubiatowo - Kopalino site with the difference that from the perspective of some NPP workers, areas located in the close vicinity of the power plant (the Krokowa and Gniewino communes) would be considered attractive and people would be willing to settle there. This may offset the potential decline in residential property values caused by the possible impact of the NPP on the landscape, or the reluctance to live in the vicinity of the NPP. The operation of the nuclear power plant in the Krokowa and Gniewino Communes may contribute to changing the character of the communes, especially the potential of the areas adjacent to the Project Area. It is forecast that in the areas predisposed to the development of the settlement facilities a more dynamic development of housing and tourism may occur, especially in the northern part of the Krokowa Commune (e.g. Brzyno, Żarnowiec or Odargowo).

Decommissioning phase

The impact will be similar to that for Variant 1 - Lubiatowo - Kopalino site. The NPP decommissioning in the Krokowa and Gniewino communes may change the nature of these communes, especially the potential of the areas adjacent to the Project, but at this stage it is hard to predict the direction of changes.

VI.4.19 Cumulative impacts

VI.4.19.1 Cumulative impact assessment methodology

According to the European Commission's Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions, there are three types of impacts that cause cumulative negative effects for the environment:

- Indirect impact - an impact on the environment which is not a direct result of the implementation or operation of an investment project, often occurring at a significant distance from the source. A direct impact on one environmental component may have an indirect impact on another environmental component;

Przedsięwzięcie	Project
Oddziaływanie A	Impact A
Oddziaływanie B	Impact B

- Cumulative impact - intensification of changes in the environment caused by overlapping of the same type of impacts of the planned Project with the impacts of other Projects, including those in the past as well as those planned;

Przedsięwzięcie	Project
Oddziaływanie A	Impact A

- Impact interactions - reactions between different impacts from the same or different investment projects, leading to an emergence of a new type of adverse environmental impact.

Przedsięwzięcie	Project
Oddziaływanie A	Impact A
Interakcja	Interaction
Oddziaływanie C	Impact C
Oddziaływanie B	Impact B

For the purposes of the assessment, the available knowledge of the project was considered, including, but not limited to, the site, type of activity, major emissions, and the range of impact for:

- third-party investment projects under execution (construction underway) and during operation (completed), for which the decision on environmental conditions was issued or the procedure for its issuance was instigated, or for which an Environmental Scoping Report or an Environmental Impact Assessment Report was submitted - if during the proceedings the process entered another stage of assessment,
- associated investments, which are executed for the purposes of construction and operation of the NPP, for which pursuant to the Act of 29 June 2011 on development and execution of investment projects pertaining to the nuclear power facilities and associated investments, decisions on environmental conditions will be issued under a separate procedure, and the implementation of which, due to the zone of impact and time convergence of execution with the main Project, will be associated with a probability of occurrence of a significant cumulative effect,
- the main Project, especially in the construction and operational phases.

Impacts resulting from the development, construction, commissioning and operation of the NPP were cumulated (including both direct and indirect impacts from road and rail traffic as well as local, regional and national impacts).

Impact categories:

- intra-project impacts - resulting from one or more activities that are part of the planned Project, including the NPP and associated investments, and
- inter-project impacts - arising in connection with the planned Project and one or more external investment projects, which are underway or which are planned and have obtained a decision on environmental conditions or such a decision is pending.

In the event of potential cumulative impacts resulting from provisions presented in the strategic documents, first and foremost it should be indicated that the range of the impacts may cover the entire country, and the time range may extend over many years or even beyond that period. Additionally, it should be stated that diversification of energy sources is directly related to safeguarding the energy security, which is one of the pillars of the Polish Nuclear Power Programme (PPEJ).

The impacts identified during the analyses related to the impact assessment of the Project on various components of the environment were analysed in relation to the potential impacts that may occur during the construction and operation of the associated investments and third party investments. Such impacts were described in qualitative terms.

These analyses considered the type, duration, and extent of impacts from the Project and from associated and third-party investments. Consideration was also given to the timing of individual investments in conjunction with the timing of the Project, as well as their site relative to the Project.

Cumulative impacts with associated investments

From the perspective of Project impacts with the accompanying infrastructure, the territorial range of impacts was analysed for individual associated investments as well as preliminary assumed technical and technological solutions, and as estimated emissions that may result from construction works and processes during operation of individual associated investments.

When the ranges of impacts on a given environmental component originating from the planned Project and the associated investments overlapped, a probability of a cumulative impact was analysed. The analysis took into account impacts on biotic and abiotic environmental components and on humans (socio-economic aspects).

Cumulative impacts with third party investments

The impacts of the Project in the construction and operational phases, identified during the assessments of impacts on various environmental components, were analysed in relation to potential impacts that may occur as part of third party investment projects:

- existing third party projects for which a decision on environmental conditions has been issued and which are under construction or in operation, and whose potential range of impact falls into the area of the NPP impact,
- investment projects for which a decision on environmental conditions has been issued and which are being implemented - it is assumed that they have obtained a building permit or another permit which uses the decision on environmental conditions as an input,
- investment projects for which the procedure of issuing a decision on environmental conditions has been initiated but it has not been issued yet (their implementation has not started yet).

Similarly as in the case of cumulative impacts with associated investments, the territorial range of impacts for individual third party investment projects, applied technical and technological solutions and emissions were also analysed here.

Information on third party investment projects (existing, ongoing and planned) for which the decisions on environmental conditions were issued and on investments for which the procedure for issuing decisions on environmental conditions was initiated for Variant 1 - Lubiatowo - Kopalino site and Variant 2 - Żarnowiec site cover the period from 1 January 2013 to 30 June 2020. In total, information about 500 investment projects was obtained for both site variants in the Administrative Site Regions of Lubiatowo - Kopalino and Żarnowiec for the period of time specified. Finally, the analysis of cumulative impacts for most environmental components covered a total of 263 investments, of which the focus was primarily on large investment projects such as infrastructural (mainly linear investments, that is, roads and railroads), renewable energy sector (wind farms and photovoltaic farms), overhead power lines (110 kV and 400 kV). Then, from a list of 263 investment projects, for each environmental component (biotic and abiotic), the projects that could potentially interact with the construction and operation of a nuclear power plant were selected.

VI.4.19.2 Natural environment

Land area

Within the framework of selected and analysed projects that may cause impacts on individual species or natural habitats, proposals were described to minimise such impacts or recommendations for further investment activities and future administrative procedures dedicated to associated (cumulative) investments were made.

Intra-project impact

The potential threats to individual natural elements that may occur in the case of cumulative impacts involving the Project and the associated infrastructure were analysed. Potential impacts resulting from possible overlapping impacts were identified, including spatial impacts, that is, direct destruction of habitats, plant species, etc. Possible cumulative impacts on ecological corridors were also analysed. The following threats with related impacts were identified:

- 400 kV power line corridor

A 400 kV line is planned in both site variants.

Under both Variant 1 and Variant 2, the potential for cumulative impacts may occur to avifauna with respect to enhanced risk of collision with facilities (overhead lines). Impacts may be more significant for Sub-variants 1B and 1C for which cooling towers are planned. With respect to chiropterofauna, additional tree clearing and interruption of tree canopy will likely lead to possible cumulative impacts with respect to this animal group.

- A waterfront with Marine Offloading Facility (MOLF)

A Marine Offloading Facility (MOLF) - which will be an openwork structure that interferes with the beach and dune zone - is planned for both site variants.

For both site variants, possible cumulative impacts on the protected invertebrate species - sand hopper (*Talitrus saltator*) may be expected. Additionally, the MOLF together with the technical road may cause cumulative impacts to habitat 2130 and the species of creeping willow (*Salix repens arenaria)*.

- Access roads and railway lines

Cumulative impacts will occur especially in places where the above-mentioned infrastructure is connected to the NPP (in the Project Area).In Variant 1, there will be the connection of three roads to the Project Area, that is, an access road (from the south), an auxiliary road (from the west) and an evacuation road (from the east), as well as the connection of a railroad line from the south. Cumulative impacts are expected to be particularly significant in terms of additional physical barriers that will be erected in space and will result in reduced opportunities for animal migration.

Under Variant 2, cumulative impacts would occur along the entire section of ongoing works associated with the construction of the MOLF access road, which would run through Subareas 2 and 3 along the auxiliary water channels planned to be constructed for the cooling system. These impacts will be high for both site variants and will affect groups such as amphibian and reptile herpetofauna, avifauna, chiropterofauna, and terrestrial mammals (Variant 2 also includes wolf, beaver, and otter).

<u>Inter-project impacts</u>

Twenty-two projects were identified as having the potential to interact with the NPP under both site variants. These included photovoltaic farms, wind farms and a 400 kV and 110 kV power station. However, most of them are located at a considerable distance from the NPP and therefore a risk of a cumulative impact has not been demonstrated.

Nevertheless, a probability of cumulative impacts was found in relation to the Project executed under Variant 1 and investment projects involving the construction of two wind farms: "Construction of Ciekocinko II Wind Power Farm" located approximately 2km south of the Project Area and "Construction of a wind power plant complex with a rated capacity of maximum 10 MW along with the required power infrastructure, access roads and manoeuvring sites, located on site No. 152/13 within Ciekocino, in the Choczewo Commune", located at a distance of approximately 5km also in the southern direction. In the case of these investments, cumulative impacts regarding increased collision with avifauna and chiropterofauna can be expected (mainly in the case of Sub-variants 1B and 1C - related to the construction of cooling towers), however these impacts will be negligible. Under Variant 2, cumulative impacts will not occur due to the significant distance of the NPP from the identified investment sites.

Marine area

In order to evaluate cumulative impacts with other projects, plans, and programmes, the maximum geographic area was designated around the Project Site and associated investments, which has a potential for impact on the marine environment.

The carried out analysis (which included modelling of e.g. heated water dispersion model, suspended matter dispersal modelling and project impact assessment) shows that the maximum geographical area of the marine zone of impact for the Project may extend up to approximately 40 km east of the site in the direction of Władysławowo. While searching for other investment projects to be taken into account in the cumulative impact assessment, it was not possible to find any large projects that were within the zone of impact that could be included in the baseline. There were also no investment projects identified to be completed prior to the Project start date that could be incorporated into the future baseline.

However, the review of the Spatial Development Plan for Polish maritime areas has identified water bodies intended for offshore wind farms as "permitted tasks". It covers certain projects outside the zone of impact but they have been included where they are considered to have pathways of potential cumulative effects. Potential landfall sites for power cables from planned offshore wind farms (OWF) were also included in the assessment of cumulative impacts.

Summary of the assessment of cumulative impacts for marine areas.

On the basis of the analysis of the assessment of cumulative impacts added to the Project, it has been concluded that even if works concerning investment projects unrelated to the Project, and even intra-project investments, were carried out in parallel to the Project works, it is very unlikely that the zone of impacts for sediment plumes generated by dredging activities and underwater noise would overlap. Thus, it is concluded that a cumulative impact would not occur.

VI.4.19.3 Inland waters

There will be a cumulative impact of the planned Project on water quality indicators due to the implementation of the associated infrastructure.

For the assessment of cumulative impacts, scenarios of change for land cover, that is, land use change - were considered. In order to keep the results transparent and at the same time avoid presenting the impact assessment for each site, cooling option and years in which the coverage changes are planned, it was checked in which year the largest transformation area of the site from the zero state would occur. For the detailed analyses, those land cover scenarios were selected which, for the individual site options, are associated with the heaviest land transformation (Sub-variant 1A in 2032 and Sub-variant 1B in 2038).

Other activities and conceptual assumptions that could potentially affect surface water were also analysed, including:

- securing excavations against groundwater inflow, transport of drainage water, and draining rainwater and snowmelt into Kanał Biebrowski (Variant 1) or Lake Żarnowieckie (Variant 2),
- water intake, including the use of a new groundwater intake for potable and household use purposes and to supply the construction site,
- discharge of wastewater to the sea (Variant 1) and to the vacuum sewerage network of the Krokowa Municipal Enterprise (Variant 2).

The results of surface water quality monitoring studies were analysed to estimate the increase in pollutants from wastewater discharge into the environment. It was assumed that the volume of wastewater would be proportional to the number of workers performing work in a given site. The amount of pollutants from road surfaces and other transport infrastructure was also estimated based on land development maps (roads, shoulders and green belts), and the unit load of typical pollutants (petroleum hydrocarbons and suspended solids) was assumed. The analysis was carried out in surface water body (SWB) catchments. The potential impacts of the planned activities were identified in five SWB catchments under Variant 1, and in six SWB catchments under Variant 2.

The potential impact on the SWB through hydraulic connections with affected SWB catchments was identified in one SWB catchment under Variant 1, and in two SWB catchments under Variant 2.

The calculation results were considered, taking into account three possible scenarios for each site variant.

Variant 1 provides for:

1. Scenario comprising the NPP construction and operation for the year 2032,
2. Scenario comprising the NPP construction and operation with the associated infrastructure - marked with "LC1T" symbol, for the year 2032,

3. Scenario comprising the construction and operation of only the associated infrastructure related to the NPP construction for the year 2030.

Variant 2 provides for:

1. Scenario comprising construction and operation of NPP for the year 2038,
2. Scenario comprising the NPP construction and operation with the associated infrastructure - marked with "LC1T" symbol, for the year 2038,
3. Scenario comprising the construction and operation of only the associated infrastructure related to the NPP construction for the year 2035.

Variant 1 — Lubiatowo - Kopalino site

The impact assessment of the NPP and accompanying infrastructure under Variant 1 indicates that the planned Project may cause changes in flow rates. These changes, as opposed to the current status, are not large and diminish with the distance from the site of planned activities. Immediately on the NPP site boundary, the change in flow rate in Kanał Biebrowski was estimated to be at 3.4% of the current flow. At the mouth of Kanał Biebrowski into the Chełst river (about 2.5 km downstream from the location of the main surface water outflow from the NPP site), the change is 1.9%. In the estuary part of the SWB, where the NPP site is located (approximately 7.5 km downstream of the main surface water outflow from the NPP site), the change in the mean flow rate of the Chełst river was estimated to be 1.2%, and in the estuary of the direct catchment of Lake Sarbsko, the change in flow rate fell down to 1%. All of these changes are approximately 0.01 m^3/s.

