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Construction and Operation of the Off-shore Wind Farm Gennaker

Application according to §§ 16 BImSchG



Short description

According to § 4(3) of the 9th BImSchV with additional information on the environmental impact assessment according to § 4e of the 9th BImSchV

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Offshore Wind Farm Gennaker

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1 Introduction

Since 15 May 2019, OWF Gennaker GmbH holds a permission according to the German Federal Immission Control Act (BImSchG) to construct and operate the offshore wind farm (OWF) Gennaker within the designated priority area for wind power 'Darß'. It comprises 103 offshore wind turbines (OWT), 2 identical transformer platforms (USP) and the submarine cables within the wind farm.

As the initially planned type of offshore wind turbine generator (OWTG) was no longer available for the planned installation period, a change of turbine type became necessary, resulting in the necessity of an application for alteration approval according to § 16 BImSchG. The amendment licence was granted at the beginning of 2024.

Due to international political and economic events it was necessary to postpone commissioning until 2028 and subsequently to re-examine a switch to a turbine class available at the time of installation.

The postponement of commissioning also requires a new approval procedure.

The updated planning for the OWF Gennaker project includes the construction and operation of 63 WTGs in the 15-megawatt (MW) output class as well as the internal wind farm cabling. The construction and operation of the two already approved USP is not part of the current approval procedure.

In accordance with § 4 (3) of the regulation on the approval process (9th BImSchV), this short description gives an overview of the planned offshore wind farm, its operation and the expected effects on the public and the surrounding area. As the planned project requires an Environmental Impact Assessment (EIA), this short description also covers the documents required for the EIA. Abbreviations used will be explained at the end of this document.

The following table outlines the changes between the approved permission in 2019 and the applications for alteration approval:

| | Approved (2019) | Approved (2024) | Current application |
|---------------------------|--------------------|-------------------------------|--|
| OWTG type | SWT-8.0-154 | SG 167-DD | SG DD236++ |
| electrical power per OWTG | max. 8,4 MW | max. 9 MW | max. 15,5 MW |
| number of OWTG | 103 | No changes | 63 |
| hub height | max. 98 metres | 104,5 metres | max. 143 metres |
| rotor diameter | 154 metres | 167 metres | 236 metres |
| OWTG overall height | max. 175 metres | max. 190 metres | max. 261 metres |
| total capacity | 865,2 MW | max. 927 MW | max. 976,5 MW |
| foundation type | Monopiles | No changes | No changes |
| Offshore Substation (OSS) | Jacket/Topside | No changes | Already approved; not part of the permit application |
| position of OSS | OSS East, OSS West | Both relocated several metres | |

Efficient and Economical

The offshore wind turbine generators for the OWF Gennaker are multi-megawatt OWTG of the newest generation with monopiles (MP) and transition piece (TP) foundations. The OWTG will be produced by Siemens Gamesa Renewable Energy. The foundation structures will be designed by a renowned engineering company specifically for the project Gennaker and will be produced by an experienced company.

Important Contribution to Energy Transition and Climate Protection

The development of renewable energy essentially contributes to achieving the ambitious climate targets of the German government. In future, fossil fuels will increasingly be replaced by renewable energy in all consumption areas (electricity, heating, traffic). The resulting savings in greenhouse emissions are an important element to reach Germany's long-term goal to become largely greenhouse gas-neutral by 2050.

With an annual electricity generation of approx. 4 TWh of green electricity, the OWF Gennaker project supplies the energy requirements of approx. 1 million households. The OWF thus contributes to the accelerated achievement of the expansion targets of the federal government, the climate protection targets of the Federal Climate Protection Act (KSG) adopted on 24 June 2021 and the fulfilment of the energy policy concept of the state of Mecklenburg-Western Pomerania.

2 Site Description

The project area belongs to the western part of the Arkona Sea, a section of the Baltic Sea. The planned wind farm lies within the 12 nautical miles zone (territorial waters/coastal sea) of the Federal Republic of Germany off the shore of Mecklenburg-Western Pomerania.

It is located about 15 km north of settlement areas of the peninsula Fischland-Darß-Zingst (shortest distance to the Darß: about 10 km), about 24 km west of the island Hiddensee. The next prominent coastal sites are the lighthouse 'Darßer Ort', the viewpoint 'Hohe Düne' and the pier in Zingst.

The planned OWF Gennaker encloses the already existing wind farm EnBW Baltic 1 and parts of several cable routes. The project area lies within a *priority area for wind energy at sea* designated in June 2016 by the government of the federal state of Mecklenburg-Western Pomerania (spatial planning programme 'LEP MV' 2016).

A contract of use for the planned project area is concluded between the owner of the area (Federal State of Mecklenburg-Western Pomerania) represented by the Directorate for Waterways and Shipping ('Wasser- und Schifffahrtsverwaltung') represented by the Water and Shipping Authority ('Wasser- und Schifffahrtsamt Ostsee in Stralsund') and the OWF Gennaker GmbH.

3 Project Proposal

To generate renewable electricity from wind energy at sea, 63 OWTGs are to be erected on the site of the amended Gennaker offshore wind farm project. Wind turbines of the 15 MW class are to be installed in the Gennaker OWF, resulting in a total output of max. 976,5 MW.

