6 ALTERNATIVES TO THE SOLUTIONS INCLUDED IN THE PROGRAM

AUTHORS: *Dominika Lewicka-Szczebak, Andrzej Strupczewski, Władysław Kiełbasa, Wojciech Drzewicki, Wojciech Ciurzycki, Wojciech Błędowski, Wiktoria Ryng, Kacper Jancewicz, Łukasz Szkudlarek*

TABLE OF CONTENTS:

6.1 Alternative solutions for energy security

The structure of electricity generation in Poland (Fig. 6.1.1), by primary energy carriers consumed, is characterized by unique in the EU, and even in the world, dominance of coal (about 92% share), the total absence of nuclear energy and the small share of RES (4.6%). In contrast, in EU-27 states (Fig. 6.1.1), the structure of sources used for electricity generation is well-balanced: nuclear energy has the largest share - about 28%, then coal, ca. 27%, natural gas ca. 23% and RES ca. 18%.

We should realise that nuclear power is the main source of electricity in EU-15, while in Poland coal continues to dominate. Diversification of energy sources in Poland is therefore necessary and the society must be aware of the total real cost of the various energy sources to make an informed decision as to the directions of the country's development (cf. Chapter 5).

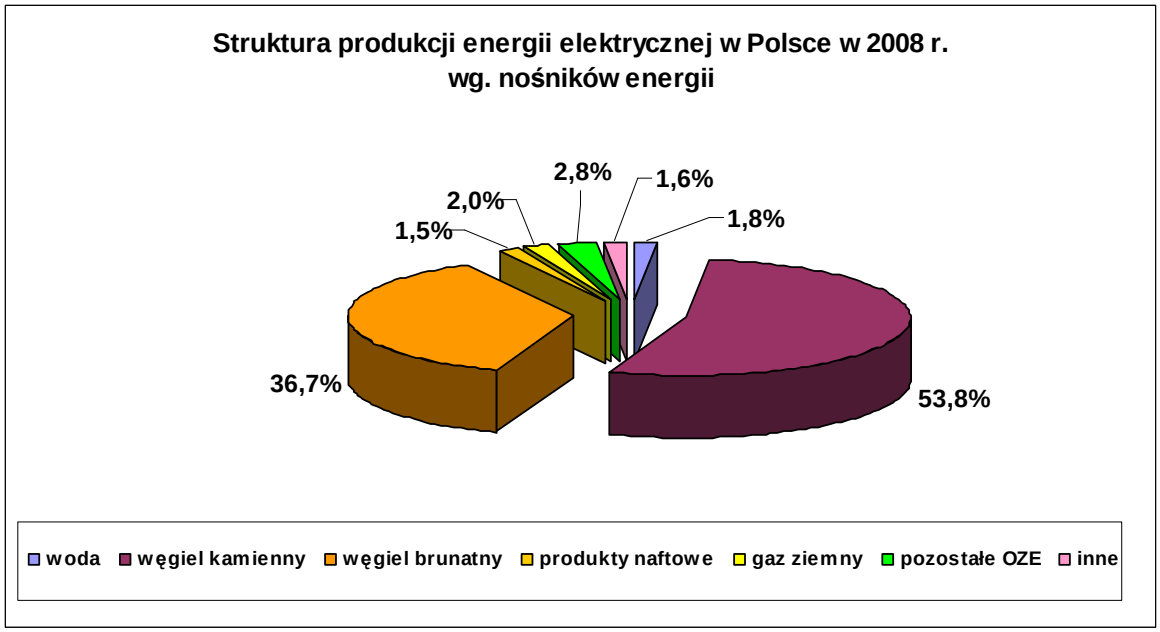

Fig. 6.1.1 The structure of electricity generation in Poland by primary energy carriers [own study based on Eurostat 2010 data].[353].

[Structure of electricity production in Poland in 2008 by energy carriers
Water
Hard coal
Brown coal
Petroleum products
Natural gas
Other RES
Others]

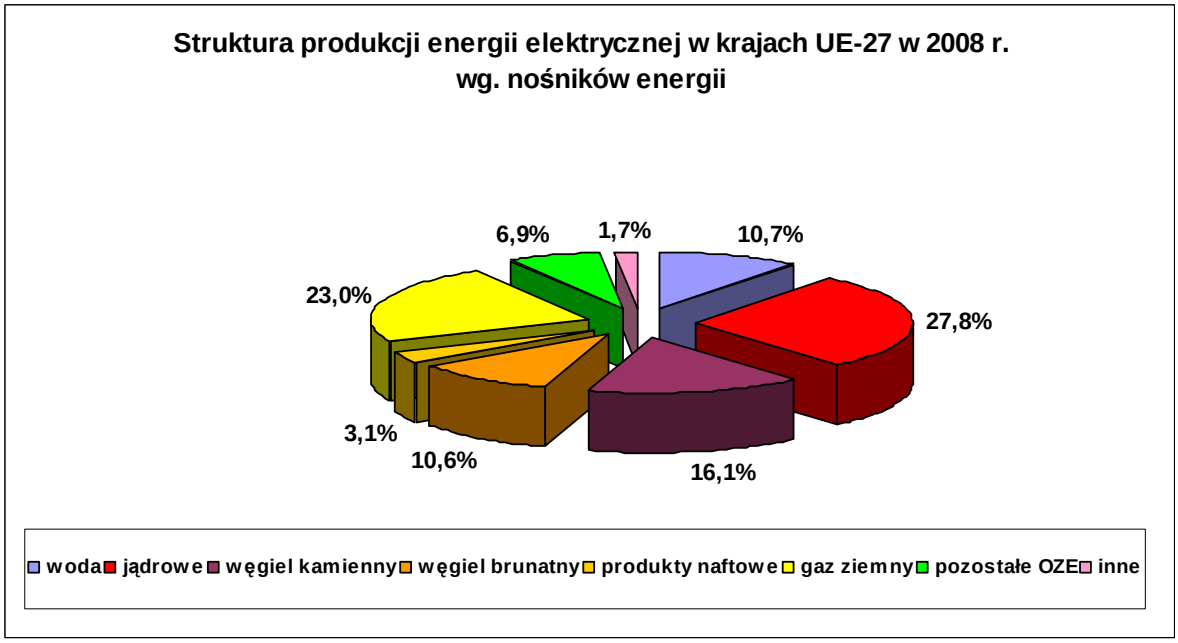

Fig. 6.1.2 The structure of electricity generation in EU-27 by primary energy carriers [own study based on Eurostat 2010 data]

[Structure of electricity production in EU-27 states in 2008 by energy carriers
Water
Nuclear
Hard coal
Brown coal
Petroleum products
Natural gas
Other RES
Others]

Poland needs to diversify its electricity production sources as soon as possible. On the one hand, the current structure of electricity generation has a number of negative environmental impacts (cf. Chapter 5); on the other, the country must become independent of the depletable resources of fossil fuels, which will guarantee energy security in a long-term perspective.

This Chapter discusses the potential outcomes of the implementation of the various alternatives for the strategy of development of the Polish energy sector.

6.1.1 Variant 1: Improving energy efficiency

Improvement of energy efficiency has a relatively high potential to reduce the emissions of greenhouse gases (by 29%) **Błąd! Nie zdefiniowano zakładki.**; and it will bring economic benefits, reduction of social costs, and potential reduction in the demand for electricity. However, energy savings alone are insufficient, both in terms of reduction of emissions and the ever-growing demand for electricity. Still, it must be noted that investments in this area are absolutely necessary and should be considered a top priority as the most effective method to achieve measurable results, especially in the form of reduced emissions.

Forecast of demand for fuel and energy by 2030 developed by ARE SA and adopted in "Polish Energy Policy until 2030"(Fig. 6.1.3)[354], predicts an increase in gross electricity demand by about **54%**: from 141.0 TWh (2010) do 217.4 TWh (2030). Very significant reduction in electricity intensity of GDP was assumed: from 137.7 MWh/PLN'07 in 2006 to 60.6 MWh/PLN'07. A similar estimate was adopted by McKinsey&Company**Błąd! Nie zdefiniowano zakładki.**; – assuming that all energy-efficiency

initiatives are implemented (reduction of transmission losses, improvement of production efficiency), the demand for electricity will still increase from 157 TWh in 2005 to 198 TWh in 2030. (based on the forecast increase in GDP – as estimated by Global Insight) **Błąd! Nie zdefiniowano zakładki.**. This unavoidable increase in demand will need additional energy sources.

In order to produce these electricity volumes at reasonable cost and in an environmentally-friendly manner, Poland will need new energy sources based on different technologies with low emissions of CO_2, including high-capacity coal-fired, gas-fired and nuclear power plants, as well as renewable energy sources.

According to the above ARE forecast of power and fuel demand until 2030, taking into account the anticipated effects of the implementation of energy efficiency projects in the economy, the requirements of the European Union in reducing air emissions and fossil fuel prices forecast until 2030, there will be a **moderate increase in final demand for electricity** to ca. 172 TWh, i.e. by ca. **55%** compared to 2006 (that year was adopted in the forecast as the base year).

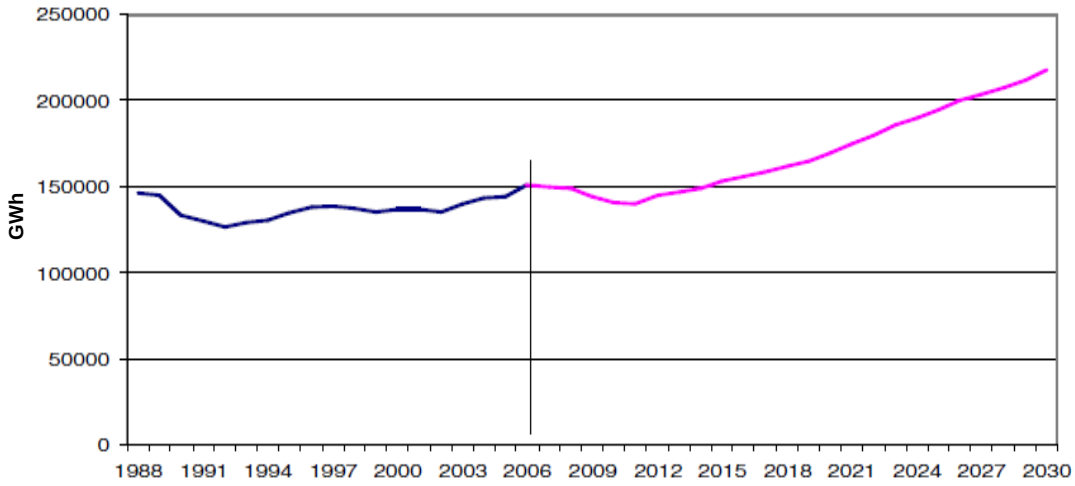

Fig. 6.1.3 Forecast gross consumption of electricity in Poland by 2030.[355]

6.1.2 Variant 2: Development of Renewable Energy Sources (RES)

Under the EU Energy and Climate Package, the share of RES in total consumption of energy (both heat and electricity) in Poland must reach 15% in 2020. Achievement of this target will be not only very difficult with the limited RES resources, but also expensive – considering the high cost of production of energy (especially electricity) from renewable energy sources. According to expertise developed by the National Agency for Energy Conservation [KAPE 2007][356]: "Total estimated potential of RES will not allow Poland to achieve the adopted target of 20% share of RES energy in the country's total balance of primary energy consumption".

In addition, the energy potential of RES has not been estimated in a reliable manner:

- [KAPE 2007]: "Results of assessments of the RES potential conducted to date are divergent. They have a limited scope and are often not based on the methodology adopted for scientific work"
- [ARE 2007] [357]: "The available studies on the potential of renewable energy sources present different results, which is caused mainly by the adoption of different definitions of the potential of RES. None of these analyses will answer the question what portion of this potential can be used in practice and, more importantly, at what cost and rate. Therefore, our Forecast assumes

the potential of RES based on the expert's assessment of the accuracy of data published in the relevant studies."

Various experts agree that **biomass and wind energy** have **the highest potential for growth** in Poland. The growth potential of hydropower, already the dominant source of electricity using renewable energy (about 2.3 TWh/a), is assessed as relatively small.

The analysis performed by ARE S.A.[357] (Fig. 6.1.4) presents the following potential of electricity production from these renewable energy sources usable until 2030:

– solid biomass (including co-firing with coal) and biogas: 29 TWh in total;
– wind power: 13 TWh;
– water: 1.5 TWh.

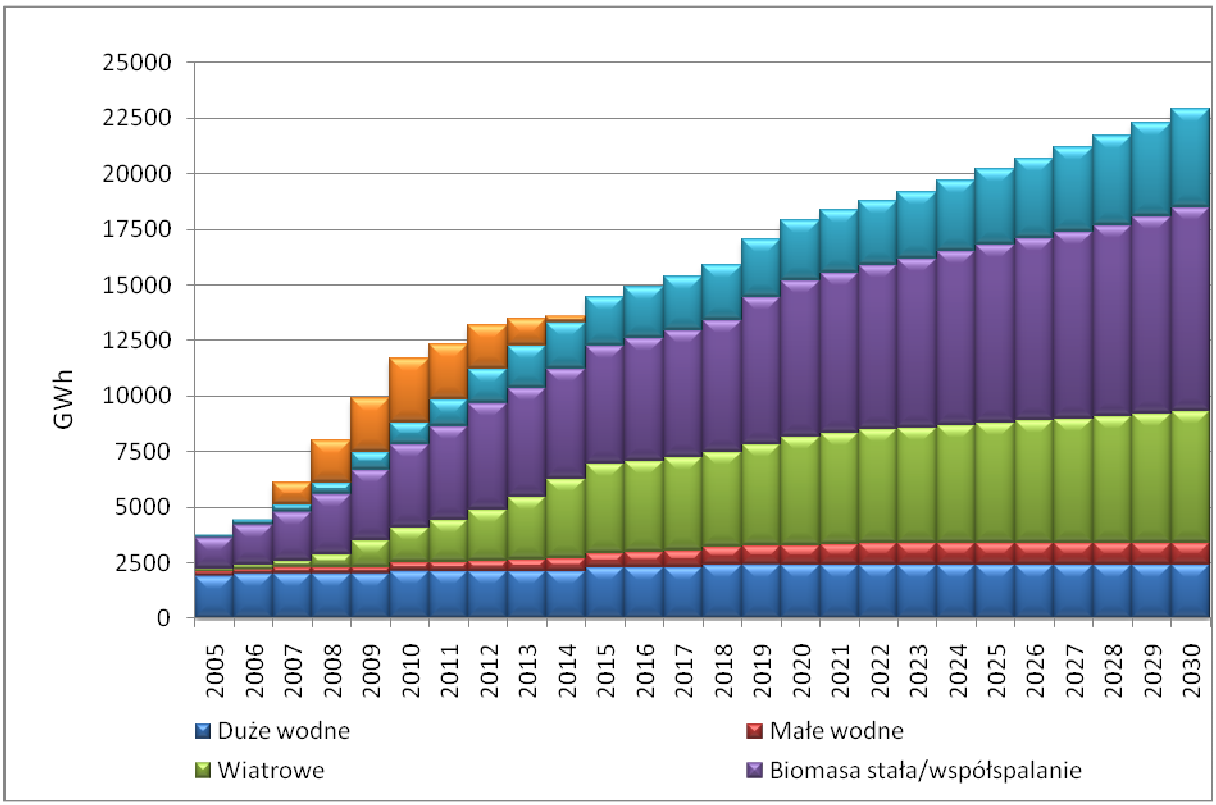

Fig. 6.1.4 Forecast production of electricity from RES by 2030 [ARE 2007].

[Large hydroelectric power plants
Wind power plants
Small hydroelectric power plants
Solid biomass/co-combustion]

Renewable energy sources are often presented as an alternative to nuclear power. Therefore, this Chapter discusses renewable energy sources that represent the highest potential for electricity production in Poland and attempts to define their environmental impacts and actual energy-generating capacity. Renewable energy sources may be broken down into two groups: The first group includes hydroelectric power, biomass and biogas. The second option is to build wind power projects. However, the average unit cost of wind power produced in Poland is much higher that the break-even point. The comparison of costs of electricity from different sources developed by ARE and shown in Fig. 6.1.5 indicates that the cost of wind energy exceeds 100 euro/MWh in all cases. Construction of wind turbines will therefore cause an increase in electricity production costs. [372] ARE prepared similar

analyses for a longer-term perspective, i.e. 2030, 2040 and 2050. They clearly indicate that even after 2030, the cost of RES will still exceed costs of nuclear power.

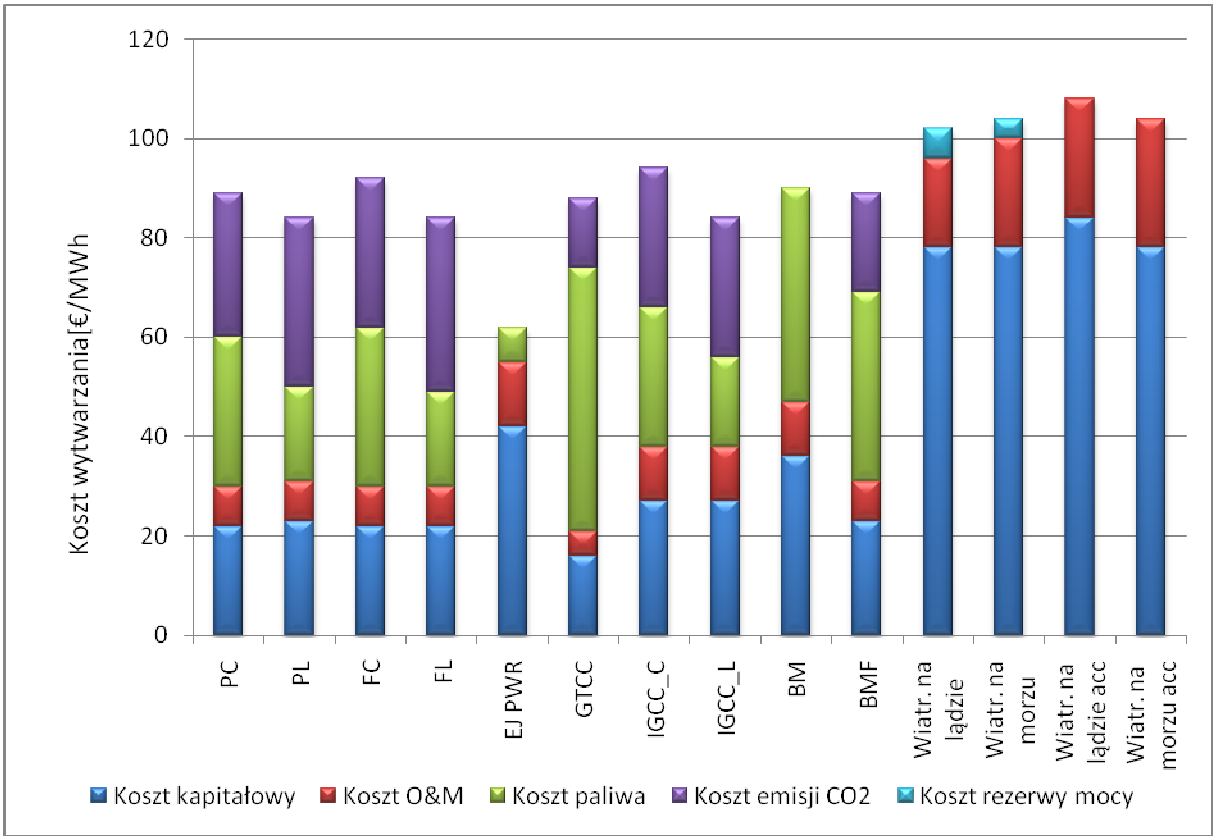

Fig. 6.1.5 Comparison of forecast costs of electricity production from various sources in 2020 [ARE 2009]

PC (pulverised coal) - condensing power plants burning black coal in pulverised coal-fired boilers with flue gas desulphurisation and denitrification systems;
PL (pulverised lignite) - condensing power plants burning brown coal in pulverised lignite-fired boilers with flue gas desulphurisation and denitrification systems;
FC (– fluidized coal) – condensing power plants burning black coal in fluidised bed boilers;
FL (– fluidized lignite) – condensing power plants burning brown coal in fluidised bed boilers;
PWR NPP – nuclear power plants with LWRIII reactors (III Generation Light Water Reactors) represented by power plants with Pressurised Water Reactors type PWR (nuclear power plant with a PWR);
GTCC (– gas turbine combined cycle) – steam and gas power plants – burning natural gas;
IGCC_C (– coal integrated gasification combined cycle) – power plants burning gas from the integrated coal gasification system;
IGCC_L (– lignite integrated gasification combined cycle) – power plants burning gas from the integrated lignite gasification system;
BM (– biomass integrated gasification combined cycle) – power plants burning gas from the integrated biomass gasification system;
PMF (– pulverised multifuel) – power plants with pulverised boilers that use biomass and coal co-firing;

[Generation cost [Euro/MWh]
CapEx
O&M cost
Fuel cost
CO2 emission cost
Power reserve cost]

6.1.2.1 Hydroelectric power plants

In 2008, hydroelectric power plants in Poland generated 2.2 TWh of electricity [358]. The total hydroelectric potential of Polish rivers (in accordance with the World Energy Council guidance)

amounts to 23 TWh (theoretical), 12 TWh (technical), and 8.5 TWh (economically viable) [359]. As we can see, there is still room for further development of hydroelectric power, although to a limited extent. Poland's relatively low hydroelectric potential results from small total precipitation and its uneven distribution, high permeability of the ground, and the predominantly lowland area of the country.

Hydroelectric energy is a source of electricity that does not generate emission to the environment and does not use any natural resources. In addition, generation of electricity in hydroelectric power plants is relatively cheap – the cheapest of all renewable energy sources, and they are the most efficient and steady sources of electricity of all known RES technologies. Furthermore, barrages are an important element of the system of flood defences, regulation of hydrographic conditions, water supply for the population and the economy, and they make it easier or even make it at all possible to use the inland waterways network. They are also attractive for tourists. And lastly, barrages provide a passage over rivers and are used as bridges.

However, construction and use of barrages has a number of negative environmental impacts. Barrages undermine the natural ecosystems of rivers, both directly (interrupting the migration of aquatic species) and indirectly (changing the hydrological parameters of the entire river). The river flow after the barrage is regulated artificially and kept at a constant level, which is not natural for any river. It has a positive effect for people and their property as a protection against flooding, but at the same time may have a negative impact on the natural ecosystem of the river. The man-made reservoir below the dam also affects the groundwater system – the level of ground waters is increased before the dam and decreased after the dam. As artificial lakes cover a vast area of land in a river valley, they sometimes require permanent relocation of people which has a negative impact on the local population. However, the key environmental impacts affect the ecology of man-made reservoirs.

Given the high surface-to-volume ratio, man-made reservoirs in lowland rivers are especially sensitive to eutrophication. Bloom of toxic cyanobacteria (blue-green algae) is the most serious form of eutrophication regularly observed in man-made reservoirs. This problem applies to the majority of river-dam reservoirs in Poland, and in particular the Sulejów, Dębe, Goczałkowice, Włocławek and Jeziorsko Lakes. The main problems with water quality in man-made reservoirs are caused by sedimentation of suspended matter carried by the river, often from a vast drainage basin, as a result of a rapid reduction of its flow rate. Deposits contain organic matter, nutrients, and hazardous pollutants – including pesticides and traces of heavy metals. They may be re-circulated by living organisms – nutrients deposited at the bottom are released and made accessible to the phytoplankton, which additionally increases productivity (or eutrophication) of the lake and causes the so-called 'secondary pollution'. Mobilisation of deposits is facilitated by the variable water level, mixing by wind, activity of benthic organisms, and the existing anaerobic conditions at the deposit-water column point of contact (reducing environment – redox potential < 200mV and O_2 concentration < 2mg/l). [360] In these conditions, algae develop rapidly and create blooms, mostly of cyanobacteria, that produce and release toxins into the reservoir. Exposure to cyanobacteria toxins, including hepatotoxins and neurotoxins, may have harmful effects on human health: skin diseases, allergic reactions, paralysis, fever, poisoning, kidney and liver damage. A relation between liver cancer and consumption of potable water contaminated with cyanobacteria was also demonstrated. 360

However, the optimum design of man-made reservoirs will reduce these impacts to insignificant levels. All in all, despite these negative aspects of environmental impacts, hydroelectric power is still one of the most environmentally-friendly sources of electricity. This is demonstrated by the low level of external costs of hydropower generation (see: results of the European Commission study ExternE – Fig. 6.1.6).

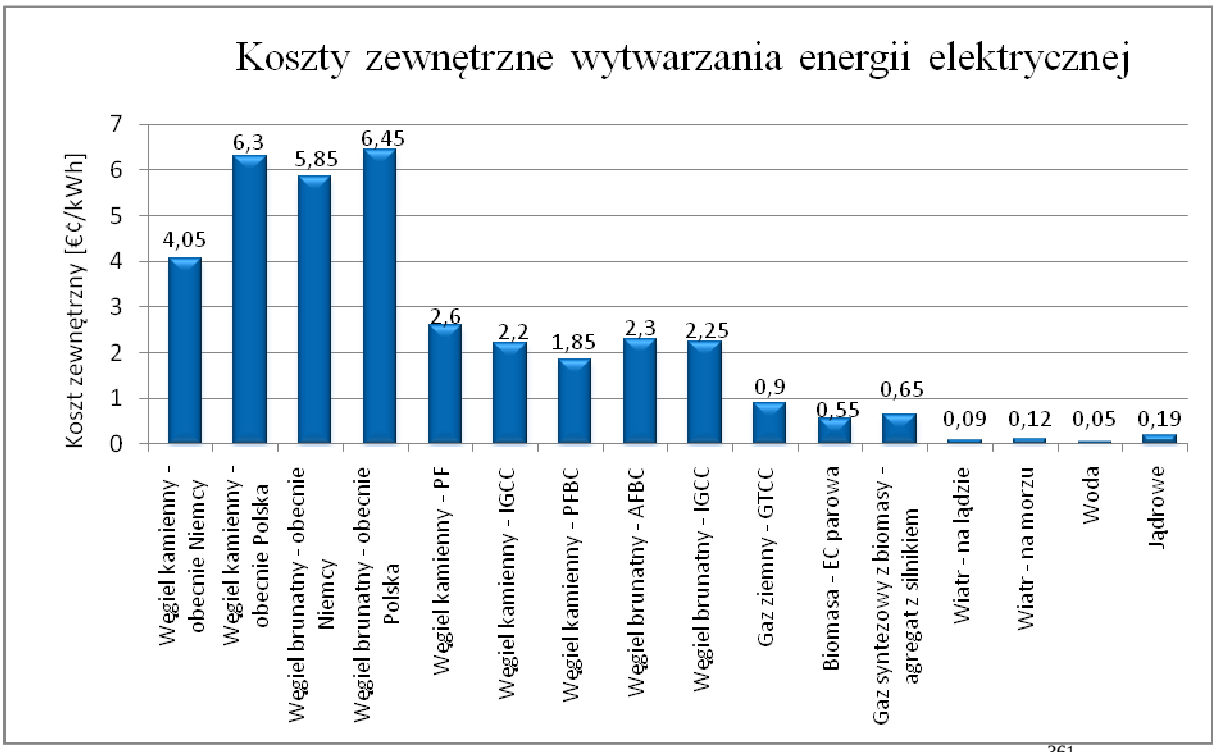

Fig. 6.1.6 External cost of electricity production in various technologies [own study based on ExternE-Pol][361]

[External cost (Eurocent/kWh)
Hard coal – currently Germany
Hard coal – currently Poland
Brown coal – currently Germany
Brown coal – currently Poland
Hard coal – PF
Hard coal – IGCC
Hard coal – PFBC
Brown coal – AFBC
Brown coal – IGCC
Natural gas – GTCC
Biomass – steam EC
Synthetic gas from biomass – generator with motor
Wind – on land
Wind – on sea
Water
Nuclear]

In addition, the vast majority of the discussed negative environmental aspects apply to large hydroelectric power plants that require an extensive area of man-made reservoirs and large dams. The environmental impact of small hydropower plants is much more positive, and their development should be a priority in this area. Development of small hydropower plants, and maintenance of energy production from large power plants at a constant level, is implied in "Polish Energy Policy until 2030", which is the overriding document in relation to the evaluated program. According to the data of Hydropower Plants Association (TEW) and the Society for the Development of Small Hydropower Plants (TRMEW) [362] electricity production in small hydropower plants (<10 MW) by 2020 can be increased by about 1.2 TWh in comparison to the level from 2009 (0.92 TWh). However, the potential of electricity production in hydroelectric power plants in terms of its quantity is so small vs. the country's total energy balance that is may be used only as a valuable addition in the energy sector, but cannot satisfy the ever-growing demand for energy in Poland. In 2030, the estimated electricity

production volume in hydroelectric power plants will reach 3.2 TWh, using the potential of small hydropower units in 100%. [363]

6.1.2.2 Biomass and biogas burning

Production of electricity in biomass power plants is based on the supply of raw materials from local sources. Agricultural or forestry waste as well as energy crops produced in special plantations are used as fuels to generate electricity. The possibility to keep energy in store – in the form of raw materials (biomass), is of key importance. It offers a great advantage over other RES. Carbon dioxide released in the process of biomass burning does not represent additional GHG emissions – it is integrated in the biomass structure in the photosynthesis process. In this way the emission caused by combustion is balanced by absorption by plants during the assimilation of CO_2. Biomass is also characterized by much lower sulphur content than fossil fuels, thereby reducing the costs of flue gas desulfurization

Production of biomass and opening of smaller biomass-fired CHP plants would also offer a number of benefits for people, especially inhabitants of rural areas, including the creation of new jobs, additional market for agricultural products (also of inferior quality), and potential involvement of local communities in new projects. Development of biomass energy production will also de-centralise the production of electricity in Poland, thus improving the country's energy security by reducing transmission losses and increasing diversification of energy sources, with biomass as a reliable and stable source.