At the mouth of Kanał Biebrowski into the Chełst River, the biological flow rate of 0.28 m3/s will, according to the impact assessment, be breached 2.2% more frequently than that calculated for the current status.

Variant 2 - Żarnowiec site

The impact assessment of the NPP along with accompanying infrastructure indicates that there may be an impact through changes in surface water flow rates. These changes, as opposed to the current status, are not significant and they diminish with the distance from the location of the planned activities.

Downstream Lake Żarnowieckie, the increase in flow rate is estimated at 0.9%, and this increase continues in the Piaśnica River to the inflow from Dębki I polder. In the estuary of the Piaśnica River, the increase in flow rate is 0.7%. All these changes total approximately 0.02 m^3/s.

On the site of the exit of the nearest elementary catchment MPHP10 downstream of the NPP site, that is, at the estuary from Lake Żarnowieckie, the biological flow of 0.63 m3/s, according to the results of the impact assessment, is neither affected in the current state nor will be under the scenario including all the Project activities.

At the same time, the results of the calculations were compared with the environmental goals for all SWBs, which are supposed to have good chemical status. The following was found:

- for SWB **RW200017476925**: in the current state of the environment, the concentration of suspended solids which allows to achieve good chemical status is exceeded; the results of calculations indicate that the changes of concentration due to the associated infrastructure **in both sites considered will be positive**, at the level below the quantification limit and will not contribute to the improvement of chemical status; therefore it is necessary to minimise the impact in the scope of suspended solids discharge; as regards the remaining parameters, that is, oxygen and nutrients concentration, no significant impact on the chemical status of water is predicted;
- for SWB **CWDW1801**: the potential impact is predicted only **for the Lubiatowo - Kopalino site** and only as a result of activities related to the associated infrastructure; the biggest change is the concentration of suspended solids at the point corresponding to PPK 36 on the Lubiatówka River, this change should be addressed when planning measures to minimise the impact on the environment; the hydrological

modelling did not analyse the impact on the changes occurring outside the catchment and the watercourses; therefore, although the nitrogen and phosphorus concentrations observed in the Lubiatówka River exceed the limit values established for the coastal waters, these exceeded levels should not be taken into account as a criterion for the impact assessment, because the concentration in the Lubiatówka River is not the only factor determining the condition of the coastal water body;

- For SWB **LW21047**: observations in the catchment area of Lake Sarbsko indicate exceeded levels of total nitrogen concentration and thus failure to achieve the good chemical status; a slight increase in concentration (below the quantification level) is predicted for activities connected with the NPP construction **at the Lubiatowo - Kopalino site** and construction of associated infrastructure for the Żarnowiec site, while the latter activities will result in a change of 0.0001 mg/l, which is a negligible value. If the Lubiatowo - Kopalino site is selected, it is recommended that efforts are taken to minimise the nitrogen load and subsoil erosion, which may lead to the transport of larger loads;
- for SWBs **RW200025477249** and **RW20001747839**: for activities related to the associated infrastructure of both sites, an increase in suspended solids concentration is predicted, which already exceeds the limit value for the good chemical status;
- for SWBs **RW200017477259** and **LW21049**: no impact compromising the achievement of the good chemical status;
- for SWB **RW200023477289**: only in case of simultaneous impact of activities related to the construction of the NPP and associated infrastructure **at the Żarnowiec site** is a threat to the good chemical status anticipated, due to the predicted decrease in the dissolved oxygen concentration.

VI.4.19.4 Marine waters

The assessment of cumulative effects focused on assessing the in-combination environmental impact of the NPP, associated infrastructure and third party projects and activities identified in the Polish Maritime Spatial Development Plan. The findings of assessments related to the Water Framework Directive and the Marine Strategy Framework Directive were also applied.

The associated investments (MOLF and technical road, sewage treatment works, etc.) were considered the most relevant part of the assessment of cumulative impacts, due to their vicinity and the fact that they are inextricably linked to the NPP execution. The assessment also examined interactions with external [third-party] investment projects that will be implemented in parallel to the NPP. In the case of Lubiatowo - Kopalino site, the Baltica-2, Baltica-3 and Baltic Power offshore wind farms were covered by further analysis. In the case of Żarnowiec site, no risk of significant cumulative impacts with third-party investment projects at the investment selection phase was found for further analysis.

In order to assess cumulative effects with other projects, plans and programmes, an appropriate maximum geographical area around the main Project site and associated infrastructure [investments] sites where potential cumulative impacts may occur has been determined and identified as the Zone of Impact, and an analysis has been carried out for it.

The key cumulative impacts have been identified for the construction phase: the development stage and the construction stage, and operational phases of the Project, taking into account a possible worst case scenario. The MOLF and the technical road were examined from the angle of their impacts on: coastal processes and hydromorphology, the coastal dune zone, coastal management, sea water quality and marine ecology. In turn, the wastewater treatment plant was examined in terms of its impact on: coastal processes and hydromorphology, seawater quality and marine ecology.

Variant 1 — Lubiatowo - Kopalino site

Inter-project impact assessment

A total of 15 investment projects were analysed (some projects such as offshore wind farms, were analysed jointly if they were built in clusters or using a phased-out approach). Out of 15 investment projects, the following were qualified for further assessment: "Offshore wind farms: Bałtyk II and III and NEPTUN", "Offshore wind farms: Baltica-2, Baltica-3, A-Wind, B-Wind and C-Wind" and "Offshore wind farm: Baltic Power". These investment projects have been covered by the assessment, because the potential landfall of the power cables is in the vicinity of the offshore works location for the Project. Moreover, from the available information it appears that the works related to the landfall point of the cables from the OWF could be carried out in parallel to the works under the Project.

The cumulative effects resulting from the simultaneous construction of the landfall of offshore OWF cables and offshore infrastructure for the NPP were examined and the following conclusions were drawn:

- significant increases in suspended sediment concentrations are unlikely,
- a significant increase in sediment deposition is unlikely,
- the prey base of marine predators will not change,
- collisions involving marine mammals and ships are unlikely,
- a significant increase in marine fauna disturbance is unlikely,
- impacts on the sea mammals exerted by piling will be insignificant once the minimising measures have been implemented.

Thus, cumulative impacts of the project will be negligible or insignificant vis-a-vis all analysed taxonomic groups. The assessment under the Water Framework Directive of all phases and sub-variants has shown that there will be no significant adverse impact on biological, hydromorphological or physicochemical quality elements that would compromise the current status under the WFD for the groundwater bodies where the works take place.

Intra-project impact assessment

The associated infrastructure/investment, i.e. a wastewater treatment plant together with a header for treated wastewater discharge into the sea will be constructed at the development stage, while the MOLF structure will still be under construction at an early stage of NPP construction works. It was concluded that although some local and temporary impacts could be expected during their construction, these were considered to be negligible and insignificant. Once the MOLF is completed, it will be in operation throughout the entire life cycle of the NPP. However, due to its skeletal structure, the long-term effects of the MOLF on coastal geomorphology were assessed as negligible and insignificant.

From a marine environmental perspective, the highest potential impact of the MOLF construction is related to the generation of underwater noise and vibration during piling works. However, with appropriate mitigation measures, impacts would be minor and insignificant.

During the construction phase, effluent from the waste water treatment plant (WWTP) will be discharged into the adjacent marine environment. The modelling exercise has shown that the discharge of treated wastewater will comply with environmental quality standards and will not have impact on the water quality of the identified bathing waters, nor affect eutrophication.

Variant 2 - Żarnowiec site

Inter-project impact assessment

In total 13 investment projects were analysed (some projects such as offshore wind farms, were analysed together if they were built in clusters or using a phased-out approach). These were investments belonging to groups such as: coastal fortifications (strengthening of quays, construction of groins), construction of ports

(External Port of Gdynia, External Port of Gdańsk), dredge spoil disposal areas, wind farms, construction of the Harmony-Link submarine power cable. The analysis of potential cumulative impacts of the above-mentioned projects with the Project shows that there are no potential threats of impacts and none of the investment projects have been qualified for further impact assessment.

Intra-project impact assessment

The associated infrastructure/investments (MOLF and WWTP) will result in insignificant impacts under Variant 1.

VI.4.19.5 Ambient air quality

As part of the analysis of the cumulative impact of the Project on the atmospheric air quality, the quantities of pollutants emitted into the air for all sub-variants were estimated, the dispersion of these pollutants was modelled and the impact on people and the environment was assessed. The following air emissions were taken into account for the calculation of the cumulative impact:

- the pollution background, i.e. the projection for the year of the commencement of the construction phase of the planned Project, which takes into account emission changes from other sources, including other projects for which a decision on environmental conditions has been issued in the site Region,
- emission sources associated with construction of the Project,
- emission sources from associated infrastructure/investments - not covered by the scope of this EIA Report.

The analysis covered the site Region, including both the onshore and offshore parts, in order to consider the full extent of Project impact. The cumulative assessment takes into account the construction and operational phases.

Construction phase

At the development stage of the Project for all sub-variants, cumulative (combined impacts for the development stage, projected background and development of associated infrastructure/investments) concentrations of carbon oxides, benzene and lead in the air will be negligibly low. The annual average and short-term concentrations of nitrogen dioxide, PM 2.5 and sulphur dioxide will be low, and may reach a maximum in the calculated area of respectively 13 - 24% of the permissible level for Variant 1 and approximately 42% of the permissible level for Variant 2. Only concentrations of particulate matter PM10 would be high just on the boundary of the Project Area. For Variant 1, the 24-hour average concentrations of PM10 may reach approximately 99% of the permissible level, but will decrease rapidly as you move away from the Project Area. On the other hand, for Variant 2 the concentrations of PM10 will be high - the concentrations exceeding the permissible level may occur on the eastern side beyond the Project Area (for 24-hour average concentrations of PM10 may reach approx. 225% of the permissible level, and for annual average concentrations - approx. 137%). However, this will be a short-term impact, which will cover only forest areas and as one moves away from the borders of the Project Area the concentrations of this pollutant will decrease and will not exceed the permissible levels in the built-up areas.

During the construction and commissioning stages for all sub-variants, the cumulative concentrations of carbon oxides, benzene and lead in ambient air will be negligibly low. For short-term concentrations of sulphur dioxide and annual average concentrations of PM2.5 will be low. In the calculation area they can reach a maximum of 8 - 9% of the permissible level, and less than 19% of the permissible level in Variant 1. For Variant 2, they may reach outside the Project Area from 15% to less than 35% of the permissible level. Similarly, for one hour concentrations of nitrogen dioxide, for which the maximum concentrations at the boundary with the Project Area (Variant 1) may reach 138 µg/m3, i.e. up to approx. 69% of the permissible level, but will decrease rapidly with distance from the construction site. In Variant 2, the one-hour and annual average concentrations of nitrogen dioxide will not exceed 71% of the permissible level and 46% of the permissible level, respectively.

Only particulate matter PM10 concentrations will be high. For Variant 1, just outside the boundary of the Project Area, concentrations of PM10 may reach approximately 95% of the permissible level (for 24-hour average), but will decrease rapidly as you move away from the site. In Variant 2, the 24-hour average concentrations of PM10 may reach approximately 227% of the permissible level, and the annual average concentrations may reach approximately 139% of the permissible level, but will decrease rapidly as one moves away from the border of the Project Area, with no exceedance in the built-up areas.

Operational phase

The cumulative concentrations of all tested pollutants during the operational phase of the planned Project will be the same for each of the site variants. Concentrations of carbon oxides, benzene, and lead in the air will be negligibly low. For other pollutants, concentrations will also be very low. The highest concentrations outside the Project Area are likely to occur for 24-hour average PM10 (more than 28% of the permissible level for Variant 1 and about 59% of the permissible level for Variant 2) and 1-hour nitrogen dioxide (less than 22% of the permissible level for Variant 1 and about 41% of the permissible level for Variant 2). However, higher concentrations of these pollutants do not occur in the vicinity of the Project Area, but in built-up areas (in nearby localities) and along main roads, and are related to residential and traffic emissions. The highest concentrations of NO_2 will occur in Bolszewo, in the close vicinity of S6 road, in Rumia, whereas for PM10 in Lębork and Gdynia-Cisowa in close vicinity of DK6 national road. For all substances, the cumulative impact of the planned Project will be insignificant.

VI.4.19.6 Acoustic climate

The cumulative impact takes into account the infrastructure associated with the Project and the investments and projects under construction in the Administrative Site Region. Cumulative impacts are such impacts on the acoustic climate that result from successive, accruing and/or combined effects of the planned Project after they are added to other effects resulting from existing, planned and/or reasonably predicted future projects, the effect of which is normally an increased noise impact. Cumulative impacts of acoustic climate were evaluated and divided into two categories:

- intra-Project impacts – resulting from one or more activities included in the planned Project, covering the NPP and the associated infrastructure/investments; and
- inter-project impacts - arising in connection with the planned Project and one or more external investments, which are in progress or planned and have obtained a decision on environmental conditions.

In terms of intra-project impacts, the Project would cumulate with associated developments constructed for the NPP. Unit and cumulative noise were evaluated using a quantitative and qualitative method. Minimising measures for the unit impact of a given associated infrastructure related to the activities evaluated were quantified (where possible) to demonstrate their feasibility and effectiveness.

Owing to the fact that all data entered in the noise model were an assumptions to a certain extent, the analysis was conducted with consideration of the "boundary condition envelope". A reasonable approach based on the worst-case scenario was adopted. Any deviation from the assessed assumptions would therefore not result in an impact assessment higher than that assessed within the "envelope". Whenever the assessment indicated significant impacts, the "assessment envelope" was reviewed to verify the assumptions made.

The noise model is based on a virtual three-dimensional version of the site topography and relevant noise-attenuating factors in the analysed area. All noise modelling and calculations of anticipated noise levels were conducted using a specialised software. The 2014 "Noise Impact Assessment Guidelines" from the Institute of Environmental Management and Assessment (IEMA) were used as the methodological basis. Numerical Terrain Model and Database of Topographic Objects (BDOT10k) were used to perform model analyses. The data source for creating the land cover was the CORINE Land Cover (CLC) 2018 numerical layer. The development area was the primary receptor of noise levels during the analyses.