As OWF Gennaker GmbH plans to use the project area after the operating time of 35 years, it requests an unlimited permission for the use of the area.

Cables connect the OWTG within the wind farm and to the two OSS in the project area. At the OSS, the electricity is transformed to 220 kV transmission voltage and brought ashore by the 50Hz Transmission GmbH (onshore transmission not being part of the project proposal).

4 Project Description

4.1 Offshore Wind Turbines

The layout of the OWF is the result of an optimised utilisation of space and wind farm energy efficiency, also considering the geological situation and turbulence conditions.

The rotor diameter of the OWTG amounts to 236 m and its hub height to 143 m above MSL. The maximum total height reaches 261 m (vertical position of rotor blades). The chosen OWTG type has optimal performance characteristics and good power grid compatibility. Its lifetime is optimised for sea conditions and is designed for an operating time for a minimum of 25 + x years.



Schematic diagram of an OWTG by Siemens Gamesa Renewable Energy

The foundation of the OWTG is designed as a pile foundation using monopiles (so-called deep foundation). With this foundation concept, a steel pipe is inserted vertically into the seabed. A transition piece is then placed on the part of the monopile protruding from the seabed using a ring flange or grout connection and firmly connected to the monopile.

From today's perspective, the pile foundation is suited for water depths of 45 to 50 m

and is nowadays the most well proven and economic foundation concept for OWTG.

The draft design of the foundation structure of the OWTG consisting of monopile and transition piece is determined based on the relevant design parameters such as building site, water depth, wind, sea ice, waves, currents, turbine loads and the natural frequencies of the OWTG. The draft design of the foundation varies depending on the site conditions and can lead to different implementations and dimensioning within the project. The foundation structure will be collision friendly.

FOUNDATION STRUCTURE

- 🌀 foundation type:
Monopiles with Transition Piece
- 🌀 length:
max. 75 m
- 🌀 cross section:
max. 9 m
- 🌀 mass:
max. 1.000 t without attachments
- 🌀 collision friendliness:
yes, evidence provided

A scour protection surrounds the OWTG foundations as a protective layer between seabed and foundation to prevent undermining the foundation by washing out sand.

The OWTG are equipped with day and nighttime identification, indicating them as shipping and aviation obstruction. OWTG at exposed locations on the edge of the project area feature sonar transponders to ensure safety of submarine traffic.

WIND TURBINE GENERATORS

- system type:
15 MW power class
- number of WT:
63
- rotor diameter:
236 m
- total height above MSL:
261 m
- hub height above MSL:
143 m
- length of tower:
128,3 m
- transition TP / tower:
14.7 m above MSL

4.2 Offshore Substations (OSS)

Two largely identical transformer platforms are planned for the Gennaker OWF on the eastern and western periphery of the project area to bundle and transform the electrical energy generated in the wind turbines and transmit it to the respective onshore grid node via three-phase submarine cable systems of the transmission system operator (TSO). 50Hz Transmission GmbH is responsible for providing the external grid connection at sea.

Construction and operation of the two USPs has already been authorised. They are therefore not part of the current permit application. The USPs are mentioned for information purposes only, as they form the interface between the OWF and the grid connection.

4.3 Internal Cable Routing and Grid Connection

The cable connections between the OWTG are realised by medium voltage cables (three phase alternating current), which operate with a nominal voltage of 66 kV. The current cable planning is based on the maximum output of OWTGs of the 15MW class. Up to 6 OWTGs can be connected per string. The length of the wind farm cabling amounts to about 117 km (max. 130 km).

At the sea-bound transformers of the OSS, 66 kV current is transformed to 220 kV current and prepared for transport ashore.

The transmission system operator 50Hz Transmission GmbH transports the electricity generated by the OWF Gennaker from the two OSS onshore via 220 kV subsea export power cables, and then further via buried high-voltage electrical cables to the designated entry points.

The electricity is transmitted via so-called HVAC cable systems with a transmission capacity of just over 300 MW per cable. The submarine cable systems run seaward from the USP in the project area, mostly within the reserved areas for transmission lines, to the coast of Dierhagen and onshore in the form of underground HVAC land cable systems to a new 380/220 kV substation to be built in the [Gnewitz area](#).

4.4 Construction Process

Before construction begins, the construction activity is announced, the construction area is secured and [closed to traffic](#) by means of buoys and a safety zone of 500 metres is set up around the [construction area](#). With the start of construction works, a traffic safety ship is installed.

The basic installation sequence at the respective OWTG location is the installation of the foundation structure, the insertion of

the submarine cables, followed by the installation of the tower, nacelle with hub and attachment of the rotor blades. The individual installations will be staggered.

Depending on weather and ground conditions, the installation of a OWTG foundation structure takes approx. 2-3 days.

A total installation time of approx. 4 months is assumed for the 63 foundation piles (monopiles). Depending on the weather conditions (especially wind), 1 to several days are estimated for the installation of a OWTG. The cables are laid at a speed of approx. 100 to 300 metres per hour. A precise construction schedule can only be drawn up in consultation with the suppliers and after the permit has been issued, considering all the conditions and ancillary provisions specified therein. A total construction period of approx. 16 months is currently planned for the erection of the OWTGs and the cable systems.

