

ENVIRONMENTAL IMPACT REPORT
PROJECT INVOLVING THE CONSTRUCTION
OF A WIND TURBINE COMPLEX,
TOGETHER WITH THE ACCOMPANYING TECHNICAL
INFRASTRUCTURE, IN THE AREA OF ŻARCZYN-ŻELECHOWO
IN THE WIDUCHOWA MUNICIPALITY

Investor: **ENERTRAG Krajnik sp. z o.o.**
Al. Jana Pawła II 15/4
70-445 Szczecin

Author: **Tomasz Zapaśnik, MA**

Contractor for the
ornithological and
chiropterological part: **Wildlife Conservation Office in Szczecin.**

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1. Introduction

This report was prepared at the request of ENERTRAG Krajnik sp. z o.o. with its registered office in Szczecin and it concerns the project involving the construction of a wind turbine complex, together with the accompanying technical infrastructure, in the area of Żarczyn–Żelechowo in the Widuchowa Municipality (Gryfino county).

1.1. Legal basis for the document

Pursuant to the Act of October 3, 2008 on providing access to information on the environment and its protection, public participation in the environmental protection and on environmental impact assessment (Journal of Laws 199, item 1227), performance of a planned project that may have a significant impact on the environment is allowed only after obtaining a decision on environmental conditions of the consent.

At the time of initiation of the administrative procedure the types of projects that may significantly affect the environment were defined in the Ordinance of the Council of Ministers of November 9, 2004 on the determination of type of projects that may have a significant impact on the environment and on detailed criteria for business qualification with respect to the obligation to prepare an environmental impact report (Journal of Laws No. 257, item 2573 as amended).

Pursuant to the above mentioned Ordinance, the planned project has been classified as a project likely to have a significant impact on the environment (§3(1)(6) of the Ordinance: plants using wind power for the generation of electricity other than those mentioned in §2(1)(5) with a total height of not less than 30 m.).

A new Ordinance of the Council of Ministers of November 9, 2010 on determination of the types of projects likely to have a significant impact on the environment (Journal of Laws of 2010, No. 213, item 1397) entered into force on November 15, 2010. Pursuant to §4 of the new Ordinance, the procedures on decisions on environmental conditions, initiated before the entry into force of the new Ordinance, are governed by the current provisions.

The Head of Widuchowa Municipality having consulted relevant authorities, i.e. National District Sanitary Inspector in Gryfino (opinion PS-N-NZ/4011-26/156/10 of September 6, 2010), and Regional Director for Environmental Protection in Szczecin (decision RDOŚ-22-WOOS.TŚ-6642/21-2/10/at of October 19, 2010), imposed an obligation to conduct environmental impact assessment by way of decision GNG:7624/3/2010 of November 24, 2010.

1.2. Purpose and scope of the document

This report was prepared for the purposes of the administrative procedure for the issuance of a decision on environmental conditions. Its purpose is to assess the impact of the proposed project on the environment, human health, and historical monuments. Pursuant to Article 66 of the EIA Act, the report on the impact of the project should include:

1. a description of the planned project, and specifically:
 - a) the characteristics of the entire project and the conditions of land use during the construction and operation or use stages,
 - b) main characteristics of the production processes,
 - c) the expected types and quantities of pollutants resulting from the operation of the planned project;
2. a description of the environmental components covered by the scope of the expected environmental impact of the planned project, including the environmental components protected under the Act of April 16, 2004 on Nature Conservation;
3. a description of the monuments protected under the regulations concerning monument protection and care for monuments, located within the impact range of the planned project and its immediate neighborhood;
4. a description of the foreseen effects on the environment in the event that the project is not undertaken;
5. a description of the options analyzed, including:
 - a) the applicant's proposed option and a reasonable alternative option;
 - b) the most environmentally-friendly option with the reasons for their selection;
6. a specification of the anticipated environmental impact of the analyzed
7. options, including in the event of a risk of a serious industrial accident, as well as possible cross-border impact on the environment;
8. a justification for the applicant's proposed option, indicating its impact on the environment, in particular on:
 - a) people, plants, animals, fungi and natural habitats, water and air,
 - b) the earth's surface, taking into account soil mass movements, climate and landscape;
 - c) tangible property;
 - d) monuments and cultural landscape covered by the existing documentation, in particular by the register or records of monuments;
 - e) the interaction between the elements referred to in items a-d;

9. a description of forecasting methods applied by the applicant and a description of forecast significant environmental impacts of the planned project, including direct, indirect, secondary, cumulative, short-, medium- and long-term, permanent and temporary impacts on the environment, resulting from:
 - a) the existence of the project,
 - b) the use of environmental resources,
 - c) emissions;
10. a description of anticipated actions aiming at prevention, limitation or natural compensation of negative impacts on the environment, in particular on the objectives and the subject of protection of the Natura 2000 site and on its integrity;
11. for roads which are projects that may always have a significant impact on the environment
 - a) defining assumptions for
 - rescue surveys of monuments identified which are located in the area of the planned project, as discovered during the construction works;
 - the program of securing existing monuments against the negative impact of the planned project and protecting the cultural landscape;
 - b) analysis and evaluation of possible threats and damages to the monuments protected under the provisions on the protection and care of monuments, in particular archaeological monuments, in the vicinity or within the direct range of the impact of the planned project;
12. if the planned project involves the use of installation, a comparison of the proposed technology with the technology complying with the requirements referred to in Article 143 of the Act of April 27, 2001 – Environmental Protection Law;
13. indication whether it is necessary for the planned project to establish the limited use area within the meaning of the provisions of the Act of April 27, 2001 – Environmental Protection Law, and determination of the boundaries of such area, restrictions on land use, technical requirements for civil structures and ways of using them; it does not apply to projects involving the construction of a national road;
14. graphical presentation of the matters;
15. presentation of issues in cartographic form at a scale corresponding to
16. the subject and detail of the issues analyzed in the report and enabling comprehensive presentation of the analyses carried out
17. environmental impact of the project;

18. analysis of potential social conflicts related to the planned project;
19. presentation of a proposal for the monitoring of the environmental impact of the planned project during its construction and operation or use, especially on the objectives and the subject of protection of the Natura 2000 site and on its integrity.
20. description of difficulties resulting from technological deficiencies or gaps in current knowledge which have been encountered while preparing the report;
21. a non-technical summary of the information contained in the report, in relation to each element of the report;
22. the name of the person(s) preparing the report;
23. source of information providing the basis for the preparation of the report.

The environmental impact report for the project should take into account the impact of the project at the stages of its execution, operation or use, and decommissioning.

The following studies, literature and documentation, among other things, were used in preparing this report:

- Program for Environmental Protection of Widuchowa Municipality for 2004–2012;
- Natural value assessment of the Widuchowa municipality (general report); Wildlife Conservation Office in Szczecin; Szczecin 2006;
- Environmental valuation of the Banie Municipality (general report); Nature Conservation Office in Szczecin; Szczecin 1998;
- Reports on the environmental status in Zachodniopomorskie Voivodship; Voivodship Inspectorate of Environmental Protection in Szczecin;
- Hydrogeological Map of Poland – Banie sheet; Polish Geological Institute;
- Detailed Geological Map of Poland – Banie sheet; Polish Geological Institute;
- Poradniki ochrony siedlisk i gatunków Natura 2000 – podręcznik metodyczny [Guidebooks for protection of Natura 2000 habitats and species – methodical guidebook.]; Ministry of Environment
- Przewoźniak A., Gromadzki M. 2002. Expert opinion on environmental and landscape conditions for the location of wind turbines in the northern (Baltic Coast) and central part of the Pomeranian Voivodship;
- Electromagnetic fields in the environment – description of sources and survey results; Chief Inspectorate for Environmental Protection; Warsaw, August 2007
- Environmental impact forecast in the strategic environmental impact assessment (for draft local spatial development plan of Widuchowa Municipality in area of Żelechowo locality, designating

areas for location of a wind farm together with technical infrastructure and impact zones; Szczecin, September 2010.

- Draft guidelines for forecasting environmental impacts of wind farms (authors: Maciej Stryjecki, Krzysztof Mielniczuk)

The literature used during the assessment of the project's impact on birds and bats is listed in Appendix 5.

The report has been prepared taking into account applicable legal acts regarding environmental protection.

2. Description of the planned project

Project data, including, primarily, the technical parameters, provided in this report are approximate and indicative.

This is due to the fact that the decision on environmental conditions, for which the report was prepared, is issued before the building permit design is prepared (the decision specifies the requirements necessary from the perspective of environmental protection, which must be taken into account in the building permit design).

For this reason, the technical parameters of the project may vary slightly at the final stage of the investment process.

2.1. Basic data of the project (option requested by the investor)

The proposed project will involve the construction of a wind turbine complex, together with the accompanying technical infrastructure, in the area of Żarczyn-Żelechowo in the Widuchowa Municipality (Poviat of Gryfino). The project will enable the generation of electricity from wind.

Up to 16 wind turbines are planned as part of the project. The total nominal capacity of all turbines will not exceed 56 MW. The characteristics of the wind turbine are as follows:

- Rotor diameter: up to approx. 112 m (3 propellers with the length of up to approx. 56 m each)
- Conical steel-tube tower
- Tower height: up to about 140 m
- Total height of the wind turbine: up to approx. 196 m
- Maximum noise level of a single turbine: 106 dB (it will be possible to adjust the sound power level – its reduction – by appropriately adjusting the blade angle of attack to the wind direction thus, at the expense of energy production, it will be possible to reduce the sound power level of the device).
- Wind speed for start-up: 3 m/s; optimum wind speed: approx. 12–15 m/s; wind speed for stopping: 25 m/s.
- Tower colors: white or gray

An example shape of a wind turbine is shown in the attached diagram (appendix 4 to the report).

The wind turbines will be installed on plots of land:

- Cadastral district of Żelechowo – plot No.: 779

- Cadastral district of Żarczyn – plots No.: 313, 310, 306, 294/1, 308, 304, 299, 289, 298, 297

The tower core of each wind turbine will be placed on a foundation. Standard foundations are circular in shape and approximately 18 to 20 meters in diameter. Only after thorough geological research and structural calculations (performed at the stage of preparing the building permit design – after obtaining the decision on environmental conditions) can their target size be determined.

The depth of the foundation shall be approx. 1.8–3 m from the existing ground level (depending on local subsurface conditions). In the event of unfavorable subsurface conditions, it will be necessary to lay deeper foundations, e.g. so-called “pile foundations”, or, alternatively, the foundations shall be laid on reinforced soil.

The foundations shall be made of reinforced concrete and the wind turbine tower structures shall be bolted to them.

In the proposed method of construction of the foundation above the ground level, a circular foundation shall stick out with a diameter of approx. 5 m (the remaining foundation shall be invisible — hidden under the surface of the ground and covered with a layer of soil).

The control of the wind turbines will be implemented using special software that continuously monitors all the sensors connected for the values being measured, analyzes the results and, based on them, creates the control parameters for the turbine. Remote monitoring will include, but not be limited to, key parameters (temperature monitoring, wind direction and speed monitoring, hydraulic monitoring). A control monitor at the PC will allow observation and control of all operating data as well as control of functions such as run-up, shutdown and orientation into the wind (yaw system). The farm will also be equipped with remote data monitoring. The transmission of data and signals shall take place via an ISDN connection and a web browser.

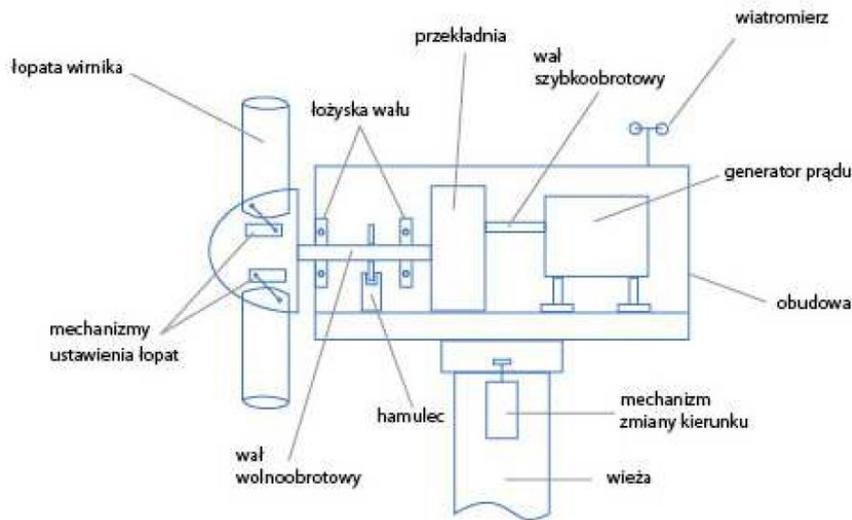
In addition to the wind turbines, the proposed project will consist of the following basic accompanying elements:

- MV and EHV power cables (running in the ground);
- telecommunications infrastructure that enables operational surveillance (running in the ground);
- access roads;
 - top layer ~ 5–10 cm (recycled concrete debris or crushed stone)
 - bearing layer ~. 40 - 50 cm (recycled crushed bricks, concrete debris or crushed stone)
 - nonwoven geotextile fabric

the width of the designed roads shall be approx. 4.5–5.0 m.; the roads shall allow access to the turbines from the existing roads – these shall not be public roads;

- assembly/technical yards at each wind turbine with approximate dimensions of 25 x 50 m; yards shall be constructed in a similar manner as access roads.

The essence of wind turbine operation is the conversion of kinetic energy of the wind into mechanical energy, and ultimately into electricity. The conversion of wind energy into mechanical energy takes place in the rotor, which is thus the most important part of the wind turbine. The rotor sits on a shaft through which the generator is driven. The generator, in turn, generates electricity. A simplified diagram of a wind turbine is presented below:



PL	EN
łopata wirnika	rotor blade
łożyska wału	shaft bearings
przekładnia	gear box
wał szybkoobrotowy	high-speed shaft
wiatromierz	anemometer
generator prądu	power generator
obudowa	housing
mechanizm zmiany kierunku	yaw mechanism
wieża	tower
hamulec	brake
wał wolnoobrotowy	low-speed shaft
mechanizmy ustawienia łopat	blade pitch control mechanism

Fig. 1. Example diagram of a wind turbine

The current generated in the generator will be transmitted through a transformer (the transformer increases the voltage to the value required by the grid), located in each tower, to the medium voltage grid connecting the wind farm with the substation (MV/HV Main Power Supply Point), in the case under assessment, located outside the wind farm.

2.2. Characteristics of project options

The purpose of the options analysis is to answer the question of whether the selected solution best meets the project objective with the least negative environmental impacts.

The purpose of the analyzed project is to increase the production of "clean" energy – energy produced without the emission of solid and gaseous pollutants into the air. Annual energy production is expected to reach about 96,000 MWh (investor estimates).

While analyzing the project options, one should not forget about the overriding principle of sustainable development, which is seen as an essential component of sustainable development of societies on our continent. The principle of sustainability dictates that social, economic and ecological rationales be treated equally.

Following the principle of sustainable development, first of all different locations were subjected to analysis of options (technical parameters such as height, propeller span, etc. in the case of projects like wind parks are of secondary importance). All considerations that make up the principle of sustainability were taken into account here. The analysis initially excluded locations that were unfavorable:

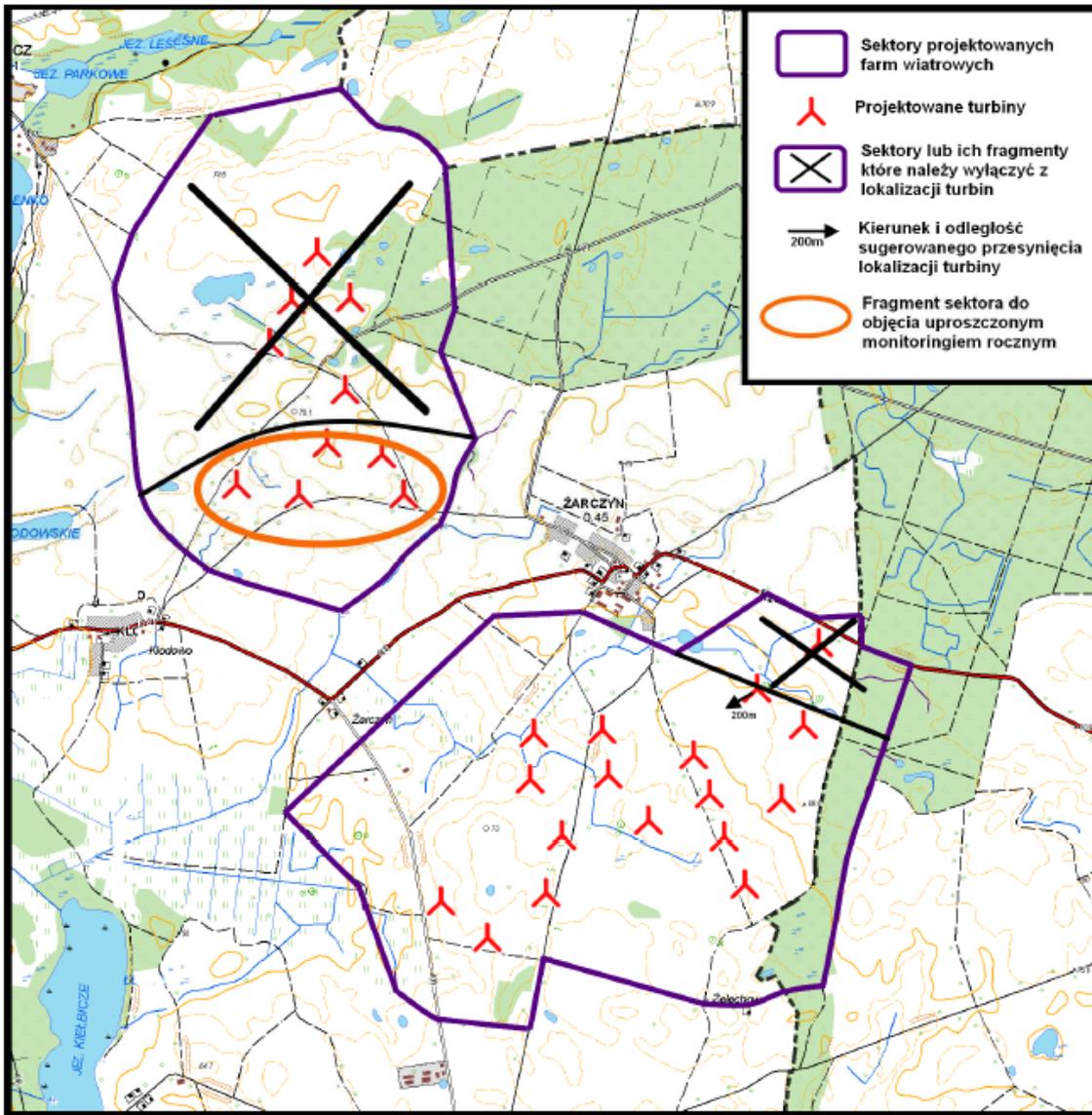
- for social reasons – localizations in the very close proximity of human settlements or areas with scattered buildings; wind park location in the very close vicinity of human settlements (including the location of wind turbines between individual buildings) could lead to the violation of permissible noise levels in the environment, and thus have a negative impact on human health (protection against noise covers areas of residential development – including farmsteads, areas of development connected with permanent or long-time stay of children and young people, areas of nursing homes, areas of hospitals, recreation areas outside of the city, areas of single-family residential development with craft services);
- for ecological reasons – locations within the boundaries of legal forms of area-related nature protection whose purpose of protection clearly collides with the planned project (nature reserves important for birds, landscape parks, protected landscape areas, Natura 2000 special bird protection areas, local nature conservation sites attractive for birds, etc.), locations in the vicinity of known large concentrations of birds or within the boundaries of delineated supra-local ecological corridors;
- for economic reasons – locations for which the owners of the land would not agree or the cost of the possible lease/purchase of the land would be too high for the investor.

As a result of the analysis, a site in the area of Żarczyn-Żelechowo in Widuchowa Municipality was selected for further evaluation. The selected location meets the criteria cited above. It should also be noted that the Study of conditions and directions of spatial development of Widuchowa municipality envisages the construction of a wind farm in this area (no local development plan has been passed for this area – the Widuchowa Municipality Council passed a resolution on commencing the preparation of a local development plan and the planning works are well advanced – among others a draft plan and a forecast of environmental impact have been prepared).