Cumulative impacts from the Project refer to the potential for noise from different parts of the Project to add up and thus create a different impact. Only the construction phase of the Project (development stage and construction stage) was considered in the cumulative assessment as the most intensive in terms of impacts. During the operational phase of the Project, the operational components, associated infrastructure and other construction investment projects, or projects with decisions on environmental conditions, are sufficiently distant from each other that the impact of each system will not cause cumulative impacts on the same noise receptor. However, it is not anticipated that during the decommissioning phase any of the associated infrastructure or other third party installations would be demolished/dismantled at the same time as the Project.

Land area

Within the sensitive noise protection zones, there are permissible noise levels depending on the daytime (6:00 - 22:00) and night-time (22:00 - 6:00). Noise-sensitive areas include receptors such as: residential buildings, hospitals and social welfare buildings, public buildings temporarily or permanently occupied by children and adolescents, health centres, recreational areas, residential areas and commercial areas.

Since the environmental impact assessment requires consideration of the baseline environment, the scale of the impact also accounts for the difference between the noise levels generated by the Project and existing noise levels. The impact was then analysed in terms of duration to determine the magnitude of impact and intensity of effects. All receptors are regarded as regional, and this fact has been taken into account in the considerations of the effects.

The modelling of the noise generated by the associated infrastructure related to the development and construction stages took into consideration:

- construction of the MOLF (Marine Off-Loading Facility),
- construction of 400 kV overhead power lines, and 110 kV and 15 kV cable lines,
- construction of a technical/service road between the MOLF and the NPP,
- construction of an accommodation base for NPP construction workers in the locality of Choczewo and a Local Information Centre in the locality Nadole, outside the Project Area.

The construction works were modelled with the application of polygons as area sources. Where appropriate, two polygons of noise sources were identified within every activity, one accounting for noise sources with a lower level at the height of 2.5 m above ground level and another for noise sources with a higher level at the height of 4 m above ground level (tower cranes). All forecast noise levels in key receptor points were established at the height of 4m above ground level, 2m away from the outer wall of the vulnerable building, except for situations where the vulnerable receptor points are situated in an open space where the receptors were modelled at 1.5m above the ground level.

At the development stage, all works falling into the scope of associated infrastructure/investments carried out at this stage, which could be a source of noise, were identified to be short-term and negligible.

At the construction stage predicted noise levels generated by the construction of the marine offloading structure (MOLF) will not exceed permissible noise levels for any receptor. The scale of the impact is therefore negligible for all receptors, and the effects are insignificant. Consequently, there is no need to minimise the effects. The modelling analysis concerned the potential impacts exerted by the noise generated during the construction of the accommodation base for workers in the locality of Choczewo, and the Local Information Centre in the locality of Nadole. Where construction-related noise levels are predicted to be less than 10 dB than the permissible level, this will be a low intensity impact. Where noise exceeds permissible levels, it will be a very high intensity impact. The impact of noise generated by the construction of the accommodation base in the locality of Choczewo and the Local Information Centre in the locality of Nadole will be short lasting, direct, negative and reversible, of medium scale and with moderate impact. The assessment of potential noise impacts during construction of the Local Information Centre identified predicted cases of exceeding acceptable noise levels by 18 dB during daytime (in the locality of Nadole). Given the above, the available minimisation measures will be taken during the construction stage to reduce noise. For example, roads used by trucks carrying construction materials will be fitted with noise barriers at sensitive points.

Piles will most likely be driven under the foundations of the 400 kV overhead line pylons, using an impact system. The construction method used generates noise that can negatively impact nearby receptors. The closest receptor identified was a building east of the locality of Tawęcino, located approximately 90 m from the axis of the 400 kV line corridor. It is assumed that all construction works will be performed only in daytime. The predicted noise level exceeds the permissible level by 8 dB. This results in an impact of very high intensity. It should be noted that this impact is likely to be temporary and/or short-term, whereas the direct, negative, and reversible impact would have medium scale and effect will have moderate significance.

<u>Intra-Project impacts</u>

The outcome of acoustic modelling show that as a result of construction works within the Project Area and during the construction of most of the nearby NPP associated infrastructure/investments, noise associated with the works will be at least 10 dB below the permissible levels. The minimising measures (within the Project Area and for the associated infrastructure) have been implemented where the exceeded permissible levels are anticipated for earthworks, piling, foundation works, and construction of onshore make-up water channels/pipelines near pumping stations. These are considered to be fully sufficient.

One scenario of cumulative impacts from the Project was quantitatively evaluated. Cumulative noise levels associated with the construction of the MOLF and onshore make-up water channels/pipelines near the pumping stations were predicted. The results of the noise assessment indicated that exceedance of permissible levels by 1 dB would occur for the option with the implementation of open trench for the make-up water channels/pipelines. However, if the above-mentioned channels/pipelines are erected using the controlled drilling option, the permissible noise values will be exceeded by 2 dB. Therefore, this results in a very high intensity impact. As the noise emissions for this impact are not very likely to persist for more than a year, it should be considered as short-term. That is why such a direct, negative and reversible impact would have a medium scale and moderate effect.

In summary, it should be noted that the level of cumulative noise that will be generated during construction of the MOLF facilities, and with the concurrent development stage works for the construction of the make-up water infrastructure could generate significant impacts.

<u>Inter-project impacts</u>

The analysis is mainly based on the increased vehicle traffic on the main roads in the site Region that would result from the simultaneous implementation [construction] of the Project itself, the associated infrastructure/ investments as well as the implementation of third party projects. Given the above, a list of third party investment projects was analysed and evaluated for likely cumulative noise impacts. The results confirmed that a significant cumulative impact is unlikely. Only in the case of simultaneous implementation [construction] of the Project, associated infrastructure/investments, and construction of a submarine cable between Poland and Lithuania (Harmony-Link), between Krokowa (the Pomorskie Voivodeship) and the locality of Darbenai located in the territory of the Republic of Lithuania, there may be a potential cumulative impact of noise generated during construction works and traffic noise for Variant 2 - Żarnowiec site.

Marine area

Noise analyses and modelling in the marine area were prepared for both site variants: Variant 1 - Lubiatowo - Kopalino site and Variant 2 - Żarnowiec site. There are no permanent receptors in this area, as it was the case onshore Consequently, the modelling and analysis carried out focus mainly on marine mammals, which are sensitive to high-frequency sounds.

In order to collect data for the purpose of evaluating cumulative impacts with other projects, plans, and programs, the maximum geographic area around the Project site and associated infrastructure/investment projects where underwater noise impacts are possible has been identified. Based on the modelling results, maximum zones of impacts were considered up to 20 km from each site Variant. This is the distance where underwater noise levels would fall slightly below the thresholds for the marine mammal species (particularly cetaceans sensitive to high-frequency sounds), subject to the assessment.

Intra-Project impacts

To begin with, an assessment of the infrastructure within the Project and associated infrastructure/investment projects was carried out with regard to the potential for noise cumulation. The Project and associated infrastructure/investment projects (cooling water intake and discharge heads/diffusers, intake/discharge channels/pipelines, MOLF, fish recovery and return system [FRRS], and works and operations performed using watercrafts) were selected for further cumulative impact assessment. These intra-project aspects were included because of the potential for overlap of works in different Project phases.

The table below [Table VI.20.6- 1] shows an assessment of the potential cumulative intra-project impacts that may arise during the construction, operational, and decommissioning phases of the Project as a result of works related to the Project, and associated infrastructure/investment projects.

Table VI.20.6- 1 Assessment of intra-project cumulative impact

Associated infrastructure and the Project	Scope	Assessment
Cooling water intake/discharge diffusers (installation/demolition of temporary sheet piling, dredging and placement of rock armour) **Water intake/discharge channels/pipeline** **Marine Off-Loading Facility [MOLF] (impact and vibratory piling)** **Fish recovery and return system [FRRS] (installation/demolition of temporary sheet piling [vibratory piling], dredging and placement of rock armour)** **Fish recovery system channels/pipelines to allow fish to return to the sea** **Works and operations using watercrafts**	Assumptions Cumulative underwater noise impacts are possible for all planned infrastructure and activities during construction and decommissioning [phases]. There is no potential for cumulative underwater noise impacts during operation, except for works and operations involving watercrafts. Potentially cumulative underwater noise impacts may take place during works and operations with watercrafts in all phases (from development stage to Project decommissioning). The Project and associated infrastructure/investment projects will implement standard mitigation measures, including a piling management plan, a dredging management plan, and a vessel movement management plan.	Piling (impact and vibratory) There is the potential for overlap between temporary sheet piling (vibratory piling) and MOLF (impact and vibratory piling) works in the Project Area and the site of associated infrastructure/investment projects. This plays a pivotal role if piling works (water intake/discharge diffusers, MOLF, and FRRS [fish recovery and return system] inlet) are carried out simultaneously and/or over a long period of time. A synchronised schedule of piling activities will be required to ensure that cumulative impacts are not significant. It is also necessary to select and use the optimum pile driving techniques, and drilling rigs best suited to the site conditions and the task required, thereby avoiding extended duration of works and the risk of cumulative impacts. Dredging There is the potential for overlap between the dredging works conducted as part of the Project and the associated infrastructure/investment projects. This plays a pivotal role, if dredging (water intakes/discharge diffusers, fish return system channels/pipes) are carried out simultaneously and/or over a long period of time. A synchronised schedule of dredging activities will be required to ensure that cumulative impacts are not significant. Optimal dredging techniques and watercrafts best suited to the site conditions and the tasks at hand should also be selected and used to avoid extended duration of dredging works and the risk of cumulative impacts. Placement of rock and sand backfill The rock and sand filling scattering work could potentially overlap under the Project and associated infrastructure/investment projects. This plays a pivotal role if rock and sand backfill placement activities (water intakes/discharge diffusers, fish recovery and return system channels/piping) are carried out simultaneously and/or over a long period of time.

Associated infrastructure and the Project	Scope	Assessment
		A synchronised work schedule for rock and sand backfill placement will need to be developed to make sure the impacts are not cumulative. Care must also be taken during rock/sand backfill placement, transfer of rock/sand material, and/or removal of stones from the seabed to avoid excessive underwater noise levels and the risk of cumulative impacts. <u>Work and operations using watercrafts</u> The Project's and associated infrastructure/investment projects' watercraft movements may potentially overlap each other. A synchronised work schedule and watercraft operations will need to be developed to make sure that cumulative impacts are not significant. Care must be taken during works and operations involving watercraft to avoid excessive underwater noise levels (e.g., compliance with speed limits on the Project Site and associated infrastructure/investment projects' sites) and the risk of cumulative impacts.

Source: *Jacobs (2021) Noise and Vibration Impact Assessment. Waterborne noise and vibration (impact on marine mammals and fish) impact assessment.*

<u>Inter-project impacts</u>

In order to identify potential cumulative impacts of the Project along with other projects, available offshore spatial development plans and maps were analysed, and spatial relationships between the surveyed facilities were determined. For further assessment of cumulative impacts with the Project, the Baltica 2 and 3 wind farms and the Baltic Power offshore wind farm were included.

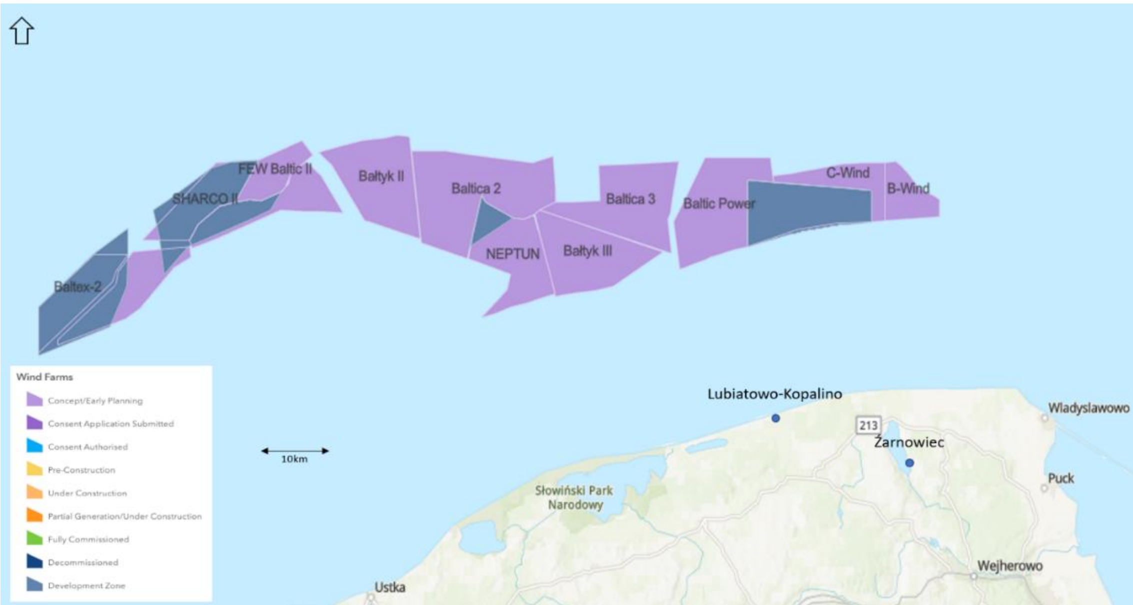


Figure VI.4.20- 1 License units for offshore wind farms located outside the zone of impact.

Source: <u>www.4coffshore.com/offshorewind</u>

These projects have been included due to the potential overlap of construction activities such as: deep water piling, dredging, vessel movement and cable installation at landfall and offshore works in both site Variants.

The table below [Table VI.20.6- 2] shows an assessment of potential cumulative inter-project impacts associated with implementation of the Project and installation of offshore wind farms.