However, despite all positive environmental aspects, the potential volume of energy produced from biomass is also limited to a large extent. Obviously, using the agricultural and forestry waste as biomass offers a number of environmental, social and economic benefits. But establishment of special plantations of energy crops involves certain negative impacts – including creation of plant monocultures and reduction of surface area for crops used in food production. On the other hand, land of inferior quality that is not suitable for typical agricultural production can be used to produce biomass.

Real chances and potential scale of development of the so-called "agroenergetics" were estimated by prof. Antoni Faber from the Institute of Soil Science and Plant Cultivation (IUNG) in Puławy [364] [365]. Prof. Faber has performed computational simulations for four scenarios of agricultural development in Poland, with different degrees of liberalization, namely: scope of intervention in agricultural market (price regulation), increasing farmers' income support (direct payments), support for areas with unfavourable management conditions and stimulation of the production of energy crops.

Simulations performed by prof. Faber show that for the purposes of biomass production, the agricultural sector could "…assign **the maximum of 830 thousand hectares**, assuming the self-sufficiency in food production at 97.2%, the required biodiversity, and carbon capture and storage. If this limit is exceeded, either the food production sector or the environmental value of agriculture will be affected. Therefore, biomass will become a scarce resource, especially given that after 2015 production of generation II liquid biofuels will start to develop and will also require lignin and celulose biomass." Moreover, analysis have shown that even in the most favourable scenario for the development of biomass, which is also a relatively favourable scenario for farmers, their income and social security will decrease.

We should also note that burning of biofuels apart from environmentally neutral CO_2 emissions, produces nitrogen oxides (NO_x) that are more difficult to eliminate than in the case of conventional energy sources. In addition, if biomass is contaminated with pesticides, plastic waste, or chlorine compounds, it may release toxic dioxanes and furans to the atmosphere on combustion.

Biogas burning technologies offer similar benefits. Biogas is a side-product of waste and sewage decomposition. Agricultural waste (manure), sludge, and landfills offer the highest biogas production potential in terms of its quantity. Combustion of biogas is environmentally beneficial in terms of greenhouse gas emissions as, although it produces CO_2, simultaneously emission of methane is limited, which is significantly more effective greenhouse gas than CO_2 (greenhouse effect of methane is about 32 times greater than for carbon dioxide[359]). If waste is decomposed naturally and the resulting biogas is not collected and burned, methane will be released to the atmosphere. However, just as in the case of biomass, biogas resources are limited in quantity and may be used successfully only in the form of dispersed energy sources supplying electricity to individual farms or elements of infrastructure, such as waste landfills or wastewater treatment plants; but their potential is not sufficient to satisfy the ever-increasing demand for energy for the industry or urban areas. The Polish Energy Policy until 2030, which is a document that takes precedence over the Programme, assumes very dynamic development of biogas burning applications – its potential is expected to be used in 100% already in 2020. A similar trend is expected for biomass – 100% of its potential is to be reached in 2030. [363]

6.1.2.3 Wind farms

Despite the necessary high investment costs, wind farms have been developing quite dynamically in Poland. It results from the fact that the development of RES is strongly supported by the state, and the imposed (regulatory) rules of operation of RES facilities are much less stringent than for other energy sources. This support includes guaranteed production subsidies, guaranteed purchase of any amount of electricity produced from renewable sources, and waiver of any liability for the costs of the balancing of differences from the planned electricity production schedules and costs of maintaining the required capacity reserves. Under EU directives, RES are given priority in the access to power grid – which means that electricity produced in RES facilities must be connected to the power grid first.

These regulations pose a number of problems for networks that include wind farms. Wind turbines operate at variable power, which is equivalent to work at full power for about 20% of the time (in Polish conditions, often less). As a result, the power grid that will receive this electricity must offer the capacity 5 times higher than usual, which is a source of high costs of network extension and which makes traffic planning and maintenance difficult. Because electricity supplies are not reliable, the network must include baseload plants – an independent source of constant and uninterrupted electricity supply. As a result, wind turbines destabilise the power grid and the operation of conventional power plants. The fact that wind farms offer intermittent capacity (equal to their full capacity for just about 20% of their time of operation) has two types of negative effects. First of all, conventional power plants must supply electricity to the grid for the remaining 80% of the time of operation, and so the apparently high capacity of wind farms reduces the demand for electricity produced by other power plants (baseload, coal-fired, gas-fired, or nuclear) only to a limited extent. And secondly, when the wind is gone or when stronger winds start it is simply not possible to switch baseload power plants on or off. They must operate continuously to secure the supply of electricity, because winds change so quickly that it is impossible to compensate these changes by regulating the output of coal-fired power plants. The problem is acknowledged even by strong supporters of wind power at Greenpeace[366]. Experience shows that not only coal-fired power plants, but also much more flexible gas-fired power plants cannot be switched on and off fast enough. In addition, it is impossible to predict wind speed in a precise manner in order to plan electricity production from different sources. As a result, it is necessary to keep a spinning reserve in the system, i.e. idle capacity or small capacity of power plants.

Unfortunately, maintaining a spinning reserve of power plants mean that their operation is far away from their optimum parameters, which will increase the cost of electricity production and emissions of gases and dusts. Consequently, the environmental benefits of wind power are reduced to a large

extent when combining wind turbines and back-up power plants. The high costs of construction of wind power projects and investment outlays on the necessary baseload plants will still remain. In addition, most wind power plants introduce 'distorted' electric current to the grid (with waveforms much different from sinusoidal) and absorbs passive energy from the grid – which causes serious problems with the quality of electricity supplied to customers[367].

We must therefore remember that wind power is intermittent, needs large investments, and is expensive. The capacity of a power system must be sufficient to satisfy the needs of customers irrespective of the actual capacity of wind turbines, and therefore it is necessary to keep a spinning reserve in the system, i.e. idle capacity of power plants. Wind speed in Poland is unfavourable from an energy point of view, about 5 m/s in the most favourable region - around Łeba, which is relatively small compared with Denmark, Scotland and Ireland (about 8.5 m/s). Wind turbine load factor is relatively small, used power ranges from approximately 15% (Germany 1998-2003)[368] to ca. 24% (UK, 2003). [369]In 2007, wind turbines in Germany supplied electricity equal to 6.4% of the country's demand for power[370]. Given the number of wind farms in Germany (about 16 thousand turbines), their surface area, and significant (even if dispersed) impacts on people and the landscape, as well as the cost of the necessary investments, 6% of the country's demand for electricity seems rather disappointing. Denmark has recorded similar results. [372] In addition, Germany expects that in 2020 wind turbines will be able to replace only 2 GW of traditional energy sources, with the planned installed capacity in wind power plants of over 48 GW. [368]

A wind farm will remain in operation up to 20 years (compared to about 60 years in the case of nuclear power plants). Wind farm investment costs are 4.5 higher compared to the cost of construction of a nuclear power plant if we take into account the volume of produced electricity and time of operation. As these investment outlays include the cost of materials, the costs of use of environmental resources are certainly much higher for wind farms. These costs are ultimately borne by consumers, which is obviously a disadvantage from their point of view. According to estimates of Szczecin University of Technology[371] (assuming as a baseline ***the total volume of electricity produced*** throughout the entire life of a power plant, i.e. 40 years for nuclear power plants and 20 years for wind power plants), the typical indicators of the use of the natural environment and emissions for both types of power plants, after conversion to units of electricity, are as follows[372]:

- ***Land take*** is over 28 times larger for wind power plants;
- ***Emissions of CO_2***, including the period of construction and decommissioning, are <u>two times HIGHER for wind power plants</u>;
- ***Consumption of materials*** vs. total volume of electricity produced throughout the entire period of operation is more than <u>two times LOWER for nuclear power plants</u>! The result may come as a surprise: although nuclear power plants are commonly considered to be 'large and heavy', they need less than 50% of materials used by 'light and environmentally friendly' wind farms to produce one unit of electricity. As an example: a nuclear power plant with a AP1000 reactor will need 630 kg of concrete/GWh in the construction phase per one unit of electricity produced throughout the entire period of operation, compared to 10,000 kg of concrete/GWh in the case of a wind power plant. The same applies to iron – AP1000 will require 116 kg of iron/GWh while a wind power plant will need as much as 2200 kg of iron/GWh;
- The ratio of **total volume of electricity produced** throughout the entire period of operation vs. the cumulative energy expenditure in the construction phase is <u>4.5 times HIGHER for a nuclear power plant</u>. Information presented by Greenpeace that wind farms produce 2.3 times more electricity per one unit of investment expenditure is therefore contrary to the impartial analyses of the German institute and the Polish university of technology;

- ***Demand for aluminium*** vs. total installed capacity in a power plant is 75 TIMES HIGHER for wind farms. Each of the many wind turbines has a turbo generator with controls and power evacuation systems, while a nuclear power plant has only one system (with redundancy) – a single system is an element that is missing in a wind power plant[373]. There are more examples of this kind, all in favour of nuclear power plants. Aluminium is a major problem, because its production generates high emissions of pollutants to the atmosphere. In Poland, an aluminium plant in Skawina was closed on this account many years ago. It is a good example of the impact of emissions generated even before a wind power farm is put into operation.

Another negative side of wind turbines is the fact that their investors and producers come from abroad. Construction of wind turbines is equal to the import of electricity at a high price[372]. No new jobs are created, because wind turbines are produced outside of Poland, e.g. in Denmark as the leading producer in Europe, As a result, development of wind power will not reduce the unemployment rate in Poland. In conclusion, wind power should be viewed with caution to avoid taking decisions that are not in the best interest of Poland's economy, just based on catchy slogans.

6.1.2.4 Conclusions

The cost curve for GHG reduction presented by McKinsey&Company indicates that costs related to the introduction of renewable energy sources are much higher than costs of nuclear power. However, this curve is based on market prices and does not include any state regulations (subsidies or taxes). In practice, investors in renewable energy sources pay much lower costs than market prices would suggest, which results from considerable state subsidies. In practice, this system means that costs of implementation of RES technologies are covered by taxpayers. However, the real cost (presented both by McKinsey and ExternE) reflects the actual expenditure related to RES projects, including the high consumption of natural resources and environmental impacts caused by the production and subsequent removal of these facilities.

It is a common misconception that RES offer ‘free’ energy in a way, because it comes from ‘free’ sources such as solar energy or wind power. However, to produce this energy it is necessary to built projects with relatively limited efficiency, and their manufacture, transport, operation, and decommissioning also deplete natural resources and release certain amounts of emissions to the environment.

The most fundamental problem concerning the large-scale use of RES is the fact that there are no technologies for the effective and efficient storage of energy, and renewable energy sources (especially wind power) produce electricity in an intermittent manner. Introduction of excessive amounts of electricity to the power grid will destabilise the system of electricity generation and transmission. However, some of these technologies may be unrivalled at a local level where electricity is consumed ‘on the spot’ and long-distance transmission is not necessary (for instance, a wind turbine for a single household, solar collectors installed on a roof of a residential building, production and burning of biomass for a single agricultural holding, or power supplied to traffic lights from photovoltaic cells). If this is the case, transmission losses are reduced, as is the demand of individual consumers for electricity from the power grid, thus reducing the overall demand for electricity and the growth in electricity production volumes in the country.

On the other hand, RES projects require substantial investments and consume considerable amount of materials in the construction phase. The amount of materials and equipment required by Generation III nuclear power plants are much lower than in RES technologies. The same holds true for energy intensity in the implementation phase. Much less energy is required to produce building materials and to build a nuclear power plant. As a result, emissions of sulphur dioxide, nitrogen

oxides, dusts, heavy metals, and CO2 during the construction of a power plant and production of the associated equipment are much lower for nuclear power projects than for other sources of electricity. Long-term works under the EU's EXTERNE programme [377] have confirmed that nuclear power plants are the most environmentally-friendly and human-friendly of all sources of energy if we consider the entire period of their operation.

6.1.3 Variant 3: Development of conventional energy production and its modernization

Another alternative is to modernise the conventional energy production sector in order to increase its efficiency and reduce harmful emissions to the environment. In the past decade, considerable efforts were made in the Polish energy sector to reduce the environmental impacts of electricity production. In 2004, emissions of SO_2 dropped to 43.6%, NO_x – to 60.8%, and dusts – to 7.8% compared to 1990. [374][375] Still, emissions of gaseous pollutants from power plants in Poland are much higher than in Western Europe. In 2009, total emissions from the Polish electricity production sector were as follows: [375]

- SO_2 – 335 thousand tonnes
- NO_x – 229 thousand tonnes
- Dusts – 20 thousand tonnes.

These figures indicate a considerable reduction in these emissions compared to previous years. But CO_2 emissions did not change significantly: from 150 thousand tonnes in 1990 to 149 thousand tonnes in 2004, and are expected to remain at this level in 2010. It is a natural consequence of the adopted structure of the Polish power sector, based primarily on coal.

However, current emission charges do not force the power sector to implement modernisation projects. As we can see in Table 6.1.1, they are not only much lower than external costs borne by the society, but also several times lower than unit costs of reduction of these emissions.

Table 6.1.1 Current unit rates of gas and dust emission charges[376]

Emission	Charge [PLN/Mg]
SO_2	410
NO_x	410
Dust	440
CO	110
CO_2	0.22
CH_4	0.22

It means that there are no economic incentives to reduce emissions in the Polish power sector. Implementation of technologies that reduce emissions to the atmosphere is expensive. As a result, it would be difficult to expect intensive actions to reduce the negative environmental impacts in the conventional electricity production sector.

There is a new promising technology offering the reduction of industrial emissions, based on capturing CO_2 and pumping it to underground geological structures, called carbon dioxide sequestration (CCS – Carbon Capture and Storage). CCS is still in the testing phase, and it is not known yet whether it will be introduced on an industrial scale by 2030. We should therefore assume that this technology is not yet proven, and it is disproportionately expensive. In addition, CCS projects will have only one positive impact in the form of reduced emissions, and only of CO_2. Emissions of other exhaust gases will not be reduced, and they often have more negative impacts on the environment than CO2 emissions. But most of all, CCS is not a power-generating technology. Therefore, investments in CCS

will not improve the country's energy security or diversify its energy sources. The will reduce the negative environmental impacts of conventional energy sources, but only in the context of potential climate change related to CO_2 emissions. Other problems will remain unsolved – including emissions of other pollutants, supply of natural resources and impacts resulting from their extraction, transport, and the unavoidable depletion of non-renewable resources. Theoretical resources of coal and lignite in Poland are relatively large, but their extraction becomes more difficult with time (deposits are located deeper and are more complex in terms of their geology, for instance due to a threat of explosion), as well as more expensive, and exploration of new deposits is more difficult (social protests opposing the potential exploration of the Legnica deposit or the open-pit mine in Tomisławice near the Gopło Lake).

But even if the Polish programme of modernisation of the country's power sector is implemented in its entirety (assuming the best-case scenario), 47% of total volume of electricity in Poland will still be produced in coal-fired power plants in 2030 (according to the Programme). Therefore, the development of methods that will minimise their negative impacts on the environment is more than justified. Still, these methods cannot fully replace the planned introduction of nuclear power in any aspect.

6.1.4 Selection of the optimum alternative

We can conclude that the necessary modernisation of the Polish energy sector should not be limited to the introduction of nuclear power, as assumed in the Programme, but should also involve the development of RES (in an appropriate scale), investments aimed at the reduction of electricity consumption (energy efficiency projects), and modernisation of conventional energy sources (state-of-the-art electricity generation technologies and the so-called "clean" coal technologies, including possibly CCS), which is assumed in other strategic documents, including the Polish Energy Policy until 2030 that takes precedence over this Report (cf. Chapter 3). Considering the requirements related to the reduced emissions of greenhouse gases and the ever-growing demand for electricity, it is necessary to adopt a policy that promotes all these alternatives, as soon as possible. However, introduction of the Polish Nuclear Programme is still the key element of this policy, in the context of the necessary reduction of GHG emissions, diversification of energy sources, and reduction of the social cost of electricity production. This solution is justified by the fact that of all energy sources, nuclear power has the highest potential to reduce negative environmental impacts and to reduce social costs at the lowest cost of project implementation. Therefore, if the overriding objective of the currently updated energy strategy is to reduce emissions and ensure sustainable energy security combined with the reduction in social costs of electricity production at the lowest implementation costs possible, the development of nuclear power is the direction we should take (which is confirmed by the measurable outcomes of analyses based on the ExternE methodology and emission cost curve [377] **Błąd! Nie zdefiniowano zakładki.**).

6.2 Technological alternatives

6.2.1 Types of nuclear reactors

Structure of individual types of reactors (EPR, AP1000, ABWR, ESBWR) was discussed in detail in the initial section hereof in chapter **Błąd! Nie można odnaleźć źródła odwołania.** to enable the variant analysis in terms of the entire document. If environmental impacts potentially depend on the reactor type, individual impacts were discussed for different types of nuclear reactors. In particular, the type of reactor design will determine the release of radioactive substances to the environment. Emissions of radioactive substances during normal operation from different types of reactors (EPR, AP1000, ESBWR) are presented in chapter **Błąd! Nie można odnaleźć źródła odwołania.** - **Błąd! Nie można odnaleźć źródła odwołania.**, while comparison is performed in chapter **Błąd! Nie można odnaleźć źródła odwołania.**. Similarly, for transient and emergency conditions, possible emissions in the event of a design failure for the same three types of reactors were examined in ch. **Błąd! Nie można**

odnaleźć źródła odwołania.– Błąd! Nie można odnaleźć źródła odwołania., and their summary was presented in ch. **Błąd! Nie można odnaleźć źródła odwołania.**. Similarly, values of possible releases in case of serious failures were analysed for the discussed reactors in ch. **Błąd! Nie można odnaleźć źródła odwołania.– Błąd! Nie można odnaleźć źródła odwołania.**, and their summary was presented in ch. **Błąd! Nie można odnaleźć źródła odwołania.** . Detailed analysis broken down into various types of reactors was also performed on the impacts related to the discussed volumes of releases, based on calculations of radiation doses for exposed population:

- during normal operation of the nuclear power plant – comparison of impacts in Chapter 7.3.4;
- in transient and emergency conditions – comparison of impacts in Chapter 7.4.4;
- in the event of major accidents – comparison of impacts in Chapter 7.5.4.

Types of reactors were also analysed in terms of their energy parameters (Table 4.3.5), consumption of cooling water (Table 4.3.6, Table 4.3.7, Table 4.3.8) and land take.

6.2.2 **Cooling system technologies**

The analysis of individual environmental impacts also dealt with different systems of cooling, which can be alternatively applied to NPPs (description of the installations in ch. 4.3.2.1): open cooling systems (without the use of cooling tower) and closed cooling systems (using wet cooling towers or hybrid cooling towers). The installations display different environmental impacts in terms of size of demand for cooling water (Chapter 4.3.2.2), waste heat discharge to water or atmosphere (Chapter 4.3.2.5/4.3.2.6), chemical discharge to water or atmosphere (Chapter 4.3.3/ 4.3.4), noise emission (Chapter 4.3.5) and impact on landscape (Chapter 0).

6.2.3 **Potential use of heat generated in nuclear power plants for heating and other purposes**

A number of negative environmental impacts of nuclear power plants result from the necessary release of heat to the environment. Heat is a side product of electricity generation in a nuclear power plant. It is released to the environment via the hydrosphere (discharge of heated water) or the atmosphere (through cooling towers). Environmental fees are charged for the release of heat to the environment.

As an alternative, heat generated in nuclear power plants may be utilised. Heat may be collected from turbine extractions (for heating purposes) or from heated water in the cooling system (for other economic purposes). Utilisation of heat generated by the nuclear power plant may prove economically viable in certain locations, including Żarnowiec[378] (preliminary analyses conducted by PG indicate the supply of heat to the heating system in Trójmiasto (Gdańsk-Gdynia-Sopot) from the new nuclear power plant in Żarnowiec may be economically viable – collection of up to 250 MW_t was assumed)[379], or Warta-Klempicz (supply of heat to Poznań). It would be worthwhile to analyse the case study of the supply of heat from the planned power unit no. 3 in the nuclear power plant in Loviisa to the heating system in Helsinki (up to 1000 MW_t)[380]. There are examples of similar projects successfully implemented in other countries (e.g. in Sweden – a nuclear power plant supplying heat to Stockholm).[379] A nuclear power unit with gross power-generating capacity of 1400MW could produce up to 2885 MJ/s of heat, which is much more than the average demand for heat even in large agglomerations.[379] The project for the supply of heat to Warsaw potentially generated in a nuclear power plant is now being discussed. However, the nuclear power plant would have to be located north-east of Warsaw.[381]

Combined energy sources (producing electricity and heat at the same time) offer higher efficiency in the use of primary energy, which has a positive impact on natural resources. However, the potential

customer base and demand for heat is a pre-condition for any CHP project. Nuclear power plants are usually located at the largest possible distance from densely populated areas, which makes it rather difficult to use CHP technologies. But the heat can be transferred on a fairly large distances without significant transmission losses (heat losses are approximately 8% which is usually, depending on water temperature, ambient temperature and the quality of the transmission network used approximately 1.5 do 3°C/10km of pipeline). As a result, it would be possible to supply heat to agglomerations located even 50km away from the nuclear power plant, at least in theory. But the problem of costs remains – the longer the distance, the higher the investment costs, especially related to the construction of a pipeline. [379] Therefore, the potential of heat application should be taken into account when selecting the most optimum location for a nuclear power plant in Poland. This alternative would ensure reduction of negative environmental impacts of heat releases to the environment, elimination of the resulting charges, more effective utilisation of primary energy sources, reduction of low emission in urban areas (from local building heating systems – which is one of the biggest environmental problems in Polish towns and cities), as well as reduction of final electricity consumption (electricity used to heat water and buildings).

6.2.4 Selection of the optimum alternative

At this stage of the SEA Report, we are not able to specify the most viable technological alternative as this decision will depend to a large extent on the actual location for the project. Combined generation of electricity and heat in the planned nuclear power plant should be the recommended alternative, but its viability will depend on the sufficient number of potential customers for heat. However, this alternative should be considered on a case-by-case basis in every EIA report for a given project.

As regards the choice of different types of reactors and different types of cooling systems, the final decision should be taken at the public procurement stage on the basis of the Best Available Technology principle, considering the many aspects of their environmental impacts, dependency on the actual location, and the continuous advancement in reactor design technologies. As this decision will not be taken in the nearest future, we should not form an opinion at this stage.

6.3 Location alternatives

This section focuses on the analysis of specific impacts arising from the specific context of location. In any case it does not exhaust the range of potential impacts that may result from the implementation of the Polish Nuclear Energy Programme and thus building the first nuclear power plants in Poland. This section cannot be read in isolation from the information contained in other chapters, in particular in Chapters 6,7,8 and 9. Thus, by reading only this subsection we cannot draw any conclusions about the potential impacts and their environmental effects.

Studies aimed at determining the location of the first nuclear power plant with a capacity of about 2,000 MW have been started in the 1960s. As a result of the location studies conducted in 1969 - 1970, in December 1972 the decision was made on the location of first nuclear power plant in Poland on Lake Żarnowieckie. Construction of Nuclear Power Plant "Żarnowiec" was launched in 1982. Simultaneously, research on finding another location continued. They ended in June 1988, when Governor of Pilskie Province decided to establish the site of second nuclear power plant Warta in the town of Klempicz. In parallel with the final phase of location study and research for the second nuclear power plant, localization studies were conducted in order to prepare the materials to begin the process of localization for the third and subsequent power plants. In the first stage macro-spatial analysis was performed in terms of site options for nuclear power plants throughout Poland; 62 potential areas of location were selected. The stage was completed in 1989. The second stage limited the list of locations to 29 areas. Further studies and research were interrupted due to the resignation

from implementation of the development of nuclear energy. In 2009, the Ministry of Economy in consultation with local governments updated the nuclear power plant site proposals under consideration until 1990. Also, new offers were collected. On this basis, a list of 28 potential sites for nuclear power plants was prepared. These sites are presented in **Błąd! Nie można odnaleźć źródła odwołania.**

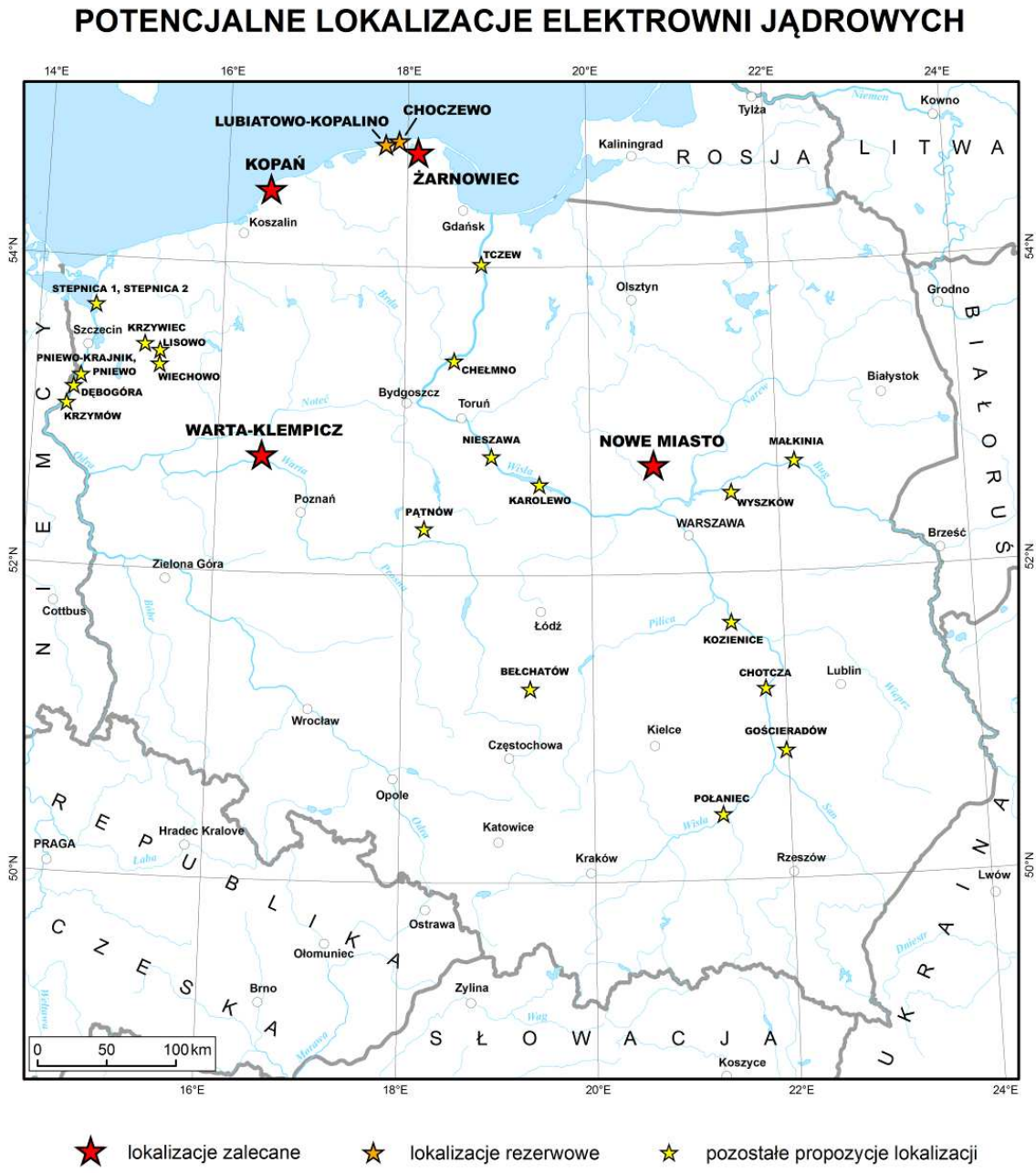

Fig. 6.3.1. Potential locations of nuclear power plants in Poland

[POTENTIAL NUCLEAR POWER PLANT SITES
Recommended locations
Reserve locations

Other site proposals]

6.3.1 Expert opinion on the siting criteria for nuclear power plants and preliminary assessment of the agreed locations

In 2010, commissioned by the Ministry of Economy, a document was prepared, entitled "The study on the siting criteria for nuclear power plants and preliminary assessment of the agreed locations". The ranking of locations was performed, taking into account the expert assessment of the 17 evaluation criteria (the last place in the ranking is the location for which no geographical coordinates were handed over, which due to formal reasons prevented its inclusion in the ranking). The expertise carried out as part of this study revealed the following sequence of the most favourable locations of the first Nuclear Power Plant in Poland (**Błąd! Nie można odnaleźć źródła odwołania.**).