It should be emphasized that initially the investor was considering a different project option – the construction of two groups of wind turbines was planned: south of Żarczyn (the Żelechowo sector) and north-west of Żarczyn (the Lubicz sector) (Fig. 2). Annual bird and bat monitoring was conducted throughout the site. The monitoring data analysis excluded location of half of the turbines in the northern part of the farm (north-west of Żarczyn in the Lubicz sector). Moreover, additional monitoring for the southern part of the so-called Lubicz farm was contracted.

Taking the above into account, the investor decided to implement a rational alternative option – consisting in construction of a wind farm south of Żarczyn (option assessed in detail in this report) and to conduct additional monitoring to investigate the possibility of future implementation of a fragment of the planned Lubicz wind farm north-west of Żarczyn.

The implementation option proposed in this report addresses the conclusions and recommendations from the analysis of bird and bat monitoring data.



PL	EN
Sektory projektowanych farm wiatrowych	Sectors of planned wind farms
Projektowane turbiny	Designed turbines
Sektory lub ich fragmenty które należy wyłączyć z lokalizacji turbin	Sectors or parts thereof that should be excluded from turbine locations
Kierunek i odległość sugerowanego przysunięcia lokalizacji turbiny	Direction and distance of suggested turbine location shift
Fragment sektora do objęcia uproszczonym monitoringiem rocznym	Fragment of sector to be covered by simplified annual monitoring

Fig. 2. Original project option and marked fragments of sectors that should be excluded from the location of turbines and fragments requiring additional monitoring

In the further part of the report the option consisting in execution of the projects and works, which were characterized in chapter 2.1 “Basic data on the project”, was analyzed in detail. The starting point was the assumption that if a significant negative

impact of the project on the environment is documented, the investor will abandon the project or will look for further alternative solutions.

It should be noted here that the environmentally preferable option will be presented at the end of the report. This approach seems logical, taking into account the fact that in the case of wind farms the most beneficial option can be indicated only after the analysis of the results of the monitoring of birds, bats, habitat analysis of the site and after the calculation of noise emission.

The basic option for the analysis of environmental conditions is the option involving no project implementation – referred to as the "Zero Option". If the Zero Option is implemented, the proposed wind turbine complex would not be constructed. The area would continue to be used exclusively for agriculture (no investment interest in other directions). The landscape would not change. The acoustic climate of the surrounding area (mainly farmland) would not deteriorate. At the same time, the production of the so-called clean energy – energy produced without the emission of solid and gaseous pollutants into the air – would not increase.

Given the constantly increasing demand for electricity, it can be assumed that if the project is abandoned, the energy would be produced using conventional methods (the most common in Poland) – in a power plant or a combined heat and wind plant, where coal is the fuel. Therefore, with the "Zero Option", a balance of the environmental costs of energy production must be provided.

The average coal parameters are as follows:

- net calorific value: 23,000 kJ/kg
- ash content: 18.8%
- sulfur content: 0.6%

In the case of electricity production in a power plant, the gross fuel chemical energy unit consumption is 10,190 kJ/kWh (the value of the fuel chemical energy unit consumption for electricity production was adopted from the ENERGOPOMIAR study "Analysis of the Development of Indicators of Fuel Chemical Energy Consumption in Utility Power Plants and Combined Heat and Power Plants"). To produce 96,000 MWh, the following volume of fuel chemical energy is needed:

$$96,000 \text{ MWh} \times 10,190 \text{ kJ/kWh} \times 10^{-3} = 978,240 \text{ GJ}$$

For this purpose, coal is needed in the following amount:

$$978,240 \text{ GJ: } (23,000 \text{ kJ/kg} \times 10^{-3}) = 9,968 \text{ tons}$$

The amount of generated waste is:

- SO₂ emissions (installation without flue gas desulphurization): 459.4 tons
- NO₂ emissions: 169.1 tons
- CO₂ emissions: 96,574.6 tons
- dust emissions: 25.6 tons
- captured ash: 5,619.3 tons
- slag: 1,490 tons

Given the amount of waste generated in the process of electricity production by conventional methods, on a broad spatial and temporal scale it can be assessed that the Zero Option is a less ecological solution and is associated with negative environmental effects (e.g. greenhouse effect).

It is important to emphasize that often coal-fired power units that are worn out need to be replaced with new generating capacity. Some of them will be based on coal, which will still be the main source of energy in Poland in the next few decades (Polish Energy Policy until 2030). However, the dwindling resources of this fuel, the growing costs of its extraction and above all the necessity to implement the energy and climate policy of the European Union cause the need for dynamic development of alternative energy sources.

It should be pointed out here that Poland has been obliged by the European Union to produce energy from renewable sources (RES). Poland has to reach 15% of energy from RES in the balance of energy consumed in 2020. Currently, the share of renewable energy in the overall balance of energy production is only about 4 %.

3. Characteristics and condition of the natural environment in the area of the planned project location

3.1. Structure and condition of the abiotic environment

3.1.1. Location, topography, geologic structure and soil resources

The proposed wind farm is located in the eastern part of Widuchowa Municipality – it is situated between Żarczyn and Żelechowo (Gryfino Powiat, Zachodniopomorskie Voivodeship).

According to physicogeographic division of Poland presented by J. Kondracki (J. Kondracki "Podział regionalny Polski" 1998), the area of the planned project is located within mesoregion Pojezierze Myśliborskie (314.41), which is a part of macroregion Pojezierze Zachodniopomorskie (314.4) and subprovince Pojezierze Południowobałtyckie (314).

The surface of Widuchowa Municipality was shaped by the Pomeranian glaciation (Pomeranian stage). Moreover, in the process of shaping the area of the municipality, an important role was played by the pre-Quaternary topography (Jaskowiak-Schoeneichowa 1979).

The proposed wind farm is located within an undulating moraine upland with associated fluvioglacial formations. The upland is hilly. The hilly upland is enriched by numerous forms characteristic of areal deglaciation. The most common forms are depressions left by lumps of dead ice. An esker hill about 1 km long and 5-7 m high (extended in NE-SW direction) was also described within the farm. The postglacial channel of the Kiełbicze Lake is located at the western border of the farm – the upland descends towards it along a long slope.

No detailed geotechnical documentation was prepared for the area of the proposed wind farm. Information on geological structure comes from the Detailed Geological Map of Poland (Banie sheet), published by the Polish Geological Institute.

The land surface is covered by Quaternary sediments. On the surface there is definitely mostly boulder clay. Their thickness is estimated to be at least several meters. The hollows left by dead ice are littered with Holocene formations – low peats. These are mainly peats: reed, wood, bryophyte and sedge peats or intermediate types. Their thickness is relatively small.

The esker dike between Żarczyn and Żelechów is built of diagonally interlayered sands with gravels (5-7 m thick) and thin clay cover (0.5-1.5 m).

The soil cover is predominantly made up of podzolic and pseudo-podzolic soils. Second place is occupied by leached brown soils. Small areas are occupied by degraded black soils and gray soils and soils of organic origin. The soils within the farm mostly belong to class 4 (very good for rye).

There are no documented mineral deposits within the area of the proposed wind farm. According to the environmental valuation of the Widuchowa Municipality the raw material resources occurring in the area of the municipality include: easily accessible Quaternary deposits of aggregate, lacustrine chalk, gyttjas and peat. Lignite deposits lie

deeper, but under current conditions their exploitation is unprofitable. There are prospect for natural gas and small oil deposits in the area of the municipality, but their depth exceeds 3000 m. Moreover, peat deposits – organic raw materials – are numerous in the area of the municipality (also within the area of the wind farm). These are mainly deposits of the low and mixed peat type – under present conditions their potential exploitation is a threat to the environment and a great loss for the preservation of valuable landscape and habitat values.

3.1.2. Surface and groundwater and their quality

Within the area of the designed farm there are small water ponds (water fills small depressions left by lumps of dead ice). Besides, the surface hydrographic objects include small-size drainage ditches (some of them are filled with water only periodically – during intense rainfall and snowmelt). Water quality in ponds and drainage ditches was not tested. Due to the nature of these facilities, it can be considered poor quality (such facilities are characterized by virtually no resistance to contamination).

The proposed wind farm is located in the Oder river drainage basin – the Oder river flows approximately 10 km away from the wind farm.

The nearest lake is Lake Kielbicze (area: 71.6 ha; maximum depth: 4.5 m), located approximately 2 km from the proposed wind farm.

Groundwater in the area of Widuchowa municipality depends on the geomorphological structure of the subsoil. Hydrographically, its area is included in the South Pomeranian Region (Malinowski 1999), where the shallowest groundwater is found in Miedzyodrze (0 to 2 m) and other river valleys. Upland areas are characterized by water levels of 10–15 m, and in areas of moraine hills from 5 to 30 m.

In the area where the wind turbines are located, groundwater lies at different depths. Shallow water tables are to be expected in depressions in the area.

At elevations, groundwater occurs deeper – several meters below the land surface.

In the area of the planned project there are two recognized usable aquifers: Tertiary and Quaternary.

The main usable aquifer is the Quaternary aquifer. According to the explanations to hydrogeological map of Poland (Banie sheet), in the area of wind turbine location, it is located at the depth of 50 - 100 m. Its thickness is in the range of 10–40 m. The potential

capacity of the drilled well is from 10 to 30 m³/h. The degree of threat to the main usable aquifer is low – an area of moderate aquifer resistance with no sources of contamination. Water quality is average (Class II – average quality, water requires simple treatment).

Due to the nature of the project, the characterization of deeper aquifers was omitted in the report.

The proposed wind farm is located outside of groundwater intake protection zones (the nearest municipal water intake is located in Żelechowo, approximately 1.7 km from one of the planned wind turbines – no indirect protection zone was established for this intake).

The proposed wind farm is located outside of the boundaries of major groundwater reservoirs.

3.1.3. Climatic conditions

According to Woś (1993), the Widuchowa Municipality lies within the VI – Western Pomeranian climatic region of Poland, as defined in the light of the frequency of different weather types. It is characterized by a very high number of warm days. There are, on average, more than 256 of these days per year, accounting for more than 70 percent of the total number of days per year. However, there are fewer days with cold weather, including both windy and windless weather (Prawdziej, 1963).

The climate of the municipality is affected by the presence of large bodies of water: the Baltic Sea and the Szczeciński Lagoon, and the climate conditions show many features of the Atlantic climate. Winters here are mild and short, the summer period is also mild and quite long (Prawdziej, 1963). Average annual temperatures vary between 8.2 and 8.6°C. The warmest areas are the southern areas of the municipality, belonging to the Myśliborski

Lake District. The warmest month is July with temperatures ranging from 17.3°C in the east to 18.6°C in the west. January is the coldest, with temperatures ranging from -1°C in the west to almost -2°C in the east. Amplitudes of average monthly temperatures are small, ranging from less than 19°C in the northern part to almost 20°C in the southern and eastern parts (Wiszniewski, 1973).

The growing season is about 225 days – it begins in late March and early April and ends in the first decade of November and is one of the longest in Poland. The level of precipitation (for the Widuchowa station) averaged for 1961-2000 amounts to 538 mm

and is close to the average precipitation in Poland. The maximum level of precipitation falls in June and July and the lowest is in February.

The average number of days with frost in May ranges from 0.2 to 1.8, which is about 9% of the growing season days. The average number of days with frost in September ranges from 0.0 to 0.3. During the year, the number of days with snow cover ranges from 40-50 days (Woś, 1993).

3.1.4. State of ambient air

There are no significant sources of air emissions in the area of the designed project.

The current state of atmospheric pollution in the area of Widuchowa municipality (letter of the Voivodeship Inspectorate for Environmental Protection in Szczecin) is as follows (the concentrations given are annual average concentrations; permissible levels of substances in the air were determined based on the Ordinance of the Minister of the Environment of March 03, 2008 on the levels of certain substances in the air):

- SO₂: 4.2 µg/m³ – the permissible level of substances in the air for reasons of plant protection is 20 µg/m³;
- NO₂: 8.5 µg/m³ – the permissible level of substances in the air for the protection of human health is 40 µg/m³;
- Suspended particulate matter PM₁₀: 21 µg/m³ – the permissible level of substances in the air for the protection of human health is 40 µg/m³;
- C₆H₆: 0.3 µg/m³ – the permissible level of substances in the air for the protection of human health is 5 µg/m³;
- CO: 200 µg/m³ – not standardized on a calendar year basis

The Voivodeship Inspectorate for Environmental Protection pointed out that the annual average concentrations of 33 benzo(a)pyrene measured in the years 2007–2009 in Widuchowa town (Bulwary Rybackie) amounted to: in 2007 1.7 µg/m³, in 2008 1.6 µg/m³, in 2009 1.4 µg/m³. Thus, the target level for benzo(a)pyrene, which is 1 µg/m³ for the annual average concentration, was exceeded.

3.1.5. Acoustic climate

The values of permissible sound levels (equivalent, designated as L_{Aeq}) in the environment are specified in the Ordinance of the Minister of Environment of June 14, 2007 on permissible noise levels in the environment (Journal of Laws of 2007, No. 120, item 826). The Polish legal requirements for environmental noise protection refer to two times of the day separately:

- 16 hours during daylight hours, between 6 a.m. and 10 p.m.;

- 8 hours at night from 10 p.m. to 6 a.m.

The limit values depend on the urban function of a given area. The lowest levels are set for areas requiring intensive noise abatement and the highest levels are set for areas where noise abatement is not a critical issue. The adopted basis for the categorization of land – its urban function – clearly indicates the close relationship between protection of environment from noise and spatial development. It follows from the ordinance that permissible levels of noise in the environment are determined mainly in residential areas (standalone or accompanying e.g. craft services) and areas that are subject to special noise protection (areas of hospitals, buildings associated with permanent or temporary residence of children, nursing homes, recreation and leisure areas).

The direct location where the wind turbines are planned to be constructed, is free from any development. In the neighborhood, at a distance of approx. 800–1000 m, there are farm buildings and single-family residential buildings, subject to noise protection.

The areas planned for the location of the wind farm are currently used for agricultural purposes. Acoustic conditions are determined here by:

- traffic noise associated with vehicle traffic on roads in the vicinity of the planned project (provincial road No. 122 with low traffic intensity and local roads with negligible traffic intensity, including access roads to agricultural land);
- seasonal noise from farm machinery during field work.

Taking into account the current land development and existing (insignificant) sources of noise, it can be assessed that noise is not a critical issue in the area under discussion, and applicable environmental standards in this scope will not be exceeded.

3.2. Structure of the biotic environment

The structure of the biotic environment is determined by current land use. The individual wind turbines will stand within arable land (aerial photo in Appendix 3). Agrocenoses are artificial ecological systems created by humans to maximize crop yields. Cereals, rapeseed, corn and vegetables are grown in the arable fields. In addition to the typical species of arable crops, one should mention here segetal plant communities (referred to as the weeds of arable crops). These are annual plants – persisting until the fields are plowed.

Access roads to the wind turbines will also run mostly through arable land.

Permanent vegetation remains only on the balks and shoulders of dirt roads.

The following plant species were recorded within agricultural lands, shoulders of communication routes and wastelands: *Ranunculus auricomus* – goldilocks buttercup, *Potentilla anserina* – silverweed, *Geum urbanum* – colewort, *Succisa pratensis* – devil's-bit, *Papave rhoeas* – common poppy, *Campanula patula* – spreading bellflower, *Artcium tomentosum* – woolly burdock, *Galium mollugo* – hedge bedstraw, *Heracleum sphondylium* – hogweed, *Dactylis glomerata* – orchard grass, *Deschampsia caespitosa* – tufted hairgrass, *Oenothera biennis* – common evening-primrose, *Alopecurus pratensis* – meadow foxtail, *Rumex acetosella* – red sorrel, *Urtica dioica* – common nettle, *Equisetum arvense* – field horsetail, *Rumex crispus* – curly dock, *Lotus corniculatus* – common bird's-foot trefoil, *Trifolium pratense* – red clover, *Trifolium repens* – white clover, *Trifolium campestre* – hop trefoil, *Vicia sativa* – common vetch, *Daucus carota* – wild carrot, *Cirsium arvense* – creeping thistle, *Lathyrus pratensis* – meadow vetchling, *Anthriscus sylvestris* – cow parsley, *Matricaria discoides* – pineappleweed, *Casella bursa-pastoris* – shepherd's purse, *Poa trivialis* – rough bluegrass, *Raphanus raphanistrum* – wild radish, *Plantago major* – broadleaf plantain, *Taraxacum officinale* – dandelion, *Artemisia vulgaris* – common mugwort, *Convolvulus arvensis* – field bindweed, *Silene alba* – white campion, *Carduus crispus* – welted thistle, *Bromus tectorum* – downy brome, *Lolium perenne* – perennial ryegrass, *Iris pseudacorus* – yellow flag, *Juncus conglomeratus* – compact rush, *Almaria officinalis* – garlic mustard, *Impatiens parviflora* – small balsam, *Achillea millefolium* – yarrow, *Tanacetum vulgare* – common tansy, *Myosotis arvensis* – field forget-me-not, *Bromus erectus* – erect brome.

Within the drainage ditches, the following were recorded: *Lemna minor* – common duckweed, *Equisetum fluviatile* – Water horsetail, *Carex fusa* – smooth black sedge, *Carex leporina* – Eggbract sedge, *Juncus effusus* – soft rush, *Polygonum amphibium* – longroot smartweed, *Cardamine pratensis* – cuckooflower, *Phragmites communis* – common reed.

None of the species listed above are legally protected under the Ordinance of the Minister of the Environment of July 9, 2004 on the species of wild plants covered by legal protection.

Small areas within the projected farm are occupied by wastelands. They have developed in small terrain depressions. A characteristic feature is the presence of hydrogenic vegetation and scrub communities. Due to the fact that the planned wind turbines (and accompanying infrastructure) will be constructed outside these facilities, a detailed floristic survey of these facilities was omitted during the field work (they are located outside the project location and outside the range of works related to its

implementation).

The proposed wind farm borders on a small forest complex to the east (the construction works of the wind farm will not disturb the forest vegetation, therefore no detailed survey of the vegetation was conducted).

Due to the nature of the planned project and its potential environmental impact, it was necessary from the environmental point of view to conduct annual monitoring of birds and bats – these are the groups of animals most exposed to the potential impact of the planned project.

3.2.1. Birds

Annual bird monitoring was conducted in the area of the proposed wind farm from April 20, 2009 to April 19, 2010. The monitoring was conducted by the Nature Conservation Office in Szczecin.

The bird monitoring covered a much larger area than the wind farm proposed for development by the investor. This is due to the fact, that initially the investor intended to execute the project in a different option – two groups of wind turbines were planned, the so called “Lubicz” and “Żelechowo” farms (according to the scheme presented in chapter 2.2 of the report). After analyzing the monitoring results, it was determined that the initial project option could adversely affect birds. A reasonable alternative option was proposed and evaluated in detail in this report.

Annual bird monitoring results are presented in Appendix 5 of the report.

3.2.2. Bats

Annual bat monitoring was conducted in the area of the proposed wind farm from April 20, 2009 to April 19, 2010. The monitoring was conducted by the Nature Conservation Office in Szczecin.

The bat monitoring covered a much larger area than the wind farm proposed for development by the investor. This is due to the fact, that initially the investor intended to execute the project in a different option – two groups of wind turbines were planned, the so called “Lubicz” and “Żelechowo” farms (according to the scheme presented in chapter 2.2 of the report). After analyzing the bird monitoring results, it was determined that the initial project option could adversely affect birds. A reasonable alternative option was proposed and evaluated in detail in this report.

Annual bat monitoring results are presented in Appendix 5 of the report.

3.3. Landscape

The concept of landscape is not unambiguous, and its definition varies depending on the scientific discipline from the point of view of which this concept is considered. The term landscape is commonly understood as the appearance of the Earth's surface. In conservation and ecology, landscape means many separate elements (such as trees, fields, rivers, buildings, roads, etc.) that together form a whole. Many professionals (including landscape architects) view landscape as a synthesis of natural, cultural and visual environments. Thus, the landscape forms a natural and cultural whole and is a resource of visual and aesthetic values created as a result of the interaction of natural and anthropogenic factors.

The physiognomy of the landscape in the area of the planned wind farm location is determined primarily by the basic elements of terrain morphology and land use. The proposed wind farm is located within an undulating moraine upland with associated fluvioglacial formations. The topography is slightly undulating, sometimes hilly. The area is used for agricultural purposes – there are arable fields (cereals, rapeseed, corn and vegetables are grown on the arable fields). The landscape is diversified by relatively few depressions with hydrogenic and scrub vegetation. In addition, the landscape is diversified with forest areas adjacent to the proposed wind farm area on the east.

The immediate area of the planned wind farm does not stand out in terms of landscape values compared to other parts of the Zachodniopomorskie Voivodeship.