Table VI.20.6- 2 Assessment of inter-project cumulated impact

Project	Scope	Assessment
Bałtyk II and III, and NEPTUN Offshore Wind Farms **Baltica-2 and Baltica-3 Offshore Wind Farms** **Baltic Power Offshore Wind Farm**	Assumptions Construction of wind farms and their power export cables, potentially overlaps with the construction stage of the Project in 2025-2026 (24 months and 12 months in he case of the Baltic Power offshore wind farm). The underwater noise generated by piling, dredging, vessel traffic, installation of the submarine cable, and at landfall locations (for the cable and landfall locations adjacent to the NPP Project) is likely to cumulate. The installation of power export cables at landfall locations will be carried out using guided drilling under the beach followed by open trench, which includes temporary sheet piling, similar to the construction of the Project's cooling/make-up water channels/pipelines. The Project and the offshore wind farms will implement standard mitigation measures	Piling There is a risk of overlapping piling works in case of simultaneous execution of the Project and the offshore wind farms (OWF). This is particularly relevant if works in are executed simultaneously in Variant 1 - Lubiatowo - Kopalino site, and Bałtyk III OWF, as they are located closest to each other (approx. 40 km). However, given that piling is unlikely to be carried out at the same time, and additional mitigation measures will be applied, this impact is considered to be insignificant. Dredging and cable installation There is a risk of works overlap, if the dredging/cable installation works are carried out simultaneously as part of the Project, and the offshore wind farms' power export cables. This is particularly relevant in case of a simultaneous execution of works under Variant 1, and the installation of power export cables from the OWF in the onshore section. Given the zone of impact and the noise level that would be generated for approximately 12 hours [per day] and the mammal receptor remaining at the same location for that entire period, which is unlikely, and with implementation of standard mitigation measures, the impact is considered to be insignificant. Vessel movement There is a potential overlap between watercraft traffic associated with the Project, and offshore wind farms installation of power export cables. This is particularly relevant in the case of concurrent increased vessel movement under Variant 1, and the installation of power export cables from the OWFs in the onshore section. Based on the local zone of impact associated with underwater noise generated by watercraft movement (modelled for Variant 1) and with the implementation of standard mitigation measures, the impact is considered to be insignificant.

Source: *Jacobs (2021) Noise and Vibration Impact Assessment. Waterborne noise and vibration (impact on marine mammals and fish) impact assessment.*

VI.4.19.7 Spatial development

The cumulative impacts on spatial development were analysed for the onshore and offshore areas, for associated infrastructure and third party projects. Corridor and buffer assumptions were used for the geospatial and planning analyses for the associated infrastructure for both site variants. In the analyses of cumulative impacts with external investment projects, reference was made to third party projects in the territories of communes where the NPP and associated infrastructure will be executed.

Subsequently, the nature of these projects was analysed from the angle of expected impact on spatial development, and potential areas where cumulative impacts could occur were identified.

Land area

The following cumulative impacts have been identified in the communes of the ASR of Variant 1 - Lubiatowo - Kopalino site:

1. Impacts associated with land occupancy by the NPP, the associated infrastructure, or third party projects that translate into restrictions on land development and use. The type of cumulative impact consisting in land occupancy is indicated in the Choczewo commune, where land will be occupied by the NPP and the associated infrastructure, and by third party projects;
2. Landscape impact - both the NPP, some of the associated infrastructure, and some of the external projects have impact on surrounding landscape, which may translate into spatial development processes and changes in the settlement network. A risk of cumulative landscape impacts was indicated in the communes within the NPP viewing range, where additionally associated infrastructure facilities will be located (400 kV power line, a substation) as well as large-scale or landscape dominating third party projects, such as wind farms, photovoltaic farms, open pit mines and lookout towers;
3. Impacts affecting spatial development processes - construction of NPP, associated infrastructure or external projects may translate into the enlargement of investment areas with different land use functions (e.g. services, manufacturing, residential). Such investment area enlargement may also result from the

emergence of new conditions in spatial development that are conducive to activation of investment areas - an increase in the quality of life in the commune, improvement of infrastructural and transport accessibility of areas as a consequence of tax revenues of communes in connection with the implementation of the above-mentioned investment projects (property tax, including in particular tax on building structures). In the communes where socio-economic development may occur in connection with the NPP implementation, a risk of cumulative impacts in terms of spatial development processes due to the construction of associated infrastructure, and due to third party projects, has been identified.

The following cumulative impacts have been identified in the ASR communes of Variant 2 - Żarnowiec site:

1. Impacts associated with land occupancy by the NPP, associated infrastructure or third party projects that translate into restrictions on land use and development (the type of cumulative impacts consisting in land occupancy was indicated in the Gniewino and Krokowa communes, where land will be “occupied" by the NPP and associated infrastructure, as well as third party investment projects);
2. Landscape impacts (a risk of cumulative landscape impacts was indicated in the communes within the NPP viewing range, where additionally associated infrastructure facilities will be located, i.e. 400 kV power line, a substation) as well as large-scale or landscape dominating third party projects, such as wind farms, photovoltaic farms, open pit mines and lookout towers);
3. Impacts affecting spatial development processes - as for Variant 1.

Marine area

Cumulative impacts in the scope of marine waters will be associated with restrictions on marine waters development, including changes to seabed and coastal morphology. These impacts will apply to the areas within the scope of NPP construction, associated infrastructure and offshore wind farm connections, which will be located in the Choczewo commune (under Variant 1 - Lubiatowo - Kopalino site) and the Krokowa commune (under Variant 2 - Żarnowiec site). The execution schedule for the installation of the said power connections is similar to that of the NPP. Impacts will include temporary restrictions on access to the beach areas and marine waters within and around the Project Area. No cumulative impacts are projected for water facilities.

VI.4.19.8 Socio-economic conditions

The significance of cumulative impacts has been assessed based on the magnitude of impacts in relation to the sensitivity of receptors. The analyses were carried out for the cumulative impacts of the NPP with associated and third party investment projects. The third party investment projects that were analysed from the socio-economic perspective are mainly large infrastructure projects, of which offshore wind farms are a significant part.

<u>Construction phase</u>

Under both, Variant 1 and Variant 2, cumulative impacts would occur due to the demand for workers to carry out the individual investment project. Both the NPP, associated investment projects as well as third party investment projects will be able to hire workers from the same labour market, including the regional market and the Pomorskie Voivodeship, which may lead to potential cumulative impacts. Cumulative impacts in terms of labour demand (employment) are assessed to be significant, as are impacts to the economy due to increased employment in the construction sector (additional aggregated effects on labour markets are of a comparable scale and their combined impact will be significant).

Demand for workers will also translate into the housing (accommodation rental) market. The distance to the place of employment is a determinant of the possible impact of an investment on a given area (the availability of accommodation and commute times). It is estimated that there will be very little overlap between the localities of temporary residence of workers under the analysed third party investment projects and the localities where workers employed for the execution of the NPP and associated investment projects will reside. In addition, workers engaged in linear infrastructure, such as road and railway construction, are likely to perform work at certain times and on certain sections of the Project, with periods of time when workers are present in the area expected to be of short duration. The employment structure of workers implementing the associated infrastructure is likely to lead to the scattering of accommodation.

During MOLF construction, access to the coast will be restricted, which may negatively affect tourist activities, especially fishing in the area, and impacts will be cumulative with NPP works. An exclusion zone will be established in the MOLF area, and the activities and unauthorised entry of third parties, including fishermen, will not be permitted. The MOLF will be retained for the duration of the operation stage to allow deliveries to the NPP site. The MOLF is an open structure (set on concrete piles) that allows free passage of fish and can be expected to have limited impact on fisheries, fish populations in the near-shore area. Therefore, there should be no negative cumulative impacts exerted by the NPP in that scope.

Upgrades and construction of new roads (associated infrastructure) leading to the NPP may have negative impacts on tourism (hiking, walking and/or biking trails) due to increased traffic, noise and air pollution. These impacts will be cumulative with those of the NPP, so the associated infrastructure should be subject to appropriate minimising measures that are also in line with the measures suggested for the NPP.

On the other hand, no very significant population growth is expected due to incoming workers employed under the associated and third party investment projects in the Choczewo commune (NPP site commune) and the surrounding communes.

Due to the implementation of new investment projects (associated infrastructure and third party projects), an increase in public revenues (tax revenues) is also expected, although their level is difficult to determine based on the available information.

The cumulative impacts on employment for Variant 2 - Żarnowiec site, as for Variant 1, is assessed to be significant.

Operational phase

No significant cumulative impacts are forecast during the operational phase for either of the site variants.

Decommissioning phase

During the decommissioning phase of the Project, it is not possible at this time to estimate the cumulative impacts for both site variants, as there is no knowledge about possible investments that would be carried out at the same time. However, this will be the subject to a separate assessment.

VI.4.19.9 Real estate market

Variant 1 – Lubiatowo – Kopalino site

Construction phase

The development stage will be the most intensive period in terms of real estate market changes related to the implementation of the associated infrastructure. The existing building structures will be also demolished at that stage. The key impacts that will occur as a result of the above include, among others lost property that will be a consequence of buyouts and compensation. There will be a change in land use/function and zoning, as well as a change in the nature and potential of the lands adjacent to the NPP and the associated infrastructure. The issue of short-term rentals may arise which will cause cumulative impacts related to residential occupancy (rentals). There may also be a cumulative demand for commercial space. Nuisances (mainly increased road traffic) are anticipated that may be cumulative with NPP construction, and may lead to a temporary decrease in the attractiveness of certain types of property (including in particular residential and tourist), but this will be a short-term cumulative impact.

Operational phase

Development of the communes and the region is projected due to the construction of the NPP, as well as due to the extensive associated infrastructure, which will be a positive and long-term cumulative impact. Such impacts will be felt both in the area of Choczewo commune and in the neighbouring communes. It should be noted, however, that localities such as Ciekocinko, Jackowo or Kurowo (located in zones of improved transport accessibility) could develop their residential and tourist sectors, but at the moment they cannot be absolutely certain to forecast such development. These localities lack primarily land bank reserves, whereas the industrial development, including wind and photovoltaic farms (power plants), has been planned. Meanwhile in the localities of: Biebrowo (the Choczewo commune) and Roszczyce and Białogarda, the development of the settlement network may be limited by the routing of the 400 kV power transmission line.

Decommissioning phase - No significant cumulative impacts are anticipated.

Variant 2 - Żarnowiec site

Construction phase

Under Variant 2, it is forecast that very similar impacts as in Variant 1 will occur in relation to the construction of associated infrastructure, taking into account the differences in location and interaction of the NPP in the Krokowa and Gniewino site communes with the adaptation of the associated infrastructure to this location and the requirements necessary for its implementation.

Operational phase

As in Variant 1, the communes and the region are forecast to develop due to the NPP, as well as due to the extensive associated infrastructure. These impacts will be felt both in the Krokowa and Gniewino communes and in the neighbouring communes. The localities with the highest probability of experiencing such impacts include Bolszewo (the Wejherowo rural commune), Tyłowo (the Krokowa commune) or Rybno (the Gniewino commune). It should be noted, however, that the negative impacts may occur, especially from a broader perspective and following the analysis of multiple factors. For instance, localities such as Dębki, Nadole, Orle and Opalino, which, due to their location in areas of improved transport accessibility could develop their residential and tourist sectors, at this point cannot be assured of such development. First and foremost there is a lack of land reserves here, and in the case of Opalino, there are restrictions on development resulting from the routing of the 400 kV high voltage power transmission line.

Decommissioning phase

No significant cumulative impacts are anticipated.

VI.5 Summary – assessment results and conclusions

VI.5.1 Description of forecasting methods used

Forecasting is a scientific method of prediction that determines the outcomes or conditions of phenomena, processes, or events in the future. Forecasting uses information about so-called external factors, where it is impossible to shape (influence) them, and internal factors, i.e., those that can (to some extent) be changed. Therefore, forecasting is used to study the relations between the above-mentioned factors and the selected process; also the knowledge about their development in the past is used to infer the future. For forecasting purposes, statistical methods and even a still quite unique tool such as Artificial Neural Networks were used, but also the more commonly used Geographic Information System along with dedicated software for collecting, managing and analysing "spatial" data. In cases where the collected data makes it impossible to apply such methods (e.g., due to a limited or non-representative dataset or lack of appropriate "tools", e.g., algorithms, software, etc.), archival data (i.e., the aforementioned "background knowledge") and so-called expert knowledge are used to more precisely extrapolate the results obtained. Due to the use of scientific methods for forecasting, including specialised computer software, the analyses mentioned above are not included in this summary. However, at this point, special attention should be paid to the role of the expert in the prediction process, because even the best performed modelling of physical phenomena still requires interpretation of results and final expert judgement. This role becomes even more important when mathematical analyses could not be harnessed for forecasting purposes.

Forecasting methods have been described in different parts of the EIA Report, often being a part of extensive chapters devoted to the environmental impact assessment methodology, which should be evident, since the foundation of this assessment are the results of the forecasting process.