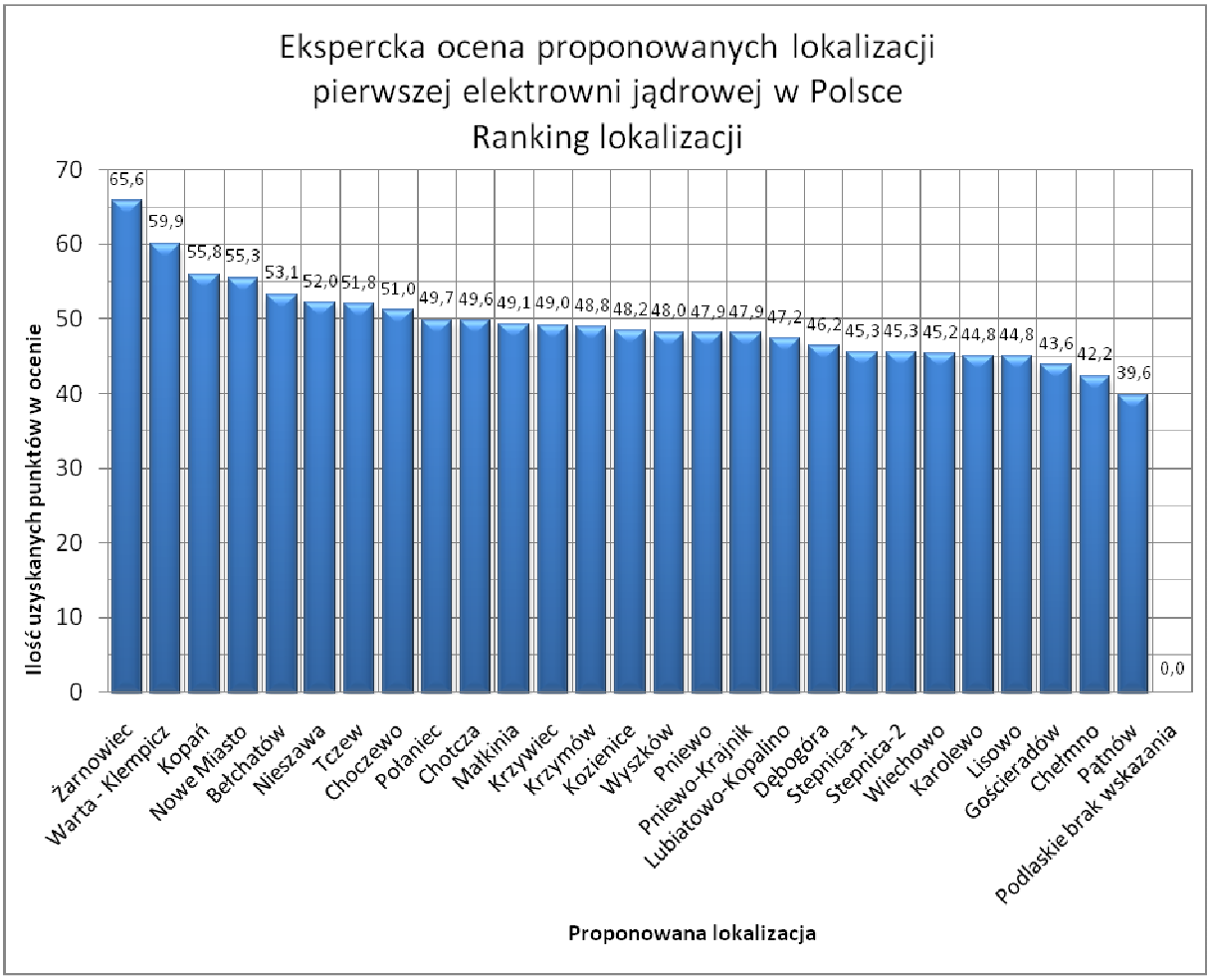

Fig. 6.3.2. Ranking of the proposed locations of nuclear power plant in Poland

[Expert assessment of proposed sites of the first nuclear power plant in Poland
Site ranking
Number of points obtained in the assessment
Proposed site
Podlaskie – no indication]

At the request of the Minister of Economy, funds were secured in the budget of the National Fund for Environmental Protection and Water Management to carry out further work on location analysis for nuclear power plants. According to information received at the Ministry of Economy, a company will be selected in the near future which will perform detailed fieldwork for three potential locations

identified by the investor (the information obtained shows that these will be locations indicated by the expert opinion). This work should be completed by the end of the first half of 2013.

Returning to the results of the already developed site expertise, attention should be paid to the fact that Żarnowiec site was assumed (with vast majority) to be the site of the first nuclear power plant, recommended by the expertise authors. Żarnowiec was also recommended for further detailed studies of location.
The expertise also recommends another three (almost equivalent) locations: Warta-Klempicz, Kopań, Nowe Miasto for simultaneous location studies.. Additionally, Choczewo and Lubiatowo-Kopalino were added. On the basis of detailed studies and location expertise, other locations were excluded for various reasons and according to the information from Ministry of Economy and PGE S.A. it is very unlikely that they will be chosen as sites for two first nuclear power plants in Poland. This forecast analyzes several parameters characterising a given site and its potential impacts on individual aspects.

6.3.2 **Description of location parameters**

Selecting the most optimal location of nuclear power plant requires an analysis of many factors that can affect the attractiveness of the location or its disqualification. These factors were divided into four major groups - the basic environmental conditions, geological and hydrogeological structure, infrastructure and biota. In each group, several characteristic parameters were included.

In basic conditions of the environment the following parameters were taken into account:

- **population density** – density was assumed for a given municipality where construction of a nuclear power plant is planned. This is an important parameter indicating how many people may be exposed to the impacts associated with construction and operation of a power plant. The population density was referenced to the average population density in the country. The lower the density the lower the potential impact on the population as a whole.

- **limited use area** – area 800 meters from the planned nuclear power plant. In this area, permanent residence of people is not allowed, and thus, at the time of acquisition by the area of existing residential buildings or buildings intended for human residence, residents of these facilities should be relocated. It should be noted that the area has been designated based on the geographical coordinates of the position of power plants set out in the study by Energoprojekt [382]; these are only proposed locations, which are subject to change, and hence an area of limited use may change.

- **wind energy zone –** wind energy zone affects the accumulation of atmospheric pollutants from power plant or from facilities situated in the vicinity. The more favourable zone (the strength of winds in the area is greater), the less likely is accumulation of pollutants in the atmosphere and the location in this regard is more favourable. This analysis was done on the basis of information contained in the study by Energoprojekt[382].

- **sufficiency of water resources for cooling –** one of the conditions precedent for nuclear power plant location is the presence of sufficient water resources, which will be used in the cooling system. Depending on access to water, a closed or open cooling system was planned in power plants. Sufficient water resources study was conducted on the basis of information contained in the study by Energoprojekt[382], as well as on the basis of information obtained from specialists in this field.

- **impact on cultural goods –** because the impact of nuclear power plants on cultural goods will occur only during construction - with earthworks, and will concern possible violation of archaeological sites, in assessing this parameter only the presence of those posts was taken

into account that have been found near the potential location of the plant. The occurrence of archaeological sites in specific sites was adopted in accordance with the data contained in the study by Energoprojekt[382].

- **impact on the availability of raw materials –** because construction of power plant occupies a large area, and no works will be allowed in the vicinity that could affect the stability of land, potentially occurring useful raw material deposits occurring in the vicinity of the site will not be used. In order to determine the occurrence of such an event, the presence of mineral deposits near the location has been analyzed. The analysis was based on maps of the raw materials developed by the Polish Geological Institute.[383]

Description of **geological and hydrological structure** was developed on the basis of data in the study by Energoprojekt[382] and literature. During the analysis, particular attention was paid to the geological structure of the substrate and susceptibility of lithology to infiltration rate, permeability, and cracking and discontinuous structures. In addition, attention was paid to the depth of groundwater levels and possible anthropogenic impacts.

Infrastructure related to electricity production and transmission is one of the most important factors affecting reasonable location of nuclear power plants. Here, accessibility of transmission grids, their current load as well as demand for electricity were analysed in the area which could be supplied in electricity from a nuclear power plant at a given site. Description of this factor uses an Expert assessment of the locations of nuclear power plants in Poland from the viewpoint of the possibility of connecting to the transmission network made for PSE S.A[384]. and data from the study by Enegroprojekt[382].

Factors affecting **fauna and flora** of a given site were described by experienced naturalists. Biodiversity in areas of individual locations was determined without field research, but only on the basis of literature data. The quality and accuracy of data in the source studies is relatively high, but the precision with which they can be accurately attributed strictly to the sites of the planned investments is approximate. Characteristics of diversity thus refer not to the point where a power plant is to be built, but to the area in which it is planned. It is difficult to precisely determine the boundaries of so adopted study, it may only be assumed that the established data refer to the area approximate in size to municipality or county. This should not however be a serious problem for two reasons: methodological and substantive. First of all, all the locations were analyzed in the same way, so regardless of their accuracy and possible errors, in all cases the data are comparable, and at this stage this is the main goal, i.e. comparison of locations. From the substantive point of view, extending the analysis from the scope of a specific place, which will be occupied by the plant, to closer or further surroundings is also justified, because construction of every plant is associated with infrastructure that can have a direct negative impact on diversity, even further away.

6.3.3 **Recommended sites**

6.3.3.1 Żarnowiec site

<u>Basic environmental conditions</u>

Żarnowiec site is a reserve location from the 1980s, additionally assigned by the Marshal of Pomorskie. Due to earlier work in this area associated with the construction of power plant (construction was halted pursuant to the resolution of the Polish Government of 04.09.1990) it is the most recognized terrain in terms of conditions associated with the location of nuclear power plants. Additionally, Żarnowiec has been positively assessed by the Mission of the International Atomic Energy Agency in 1990.[385]

The potential construction of Żarnowiec NPP would occupy the area located in the municipality Krokowa (District Puck) and the municipality Gniewino (District Wejherowo), Pomorskie. Exact location of the power plant is presented in **Błąd! Nie można odnaleźć źródła odwołania.**. The municipalities where the power plant is to be located have low population density (48 and 39 residents/km^2 at average population density in Poland 122 residents/km^2) due to which impacts of power plant construction and operation **will affect a small number of people**.

In the limited use area (800 m from the power plant) no residential buildings or other residential facilities are situated, **so there is no need for relocation** associated with power plant construction.

Near the site on the south-western shore of the lake facilities of "Żarnowiec" pumped-storage power plant (ESP „Żarnowiec") are located: drainage channel and engine room building. Upper reservoir (artificial hydrotechnical structure) of this plant is located on the plateau near the village Gniewino and is connected to the power plant with four steel derivation pipelines.

The surroundings of Żarnowiec NPP have a very favourable wind energy zone, due to which **there will be no accumulation of potential pollutions** emitted from the power plant and other facilities in vicinity.

Preliminary estimates suggest that the water resources of Lake Żarnowieckie allow for cooling of one large nuclear power plant unit (e.g. with EPR or AP1000 reactor) - using a closed cooling system with wet natural draft cooling tower. Possible use of wet-dry hybrid cooling towers with fan-assisted draft, from which the irreversible water losses are at least 4 times lower than with wet natural draft cooling towers would eliminate hydrological restrictions, but it also would involve a significantly increased internal load energy consumption, absorbed by the cooling tower fans. In addition, it must be remembered that the cooling towers require a large area, comparable to the area occupied by the main power plant buildings.

Therefore, selection of optimal cooling system has a key significance in case of „Żarnowiec" site. It will require an appropriate optimization analysis, taking into account size of the potentially available area, and possibly also the option to use sea water. As a result of this analysis, a number of power units will be specified with specific reactor types and certain cooling system solutions, possible to locate at that site.

The power plant area is limited to the west by Żarnowieckie Lake, and forested hills from the east with a height of up to approximately 100 m above sea-level. The main buildings of the new power plant will be located in the northern part of the former Żarnowiec NPP construction site, north of the abandoned main facilities of stage I of the previous construction, where after the necessary demolition work the supporting facilities will be situated.

To the north of the proposed site there is Seaside Landscape Park, but given the considerable distance and the presence of developments built between the park and the power plant, its functioning as a building **should not deteriorate landscape values** of these areas.

There are no archaeological sites in the construction area and its vicinity, **thus eliminating hazards to cultural heritage** during ground works or construction delays due to halting works for the period of work of archaeologists.

Northeast of the site there are operated oil and natural gas deposits (Mine Żarnowiec in Krokowa), but quite a distance from the planned investment to the deposits in no way **will impede access or operation of those deposits** (see: chapter 8.3.6.2).

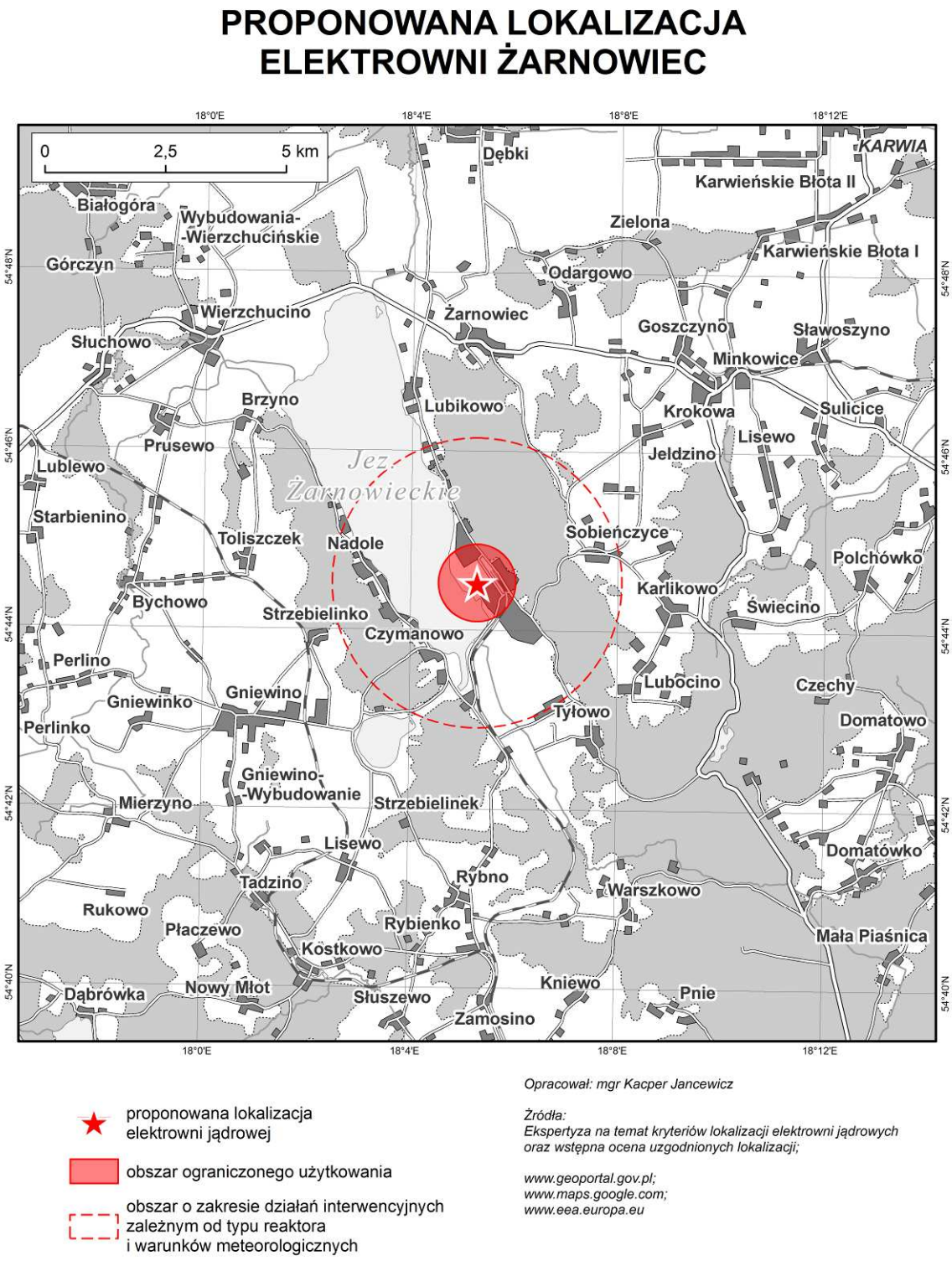

Fig. 6.3.3. Proposed site of Żarnowiec NPP

[PROPOSED SITE OF ŻARNOWIEC POWER PLANT
Proposed power plant site

Limited use area
Area of interventions depending on reactor type and weather conditions
Developed by: mgr Kacper Jancewicz
Sources:
"Expert opinion on criteria of nuclear power plant locations and preliminary assessment of established sites"
www.geoportal.gov.pl;
www.maps.google.com;
www.eea.europa.eu]

Geological structure and hydrogeology

The substrate on which the NPP is to be located mainly consists of boulder clay and fluvioglacial sand. The substrate contains a series of Tertiary Triassic outcrops within the chalk, whose tectonic conditioning is not specified. Neotectonic reactivation of this structure cannot be excluded. Mesozoic roof and Tertiary strata lay on the substrate. Historically, a small seismic quake was recorded several kilometres from the location, and maximum soil vibration acceleration is less than 0.02 g. In this area there are large area denivelations.

In the area of investment there is quaternary porous tank "Żarnowiec Fossil Valley" (GZWP 109), the average depth of groundwater intakes here is from 5 to 50 m. Depth to the main utility groundwater level varies between 2 and 5 m. The levels of aquifers show very high sensitivity to contamination. No insulation from the ground surface and the presence of sandy sediments of high permeability may cause **serious and widespread contamination** of groundwater in case of penetration of pollutions to water and ground.

Infrastructure

The site of Żarnowiec NPP has strong connections with national power supply system. 400/110 kV substation "Żarnowiec" was designed to connect to the NPS 4 pumped-storage units and 4 nuclear power plant units. This location is advantageous also due to network considerations, since this region of Poland does not have a large baseload power plant (except ESP "Żarnowiec"). Currently, this grid area has a **power production deficit** above 500 MW, and the existing transmission grid is loaded at less than 60%, which **gives the possibility to use existing transmission capacity** to evacuate power from the NPP. Connection of a new large power plant to "Żarnowiec" station would visibly improve the working conditions of the transmission grid in this region and contribute to reducing energy losses in the networks (including the transfer of energy for pumping at ESP "Żarnowiec") and improve the reliability of power supply to consumers. However, to enable the network connection to NPP, expansion of 100 to 250 km long transmission lines will be necessary. Expansion of the network will not interfere with any of the Natura 2000 areas and its course will be set away from urban areas. A detailed description of the impact of network expansion is described in chapter 8.3.7.

Site assessment made by PSE

From the viewpoint of the power balance in the NPS location is advantageous, which was emphasized with other nuclear power plant sites in the northern part of the country.

It should be noted, however, that in this case, difficulties should be expected with evacuation of full power (3200 MW) from the nuclear power plant into the NPS. In PRSP prepared by the TSO connection of the nuclear power plant to Żarnowiec node was considered. Results of analysis showed that in case of 1600 MW capacity, construction of an additional 2-track 400 kV line linking SE Żarnowiec with new station in the region of Gdansk is necessary. Expansion, however, was not sufficient for 3,200 MW and it is difficult to imagine the construction of other 400 kV lines from the

node into the NPS. It is therefore proposed to consider this location for nuclear power plant with a capacity of not more than 1600 MW.

Moreover, for these locations attention should be paid to other factors that may adversely affect the location of nuclear power plant, associated with excess energy production in that area and with overloading of existing transmission networks:

- Construction of wind farms in the north. TSO (Transmission System Operator) has already issued the connection conditions for wind farms connected to SE Żarnowiec for the total power of 346 MW, and currently proceedings are pending concerning construction of further wind farms with a total capacity approximately 1600 MW (including a sea wind farm with capacity 420 or 1560 MW). It should also be noted that TSO issued the connection conditions for wind farms in neighbouring substations with total capacity ca. 1750 MW. Then there are proceedings pending at DSO (Distribution System Operator).

- Construction of a gas power plant with a capacity of 250 MW connected to SE Żarnowiec. At present it is difficult to judge whether the investment is feasible.

These areas due to former construction of NPP have been equipped with technical infrastructure, such as: deep water intakes, water and sewage and power supply network. The following are located in the vicinity of the site: high pressure gas pipeline, two 110/15 kV substations, 400/110 kV station.

Road grid was also rebuilt for "Żarnowiec" NPP< adjusting it to heavy and large machinery transport. The roads are still useful for transporting super-standard loads in terms of size and weight.

The distance between the NPP site and existing urban infrastructure is as follows: main roads - up to 5 km, municipal roads - up to 5 km, railway lines - up to 10 km, water transport routes - from 5 to 15 km, airports - 20-60 km, other urban infrastructure - up to 5 km. So developed communication network near the plant will allow for a diverse supply of goods during construction (building materials) and during operation of the plant (spare parts, uranium) supplied from other regions of the country or outside Poland.

Fauna and Flora

Fauna

Location in the coastal zone is certainly an increased risk of conflicts with birds - the zone is a very intensively used bird migration corridor. In bird refuges adjacent to the site (9-12 km away) nesting was stated (depending on the refuge) of 7 to 10 species from Appendix I of the Birds Directive (occurrence of at least 32 species was stated).

Key bird species found in three SPAs adjacent to the site:

whooper swan *Cygnus cygnus,* white stork *Ciconia ciconia,* black stork *Ciconia nigra,* common goldeneye *Bucephala clangula,* European honey buzzard *Pernis apivorus,* black kite *Milvus migrans,* red kite *Milvus Milvus,* white-tailed eagle *Haliaeetus albicilla,* short-toed snake eagle *Circaetus gallicus,* Western marsh harrier *Circus aeruginosus,* Montagu's harrier *Circus pygargus,* hen harrier *Circus cyaneus,* lesser spotted eagle *Aquila pomarina,* golden eagle *Aquila chrysaetos,* osprey *Pandion haliaetus,* red-footed falcon *Falco vespertinus,* peregrine falcon *Falco peregrinus,* hazel grouse *Bonasa bonasia,* common crane *Grus grus,* green sandpiper *Tringa ochropus,* wood sandpiper *Tringa glareola,* stock dove *Columba oenas,* short-eared owl *Asio flammeus,* Tengmalm's owl *Aegolius funereus,* Eurasian pygmy owl *Glaucidium passerinum,* European nightjar *Caprimulgus europaeus,* green woodpecker *Picus viridis,* black woodpecker *Dryocopus martius,* woodlark *Lullula arborea,* barred warbler *Sylvia nisoria,* red-breasted flycatcher *Ficedula parva,* red-backed shrike *Lanius collurio.*

Breed of 3 species from "Polish Red Book of Animals" was recorded (although 16 species were identified). Numerous migration of prey birds *Falconiformes* was observed, and common crane population during the autumn migration is estimated at 3,000. Because of the distance (about 9 km) to neighbouring refuges, the construction of power plant should not have a significant impact on the populations of birds nesting there (although the impact cannot be excluded and should be a part of detailed study concerning the choice of location), however, expansion of transmission networks associated with power plant (transmission network impact will be the subject of a separate study - see chapter 8.3.7.2.2) can constitute a serious threat to migratory birds in the area - this is a real risk especially to the observed abundance of migrating cranes. Due to the site surrounding with Natura 2000 refuges, expansion of aerial power lines may also affect the breeding birds of these areas. Although there are no accurate studies for this site, it can be assumed that in the immediate vicinity of the planned site there are also breeding birds refuges listed in Annex I of Birds Directive and/or the "Polish Red Book of Animals".

Possible discharge of heated water can disrupt the balance of aquatic ecosystems (invertebrates, fish), leading to eutrophication. Lake Żarnowieckie can become a place of bird concentration during harsh winters, which often is observed in the vicinity of the plants discharging heated water to the environment. It is difficult to determine whether such impact has positive or negative environmental effects.

In the Bielawskie Błota 2 species were found from Annex II of the Habitats Directive - great crested newt *Triturus cristatus* and dragonfly *Leucorrhinia pectoralis*.

Bielawa Reservation is an animal reservation inside Bielawskie Błota refuge, so it does not require a separate comment.

The site **can have significant effects on Natura 2000 sites, but does not interfere in the network of ecological corridors.**

There may be increased mortality risk of many migratory birds as a result of collision with overhead power transmission network, whereas the remaining NPP infrastructure (roads, buildings, etc.). because of the distance should not have significant effects on Natura 2000 areas.

More detailed analysis of the impact of NPP on Natura 2000 will be performed at the stage of preparing the Environmental Impact Report for construction of power plant when selecting a location, though it would be advisable to exclude this location because of the potential environmental effects of its implementation.

Plants

The proposed location is near the plant refuges IPA:

PL 96 – Białogóra.

PL 106 – Łąki piaśnickie.

The location is adjacent to many forms of nature conservation, including a number of Natura 2000 sites, has a rich and valuable flora and diverse vegetation.

Flora

Based on available published data the following list of species was established:

a) in closer proximity (approximately a few km):

- *Baeothryon caespitosum*

- *Carex chordorrhiza*
- *Carex limosa*
- *Centaurium litorale*
- *Corallorhiza trfida*
- *Dactylorhiza fuchsii*
- *Dactylorhiza maculata*
- *Dactylorhiza majalis*
- *Drosera anglica*
- *Drosera intermedia*
- *Drosera rotundifolia*
- *Dryopteris cristata*
- *Empetrum nigrum*
- *Epipactis palustris*
- *Erica tetralix*
- *Gentianella baltica*
- *Glaux maritima*
- *Goodyera repens*
- *Gymnadenia conopsea*
- *Hippuris vulgaris*
- *Juncus gerardii*
- *Juncus subnodulosus*
- *Lathyrus palustris*
- *Listera cordata*
- *Lycopodiella inundata*
- *Marrubium vulgare*
- *Myrica gale*
- *Pedicularis palustris*
- *Plantago maritima*
- *Polemonium coeruleum*
- *Potamogeton alpinus*
- *Pulsatilla vernalis*
- *Radiola linoides*
- *Ranunculus lingua*
- *Ruppia maritima*
- *Sparganium angustifolium*
- *Stellaria crassifolia*
- *Triglochin maritimum*
- *Utricularia australis*
- *Utricularia intermedia*
- *Utricularia minor*
- *Zannichellia palustris*

b) further (several km):

- *Ajuga pyramidalis*
- *Aster tripolium*
- *Atriplex litoralis*
- *Batrachium baudotii*
- *Betula humilis*
- *Blysmus rufus*

- *Campanula latifolia*
- *Carex buxbaumii*
- *Cephalanthera longifolia*
- *Cnidium dubium*
- *Coronopus squamatus*
- *Dactylorhiza incarnata*
- *Diantus superbus*
- *Epipogium aphyllum*
- *Eriophorum gracile*
- *Euphrasia nemorea*
- *Galium harcynicum*
- *Gentiana pneumonanthe*
- *Hieracium echioides*
- *Huperzia selago*
- *Iris sibirica*
- *Isoetes lacustris*
- *Juncus acutiflorus*
- *Koeleria pyramidata*
- *Littorella uniflora*
- *Lolium temulentum*
- *Najas minor*
- *Nuphar pumila*
- *Ophioglosum vulgatum*
- *Pyrola media*
- *Rubus chamaemorus*
- *Salsola kali ssp. kali*
- *Scheuchzeria palustris*
- *Spergularia salina*
- *Stachys arvensis*
- *Viola stagnina*
- *Zostera marina*

In the area of the proposed site and in the area of the above surface forms of nature conservation, position (5) are listed of the following species from the Habitats Directive Annex 2:

1902 *Cypripedium calceolus*

2216 *Linaria odora*

1903 *Liparis loeselii*

1831 *Luronium natans*

1528 *Saxifraga hirculus*

In the area of the proposed site and in the area of the above surface forms of nature conservation occurrence of ca. 79 species of rare and endangered plants under strict protection is possible.