The landscape in the area of the proposed project is presented in the photographs in Appendix 7 to the report.

Looking at the landscape in a broader perspective – at the scale of the entire municipality – it should be assessed that there are areas with enhanced landscape values here. In the environmental valuation it was assessed that the area of Widuchowa Municipality is very attractive and varied in terms of landscape. The diversity of the landscape is due to the landform features and vegetation cover.

The western areas of the municipality along the Oder river present a typical open landscape of a large river valley with its numerous backwaters, oxbow lakes and channels. Especially in spring and autumn, during high water levels, the backwaters merge with each other filling the entire valley.

The ground moraine zone extends eastward from the Oder Valley. The moraine surface

is dissected by glacial river valleys. Smaller streams have created numerous erosion cuts in the edge zone; their length ranges from 2 to 5 km and they have steep slopes. The edge zone is systematically drained by small watercourses, and the groundwater is based at the level of the Oder water, hence in the zone of 2-3 km from the river bank there are only few water-filled depressions. The zone of depressions located east of Route 31 looks different, where impermeable ground and relatively flat terrain will allow for the formation of numerous ponding water, bogs, lakes and marshes. Currently, the water level in this area has been lowered due to the impact of land reclamation and a prolonged hydrological drought. Many of the ditches are deprived of water during the summer. The remaining moraine area consists of numerous hills separated by depressions, often filled with water. Most water bodies are concentrated in this area.

One of the most interesting landscapes is the central part of the municipality consisting of wetlands formed in the valleys of former glacial rivers. They are an important hydrographic element, especially when the climate is continentalized and groundwater levels are lowered. The long-term effect of drainage activities is the lowering of groundwater level, which leads to soil drying and disappearance of hydrogenic habitats as well as unfavorable transformations of vegetation. In the environmental valuation it was proposed for these areas to create a landscape-nature complex.

The project area is located outside of the boundaries of legal forms of nature protection (and their buffer zones) established to protect landscape values (e.g. landscape parks, protected landscape areas). The nearest landscape park (Krajobrazowy Park Doliny Dolnej Odry) is located about 12 km away.

3.4. Degree of transformation of the area as a result of human activity

The immediate area designated for the location of the wind turbine complex has been virtually completely transformed as a result of longstanding, agricultural human activity. Within the area of the proposed wind farm, almost all of the arable land is used for agriculture – cereals, rapeseed, corn and vegetables are grown on the arable fields. The effect of agricultural activity is practically complete eradication of the original vegetation (the natural vegetation was beech forests) and the formation of a “plow layer” in the case of soils.

The area is crisscrossed by roads, mainly providing access to agricultural fields.

4. Areas and facilities legally protected in terms of nature in the area of the planned project

The planned wind farm is practically adjacent to the Las Baniewicki Natura 2000 site (it should be emphasized that it will be implemented outside of its boundaries).

Further away there are:

- “Dolina Dolnej Odry” Natura 2000 site (SPA) – at a minimum distance of about 3 km
- “Dolna Odra” Natura 2000 site (SAC) – at a minimum distance of about 5 km

The location of the turbine in relation to the area-related legal forms of nature protection is presented on the topographic map in the scale of 1:50,000 (Appendix No. 2 to the report).

Natura 2000 site "Las Baniewicki" PLH320064 (SAC)

The area of 611.5 ha in total is designated under Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive) and is proposed for establishment to protect the natural habitats (ecosystems) of Annex I and the plant and animal populations and habitats (except birds) of Annex II of the Directive. Until a notified Natura 2000 site is potentially denied approval by the European Commission, it is treated as a designated Natura 2000 site.

The area is a dense complex of fertile deciduous forests with a fairly uniform broadleaved nature. Riparian forests develop on small areas in the local depressions, in the north-western part, there are areas which are more difficult to classify syntaxonomically and to diagnose the habitat, referring to inland acid oak forests (probably, however, it is the impact of the acidification of the habitat due to the former higher share of coniferous species in the tree stand).

Within the area 3 types of habitats from Annex I of Council Directive 92/43/EEC were identified:

- Old river beds and natural eutrophic water reservoirs with communities of Nympheion, Potamion
- Sub-Atlantic broadleaved forest (Stellario-Carpinetum)
- Willow, poplar, alder and ash riparian forests (*Salicetum albo-fragilis*, *Populetum albae*, *Alnenion*).

More than 56% of the area consists of well-developed habitats of fertile broadleaved

forests, mostly sub-Atlantic broadleaved forests – a habitat poorly represented in the N2000 network approved by the European Commission so far. The forests have good conservation prospects, characterized by species richness of flora. As much as 107 ha are habitats developed in a typical way (state A). The remaining area of the site consists of similar broadleaved forest habitats, but degraded by the breeding of mixed stands with coniferous or geographically alien species (northern red oak, hybrid black poplar). The greening of forest management, however, contributes to a gradual improvement in the composition of tree stands and with time we should rather expect an increase in the area of protected habitats.

The site contributes significantly to the achievement of appropriate representativeness within the Natura 2000 network for the habitats of sub-Atlantic broadleaved forests, whose resources are concentrated in the Zachodniopomorskie Voivodeship.

Due to the forest nature of the area, threats are largely related to forest management. The problem is to adjust the composition of tree stands to the potential of the habitat, not only in terms of production, but also ecologically and geographically (many areas are occupied by tree stands including coniferous or geographically alien species). For the purpose of keeping xylobionts it is necessary to maintain adequate numbers of old and dead trees in the forest.

In accordance with Article 33(1) of the Act of April 16, 2004 on Nature Conservation, it is prohibited to undertake actions which, separately or in combination with other actions, may have a significant negative impact on the conservation objectives of Natura 2000 site, including in particular it may:

- deteriorate the condition of natural habitats or habitats of species of plants and animals for which the Natura 2000 site was designated;
- negatively affect the species for the protection of which the Natura 2000 site was designated;
- deteriorate the integrity of the Natura 2000 site or its connections with other areas.

It should be emphasized that the prohibitions do not apply only to areas within the boundaries of Natura 2000 sites, but they also refer to actions taken outside the boundaries of the Natura 2000 sites.

If there are necessary requirements of an overriding public interest, including those of a social or economic nature, and in the absence of alternative solutions, it is possible to carry out projects which may have a negative impact on natural habitats as well as plant and animal species for the protection of which the Natura 2000 site was designated, after

consent granted by relevant authorities and following appropriate requirements and criteria specified in the Act on Nature Conservation.

“Dolina Dolnej Odry” Natura 2000 site PLB320003 (SPA)

The area selected on the basis of the Council Directive No. 79/409/EC on the conservation of wild birds (the so-called Birds Directive), established by the Ordinance of the Minister of the Environment of July 21, 2004 on Natura 2000 special protection areas for birds (Journal of Laws of 2004, No. 229, item 2313, as amended) to protect the populations of birds from Annex I of the Directive, together with their habitats as well as regularly occurring migratory species.

The area includes the Oder Valley with the surface area of 61,648.4 ha between Kostrzyn and Szczecin Lagoon (length of approx. 150 km) together with Lake Dąbie. Lake Dąbie is a shallow, delta reservoir (5600 ha, max. depth 4 m), with a diversified coastline. It is supplied by rainwater, river water and sea water (backwater phenomenon). The lake and the Oder River stream are separated by the following islands: Czaplí Ostrów, Sadlińskie Łąki, Mienia, Wielka Kępa, Radolin, Czarnołęka, Dębina, Kacza and Mewia. The south-eastern shore of the lake is adjacent to meadows and wetlands of Rokiciny, Sadlińskie and Trzebuskie Łęgi. Aquatic vegetation is richly represented in Lake Dąbie. The banks are occupied by a wide strip of rushes (mainly reeds and club-rush), behind which riverside herbs develop. Large areas are occupied by riparian forests and willow bog bushes. The interiors of large islands are covered with alder trees and ash alder riparian forests. In the estuary section the Oder River has two main branches – the Eastern Oder and the Regalica. The area between the main branches (channels) (Międzyodrze) is a flat plain with numerous lakes and smaller channels, it is marshy, with periodically flooded meadows and fragments of riverside riparian forests.

The area below Cedynia is called the Freienwald Basin, within which the so called Rozlewisko Kostrzyneckie is of particular importance to birds. On the German side, the Lower Oder Valley National Park stretches along the Oder River. In the central and southern parts of the area, fragments of forest adjacent to the valley with the highest density of birds of prey were included.

The Natura 2000 site contains at least 35 bird species listed in Annex I of the Birds Directive:

- Eurasian bittern *Botaurus stellaris*.
- little bittern *Ixobrychus minutus*
- great egret *Egretta alba* (*Ardea alba*)

- black stork *Ciconia nigra*
- white stork *Ciconia ciconia*
- tundra swan *Cygnus bewickii* (*Cygnus*)
- whooper swan *Cygnus cygnus*
- smew *Mergus albellus* (*Mergellus*)
- European honey buzzard *Pernis apivorus*
- black kite *Milvus migrans*.
- red kite *Milvus milvus*.
- white-tailed eagle *Haliaeetus albicilla*
- western marsh-harrier *Circus aeruginosus*
- hen harrier *Circus cyaneus*
- Montagu's harrier *Circus pygargus*
- lesser spotted eagle *Aquila pomarina*
- western osprey *Pandion haliaetus*
- spotted crane *Porzana porzana*
- little crane *Porzana parva*
- corn crane *Crex crex*
- common crane *Grus grus*
- ruff *Philomachus pugnax*
- wood sandpiper *Tringa glareola*
- common tern *Sterna hirundo*
- little tern *Sternula albifrons*
- black tern *Chlidonias niger*
- eagle owl *Bubo bubo*
- short-eared owl *Asio flammeus*
- European nightjar *Caprimulgus europaeus*
- kingfisher *Alcedo atthis*
- bluethroat *Luscinia svecica*
- aquatic warbler *Acrocephalus paludicola*
- barred warbler *Sylvia nisoria*
- red-breasted flycatcher *Ficedula parva*
- red-backed shrike *Lanius collurio*

Regularly occurring migratory birds on the Natura 2000 site, not listed in Annex I of the Council Directive No. 79/409/EEC, include:

- mute swan *Cygnus olor*
- taiga bean goose *Anser fabalis*
- greater white-fronted goose *Anser albifrons*
- grayleg goose *Anser anser*
- Eurasian wigeon *Anas Penelope*
- gadwall *Anas strepera*
- common teal *Anas crecca*
- mallard *Anas platyrhynchos*
- common pochard *Aythya ferina*
- tufted duck *Aythya fuligula*
- cocommon goldeneye *Bucephala clangula*
- common merganser, *Mergus merganser*
- coot *Fulica atra*
- northern lapwing *Vanellus vanellus*
- dunlin *Calidris alpina*
- great black-backed gull *Larus marinus*
- white-winged tern *Chlidonias leucopterus*
- stock dove *Columba oenas*
- barn owl *Tyto alba*
- black cormorant *Phalacrocorax carbo sinensis*
- water birds *waterfowl*

The most important threats to the area are (according to the standard data form):

- water pollution by products of agricultural, industrial and municipal origin
- poaching.

In accordance with Article 33(1) of the Act of April 16, 2004 on Nature Conservation, it is prohibited to undertake actions which, separately or in combination with other actions, may have a significant negative impact on the conservation objectives of Natura 2000 site, including in particular it may:

- deteriorate the condition of natural habitats or habitats of species of plants and animals for which the Natura 2000 site was designated;
- negatively affect the species for the protection of which the Natura 2000 site was designated;
- deteriorate the integrity of the Natura 2000 site or its connections with other areas.

It should be emphasized that the prohibitions do not apply only to areas within the boundaries of Natura 2000 sites, but they also refer to actions taken outside the boundaries of the Natura 2000 sites.

If there are necessary requirements of an overriding public interest, including those of a social or economic nature, and in the absence of alternative solutions, it is possible to carry out projects which may have a negative impact on natural habitats as well as plant and animal species for the protection of which the Natura 2000 site was designated, after consent granted by relevant authorities and following appropriate requirements and criteria specified in the Act on Nature Conservation.

Natura 2000 site “Dolna Odra” PLH320037 (SAC)

The area designated under Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive), proposed for establishment to protect the natural habitats (ecosystems) of Annex I and the plant and animal populations and habitats (except birds) of Annex II of the Directive.

The area (of 29,536 ha) includes the Oder Valley (with two main channels: East Oder and West Oder), stretching for approx. 90 km. The area is a mosaic including: wetlands with peat bogs and meadows flooded in spring, alder and riparian forests, old river beds, numerous river branches and islands. The Oder is a free-flowing river (according to the terminology of hydraulic engineers). A large proportion of the area is natural floodplains. The refuge also includes fragments of the Odra Valley edge zone with patches of xerophilic vegetation, including xerothermic swards and forests. The areas surrounding the refuge are used for agricultural purposes. Grassland management and cattle grazing are also practiced in a small section of the area. Numerous industrial plants are located in the vicinity of the refuge.

In total 21 habitats listed in Annex I of Council Directive No. 92/43/EEC were identified here. They include:

- Old river beds and natural eutrophic water reservoirs with communities of Nympheion, Potamion
- Flooded muddy river banks,
- Dry heaths (*Calluno-Genistion*, *Pohlio-Callunion*, *Calluno-Arctostaphylion*)
- Xeric sand calcareous grasslands (*Koelerion glaucae*)
- Xerothermic swards (*Festuco-Brometea*) – only grasslands with important orchid localities are prioritized
- Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion*) of variable moisture content

- Mountain herbs (*Adenostylian alliariae*) and riverside herbs (*Convolvuletalia sepium*)
- Lowland and mountain fresh meadows used extensively (*Arrhenatherion elatioris*)
- Acid beech forest (*Luzulo- Fagetum*)
- Fertile beech (*Dentario glandulosae-Fagenion, Galio odorati-Fagenion*)
- Sub-Atlantic broadleaved forest (*Stellario-Carpinetum*)
- Central European and subcontinental broadleaved forest (*Galio- Carpinetum, Tilio-Carpinetum*)
- Pomeranian acidophilus birch-oak forest (*Betulo-Quercetum*)
- Swamp woods and forests (*Vaccinio uliginosi-Betuletum pubescentis, Vaccinio uliginosi-Pinetum, Pino*)
- Willow, poplar, alder and ash riparian forests (*Salicetum albo-fragilis, Populetum albae, Alnenion*).
- Oak-elm-ash forests riparian forests (*Ficario- Ulmetum*)
- Thermophilous oak woods (*Quercetalia pubescenti- petraeae*)

The following plants and animals from Annex II of Council Directive No. 92/43/EEC occur in the area:

- Barbastelle *Barbastella barbastellus*
- Pond bat *Myotis dasycneme*
- Greater mouse-eared bat *Myotis myotis*
- European beaver *Castor fiber*
- Eurasian otter *Lutra lutra*
- Northern crested newt *Triturus cristatus*
- European fire-bellied toad *Bombina bombina*
- European pond turtle *Emys orbicularis*
- Atlantic salmon *Salmo salar*
- White-finned gudgeon *Gobio albipinnatus*
- Aspius *Aspius aspius*
- Amur bitterling *Rhodeus sericeus amarus*
- Spined loach *Cobitis taenia*
- European stag beetle *Lucanus cervus*
- Hermit beetle *Osmoderma eremita*
- Great capricorn beetle *Cerambyx cerdo*

- Lesser ramshorn snail *Anisus vorticulus*

The most important threats to the area are (according to the standard data form):

- Habitat changes caused by changes in farming (e.g. abandonment of pastoralism) leading, for example, to commencement of a succession process.
- Animal collection, poaching.
- Pollution of water and air and waste disposal.
- Regulatory works in the Oder River Valley leading to destruction of protected habitats.
- Expansion of the waterway (Szczecin - Schwedt - Hochenzen Canal).
- Organic and chemical pollution of waters, which are the feeding grounds of the species, especially unfavorable runoff of biogens from agriculturally used areas surrounding the refuge (a high level of biogenic elements may lead to overgrowth of watercourses and water bodies, which will prevent the pond bat from feeding over the water surface and will contribute to changes in the species structure of entomofauna preferred by the species).
- Improperly performed regulatory works in the Oder River Valley leading to changes or destruction of the pond bat habitat.

In accordance with Article 33(1) of the Act of April 16, 2004 on Nature Conservation, it is prohibited to undertake actions which, separately or in combination with other actions, may have a significant negative impact on the conservation objectives of Natura 2000 site, including in particular it may:

- deteriorate the condition of natural habitats or habitats of species of plants and animals for which the Natura 2000 site was designated;
- negatively affect the species for the protection of which the Natura 2000 site was designated;
- deteriorate the integrity of the Natura 2000 site or its connections with other areas.

It should be emphasized that the prohibitions do not apply only to areas within the boundaries of Natura 2000 sites, but they also refer to actions taken outside the boundaries of the Natura 2000 sites.

If there are necessary requirements of an overriding public interest, including those of a social or economic nature, and in the absence of alternative solutions, it is possible to carry out projects which may have a negative impact on natural habitats as well as plant and animal species for the protection of which the Natura 2000 site was designated, after consent granted by relevant authorities and following appropriate requirements and

criteria specified in the Act on Nature Conservation.

5. Proposed areas for legal protection

The proposed forms of nature protection were established on the basis of the environmental valuation of the Widuchowa municipality. It should be noted that despite the fact that new forms of nature protection were proposed 4 years ago, they have not been established to date. If established, all potentially implemented prohibitions will apply only within the boundaries of the proposed forms of nature conservation.

The proposed forms of nature protection proposed 12 years ago in the environmental survey of the Banie municipality were also analyzed (in case of discrepancies between both surveys, the more recent survey of the Widuchowa municipality was used).

Within the area of the planned wind farm there is a local nature conservation site proposed to be established, in the environmental survey of the Widuchowa municipality – “Oczko Żarczyńskie”. Also at a distance of:

- approx. 100 m from one of the wind turbine there is the protected landscape area proposed to be established – Wetlands (however, the majority of the area of the wind turbine is located over 1 km away)
- approx. 200 m from one of the wind turbine there is the landscape-nature complex proposed to be established – “Widuchowskie bagna” (however, the majority of the area of the wind turbine is located over 1 km away))
- approx. 2 km away there is the local nature conservation site proposed to be established – “Bagna pod Żelechowem”.

In the neighboring Banie Municipality, 12 years ago it was proposed to establish:

- Of the „Las Baniewicki” nature reserve.
- Landscape-nature complex “Las Baniewicki”

Both forms of nature protection proposed in 1998 were part of the Las Baniewicki Natura 2000 site, which was characterized in the previous chapter of the report. In the following chapter of the report, the impact assessment was made for the “Las Baniewicki” Natura 2000 site, assuming that the assessment remains valid for the proposed nature reserve and the proposed landscape-nature complex.

In Banie Municipality it was proposed in 1998 to establish several dozen of local nature conservation sites (as many as 68). These mostly included small wetland depressions. At the boundary with Widuchowa municipality, there are two such objects.

Proposed local nature conservation site "Oczko Żarczyńskie"

The purpose of establishing the local nature conservation site is to protect wetland, a breeding ground for amphibians and birds. According to the environmental survey of Widuchowa municipality it is a breeding place of amphibians: European fire-bellied toad, common frog, pool frog, grass frog and birds: red-necked grebe, bittern, grayleg goose, gadwall, duckhead, great reed warbler.

A threat to the site is a change in water relations.

The survey recommended to leave the area as it is (first of all, not to change the water conditions and not to take wood from the trees around the site).

Proposed protected landscape area — Wetlands

According to the Act on Nature Conservation, the protected landscape area includes areas includes the areas protected because of a distinguishable landscape with various ecosystems, valuable due to its capability of meeting the needs of tourism and recreation or having the function of a wildlife corridor.

According to the environmental survey of the Widuchowa municipality, the purpose of establishing the protected landscape area should be to protect the landscape (hilly ground moraine forms and fragments of eskers and kemes in a mosaic with peat- and gyttja-lined depressions, often filled with water).

At the same time, the survey included the assessment of values:

- in terms of flora – local,
- in terms of ecosystems – local,
- in terms of spatial layout – local,
- in terms of their role in the landscape – local.

A threat to the area is drying – drainage, location of waste landfills, cutting down trees, liquidation of vegetated ecotones.

The survey recommended to leave the area as it is, prevent drainage and lowering of water levels by blocking drains in ditches.

Proposed landscape-nature complex “Widuchowskie bagna”

The purpose of establishing the complex is to protect a complex of wetlands with an exceptionally rich fauna of amphibians and birds.