VI.5.2 Selection of the variant proposed by the Investor, rational variant most favourable for the environment, and rational alternative variant, along with reasoning for their selection

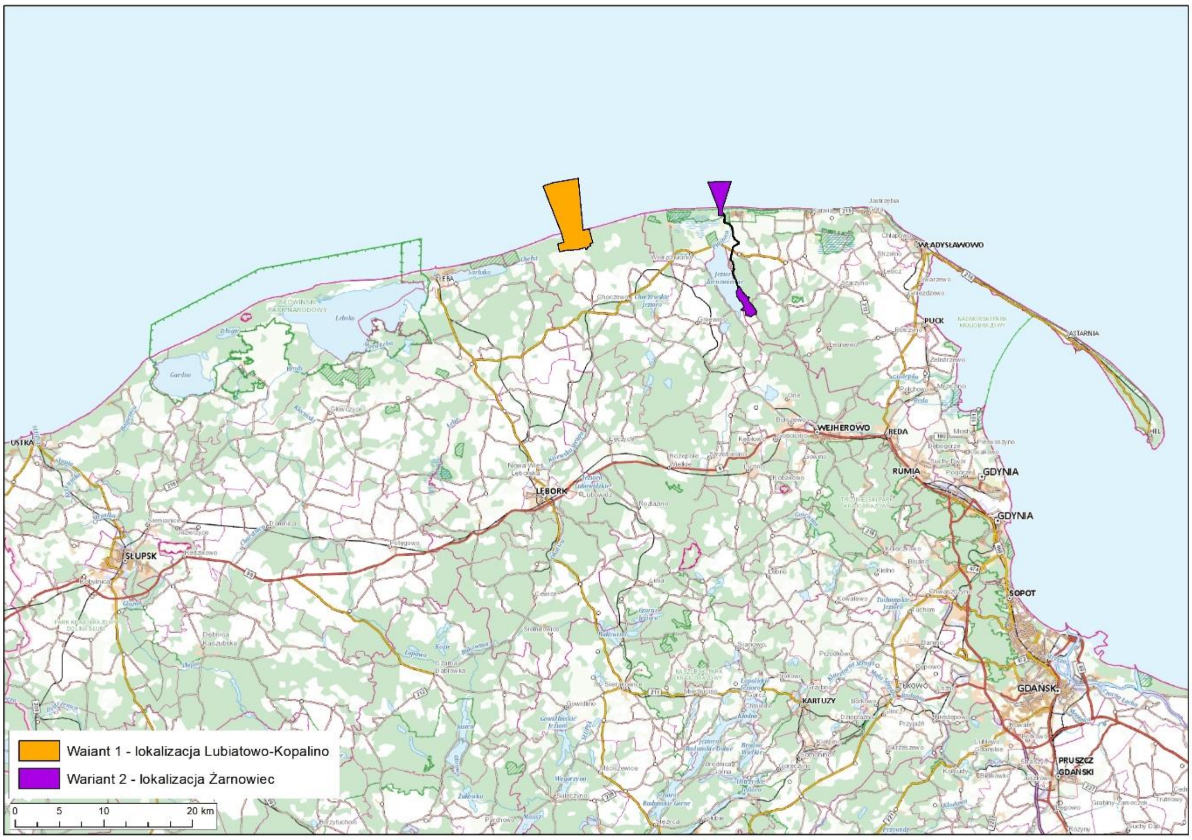
VI.5.2.1 Site selection

The process of selecting the site for a nuclear power plant consists of a number of activities, the "step by step" implementation of which allows for completing the process of selecting the site in a top-down manner. Geographic regions are considered first, followed by location-specific aspects assigned to each site, such as the availability of water sources for the cooling system, distance from high-risk industrial facilities/plants and seismically-prone areas, distance from urban areas and populated areas, access to infrastructure, or other components specific to the site under consideration to prove that the site is safe with regard to the facility operation. The site selection process is, in the first stage of selection, *inter alia*, a quantitative review of potential sites that are subject to an analysis of a set of exclusion criteria.

A detailed site selection methodology was developed in 2011, resulting in the preliminary identification of 92 potential sites. These sites were then screened using a predefined set of exclusion criteria, resulting in the narrowing down of the locations to 13 sites under consideration, which were evaluated using detailed site-specific data. After a detailed evaluation of the 13 sites considered, the coastal sites were finally selected, that is: Gąski, Choczewo and Żarnowiec (which was an area designated for the construction of and NPP in the past; now it is an industrial area in the Pomeranian Special Economic Zone). Unfortunately, the decision on selection of Gąski as the potential site for a nuclear power plant was met with a lack of acceptance from local communities and local authorities, which ultimately led the Investor to abandon this site.

At the turn of 2013/2014, the first phase of environmental and location studies was performed for two potential sites: Żarnowiec and Choczewo, which, however, showed the high environmental value of the Choczewo location. Auxiliary studies carried out on the onset of 2015 revealed the risk of significant impacts on the Natura 2000 site Białogóra PLH220003, which, after additional location analyses, resulted in moving approximately 4.5 km west of the protected area and changing the Choczewo site to Lubiatowo - Kopalino site.

Eventually, pursuant to the Decision of Director General for Environmental Protection on the determination of the scope of the environmental impact report, the site investigation and environmental survey programme launched by the Investor was developed for two site variants, Variant 1 - Lubiatowo - Kopalino, and Variant 2 - Żarnowiec.



Wariant 1 - lokalizacja Lubiatowo - Kopalino	Variant 1 – Lubiatowo - Kopalino site
Wariant 2 - lokalizacja Żarnowiec	Variant 2 — Żarnowiec site

Figure VI.5- 1 Variant 1 – Lubiatowo – Kopalino site and Variant 2 – Żarnowiec site

Source: In-house study

VI.5.2.2 Comparative analysis of site variants and multi-criteria analysis

The selection of the variant proposed by the Investor, rational variant most favourable for the environment, and rational alternative variant presented in this report is a complex assessment process consisting of two separate but interlinked analyses:

- **The site comparative analysis of** both Lubiatowo - Kopalino and Żarnowiec sites, [which] focused on comparing the two sites according to 100 different criteria, including in particular the exclusion criteria, so that a selection of the preferred site could be made in compliance with the requirements presented in the Decision of the General Director for Environmental Protection.
- **The multi-criteria analysis of the sites** along with the sub-variants that can be implemented in each site (three sub-variants under Variant 1 - Lubiatowo - Kopalino site, and two sub-variants under Variant 2 - Żarnowiec site), [which] was aimed at determining the rational most favourable for the environment variant, the variant proposed by the Investor and the rational alternative variant. The multi-criteria

analysis took into account the technical differences between the sub-variant, resulting i.a. from the site conditions, and also considered differences in the environmental and socio-economic impacts resulting from the implementation of each sub-variant at every considered site.

- **The comparative analysis** consists of steps in which the assessment criteria for the individual sites were identified and defined; each of the sites was then assessed against the defined criteria. The adopted criteria and their scoring are based on the international and national guidelines, including the current provisions of the law, taking into account exemplary similar projects. The criteria adopted in site assessment include i.a. exclusion criteria derived directly from the regulation of the Council of Ministers of 10 August 2012 on detailed scope of assessment with regard to land intended for the location of a nuclear facility, cases excluding land to be considered eligible for the location of a nuclear facility and on requirements concerning location report for a nuclear facility, in the case of which failure to meet even a single one would result in a given site being excluded. The final stage of the assessment involved the evaluation of NPP environmental impact in order to identify potential impacts and to apply possible mitigation measures to minimise the environmental impact of the Project for each of the sites under consideration. The result of the comparative analysis was the identification of the preferred site from the perspective of technical aspects.

The multi-criteria analysis takes into account the results of the comparative analysis for the sites under consideration with their five sub-variants:

Variant 1 — Lubiatowo - Kopalino Site:

- Sub-variant 1A – open cooling system (direct cooling with seawater);
- Sub-variant 1B – closed cooling system – cooling with the use of evaporative cooling towers with natural draught, operating on seawater;
- Sub-variant 1C – closed cooling system – cooling with the use of evaporative cooling towers with natural draught, operating on fresh water (desalinated seawater);

Variant 2 — Żarnowiec Site

- Sub-variant 2A – cooling with the use of evaporative cooling towers with natural draught, operating on seawater;
- Sub-variant 2B – closed cooling system – cooling with the use of evaporative cooling towers with natural draught, operating on fresh water (desalinated seawater);

The multi-criteria analysis identifies and defines evaluation criteria used to examine a certain site, taking into account the sub-variants under consideration. Each sub-variant was then assessed against a set of specific criteria. The importance of each criterion was determined using an Analytical Hierarchy Process (AHP). DecisionVue, a specialist tool designed for this purpose, was used to perform the analysis. Both the weights and the scoring were subjected to an extended sensitivity analysis and validation with the use of the DecisionVue tool. The outcome of the multi-criteria analysis is a site ranking with sub-variants and the designation of the variant proposed by the Applicant, the rational alternative, and a rational variant most favourable for the environment.

VI.5.2.3 Indication of the variant proposed by the Investor, rational variant most favourable for the environment, and rational alternative variant

Once the comparative and multi-criteria analyses have been carried out, it turned out that Sub-variants 1A and 1B were ranked the highest. The analyses showed that Sub-variants 2A, 1C and 2B are feasible, but based on the criteria used in these analyses their performance is inferior compared to Sub-variants 1A and 1B. The Sub-variant 1B was ranked the highest when considering environmental criteria only, and the Sub-variant 1A came in the second place. On the other hand, when environmental and financial aspects are taken into account simultaneously, it appears that the best Sub-variant is 1A, with Sub-variant 1B classified in the second place.

The sensitivity analysis carried out showed that the Sub-variant 1A's performance is the best with respect to a number of core criteria also concerning environmental aspects, which, however, received relatively low weights based on the expert panel's opinion. However, these criteria are linked to some of the most obvious Project environmental impacts (e.g. impacts on the landscape, traffic during the construction stage and impacts on the acoustic environment). Consequently if society considered the criteria that received relatively low weights, to be more significant, Sub-variant 1A would be more advantageous than Sub-variant of 1B, also in environmental terms.

Sensitivity analysis also indicated that the financial assessments of sub-variants largely depend on the main criteria related to the net electricity generation and the availability coefficient of the nuclear power plant, while reducing the weight of any of these criteria would result in reducing the difference between the scoring of sub-variant 1A and that of the other sub-variants.

The results of the analyses clearly point to the fact that an open or closed cooling variant using sea water works far more effectively than the closed cooling system using desalinated sea water, irrespective of the site of the Project. This is connected significantly with the energy intensity of large desalination plants, which reduces the net electricity output and increases operating costs.

Based on the results of the comparative and multi-criteria analyses, it can be concluded that:

- The Investor proposed to implement Variant 1 - **Lubiatowo - Kopalino site, Sub-variant 1A** - this is the Sub-variant, which received the highest scores while taking into account environmental aspects along with the remaining criteria;
- The rational, most environmentally-friendly option is Variant 1 - **Lubiatowo - Kopalino site**, Sub-variant **1B** - this sub-option received better or the same scores as Sub-variant 1A; however the difference between Sub-variants 1B and 1A is small and both Sub-variants have a comparable environmental impact;
- The rational alternative is Variant 1 - **Lubiatowo - Kopalino site**, Sub-variant **1B** - this option was selected due to its lower environmental impact, based on the outcome of the multi-criteria analysis, than the other Sub-variants, i.e. 1C, 2A and 2B.

VI.5.3 Description of anticipated minimising measures (avoidance, prevention, reduction or compensation)

VI.5.3.1 Minimising measures

Natural environment

With regard to the natural environment, the components of the natural environment considered included: macroscopic fungi, lichens, bryophytes, vascular plants, natural habitats, terrestrial and freshwater invertebrates, ichthyofauna, herpetofauna, i.e. amphibians and reptiles, avifauna, chiropterofauna and other species of mammals for which the risk of significant impacts related to the implementation of the Project was identified. They are divided into the following categories:

- species for which there is no need for mitigation activities,
- species to which mitigation activities cannot be applied,
- species for which mitigation activities are possible and justified,

and the list of guidelines was developed for the third of the above-mentioned categories, i.e. species for which mitigation activities were found to possible and justified.

The basis for subsuming the discussed components of the natural environment in one of the above categories included:

- the range of occurrence at the national and regional level, frequency of occurrence and territorial coverage,
- degree of hazard and protection categories (species subject to strict and partial protection).

Measures to minimise negative environmental impacts have been developed for each Project phase and stage.

Measures to minimise the Project's impacts that have been taken into account include: artificial relocation of plants from a natural site to another newly established site in free nature environment, relocation to non-endangered sites, monitoring, carrying out works outside the period of activity and creating ecological niches, leaving ecological corridors (e.g. in the form of a tree belt for bats), limiting the use of light to the minimum necessary and limiting the use of UV-emitting light, keeping the canals clear (particularly important for migratory fish), using restraining bands and anthropogenic traps (which will be controlled by qualified personnel) and hanging nesting boxes for birds.

Depending on the species of plants and animals, an appropriate method of counteracting the Project's environmental impact will be selected.

Steps will also be taken to reduce noise particularly generated by piling activities. Impact mitigation activities can be divided into activities taken before piling and during piling works. Examples of such activities that will be taken prior to the commencement of works include: selecting an appropriate method and establishing procedures in the event that marine animals and fish invade the construction area, such as sound deterrence. During piling works, measures such as observation (on which the commencement and continuation of work will depend), soft start, and deterrent devices, *inter alia*, will be undertaken.

The following minimising measures will be applied during operation: ensuring the patency of the channels; deterring fish from the intake; the use of grids and screens in the water intake; a fish recovery and return system; minimising impacts of artificial lighting; appropriate delineation of fairways for vessels so as to cause the least possible disturbance to the littoral zone; cooperation with representatives of the fisheries sector and keeping them informed of ongoing work, including monitoring the impact of increased maritime traffic; co-financing of restocking within the framework of environmental damage caused by the construction of the NPP.

Geology and hydrogeology

All earthworks and construction works will be carried out in compliance with the applicable standards, recommendations and legal regulations. The Project will be carried out in such a manner as to minimise the transformation of the topographical relief and restore them to the largest possible extent. Mitigation activities will be carried out to minimise land drainage, to adapt the discharge to the characteristics of the receiving body of water and to minimise the extent of earthworks, to optimise the use of excavated soil and to manage the emergencies appropriately and in line with established procedures.

Soils and ground surface

Protection of the soil and ground surface involves primarily its rational management and prevention of its contamination. An example of mitigation activity is keeping the construction site area to a minimum, securing the ground surface at heavy equipment parking zones, proper handling of machinery, as well as neutralising any spills and preserving and maintaining biologically active soil areas.

Inland surface waters

Examples of measures taken to protect inland waters would include: installing an adequate drainage system, arranging for immediate troubleshooting of the site's wastewater discharge systems, and, for instance, performing separator and coagulation (sedimentation) waste collection at an appropriate frequency. Additionally the requirements of the law will be complied with, including in particular the requirements of the Regulation of 12 July 2019 of the Minister of Marine Economy and Inland Navigation on substances particularly harmful to the aquatic environment and the conditions to be met when introducing wastewater into water or soil.