<u>Plants</u>

In the area of the proposed location and protected areas in the vicinity, occurrence of the following habitats from the Habitats Directive Annex 1 is reported:

1130 - estuaries

1210 - nitrophilous strandline vegetation

2110 - initial stages of yellow dunes

2120 -yellow dunes (*Elymo-Ammophiletum*)

2130 - grey dunes*

2180 - mixed forests and forests on coastal dunes

2190 - humid depressions between dunes

3110 - Lobelia lakes

3130 - shores or drained reservoir bottoms with communities with *Littorelletea*, *Isoëto-Nanojuncetea*

3160 - natural dystrophic water reservoirs

4010 - humid heaths with Erica tetralix (*Ericion tetralix*)

4030 - dry heaths (*Calluno-Genistion*, *Pohlio-Callunion*, *Calluno-Arctostaphylion*)

7110 - high peat bogs with peat-generating vegetation (live) *

7120 - degraded high peat bogs, bur able to regenerate naturally and upon stimulation

7230 - lowland bogs of an alkaline marshes, sedges and mosses

7140 - Transition mires and quaking bogs (mostly with plants from *Scheuchzerio-Caricetea*)

7150 - depressions on peat substrates with vegetation from *Rhynchosporion*

6410 - Molinia meadows (*Molinion*)

6510 - lowland hay meadows used extensively (*Arrhenatherion elatioris*)

9110 - acidic beech (*Luzulo-Fagenion*)

9130 - fertile beech (*Dentario glandulosae-Fagenion*, *Galio odorati-Fagenion*)

9160 - Subatlantic broadleaved forest (*Stellario-Carpinetum*)

9190 - Pomeranian acidic birch-oak forest (*Betulo-Quercetum*)

91D0 - bog woodland*

91E0 - riparian willow, poplar, alder and ash

91F0 - riparian forests, oak-elm-ash (*Ficario-Ulmetum*)

* indicates priority habitat

The site area has one of the highest diversities of flora, including Natura 200 areas, and habitats. The location is adjacent to many forms of surface conservation. **Investment in this place has the potential to adversely affect vegetation**. **More detailed analyses of the impact of NPP on Natura 2000 sites should be performed on the stage of preparing the Environmental Impact Report for construction of the plant when selecting a site.**

Nearby are the following nature conservation areas:

Special areas of habitat protection (**Błąd! Nie można odnaleźć źródła odwołania.**):

- Protected area: Choczewskie Lakes, Area code : PLH220096, Form of protection in terms of Natura 2000: special area of habitat protection (Habitats Directive),
- Protected area: Opalińskie Buczyny, Area code : PLH220099, Form of protection in terms of Natura 2000: special area of habitat protection (Habitats Directive),
- Protected area: Piaśnickie Łąki, Area code : PLH220021, Form of protection in terms of Natura 2000: special area of habitat protection (Habitats Directive),
- Protected area: Trzy Młyny, Area code : PLH220029, Form of protection in terms of Natura 2000: special area of habitat protection (Habitats Directive),
- Protected area: Bielawa and Bory Bażynowe, Area code : PLH220063, Form of protection in terms of Natura 2000: special area of habitat protection (Habitats Directive),
- Protected area: Orle, Area code : PLH220019, Form of protection in terms of Natura 2000: special area of habitat protection (Habitats Directive),
- Protected area: Białogóra, Area code : PLH220003, Form of protection in terms of Natura 2000: special area of habitat protection (Habitats Directive),

Special areas of birds protection (**Błąd! Nie można odnaleźć źródła odwołania.**):

- Protected area: Bielawskie Błota, Area code : PLB220010, Form of protection in terms of Natura 2000: special area of bird protection (Birds Directive),
- Protected area: Lasy Lęborskie, Area code : PLB220006, Form of protection in terms of Natura 2000: special area of bird protection (Birds Directive),
- Protected area: Puszcza Darżlubska, Area code : PLB220007, Form of protection in terms of Natura 2000: special area of bird protection (Birds Directive),
- Protected area: Białogóra, Area code : PLB220003, Form of protection in terms of Natura 2000: special area of bird protection (Birds Directive),

Landscape parks (**Błąd! Nie można odnaleźć źródła odwołania.**):

- Nadmorski Park Krajobrazowy

Nature reserves (**Błąd! Nie można odnaleźć źródła odwołania.**):

- Piaśnickie Łąki
- Długosz Królewski in Wierzchucin
- Zielone Bielawa
- Źródliska Czarnej Wody

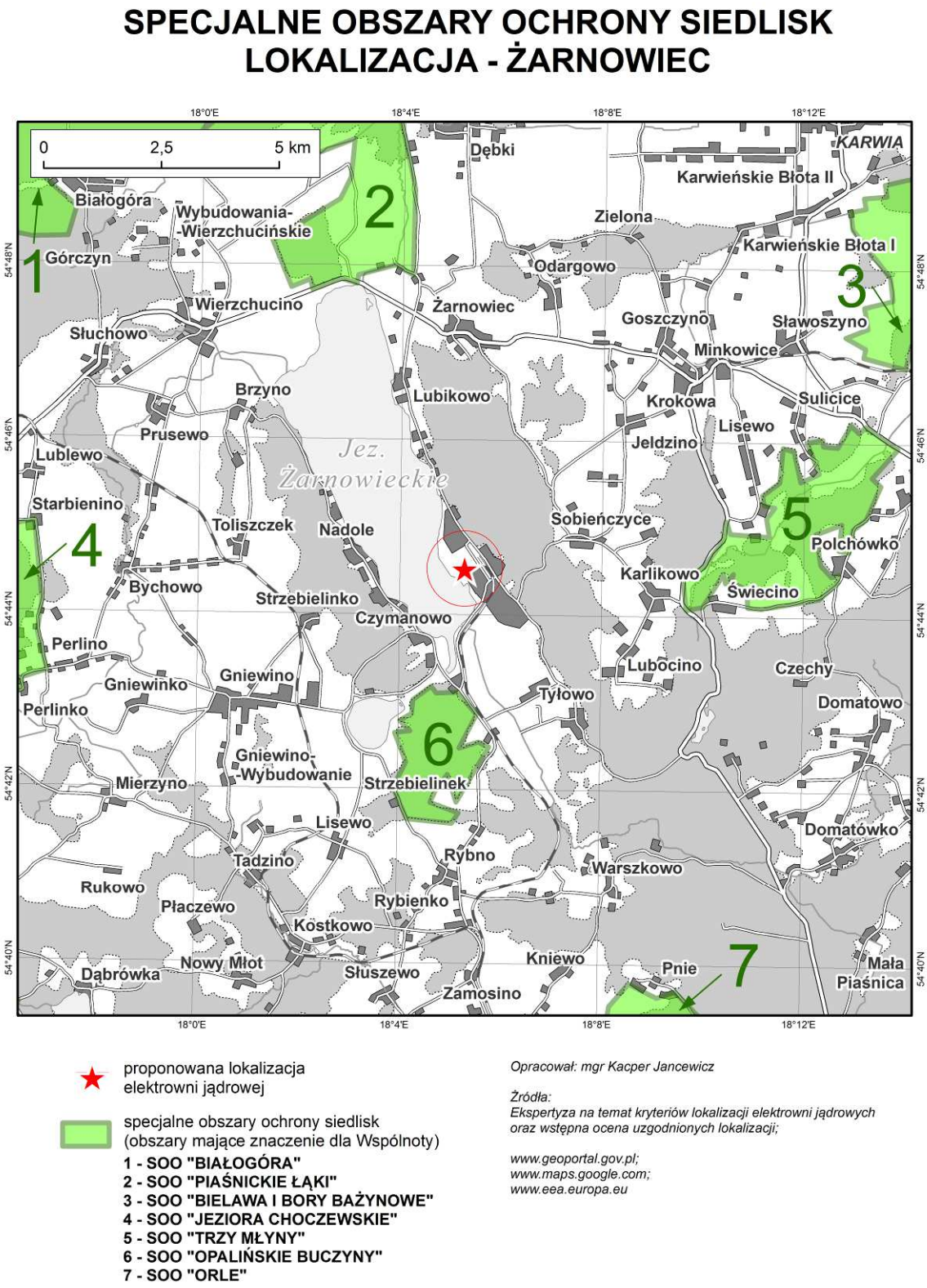

Fig. 6.3.4. Special habitat protection areas in the vicinity of Żarnowiec site

[SPECIAL HABITAT PROTECTION AREAS - ŻARNOWIEC SITE
Proposed power plant site

Special habitat protection areas (significant for the Community)
Developed by: mgr Kacper Jancewicz
Sources:
“Expert opinion on criteria of nuclear power plant locations and preliminary assessment of established sites”
www.geoportal.gov.pl;
www.maps.google.com;
www.eea.europa.eu]

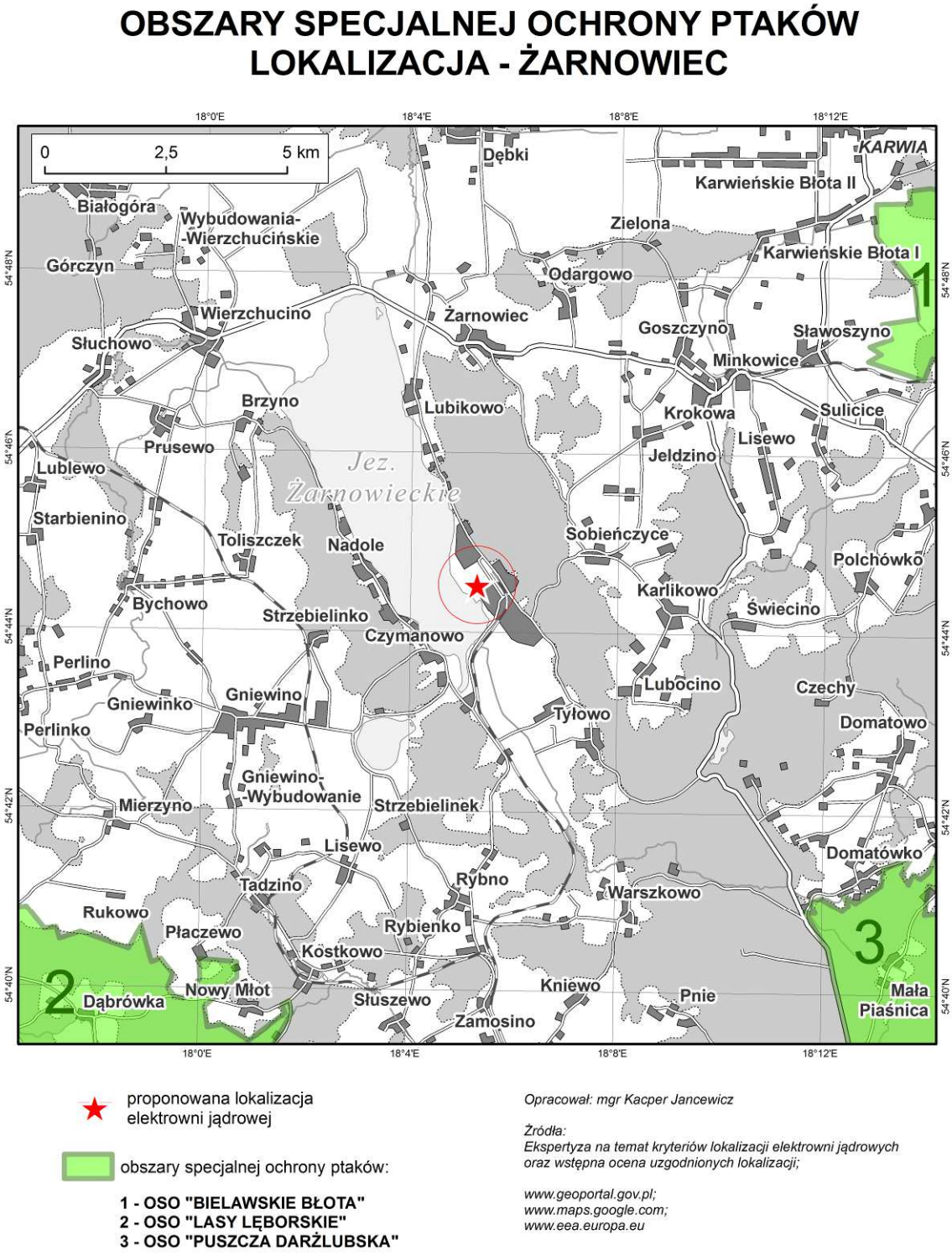

Fig. 6.3.5. Special bird protection areas in the vicinity of Żarnowiec site

[SPECIAL BIRD PROTECTION AREAS - ŻARNOWIEC SITE
Proposed power plant site

Special bird protection areas
Developed by: mgr Kacper Jancewicz
Sources:
“Expert opinion on criteria of nuclear power plant locations and preliminary assessment of established sites”
www.geoportal.gov.pl;
www.maps.google.com;
www.eea.europa.eu]

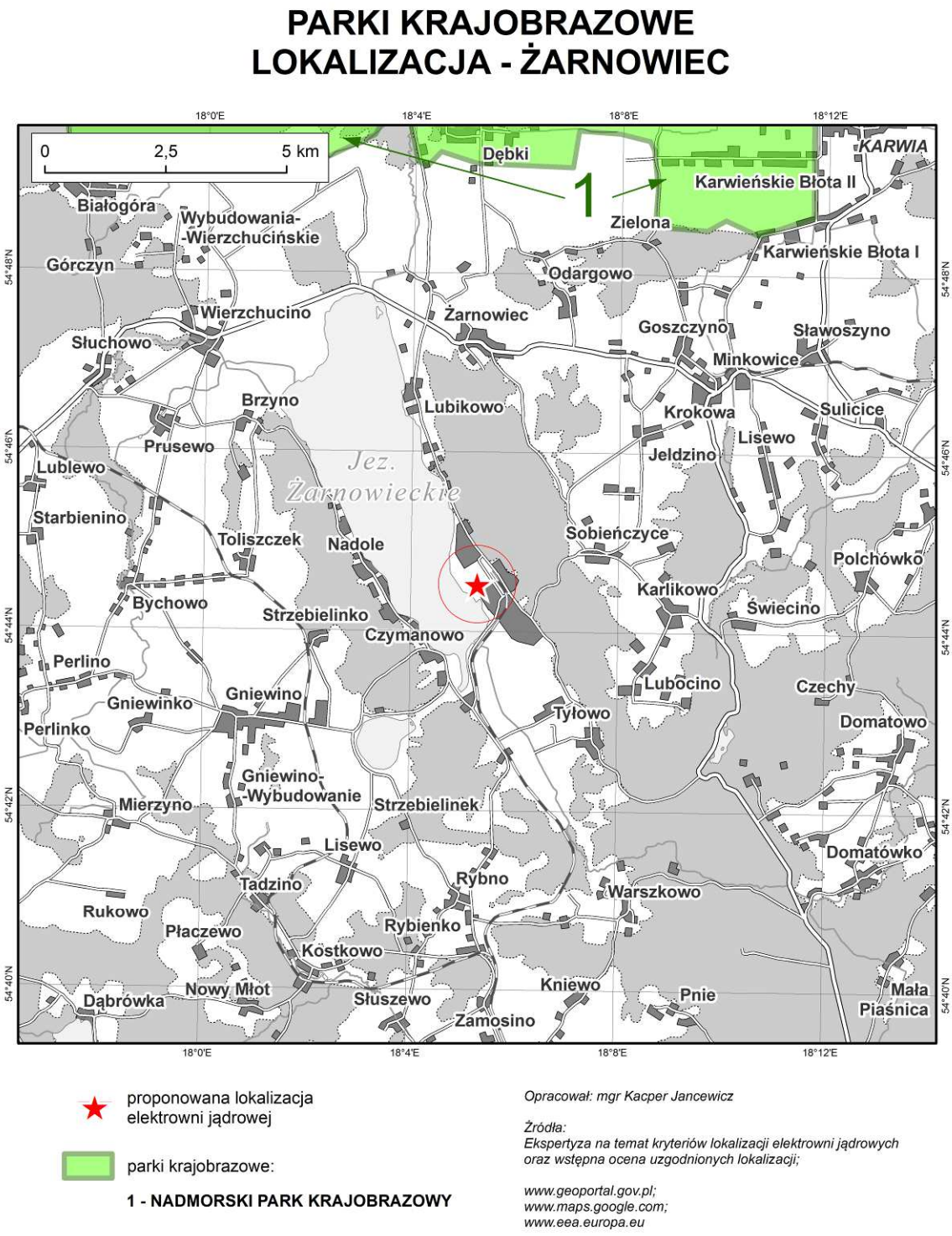

Fig. 6.3.6. Landscape parks in the vicinity of Żarnowiec site

[LANDSCAPE PARKS - ŻARNOWIEC SITE
Proposed power plant site

Landscape parks:
Developed by: mgr Kacper Jancewicz
Sources:
“Expert opinion on criteria of nuclear power plant locations and preliminary assessment of established sites”
www.geoportal.gov.pl;
www.maps.google.com;
www.eea.europa.eu]

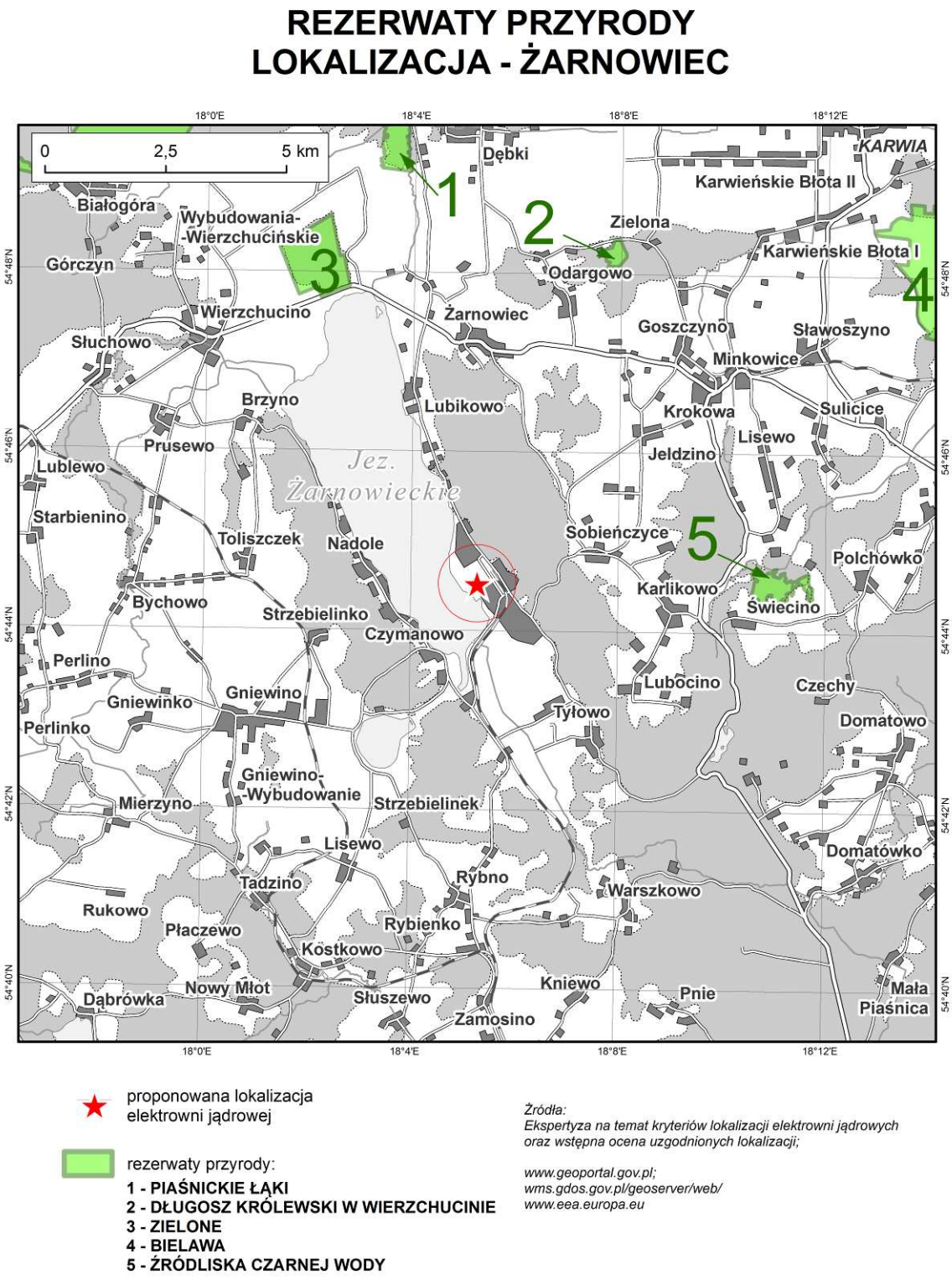

Fig. 6.3.7. Natural reserves in the vicinity of Żarnowiec site

[NATURAL RESERVES - ŻARNOWIEC SITE
Proposed power plant site

Natural reserves:
Developed by: mgr Kacper Jancewicz
Sources:
"Expert opinion on criteria of nuclear power plant locations and preliminary assessment of established sites"
www.geoportal.gov.pl;
www.maps.google.com;
www.eea.europa.eu]

6.3.3.2 Site – Warta Klempicz

Basic environmental conditions

Warta-Klempicz site is a reserve location from the 1980s, additionally assigned by the Marshal of Wielkopolskie. It is located in the municipality Lubasz, district Czarnków-Trzcianecki on the Warta River, Wielkopolskie. The exact location of the power plant is shown in **Błąd! Nie można odnaleźć źródła odwołania.**. (coordinates of the location indicated in the study by Energoprojekt). The municipality where the power plant is to be located has low population density (43 residents/km^2 at average population density in Poland 122 residents/km^2) due to which impacts of power plant construction and operation **will affect a small number of people**.

In the limited use area (the area within 800 meters from the plant) there are currently no residential or other buildings intended for human residence. Therefore, **there is no need for relocations** due to power plant construction. However, it is also possible to locate the power plant in the area where it was supposed to be built and where preparatory works began in the late 80's. It was abandoned however in 1989 (one kilometre north of the currently indicated location). Then, depending on the exact location of construction site, the scope of limited use area could partially cover the western part of the village Klempicz and residents would be relocated from there.

The surroundings of Warta Klempicz NPP have a favourable wind energy zone, due to which **there will be no accumulation of potential pollutions** emitted from the power plant and other facilities in vicinity.

Preliminary analyses show that due to location in the vicinity of the river Warta and **sufficient water resources** (SSQ = 118 m^3/s, SNQ = 53.4 m^3/s) closed cycle cooling system can be used in the power plant. For this purpose, water intake is planned on 178th kilometre of the river (ca. 4 km below the town of Obrzycko, in the distance of ca. 7 km from the plant). The environmental impact of each cooling system solution has been discussed in detail in chapter 8.3.3

There are no archaeological sites in the construction area and its vicinity, **thus eliminating hazards to cultural heritage** during ground works or construction delays due to halting works for the period of work of archaeologists.

In the vicinity of the planned investments **occurrence of natural resources and other useful minerals** was not stated, therefore a threat of difficult access and exploitation of deposits does not exist (see: chapter 8.3.6.2).

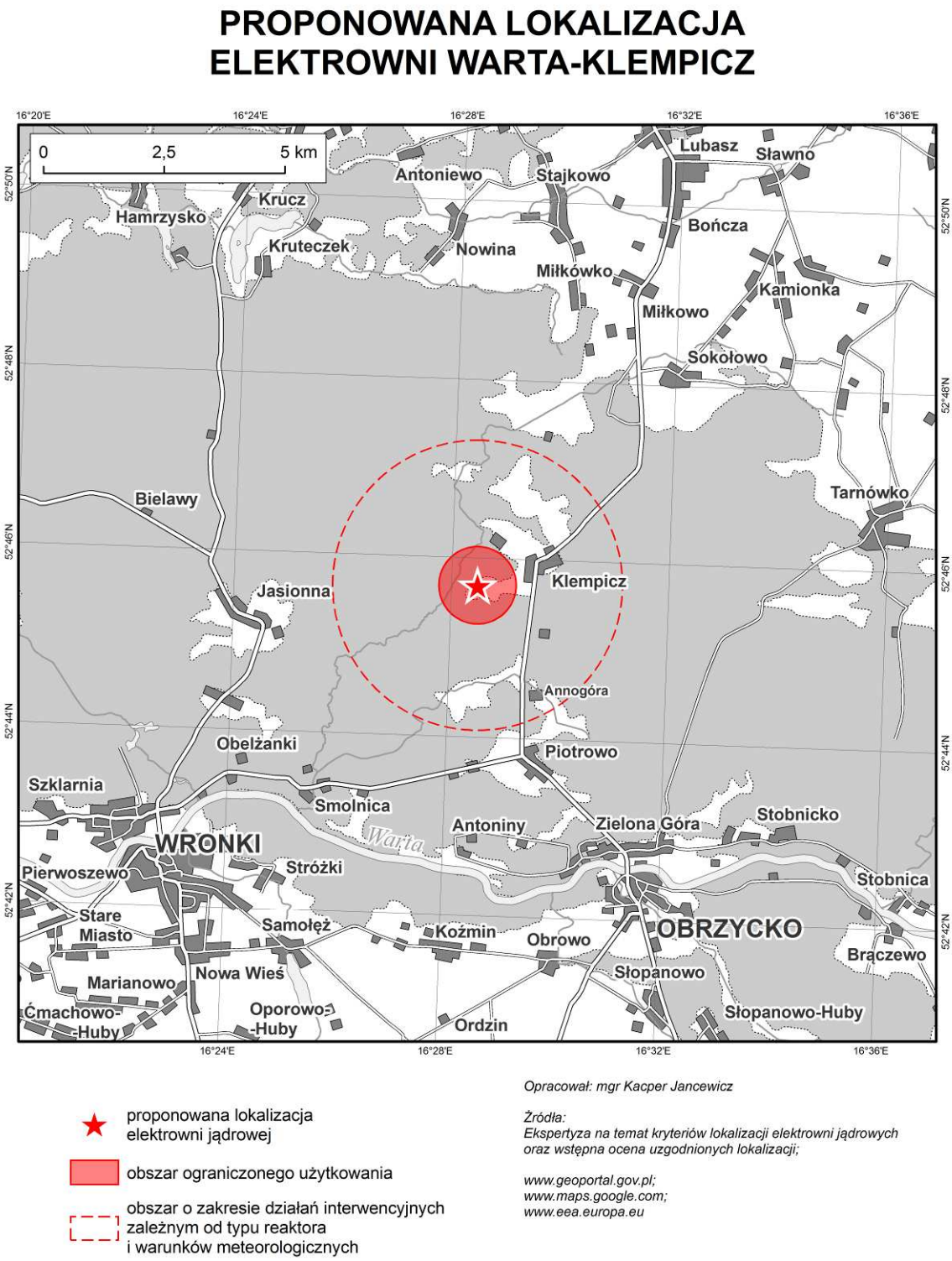

Fig. 6.3.8. Proposed site of Warta-Klempicz NPP

[PROPOSED SITE OF WARTA-KLEMPICZ POWER PLANT
Proposed power plant site

Limited use area
Area of interventions depending on reactor type and weather conditions
Developed by: mgr Kacper Jancewicz
Sources:
"Expert opinion on criteria of nuclear power plant locations and preliminary assessment of established sites"
www.geoportal.gov.pl;
www.maps.google.com;
www.eea.europa.eu]

Geological structure and hydrogeology

The surface geological formations in an area where NPP is to be located mainly consist of fluvioglacial sands and gravels. In the vicinity (a few km) there is a Miocene rift with brown coal deposits, and a slip zone active in the Mesozoic- with partially piercing salt domes. Neotectonic reactivation of this structure cannot be excluded. Mesozoic roof and Tertiary strata lay on the substrate. Historically or currently, seismic shocks were not recorded, and maximum soil vibration acceleration is less than 0.03 g.

In the area of investment there is a Tertiary porous sub-tank „Jezioro bityńskie – Wronki – Trzciel" (GZWP 146). Depth to the main utility groundwater level varies between 2 and 5 m. The levels of aquifers show **medium sensitivity to contamination**. Groundwater runoff occurs in the NE direction. No insulation from the ground surface and the presence of sandy sediments of high permeability may cause contamination of groundwater in case of penetration of pollutions to water and ground.

Infrastructure

The location is in the network area, currently characterized by a deficit of electricity production above 500 MW. The existing transmission grid is loaded at less than 60%, which gives the possibility to use existing transmission capacity to evacuate power from the NPP. However, to enable the network connection to NPP, expansion of below 100 km long transmission lines will be necessary. Potential extension may interfere with the Natura 2000 site. In addition, it is necessary to build the LV/LV/110 station. A detailed description of the impact of network expansion has been described in Chapter 8.3.7.

Site assessment made by PSE

From the viewpoint of the power balance in the NPS **location is very favourable**, since this region has no large baseload power source. The nearest power plants: Dolna Odra and ZE PAK are not alternative to this site.

At present the state of the transmission grid does not allow the connection of nuclear power plant in this location. However, development plans of TSO involve converting an existing 220 kV line Dunowo - Żydowo - Piła Krzewina - Plewiska to 400 kV voltage and construction of 400 kV line Bydgoszcz - Piła Krzewina, through which power could be evacuated to NPS from the first unit with capacity of 1600 MW. Evacuation of 3200 MW power would require building additional 400 kV lines in the direction of Poznań, and in case of significant development of wind power industry in the north, construction of a new 400 kV line from Poznań to Wrocław would be necessary.

The investment is located near the water supply network, well developed transmission infrastructure, four sewage treatment plants. There is no gas supply grid.

The distance between the NPP site and existing urban infrastructure is as follows: main roads - up to 5 km, municipal roads - up to 5 km, railway lines - up to 10 km, water transport routes - from 5 to 25 km, airports - up to 60 km, other urban infrastructure - up to 5 km. So developed communication

network near the plant will allow for a diverse supply of goods during construction (building materials) and during operation of the plant (spare parts, uranium) supplied from other regions of the country or outside Poland.

For the purpose of (primary) construction and operation of "Warta" NPP, expansion of transport infrastructure was partially performed in order to enable transport of large-size device components. Two sections of road No. 182 with a total length of 10 km were modernized (from the village Piotrowo to the border of municipalities Obrzycko / Lubasz - ca. 5.2 km, and from Piotrowo towards Wronki - ca. 4.8 km). The asphalt road in these sections was significantly widened (to more than 7 m).