According to the environmental survey of the Widuchowa municipality, it is a breeding place for amphibians: smooth newt, European fire-bellied toad, common frog, common toad, pool frog, water, moor and grass frog, reptiles: grass snake, viviparous lizard; birds: bittern, mute swan, cuckoo, wryneck, white stork, white-tailed eagle, great reed warbler, common pochard, common goldeneye, common crane, cuckoo, common merganser, western marsh-harrier, red kite, red-backed goose, grayleg goose, sand martin, European shrike, common grasshopper warbler, bearded reedling.

A threat to the site is a change in water relations.

The survey recommended to leave the area as it is (first of all, not to change the water relations).

The proposed local nature conservation site “Bagna pod Żelechowem”

The purpose of establishing the local nature conservation site is to protect wetlands, a breeding ground for amphibians and birds. According to the environmental survey of Widuchowa municipality it is a breeding place of amphibians: fire-bellied toad, common toad, common frog, pool frog, moor frog, grass frog; birds: red-breasted grebe, red-backed goose, red-backed shrike, feeding grounds of white-tailed eagle.

A threat to the site is a change in water relations.

The survey recommended to leave the area as it is (first of all, not to change the water relations).

6. Description of monuments protected under old monuments law

On the basis of the graphic sheet of the draft local development plan, it was established that within the area of the proposed farm there are zones WII and WIII of archaeological site conservator protection.

The aim of the protection is to comprehensively document the relics of the prehistoric and early medieval settlement space by conducting archaeological rescue research ahead of the process of land development.

The scope of the archaeological rescue research is each time determined by the Voivodeship Heritage Conservation Officer in the permit issued to the investor.

The above mentioned archeological sites are common to the most of Poland territory and are above all of scientific and documentation value, rather than tangible, museum or collection value.

7. Detailed environmental impact assessment of the selected project option

7.1. Construction stage

During the construction stage:

- access roads will be constructed;
- foundations for individual wind turbines will be constructed;
- assembly/technical yards will be constructed;
- individual wind turbines will be located;
- low and medium voltage power cables will be laid;
- telecommunication infrastructure will be laid.

The following equipment is planned to be used during construction:

- mobile cranes;
- car sets – with semi-trailers or trailers;
- box trucks and self-unloading vehicles;
- special vehicles (concrete mixers, excavators, graders, scrapers, road rollers);

The wind turbine structures will be transported to the site by road. This may involve the need to reconstruct the road network (mainly intersections and curves so that vehicles with long trailers can pass). The scale and type of possible alterations to the existing road system will be known when the transport company applies to the relevant road authorities for a transit permit – the road authorities will then determine the detailed route of the transit and how the roads will be adjusted.

Portable sanitary containers (TOI TOI) are planned to be set up for the use by people employed for construction works. Most likely, these containers will be moved as the work progresses (e.g., as one turbine is set up, the toilets will be moved to where the next turbine is being set up). Container service and maintenance will be outsourced to an outside entity (it can be assumed that to a container rental company).

The material and equipment base will be significantly limited (excavators and cranes

may be parked at the site; trucks will most likely drive to the “home” base for the night – the contractor has not yet been selected, so its location is unknown at this stage). The base (site back-up facilities) is planned on arable land at the site of the individual wind turbines (it will be moved to the sites of the individual wind turbines as the works progress). During the construction stage, the farm area will most be guarded, as during the construction of other wind farms there were cases of theft of even already laid cables and devastation of wind turbines (spray painting).

The construction stage will take several months (the construction period is extended by the time needed for the setting of concrete used for the foundations, which can take up to a month). The erection of the structure itself is not time consuming.

7.1.1. Ground surface and soil resources

At the construction stage, soil cover will be locally eliminated as a result of excavations for wind turbine tower foundations. The construction stage will also involve the transformation of near-surface geologic structures.

It is planned that foundations will be laid to a depth of approximately 3 m below the original ground level. It is assumed that the diameter of the foundations may vary from 18 to 20 meters (only after thorough geological research and structural calculations (performed at the stage of preparing the building permit design – after obtaining the decision on environmental conditions) can their target size be determined.

The execution of foundation excavations will require hauling of approximately 750–950 m³ of soil for a single wind turbine, which gives a total volume of approximately 12,000–15,000 m³ of soil for the entire designed wind park. An alternative to hauling may be to spread the excavated soil (or a part thereof) around the wind turbine. In the case under review, this practice is acceptable as there are practically no wetlands in the area.

Soil resources of relatively high quality classes will be permanently lost during construction. Each wind turbine will occupy a maximum area of approximately 255–315 m². It can be concluded that the area of the land occupied by the wind turbine will be the same as the area of the foundation on which the turbine will stand. The total foundation area will be approximately 4,080–5,040 m². In addition, assembly/technical yards, each approximately 1,250 m² in size, will be established during construction. The total area of technical yards and access roads will be approximately 46,000 m².

The temporary transformation of the ground surface and removal of soil cover will be

performed in the areas of cable trenches.

During the construction of the wind park, physical transformation of the soil cover in the vicinity of the immediate wind turbine sites may also occur due to the use of heavy equipment and storage of structural members.

The impacts described above will not have significantly adverse effects on the environment.

7.1.2. Surface water and groundwater

Individual wind turbines will be located outside permanently wet areas – they will stand on arable land. Whereas:

- the location of wind turbines (outside wetlands)
- the relatively shallow foundations (approx. 3 m)
- the relatively short time from excavation to pouring concrete

it is estimated that the works related to the wind turbine foundation will not permanently disturb the water relations in the discussed area.

It is worth noting that the wind turbines will be built on elevations, while the wetlands are in depressions.

The construction of access roads will involve crossing watercourses – drainage ditches. Such a need was identified at 3 sites. Watercourses will be crossed without disturbing their current flow (appropriate culverts will be constructed).

Construction works will not pose a threat to groundwater, including usable aquifers (according to the explanatory notes to the hydrogeological map of

Poland, in the area of location of wind turbines, the main usable aquifer is located at a depth of 50–100 m).

The works will be carried out outside the protection zones of water intakes and Major Groundwater Reservoirs.

7.1.3. Ambient air

The operation of transport and construction equipment will be sources of air pollution. As a guideline, it can be assumed that diesel fuel consumption (at the construction site – disregarding the material delivery routes, which are currently unknown) for the wheel excavator, loader, bulldozer, trucks, concrete mixers and the crane will be

approximately 200 L per day. The duration of the works associated with the construction of one windmill was determined approximately at 6 working days (taking into account the operation of heavy equipment). The total diesel consumption is estimated at 19200 L.

Approximately, the amount of exhaust fumes introduced (at the construction site – disregarding the routes of material transport, which are unknown) will be:

- NO_x – 0.768 Mg;
- PM10 – 0.096 Mg;
- SO₂ – 0.0008 Mg

The above-mentioned amounts of introduced pollutants are low and will not result in a noticeable change in atmospheric pollution in the area of the designed farm. The introduction of pollutants will be spread out over time and space – not all wind turbines will be built at the same time and in the same location.

The transport (of structural members and excavated material from foundations) will cause temporary deterioration of aerosanitary conditions (transport pollutants: exhaust fumes and dust) in the vicinity of the transport routes. It is not possible to accurately estimate of the amount of pollutants introduced during transport into the atmosphere at the construction stage because the exact transport route (e.g., the final destination for disposal of excavated material from foundations) is not currently known. It can be assumed; however, that the deterioration of aerosanitary conditions will be limited territorially and it will be of short duration – limited only to the construction period and it will not affect the general level of air pollution.

7.1.4. Acoustic climate

The source of noise at the construction stage will be mainly construction machinery and equipment, such as the excavator, bulldozer, concrete mixer, lifting equipment and truck transport. The sound power level of example noise sources associated with construction activities is assumed to be:

- excavator, bulldozer: 90–105 dB;
- truck: 85–95 dB.

Although the construction stage is characterized by relatively high emissions of noise to the environment, it should be noted that its duration is relatively short. It can be assessed that the construction stage will not be a factor that could permanently threaten the acoustic environment. For work outside of urbanized areas, noise will not cause any annoyance to people.

Noise emitted to the environment during the construction of the wind farm is not subject to standards determining the permissible noise levels in the environment; however, the investor is obliged to minimize the negative impact of noise on the environment of the residential buildings located in the immediate vicinity of the proposed investment project.

7.1.5. Waste

The construction stage will involve the generation of waste, which must be collected selectively and then managed in accordance with the Act of April 27, 2001 on Waste (Journal of Laws 2001, No. 62, item 628, as amended). The generator of waste resulting from the provision of construction services is the entity that provides the service, unless the contract for the provision of services concluded between the contractor and the investor provides otherwise. As the investor does not hold relevant permits for waste generation, nor does it carry out any activity in the scope of waste recovery or neutralization, the agreements concluded will not contain any provisions stipulating that the investor is the waste producer. In consequence of the foregoing, all formalities related to waste management (including the obligation to obtain relevant decisions and permits), will rest with the entity to which the construction service will be outsourced.

As a result of construction works, the following types of waste may be generated (according to the classification in accordance with the Ordinance of the Minister of Environment of September 27, 2001 on waste catalog, Journal of Laws of 2001, No. 112, item 1206):

No.	Code	Waste type
	15	Packaging wastes; sorbents, wiping cloths, filter materials and protective clothing not included in other groups
	15 01	Packaging waste (including separately collected municipal packaging waste)
1	15 01 01	Paper and cardboard packaging
2	15 01 02	Plastics packaging
3	15 01 03	Wooden packaging
4	15 01 04	Metal packaging
5	15 01 05	Multi-material packaging
6	15 01 06	Mixed packaging waste
	17	Waste from construction, renovation and demolition of civil structures and road infrastructure (including soil and soil from polluted areas)

17 01		Waste construction materials and components, as well as waste elements of road infrastructure (e.g. concrete, bricks, slabs, ceramic elements)
7	17 01 01	Concrete waste and concrete debris from demolitions and renovations
8	17 01 03	Wastes of other ceramics and equipment
9	17 01 07	Mixture of concrete, bricks, tiles and ceramics other than those mentioned in 17 01 06
10	17 01 81	Waste from road alteration and modernization
11	17 01 82	Waste not otherwise specified
17 02		Waste wood, glass and plastics
12	17 02 01	Wood
13	17 02 03	Plastics
17 04		Metallic and metal alloy waste and scrap
14	17 04 05	Iron and steel
15	17 04 11	Cables other than those mentioned in 17 04 10
17 05		Soil and earth (including the soil and earth from polluted areas and dredging spoil)
16	17 05 04	Soil and earth including stones, other than those listed in 17 05 03
17 06		Insulation and construction materials containing asbestos
17	17 06 04	Insulation materials other than those mentioned in 17 06 01 and 17 06 03
17 09		Other construction, overhaul and demolition waste
18	17 09 03*	Other construction, overhaul and demolition waste (including mixed waste) containing hazardous substances
19	17 09 04	Mixed construction and demolition wastes other than those mentioned in 17 09 01, 17 09 02 and 17 09 03

It should be noted that apart from waste 17 05 04 (Soil and stones other than those mentioned in 17 05 03), the amounts of waste generated will be small.

Provided that the rules for environmental protection and separate waste collection and transfer thereof to an authorized entity for recovery or disposal are observed, no negative impact on the environment is forecasted.

It should be noted that in accordance with the Act of April 27, 2001 on waste and the Ordinance of the Minister of the Environment of April 21, 2006 on the list of waste types, which can be transferred by the waste owner to natural persons or organizational units which are not entrepreneurs and on permissible methods of its recovery (Journal of Laws of 2006 No. 75 item 527, as amended), some of the waste listed in the table

may be transferred by the holder of waste to individuals or organizational units which are not entrepreneurs for their own needs.

7.1.6. Flora and fauna

The impact on the biotic environment will be manifested mainly through the local elimination of vegetation cover, represented by agrocenoses and ruderal communities. For one road, a strip of vegetation that is approximately 5 m wide will need to be cleared – elderberry bushes are present at the place.

Cutting down of single trees cannot be excluded (investor initially estimated the necessity of cutting down 3 trees – supplement to the information sheet at the request of the Regional Directorate for Environmental Protection). It will not be possible to determine the final quantity in this area until after the roads have been surveyed. Due to the nature of the site (sparse tree stands), it can be estimated that this quantity will not change significantly. To cut down trees, the investor will have to obtain a separate permit, issued by the head of the municipality.

In addition, the construction activities may cause periodic scaring of local fauna due to noise and increased human presence. This may lead to temporary emigration of some fauna species. The emigration will be temporary and it should be expected that it will occur to neighboring areas. Some species that are easily synanthropized and highly adaptable to changing environmental conditions will be unaffected by the construction stage. It should be pointed out that the scale of the impact in this case will depend on the time of conducting the works – the breeding period of birds is the least favorable. However, it should be emphasized that the conducted annual bird monitoring (Appendix No. 5 to the report) has shown that the area of the planned project does not constitute an above-average habitat for breeding avifauna.

It is assessed that the predicted impacts identified above will be mostly short-term and spatially limited. No significant loss of biodiversity is predicted as a result of construction works. It should be emphasized that the fauna, flora and vegetation sites indicated in the environmental survey of the Widuchowa municipality are located outside the area of the planned works (the sites include wooded or wet areas which are excluded from the project).

7.1.7. Legal forms of nature protection

Characteristics of each area covered by legal protection are presented in Chapter 4 of the report.

Las Baniewicki Natura 2000 site

The “Las Baniewicki” Natura 2000 site is located outside of the planned wind farm area. However, the nearest wind turbine will be only about 200 m from the boundary of the Natura 2000 site, and one of the planned access roads runs along the boundary of the Natura 2000 site.

The most important threats to the Natura 2000 site (according to the Standard Data Form) are largely related to poor forest management.

It should be strongly emphasized that the construction stage does not involve any threats to the Natura 2000 site, as indicated in the standard data form.

During the field works, it was found that the arable field is plowed practically to the very border of the forest.

It has been assessed that the execution of the project will not result in the loss/destruction of valuable natural habitats within the boundaries of the Natura 2000 site. Works related to the construction of the wind farm will be carried out outside this Natura 2000 site – they will be carried out on agricultural land, characterized by low natural values. Earlier in the report it was indicated that the impact associated with the construction of the wind farm will be spatially limited – no change in habitat conditions in adjacent areas is predicted, in particular:

- no physical destruction of habitats of natural value is expected – the wind turbines (and the accompanying infrastructure) will be built on agricultural land; valuable habitats within the Natura 2000 site are associated with forest areas, while the wind turbines will be built on arable land;
- no indirect impact on neighboring habitats is expected – first of all, there will be no change in groundwater relations, which, to a large extent determine the functioning of habitats within the boundaries of the Natura 2000 site;
- no indirect impact on neighboring habitats valuable from the point of view of nature is expected – the construction of the wind park is not associated with the introduction into the environment of substances that could contaminate the areas within the boundaries of the Natura 2000 site (primarily substances that pose a threat to the aquatic and groundwater environment).

The assessment of the impact on particular habitat types, for which the Las Baniewicki Natura 2000 site was designated, shows that a significantly negative impact on this area related to the construction stage can be ruled out – in particular it can be ruled out that the construction of the project will:

- deteriorate the condition of natural habitats or habitats of species of plants and animals for which the Natura 2000 site was designated;
- deteriorate the integrity of the Natura 2000 site or its connections with other areas.

Other area legal forms of nature protection

Due to the significant distance (minimum 3 km) of the works being conducted from:

- “Dolina Dolnej Odry” Natura 2000 site (SPA)
- “Dolna Odra” Natura 2000 site (SAC)

and the spatially limited impact associated with the construction stage, any negative impact on these area-related legal forms of nature protection can be ruled out. In particular, the risk of direct or indirect destruction of natural habitats should be excluded.

It should be emphasized that the wind turbines and access roads will be located on agricultural land and the construction works will cause neither direct nor indirect damage to natural habitats located outside the construction site.

7.1.8. Proposed legal forms of nature protection

Characteristics of each area proposed for legal protection are presented in Chapter 5 of the report.

It should be noted that despite the fact that new forms of nature protection were proposed 4 years ago, they have not been established to date. If established, all potentially implemented prohibitions will apply only within the boundaries of the proposed forms of nature conservation.

Proposed local nature conservation site "Oczko Żarczyńskie"

Wind turbines will be located outside of the boundaries of the proposed local nature conservation site (the nearest two turbines will be located at a distance of about 200 m from the boundaries of the area, however, most of the turbines will be located at a much greater distance – more than several hundred meters). One of the access roads will cross the eastern boundary of the local nature conservation site (along a section of approximately 2–4 m). Additionally one of the roads (for a distance of approx. 300 m) will run along the boundaries of the proposed local nature conservation site.

Running the road across the eastern border of the proposed local nature conservation site will require removal of a strip of vegetation that is approx. 5 m wide – there are

elderberry bushes and one oak tree there (it has not been decided yet whether it is necessary to cut down the oak tree – the decision in this respect will be made after the road is surveyed). However, this area is not permanently wet, and the construction of the road will not involve a change in subsurface conditions in the remaining area of the local nature conservation site.

It has been assessed that the execution of the project will not involve any loss/destruction of valuable natural habitats within the boundaries of the proposed local nature conservation site. All works (except for road construction on the section of approx. 2–4 m) associated with the construction of the wind farm will be conducted outside the boundaries of the proposed local nature conservation site – the works will be conducted on agricultural land (arable land), characterized by low natural values. Earlier in the report it was indicated that the impact associated with the construction of the wind farm will be spatially limited – no change in habitat conditions in adjacent areas is predicted, in particular:

- no physical destruction of habitats of high natural value is expected – the wind turbines plants (and the accompanying infrastructure) will be built outside wetlands, wooded and forested areas;
- no indirect impact on neighboring habitats is expected – first of all, there will be no change in groundwater relations, which determine the functioning of habitats within the boundaries of the proposed local nature conservation site;
- no indirect impact on neighboring habitats of high natural value is forecast – the construction of the wind park does not involve introduction of substances into the environment, which could contaminate areas within the borders of the proposed local nature conservation site (mainly substances that pose a threat to the aquatic and groundwater environment).

Wetlands protected landscape area proposed for establishment

The protected landscape area proposed for establishment is outside of the boundaries of the proposed wind farm. However, the nearest wind turbine will be located approx. 100 m from the boundaries of the proposed protected landscape area. However, it should be noted that further wind turbines are located approximately 400 m away, and by far the majority of the wind turbines will be located more than 1 km from the boundary of the proposed protected landscape area.

A threat to the area is drying (drainage), location of waste landfills, cutting down trees, liquidation of vegetated ecotones. The environmental survey of the Widuchowa municipality recommended to leave the area as it is, prevent drainage and lowering of water levels by blocking drains in ditches.

It has been assessed that the execution of the project will not involve any loss/destruction of valuable natural habitats within the boundaries of the proposed protected landscape area. All works related to the construction of the wind farm, will be carried out outside the boundaries of the proposed protected landscape area – the works will be carried out on agricultural land (arable land), characterized by low natural values. Earlier in the report it was indicated that the impact associated with the construction of the wind farm will be spatially limited – no change in habitat conditions in adjacent areas is predicted, in particular:

- no physical destruction of habitats of natural value is expected – the wind turbines (and the accompanying infrastructure) will be built on agricultural land; valuable habitats within the boundaries of the proposed protected landscape area are associated with wetlands (mainly local nature conservation sites), while the wind turbines will be built on arable land;
- no indirect impact on neighboring habitats is predicted – first of all, there will be no change in groundwater relations, which determine the functioning of natural habitats within the proposed protected landscape area;
- no indirect impact on neighboring habitats valuable from the point of view of nature is expected – the construction of the wind park is not associated with the introduction into the environment of substances that could contaminate the areas within the boundaries of the proposed local protected landscape area (primarily substances that pose a threat to the aquatic and groundwater environment).

It should also be emphasized that the ecological barrier (indicated in the environmental survey of the Widuchowa municipality) separating the wind park from the proposed protected landscape area is the paved road Wilcze–Żelechowo. This barrier affects mainly amphibians. In the case of birds, the areas in the immediate vicinity can be considered less attractive than the areas further inland.

Proposed landscape-nature complex "Widuchowskie bagna"

The landscape-nature complex proposed for establishment is located outside of the boundaries of the proposed wind farm. However, the nearest 2 wind turbines will be approximately 200–300 m from the boundaries of the proposed complex. However, it should be noted that further wind turbines are located approximately 500 m away, and by far the majority of the wind turbines will be located more than 1 km from the boundary of the proposed landscape-nature complex.

A threat to the site is a change in water relations. In the environmental valuation of the Widuchowa Municipality it was recommended to leave the area in its present state (first of all, not to change the water relations).