Marine surface waters

The assessment of the impact of the planned Project on marine surface water shows that most of the activities during the construction and operational phases of the Project will not have a negative impact on marine hydrodynamics and geomorphology, seawater quality or biology. However, for some activities in the operational phase, it will be necessary to apply minimisation activities that will avoid significant negative impacts on the environment. The minimising measures will include:

- accurate dosing of chemicals thanks to modern concentrations measurement methods,
- neutralisation of harmful substances,
- reduction of chemicals' volume by using other methods (e.g. in the case of components on which a layer of microorganisms may form on the surface, appropriate paints or mechanical cleaning can be used),
- wastewater quality control and pretreatment prior to discharge,
- Proper distribution of post-cooling water to minimise thermal impact.

Ambient air quality

Mitigation measures applied to air protection will mainly involve the use of equipment that complies with emission standards, the use of appropriate low sulphur content fuel under the legal regulations in force and taking care of the technical condition of vehicles, the use and proper control of dust removal efficiency in cement unloading installations, and the protection of banks and embankments against erosion. In addition, tire washing stations will be prepared and mechanical cleaning of roads around the construction site will be applied, as well as periodic measurement of exhaust gases at the boiler room and [emergency] power generators.

Acoustic environment

The following measures will be taken to reduce noise generated by the Project:

- an adequate work scheduling, thus limiting night work to a minimum, as absolutely necessary, and scheduling work in such a way as to avoid overlapping of the most onerous works,
- the use of machinery only in good working order and the proper management and control of construction equipment, as well as ongoing monitoring of their technical condition,
- proper planning/arrangement of the construction site,
- the use of sound-absorbing enclosures and noise barriers where necessary.

The protection of the marine acoustic environment has already been described when writing about the impact on natural environment.

Vibrations

Piling activities will represent a significant source of vibration. Their impact will be minimised by an appropriate selection of method depending on ground conditions.

In the case of rotating equipment, vibrations will be minimised by appropriate design solutions related to the setting of the machinery and ensuring their good technical condition.

Other on-site activities, due to the distance from other buildings, do not represent any hazard.

Waste management

Minimising measures for conventional waste will take place through proper waste management (e.g., waste minimisation or proper storage). Waste collection will be carried out by specialised operators to ensure proper disposal and storage.

In the case of radioactive waste, the minimising measures will consist of minimising the quantity, proper segregation, volume reduction, and solidifying and packaging radioactive waste so that they are chemically and physically stable. These actions will follow the optimisation principle, the ALARA principle, and using the best available techniques (BAT).

Waste storage will take place in areas with the right geological structure and with all possible technologies and barriers that effectively isolate the waste from the environment.

Monuments, archaeological sites, ship wrecks

The construction activities that will take place in close proximity to historic sites will be carried out without the use of heavy equipment whenever possible. If this is not possible, vibration impact studies will be carried out and, if necessary, measures will be taken to minimise the impact, e.g. isolation mats will be used.

If works are carried out in the area of historical monuments (at the risk of their damage), an application will be filed with the Pomorskie Voivodeship Conservator in Gdańsk for issuing conservation guidelines. In case of discovering new monuments during construction works, the appropriate authority will be notified and rescue actions will be taken to protect them.

In the case of shipwrecks, protection will be based on the routing of the watercraft so that they avoid the shipwreck site.

Landscape

Minimising the impact of the project on the landscape will consist of: analysis of building layout, restoration of vegetation where possible and planting in places where vegetation can effectively obscure the Project Area.

Human health and life

Issues related to protection of human health and life are related both to protection against operational impact such as emission of radioactive substances, and those related to the Project's physical execution and its impact on the quality of life.

The impact of radioactive substances and ionising radiation on human life will be limited to a level as low as reasonably achievable (ALARA), taking into account economic, social and health factors by implementing the principle of optimisation, which is commonly referred to in the world as the ALARA principle or the ALARP (as low as reasonably practicable) principle. In addition, radiation monitoring will be applied both on the NPP site and in the surrounding area.

In order to ensure the quality of life of the local community at an appropriate level, a stakeholder outreach plan will be developed to increase their involvement in each phase of implementation and to improve the flow of information related to the implementation of the Project. In addition, efforts will be made to monitor public opinion regarding the Project, including the opportunity to file comments and lodge complaints. Solutions will be employed to mitigate any transitional nuisance or damage, including financial compensation for impacts associated with physical implementation.

Discussions will be undertaken with local authorities regarding access to alternative recreational areas. Efforts will be taken to improve and expand local cycling paths and traffic routes, and measures will be taken to ensure traffic safety.

Health, Safety and Environmental plan (BIOZ plan) will be implemented to protect the health of the workers. The workers will have access to medical care, and radiological protection standards will be in place during the commissioning and operational phases.

Dedicated occupational medicine service and other medical services can also be provided in the analysed area, as well as at the employee accommodation facility (associated infrastructure), in which a medical centre will also be set up to reduce the demand for healthcare services provided to the general local community.

VI.5.4 Possible transboundary environmental impacts

Transboundary impact means any NPP impact exerted directly on the areas outside the borders of Poland. Given the location of the two NPP sites at a considerable distance from potentially affected countries (more than 100 km to the nearest Russia - Kaliningrad Oblast), conventional nuclear power plant impacts, such as noise, are not considered. The only type of transboundary impact considered is a radiation impact associated with an accident representative of emergency planning. When analysing such impact, the countries directly bordering Poland, the countries of the Baltic Sea basin, and countries not adjacent to Poland, which applied for or were recognised by the General Directorate for Environmental Protection as countries having an Affected Party status, were taken into account.

The calculations made consisted in determining meteorological sequences that would cause the passage of a contaminated cloud from the NPP to the considered receptor (borders of the considered country) in the shortest possible time. Based on the determined sequence, meteorological data sets were prepared and simulations were performed on the dispersion of radioactive substances in the atmosphere. The results obtained were then used to calculate the amount of doses received via indigestion. In this way, doses were determined taking into account all pathways of exposure.

The resulting doses included effective doses: 2-day, 7-day, annual, and lifetime as well as analogous doses absorbed by the thyroid gland. The above doses were determined separately for adults and children.

The determined maximum dose values for neighbouring countries are at least an order of magnitude lower (the highest determined value was 2.43E-5 mSv/h and concerned the border with Germany) than the average radiation background in Poland (2.74E-4 mSv/h). For the maximum doses from external exposure, the highest dose determined (2.89E-4 mSv for the border with Slovakia and Germany) is 4 orders orders of magnitude lower than the annual dose from natural background radiation in Poland (2.4 mSv/year).

This means that a severe accident representative for emergency planning will not pose any risk to human health in areas remote from the site, particularly in countries directly bordering Poland, **and that the transboundary impact of the Polish nuclear power plant will be entirely insignificant.**

VI.5.4.1 Compensation

No need to provide compensation to protect the natural environment has been identified. The mitigation measures presented above for biotic environmental components are considered sufficient to minimise any potential significant and negative impacts on the biotic environment as a result of Project implementation.

Some cases of exceeding air quality standards were observed in the Pomorskie voivodeship zone. The Project Area is outside the area where standard permissible levels are exceeded. To sum up, <u>the planned Project in Lubiatowo - Kopalino site, under Sub-variant 1A, will not require any emission compensation procedures.</u> However, due to the changing climate and emission conditions and annual assessments of the levels of substances in the air conducted by the Chief Inspectorate for Environmental Protection, during the implementation process, it is necessary to follow the results of the above-mentioned assessments in terms of possible changes in the classification of zones, in particular with respect to particulate matter PM2.5 and nitrogen dioxide.

VI.5.5 Analysis of potential social conflicts

Each large infrastructure investment project, and in particular the preparation of an investment project such as the construction of a nuclear power plant, generates conflicts already at the initial stage of planning, and in particular at the stage of selecting potential sites. A project of such scale interferes with the social, economic, and environmental spheres both on the site in question and, because of the scale of the investment, including related associated infrastructure/investments, throughout the region. Most often, the site selection generates a conflict between the Investor and a part of local community from the group remaining in the Project's zone of impact. Non-governmental organisations (NGOs) that oppose the use of nuclear power as a source of electric energy generation, both nationally and internationally, are also a party to the conflict.

For years, both the government and the Investor have engaged in extensively planned information and educational activities at all communication levels (local, regional, and national), and at the local and regional level - in systematic information and consultation activities aimed at minimising social conflicts. The projects discussed here focused on running information and education campaigns, including raising awareness of nuclear energy and nuclear power plant operation in the public space, and its coexistence in both social and economic environments, at the local and regional levels. These activities include study visits to operational nuclear facilities and meetings with representatives of the authorities and local community living in the areas where the NPPs operate. The representatives of the general public were also introduced to the entities and institutions that in the near future would be involved in the investment process, and legal aspects related to the development and operation of a nuclear power plant were discussed. The scope of the Project was presented, as well as the scope of associated infrastructure/investments necessary for the proper execution and operation of the nuclear facility. The benefits to the region resulting from a project of such scale and scope were also discussed. The principles of education and training of personnel for institutions related to nuclear energy and the degree of involvement of domestic industry in the project were explained.

Since 2011, nationwide and local opinion polls have been carried out. Due to the division of responsibilities for information and education activities, the Ministry competent for energy (currently - 2021 - Ministry of Climate and Environment, Department of Nuclear Energy) monitors public attitude towards NPP at national level, whereas the Investor - at local level (site Communes). In both cases, 10 editions of social surveys have been carried out so far. The results indicate an invariably high level of support for nuclear energy development. As many as 62.5% of Poles support the construction of nuclear power plants in Poland, according to a survey commissioned by the Ministry of Climate and Environment in November 2020. This is the best result in the history of nationwide surveys carried out by the Department of Nuclear Energy. A public opinion poll carried out in November 2019 among residents of the site Communes (commissioned by the Investor) also confirmed that the vast majority of the local community members supports the construction of a nuclear power plant near their place of residence (67%).

From the very beginning, the Investor's objective has been to obtain and maintain a high level of support for the Project through direct dialogue with the residents of the site communes. The dialogue was initiated just after the list of potential nuclear power plant locations was announced, therefore the Company has been actively participating in events and projects important for the local community for many years (i.e.: Commune Days, Harvest Festival, Children's Day, festivals and other cultural or sports events). The Company's experts have repeatedly participated in communication meetings regarding the presentation of Project successive stages.

In 2013 the Investor launched three Local Information Points, where the residents, tourists and all interested persons can obtain necessary information about nuclear power and the Project. The Investor also has also run educational and informational activities, some of which have been held in information and consultation meeting format, (moderated, open meetings for the Choczewo commune population, i.e.: Variant 1 - Lubiatowo - Kopalino site, and Gniewino and Krokowa, i.e.: Variant 2 - Żarnowiec site), and some in the form of workshops for local opinion leaders and exhibitions for residents, dedicated to site investigation and environmental assessment.

Along with the implementation of successive activities as part of the Project development, social needs, which are regularly monitored by the Investor, have changed. Initially, they focused on gaining and extending knowledge about nuclear power and the rules governing the operation of nuclear power plants, then they evolved towards obtaining practical information about the preparations for the Project implementation, to focus in the next stage on the topic of the construction and operation of the planned NPP and its impact on the everyday life of the residents. Detailed information regarding the education and information activities organised by the Company, as well as the latest news concerning the nuclear sector from Poland and the world, can be found on the Company’s website www.swiadomieoatomie.pl.

The inhabitants of the site communes also expect that the Investor should be involved in the life of their community and participate in their initiatives. The answer to such needs is the Support Programme for the Development of Site Communes, launched in 2015. The programme results from the “Agreement on Cooperation and Development” concluded in January 2014 with the Choczewo, Krokowa and Gniewino communes and the Local Government of the Pomorskie Voivodeship. The purpose of the programme is to strengthen the partnership between the Investor and the local community and authorities of the site communes by providing financial support to initiatives relevant for the residents and for regional development. In the course of the Program's operation, a number of investment projects key to the local population of individual villages were implemented, including but not limited to: redevelopment of road sections and pedestrian pathways, sewer infrastructure, playgrounds and small sports facilities, additional equipment for schools and fire stations, as well as funding for English language classes for children and many other initiatives requested by the representatives of the site Communes.

Pursuant to the requirement of Art. 66 par. 1, subpar. 15 of the Environmental Impact Assessment Act, as part of the environmental impact assessment, the analysis of possible social conflicts associated with the planned Project was carried out.

Possible social conflicts will stem from both the scope of the impacts identified, and from the context in which the impacts are seen by the society. A source of conflict may be both a divergence of goals and interests of the parties. Considering the nature of the Project, the social conflict will be predominantly a conflict of data and a conflict of values. Data conflicts may arise when the Parties have different information at hand, or they interpret it differently. This may lead to the situation where the Parties would question the reliability of the data or their importance. In view of this, it will be crucial to distinguish between facts and interpretations. When it comes to the conflict of values, the differences will mainly stem from the systemic approach of the opponents of NPP construction to nuclear power, in which this form of energy is perceived as a critical threat for the environment on the local, regional, and global scale. This results from a different perception of the risk associated with the operation of the NPP and is, in this case, mainly caused by the socio-cultural context.

The surveys carried out and the work of experts, including international experts, allowed to draw up a list of potential sources of social conflicts. The analysis indicates that there is potential for public conflict in virtually every aspect of NPP implementation, whether it be the issue of use of nuclear power as a safe source of electricity, the scale of the investment, and the resulting impact on the social and natural environment. Environment-friendly attitudes, observation of practices in other countries, as well as personal attitudes and assessment of the energy policy pursued in Poland against the background of global trends are also important.

From the perspective of nuclear power plant safety, radioactive emissions and ionising radiation protection, a source of conflict may be the potential feeling of insecurity associated with NPP operation in close vicinity. Concerns about long-term residence in the vicinity of a nuclear plant will be bred by the fear of possible health effects, including cancer risk in humans and animals, as well as contamination of agricultural crops in the nearby fields. Insecurity will also be likely to arise from issues related to radioactive waste generated by NPP operations, as well as its storage on the NPP site and off-site transportation. Potential conflict may also be rooted in an ethical belief, i.e. the claim that no community, whether living now or living in the future, should be exposed to the risks associated with storage/disposal of nuclear waste. The above aspects were discussed during information meetings arranged by the Investor and described in educational and information materials, articles in local press, thematic conferences, study tours and visits to scientific centres.