Additionally, the original plan envisaged the construction of a railway siding with a length of 12 km to the station Lubasz and the reconstruction and modernization of the rest of the road No. 182 in the section Międzychód - Klempicz-Ujście and road No. 185 in the section Piotrowo - Szamotuły.

Fauna and Flora

Fauna

The location within the area of special protection of birds Puszcza Notecka. In close proximity there are no other Natura 2000 sites (the nearest SPA refuge Nadnoteckie Łęgi lies about 13 km from the planned location), or faunistic reserves.

In the refuge Puszcza Notecka 234 species of birds were found, of which 162 are nesting birds. Breed of 30 species from Annex I of the Birds Directive has been reported here, although a total of 38 species were found from this list. Also 12 species have been identified from the "Polish Red Book of animals."

Key bird species for the refuge Puszcza Notecka:

Eurasian bittern *Botaurus stellaris*, little bittern *Ixobrychus minutus*, white stork *Ciconia ciconia*, black stork *Ciconia nigra*, tundra swan *Cygnus columbianus*, bean goose *Anser fabalis*, greater white-fronted goose *Anser albifrons*, mallard *Anas platyrhynchos*, common goldeneye *Bucephala clangula*, smew *Mergus albellus*, common merganser *Mergus merganser*, European honey buzzard *Pernis apivorus*, black kite *Milvus migrans*, red kite *Milvus milvus*, white-tailed eagle *Haliaeetus albicilla*, Western marsh harrier *Circus aeruginosus*, Montagu's harrier *Circus pygargus*, osprey *Pandion haliaetus*, common crane *Grus grus*, spotted crake *Porzana porzana*, corn crake *Crex crex*, Eurasian coot *Fulica atra*, Eurasian curlew *Numenius arquata*, Eurasian eagle-owl *Bubo bubo*, Tengmalm's owl *Aegolius funereus*, European nightjar *Caprimulgus europaeus*, common kingfisher *Alcedo atthis*, grey-headed woodpecker *Picus canus*, black woodpecker *Dryocopus martius*, middle spotted woodpecker *Dendrocopos medius*, woodlark *Lullula arborea*, tawny pipit *Anthus campestris*, barred warbler *Sylvia nisoria*, red-breasted flycatcher *Ficedula parva*, collared flycatcher *Ficedula albicollis*, red-backed shrike *Lanius collurio*, ortolan bunting *Emberiza hortulana.*

Puszcza Notecka is one of the largest domestic refuges for nightjar, woodlark, red kite, black kite, black woodpecker and white-tailed eagle. In the region it is an important breeding ground for the crane, marsh harrier, black stork and white stork. Location in the bifurcation of Noteć and Warta makes this area important for migratory prey birds *Falconiformes*, ducks, coots and geese *Anser sp*. - autumn and winter concentrations reach 25 000 individuals here.

The forest is also included in the network of Polish ecological corridors, it is a place of permanent occurrence of wolves, but because of the vastness of the area, the possible investment **should not significantly impair the functions of the ecological corridor**. The world of animals leading water or surface water life is also rich - there are European beavers *Castor fiber*, European otter *Lutra lutra*, European pond turtles *Emys orbicularis* and five fish species from Annex II to Habitats Directive.

In addition to occupancy of land and the obvious nuisance arising from construction and operation of the facility, one must take into account **effect of the potential development of the traction network** (impact of transmission networks will be the subject of separate studies - see chapter 8.3.7.2.2) **on mortality of numerous migrating and nesting birds - in case of this site this is a significant hazard.**

The choice of this location is associated with a significant impact on the conservation objectives of Natura 2000 area as well as the impact on the integrity of the Natura 2000 site (construction of infrastructure necessary for the operation of NPP will directly affect the area). More detailed analysis of the impact of NPP on the Natura 2000 sites should be performed at the stage of preparing the Environmental Impact Report for construction of power plant when selecting a location, although for environmental reasons it is recommended to exclude the location from further proceedings already at the stage of strategic assessment.

Plants

Forest area (one of the largest in central and northern Poland); refuge for rare and endangered plant species, including the legally protected in Poland. The dunes are covered with monotonous, same-age forest, mainly pine, planted here after the great defeat in the interwar period, caused by the emergence of insect pests. Residues of natural forest stands are protected in the reserves.

Flora

Based on available published data the following list of species was established:

a) in closer proximity (approximately a few km):

- *Alchemilla glabra*
- *Allium ursinum*
- *Asperugo procumbens*
- *Botrychium multifidum*
- *Carex praecox*
- *Dactylorhiza incarnata*
- *Dactylorhiza maculata*
- *Dactylorhiza majalis*
- *Diantus superbus*
- *Dryopteris cristata*
- *Epipactis palustris*
- *Gentianella amarella*
- *Gladiolus imbricatus*
- *Hierochloe australis*
- *Najas minor*
- *Ophioglosum vulgatum*
- *Potamogeton alpinus*
- *Ranunculus arvensis*
- *Ranunculus lingua*
- *Scorzonera purpurea*
- *Scutellaria hastifolia*
- *Teucrium scordium*
- *Valerianella locusta*

b) further (several km):

- *Allium scorodoprasum*

- *Bromus secalinus*
- *Diphasiastrum tristachyum*
- *Drosera intermedia*
- *Gentiana pneumonanthe*
- *Hierochloe odorata*
- *Huperzia selago*
- *Kickxia elatine*
- *Marrubium vulgare*
- *Myosrus minimus*
- *Pedicularis palustris*
- *Pulicaria vulgaris*
- *Pulsatilla pratensis*
- *Pulsatilla vernalis*
- *Scheuchzeria palustris*
- *Trollius europaeus*
- *Utricularia intermedia*
- *Utricularia minor*

In the area of the proposed site and in the area of the above surface forms of nature conservation, positions are listed of the following species from the Habitats Directive Annex 2:

- 1477 *Pulsatilla patens*

- 1437 *Thesium ebracteatum*

In the area of the proposed site and in the area of the above surface forms of nature conservation occurrence of ca. 43 species of rare and endangered plants under strict protection is possible, including, e.g. 9 species of orchids.

Plants

In the area of the proposed location and protected areas in the vicinity, occurrence of the following habitats from the Habitats Directive Annex 1 is reported:

- 3270 - flooded muddy riverbanks

- 6410 - Molinia meadows (*Molinion*)

- 6430 - riparian tall herbs (*Convolvuletalia sepium*)

- 6510 - lowland hay meadows used extensively (*Arrhenatherion elatioris*)

- 7230 - lowland bogs of alkaline marshes, sedges and mosses

- 9170 - mid-European broadleaved forest (*Stellario-Carpinetum*)

- 9190 - Pomeranian acidic birch-oak forest (*Betulo-Quercetum*)

- 91E0 - riparian willow, poplar, alder and ash (*Salicetum albo-fragilis*, *Populetum albae*, *Alnenion glutinoso-incanae*, spring alders)*

- 91F0 - riparian forests, oak-elm-ash (*Ficario-Ulmetum*)

- 9110 - thermophilous oak forests (*Quercetalia pubescenti-petraeae*)*

* indicates priority habitat

The site is average with regard to flora and habitat diversity compared to others, however it is within the forest complex in Protected Landscape Area and is therefore unfavourable.

Near the site, the following sites protected due to the environment occur:

Special areas of habitat protection (**Błąd! Nie można odnaleźć źródła odwołania.**):

- Protected area: Dąbrowy Obrzyckie, Area code : PLH300003, Form of protection in terms of Natura 2000: special area of habitat protection (Habitats Directive),

Special areas of birds protection (**Błąd! Nie można odnaleźć źródła odwołania.**):

- Protected area: Puszcza Notecka, Area code : PLB300015, Form of protection in terms of Natura 2000**:** special area of bird protection (Birds Directive),

Nature reserves (**Błąd! Nie można odnaleźć źródła odwołania.**):

- Świetlista Dąbrowa

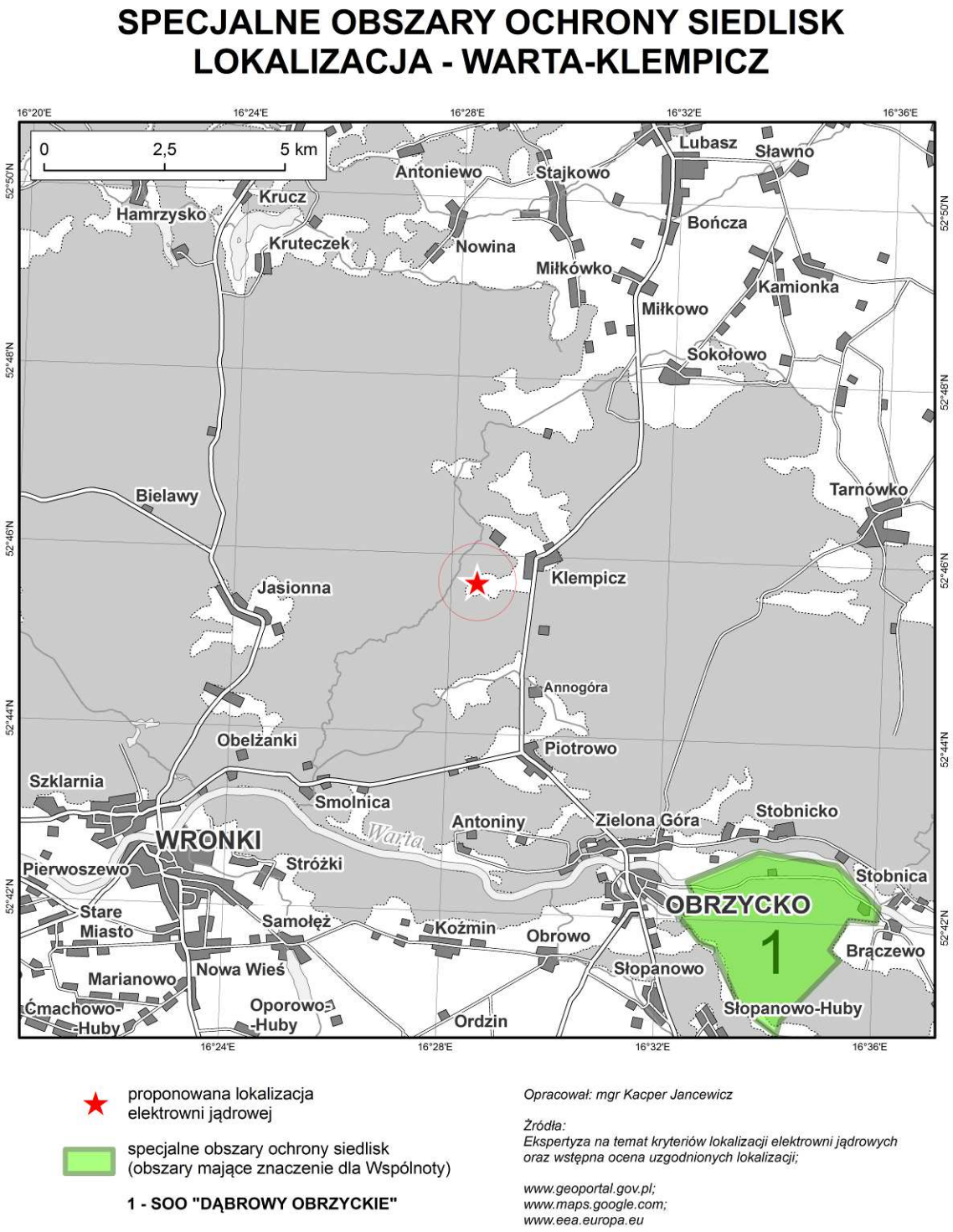

Fig. 6.3.9. Special habitat protection areas in the vicinity of Warta - Klempicz site

[SPECIAL HABITAT PROTECTION AREAS – WARTA-KLEMPICZ SITE
Proposed power plant site

Special habitat protection areas (significant for the Community)
Developed by: mgr Kacper Jancewicz
Sources:
“Expert opinion on criteria of nuclear power plant locations and preliminary assessment of established sites”
www.geoportal.gov.pl;
www.maps.google.com;
www.eea.europa.eu]

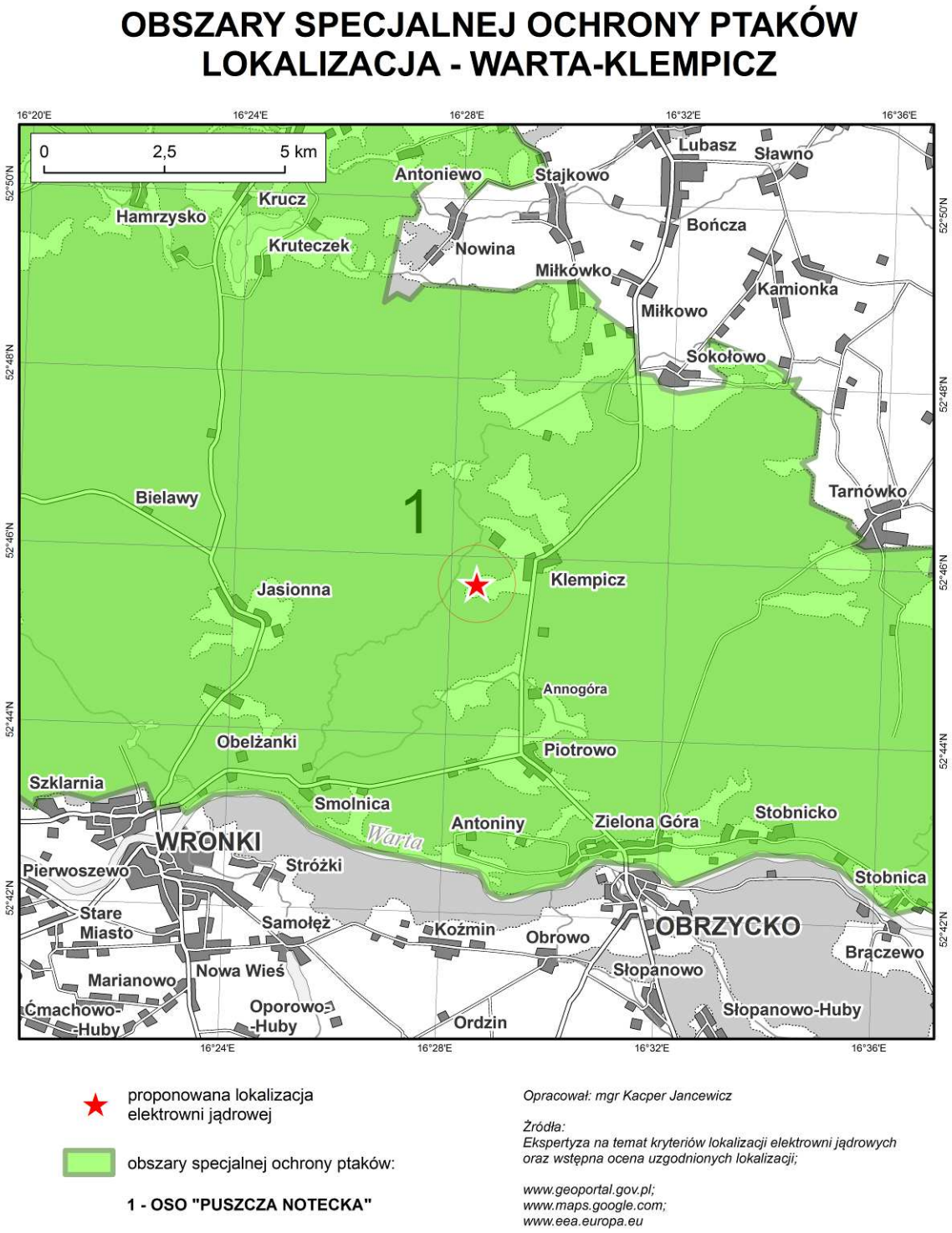

Fig. 6.3.10. Special bird protection areas in the vicinity of Warta - Klempicz site

[SPECIAL BIRD PROTECTION AREAS – WARTA-KLEMPICZ SITE
Proposed power plant site

Special bird protection areas
Developed by: mgr Kacper Jancewicz
Sources:
“Expert opinion on criteria of nuclear power plant locations and preliminary assessment of established sites”
www.geoportal.gov.pl;
www.maps.google.com;
www.eea.europa.eu]

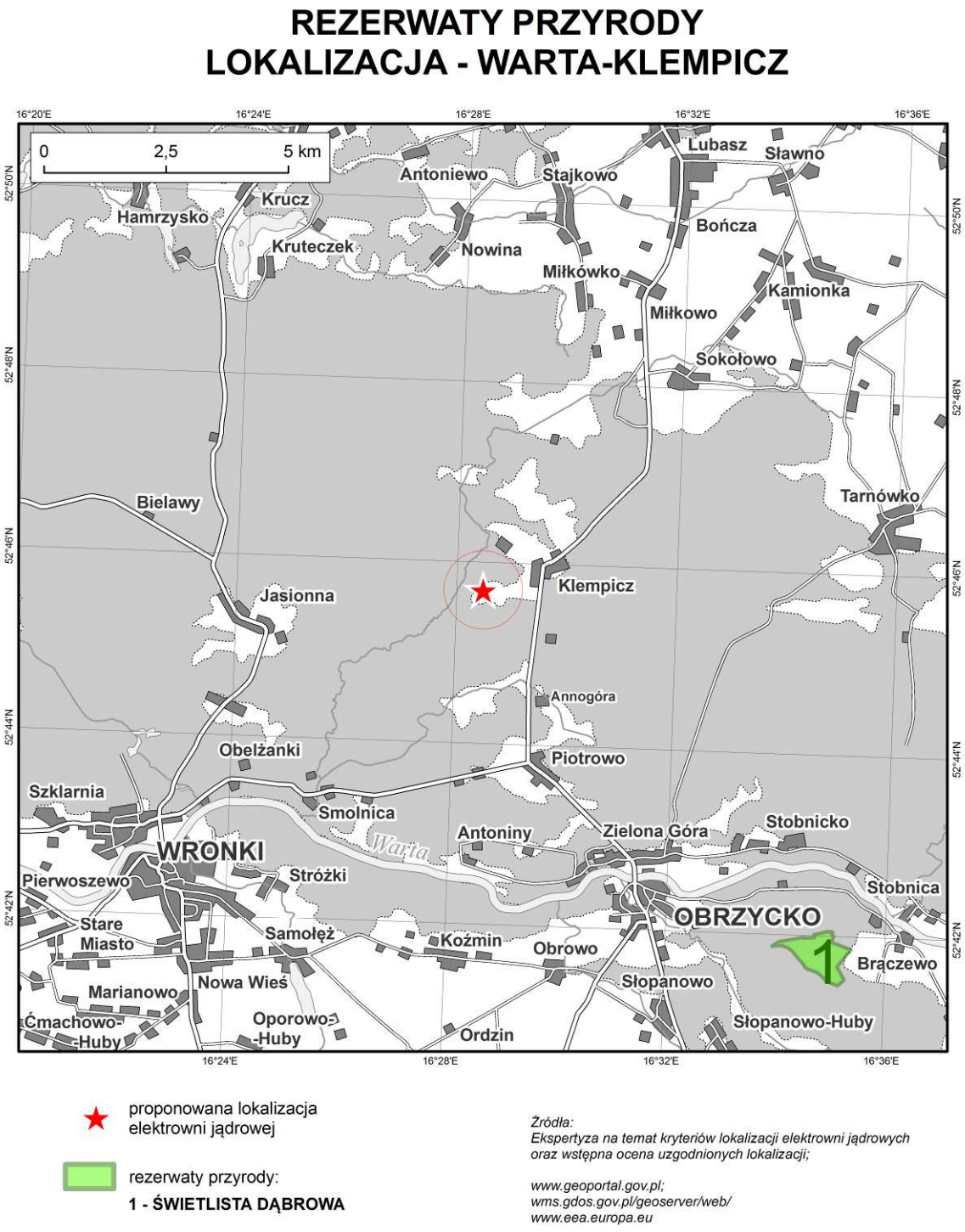

Fig. 6.3.11. Natural reserves in the vicinity of Warta - Klempicz site

[NATURAL RESERVES – WARTA-KLEMPICZ SITE
Proposed power plant site

Natural reserves:
Developed by: mgr Kacper Jancewicz
Sources:
"Expert opinion on criteria of nuclear power plant locations and preliminary assessment of established sites"
www.geoportal.gov.pl;
www.maps.google.com;
www.eea.europa.eu]

6.3.3.3 Site - Kopań

Basic environmental conditions

Kopań site is a reserve location from the 1980s, additionally assigned by the Marshal of Zachodniopomorskie. It is located in the municipality of Darłowo, Sławieński district, Zachodniopomorskie Province. The exact location of the power plant is shown in **Błąd! Nie można odnaleźć źródła odwołania.**. The municipality where the power plant is to be located has low population density (28 residents/km^2 at average population density in Poland 122 residents/km^2) due to which impacts of power plant construction and operation **will affect a small number of people**.

In the limited use area (the area within 800 meters from the plant) there are currently no residential or other buildings intended for human residence. Therefore, **there is no need for relocations** due to power plant construction.

The surroundings of Kopań NPP have a very favourable wind energy zone, due to which **there will be no accumulation of potential pollutions** emitted from the power plant and other facilities in vicinity.

Preliminary analyses show that due to location in the vicinity of the sea coast (3 km) and Wieprza River (SSQ = 14.2 m^3/s, SNQ = 7.68 m^3/s) open cycle cooling system can be used in the power plant. The environmental impact of each cooling system solution has been discussed in detail in chapter 8.3.3.

In the surrounding area provided for the construction of power plant in Palczewice and Barzowice, there are 13 archaeological sites, but due to the distance from the places where ground works will be carried out, **we do not expect any risk to cultural assets** in the construction stage, or any delays if the project is suspended for the period of archaeological works.

In the vicinity of the planned investment **occurrence of natural resources and other useful minerals** was not stated, therefore a threat of difficult access and exploitation of deposits does not exist (see: chapter 8.3.6.2).

Fig. 6.3.12. Proposed site of Kopań NPP

[PROPOSED SITE OF KOPAŃ POWER PLANT
Proposed power plant site

Limited use area
Area of interventions depending on reactor type and weather conditions
Developed by: mgr Kacper Jancewicz
Sources:
"Expert opinion on criteria of nuclear power plant locations and preliminary assessment of established sites"
www.geoportal.gov.pl;
www.maps.google.com;
www.eea.europa.eu]

Geological structure and hydrogeology

Geological structure of surface geological layers in which NPP is to be located is dominated by boulder clay with thickness of more than 30 m. This area is characterized by significant terrain denivelation. Although in the vicinity young and active faults have not been documented, the fault zone designated on the Baltic Sea may continue in the direction of this location. Mesozoic roof and Tertiary strata lay on the substrate. Historically or currently, seismic shocks were not recorded, and maximum soil vibration acceleration is less than 0.02g.

In this area, main groundwater reservoir does not occur. Depth to the main utility groundwater level varies between 15-50 m. The levels of aquifers show **low sensitivity to contamination.** Groundwater runoff occurs in the direction of NW, N. Good insulation from the ground surface with thick layer of aluminium sediments with low infiltration and movement of pollutants **should not cause** contamination of groundwater in case of contamination from the surface.

Infrastructure

The location is in the network area, currently characterized by **a deficit of electricity production** amounting to 100 ≤ dP < 300 MW. The existing transmission grid is loaded at less than 60%, which **gives the possibility to use existing transmission capacity** to evacuate power from the NPP. However, to enable the network connection to NPP, expansion of 100 to 250 km long transmission lines will be necessary. There is a possibility of interference of the expansion with two Natura 2000 sites and its course near urban areas. In addition, it is necessary to build the LV/LV/110 station. A detailed description of the impact of network expansion has been described in Chapter 8.3.7.

During emergency shutdown of the unit with capacity 1600 MW, **there may occur a threat to stable operation** of NPS and stable cooperation of NPS with systems in neighbouring countries.

Construction of NPP in this location will improve the conditions for cross-border trade.

Site assessment made by PSE

From the viewpoint of the power balance in the NPS **location is advantageous,** and is an alternative for three locations in Żarnowiec area and for Warta-Klempicz site.

Connection of nuclear power plant could be madeto the station Dunowo or Slupsk. TSO development plans assume a significant improvement in the connection of these stations to a 400 kV network. However, also in this case negative impact of wind energy on this location should be noted. Currently, terms of connection of wind farms with total capacity of 660 MW have been specified for Dunowo station, and proceedings are pending for another 468 MW. Terms of connection of wind farms with total capacity of 660 MW have been specified for Słupsk station, and proceedings are pending for another 345 MW.

As in case of the site to SE 400/110 kV Żarnowiec, considering capacity not exceeding 1600 MW for a nuclear power plant is proposed.

The following are located in the vicinity of the site: high pressure gas pipeline not supplying any municipality, 100/15 kV station.

The distance between the NPP site and existing urban infrastructure is as follows: main roads - up to 5 km, municipal roads - up to 5 km, railway lines - up to 10 km, water transport routes - up to 5 km, airports - more than 60 km, other urban infrastructure - up to 5 km. So developed communication network near the plant will allow for a diverse supply of goods during construction (building materials) and during operation of the plant (spare parts, uranium) supplied from other regions of the country or outside Poland.

Fauna and Flora

Fauna

In the vicinity (2 km) bird refuge Przybrzeżne Wody Bałtyku [Baltic Coastal Waters]. In this vast basin sea ducks winter in large numbers.

Key bird species for Natura 2000 Przybrzeżne Wody Bałtyku site:

red-throated loon *Gavia stellata*, black-throated loon *Gavia arctica*, horned grebe *Podiceps auritus*, long-tailed duck *Clangula hyemalis*, common scoter *Melanitta nigra*, velvet scoter *Melanitta fusca*, European herring gull *Larus argentatus*, common murre *Uria aalge* and razorbill *Alca torda*.

Approximately 12% of velvet scoters, 2% of common scoters i 35% of long-tailed ducks occurring within the Polish zone of Baltic sea gather here. Small crustaceans dominate the benthic fauna. Large marine mammals are rarely observed - grey seals *Halichoerus grypus*, ringed seals *Phoca hispida* and harbour porpoises *Phocoena phocoena*. The location is in the coastal zone, in the area particularly intensively used by migrating birds. At a distance of about 5 km from the planned location, Akcja Bałtycka bird-ringing camp has been operating for 50 years, organized here by the Bird Migration Research Station, the unit of the Department of Biology, University of Gdansk. This camp captures tens of thousands of birds every year in spring and autumn, both passerines *Passeriformes,* and prey birds *Falconiformes*, or owls *Stigiformes*. Despite lack of information on nesting birds from Annex I of the Birds Directive, this area is undoubtedly very important from the standpoint of migratory birds. In this context, **the question of possible expansion of overhead transmission networks** occurs again (impact of transmission networks will be the subject of separate study - see chapter 8.3.7.2.2) as well as resulting **high risk of significant direct mortality of birds due to collisions.** Possible discharge of heated water into the lake can affect the imbalance of the aquatic ecosystem and disrupt the structure of wintering of water birds.

The location potentially significantly affecting Natura 2000 sites, traction network can be a major threat to migratory birds, but without collisions with ecological corridors. **More detailed analysis of the impact of NPP on Natura 2000 sites will be performed at the stage of preparing the Environmental Impact Report for construction of power plant when selecting a location, though it would be advisable to exclude this location because of the potential environmental effects of its implementation.**

Plants

In the site area, numerous types of habitats were observed, particularly precious peat bogs and bog woodland. Species richness of flora on the basis of available data is smaller than the wealth of habitats.

Flora

Based on available published data the following list of species was established:

a) in closer proximity (approximately a few km):

- *Empetrum nigrum*
- *Erica tetralix*
- *Gagea spathacea*
- *Lathyrus palustris*
- *Orchis morio*
- *Pedicularis palustris*

b) further (several km):

- *Allium scorodoprasum*
- *Bromus secalinus*
- *Campanula latifolia*
- *Carex limosa*
- *Corallorhiza trfida*
- *Dactylorhiza majalis*
- *Drosera rotundifolia*
- *Dryopteris cristata*
- *Epipactis palustris*
- *Glaux maritima*
- *Goodyera repens*
- *Hippuris vulgaris*
- *Listera cordata*
- *Myosrus minimus*
- *Myrica gale*
- *Radiola linoides*
- *Scorzonera purpurea*
- *Triglochin maritimum*
- *Valerianella locusta*
- *Zostera marina*

Near the proposed site positions of plant species from Annex 2 of the Habitats Directive were not observed.

In the area of the proposed site and in the area of the above surface forms of nature conservation occurrence of ca. 26 species of rare and endangered plants under strict protection is possible.