It has been assessed that the execution of the project will not involve any loss/destruction of valuable natural habitats within the boundaries of the proposed protected landscape area. All works related to the construction of the wind farm, will be carried out outside the boundaries of the proposed complex – the works will be carried out on agricultural land (arable land), characterized by low natural values. Earlier in the report it was indicated that the impact associated with the construction of the wind farm will be spatially limited – no change in habitat conditions in adjacent areas is predicted, in particular:

- no physical destruction of habitats of natural value is expected – the wind turbines (and the accompanying infrastructure) will be built on agricultural land; valuable habitats within the boundaries of landscape-nature complex are associated with wetlands (mainly local nature conservation sites), while the wind turbines will be built on arable land;
- no indirect impact on neighboring habitats is predicted – first of all, there will be no change in soil and water relations, which determine the functioning of natural habitats within the proposed landscape-nature complex;
- no indirect impact on neighboring habitats valuable from the point of view of nature is expected – the construction of the wind park is not associated with the introduction into the environment of substances that could contaminate the areas within the boundaries of the proposed landscape-nature complex (primarily substances that pose a threat to the aquatic and groundwater environment).

It should also be emphasized that the ecological barrier (indicated in the environmental survey of the Widuchowa municipality) separating the wind park from the proposed complex is the paved road Wilcze–Żelechowo. This barrier affects mainly amphibians. In the case of birds, the areas in the immediate vicinity can be considered less attractive than the areas further inland.

The proposed local nature conservation site “Bagna pod Żelechowem” The proposed local nature conservation site is located approximately 2 km from the nearest wind turbine.

A threat to the site is a change in water relations. In the environmental valuation of the Widuchowa Municipality it was recommended to leave the area in its present state (first of all, not to change the water relations).

It has been assessed that the execution of the project will not involve any loss/destruction of valuable natural habitats within the boundaries of the proposed local nature

conservation site. All works related to the construction of the wind farm, will be carried out outside the boundaries of the proposed local nature conservation site – the nearest works will be carried out at a distance of approx. 2 km – on agricultural land (arable land), characterized by low natural values. Earlier in the report it was indicated that the impact associated with the construction of the wind farm will be spatially limited – no change in habitat conditions in adjacent areas (let alone those located approximately 2 km away) is predicted, in particular:

- physical destruction of valuable habitats is not expected – the wind turbine (and accompanying infrastructure) will be constructed on agricultural land; valuable habitats within the boundaries of the local nature conservation site are associated with wetlands;
- no indirect impact on neighboring habitats is expected – first of all, there will be no change in groundwater relations, which determine the functioning of habitats within the boundaries of the proposed local nature conservation site;
- no indirect impact on neighboring habitats valuable from the point of view of nature is expected – the construction of the wind park is not associated with the introduction into the environment of substances that could contaminate the areas within the boundaries of the proposed local nature conservation site (primarily substances that pose a threat to the aquatic and groundwater environment).

Local nature conservation sites in Banie Municipality

The local nature conservation sites proposed for establishment are located in the neighboring municipality and two of them are approximately 300–500 m from the nearest wind turbine. One of the roads will run approximately 200 m from the proposed site.

A threat to these sites is a change in water relations.

It has been assessed that the execution of the project will not involve any loss/destruction of valuable natural habitats within the boundaries of the proposed local nature conservation sites. All works related to the construction of the wind farm, will be carried out outside the boundaries of the proposed local nature conservation sites – the nearest works will be carried out at a distance of approx. 200 m – on agricultural land (arable land), characterized by low natural values. Earlier in the report it was indicated that the impact associated with the construction of the wind farm will be spatially limited – no change in habitat conditions in adjacent areas is predicted, in particular:

- physical destruction of valuable habitats is not expected – the wind turbine (and accompanying infrastructure) will be constructed on agricultural land; valuable

habitats within the boundaries of the local nature conservation sites are associated with wetlands;

- no indirect impact on neighboring habitats is expected – first of all, there will be no change in groundwater relations, which determine the functioning of habitats within the boundaries of the proposed local nature conservation site in the Banie municipality;
- no indirect impact on neighboring habitats valuable from the point of view of nature is expected – the construction of the wind park is not associated with the introduction into the environment of substances that could contaminate the areas within the boundaries of the proposed local nature conservation sites in the Banie municipality (primarily substances that pose a threat to the aquatic and groundwater environment).

7.1.9. Human health

The number of people employed on construction will vary – depending on the stage of construction. It is anticipated that the following number of people will be employed during the various stages of the project:

- construction of access roads – approx. 10 people;
- foundation construction – approx. 10 people;
- turbine erection – approx. 15 people;
- electrical work – approx. 5 people;

The hazard posed to people employed will be primarily accidental – difficult or even impossible to predict. However, with strict adherence to health and safety regulations, accident hazards will practically be reduced to a minimum and will not be significant.

At the construction stage the following factors may occur to affect the health of the bystanders (mainly residents of the surrounding municipalities):

- traffic noise and noise from the operation of construction equipment;
- emissions of transport pollutants (exhaust fumes, dust from roads) and pollutants associated with the operation of construction equipment;
- accident hazards (mainly traffic related);

Impacts to bystander health will be limited spatially (primarily to the roadway environment) and temporally (to the duration of the works).

Periodic environmental nuisances associated with the investment process are not subject to standardization in environmental regulations.

It is assessed that the construction stage does not pose any above-average risk to human health and life. Its nuisance is greatly reduced.

7.1.10. Cultural and tangible assets

On the basis of the graphic sheet of the draft local development plan, it was established that within the area of the designed wind farm there are zones WII and WIII subject to archaeological site conservator protection.

The aim of the protection is to comprehensively document the relics of the prehistoric and early medieval settlement space by conducting archaeological rescue research ahead of the process of land development. The scope of the archaeological rescue research is each time determined by the Voivodeship Heritage Conservation Officer in the permit issued to the investor. If the applicable regulations and conditions specified in the relevant permits are observed, accidental negative impacts on protected sites are excluded.

It should be mentioned that the aforementioned archeological sites are common to the most of Poland territory and are above all of scientific and documentation value, rather than tangible, museum or collection value.

No significant (permanent) impact to tangible property is expected to occur during the construction phase. Due to the construction of the wind turbine complex, no demolition of existing buildings in the vicinity is expected.

Any works related to temporary reconstruction of the road system required to transport the structures will be carried out at the investor's expense. The scale of the works cannot be detailed at this stage as the transport route is not known – this will be determined by the road managers. The works will most likely involve properly contouring curves and intersections so that vehicles with long trailers can pass freely. Once the structures have been transported, the road system will be restored to its previous condition at the investor's expense (unless otherwise permitted by the road manager).

7.2. Operation stage

During the operation stage of the project, electricity will be generated (kinetic energy of the wind will be initially converted into mechanical energy and then into electrical energy according to the scheme presented in chapter

2.1. “Basic data on the project”). The current generated in the generator will be transmitted through a transformer, placed in each tower, to the medium voltage grid

connecting the wind farm with the substation (located outside the wind farm). The investor estimates the production of electricity at approx. 96,000 MWh per year.

During the operation period, it will be necessary to maintain the wind park. During the maintenance service the technical condition of the equipment will be checked and gear and hydraulic oils will be replaced. All service works will be performed by properly trained personnel, in favorable weather conditions (especially oil changes will not be performed during rainfall).

The operation of the devices will be constantly supervised remotely – the transmission of data and signals will take place via the ISDN connection and a web browser.

With little or no wind, wind turbines use electricity to power their internal systems. A single turbine requires no more than 4.5 kW of capacity. However, in a month the amount of energy consumed can reach in extreme cases approx. 400 kWh (generally approx. 200 kWh). This is a relatively small amount of energy that has no practical significance from an environmental perspective.

Access roads to the turbine are planned as internal roads – not intended for general access. Therefore, they will be appropriately marked or secured with a rising arm barrier.

7.2.1. Ground surface and soil resources

During correct operation of the wind turbine complex, there will be no impact on the ground surface and on soil resources which could result in negative effects in the environment.

7.2.2. Surface water and groundwater

During the operation stage of the wind turbines and the accompanying infrastructure, there will be a local reduction in the infiltration of rainwater and meltwater into the ground. Storm and thaw water will run off the surface of the wind turbine foundations and soak into the ground in their immediate vicinity. Therefore, impacts on groundwater (e.g., lowering of the groundwater table) should not be predicted.

During their proper operation, wind turbines will not impact surface waters to any degree.

7.2.3. Ambient air

The operation of the wind turbines and their accompanying infrastructure will not involve any emission of gases, dust or odors into the atmospheric air.

Wind turbines are environmentally friendly devices in terms of air pollution – they reduce the emission of gaseous and particulate pollutants into the atmosphere in the power sector.

Annual energy production is estimated to be approximately 96,000 MWh. Producing such a volume of electricity with conventional methods (in a power plant) involves the emission of pollutants in following amounts:

- SO₂ emissions (installation without flue gas desulphurization): 459.4 tons
- NO₂ emissions: 169.1 tons
- CO₂ emissions: 96,574.6 tons
- dust emissions: 25.6 tons
- captured ash: 5,619.3 tons
- slag: 1,490 tons

7.2.4. Acoustic climate

Noise assessment criteria

The permissible environmental noise levels generated by different groups of noise sources, expressed as the indicators $L_{Aeq D}$ and $L_{Aeq N}$, are given in Table 1 of the Annex to the Ordinance of the Minister of Environment of June 14, 2007 on permissible environmental noise levels (Journal of Laws No. 120, item 826). Indicators $L_{Aeq D}$ and $L_{Aeq N}$ are applied in determining and monitoring the conditions for the use of the environment in relation to one day.

For noise emitted by plants, the indicator $L_{Aeq D}$ refers to a reference period equal to 8 consecutive least favorable hours of the day, and $L_{Aeq N}$ refers to a reference period equal to 1 least favorable hour of the night.

The limit values depend on the urban function of a given area. They have been divided into 4 classes. The lowest levels are set for areas requiring intensive noise abatement and the highest levels are set for areas where noise abatement is not a critical issue. The adopted basis for the categorization of land – its urban function – clearly indicates the close relationship between protection of environment from noise and spatial development.

In light of the above ordinance, acoustically protected sites include residential areas. No environmental noise normative values are provided for agricultural land as well as production and service areas.

The permissible environmental noise levels generated by plants are shown in the Table

below.

No.	Type of area	Permissible noise level in dB			
		Roads or railway lines		Other structures and activities being the noise source	
		$L_{Aeq D}$ reference time interval equal to 16 hours	$L_{Aeq N}$ reference time interval equal to 8 hours	$L_{Aeq D}$ reference time interval equal to 8 least favorable consecutive hours during the day	$L_{Aeq N}$ reference period equal to 1 least favorable hour in the night
1	a. Protection zone "A" - health resorts	50	45	45	40
2	a. Single-family residential areas b. Residential areas associated with the permanent or temporary presence of children and youth c. Grounds of social care centers d. Hospital grounds within urban areas	55	50	50	40
3	a. Multi-family and collective occupancy housing areas b. Farmstead areas c. Recreation and leisure areas d. Housing and services areas	60	50	55	45
4	Areas in the downtown zone of cities with the population above 100	65	55	55	45

There are no applicable local spatial plans for the area of the proposed wind farm and neighboring villages.

The wind turbines will be located in the vicinity of villages where there is, among others, farmsteads, single-family residential development, and residential and commercial development. Determinations in this regard were made on the basis of maps, aerial photographs, and field visits.

According to points 3b and 3d of the table above, the permissible equivalent sound level A of the noise generated by plants in the areas of farmsteads and residential and service development, expressed as the equivalent sound level A in dB, should not exceed the following values:

- $L_{Aeq D} = 55$ dB for day time,
- $L_{Aeq N} = 45$ dB for night time.

According to point 2a of the table above, the permissible equivalent sound level A of the noise generated by plants in the areas of single-family residential development, expressed as the equivalent sound level A in dB, should not exceed the following values:

- $L_{Aeq D} = 50$ dB for day time,
- $L_{Aeq N} = 40$ dB for night time.

In the practice of application of solutions arising from the Environmental Protection Law in the field of environmental protection against noise, the most practical doubts arise as to the correct determination of the area taken into account when determining the noise intensity in the absence of a local development plan. This is the situation we are dealing with in the case of the farm under assessment. The areas of Żarczyn and Żelechowo (including the adjacent areas) are not included in the local development plan. It seems that the simplest criterion for determining the extent of the site analyzed in a particular case will be to determine the impact range of the project being the source of noise emissions (Commentary to Article 115 of the Environmental Protection Law Act, [in:] Gruszecki K., *Prawo ochrony środowiska [Environmental Protection Law]. Commentary*, LEX, 2008, 2nd ed.). The 40 dB noise isoline was assumed to be the maximum impact range of the project – this is the most restrictive value specified in the currently applicable regulations. To determine the actual noise limit within the project's impact range, existing land uses in the area between the noise source and the 40 dB isoline were analyzed. The criterion used here was the actual land development and use, as well as the use of adjacent land. This analysis showed that there are arable fields immediately surrounding the wind turbine for which permissible environmental noise levels have not been set. On the other hand, in acoustically protected areas (such areas occur in principle between 45 and 40 dB isoline) there is a predominance of farmsteads (e.g. a large former state farm in Żarczyn village and scattered farmsteads apart from the compact development of the villages of Żarczyn and Żelechowo). As a result of the analysis carried out in this report, it has been assumed that the permissible noise level in acoustically protected areas cannot exceed 55 dB during daytime and 45 dB at night.

The classification of sites made in this report is a proposal of the report author. Under current law, a “binding” qualification can only be made by the administrative body conducting the procedure.

Calculation of sound level A in the environment

Reduction of noise emission to the environment

The sources of noise emissions to the environment during wind turbine operation are:

- noise induced by rotor operation;

- aerodynamic noise, associated with the flow of air masses over the edge of the windmill propellers.

The main source of noise emitted by a wind turbine is the rotor blades, which must overcome the drag force as they rotate. The genesis of its formation is related to the vibration of the edges of windmill propellers in connection with the flow of air masses. The energy conversion system (rotor, gearbox, generator) also contributes to the generation of annoying noise.

The wind turbine sound power level, due to the significant contribution of aerodynamic noise, is closely related to the wind speed at which the wind turbine operates.

In the area of the farm, in the option requested by the investor, the construction of 16 wind turbines is designed. The maximum sound power level of one wind turbine can be up to 106 dB (at the least favorable wind speeds). It will be possible to adjust (lower) the sound power level by appropriately adjusting the blade angle of attack to the wind direction. Thus it will be possible to reduce the sound power level of the equipment at the expense of energy production.

For the purposes of this report, it was assumed, among other things, that each wind turbine operates continuously at its nominal capacity, which in practice does not happen. Such an assumption requires the occurrence of least-favorable wind speeds throughout the reference period.

The noise that is generated in a protected area as a result of a wind turbine is referred to as noise immission. The size of the immission is determined, in principle, by the equivalent sound level A and in special cases by the maximum sound level A. All phenomena occurring between emission (noise source) and immission (receiver) are referred to as propagation.

$$EMISSION + PROPAGATION = IMMISSION$$

We understand the term propagation as factors that affect the reduction or increase of the sound level A of noise in the immission area as a result of a sound wave propagation. These requirements include:

- distance between the noise source and the immission point;
- shielding of sound waves by natural and artificial obstacles;
- reflections and deflections of the sound wave on obstacles;

- sound attenuation by dense greenery, air and ground.

In the case of a wind turbine, the main factor affecting sound propagation is the distance between the turbine rotor and the immission point in the protected area.

Methods for calculating immission levels of noise in the environment

The substantive background for performing the noise propagation forecast from the study area is *PN-ISO 9613-2 Acoustics. Attenuation of sound during propagation outdoors. General computational method*. In accordance with Appendix No. 6 to the Ordinance of the Minister of Environment of November 4, 2008 *on the requirements for performing measurements of emissions and measurements of the amount of water consumed* (Journal of Laws No. 206, item 1291), noise calculation methods must be based on the model of noise propagation in the environment contained in *PN-ISO 9613-2* standard. The basic source data for the calculation of sound levels based on the above model, described in *PN-ISO 9613-2*, are sound powers of noise sources (plants and equipment).

The calculations of sound immission levels in the environment during the operation of designed wind turbines were performed on the basis of LEQ Professional ver. 6.x. The calculation model adopted in the program complies with *PN-ISO 9613-2*.

Wind turbines can be treated as a point source of sound, that is, one for which each linear dimension is less than half the distance between the geometric center of the source and the nearest point of observation. The second assumption of the model is that the turbine emits acoustic energy uniformly in all directions.

The parameter characterizing a point source of sound is the equivalent sound power level, $L_{WA,T}$, expressed in dB, determined on the basis of measurements, which in the case of the designed farm is 106 dB for a single wind turbine.

The main factor affecting the propagation of the sound wave on the path between the source and the observation point is sound absorption by the air, which is of practical importance for distances greater than 200 m. The adopted calculation model includes an adjustment for sound absorption in the air as well as other adjustments for the presence of greenery or sound attenuation by the ground. In the case under analysis, the soil factor $G=1.00$ was assumed, which is characteristic for the areas occurring in the vicinity of the designed wind turbines (porous soil, grass, fields).

Results of acoustic calculations

The results of the noise level calculations are shown graphically in the figure attached as Appendix No. 6 to the report. Calculations were performed at an altitude of 4 m above

sea level. In the figure, the projected acoustic impact range of the designed wind turbines is shown using isolines of 40, 45, and 50 dB.

As can be seen from the calculations presented in the figure, both during the day and night, the permissible noise level will not exceed the permissible values specified for the areas of farmsteads. On the edge of the housing development of Żarczyn village the noise level will reach just under 42 dB.

It should also be noted that the noise immission standards will apply to the investor regardless of the choice of turbines. This means that no matter how “noisy” the wind turbine are, the investor will have to comply with the applicable environmental noise levels by controlling the operation of the wind turbines in an appropriate manner.

7.2.5. Electromagnetic field

Introduction to the electromagnetic field theory

The electromagnetic field is a particular form of energy, composed of two inextricably linked components – an electric field and a magnetic field. The electromagnetic field is distinguished by its continuity of distribution in space, its ability to propagate in a vacuum, and its exertion of force on charged particles of matter.

The basic quantities that characterize the electromagnetic field include:

- f – field frequency [Hz];
- E – intensity of the electric component [V/m];
- H – intensity of the magnetic component [A/m].

The sources of electromagnetic field, occurring in the environment, can be divided into two types:

- natural (natural radiation from the Earth, Sun and ionosphere);
- artificial (electrical equipment, radio and television broadcasting stations, cell phone base stations, radiolocation equipment, radio navigation equipment).

Of particular interest, due to their universality, are artificial sources of 50 Hz electromagnetic field, mainly electrical devices. The specific nature of the electromagnetic field generated by such devices means that its electrical and magnetic components can be considered separately. A magnetic field accompanies every current flow, and an electric field occurs wherever there is an electric voltage.

Permissible values for physical parameters of electromagnetic fields in the environment

The permissible values for physical parameters of electromagnetic fields are defined in

the Ordinance of the Minister of Environment of October 30, 2003 on admissible electromagnetic field levels in the environment and examination methods for maintaining these levels (Journal of Laws No. 192., item 1883).

This Ordinance differentiates permissible levels of electromagnetic fields for:

- areas designated for residential development;
- places that are accessible to the public (such areas include all agricultural and field crops areas – people can stay in these areas, do field works, locate facilities for business purposes, etc.).

In residential development areas, the 50 Hz electric field strength cannot exceed 1 kV/m, and the magnetic field strength cannot exceed 60 A/m.

In areas accessible to the public, the 50 Hz electric field strength cannot exceed 10 kV/m and the magnetic field strength cannot exceed 60 A/m.

Protection of people against electromagnetic fields

The protection of people and the environment against radiation of electromagnetic fields with a frequency of 50 Hz, generated by power substations and high voltage lines, is based on the designation of protection zones around these structures.

In the case of the magnetic component, the magnetic field strength cannot exceed 60 A/m for both residential areas and areas where people are temporarily allowed to stay.

There are two protection zones for the electrical component:

- first level protection zone – it includes areas where the electric field strength exceeds 10 kV/m. It is forbidden for people to stay in this zone. This zone occurs only very close to high voltage components. Practically, only power sector workers performing works in the area inside the Main Power Supply Point, directly at the sources of radiation, can be in this zone;
- second level protection zone – it includes areas where the electric field strength is between 1 and 10 kV/m. People are allowed to temporarily stay in this zone. However, residential buildings, schools, hospitals, etc. cannot be located in this zone. For example, workshops, farm fields, etc. may be located in this zone.