The impact of the NPP construction and operation on the Baltic Sea may be a potential source of conflict, which can be viewed in terms of the divergence of objectives and interests of the parties in both environmental and economic and tourism uses of this part of the coastline. A likely source of conflict will be the loss of some of the landscape values and violation of the natural integrity of the area, and most importantly impact of the NPP on protected sites and qualified features, and changes in their functioning resulting from the impact of construction and operational activities. First of all, it concerns the issue of possible impact of the nuclear power plant on residence and migration of sea birds and qualified features, including Natura 2000 site, as well as integrity of environmentally valuable areas, including coastal ecological corridor as a result of e.g. planned deforestation.

Another conflict-breeding factor may be the uncertainty associated with maintaining the well-being of people and their daily lives in social, material and cultural terms, as well as differences in the Investor's assessment of the impact of the NPP construction and operation on the local community, economy and health. They will also result from the divergence of objectives and interests of the parties with respect to the intentions to manage and develop tourism, agriculture, forestry, fisheries or other economic activities.

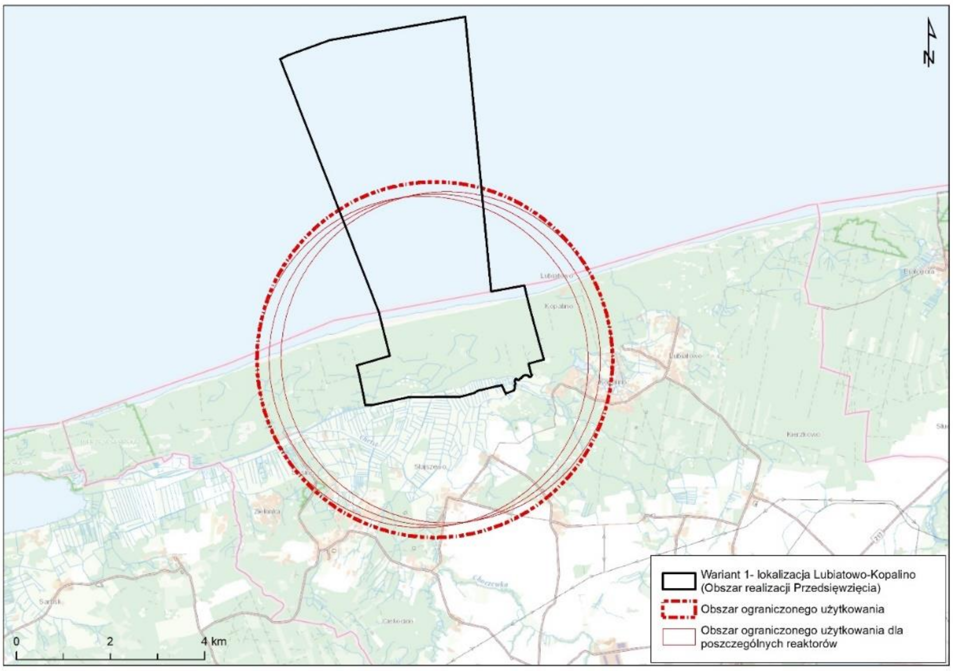
The conducted analysis in the scope of possible social conflicts represents a basis both for planning management activities, including selection of the site and technology for the implementation of the Project, as well as for countermeasures, including the implementation of informational and educational activities, the aim of which will be to mitigate the level of potential social conflict. Their fundamental premise is:

- maintaining a high level of transparency of the Investor's objectives and activities;
- maintaining a high level of awareness of nuclear energy and the investment project by the general public;
- Holding a constructive dialogue between the parties, with the aim to limit to the largest possible extent, using best available technology, the social (including socio-economic) and environmental impact of the NPP construction, operation and decommissioning activities;
- analysis of the needs and expectations of the local community in order to maximise the benefits associated with residing in the vicinity of a nuclear power plant.

The implementation of the above assumptions/premises, serves to maintain the main objective, i.e. to obtain and maintain social approval for the construction of a NPP in Poland, in the location indicated by the Investor. Therefore, the list of actions presented is not a closed catalogue.

VI.5.6 Indication whether it is necessary to establish a Restricted Use Area for the planned Project

The requirements for designating a Restricted Use Area (RUA) around a nuclear facility are contained in the Atomic Law Act of 29 November 2000. The implications of these requirements are respectively (on a conservative interpretation): to take into account internal exposure through digestive system in determining the annual dose (maximum of 0.3 mSv in operational states and 10 mSv in case of accident without core melt) and to include the most unfavourable meteorological conditions. Applying the above-mentioned criteria the Restricted Use Area (RUA) for Variant 1 - Lubiatowo - Kopalino site was determined, which should be 3 781 m and is presented in the figure below [Figure VI.5.6- 1]. This distance is calculated from the geometric centre of the line connecting the reactors, and takes into account the results of release analyses from each of the 3 reactors separately.



Wariant 1- lokalizacja Lubiatowo - Kopalino (Obszar realizacji Przedsięwzięcia)	Variant 1 – Lubiatowo - Kopalino site (Project Area)
Obszar ograniczonego użytkowania	Restricted use area
Obszar ograniczonego użytkowania dla poszczególnych reaktorów	Restricted use area for individual reactors

Figure VI.5.6- 1 Restricted Use Area for Variant 1 - Lubiatowo - Kopalino site

Source: In-house study

The RUA boundaries will be redefined for the purposes of the Preliminary Safety Report (PSR) and will be performed for the selected NPP design in compliance with the legal regulations in force at that time.

VI.5.7 Proposed scope of monitoring for individual components of the environment

This chapter presents a proposal for the scope of monitoring of biotic and abiotic components of the environment for the purpose of ongoing monitoring of potential changes that may occur within the Project zone of impact for Variant 1 - The Lubiatowo - Kopalino, Site implemented under Sub-variant 1A - open cooling system using sea water.

VI.5.7.1 Natural environment

In order to achieve effective nature conservation, it is necessary to have information on its condition, transformation directions and dynamics. The scope of monitoring includes assessment of the condition of nature components, dynamics occurring in the area under study.

- The scope of monitoring will concern mainly Natura 2000 natural components as well as other forms of protection, including species protection, or rare and endangered species on the national and regional scale.

The marine monitoring area will function on the basis of the same principles as the land monitoring area. A key factor, in addition to biotic elements, represented primarily by animal organisms, will be the observation of some parameters of non-living environmental components having a significant impact on fauna. These undoubtedly include changes in thermal properties and oxygenation levels of waters. The selection of monitoring plots, as well as the detailed monitoring area and its scope, will be prepared within the framework of the nature supervision and submitted for information to the competent authority in charge of nature protection, before the development stage begins.

In parallel additional monitoring activities will be carried out in the reference area. The area in question is delimited between 209 and 214 km of the coastline. The reference area is 5 km wide, 8.5 km long (into the sea) and has an area of approximately 4310 ha, which is approximately one-fifth of the assumed survey area under Variant 1. Final confirmation of the selection of the reference area will only be possible at the stage of development of the building permit design and before the start date of development stage.

The nature monitoring will be carried out before the start of construction works and for a period of 5 years from the completion of construction works, i.e. in the operational phase of the Project.

VI.5.7.2 Geology

Geotechnical monitoring will be carried out from the moment of site selection, through the construction and operational phases, until the completion of the nuclear facility decommissioning phase.

In the construction stage, the stability of excavation walls and its bottom will be controlled, as well as the impact of construction works on neighbouring building structures; also the correctness of design solutions with reference to actual ground conditions will be verified. It will also be necessary to monitor groundwater levels along with their fluctuations. The above works will be carried out under the supervision of a qualified geologist or geotechnical engineer.

The number, type and frequency of planned geotechnical monitoring surveys will be specified in the geotechnical design. The monitoring programme will be updated periodically after the analysis of the collected measurement data.

The seismic monitoring network (e.g. number of stations, station locations, types of measuring devices - seismometers, accelerometers) will be adapted to the nuclear power plant site conditions and its surroundings, taking into account the results of seismic hazard analysis and fault activity. The designed and installed seismic monitoring network will be modified on an ongoing basis during subsequent Project phases/stages, so that it is tailored to match current needs.

A seismic monitoring network will be in place during each Project phase. Monitoring and its results are essential for safeguarding nuclear safety and radiological protection, both during site assessment and during the construction phase, but most importantly during the Project operational and decommissioning phases.

VI.5.7.3 Soils and ground surface

Protection of the soil and ground surface involves primarily its rational management and prevention of contamination.

Prior to commencement of the development stage, a so-called raw state assessment will be carried out in order to verify that the soil and ground quality have not changed. It is also assumed that an assessment of land surface contamination will be carried out in the previously non-surveyed parts within the Project Area.

Systematic studies of soils potentially exposed to contamination will be carried out, especially in the vicinity of communication pathways, hazardous waste storage yards and other potential contamination sources. The type of parameters determined will be matched to potential contaminants. A detailed description of the monitoring activities will be determined at the building permit design [preparation] stage.

Monitoring will be carried out throughout the entire construction phase and will be continued during the operational phase, with the extent of monitoring modified according to the Project phase.

VI.5.7.4 Groundwater

Groundwater monitoring will be carried out during the construction phase as well as during the operational phase of the nuclear facility. Locations of monitoring points will be adapted to the location of the facility and expected scenarios of release of pollutants (radionuclides), frequency of sampling has to correspond to velocities of groundwater flows and types of likely hazards, and the scope of analyses should address the nature of the nuclear facility and likely isotopes or compounds likely to be released to environment as a result of an incident.

During the construction phase, monitoring of groundwater fluctuations and quality will be carried out in observation wells in the immediate vicinity of the Project Area; the monitoring will comprise in particular the wells capturing the first (QI) and second (QII) aquifers.

Additionally, observation wells will be bored in close proximity to the protected areas and water-dependent environments.

Upon completion of construction of all nuclear units and other nuclear island facilities, the monitoring network of existing piezometers around the NPP site will be supplemented through boring additional observation wells.

Monitoring of groundwater fluctuations and quality will be performed at selected measurement points during the operational phase. Physiochemical measurements will be reduced to the minimum, but isotopes such as Kr-85, Tritium, C-14, Sr-90, and Cs-137 will be included in the study.

VI.5.7.5 Surface water

In connection with the discharge of rainwater or snowmelt, as well as water discharged from construction excavations into inland waters, the scope of monitoring, the minimum frequency of sampling, the reference methods of analysis and the method of assessing whether water discharged into surface waters or water facilities will comply with the requirements under the legal regulations in force.

Water monitoring (measuring nozzles) will be fitted at the outlet of the water device discharging rainwater to inland waters. In addition, hydrometric measurements will be taken of the watercourses (measuring water levels, intensity and flow) into which the discharge will take place.

Sea waters monitoring can be divided into monitoring of physiochemical elements, monitoring of hydrological parameters, and geomorphological and beach change. Measurements will be taken in compliance with legal requirements and their scope will be adapted to the Project Sub-variant.

Monitoring will be carried out throughout the entire construction phase and will be continued during the operational phase, with the extent of monitoring modified according to the Project phase.

VI.5.7.6 Climate

In accordance with the recommendations of the International Atomic Energy Agency, continuous weather monitoring will be performed throughout the nuclear power plant life cycle. The scope of the monitoring will include standard and enhanced weather measurements that will provide full and complete information on current weather conditions on site, as well as provide information necessary for modelling atmospheric dispersion and variability in climatic conditions.

VI.5.7.7 Ambient air quality

As part of air quality monitoring, measurements of emissions and immissions of pollutants (non-radioactive) into the air are proposed during Project implementation.

Under the scenario of emission measurements, the scope, frequency and reference measurement methodologies for fuel combustion sources will be adapted to the relevant regulations in effect on the date of commissioning these sources. It is assumed that the measuring range will comprise substances such as particulate matter, SO_2, NO_x, CO, CO_2.

Emissions will be measured once a year due to the operating period not longer than 6 months. Only in the case of boilers may there be a need of measurements twice a year in the construction phase.

Project construction and operation may cause significant changes in the immission structure (air pollution status in the vicinity of the site). On the basis of the analyses carried out at this stage, it appears that at least the following substances should be covered by monitoring: particulate matter PM2,5 and PM10 and nitrogen oxides. It is advisable to situate a minimum of two measurement points for the selected site variant: one in the vicinity of the Project and the other - within the locality where the workforce accommodation base will be primarily located. At the same time, air quality monitoring within the Project Area will also be carried out during the construction phase. The measurement, in addition to examining the content of pollutants, will be aimed at identifying the directions and sources of dust, as well as assessing the effectiveness of measures to minimise emissions into the air.

VI.5.7.8 Ionising radiation

Radiation monitoring, which is the continuous measurement of dose strengths or ionising radiation doses and concentrations of selected radioactive substances, is a routine activity at every nuclear power plant. Depending on its location, the radiation monitoring will comprise:

- monitoring the NPP premises:
  - source monitoring (measurements of gaseous, aerosol, or liquid emissions/discharges of radioactive substances into the environment),
  - radiation monitoring of the environment at the power plant (within the boundaries of the facilities and the power plant premises),
  - monitoring of individual exposure of workers to ionising radiation,
- environmental monitoring in the power plant surroundings:
  - pre-operational monitoring to establish a baseline,
  - operational monitoring (testing of soil, water, air and plant and animal product samples),
  - external radiation measurements,
  - monitoring of selected population representatives.

Based on the draft regulation of the Council of Ministers on the scope of the environmental radiation monitoring program, which is to implement the requirements of Council Directive 201/59/EURATOM, it is possible to define the general scope and requirements for radiation monitoring, both at a nuclear facility and in its surroundings.