Plants

In the area of the proposed location and protected areas in the vicinity, occurrence of the following habitats from the Habitats Directive Annex 1 is reported:

- 1130 - estuaries
- 1150 - bays and sea lakes (lagoons)*
- 2110 - initial stages of yellow dunes
- 2120 -yellow dunes (Elymo-Ammophiletum)

- 2130 - grey dunes*
- 2180 - mixed forests and forests on coastal dunes
- 3110 - Lobelia lakes
- 3150 - oxbow lakes and natural eutrophic reservoirs with the communities with Nympheion, Potamion
- 3160 - natural dystrophic water reservoirs
- 3260 - lowland and foothill rivers of Batrachion vegetation Ranunculion fluitantis
- 3270 - flooded muddy riverbanks
- 4030 - dry heaths (Calluno-Genistion, Pohlio-Callunion, Calluno-Arctostaphylion)
- 6120 - thermophilic, inland psammophilous grasslands (Koelerion glaucae)*
- 6430 - riparian tall herbs (Convolvuletalia sepium)
- 6510 - lowland hay meadows used extensively (Arrhenatherion elatioris)
- 7110 - high peat bogs with peat-generating vegetation (live) *
- 7120 - degraded high peat bogs, but able to regenerate naturally and upon stimulation
- 7140 - transition mires and quaking bogs (mostly with plants from Scheuchzerio-Caricetea)
- 7150 - depressions on peat substrates with vegetation from Rhynchosporion
- 7220 - limestone springs with the communities Cratoneurion commutati*
- 7230 - lowland bogs of alkaline marshes, sedges and mosses
- 9110 - acidic beech (Luzulo-Fagenion)
- 9130 - fertile beech (Dentario glandulosae-Fagenion, Galio odorati-Fagenion)
- 9160 - subatlantic broadleaved forest (Stellario-Carpinetum)
- 91D0 - bog woodland*
- 9190 - Pomeranian acidic birch-oak forest (Betulo-Quercetum)
- 91E0 - riparian willow, poplar, alder and ash (Salicetum albo-fragilis, Populetum albae, Alnenion glutinoso-incanae, spring alders)*

* indicates priority habitat

The location has a very high diversity of habitats and relatively small share of rare species, this may be partly an artefact resulting from the adopted methodology and the data available. The potential negative impact is possible.

Near the site, the following sites protected due to the environment occur:

Special areas of habitat protection (**Błąd! Nie można odnaleźć źródła odwołania.**):

- Protected area: Słowińskie Błoto, Area code : PPLH320016, (outside the map), Form of protection in terms of Natura 2000: special area of habitat protection (Habitats Directive), Area status : area proposed by the Government of Poland.

- Protected area: Kopań Lakes Area code : PLH320059, Form of protection in terms of Natura 2000: special area of habitat protection (Habitats Directive),

- Protected area: Wieprza and Studnica valley, Area code : PLH220038, Form of protection in terms of Natura 2000: special area of habitat protection (Habitats Directive),

Special areas of birds protection (**Błąd! Nie można odnaleźć źródła odwołania.**):

- Protected area: Przybrzeżne Wody Bałtyku, Area code : PLB990002, Form of protection in terms of Natura 2000: special area of bird protection (Birds Directive),Area status : designated area [by Resolution of Minister of Environment]

Shadow List 2010 areas (**Błąd! Nie można odnaleźć źródła odwołania.**):

- Protected area: Wicko Lake and Modelskie Wydmy, Area code : PLTMP551

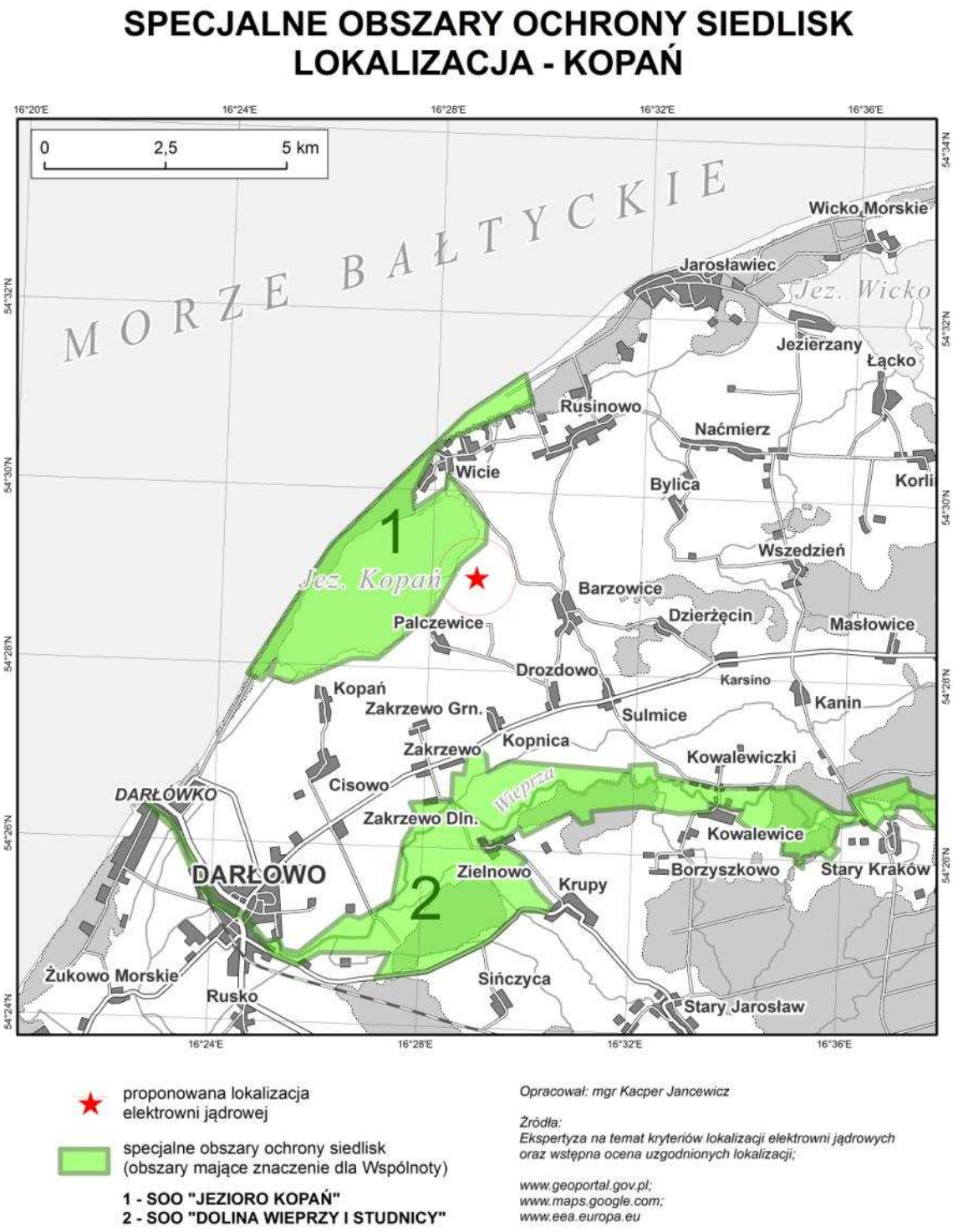

Fig. 6.3.13. Special habitat protection areas in the vicinity of Kopań site

[SPECIAL HABITAT PROTECTION AREAS - KOPAŃ SITE
Proposed power plant site

Special habitat protection areas (significant for the Community)
Developed by: mgr Kacper Jancewicz
Sources:
“Expert opinion on criteria of nuclear power plant locations and preliminary assessment of established sites”
www.geoportal.gov.pl;
www.maps.google.com;
www.eea.europa.eu]

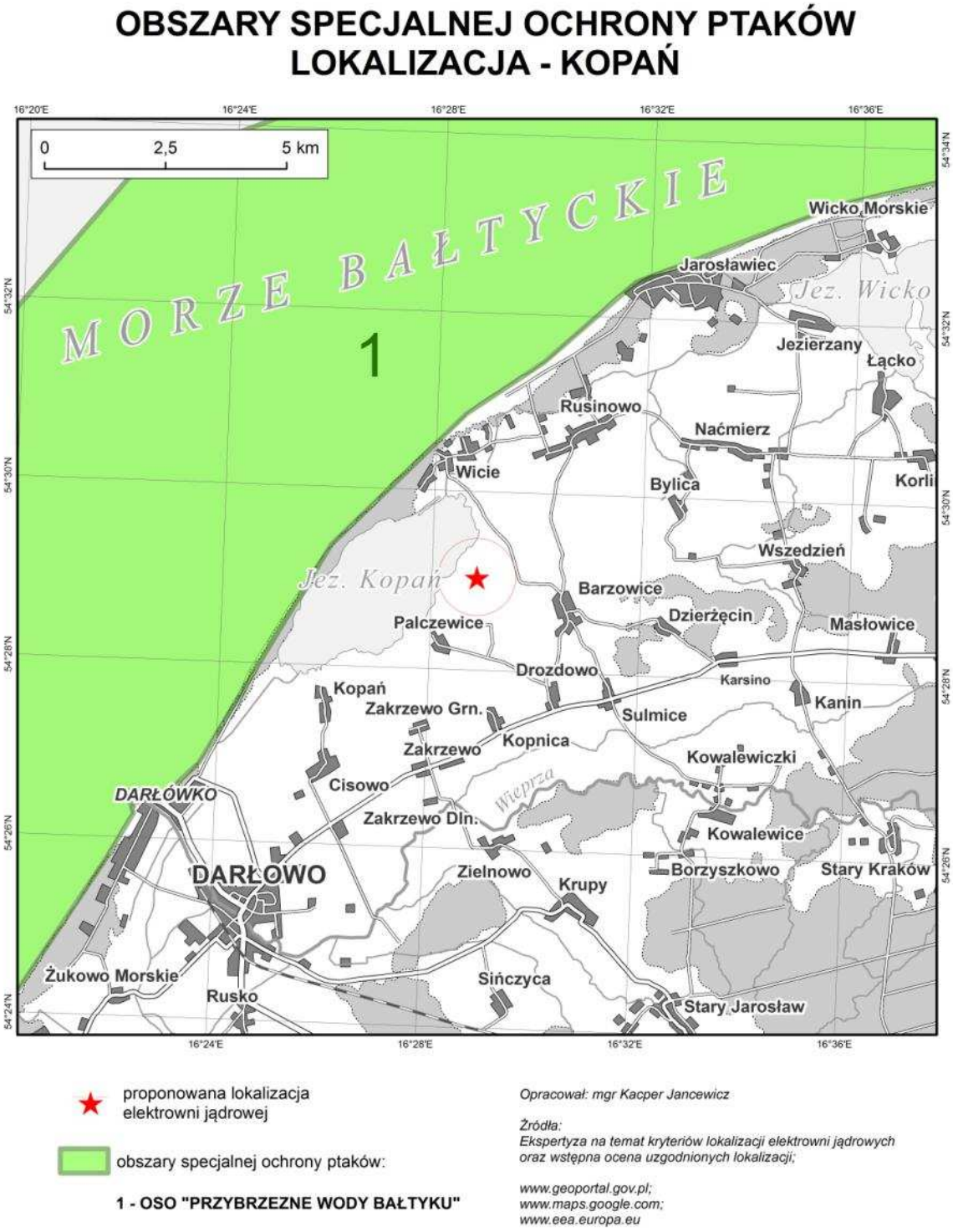

Fig. 6.3.14. Special bird protection areas in the vicinity of Kopań site

[SPECIAL BIRD PROTECTION AREAS - KOPAŃ SITE
Proposed power plant site

Special bird protection areas
Developed by: mgr Kacper Jancewicz
Sources:
“Expert opinion on criteria of nuclear power plant locations and preliminary assessment of established sites”
www.geoportal.gov.pl;
www.maps.google.com;
www.eea.europa.eu]

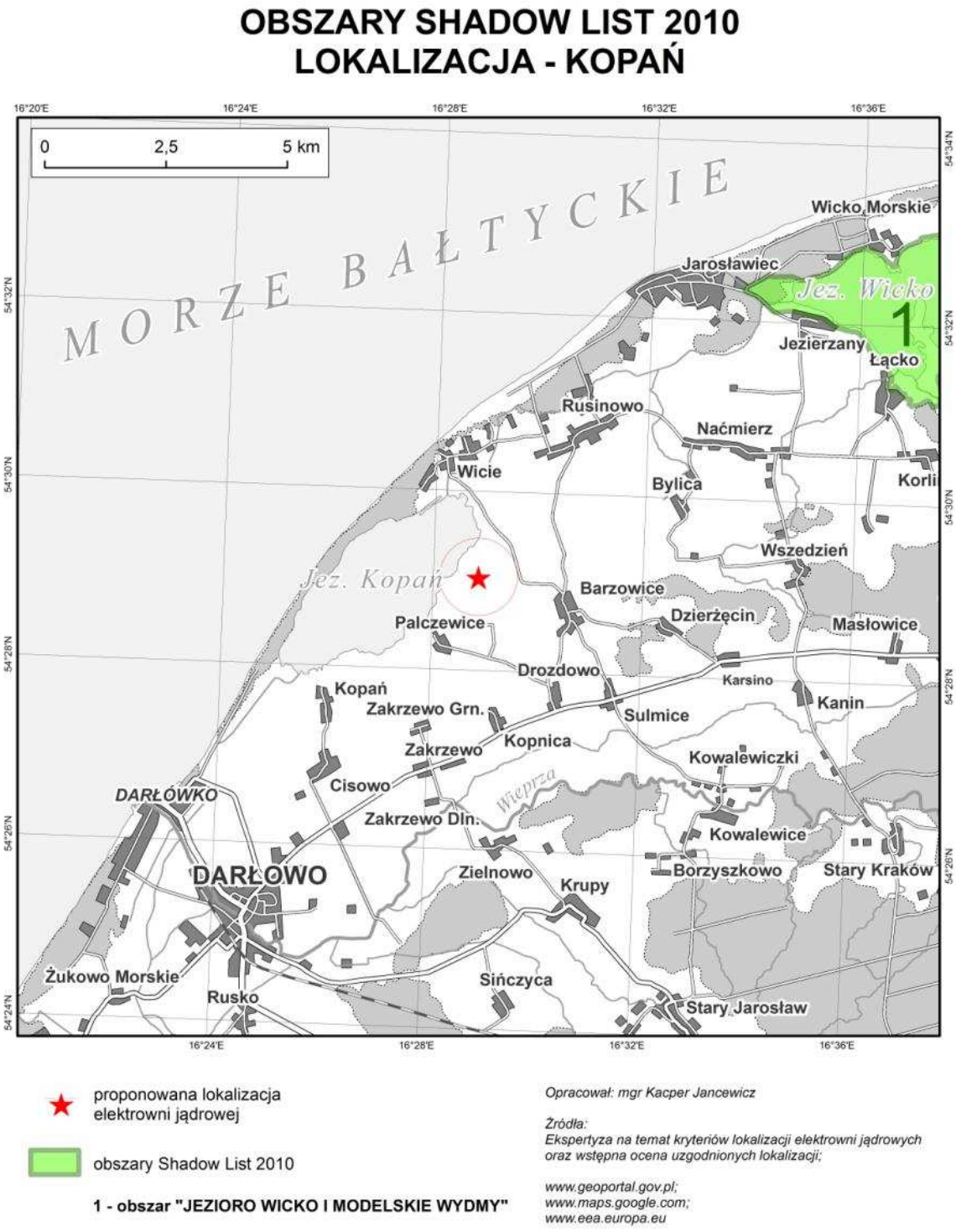

Fig. 6.3.15. Shadow List 2010 areas in the vicinity of Kopań site

[SPECIAL BIRD PROTECTION AREAS - ŻARNOWIEC SITE
Proposed power plant site

Shadow List 2010 areas
Developed by: mgr Kacper Jancewicz
Sources:
"Expert opinion on criteria of nuclear power plant locations and preliminary assessment of established sites"
www.geoportal.gov.pl;
www.maps.google.com;
www.eea.europa.eu]

6.3.3.4 Site –Nowe Miasto

Basic environmental conditions

Nowe Miasto site is a reserve location from the 1980s. It is located in the municipality of Nowe Miasto, Płoński district, Mazowieckie Province. The exact location of the power plant is shown in **Błąd! Nie można odnaleźć źródła odwołania.**. The municipality where the power plant is to be located has low population density (42 residents/km^2 at average population density in Poland 122 residents/km^2) due to which impacts of power plant construction and operation **will affect a small number of people**.

In the limited use area (the area within 800 meters from the plant) there are currently no residential or other buildings intended for human residence (in Jurzyn and Spądoszyn) , **therefore there may be a need of relocations** due to power plant construction.

The surroundings of Nowe Miasto NPP site have a very favourable wind energy zone, due to which **there will be no accumulation of potential pollutions** emitted from the power plant and other facilities in vicinity.

Preliminary analyses show that due to location in the vicinity of Zalew Zegrzyński (distance 32 km area 30 km^2, capacity 94.3 million m^3) and river Wisła (distance 33 km, SSQ = 1140m^3/s, SNQ = 352 m^3/s) closed cycle cooling system can be used in the power plant. The environmental impact of each cooling system solution has been discussed in detail in chapter 8.3.3.

There are no archaeological sites in the construction area and its vicinity, **thus eliminating hazards to cultural heritage** during ground works or construction delays due to halting works for the period of work of archaeologists.

In the vicinity of the planned investment **occurrence of natural resources and other useful minerals** was not stated, therefore a threat of difficult access and exploitation of deposits does not exist (see: chapter 8.3.6.2).

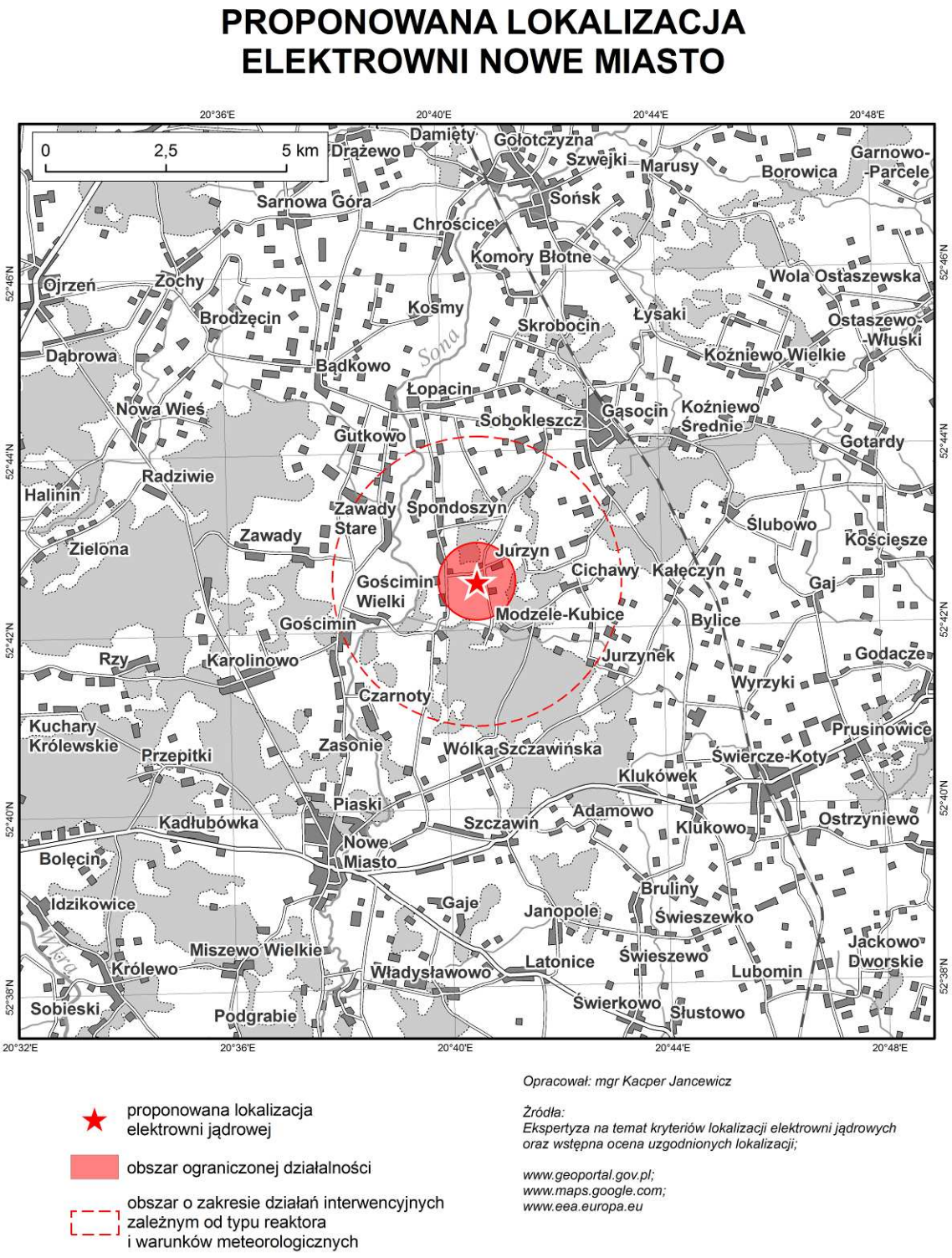

Fig. 6.3.16. Proposed site of Nowe Miasto NPP

[PROPOSED SITE OF NOWE MIASTO POWER PLANT
Proposed power plant site

Limited use area
Area of interventions depending on reactor type and weather conditions
Developed by: mgr Kacper Jancewicz
Sources:
"Expert opinion on criteria of nuclear power plant locations and preliminary assessment of established sites"
www.geoportal.gov.pl;
www.maps.google.com;
www.eea.europa.eu]

Geological structure and hydrogeology

In the substrate of the area where NPP is to be located, mainly boulder clay occurs with boulder structures in the areas of end moraines, and sands and gravels on the deeper level. Occurrence of young and active fault zones in the area was not documented. Mesozoic roof and Tertiary strata lay on the substrate. A seismic shock recorded in modern times occurred more than 30 km away, and maximum soil vibration acceleration is less than 0.04 g.

In the area there is tertiary porous tank "Subniecka Warszawska (central part)" (GZWP 215 a), the average depth of groundwater intakes here is 180 m. Depth to the main utility groundwater level varies between 5 and 15 m, on the boundary there is a quaternary porous tank "Działdowo" . The average depth of groundwater intakes here is from 100 m. The levels of aquifers show **low sensitivity to contamination**. Groundwater runoff occurs in the direction of W. Good insulation from the ground surface with thick layer of aluminium sediments with low infiltration and movement of pollutants **should not cause** contamination of groundwater in case of contamination from the surface.

Infrastructure

The location is in the network area, currently characterized by **a deficit of electricity production** amounting to 300 ≤ dP < 500 MW. The existing transmission grid is loaded at less than 60%, which **gives the possibility to use existing transmission capacity** to evacuate power from the NPP. However, to enable the network connection to NPP, expansion of > 250 km long transmission lines will be necessary. There may be a possibility of network expansion near urban areas. In addition, it is necessary to build the LV/LV/110 station. A detailed description of the impact of network expansion has been described in Chapter 8.3.7.

Site assessment made by PSE

Unfavourable site primarily due to lack of network infrastructure in this region of the country, and the TSO development plan does not provide for construction of 400 kV network in the area.

To lead out 1600 MW from a nuclear power plant, the following are needed:

- construction of 400 kV station
- construction of two 400 kV lines.

GPZ 110/15 kV station is located near the site.

The distance between the NPP site and existing urban infrastructure is as follows: main roads - up to 5 km, municipal roads - up to 5 km, railway lines - up to 10 km, water transport routes - above 15 km, airports - more than 60 km, other urban infrastructure - up to 5 km. So developed communication network near the plant will allow for a diverse supply of goods during construction (building materials) and during operation of the plant (spare parts, uranium) supplied from other regions of the country or outside Poland.

Fauna and Flora

Fauna

The area is not distinguished by the richness of fauna. No nature conservation forms, significant from the faunistic point of view, can be observed in the area. This implies lack of precise information on fauna. The closest bird refuges of Natura 2000 network (Dolina Dolnej Narwi and Dolina Środkowej Wisły) are 30 km away from the planned site. Also the "Atlas of Polish nesting birds distribution" does not provide too much information about the avifauna of the area - the majority of Polish nesting species in the square was not found. The Birds Directive Annex I states that only ortolan *Emberiza hortulana* and white stork *Ciconia ciconia* breed here. It's hard to assess to what extent this is the effect of low values of ornithofauna or poor reconnaissance, however at the current faunistic level it can be safely assumed that this area does not provide above-average wealth of fauna.

It can be assumed that transmission networks expansion associated with the construction of power plant (the impact of transmission networks will be the subject of separate study - see chapter 8.3.7.2.2) will entail an impact on even remote areas of Natura 2000, but the location of the power plant 30 km away from existing areas will result in the highest density of transmission networks (and thus the accumulation of negative impacts, such as death in the collision, the barrier effect, etc.) outside the protected area and beyond the valleys of large rivers (which are a natural bird migration corridor), and thus the potential impact on individual areas will be less than the site located inside or near an SPA or on large rivers. This site seems to **collide the least with fauna protection** and the protection areas, **and furthermore it does not interfere with the ecological corridors. Infrastructure associated with the construction and operation of a NPP will be the least environmentally burdensome of the analyzed locations.**

In conclusion - Nowe Miasto site, due to the impact of the investment on fauna and Natura 2000 areas is the most favourable among analyzed sites.

Plants

The vegetation is scarce, consisting mainly of common species.

Flora

Based on available published data the following list of species was established:

a) in closer proximity (approximately a few km):

- *Carex praecox*
- *Myosrus minimus*

b) further (several km):

- *Dactylorhiza majalis*
- *Diantus superbus*
- *Pulsatilla pratensis*

Near the proposed site positions of plant species from Annex 2 of the Habitats Directive were not observed.

In the area of the proposed site and in the area of the above surface forms of nature conservation occurrence of ca. 5 species of rare and endangered plants under strict protection is possible.

Plants

Due to lack of surface nature conservation forms in the area, there are no documented data on habitats. However, occurrence of certain common habitats from Annex 1 is possible.

The site is the poorest in every respect - habitat flora, nature conservation - among all the analyzed sites, therefore **potential negative impacts will also be the lowest.**

Lack of protected areas

6.3.4 **Reserve sites**

6.3.4.1 Site – Choczewo

Basic environmental conditions

Choczewo NPP site was reported by Marshal of Pomorskie. It is located in the municipality of Choczewo, Wejherowski district, Pomorskie Province. The exact location of the power plant is shown in **Błąd! Nie można odnaleźć źródła odwołania.**. The municipality where the power plant is to be located has low population density (32 residents/km^2 at average population density in Poland 122 residents/km^2) due to which impacts of power plant construction and operation **will affect a small number of people**.

In the limited use area (the area within 800 meters from the plant) there are currently no residential or other buildings intended for human residence. Therefore, **there is no need for relocations** due to power plant construction.

Preliminary analyses show that due to location in the vicinity of the sea coast and **sufficient water resources** open cycle cooling system can be used in the power plant. The environmental impact of each cooling system solution has been discussed in detail in chapter 8.3.3.

To the east of the proposed site there is Nadmorski Park Krajobrazowy [Seaside Landscape Park]. Depending on the plant's architectural form, **it may decrease landscape values** of this area.

The surroundings of Choczewo NPP have a very favourable wind energy zone, due to which **there will be no accumulation of potential pollutions** emitted from the power plant and other facilities in vicinity.

There are no archaeological sites in the construction area and its vicinity, **thus eliminating hazards to cultural heritage** during ground works or construction delays due to halting works for the period of work of archaeologists.

In the vicinity of the planned investment **occurrence of natural resources and other useful minerals** was not stated, therefore a threat of difficult access and exploitation of deposits does not exist (see: chapter 8.3.6.2).