Staying in areas where the electric field does not exceed 1 kV/m and the magnetic field does not exceed 60 A/m is not subject to any restrictions.

Further in the report the area where $E > 10 \text{ kV/m}$ or $H > 60 \text{ A/m}$ will be treated as level 1 zone, while the area where $1.0 \text{ kV/m} < E < 10.0 \text{ kV/m}$ and $H < 60 \text{ A/m}$ will be treated as level 2 zone.

Impact of the Main Power Supply Point

According to the information provided by the investor, the Main Power Supply Point will not be located within the area of wind turbines – it will be located outside the wind farm area.

It should be stressed that for properly built (in accordance with applicable regulations) substations (Main Power Supply Points), only areas inside the substation are classified as the 1st level protection zone. Outside, beyond the substation fence, in practice there is not even a level 2 protection zone.

The above statement is confirmed by research conducted in recent years, among others by Voivodship Inspectorates of Environmental Protection.

It is worth citing here the results of research conducted by the Voivodship Inspectorate of Environmental Protection, published in the work of the Chief Inspectorate for Environmental Protection “Electromagnetic fields in the environment – description of sources and research results” (2007). The study indicated that “*Higher magnetic field intensity levels are primarily applicable to measurements around sources of strong magnetic field, which include power lines and substations rated 110 kV and above. The highest value of the magnetic field strength*

27.5 A/m, (which corresponds to 45.8% of the permissible standards defined for places accessible to the public) was measured in 2005 by the laboratory of the Mazovian Voivodeship Inspectorate of Environmental Protection for the power line with a rated voltage of 400 kV, Miłosna–Płock traction.

In 2006, the highest value of magnetic field strength 12.9 A/m (21.5% of the permissible standards for places accessible to the public), was obtained for high-voltage 220 V and 110 kV traction...

...The highest measured value of electric field strength in 2005 was 5.03 kV/m (50.3% of the permissible standards for places accessible to the public), and in 2006 it was 4.85 kV/m (48.5% of the permissible standards for places accessible to the public). Both measured highest values of electric field strength were obtained by the Lublin WIOŚ laboratory for the 400 kV power line”.

Impact of the designed wind turbines

Analyses, simulations and measurements carried out in Poland and globally have shown that high-voltage transformer stations along with overhead line outlets are the only components of wind turbine complexes capable of generating field levels that are significant from the point of view of environmental protection.

The main electromagnetic field sources directly associated with a wind turbine are the wind turbine generator and the output transformer. All these components of the wind turbine operate with low voltage up to 690 V. Medium voltage, which is transferred to the cable network, is present only at the transformer output.

Medium-voltage cable networks generate electromagnetic fields whose level is low enough not to pose any threat to the environment (only high-voltage lines above 110 kV are capable of generating electromagnetic fields with levels that may violate electromagnetic climate quality standards). For typical medium-voltage lines, electric field intensity levels reach up to 0.6 kV/m. However, the typical magnetic field intensity does not exceed 5 A/m.

7.2.6. Waste

In fact, the only materials that wear out during the operation of the equipment and require replacement during servicing will be gear oils and hydraulic oils. According to the classification in compliance with the Ordinance of the Minister of Environment of September 27, 2001 on waste catalog (Journal of Laws of 2001, No. 112, item 1206), gear oils are classified as waste with the following code:

No.	Code	Waste type
	13	Waste oils and liquid fuel waste (except for edible oils and groups 05, 12, and 19)
	13 01	Waste hydraulic oils
1	13 01 10*	Mineral-based non-chlorinated hydraulic oils
	13 02	Waste engine, gear and lubricating oils
2	13 02 05*	Mineral-based non-chlorinated engine, gear and lubricating oils

* means hazardous waste

A single wind turbine usually contains approx. 360 L (i.e. about 315 kg) of gear oil and approx. 300 L (i.e. 265 kg) of hydraulic oil.

The gear oil shall be replaced depending on the results of the inspection conducted

(replacement intervals depend on the intensity of the turbine operation).

Hydraulic oil shall be replaced on average once every 5 years (depending on the intensity of the turbine operation).

The wind farm operator will outsource the gear oil change service to an external entity with appropriate permits and technical back-up facilities.

According to the Act of 27 April 2001 on waste (consolidated text: (Journal of Laws of 2007, No. 39, item 251), the producer of waste generated as a result of the provision of maintenance and repair services shall be an entity rendering such a service, unless the service agreement provides otherwise. As the investor does not hold relevant permits for waste generation, nor does it carry out any activity in the scope of recovery or neutralization of hazardous waste, the agreements concluded will not contain any provisions stipulating that the investor is the waste producer. In consequence of the foregoing, all formalities related to the management of hazardous waste (including the obligation to obtain relevant decisions and permits), will rest with the entity to which the oil replacement service will be outsourced.

7.2.7. Flora and fauna

At the stage of operation of the wind turbine complex, there will be no negative impact on vegetation.

Due to the nature of the planned project, the potential impact on birds and bats is of the greatest significance. The assessment of impacts on these groups of animals is crucial in issuing the project approval, and in this report, it was performed on the basis of annual monitoring studies.

7.2.7.1 Birds

Annual bird monitoring was conducted in the area of the proposed wind farm from April 20, 2009 to April 19, 2010. The monitoring was conducted by the Nature Conservation Office in Szczecin.

Based on monitoring data, the impact of the planned project on avifauna was assessed.

The results of the annual bird monitoring, as well as the impact assessment for this group of animals, are presented in Appendix 5 to the report.

After taking into account the recommendations of the above mentioned study – abandonment of one wind turbine located to the north-east of the Żelechowo farm, and

application of minimizing measures (change of crop structure: abandonment of maize in favor of less attractive forage crops: cereals, oilseed rape, root crops, or strict adherence to the obligation to remove crop residues and plough stubble fields immediately after harvest) no significant negative impact on avifauna is expected.

7.2.7.2 Bats

Annual bat monitoring was conducted in the area of the proposed wind farm from April 20, 2009 to April 19, 2010. The monitoring was conducted by the Nature Conservation Office in Szczecin.

Based on monitoring data, the impact of the planned project on chiropterofauna was assessed.

The results of the annual bat monitoring, as well as the impact assessment for this group of animals, are presented in Appendix 5 to the report.

After taking into account the recommendations of the above mentioned study – abandonment of one wind turbine located to the north-east of Żelechowo farm and relocation of one turbine – no significant negative impact on this group of animals is expected.

7.2.8. Legal forms of nature protection

The characteristics of each area are presented in chapter 4. “Legal forms of nature conservation in the area of the proposed project”. Their location in relation to the wind farm is shown in the topographic map attached as an appendix to the report.

Las Baniewicki Natura 2000 site

The previous chapters of the report have shown that the impact of the wind turbine complex will be limited territorially. The operation of the wind turbines:

- will not involve emissions of pollutants hazardous to the environment (including those posing a threat to the ground and water environment);
- will not involve significant changes in groundwater relations that affect the functioning of habitats of high natural value within the boundaries of the Natura 2000 site;
- will not cause any changes in the land use within the Natura 2000 site (which is a forest area);
- will not result in significant changes in land use in the vicinity of the Natura 2000 site (the current agricultural land use will be maintained).

Taking the above into account, no impact on the protection objective for which the Las Baniewicki Natura 2000 site was designated is forecasted. Operating wind turbines will not impact the habitats for the protection of which the area was designated.

The assessment of the impact on particular habitat types, for which the Las Baniewicki Natura 2000 site was designated, shows that a significantly negative impact on this area can be ruled out – in particular it can be ruled out that the functioning of the project:

- will deteriorate the condition of natural habitats for the protection of which the Las Baniewicki Natura 2000 site was designated;
- deteriorate the integrity of the Las Baniewicki Natura 2000 site or its relations to other areas (the designed wind farm will be located outside the borders of wildlife corridors established to ensure the integrity of the Natura 2000 network – according to the map available on the website of the Polish network of Natura 2000 sites – <http://natura2000.mos.gov.pl/natura2000> .

“Dolina Dolnej Odry” Natura 2000 site (SPA)

A detailed assessment of the impact on birds was carried out by the Nature Conservation Office in Szczecin. The assessment was based on annual monitoring data. The assessment of the impact on birds is provided in appendix 5 to the report.

The assessment shows that the implementation of the project option proposed in this report will not significantly affect the “Dolina Dolnej Odry” Natura site. It has been assessed that the operating wind turbines will neither impact the habitats nor the bird species for the protection of which the site was established.

The planned project will not impair the integrity of the “Dolina Dolnej Odry” Natura 2000 site or its connections with other areas. The designed wind farm will be located outside the borders of wildlife corridors established to ensure the integrity of the Natura 2000 network – according to the map available on the website of the Polish network of Natura 2000 sites – <http://natura2000.mos.gov.pl/natura2000>

“Dolna Odra” Natura 2000 site (SAC)

The Natura 2000 site is quite far from the planned project – about 5 km. Earlier in the report, it was assessed that the impact of the wind turbine will be spatially significantly limited (only the impact on the landscape will cover a larger area). Given a significant distance of the Natura 2000 site from the planned wind farm, any impact (direct and indirect) on natural habitats can be excluded.

The species for which the Dolina Dolnej Odry Natura 2000 site was designated include bats:

- Barbastelle *Barbastella barbastellus*
- Pond bat *Myotis dasycneme*
- Greater mouse-eared bat *Myotis myotis*

None of the bat species listed above was found during the annual bat monitoring conducted by the Nature Conservation Office in Szczecin (Appendix 5). On this basis, a negative impact of the planned wind farm on the bat species, for whose protection the "Dolna Odra" Natura 2000 site was designated, can be excluded.

Due to the project nature and the distance from the Natura 2000 site, a negative impact on other animal species (mammals, reptiles, amphibians, fish and invertebrates) can also be excluded.

The planned project will not deteriorate the integrity of the "Dolna Odra" Natura 2000 site or its connections with other areas. The designed wind farm will be located outside the borders of wildlife corridors established to ensure the integrity of the Natura 2000 network – according to the map available on the website of the Polish network of Natura 2000 sites – <http://natura2000.mos.gov.pl/natura2000>

It has been assessed that operating wind turbines will have no impact on either the habitats or species for whose protection the area was designated. Therefore, any impact on the "Dolna Odra" Natura 2000 site can be completely excluded.

7.2.9. Proposed legal forms of nature protection

Characteristics of each area proposed for legal protection are presented in Chapter 5 of the report.

It should be noted that despite the fact that new forms of nature protection were proposed 4 years ago, they have not been established to date. If established, all potentially implemented prohibitions will apply only within the boundaries of the proposed forms of nature conservation.

Proposed local nature conservation site "Oczko Żarczyńskie"

Wind turbines will be located outside of the boundaries of the proposed local nature conservation site (the nearest two turbines will be located at a distance of about 200 m from the boundaries of the area, however, most of the turbines will be located at a much greater distance – more than several hundred meters). One of the access roads will cross the eastern boundary of the local nature conservation site. Additionally one of the roads (for a distance of approx. 300 m) will run along the boundaries of the proposed local nature conservation site.

It has been assessed that operation of the project will not involve loss/destruction of valuable natural habitats within the boundaries of the proposed local nature conservation site. Operation of the wind park will not involve the introduction of substances into the environment that could potentially pollute/contaminate the proposed local nature conservation site. In addition, it should be pointed out that newly constructed roads should not pose a threat to amphibians. It should be emphasized that these will be internal service roads. The traffic volume here will be negligibly low (a few travels per technical supervision month).

Wetlands protected landscape area proposed for establishment

The protected landscape area proposed for establishment is outside of the boundaries of the proposed wind farm. However, the nearest wind turbine will be located approx. 100 m from the boundaries of the proposed protected landscape area. However, it should be noted that further wind turbines are located approximately 400 m away, and by far the majority of the wind turbines will be located more than 1 km from the boundary of the proposed protected landscape area.

A threat to the area is drying – drainage, location of waste landfills, cutting down trees, liquidation of vegetated ecotones.

An earlier chapter of the report assessed that the impact of the wind turbine would be significantly limited spatially. Only the landscape impact will cover a larger area, as discussed in the next chapter of the report.

It has been assessed that the wind turbines in operation will have no impact on either the habitats or species occurring within the boundaries of the proposed protected landscape area, in particular, no change to the ground and water relations that determine the functioning of the natural habitats within the boundaries of the proposed protected landscape is predicted. In addition, it should be noted that the operation of the wind park is not associated with the introduction of substances into the environment that could contaminate areas within the boundaries of the proposed protected landscape area.

According to M. Gromadzki and M. Przewoźniak (2002), in the case of impact on landscape, distances up to about 3 km from the wind turbine are of significant landscape importance, because at longer distances, the wind turbine becomes less and less visible, which is mainly due to its narrow structure. In undulating landscape with diversified topography, wind turbines disappear almost completely at a distance of about 6 km.

It can be seen from the above that the proposed protected landscape area will be within the landscape impact of the wind park. An assessment of landscape impacts (including the nature of those impacts) is presented in the next chapter of the report. At this point

it should only be emphasized that when assessing the impact of wind turbines on landscape, it should be kept in mind that each such assessment is very complex and always partly subjective in nature, depending on personal feelings and preferences. It should also be emphasized that so far the problem of assessing the impact of wind farms on landscape has not been legally regulated (first of all, there are no standards in this respect).

Given that:

- the wind park will be located outside of the borders of the protected landscape area (any prohibitions after the protected landscape area has been established will apply only within its borders);
- establishment of the protected landscape area was proposed 4 years ago and it has not been established so far so there are no legal contraindications to build a wind park.

Proposed landscape-nature complex "Widuchowskie bagna"

The landscape-nature complex proposed for establishment is located outside of the boundaries of the proposed wind farm. However, the nearest 2 wind turbines will be approximately 200–300 m from the boundaries of the proposed complex. However, it should be noted that further wind turbines are located approximately 500 m away, and by far the majority of the wind turbines will be located more than 1 km from the boundary of the proposed landscape-nature complex.

A threat to the site is a change in water relations. In the environmental valuation of the Widuchowa Municipality it was recommended to leave the area in its present state (first of all, not to change the water relations).

An earlier chapter of the report assessed that the impact of the wind turbine would be significantly limited spatially. Only the landscape impact will cover a larger area, as discussed in the next chapter of the report.

It has been assessed that the wind turbines in operation will have no impact on either the habitats or species occurring within the boundaries of the proposed natural and landscape complex, in particular, no change to the ground and water relations that determine the functioning of the natural habitats within the boundaries of the proposed area is predicted. Furthermore, it should be noted that the operation of the wind park is not associated with the introduction of substances into the environment that could contaminate the areas within the boundaries of the proposed landscape-nature complex.

In assessing the impact on the landscape, it should be noted that the wind turbines will be highly visible from parts of the proposed landscape-nature complex. This is due to the very high height of the planned facilities and the shape of the terrain within the landscape-nature complex (these are marshy depressions).

When assessing the impact of wind turbines on the landscape, it should be kept in mind that any such assessment is very complex and always partly subjective in nature, depending on personal feelings and preferences. It should also be emphasized that so far the problem of assessing the impact of wind farms on landscape has not been legally regulated (first of all, there are no standards in this respect).

More on the impact of wind turbines on the landscape in the next chapter of the report.

Given that:

- the wind park will be located outside of the boundaries of the proposed landscape-nature complex (any prohibitions after the complex has been established will apply only within its boundaries);
- the establishment of the complex was proposed 4 years ago and to date it has not been established

there are no legal objections to building a wind park.

The proposed local nature conservation site “Bagna pod Żelechowem” The proposed local nature conservation site is located approximately 2 km from the nearest wind turbine.

A threat to the site is a change in water relations. In the environmental valuation of the Widuchowa Municipality it was recommended to leave the area in its present state (first of all, not to change the water relations).

An earlier chapter of the report assessed that the impact of the wind turbine would be significantly limited spatially. Only the landscape impact will cover a larger area, as discussed in the next chapter of the report. It has been assessed that the wind turbines in operation will have no impact on either the habitats or species found within the boundaries of the proposed local nature conservation site; in particular, no change is expected in the soil-water relations that determine the functioning of natural habitats within the boundaries of the proposed local nature conservation site.

Local nature conservation sites in Banie Municipality

Wind turbines will be located outside of the borders of the proposed local nature

conservation sites (the nearest turbine will be located at a distance of approximately 300-500 meters from the borders of the land, however, most turbines will be located at much greater distances – more than several hundred meters).

It has been assessed that the operation of the project will not involve loss/destruction of valuable natural habitats within the boundaries of proposed local nature conservation sites in Banie Municipality. Operation of the wind park will not involve the introduction of substances into the environment that could potentially pollute/contaminate the proposed local nature conservation site.

7.2.10. Landscape

Wind turbines are among the specific facilities. Their impact on the local landscape is undeniable and is primarily due to their very high altitudes. The wind turbine is a foreign element in the landscape. Its explicitly technical nature and height mean that it cannot be completely masked. In addition, wind turbine propellers are most often in motion, which attracts the human eye. Wind turbines are also visible at night because of a red light placed on top of the tower. The above mentioned features make wind turbines a kind of landscape dominant.

According to M. Gromadzki and M. Przewozniak (2002), the most important factors affecting the exposure of wind turbines in the landscape are:

- site topography;
- land use forms;
- the geometry of wind turbine arrangement and their distance from settlement units;
- wind turbine mast type (solid or truss) and turbine type;
- height of the wind turbine structure;
- colors of the structure.

Distances up to about 3 km from the wind turbine are of significant landscape importance because at longer distances, a wind turbine becomes less and less visible, which is mainly due to its narrow construction. In undulating landscape with diversified topography, wind turbines disappear almost completely at a distance of about 6 km. In flat terrain, a wind turbine is visible from greater distances. In some cases (e.g. location of a wind turbine at the edge of a large valley), wind turbines can be visible from a distance of up to 10 km (e.g. to observers on the other side of the valley).

In general, the impact of a wind farm on the surrounding landscape decreases as the distance from the project increases. On this basis, the following zones of the so-called

"visual impact" of wind turbines were distinguished for flat terrain (<http://www.wind-energy-the-facts.org/en/environment/chapter-2-environmental-impacts/onshoreimpacts.html>) (23.08.2009):

- Zone 1 (within 2 km of the wind farm) – the wind farm is a dominant feature in the landscape. The rotational movement of the rotor is clearly visible and perceived by people.
- Zone 2 (at a distance of 1 to 4.5 km from the wind farm in good visibility conditions) – wind turbines stand out in the landscape and are easy to spot, but are not necessarily a dominant element. The rotating movement of the rotor is visible and can attract people's eyes.
- Zone III (at a distance of 2 to 8 km from the wind farm, depending on weather conditions) – wind turbines are visible, but they are not an "imposing" element in the landscape. Under clear visibility conditions, the rotating rotor can be seen, but the turbines themselves appear relatively small against their surrounding.
- Zone IV (at a distance of more than 7 km from the wind farm) – wind turbines appear to be small in size and do not stand out in the surrounding landscape. The rotating movement of the rotor from such a distance is virtually imperceptible.

In hilly terrain these distances can be significantly lower, or higher depending on the location of the observation point and the location of the wind turbine. The wind turbines located outside the hills along the line of sight may not be visible, despite their close proximity. However, if they are located on the tops of hills, their visibility will increase.

An important, time-varying condition affecting the perception of wind turbines is the weather conditions, and most importantly the level of cloud cover (including cloud color and the direction of illumination of the wind turbine in relation to the observer). The wind turbines are much more visible in cloudless (blue sky), sunny weather.

The assessment of the impact of wind farms on the landscape (including the determination of the extent of their visibility) faces many difficulties. This is due to, among others, many variables that affect the visibility range of a wind turbine. In the case in question, the scale of expected visibility of wind turbines was assessed on the basis of landform and land cover profiles determined in the axis of selected views associated with conducting observations from the direction of selected municipalities and communication routes.