It should be mentioned that radiation monitoring in the vicinity of a nuclear power plant is specific depending on the distance from the facility boundary and the zone in which the intake point is located. Therefore, in the draft of the above-mentioned regulation one can find detailed instructions for radiation monitoring with a breakdown into emergency planning zones (internal and external) and extended planning distance. However, as the aforementioned regulation has not yet entered into force, these details will not be described here.

VI.5.7.9 Acoustic environment

Conducted acoustic calculations for the construction phase for the different types of works associated with the construction activities showed the possibility of exceeding acceptable noise levels.

The purpose of noise monitoring would be to verify the calculated analyses performed, to confirm the correct implementation of the mitigation measures, and to monitor compliance with the permissible noise levels in the environment. The measurement results obtained, in case it is shown that further corrective actions are necessary, would allow for appropriate selection of additional technical or organisational solutions. It is assumed that control measurements will be repeated after any additional corrective measures have been implemented to confirm their effectiveness.

The calculations show that the sensitive area is the northern part of developed areas in the locality of Słajszewo, especially when night-time works such as concreting of foundations are performed.

In addition, it is assumed that noise monitoring will also be performed in the marine part of the Project and that monitoring will be part of the procedure to minimise the risk of injury or death to marine mammals.

The acoustic calculations made for the Project operational phase showed a risk of exceeding the permissible noise levels. The analysis of the scale and extent of acoustic impact allowed for the identification of areas requiring additional mitigation measures. Environmental noise control measurements will be taken for these areas to confirm the effectiveness of the proposed mitigation measures.

The post-completion analysis is proposed to be performed 1 year after the transfer for use of all 3 planned nuclear units. It is recommended to perform noise monitoring measurements in the northern part of developed and requiring noise-protection areas of Słajszewo between 4 and 11 years from the beginning of the Project, and one year after the start of operation of the first unit, and one year after the start of operation of the third unit of the NPP.

VI.5.7.10 Vibrations

According to the requirements, the influence of vibrations transmitted through the ground onto buildings can be ignored if the amplitude of acceleration of the horizontal ground vibrations in the place where the building is set, is lower or equal to $0.05 ms^{-2}$, and the building is situated at a distance greater than 20 m from the source of vibrations caused by construction works or at a distance greater than 60 m from the route of vibrating road rollers. Given the above conditions, no vibration minimising measures, nor vibration monitoring activities are suggested.

The decision to monitor vibrations may be taken during Project implementation when its negative impact on buildings, including architectural heritage, and people has been confirmed.

VI.5.7.11 Waste management

Management of on-site conventional waste will be governed by the Waste Management Plan. The waste generated will be monitored regardless of where it is generated. The monitoring activities will aim at the proper handling of waste, e.g. waste segregation, waste storage, waste treatment and its final management.

It is assumed that hazardous waste will be generated in the construction phase, so this information will be included in the "Safe Work Method Statement". The location of the on-site laboratory will support monitoring of waste and hazardous substances.

Monitoring of conventional waste management during the operational phase will include keeping records of the types and quantities of waste produced of particular types and the methods of handling waste using the Products and Packaging Database.

Gaseous, liquid and solid radioactive waste is produced during the operation of a nuclear power plant. The management of radioactive waste at the nuclear power plant includes its collection, separation, treatment and temporary storage before it is expedited to the landfill for radioactive waste. Continuous radiation monitoring is carried out at all these stages.

Monitoring is also carried out for radioactive emissions into the environment, both liquid and gaseous, to ensure that permissible limits are not exceeded.

VI.5.7.12 Monuments and archaeological sites

No monitoring is foreseen for the Project impact on architectural monuments and archaeological sites other than those activities that may result from guidelines obtained from the Voivodeship Monument Conservator.

VI.5.7.13 Human health and life

The following elements will be monitored to determine the Project impact on human health and life: public opinion (e.g., in terms of information provided regarding the Project, major concerns raised by the Project), morbidity and the health care system, as well as occupational health and safety and traffic organisation.

VI.5.7.14 Socio-economic environment

The Project impact on the socio-economic environment is based on monitoring such factors as changes that will occur in the local community due to the influx of workforce, the use of local services, and the Project impact on the local labour market, including but not limited to the tourism and fisheries sectors.

It is recommended that the above elements be monitored during the construction phase and for a period of 5 years from the date of completion of the construction phase.

VI.5.8 Indication of difficulties resulting from technical deficiencies or gaps in current knowledge as encountered during report preparation

The difficulties encountered in drawing up this EIA Report were related in particular to the unique nature of the Project. As there has not been any investment involving construction and operation of a nuclear power plant in Poland to date, it was not possible to take advantage of the experience, established practices and guidelines, or judicial or administrative rulings to prepare the EIA Report, as is the case with other projects.

Due to the fact that the construction of a nuclear power plant is generally considered to be an investment with the highest level of difficulty and complexity, the Applicant, while drawing up the EIA Report, faced challenges never encountered before in preparing such type of studies in Poland. It should be emphasised that the difficulties in the scope in question appeared already at the stage of launching the complex program of site and environmental surveys/studies and resulted, on the one hand, from its complexity and comprehensiveness and, on the other hand, from the lack of full knowledge at that stage, about the adopted design solutions. Another problem was the diversity, incompleteness, and varying quality of the historical data found, i.e., data collected by third parties (not derived from our own surveys/research). Public administration bodies, or other entities from which the above-mentioned data was obtained, have different systems of collecting, processing and presenting it. In addition to quality flaws, the data extracted often came in different formats and originated at different periods of time. Thus, for the purposes of the EIA Report, the Investor had to standardise and/or validate data provided in order to use it later, e.g. for comparative analyses purposes.

At this point, it is necessary to refer to the turmoil triggered by the Covid-19 pandemic (caused by the SARS-CoV-2 virus), to date an unprecedented phenomenon on a global scale. The restrictions and limitations introduced in the aftermath of the Covid-19 pandemic caused great difficulty in data acquisition. The effects of the pandemic were also reflected in the data collected on the issues studied in the last two years (i.e. 2020 and 2021), sometimes representing a rupture with past trends. Given the above as well as the uncertainty about the further course of the epidemic, in turn made it fairly difficult to forecast trends in a given area. Moreover, the process of preparation of the EIA Report itself became also more complicated (it was necessary to reorganise work, including the introduction of home office).

It must be emphasised that the Contractor made efforts to ensure that the aforementioned difficulties did not affect the quality of the EIA Report, applying internationally developed solutions during its preparation and using the extensive experience of the Technical Advisor in preparing this type of documentation for nuclear facilities.

VI.5.8.1 Difficulties arising from the state of knowledge on specific design solutions for the Project at the EIA Report preparation stage

As mentioned above, at the time of preparation of the EIA Report all detailed design solutions for Project implementation were not known, which will be determined only in the building permit design of the nuclear power plant.

Accordingly, the nuclear safety and radiation protection, and nuclear technology analyses were based on the generic design of the nuclear power unit equipped with AP1000 reactor, in particular the European version (UK AP1000) submitted for assessment by the UK nuclear regulator as part of the Generic Design Assessment (GDA) process. In particular, the following documents filed by the AP1000 provider, Westinghouse Electric Company, with the UK Office for Nuclear Regulatory Affairs (ONR) were used: the AP1000 Pre-Construction Safety Report, the UK AP1000 Environment Report, and the AP1000 European Design Control Document. It should be added that it is only at the Pre-Construction Safety Report stage that the building permit design of the nuclear power plant will be at an appropriate level of detail.

This problem has also arisen with regard to defining the detailed parameters of certain components of the NPP infrastructure. For example, the EIA Report proposed the use of cooling towers with the dimensions indicated by the Technical Advisor (height 202 m, diameter at the base approx. 169 m). It is likely that at the stage of preparing the design documentation, the aforementioned dimensions of the cooling towers will be clarified.

The state of progress of the project at the stage of EIA Report preparation also did not allow for a detailed assessment of greenhouse gas (GHG) emissions into the atmosphere. However, where possible, the estimation of GHG emissions at this stage of the design process has been carried out as closely as possible to the Project specifics, taking into account the site Variants considered. For the same reasons, it was not possible to fully assess the emissions into the atmosphere of substances during the NPP construction and operational phases; nevertheless, the practice of power facilities indicates that key sources and types of emissions were identified and estimated.

The waste management aspects were also analysed taking into account the available information, documents and experience in this field, adopting the principle of evaluating the parameters and assumptions with the highest potential impact.

At this stage of the Project implementation, the detailed solutions for the decommissioning phase of the NPP are not known. Given that the NPP decommissioning process will start in approximately 70 years from now, at the earliest, it is hard to determine its course and the technical solutions that will be applied at that time. Thus, in the case in question, the general assumptions of the NPP decommissioning phase are made, taking into account regulations of the national and international legislation, as well as practices developed on the grounds of relevant experience of other countries.

VI.5.8.2 Difficulties arising from the availability and quality of historical data collected

Another problem was the diversity, incompleteness, and varying quality of the historical data found, acquired from public administration bodies or other entities. In addition to quality flaws, the data extracted often came in different formats and originated at different periods of time, and sometimes suffered from inconsistencies or incompleteness.

An example of the above are, among others, the difficulties that have been encountered in preparing issues related to spatial development, resulting primarily from the need to obtain data from many different sources, and varying quality of these data.

Also, with regard to forecasting the expected level of property prices, a number of technical difficulties were encountered, mainly related to the availability and quality of information (e.g. limited information on properties or incomplete or outdated information on land development).

Also, ongoing seismic and tectonic studies have encountered difficulties related to data availability and quality. As for the study of the geological structure and tectonics of the deep bedrock, some interpretation problems were caused by the quality of some of the reflection seismic profiles, the lack of boreholes and the insufficiency of geophysical borehole logging, and the uncertainty of determining the course of stratigraphic boundaries (for some boreholes). However, the interpretation problems that occurred did not affect the reliability of the identified deeply rooted fault zones. Similar difficulties were identified for the earthquake catalogue for natural quakes. Another source of uncertainty is the lack of information about the depth of seismic shaking. The problematic issues of seismic hazard assessment should also be mentioned here. A common problem in seismic hazard assessment in stable continental regions is the scarcity of strong earthquake data, as well as the scarcity of appropriate ground shaking models. Therefore, a sufficiently deep well is planned to be bored as part of the seismic hazard assessment update to confirm that there is no influence of the local geological structure on the calculated seismic hazard value.

The archaeological inventory carried out between 2017 and 2019, which included analysis of archival searches and field research, also revealed numerous deficiencies in archival documentation (inconsistencies in, among other things, location, legal protection status, identifying numbers, and dates of listing on the Register of Historic Places for archaeological sites, architectural monuments, and culturally protected areas). It should also be emphasised that during the inventory, it was not possible to verify all the known archaeological sites, because during the field reconnaissance areas were found that were inaccessible for examination (wetlands or partially/completely flooded with water). In addition, a fundamental gap in most archival studies appeared to be the lack of, or inadequate elaboration on, issues of workmanship and construction technology for architectural monuments.

The problem of availability and quality of data made available by public administration bodies and other entities also concerned issues related to socio-economic determinants, including public health. The data released had varying degrees of detail. Efforts were made to acquire data at the commune level, but in many cases the data was available at the poviat or voivodeship levels. Among other things, there is a lack of up-to-date, publicly available data on the incidence of various diseases in individual communes, and hence most of the diseases analysed were assessed at the voivodeship level and some at the poviat level. In contrast, epidemiological data available worldwide on the effects of ionising radiation on human health are inconclusive. There are many indications that the real impact of low doses of ionising radiation and low concentrations of radioactive substances on human health may be lower than commonly believed.

It should be emphasised that the Covid-19 pandemic has some implications for the baseline data that were collected and analysed. The presented trends in socio-economic determinants recorded from 2010 to 2019 (2008 to 2017 for public health data) do not yet take into account the effects of Covid-19.

VI.5.8.3 Other difficulties or constraints of the methodologies or mathematical modelling used and the assumptions adopted

Any research method that seeks to reflect complex issues in a simplified manner is subject to error due to, among other things, the need for data standardisation and accuracy of computational methods, as well as limitations in the applicability of mathematical modelling.

For instance, many of the predictions used in the assessment of the Project's impact on environmental components in the marine part are based on a set of hydrographic models and dispersion modelling. While these techniques are widely used, both as assessment and regulatory tools, it is important to keep in mind that the complexity of the systems modelled inevitably implies some degree of simplification, and the models themselves are dependent on the accuracy of the input data.

It should also be emphasised that in the Site Regions, the values of pollutant concentrations in the air, [derived] both from measurements and from model calculations, are much lower than the respective permissible level values, which may result in high modelling uncertainties. Additionally, taking into account the fact that the impact of the facility on the environment is analysed in a perspective of several dozen years, the obtained results of pollutant concentrations may be characterised by a certain error.

Also, determining the extent of noise impact is subject to error due to the accuracy of the calculation methods, which is affected by simplifications and limitations of the mathematical model. A key issue, however, is the quality of input data, especially the number of acoustic events, the noise emission time, and the acoustic power of individual devices.

Difficulties were also encountered in developing the assumptions and modelling inputs for the Project's impact on marine surface waters. For instance, when calculating the composition of the discharged wastewater, a simplifying assumption was made that the entire volume of a given chemical substance that is consumed (e.g. the annual volume) will enter the environment (into seawater). This means that no decomposition of the substance or its reaction with other compounds present in the water was assumed. Bearing this in mind, it must be concluded that the actual impact will be less than the modelling indicates. In contrast, for the assessment of Project's impact on inland surface waters, all changes in biological indicators based on SSN modelling in terms of ecological status qualification for the water bodies considered were estimated to be below 30% of the baseline. This range is much lower than the uncertainty of the assessment of the ecological status or potential based on the errors analysis conducted by the GIOŚ in accordance with the methodology for estimating measurement uncertainty for SEM purposes, which is 41% for the SWB code: RW200017476925. In view of the overall level of uncertainty, which constitutes a natural element of each system of assessment based on the measurements of physical values (41%) and in the light of the small changes in the indices for biological elements acquired from the ANN, one may conclude that the level of uncertainty in the ANN calculations is much lower than that reported by the regulatory body (GIOŚ), and therefore acceptable.

Reference materials

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