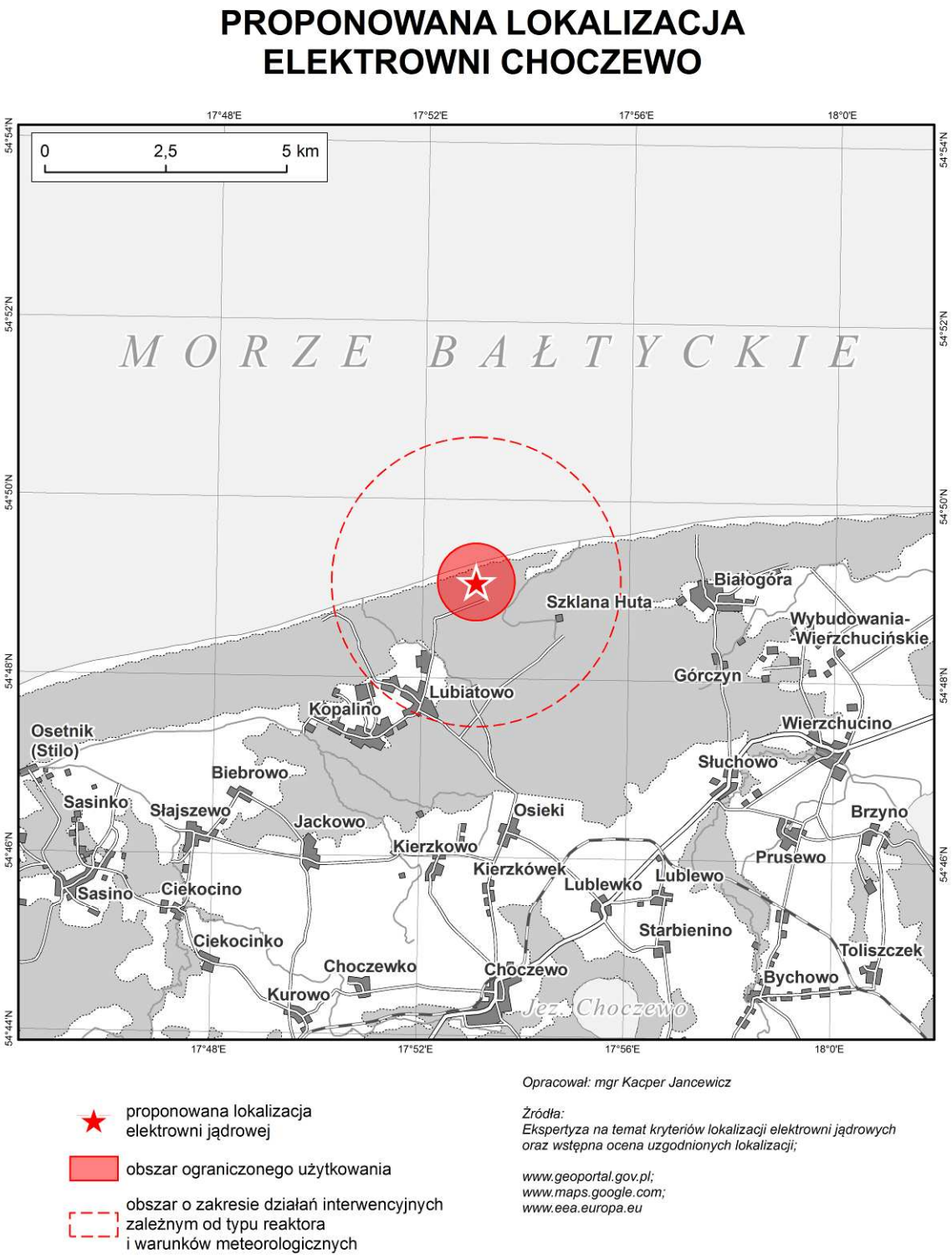

Fig. 6.3.17. Proposed site of Choczewo NPP

[PROPOSED SITE OF CHOCZEWO POWER PLANT
Proposed power plant site

Limited use area
Area of interventions depending on reactor type and weather conditions
Developed by: mgr Kacper Jancewicz
Sources:
"Expert opinion on criteria of nuclear power plant locations and preliminary assessment of established sites"
www.geoportal.gov.pl;
www.maps.google.com;
www.eea.europa.eu]

Geological structure and hydrogeology

Near the surface of the area where the NPP is to be located, there are Aeolian sands and deeper - boulder clays. In the vicinity (ca. 10 km) the substrate contains a series of Triassic outcrops within the chalk, whose tectonic structure is not specified. Neotectonic reactivation of this structure cannot be excluded. Mesozoic roof and Tertiary strata lay on the substrate. In the distance exceeding 20 km a weak seismic shock was recorded, and maximum soil vibration acceleration is less than 0.02 g.

In this area, main groundwater reservoir does not occur. Depth to the main utility groundwater level varies between 5 and 15 m The levels of aquifers show medium sensitivity to contamination. Groundwater runoff occurs in the N direction. In some cases, **there is a threat** of groundwater contamination.

Infrastructure

The location is in the network area, currently characterized by **a deficit of electricity production** amounting to 300 ≤ dP < 500 MW. The existing transmission grid is loaded at less than 60%, which **gives the possibility to use existing transmission capacity** to evacuate power from the NPP. However, to enable the network connection to NPP, expansion of 100 to 250 km long transmission lines will be necessary. There is a possibility of interference of the expansion with two Natura 2000 sites and its course near urban areas. In addition, it is necessary to build the LV/LV/110 station. A detailed description of the impact of network expansion has been described in Chapter 8.3.7.

During emergency shutdown of the unit with capacity 1600 MW, there may occur a threat to stable operation of NPS and stable cooperation of NPS with systems in neighbouring countries.

Construction of NPP in this location will improve the conditions for cross-border trade.

Site assessment made by PSE

From the viewpoint of the power balance in the NPS **location is advantageous**, which was emphasized with other nuclear power plant sites in the northern part of the country.

It should be noted, however, that in this case, difficulties should be expected with evacuation of full power (3200 MW) from the nuclear power plant into the NPS. In PRSP prepared by the TSO connection of the nuclear power plant to Żarnowiec node was considered. Results of analysis showed that in case of 1600 MW capacity, construction of an additional 2-track 400 kV line linking SE Żarnowiec with new station in the region of Gdansk is necessary. Expansion, however, was not sufficient for 3,200 MW and it is difficult to imagine the construction of other 400 kV lines from the node into the NPS. It is therefore proposed to consider this location for nuclear power plant with a capacity of not more than 1600 MW.

110 kV power supply line runs near the site, large distances between main supply points. Lack of centralised heat supply, lack of gas supply network.

The distance between the NPP site and existing urban infrastructure is as follows: main roads - 5-15 km, municipal roads - up to 5 km, railway lines - up to 10 km, water transport routes - up to 5 km, airports - more than 60 km, other urban infrastructure - up to 5 km. So developed communication network near the plant will allow for a diverse supply of goods during construction (building materials) and during operation of the plant (spare parts, uranium) supplied from other regions of the country or outside Poland.

Fauna and Flora

Fauna

The site is planned in the distance of ca. 1 km from the refuge Przybrzeżne Wody Bałtyku [Coastal Baltic Waters]. Small crustaceans dominate the benthic fauna. Large marine mammals are rarely observed - grey seals *Halichoerus grypus*, ringed seals *Phoca hispida* and harbour porpoises *Phocoena phocoena*. The area is a bird sanctuary of European rank.

Key bird species for Natura 2000 Przybrzeżne Wody Bałtyku site:

red-throated loon *Gavia stellata*, black-throated loon *Gavia arctica*, horned grebe *Podiceps auritus*, long-tailed duck *Clangula hyemalis*, common scoter *Melanitta nigra*, velvet scoter *Melanitta fusca*, European herring gull *Larus argentatus*, common murre *Uria aalge* and razorbill *Alca torda*.

This area is a wintering location for 3 bird species from Annex I of the Birds Directive: black-throated loon, red-throated loon and horned grebe. Also populations of long-tailed duck, common scoter, velvet scoter and common murre and periodically European herring gull are significant (depending on intensity of fishing). In the vicinity there is a nesting ground for Eurasian eagle-owl *Bubo bubo* and place of permanent stay for white-tailed eagle *Haliaeetus albicilla* and osprey *Pandion haliaetus*.

Similarly to other sites located on the coast, the site, due to expansion of aerial transmission lines and their impact will be the subject of the separate study - see chapter 8.3.7.2.2 **as it can have significant impact on mortality of migrating birds.**

The location potentially significantly affecting Natura 2000 site Przybrzeżne Wody Bałtyku, but without collisions with ecological corridors. **More detailed analysis of the impact of NPP on Natura 2000 sites will be performed at the stage of preparing the Environmental Impact Report for construction of power plant when selecting a location, though it would be advisable to exclude this location because of the potential environmental effects of its implementation.**

Plants

The site has the only on Polish coast - apart from Słowiński National Park - complex of embankment and parabolic dunes (partially walking) and seaside pine forests of various humidity. The depressions between dunes (deflation troughs) are filled with peat. Often there are wet willow heaths, disappearing communities in Poland with few positions. Large part of the area is covered with forest communities. Apart from pine forests, there are also well-preserved, acidic and fertile alders and swamp birch complexes. The value of the area is increased by bushes with very rare *Myrica gala*, and (scarce in Poland) *Linaria odora*. Populations of vascular and legally protected plant species are exceptionally well represented. Here we have a complex of peat bog and forest communities, creating the natural succession series, unique on the south coast of the Baltic. Also, very rare on national scale plant communities of Atlantic character have been found: *Eleocharitetum multicaulis*, Rhynchosporetum fuscae, Ericetum tetralicis, *Myricetum gale*, occurring in dense patches and on relatively large surfaces, and coastal swamp forest variety with *Erica tetralix* and *Myrica gale*, humid, regionally rare forms of swamp woods, fragments of well-preserved bog birch and birch-oak and beech-oak forests. Vascular plants and cryptogams are unique, including mycoflora with many

species of Atlantic range. Several of these species occur here in numerous populations, e.g. *Drosera intermedia, Rhynchospora fusca, Myrica gale, Erica tetralix.* The only one in Pomerania and one of 5 in Poland, position of *Eleocharis multicaulis*. The area of special landscape values.

The proposed location is near the plant refuges IPA:

PL 96 – Białogóra.

PL 106 – Łąki piaśnickie.

Flora

Based on available published data the following list of species was established:

a) in closer proximity (approximately a few km):

- *Baeothryon caespitosum*
- *Betula humilis*
- *Carex buxbaumii*
- *Centaurium litorale*
- *Cnidium dubium*
- *Dactylorhiza fuchsii*
- *Dactylorhiza incarnata*
- *Dactylorhiza maculata*
- *Diantus superbus*
- *Drosera rotundifolia*
- *Dryopteris cristata*
- *Empetrum nigrum*
- *Epipactis palustris*
- *Erica tetralix*
- *Euphrasia nemorea*
- *Galium harcynicum*
- *Gentiana pneumonanthe*
- *Glaux maritima*
- *Goodyera repens*
- *Hieracium echioides*
- *Hippuris vulgaris*
- *Huperzia selago*
- *Iris sibirica*
- *Juncus acutiflorus*
- *Juncus gerardii*
- *Juncus subnodulosus*
- *Lathyrus palustris*
- *Listera cordata*
- *Lycopodiella inundata*
- *Marrubium vulgare*
- *Myrica gale*
- *Najas minor*
- *Nuphar pumila*
- *Ophioglosum vulgatum*
- *Pedicularis palustris*
- *Plantago maritima*

- *Polemonium coeruleum*
- *Potamogeton alpinus*
- *Pyrola media*
- *Radiola linoides*
- *Ranunculus lingua*
- *Rubus chamaemorus*
- *Salsola kali ssp. kali*
- *Scheuchzeria palustris*
- *Stachys arvensis*
- *Triglochin maritimum*
- *Utricularia australis*
- *Utricularia intermedia*
- *Utricularia minor*
- *Viola stagnina*

b) further (several km):

- *Ajuga pyramidalis*
- *Alisma lanceolatum*
- *Bromus secalinus*
- *Campanula latifolia*
- *Carex chordorrhiza*
- *Carex limosa*
- *Carex puilicaris*
- *Cephalanthera longifolia*
- *Corallorhiza trfida*
- *Diphasiastrum tristachyum*
- *Drosera anglica*
- *Drosera intermedia*
- *Epipogium aphyllum*
- *Gentianella baltica*
- *Gymnadenia conopsea*
- *Isoetes lacustris*
- *Koeleria pyramidata*
- *Littorella uniflora*
- *Lobelia dortmanna*
- *Lolium temulentum*
- *Nymphoides peltata*
- *Osmunda regalis*
- *Pulsatilla pratensis*
- *Pyrola media*
- *Rhynchospora fusca*
- *Ruppia maritima*
- *Sparganium angustifolium*
- *Stellaria crassifolia*
- *Zannichellia palustris*

In the area of the proposed site and in the area of the above surface forms of nature conservation, positions (4) are listed of the following species from the Habitats Directive Annex 2:

- 2216 *Linaria odora*
- 1903 *Liparis loeselii*
- 1831 *Luronium natans*
- 1528 *Saxifraga hirculus*

In the area of the proposed site and in the area of the above surface forms of nature conservation occurrence of ca. 84 species of rare and endangered plants under strict protection is possible.

Plants

In the area of the proposed location and protected areas in the vicinity, occurrence of the following habitats from the Habitats Directive Annex 1 is reported:

- 1150 - bays and sea lakes (lagoons)*
- 1210 - nitrophilous strandline vegetation
- 2110 - initial stages of yellow dunes
- 2120 -yellow dunes (*Elymo-Ammophiletum*)
- 2130 - grey dunes*
- 2140 - seaside pine heaths (*Empetrion nigri*)*
- 2170 - dunes with sand willow bushes
- 2180 - mixed forests and forests on coastal dunes
- 2190 - humid depressions between dunes
- 3110 - Lobelia lakes
- 3130 - shores or drained reservoir bottoms with communities with *Littorelletea*, *Isoëto-Nanojuncetea*
- 3150 - oxbow lakes and natural eutrophic reservoirs with the communities with *Nympheion*, *Potamion*
- 3160 - natural dystrophic water reservoirs
- 4010 - humid heaths with Erica tetralix (*Ericion tetralix*)
- 6510 - lowland hay meadows used extensively (*Arrhenatherion elatioris*)
- 7110 - high peat bogs with peat-generating vegetation (live) *
- 7120 - degraded high peat bogs, but able to regenerate naturally and upon stimulation
- 7140 - Transition mires and quaking bogs (mostly with plants from *Scheuchzerio-Caricetea*)
- 7150 - depressions on peat substrates with vegetation from *Rhynchosporion*
- 6410 - Molinia meadows (*Molinion*)

- 9110 - acidic beech (*Luzulo-Fagenion*)
- 9190 - Pomeranian acidic birch-oak forest (*Betulo-Quercetum*)
- 91D0 - bog woodland*
- 91E0 - riparian willow, poplar, alder and ash (*Salicetum albo-fragilis*, *Populetum albae*, *Alnenion glutinoso-incanae*, spring alders)*

* indicates priority habitat

Site with significant diversity of vegetation and numerous forms of nature conservation, **potential negative impact is relatively high**. **More detailed analyses of the impact of NPP on Natura 2000 sites should be performed on the stage of preparing the Environmental Impact Report for construction of the plant when selecting a site.**

Near the site, the following sites protected due to the environment occur:

Special areas of habitat protection (**Błąd! Nie można odnaleźć źródła odwołania.**):

- Protected area: Białogóra, Area code : PLH220003, Form of protection in terms of Natura 2000: special area of habitat protection (Habitats Directive), Area status : area proposed by the Government of Poland.
- Protected area: Mierzeja Sarbska, Area code : PLH220018, Form of protection in terms of Natura 2000: special area of habitat protection (Habitats Directive), Area status : area proposed by the Government of Poland.
- Protected area: Choczewskie Lakes, Area code : PLH220096, Form of protection in terms of Natura 2000: special area of habitat protection (Habitats Directive),
- Protected area: Piaśnickie Łąki, Area code : PLH220021, Form of protection in terms of Natura 2000: special area of habitat protection (Habitats Directive),

Special areas of birds protection (**Błąd! Nie można odnaleźć źródła odwołania.**):

- Protected area: Przybrzeżne Wody Bałtyku, Area code : PLB990002, Form of protection in terms of Natura 2000: special area of bird protection (Birds Directive),Area status : designated area [by Resolution of Minister of Environment]

Landscape parks (**Błąd! Nie można odnaleźć źródła odwołania.**):

- Nadmorski Park Krajobrazowy

Nature reserves (**Błąd! Nie można odnaleźć źródła odwołania.**):

- Choczewskie Cisy
- Babnica
- Białogóra
- Długosz Królewski in Wierzchucin

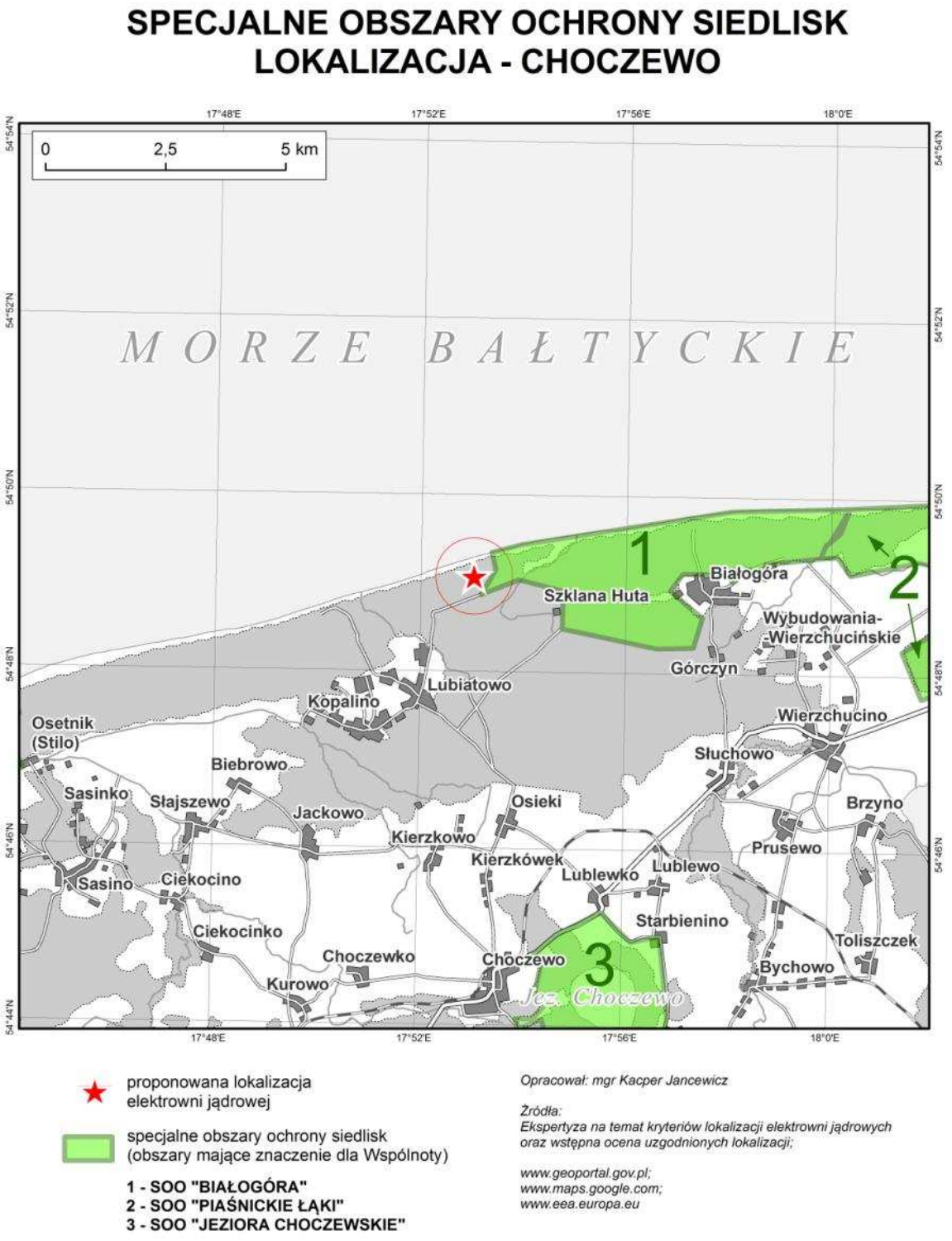

Fig. 6.3.18. Special habitat protection areas in the vicinity of Choczewo site

[SPECIAL HABITAT PROTECTION AREAS - CHOCZEWO SITE
Proposed power plant site

Special habitat protection areas (significant for the Community)
Developed by: mgr Kacper Jancewicz
Sources:
“Expert opinion on criteria of nuclear power plant locations and preliminary assessment of established sites”
www.geoportal.gov.pl;
www.maps.google.com;
www.eea.europa.eu]

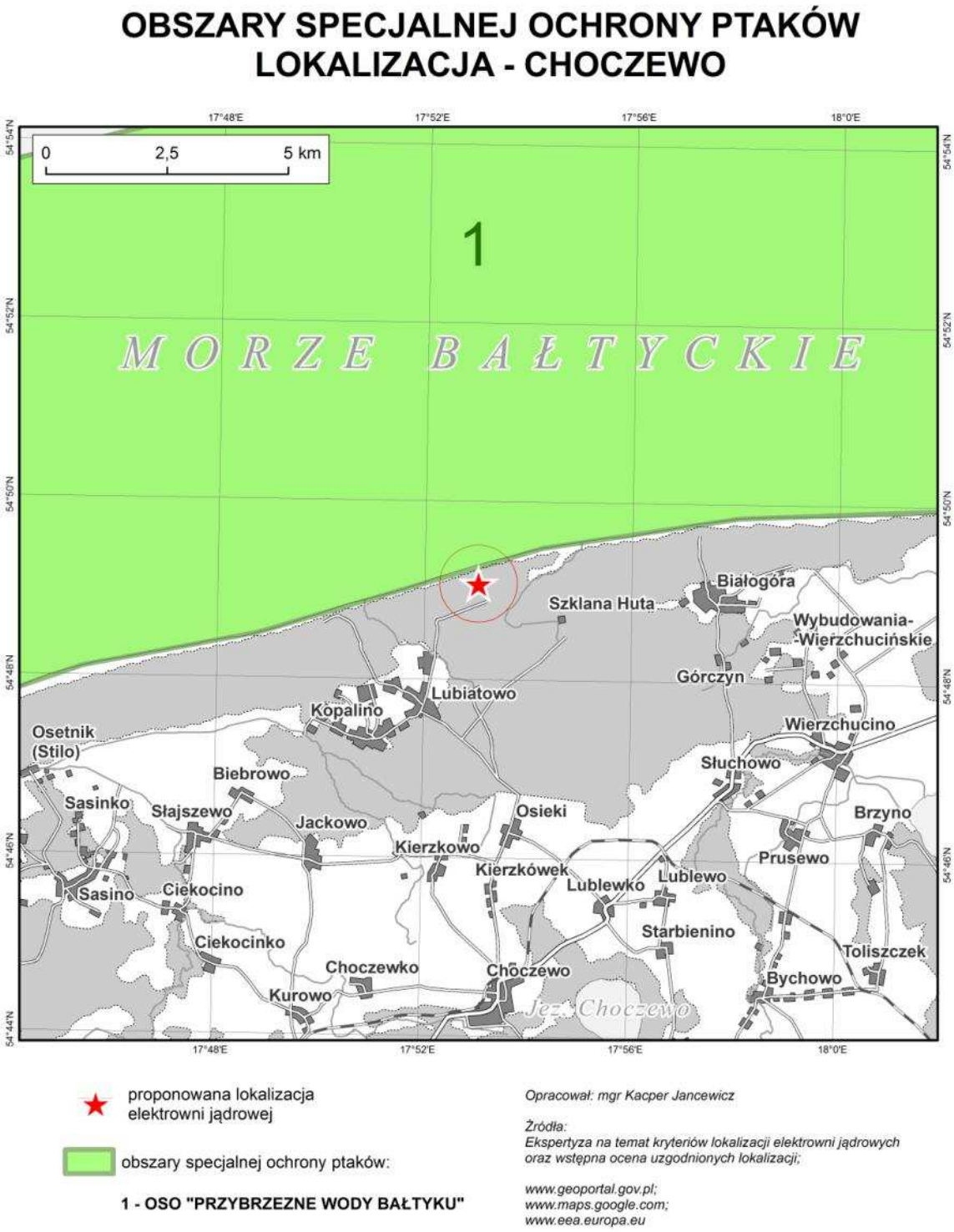

Fig. 6.3.19. Special bird protection areas in the vicinity of Choczewo site

[SPECIAL BIRD PROTECTION AREAS - CHOCZEWO SITE
Proposed power plant site

Special bird protection areas
Developed by: mgr Kacper Jancewicz
Sources:
“Expert opinion on criteria of nuclear power plant locations and preliminary assessment of established sites”
www.geoportal.gov.pl;
www.maps.google.com;
www.eea.europa.eu]

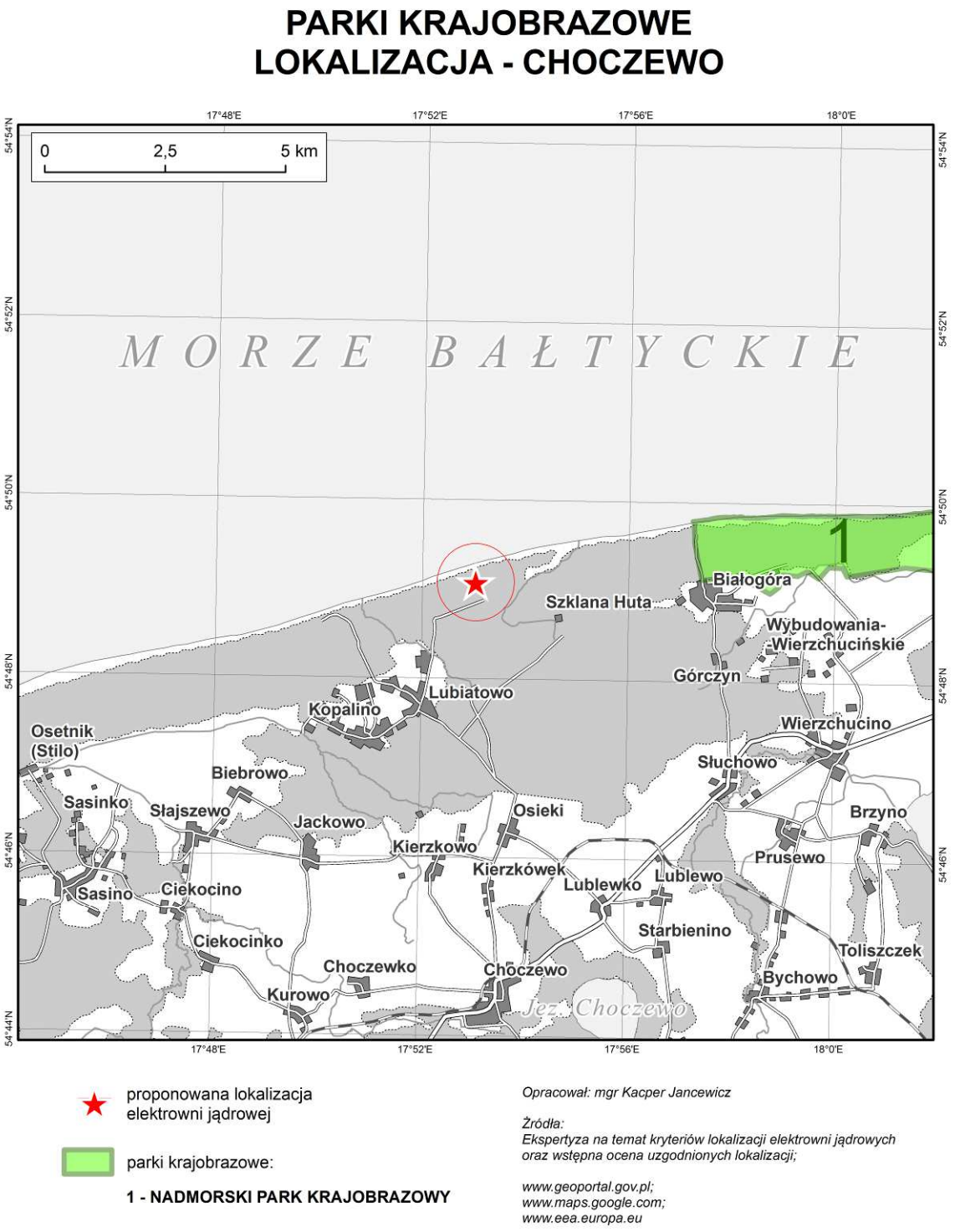

Fig. 6.3.20. Landscape parks in the vicinity of Choczewo site

[LANDSCAPE PARKS – CHOCZEWO SITE
Proposed power plant site

Landscape parks:
Developed by: mgr Kacper Jancewicz
Sources:
“Expert opinion on criteria of nuclear power plant locations and preliminary assessment of established sites”
www.geoportal.gov.pl;
www.maps.google.com;
www.eea.europa.eu]

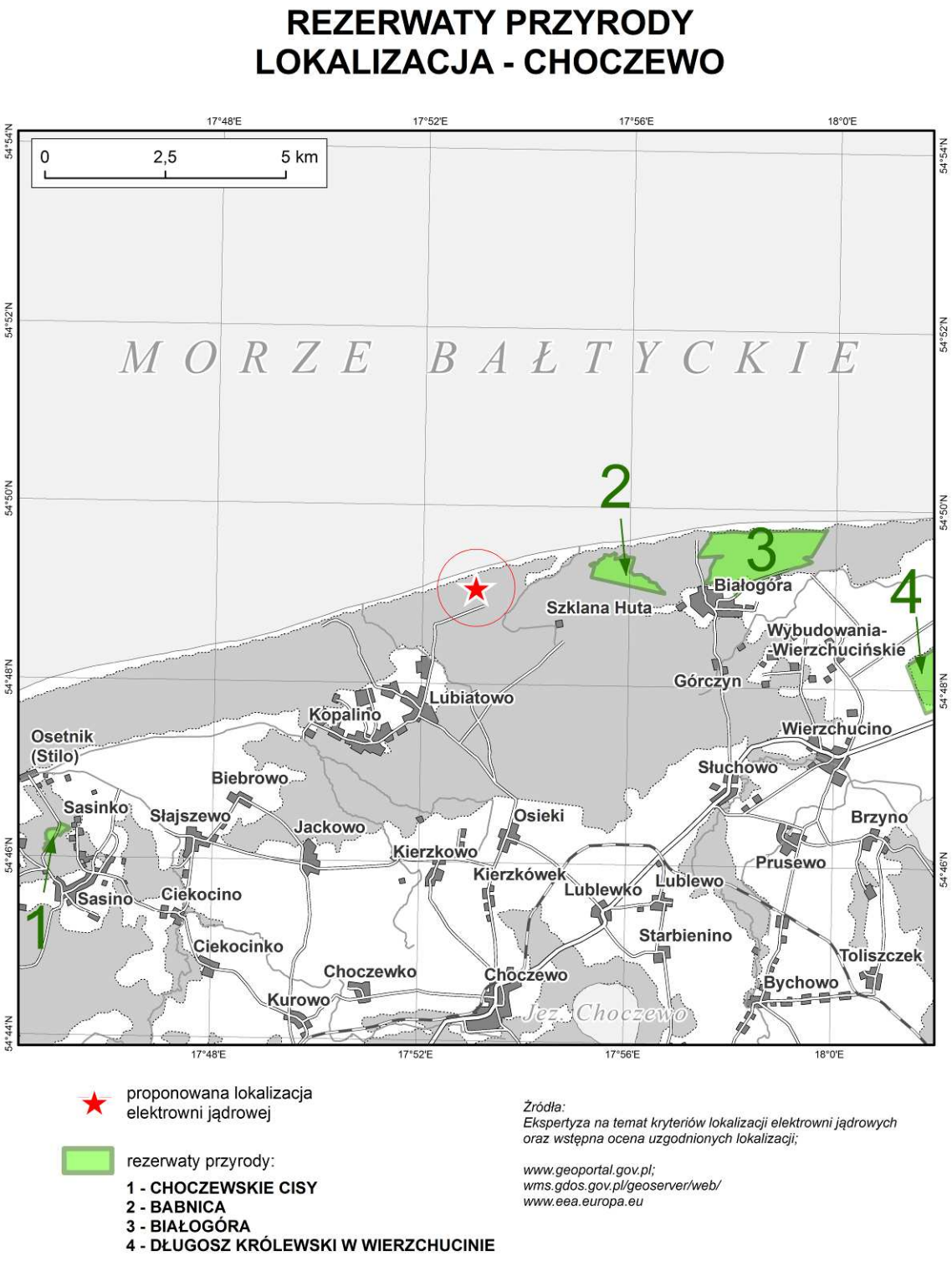

Fig. 6.3.21. Natural reserves in the vicinity of Choczewo site

[NATURAL RESERVES - CHOCZEWO SITE
Proposed power plant site

Natural reserves:
Developed by: mgr Kacper Jancewicz
Sources:
"Expert opinion on criteria of nuclear power plant locations and preliminary assessment of established sites"
www.geoportal.gov.pl;
www.maps.google.com;
www.eea.europa.eu]

6.3.4.2 Lubatowo-Kopalino site

Basic environmental conditions

Lubiatowo-Kopalino NPP site was reported by Marshal of Pomorskie. It is located in the municipality of Choczewo, Wejherowski district, Pomorskie Province. Exact location of the power plant is presented in **Błąd! Nie można odnaleźć źródła odwołania.**. The municipality where the power plant is to be located has low population density (32 residents/km^2 at average population density in Poland 122 residents/km^2) due to which impacts of power plant construction and operation **will affect a small number of people**.