The analysis performed allows the following conclusions:

- the wind park will be well visible from neighboring villages (Żarczyn, Żelechowo, Wilcze, Kłodowo) and the communication routes connecting them;

the wind turbines will be well visible mainly from the outskirts of the village, as inside of the village, the visual barriers for the observers will be constituted by the existing buildings and high vegetation;

- the wind park will be clearly visible from some parts of the voivodeship road No. 122 and the powiat road between Wilcze and Żelechowo;
- visibility of the wind turbine will be considerably reduced by quite numerous forest complexes (map with a scale of 1:50,000 in Appendix 2); the fact that these complexes are not dense and form a mosaic with open areas is also significant here;
- the wind turbines will not be visible in the Oder valley – the Oder river is more than 10 km away and at the height of the proposed farm it is screened by forests;

During the assessment of the impact of the wind turbine complex on the landscape, the following considerations were taken into account:

- the wind turbine complex will be located outside the boundaries of legal forms of nature protection established for the protection of landscape values, as well as their buffer zones (e.g. protected landscape areas, landscape parks, landscape-nature complexes); the nearest landscape park (Lower Oder Valley Landscape Park) is located at a distance of approximately 12 km – positive condition;
- the wind turbine complex will be located outside the borders of legal forms of nature protection proposed for nature protection – positive condition (nevertheless, the park will be located on the border of the proposed forms);
- the wind turbine complex will be located outside the borders of recreational and tourist resorts (including spas and resorts) – positive condition;
- the wind turbine complex will be located outside the boundaries of towns featuring outstanding historical values, where the wind turbines could disturb the perception of the outstanding panoramas of the landscape (e.g. the panorama of the Teutonic Castle in Malbork) – a positive condition.

See Appendix 7 for a photo with an example of a completed wind farm.

When assessing the impact of wind turbines on the landscape, it should be kept in mind that any such assessment is very complex and always partly subjective in nature, depending on personal feelings and preferences. It should also be emphasized that so far the problem of assessing the impact of wind farms on landscape has not been legally regulated (first of all, there are no standards in this respect).

While assessing the impact of wind farms in terms of impact on landscape, it should be emphasized that, although the impact is long-term (the estimated lifetime of a wind farm

is 20-30 years), the effects are fully reversible – when the farm is decommissioned (which, in technical terms, is not a complicated procedure), the landscape is restored to its previous condition.

To sum up the assessment of the impact of wind turbines on the landscape, it can be concluded that there are no formal contraindications to the construction of a wind turbine complex at the proposed site. However, it should be remembered that the wind farm will be a significant element of landscape anthropization.

7.2.11. Climate

The impact of wind turbines on the climate will be manifested by weakening of the wind force in the zone of propeller location, i.e. approximately 80-200 m above sea level. This follows directly from the laws of physics: the kinetic energy of the wind will be converted into mechanical energy for the generators.

In addition, there will be increased shading of the ground area by the wind turbine tower structures and rotating propellers.

The climate impact of the wind turbine in the example described above will not be significant and can be almost completely ignored in the environmental impact assessment.

It is important to note that on an overall scale, the wind farm will positively impact the climate by reducing greenhouse gas emissions.

7.2.12. Human health

The main factors that could potentially affect human health are:

- noise – as shown in Chapter 6.2.4. “Acoustic climate”, both during the day and night, the permissible noise level will not exceed the permissible values specified for the areas of farmstead development. On the edge of the housing development of Żarczyn village the noise level will reach just under 42 dB. It should be noted that the noise immission standards apply to the investor regardless of the project implementation option. Therefore, no negative impact on human health is predicted.
- electromagnetic field – analyses, simulations and measurements carried out in Poland and globally have shown that high-voltage transformer stations along with overhead line outlets are capable of generating field levels that are significant from the point of view of human health. According to the information provided by the investor, the Main Power Supply Point will not be located within the wind turbines – it will be located outside the wind farm area. When building

the Main Power Supply Point, the investor will be obliged to comply with the permissible levels of electromagnetic fields in the environment, as specified in applicable regulations. Therefore, no electromagnetic field impacts that would have a significant impact on human health are predicted.

Theoretically, one could consider an extraordinary situation – such as a structural failure that results in a wind turbine falling over. The probability of such an event is practically zero since the wind turbine construction will meet all standards in terms of load resistance (no case of a wind turbine tipping over has been reported so far). Besides, tipping over of wind turbines, if any, will not threaten human habitats, which are located at a safe distance (several hundred meters).

7.2.13. Cultural and tangible assets

At the stage of the wind turbine complex operation, there will be no negative impact on cultural and tangible assets.

7.3. Decommissioning stage

It is assumed that the planned wind turbines will operate over a period of approximately 30 years. It is currently unknown whether the farm will be decommissioned after this period or whether the end-of-life wind turbines will be replaced with new ones.

If the wind farm is completely decommissioned, it will be necessary:

- remove wind turbine towers – it seems that the most reasonable form of their management will be scrapping (it will be necessary to manage waste gear oils and hydraulic oils that constitute hazardous waste in an environmentally safe manner);
- remove foundations – they should be demolished (foundation pits should be recultivated);
- eliminate technical infrastructure, including access roads (the land will have to be reclaimed).

7.3.1. Ground surface and soil resources

If the project is decommissioned, the foundations, utility yards and access roads will be removed. Remediation (including restoration of the soil layer) will be required, leading to the restoration of the original agricultural use. The foundation pits will be recultivated by filling them with loamy sand (or other material), spreading soil substrate and introducing vegetation (most likely field crops).

7.3.2. Surface water and groundwater

The individual wind turbines will be sited outside of the wetlands. Foundation removal activities will not disturb water relations in the area in question. Also, the removal of access roads would not adversely affect surface water or groundwater.

7.3.3. Ambient air

During the decommissioning stage of the wind park, there will be fugitive emissions to the atmosphere. Sources of pollution will be machinery used during demolition work and means of transportation. It can be estimated that emissions at the project decommissioning stage will not exceed emissions at the construction stage.

Air emissions will be time-limited and sources of pollutants will have relatively low emissions. The overall assessment is that the decommissioning stage will not have a significant impact causing increased air pollution.

7.3.4. Acoustic climate

The source of noise at the decommissioning stage will be mainly construction machinery and equipment, such as the excavator, bulldozer, concrete mixer, lifting equipment and truck transport. The sound power level of example noise sources associated with construction activities is assumed to be:

- excavator, bulldozer: 90–105 dB;
- truck: 85–95 dB.

Given the limited operation time of these equipment, it can be concluded that the acoustic nuisance occurring during the decommissioning stage will be short-lived and will not cause significant effects on the environment. It can be assessed that the project decommissioning stage will not be a factor that could permanently threaten the acoustic environment. For work outside of urbanized areas, noise will not cause any annoyance to people.

Noise emitted to the environment during wind farm demolition works is not subject to standards determining the permissible noise levels in the environment, however, the investor is obliged to minimize the negative impact of noise on the environment of the residential buildings located in the immediate vicinity of the works.

7.3.5. Waste

The decommissioning stage will involve the generation of considerable quantities of waste, which must be collected separately and then managed in accordance with applicable regulations. Under current legislation, the generator of waste resulting from

the provision of demolition services is the entity that provides the service, unless the contract for the provision of services concluded between the contractor and the investor provides otherwise.

As a result of demolition works, the following types of waste may be generated (according to the classification in accordance with the Ordinance of the Minister of Environment of September 27, 2001 on waste catalog, Journal of Laws of 2001, No. 112, item 1206):

No.	Code	Waste type
	13	Waste oils and liquid fuel waste (except for edible oils and groups 05, 12, and 19)
	13 01	Waste hydraulic oils
1	13 01 10*	Mineral-based non-chlorinated hydraulic oils
	13 02	Waste engine, gear and lubricating oils
2	13 02 05*	Mineral-based non-chlorinated engine, gear and lubricating oils
	13 03	Waste insulating and heat transmission oils
3	13 03 07*	Mineral-based non-chlorinated insulating and heat transmission oils
	16	Waste not included in other groups
	16 02	Waste electric and electronic equipment
4	16 02 13*	Discarded equipment containing hazardous components other than those mentioned in 16 02 09 to 16 02 12
5	16 02 14	Used devices other than listed under 16 02 09 to 16 02 13
6	16 02 15*	Hazardous components or parts removed from discarded equipment
7	16 02 16	Components removed from discarded equipment other than those mentioned in 16 02 15
	17	Waste from construction, renovation and demolition of civil structures and road infrastructure (including soil and soil from polluted areas)
	17 01	Waste construction materials and components, as well as waste elements of road infrastructure (e.g. concrete, bricks, slabs, ceramic elements)
8	17 01 01	Concrete waste and concrete debris from demolitions and renovations
9	17 01 03	Wastes of other ceramics and equipment
10	17 01 07	Mixture of concrete, bricks, tiles and ceramics other than those mentioned in 17 01 06
11	17 01 81	Waste from road alteration and modernization
12	17 01 82	Waste not otherwise specified

	17 02	Waste wood, glass and plastics
13	17 02 03	Plastics
	17 04	Metallic and metal alloy waste and scrap
14	17 04 05	Iron and steel
15	17 04 07	Mixed metals
16	17 04 11	Cables other than those mentioned in 17 04 10
	17 05	Soil and earth (including the soil and earth from polluted areas and dredging spoil)
17	17 05 04	Soil and earth including stones, other than those listed in 17 05 03
	17 06	Insulation and construction materials containing asbestos
18	17 06 03*	Other insulation materials containing hazardous substances
19	17 06 04	Insulation materials other than those mentioned in 17 06 01 and 17 06 03
	17 09	Other construction, overhaul and demolition waste
20	17 09 03*	Other construction, overhaul and demolition waste (including mixed waste) containing hazardous substances
21	17 09 04	Mixed construction and demolition wastes other than those mentioned in 17 09 01, 17 09 02 and 17 09 03

* means hazardous waste

Provided that the rules for environmental protection and separate waste collection and transfer thereof to an authorized entity for recovery or disposal are observed, no negative impact on the environment is forecasted.

Some of the waste will be a valuable material (e.g. iron and steel) that can be transferred to a recycler for a fee.

7.3.6. Flora and fauna

Impacts to the biotic environment will be manifested by:

- local damage to or removal of vegetation, represented mainly by agrocenoses, in places where equipment for demolition and temporary accumulation of dismantled elements of the wind park are located.
- emigration of some fauna species due to noise and increased human presence. The emigration will be temporary and it should be expected that it will occur to neighboring areas. Some of the species that are easily subject to synanthropization and are characterized by high adaptability to changing environmental conditions will remain unaffected by the decommissioning stage; it should be noted that the scale of the impact in this case will depend on the

timing of the works – the breeding period of birds is the least favorable. However, it should be pointed out that the conducted annual birds monitoring showed that the area of the planned project does not constitute an above average habitat for breeding avifauna and a change of this state seems very unlikely during the period of the wind park operation.

With reference to the biotic structure of the immediate project area (predominantly arable land), the predicted impacts indicated above will be short-term and spatially limited. On an overall scale, they will not be significant and will not involve a significant loss of biodiversity.

7.3.7. Legal forms of nature protection

Characteristics of each area covered by legal protection are presented in Chapter 4 of the report.

Las Baniewicki Natura 2000 site

The “Las Baniewicki” Natura 2000 site is located outside of the planned wind farm area.

The most important threats to the Natura 2000 site (according to the Standard Data Form) are largely related to poor forest management.

It should be strongly emphasized that the project decommissioning stage does not involve any threats to the Natura 2000 site, as indicated in the Standard Data Form.

It has been assessed that the decommissioning of the project will not result in the loss/destruction of valuable natural habitats within the boundaries of the Natura 2000 site. Works related to the demolition of the wind farm will be carried out outside this Natura 2000 site – they will be carried out on agricultural land, characterized by low natural values.

Other area legal forms of nature protection

Due to the significant distance (minimum 3 km) of the demolition work being conducted from:

- “Dolina Dolnej Odry” Natura 2000 site (SPA)
- “Dolna Odra” Natura 2000 site (SAC)

and the spatially limited impact associated with the decommissioning stage of the project, any negative impact on these area-based legal forms of nature conservation can be ruled out. In particular, the risk of direct or indirect destruction of natural habitats should be excluded.

7.3.8. Proposed legal forms of nature protection

Virtually all of the proposed areas for legal protection are outside the planned project site. Only in the case of the proposed local nature conservation site "Oczko Żarczyńskie", one of the roads will cross its eastern border.

Impacts associated with the decommissioning stage will be similar in nature to those associated with the construction stage. It has been assessed that there will be no change in habitat conditions within the boundaries of the proposed forms of nature conservation during decommissioning of the project, in particular:

- no physical destruction of habitats of natural value is forecast;
- no indirect impacts on neighboring habitats are expected – first of all, there will be no change in soil-water relations, which most often determine the functioning of habitats within the boundaries of the proposed forms of nature protection;
- no indirect impact on neighboring habitats valuable from the point of view of nature is forecast – the decommissioning of the wind park is not associated with the introduction into the environment of substances that could contaminate the areas within the boundaries of the proposed forms of nature protection (primarily substances that pose a threat to the aquatic and groundwater environment).

7.3.9. Landscape

The decommissioning phase will have no lasting impact on the landscape. In case of decommissioning, the landscape will be restored to its original state (assuming that the appearance of the surroundings will not change significantly during the operation of the farm).

7.3.10. Human health

The decommissioning stage will have a similar impact to that at the construction stage. Impacts to human health will result primarily from truck traffic (removal of wind turbine structures from the area, hauling crushed concrete from foundation demolition and hauling soil to reclaim the foundation area). The following human health impacts may occur:

- traffic noise and noise from the operation of construction equipment;
- emission of transport pollutants (exhaust fumes, dust from roads) and pollutants from the operation of construction equipment;
- accident risk.

With strict adherence to occupational health and safety regulations, any health risks for demolition workers will be practically reduced to a minimum and will not be significant.

Impacts to bystander health will be limited spatially (primarily to the roadway environment) and temporally (to the duration of the works).

7.3.11. Cultural and tangible assets

The demolition works will leave no impact on cultural assets and no significant impact on tangible assets.

8. Proposal of the most environmentally beneficial option

Chapter 2.2 of the report presents the project option that was originally intended by the investor – before the annual monitoring of birds and bats was performed.

This report assesses a reasonable alternative option – one in which a part of the farm north-west of Żarczyn (“Lubicz” sector) is abandoned (Fig. 2).

The option finally proposed for implementation takes into account the comments and recommendation proposed by the Nature Conservation Office in Szczecin, including but not limited to:

- resignation from one of the turbines planned for location in the north-eastern corner of the sector Żelechowo, by the planned local nature conservation site "Żarczyńskie Oczka" (Fig. 2),
- moving the turbine adjacent to "Żarczyński Oczek" to a distance of 200 m from the edge of the projected local nature conservation site (Fig. 2).

Given that the investor, at the consultation stage before submitting the application for issuing the decision on environmental conditions, implemented the recommendation of the Nature Conservation Office and the author of the remaining part of the report, it can be concluded that the finally proposed project option is also the most beneficial for the environment.

9. Diagnosis of potential significant impacts of the designed project on the environment and a description of forecasting methods applied

9.1. Impacts resulting from the existence of the project, including cumulative impacts

The assessment presented in the report showed that the planned wind farm complex in the area of Żarczyn-Żelechowo village in the Widuchowa Municipality, generally will not have a significant impact on the environment and will not cause a significant negative impact on the environment.

Assessment of cumulative impact in terms of noise immission

A possible cumulative impact of wind farms in terms of noise immission can occur for two wind farms located at a relatively close distance of 1.5-2.5 km (depending on the turbines' placement, their height and acoustic power level). In this case, there may be noise accumulation (to the extent relevant to environmental noise protection, i.e., in the noise range greater than 40-45 dB).

For the wind farm under assessment, there is a projected wind farm of the same developer approximately 1.8 km away. It was temporarily abandoned due to the need to conduct additional bird monitoring (as mentioned in Appendix No. Appendix 5 and in the report chapter presenting project options). If this farm is constructed, the investor will be required to control the operation of the wind turbines in such a way as to meet noise immission standards. The nearest planned wind farm in the neighboring Banie Municipality is located approximately 3 km away (Fig. 3). In addition, it should be noted that there is agricultural land between these farms that is not subject to noise protection.

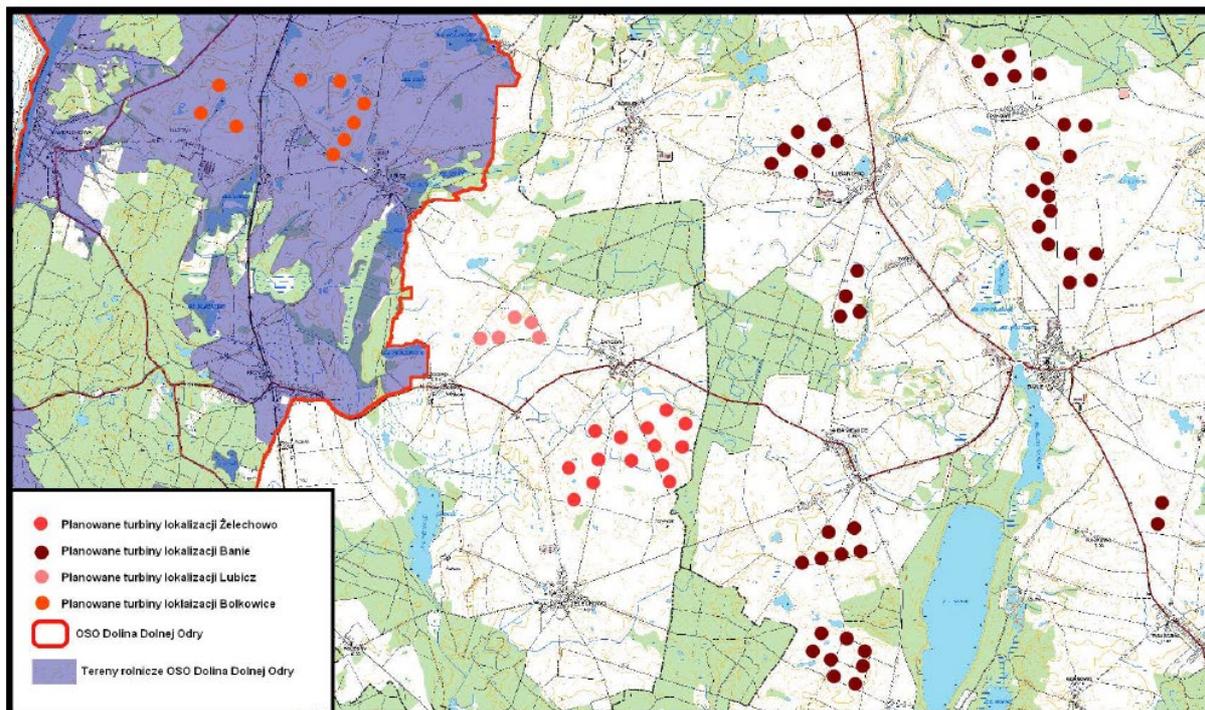
With regard to all of the foregoing, it can be assessed that there will not be any possible cumulative noise impact or it will not be significant from the point of view of environmental noise protection – in accordance with the Ordinance of the Minister of Environment of June 2007, 14 on permissible environmental noise modes (Journal of Laws No. 120, item 826).

Assessment of cumulative impact on birds (assessment performed by Nature Conservation Office in Szczecin)

As part of works connected with identification of sources, paths and effects of cumulative actions, numerous onsite inspections were made, available literature was analyzed, community interviews were conducted and legislative acts concerning changes in the way of agricultural areas management in Widuchowa Municipality and neighboring Banie Municipality were analyzed. All undertakings and plans that could

have a cumulative impact together with the Żelechowo project have been identified within the project. The dominant types of impacts were then identified, and these include disruption of local migration and flights as well as loss of feeding grounds for species with strong avoidance responses. A major pathway for potential accumulation was identified: the accumulation of impacts in space. The conditions of the nearest bird area under the Natura 2000 Dolina Dolnej Odry SPA were also analyzed in order to identify components of the structure and functions of the area at risk. On the basis of the collected data, a forecast of the intensity of the expected cumulative impacts was made in terms of a possible disruption of migration and a possible loss of feeding grounds of species, including in particular the species that are protected in the nearest SPA: Dolina Dolnej Odry.

The planned wind farms in the vicinity of the Żelechowo project (up to 10 km around the site) are distributed in the form of wind turbine clusters scattered fairly evenly across the agricultural landscape (Fig.3.).



PL	EN
Planowane turbiny lokalizacji Żelechowo	Planned turbines at Żelechowo location
Planowane turbiny lokalizacji Banie	Planned turbines at Banie location
Planowane turbiny lokalizacji Lubicz	Planned turbines at Lubicz location
Planowane turbiny lokalizacji Bolkowice	Planned turbines at Bolkowice location
OSO Dolina Dolnej Odry	Special Protection Area "Lower Oder Valley"
Tereny rolnicze OSO Dolina Dolnej Odry	Agricultural areas of the Special Protection Area "Lower Oder Valley"

Fig. 3. Planned wind farms in the vicinity of the farm under assessment

Groupings range from 2 to 14 turbines, usually several (4-7) turbines. Wide spaces without turbines (2-3 km wide) are left between the groupings, which will allow migratory species to migrate freely. With such a distribution of wind turbines of individual projects in the landscape, even with the implementation of all the proposed wind farm projects, including discontinued ones, the cumulative effect on migration routes should not reach a significant level of impact. Given that the main migration direction in the region of Widuchowa Municipality is north-south and migration is concentrated within the Oder valley, projects located outside of the important bird area will have little impact on the migration of most species.

In summary, the construction of the Żelechowo wind farm, even if other projects being sources of similar impact are implemented in its vicinity (Gminas of Widuchowa and Banie), will not result in the total impact of these projects on bird species migrations being significant.

The Żelechowo project is located in open agricultural areas, poor in valuable more natural landscape elements. These are large monocultures of hectares as part of relatively intensified agriculture. The abundance of similar land around the site and around other wind farm projects will not result in the loss of significant bird feeding grounds even if all wind farm projects in the area are implemented. The closest important bird area – Natura 2000 SPA Lower Oder Valley – is also rich in open agricultural areas that serve as feeding grounds for breeding and migrating species (Fig. 3.), thus, areas of the Żelechowo project as well as other projects in its immediate vicinity are not key feeding grounds for the populations of species that are the subject of protection in the SPA Lower Oder Valley. If the recommendation to change the structure of cultivation (abandonment of maize cultivation) is implemented in all projects in the vicinity, their area (including the Żelechowo project area) will not be an attractive feeding ground for migratory species (anseriformes, cranes, lapwings). In conclusion, it should be considered that the potential cumulative impacts of the wind farm projects with respect to potential loss of feeding grounds will not be significant for the nearest Natura 2000 SPA “Dolina Dolnej Odry”. Therefore, there are no scientific grounds to assume that the implementation of the Żelechowo project and other wind farm projects planned in its vicinity may adversely affect the integrity of the Natura 2000 site or its functioning.

Cumulative impact on bats (assessment by the Nature Conservation Office in Szczecin)

All wind turbines planned in the vicinity of the Żelechowo project are located within a large area of intensive farming, poor in linear structures (watercourses, strips of wooded areas). These areas do not serve as ecological corridors through which bat species could

freely migrate, which is evident not only from the surveys at the Żelechowo site, but also from the adjacent areas (Banie site). The main concentration of bat migration, including the *Pipistrellus* sp., takes place within the Oder Valley, far from the wind farm projects in the Widuchowa Municipality and the Banie Municipality.

Sources of food for bats in intensively used open agricultural areas are scattered, concentrated around ponds, flowering alleys, wetlands, etc. The occupation of open areas with a large-scale cropping system and poor landscape even if all planned projects in the vicinity of the Żelechowo project are implemented will not result in a significant loss of bat feeding grounds. As a result, the combined effect of the Żelechowo project and adjacent projects will be negligible for the functioning of bat populations in the region.

9.2. Impacts resulting from the use of natural resources

During the construction stage, natural resources such as sand, gravel, etc. will be used in relatively small amounts. The impact resulting from the use of natural resources cannot be assessed at this stage as the source of origin of the raw materials is unknown (the investor has no knowledge from which entity the raw materials will be purchased). Mineral resources, used during the construction stage, will come from legal gravel pits, which operate under issued administrative decisions (licenses).

During operation, the proposed project will not involve the use of natural resources. The operation of the wind farm will lead to a reduction in coal consumption – 9,968 tons per year.

9.3. Impacts related to potential environmental contamination

As shown in Chapter 6, "Detailed Environmental Impact Assessment of the Selected Project option", the proposed wind turbine complex will not cause significant environmental impacts associated with potential environmental contamination.

The project will not be a source of gaseous or particulate emissions to air, soil, or water.

It has been assessed that noise emissions will not lead to violation of acceptable standards in this regard.

9.4. Description of forecasting methods

The starting point in the environmental impact assessment for the proposed wind farm was a description of the state of the environment. For this purpose, annual monitoring of two animal groups most exposed to potential impacts – birds and bats – was carried

out (the monitoring methodology, including the equipment used, is described in Appendix 5 to the report).

During the fieldwork, the method used included field mapping, which involves marking objects or phenomena identified in the field on a topographic map. Cartographic analyses were also conducted to determine, among other things, the boundaries of areas under legal protection or to identify other elements and objects of potential importance from the point of view of the planned project.

See Chapter 3 of the report and Appendix No. 5 of the report for a description of the environmental situation.

The following forecasting methods were used in the environmental assessment:

- Environmental analogies
- Mathematical modeling
- Expert evaluation

Environmental analogy method

Experience from other existing wind farms was used here. The impact recorded at the existing farms was referred to the projected farm, but the impact was adjusted to include the environmental conditions and parameters of the planned project. It should be pointed out that Western countries have much more experience in wind power. Effects on birds and bats, among others, have been described in numerous scientific publications.

A mathematical modeling method:

The mathematical model is based on mathematical formulas that describe the interrelationships between variables. This forecasting method was used to determine the impact resulting from noise emissions. The noise calculation method used during the assessment was based on the mathematical model of noise propagation in the environment contained in *PN-ISO 9613-2*. The calculations of sound immission levels in the environment during the operation of wind turbines were performed based in LEQ Professional ver. 6.x. The calculation model adopted in the program complies with *PN-ISO 9613-2*.

Expert evaluation method

The expert forecasting method relied on the knowledge and experience of experts. Such modeling included descriptively expressed reasoning relationships, described and programmed on the basis of the knowledge, experience and intuition of the experts being

the authors of the report. This determines how the environment will respond to specific impacts and the magnitude – and most importantly the significance – of the impacts. The expert forecasting used information from existing sources and data collected through monitoring.

It should be noted that the expert method was combined with the method of evaluation by analogy.

10. Assessment of the possibility of transboundary environmental impact

The assessment presented in Chapter 6 "Detailed Environmental Impact Assessment of the selected project option" showed that the impact of the planned project will be limited territorially. Therefore, the possibility of cross-border environmental impact must be excluded.

11. Serious industrial accident potential analysis

The designed group of power turbines will not be classified as a plant with increased or high risk of the occurrence of serious industrial accidents according to the quality and quantity criteria set out in the Ordinance of the Minister of Economy of April 9, 2002 on the types and quantities of hazardous substances whose presence at a plant determines qualifying the plant as an increased risk plant or a plant with high risk of the occurrence of a serious industrial accident (Journal of Laws of 2002, No. 58, item 535, as amended). Therefore, there will be no risk of a serious industrial accident within the meaning of the Environmental Protection Law.

12. Proposed actions to prevent, reduce or compensate adverse environmental impacts

The proposed project option takes into account the application of solutions aimed at preventing and reducing harmful effects on the environment.

In order to protect the environment, the following solutions should be implemented and the following actions should be taken:

- during the construction stage:
 - limit the size of construction sites as much as possible;
 - in order to protect small animals (e.g. reptiles or amphibians), make

- foundations and lay cable lines as soon as possible after excavation; if small animals enter the excavation, bring them to the surface before pouring concrete or backfilling the excavation with soil;
- equip construction sites with means for quick collection of possible oil spills;
 - the construction site should be equipped with portable toilet cabins (e.g. TOI-TOI type);
 - apply the principle of minimal environmental interference;
 - collect waste generated separately, store in places adapted for this purpose, and afterwards hand over to authorized entities for recovery or disposal;
 - use technically efficient equipment, certified machines and devices, including high-quality equipment, meeting the requirements for equipment used outdoors in terms of noise emission to the environment;
 - perform construction works involving noise emissions only during daylight hours – between 7:00 a.m. and 8:00 p.m.;
 - switch off machines and equipment when not in use (avoid idling);
 - conduct construction works that are a significant source of noise (first of all, excavation for foundations) outside of the bird hatching season;
- at the operation stage:
 - clean up the carcasses from the area of wind fields and the nearest neighborhood on a regular basis (in autumn and winter, every week);
 - change the cropping system – abandon maize in favor of less attractive foraging crops: cereals, rapeseed, root crops. Alternatively, strictly adhere to the obligation to clean up crop residues and plow stubble immediately after harvesting;
 - service works (replacement of gear and hydraulic oil) should be carried out in favorable weather conditions (no precipitation), and while they are being carried out, substances enabling fast collection of any accidental leakages should be distributed in the area around the wind turbine;
 - conduct periodic inspection of the technical condition of the equipment to detect irregularities and prevent technical failures;
 - at the decommissioning stage:
 - remove gear oils and hydraulic oils from the wind turbine before disassembly and subject them to recovery or disposal in accordance with applicable law;
 - disassemble used wind turbines and subject them to recovery or disposal

in accordance with the applicable regulations (electrical and electronic parts must be separated from the construction of the wind turbine as hazardous waste and disposed of in accordance with applicable regulations);

- land after removed wind turbines and access roads should be recultivated and restored for agricultural production;
- use technically efficient equipment, certified machines and devices, including high-quality equipment, meeting the requirements for equipment used outdoors in terms of noise emission to the environment;
- perform demolition works involving noise emissions only during daylight hours – between 7:00 a.m. and 8:00 p.m.;
- switch off machines and equipment when not in use (avoid idling);

13. Analysis of the necessity of establishing a limited use area

Pursuant to the regulations of the Environmental Protection Law, if the procedure concerning the environmental impact assessment, post-construction analysis or the ecological survey shows that – in spite of the use of the available technical, technological and organizational solutions – the environment quality standards outside of the premises of the plant or another facility cannot be met, a limited use area shall be established for wastewater treatment plants, municipal waste landfills, composting plants, communication routes, airports, power lines and substations, as well as radio communication, radio navigation and radio location systems.

In the case of the project under consideration, involving the construction of a wind turbine complex, there is no need to establish a limited use area.

14. Analysis of potential social conflicts related to the planned project

Social conflict, as one of the basic concepts of sociology, refers to a social process occurring between individuals or groups as a result of conflicting interests and causing hostility between them. The aftermath of conflict is competition and struggle (in varying degrees of intensity) leading to the total defeat of one side (sometimes both) or trade-offs.

For the analyzed project, two basic groups can be distinguished among which a conflict may potentially arise:

- supporters of the project implementation – owners of the property on which wind turbines are going to be placed;
- potential opponents of the project – owners of properties adjacent to those on which the wind turbines will be built and residents of surrounding towns.

Additionally, broadly defined environmental organizations should be mentioned at this point. A concern of conservationists is often the impact of wind turbines on avifauna, chiropterofauna and the landscape. Experience from some locations in the Pomorskie and Zachodniopomorskie Voivodeships shows that a conflict between an investor and an environmental organization can effectively delay project implementation.

Experience shows that supporters of wind turbines (owners of properties on which the wind turbines are to be located) rarely change their positive attitude towards the project. The financial factor is of major importance here – the investor's purchase or long-term lease of land for wind turbines and roads. A major problem, however, is often to convince the rest of the community – people who will not directly benefit personally from the project.

What underlies the conflict is often ignorance about the planned project. Meetings with local communities at various wind farm locations show that the most common concerns are:

- potential health impacts of wind turbines – people are concerned about high levels of noise and radiation (often unspecified) and the illnesses they cause;
- potential impact of the wind turbine on the comfort of life – people are afraid of deterioration of landscape values, interference in radio and television reception, continuous disturbing noise (both day and night);
- potential impact of wind turbines on the natural environment – people are concerned about significant degradation of the landscape, killing and scaring off birds, scaring wildlife, etc.;
- potential decline in the value of the properties.

As demonstrated by this report, the concerns cited above will be mostly completely unfounded and without any factual basis.

It should be borne in mind, however, that substantive arguments are not always able to convince 100% of the public.

15. Impact of the project on future land use

When analyzing the future land use, it should be pointed out that the current agricultural land use will be maintained. However, the opportunities for erecting buildings subject to noise protection (e.g. residential buildings, buildings related to permanent or temporary residence of children, etc.) between wind turbines will be restricted. These restrictions result both from the need to meet acceptable levels of noise in the environment and from the local development plan under preparation.

However, it should be pointed out that a wind farm (as opposed to many other projects, e.g. highways) is a project with a limited lifetime – the expected lifetime is 30 years and after that period its complete decommissioning is possible in a fast and technically uncomplicated manner.

16. Proposals of environmental impact monitoring of the planned project

During the construction stage, it is pointless to conduct monitoring. This is due to the fact that this period will be of short duration and will be characterized by a relatively minor and, in general, insignificant impact on the wider environment.

After completion of the investment stage it is recommended to conduct monitoring of the actual noise level in the environment as well as monitoring of the impact of the wind farm on birds and bats.

Monitoring of the actual noise level in the environment

To assess the changes of the acoustic climate caused by the operation of the wind turbines, it at least two measurement series are recommended:

- one series before commencing the project (or after completing the project, but with the wind turbines not in operation);
- second series after completing the Wind Farm and handing it over for commercial operation.

Measurement points should be planned in the vicinity of the outermost buildings in the neighboring villages (however, measurements before and after the start of the farm operation should be conducted in the same points and possibly in the same conditions). Further measurements of the noise level in the environment, if any, should be made when new significant sources of acoustic nuisance appear in the area.

Monitoring of the farm impact on birds

The construction of the planned wind farm should require the commencement of post-construction monitoring. As a result of monitoring works after the construction of the wind farm, it will be possible to assess the actual project impact project on avifauna. Post-construction monitoring, as at most sites, should continue for at least 3 years in the next 5 years after the turbine start-up. The choice of years (e.g., in years 1, 2 and 3, or years 1, 3, 5) may depend on agreements made with the developer and environmental decision-making authorities (NWEA 2008).

The purpose of conducting faunistic post-construction monitoring will be:

- to formulate empirical assessment of the wind farm impact on the breeding, migrating, nomadic and wintering avifauna occurring within its area and in the immediate vicinity,
- to verify the project's potential impact assessment prepared at the pre-investment stage,
- to analyze the this wind farm's actual impact on birds in this part of Pomerania.

The observations and information collected during the works should be used to conduct an assessment of the scale of the threat to birds and to propose possible rescue or compensation measures.

Monitoring should be conducted by persons professionally prepared for research (researchers) or amateurs with good field preparation (in this case under the substantive supervision of a coordinator with appropriate qualifications for conducting ornithological research).

Studies conducted during post-construction monitoring should consist of the following basic modules:

- observations within the project area, being a replication of monitoring conducted at the pre-investment stage;
- observations outside of the turbine operating zone, replicating pre-investment studies;
- observing birds' behavior and their reactions to working or standing still wind turbines;
- documenting all cases of collision victims.

A work breakdown framework is proposed for the planned project with the minimum number of field inspections necessary for proper evaluations.

Monitoring of farm impact on bats

After the farm start-up, a three-year post-construction monitoring should be carried out, based on the search for any killed bats and automatic registration of their activity at selected wind turbines, which will allow to estimate the current project impact on the chiropterofauna according to the methodology contained in the current national "Guidelines for assessing the impact of wind turbines on bats" and the studies by Brinkmann (2006) and Arnett (2005).

Should high bat mortality be recorded during any of the phenological periods, it should be considered whether to shut down selected turbines during the period of highest activity at night during low winds (less than 6 m/s).

17. List of difficulties arising from technical deficiencies or gaps in the contemporary knowledge that were encountered when preparing the report

When preparing the report and forecasting the environmental impact of the project, no other significant deficiencies or gaps in contemporary technical knowledge were encountered.

18. Non-technical summary

This report was prepared at the request of ENERTRAG Krajnik sp. z o.o. with its registered office in Szczecin and it concerns the project involving the construction of a wind farms complex, together with the accompanying technical infrastructure, in the area of Żarczyn-Żelechowo in the Widuchowa Municipality.

Project characteristics

Up to 16 wind turbines are planned as part of the project. The total nominal capacity of all turbines will not exceed 56 MW. The characteristics of the wind turbine are as follows:

- Rotor diameter: up to approx. 112 m (3 propellers with the length of up to approx. 56 m each)
- Conical steel-tube tower
- Tower height: up to about 140 m
- Total height of the wind turbine: up to approx. 196 m
- Maximum noise level of a single turbine: 106 dB (it will be possible to adjust the

sound power level – its reduction – by appropriately adjusting the blade angle of attack to the wind direction thus, at the expense of energy production, it will be possible to reduce the sound power level of the device).

- Wind speed for start-up: 3 m/s; optimum wind speed: approx. 12–15 m/s; wind speed for stopping: 25 m/s.
- Tower colors: white or gray

The essence of wind turbine operation is the conversion of kinetic energy of the wind into mechanical energy, and ultimately into electricity.

The conversion of wind energy into mechanical energy takes place in the rotor, which is thus the most important part of the wind turbine. The rotor sits on a shaft through which the generator is driven. The generator, in turn, generates electricity.

In addition to the wind turbines, the proposed project will consist of the following basic accompanying elements:

- low and medium voltage power cables;
- telecommunications infrastructure;
- access roads;
- assembly yards.

Legal forms of nature protection in the project area

The planned wind farm is practically adjacent to the Las Baniewicki Natura 2000 site (it should be emphasized that it will be implemented outside of its boundaries).

Further away there are:

- “Dolina Dolnej Odry” Natura 2000 site (SPA) – at a minimum distance of about 3 km
- “Dolna Odra” Natura 2000 site (SAC) – at a minimum distance of about 5 km

The location of the turbine in relation to the legal forms of nature protection is presented on the topographic map with a scale of 1:50,000 (Appendix No. 2 to the report).

Proposed legal forms of nature protection

Within the area of the planned wind farm there is a local nature conservation site proposed to be established, in the environmental survey of the Widuchowa municipality – “Oczko Żarczyńskie”. Also at a distance of:

- approx. 100 m from one of the wind turbine there is the protected landscape area proposed to be established – Wetlands (however, the majority of the area of the

wind turbine is located over 1 km away)

- approx. 200 m from one of the wind turbine there is the landscape-nature complex proposed to be established – “Widuchowskie bagna” (however, the majority of the area of the wind turbine is located over 1 km away))
- approx. 2 km away there is the local nature conservation site proposed to be established – “Bagna pod Żelechowem”.

In the neighboring Banie Municipality, 12 years ago it was proposed to establish:

- Of the „Las Baniewicki” nature reserve.
- Landscape-nature complex “Las Baniewicki”

Both forms of nature conservation proposed in 1998 became part of the Las Baniewicki Natura 2000 site.

In Banie Municipality it was proposed in 1998 to establish several dozen of local nature conservation sites (as many as 68). These mostly included small wetland depressions. At the boundary with Widuchowa municipality, there are two such objects.

Construction stage

The construction stage will be limited in space and time. Typical inconveniences associated with construction works (noise from the operation of construction equipment, emission of pollutants from the transport of structures and construction materials) are expected to occur.

The works will be conducted mainly in agricultural areas, several hundred meters away from residential development.

No significantly adverse impacts on the natural environment are anticipated as a result of the works.

The report shows that there will be no adverse impacts to legal forms of nature conservation and legal forms of nature conservation proposed in the gminas’ environmental valuations.

Operation stage

Electricity will be produced during the operation stage.

The report presents the results of bird and bat monitoring and an assessment of impacts on birds and bats. The assessment shows that there will be no significantly adverse impacts to birds and bats if the proposed option is implemented with the proposed impact mitigation measures (described in the report).

The report assessed landscape impacts (identifying areas and sites from which the wind turbines will be visible). To sum up the assessment of the impact of wind turbines on the landscape, it was pointed out that there are no formal contraindications to the construction of a wind turbine complex at the proposed site. However, it should be remembered that the wind farm will be a significant element of landscape anthropization.

The report assesses the impact on people – primarily addressing the need to comply with applicable noise immission standards. The assessment in this regard was based on computer calculations of noise dispersion in the environment. The report states that the farm will be safe for human health and life.

Decommissioning stage

Nuisances during the decommissioning stage will be similar to those during the construction stage. The most significant difference between the two stages comes from the need to dispose of the waste equipment when the project is decommissioned. Waste equipment will constitute waste and will be transferred to entities with appropriate administrative permits for waste management (recovery or disposal).

Additional information

In the report:

- the cumulative impact has assessed – it has been assessed that the proposed wind farm will not have a significant negative impact on birds, bats and acoustic climate in case of implementation of the wind projects planned in the vicinity;
- as-built monitoring (birds, bats and acoustic climate) has been proposed;
- potential community conflicts have been identified;
- the impact of the proposed project on future land use has been evaluated;
- it has been assessed that the project will not have a cross-border impact on the environment.

Summary

The assessment presented in the report showed that the project will not have a significant impact on the environment, provided that it is implemented in the option proposed in the report as the most beneficial for the environment and with the recommended mitigating measures.