In the limited use area (the area within 800 meters from the plant) there are currently no residential or other buildings intended for human residence. Therefore, **there is no need for relocations** due to power plant construction.

Preliminary analyses show that due to location in the vicinity of the sea coast and **sufficient water resources** open cycle cooling system can be used in the power plant. The environmental impact of each cooling system solution has been discussed in detail in chapter 8.3.3.

The surroundings of Lubiatowo-Kopalino NPP have a very favourable wind energy zone, due to which **there will be no accumulation of potential pollutions** emitted from the power plant and other facilities in vicinity.

In the surrounding area provided for the construction of power plant, there are 13 archaeological sites in Kurowo. Due to possible violation of these sites **ground works should be conducted with extreme caution under the archaeological supervision**. In addition, construction at these sites may be withheld for the duration of work of archaeologists, when during earth works discovery of valuable cultural objects takes place.

In the vicinity of the planned investments **occurrence of natural resources and other useful minerals** was not stated, therefore **a threat of difficult access and exploitation of deposits does not exist** (see: chapter 8.3.6.2).

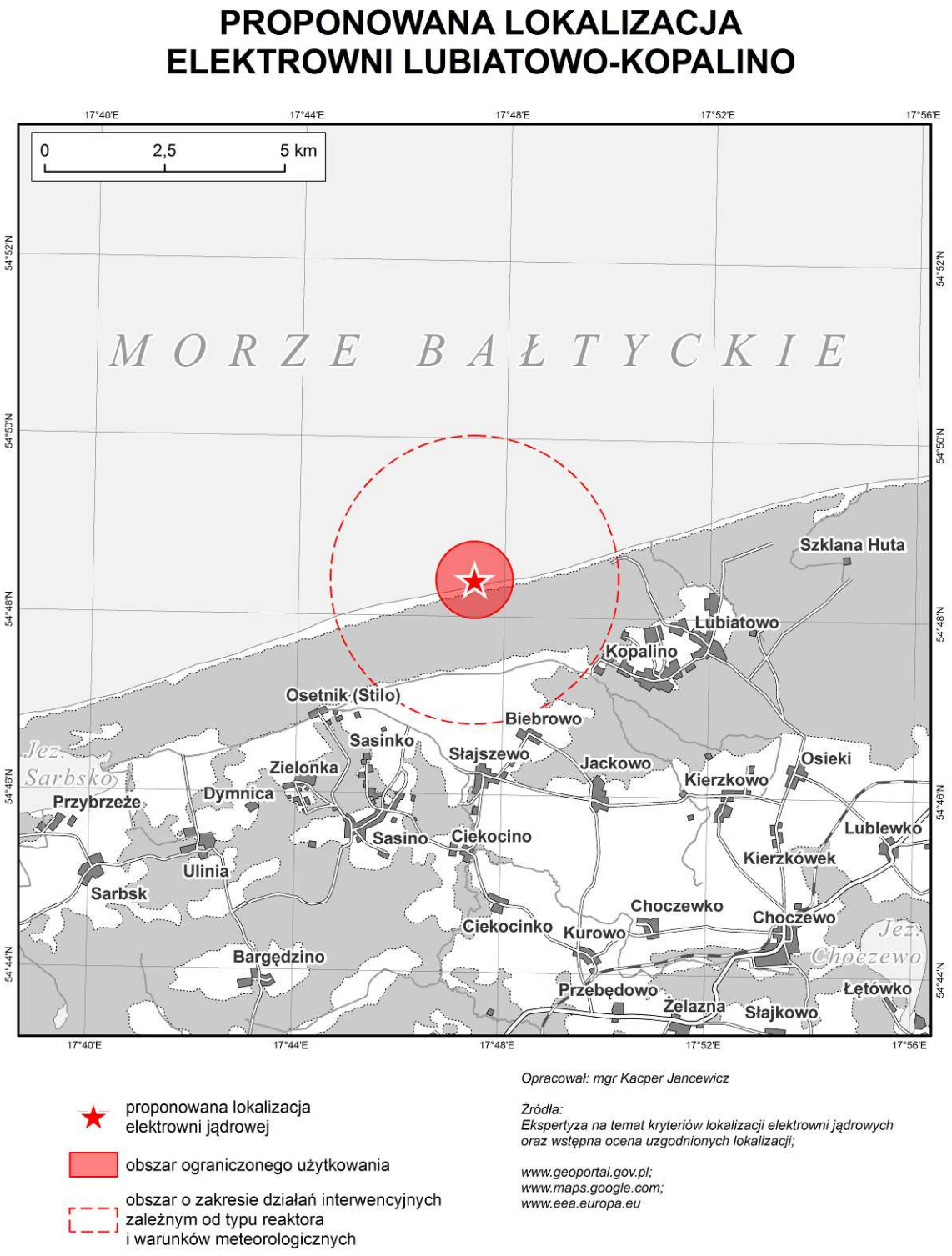

Fig. 6.3.22. Proposed site of Lubiatowo-Kopalino NPP

[PROPOSED SITE OF LUBIATOWO-KOPALINO POWER PLANT
Proposed power plant site

Limited use area
Area of interventions depending on reactor type and weather conditions
Developed by: mgr Kacper Jancewicz
Sources:
"Expert opinion on criteria of nuclear power plant locations and preliminary assessment of established sites"
www.geoportal.gov.pl;
www.maps.google.com;
www.eea.europa.eu]

Geological structure and hydrogeology

In the area of potential NPP site there are boulder clays, and deeper - river and fluvioglacial sands. In the vicinity (ca. 10 km) the substrate contains a series of Triassic outcrops within the chalk, whose tectonic structure is not specified. Neotectonic reactivation of this structure cannot be excluded. Mesozoic roof and Tertiary strata lay on the substrate. In the distance exceeding 20 km a weak seismic shock was recorded, and maximum soil vibration acceleration is less than 0.02 g.

In the area of investment there is quaternary porous tank "Zbiornik Morenowy Salino" (GZWP 108), the average depth of groundwater intakes here is from 10 to 40 m. Depth to the main utility groundwater level varies between 5 and 10 m. The levels of aquifers show very low sensitivity to contamination. Groundwater runoff occurs in the direction of N. Good insulation from the ground surface with thick layer of aluminium sediments with low infiltration and movement of pollutants **should not cause** contamination of groundwater in case of contamination from the surface.

Infrastructure

The location is in the network area, currently characterized by a **small deficit of electricity production** below 100 MW. The existing transmission grid is loaded at more than 60%, which **does not give the possibility to use existing transmission capacity** to evacuate power from the NPP. To enable the network connection to NPP, expansion of > 250 km long transmission lines will be necessary. Potential extension may interfere with the Natura 2000 site. In addition, it is necessary to build the LV/LV/110 station. A detailed description of the impact of network expansion has been described in Chapter 8.3.7.

Site assessment made by PSE

From the viewpoint of the power balance in the NPS **location is advantageous**, which was emphasized with other nuclear power plant sites in the northern part of the country.

It should be noted, however, that in this case, difficulties should be expected with evacuation of full power (3200 MW) from the nuclear power plant into the NPS. In PRSP prepared by the TSO connection of the nuclear power plant to Żarnowiec node was considered. Results of analysis showed that in case of 1600 MW capacity, construction of an additional 2-track 400 kV line linking SE Żarnowiec with new station in the region of Gdansk is necessary. Expansion, however, was not sufficient for 3,200 MW and it is difficult to imagine the construction of other 400 kV lines from the node into the NPS. It is therefore proposed to consider this location for nuclear power plant with a capacity of not more than 1600 MW.

Moreover, for these locations attention should be paid to other factors that may adversely affect the location of nuclear power plant, associated with excess energy production in that area and with overloading of existing transmission networks:

- Construction of wind farms in the north. TSO (Transmission System Operator) has already issued the connection conditions for wind farms connected to SE Żarnowiec for the total

power of 346 MW, and currently proceedings are pending concerning construction of further wind farms with a total capacity approximately 1600 MW (including a sea wind farm with capacity 420 or 1560 MW). It should also be noted that TSO issued the connection conditions for wind farms in neighbouring substations with total capacity ca. 1750 MW. Then there are proceedings pending at DSO (Distribution System Operator).

- Construction of a gas power plant with a capacity of 250 MW connected to SE Żarnowiec. At present it is difficult to judge whether the investment is feasible.

110 kV power supply line runs near the site, large distances between main supply points. Lack of centralised heat supply, lack of gas supply network.

The distance between the NPP site and existing urban infrastructure is as follows: main roads - up to 5 km, municipal roads - up to 5 km, railway lines - up to 10 km, water transport routes - from 5 to 15 km, airports - 20- 60 km, other urban infrastructure - up to 5 km. So developed communication network near the plant will allow for a diverse supply of goods during construction (building materials) and during operation of the plant (spare parts, uranium) supplied from other regions of the country or outside Poland.

Fauna and Flora

Fauna

Location on the border of the refuge Przybrzeżne Wody Bałtyku. Small crustaceans dominate the benthic fauna. Large marine mammals are rarely observed - grey seals *Halichoerus grypus*, ringed seals *Phoca hispida* and harbour porpoises *Phocoena phocoena*. The area is a bird sanctuary of European rank.

Key bird species for Natura 2000 Przybrzeżne Wody Bałtyku site:

red-throated loon *Gavia stellata*, black-throated loon *Gavia arctica*, horned grebe *Podiceps auritus*, long-tailed duck *Clangula hyemalis*, common scoter *Melanitta nigra*, velvet scoter *Melanitta fusca*, European herring gull *Larus argentatus*, common murre *Uria aalge* and razorbill *Alca torda*.

This area is a wintering location for 3 bird species from Annex I of the Birds Directive: black-throated loon, red-throated loon and horned grebe. Also populations of long-tailed duck, common scoter, velvet scoter and common murre and periodically European herring gull are significant (depending on intensity of fishing). In the vicinity there is a nesting ground for Eurasian eagle-owl *Bubo bubo* and place of permanent stay for white-tailed eagle *Haliaeetus albicilla* and osprey *Pandion haliaetus*.

Similarly to other sites located on the coast, the site, due to expansion of aerial transmission lines and their impact will be the subject of the separate study - see chapter 8.3.7.2.2 **as it can have significant impact on mortality of migrating birds.**

The location potentially significantly affecting Natura 2000 site Przybrzeżne Wody Bałtyku, but without collisions with ecological corridors. **More detailed analysis of the impact of NPP on Natura 2000 sites will be performed at the stage of preparing the Environmental Impact Report for construction of power plant when selecting a location, though it would be advisable to exclude this location because of the potential environmental effects of its implementation.**

Plants

With the adopted methodology of characteristics of the vegetation - based on the literature, the discussed location is close enough to a location in Choczewo that at this stage it is impossible to differentiate the description analysis of diversity of flora and vegetation for both locations. (See chapter 10.3.4.1)

Site with significant diversity of vegetation and numerous forms of nature conservation, **potential negative impact is relatively high**. **More detailed analyses of the impact of NPP on Natura 2000 sites should be performed on the stage of preparing the Environmental Impact Report for construction of the plant when selecting a site.**

Near the site, the following sites protected due to the environment occur:

Special areas of habitat protection (**Błąd! Nie można odnaleźć źródła odwołania.**):

- Protected area: Białogóra, Area code : PLH220003, Form of protection in terms of Natura 2000: special area of habitat protection (Habitats Directive), Area status : area proposed by the Government of Poland.
- Protected area: Mierzeja Sarbska, Area code : PLH220018, Form of protection in terms of Natura 2000: special area of habitat protection (Habitats Directive), Area status : area proposed by the Government of Poland.
- Protected area: Choczewskie Lakes, Area code : PLH220096, Form of protection in terms of Natura 2000: special area of habitat protection (Habitats Directive),

Special areas of birds protection (**Błąd! Nie można odnaleźć źródła odwołania.**):

- Protected area: Przybrzeżne Wody Bałtyku, Area code : PLB990002, Form of protection in terms of Natura 2000: special area of bird protection (Birds Directive),Area status : designated area [by Resolution of Minister of Environment]

Nature reserves (**Błąd! Nie można odnaleźć źródła odwołania.**):

- Babnica, Borkowskie Wąwozy
- Mierzeje Sarbska
- Choczewskie Cisy

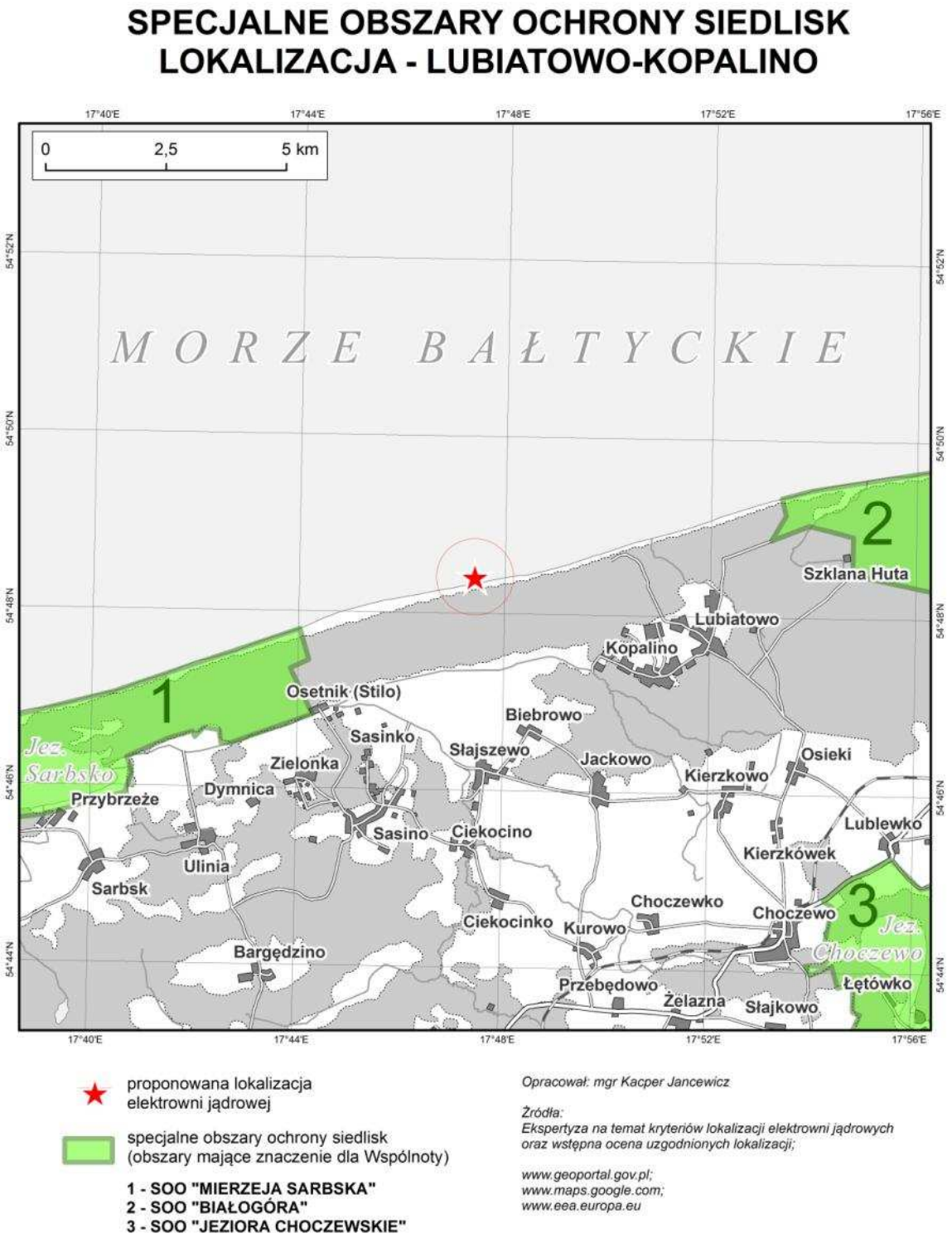

Fig. 6.3.23. Special habitat protection areas in the vicinity of Lubiatowo-Kopalino site

[SPECIAL HABITAT PROTECTION AREAS – LUBIATOWO-KOPALINO SITE
Proposed power plant site

Special habitat protection areas (significant for the Community)
Developed by: mgr Kacper Jancewicz
Sources:
“Expert opinion on criteria of nuclear power plant locations and preliminary assessment of established sites”
www.geoportal.gov.pl;
www.maps.google.com;
www.eea.europa.eu]

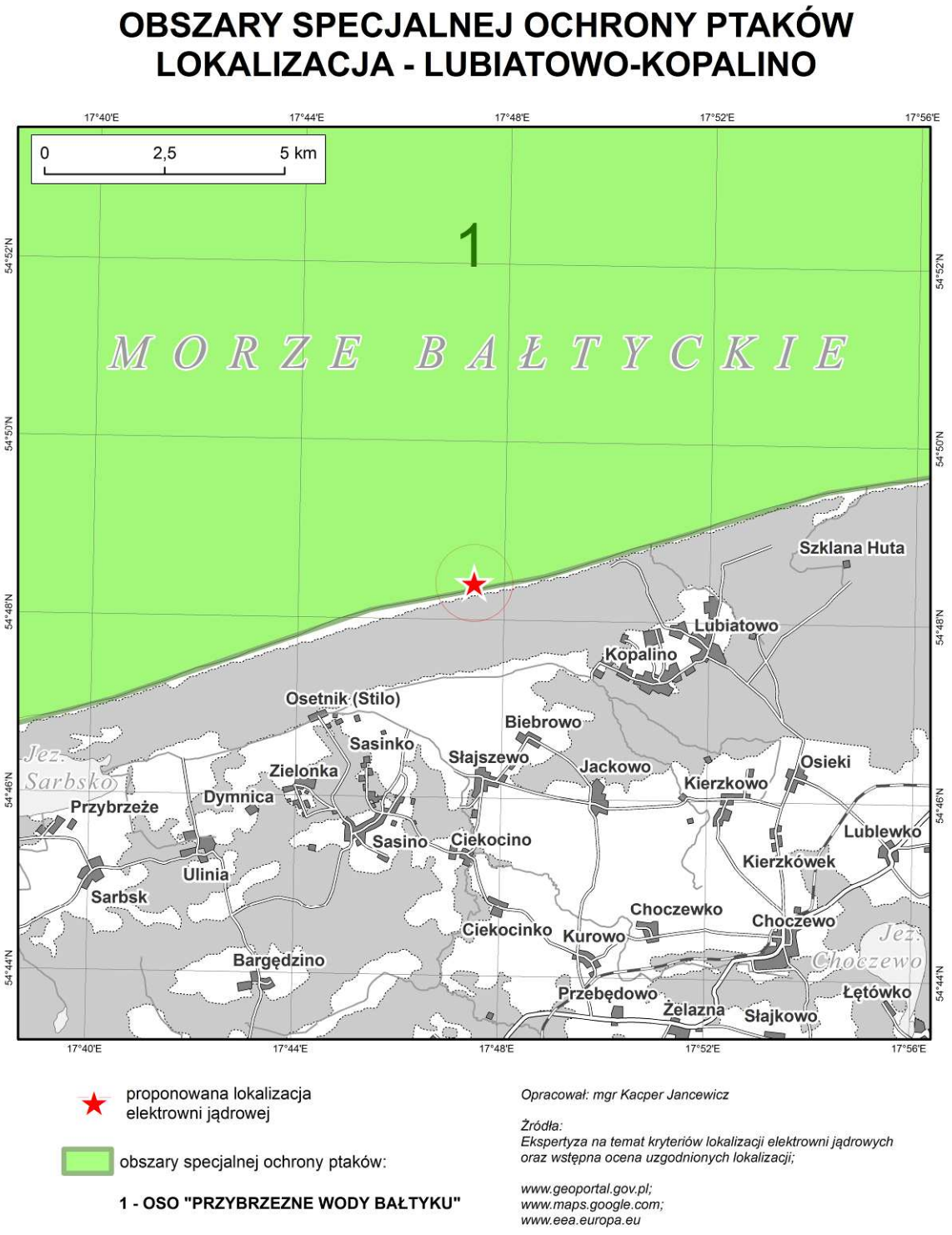

Fig. 6.3.24. Special bird protection areas in the vicinity of Lubiatowo-Kopalino site

[SPECIAL BIRD PROTECTION AREAS – LUBIATOWO-KOPALINO SITE
Proposed power plant site

Special bird protection areas
Developed by: mgr Kacper Jancewicz
Sources:
“Expert opinion on criteria of nuclear power plant locations and preliminary assessment of established sites”
www.geoportal.gov.pl;
www.maps.google.com;
www.eea.europa.eu]

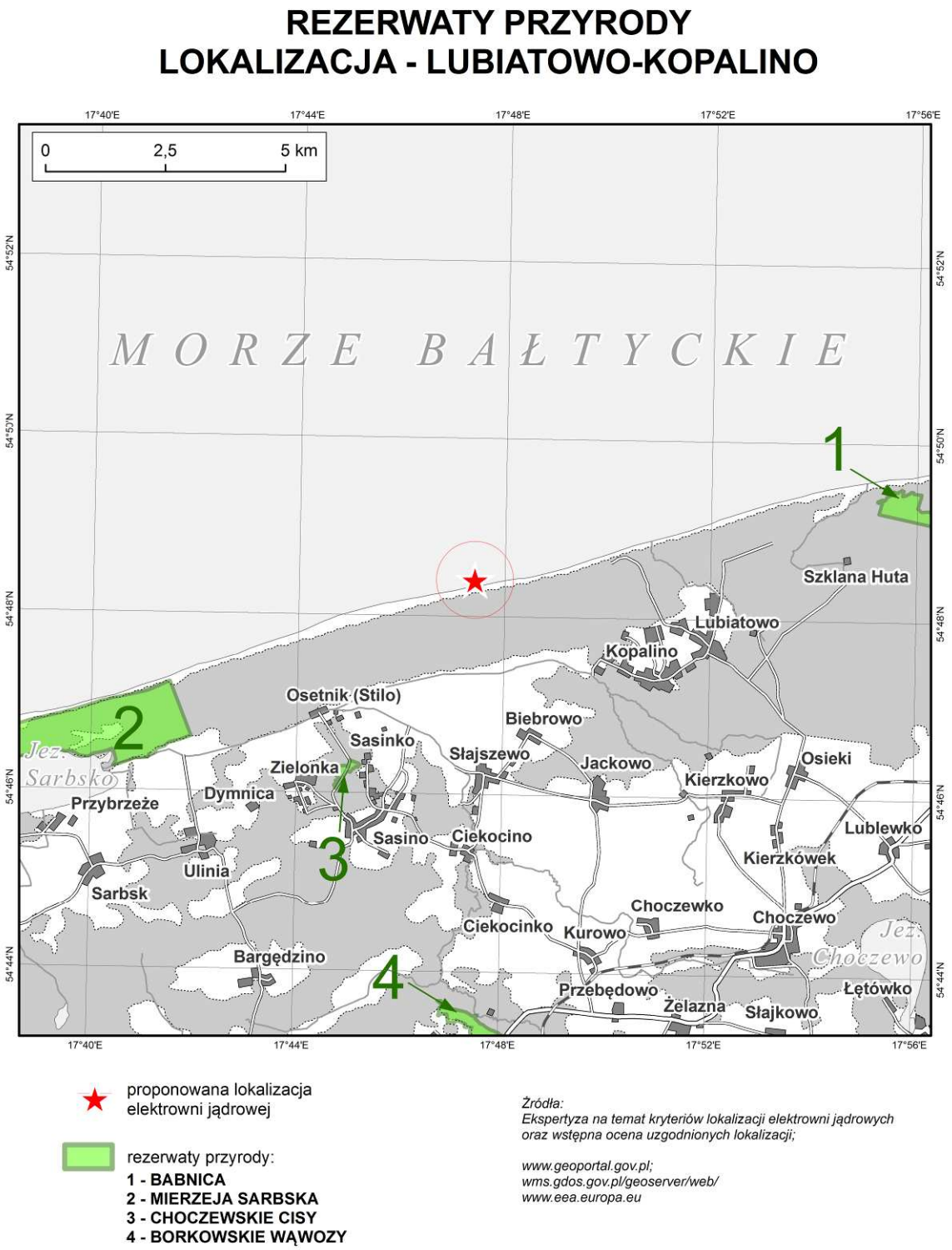

Fig. 6.3.25. Natural reserves in the vicinity of Lubiatowo-Kopalino site

[NATURAL RESERVES – LUBIATOWO-KOPALINO SITE
Proposed power plant site

Natural reserves:
Developed by: mgr Kacper Jancewicz
Sources:
"Expert opinion on criteria of nuclear power plant locations and preliminary assessment of established sites"
www.geoportal.gov.pl;
www.maps.google.com;
www.eea.europa.eu]

6.3.5 Summary and tabulation of major parameters for the recommended and reserve locations

Among the analyzed recommended and reserve locations, the safest in terms of animal biodiversity conservation and implementation of conservation objectives of Natura 2000 sites, is undoubtedly the location in Nowe Miasto. Located 30 km from the nearest refuges, it will have the smallest impact among the analyzed locations on Natura 2000 network (the potential impact of expansion of overhead transmission lines), it does not interfere with the network of ecological corridors, there is also nothing to suggest that there are particularly well attended bird migration routes and there are no data on the wealth of fauna of the area (no data at the current level of faunistic knowledge in Poland certainly demonstrates not outstanding natural values of this area, although they are not necessarily very small). This location looks particularly well against the other five location, four of which lie in the coastal zone, which is on most important Polish migration route of birds, additionally neighbouring the Natura 2000 bird refuges. Warta-Klempicz lies within SPA refuge and in the place of increased migration of birds, and also interferes with the ecological corridor.

It is worth mentioning that due to the fact that the assessment was based on the fragmentary, heterogeneous, literature data, not dedicated to individual locations, when assessing the locations attempts were made at maintaining care in drawing far-reaching conclusions. Hence, locations not far away from the Natura 2000 sites or those placed on the migratory path of birds, gained the status of risky, and they were not given a negative assessment (as was done for locations within Natura 2000 sites). In such situations, there are no clear, compelling premises to exclude a given location from analyzed ones, it can only be regarded as risky (i.e. high probability of significant impact on Natura 2000 sites and/or resources of flora and fauna).

Collective analysis of individual parameters for each of these locations is presented in Table 10.3.1. on the next page.

6.3.6 Other proposals and location variants

Considering the size of the location analysis, this entire section was moved to an Annex constituting an integral part of the Strategic Environmental Assessment Report for the Polish Nuclear Programme.