Developed and updated complex identification, protection and safety concepts minimize the risk of averages, accidents, and environmental disasters.

Construction works for the OWF Gennaker only start, when traffic regulation measures (in the form of a final maritime traffic regulation) have been issued for the relevant sea area to shift transit traffic from the project area to the north.

Accompanying measures

Pile driving generates noise immissions (hydro sound / underwater noise) that potentially harm marine mammals, particularly harbour porpoises.

The Federal Environment Agency has therefore proposed a noise protection value for limiting impulsive underwater noise during the construction of offshore wind farms, which is generally considered as a limit value for pile-driving work.

To make sure, that no marine mammals are to be found within areas in which the suggested noise levels are exceeded, a deterrence concept is prepared before the construction works start. Efficiency control for the installed scaring measures will accompany the construction works.

In addition, it is planned to install a system for minimising sound immissions before the start of pile driving (e. g. bubble curtain). To monitor and control the efficiency of the installed sound protection systems, simultaneously to the pile driving works hydro sound measurements will be carried out.

The specific measures to scare and protect marine mammals from sound immissions throughout the pile driving, and to reduce sound immissions to the suggested maximum level, will be presented in a noise mitigation concept, which will be submitted to and discussed with the relevant authorities prior to construction start.

5 Operation Description

5.1 Operation of the OWTG

Commissioning of the OWTG takes place after all OWF components have been erected and connected to the power grid.

The OWTG operate fully automatic. The rotor automatically starts to work from wind velocities of 3 m/s. With rising wind velocities, power output increases until the wind velocity reaches 14 m/s. At this point, power control sets in to assure that nominal power and electrical loads do not exceed. In advantageous environmental conditions, the 'power boost'-function can be switched on to increase power output up to 15,5 MW. If the mean wind velocity exceeds 28 m/s, the OWTG automatically shuts down to avoid operation beyond the permitted environmental conditions. An emergency shutdown of the rotor movement is possible from the control centre or the TP via remote control.

5.2 Control and Monitoring of the OWTG

The control system of the wind turbine consists of an industrial microprocessor system with switchgear and protective devices. The control system has a self-diagnosis function and a control panel with display, which can be used to read out the system status and make settings.

The OWF Gennaker is monitored 24 hours a day, 7 days a week from the central control room. The OWTGs are equipped with a SCADA system. This system offers the possibility of remote control as well as reading out various operating statuses and reports from a land-based operation centre. The status views provide information such as electrical and mechanical data, operating and error messages as well as meteorological and grid-specific data.

6 Environmental Protection

Construction and operation of the OWF Gennaker will cause sound emissions such as

- airborne sound (in construction and in operation) as well as
- underwater noise (in construction).

Some of them might require noise reduction measures.

6.1 Airborne Sound

The assessment of noise immissions for the asset *humans, in particular for human health* is carried out for the northernmost tip of the peninsula Fischland-Darß-Zingst for the construction phase (according to the general administrative regulation regarding construction noise 'AVV Baulärm') and for the operational phase (according to the technical instruction for noise 'TA Lärm').

For the protected good *avifauna*, it was assessed from which distances the prescribed threshold values were met.

In **construction**, noise immissions occur temporarily during pile foundation. According to current planning, the use of a special pile-driving method (e.g. PULSE method or similar) is planned, in which the impulse of the power transmission during the pile-driving process is distributed over a longer period and thus the average sound power level is also reduced (reduction by 3 - 4 dB).

The calculated rating levels of the most distant pile-driving works comply with the immission guide values at all immission locations (considering suitable noise protection measures). If the pile-driving work is carried out at the immission points at closer locations, exceedances of the night-time immission guide value of 35 dB (A) by up to 4 dB cannot be ruled out.

The **operation** of the Gennaker OWF generates noise emissions due to the movement of the rotor blades in the air and mechanical noise from the turbine. For the 63 OWTGs, noise assessment levels were calculated on the north coast of the Darß peninsula. Calculation was performed for the night period, which is critical in terms of noise immission control, including existing prior pollution (Baltic 1 and the two USP not subject to the application). The results show compliance with the immission guide values of the TA Lärm at all immission locations to be considered.

6.2 Underwater Noise

A specific underwater sound prognosis analysed the underwater sound emissions occurring from the **construction works** on the foundations. The level values relevant for assessment at 750 m for the foundation of the OWTGs were presented in relation to the input of different pile-driving energies and pile diameters.

The prognosis concluded that

- **noise immissions during the construction** of the pile-driving work for the Gennaker OWF result in high sound pressure levels,
- a comparison of the predicted individual event levels with the permissible noise protection values requires the use of noise protection measures,
- the use of noise reduction measures prevents the required noise protection value (BMU 2013) from being exceeded.

As part of an in-depth project- and site-specific review of the site-specific approaches, considering relevant influencing variables (local bathymetry, seasonal water characteristics), it was shown that the construction-related noise impact values for both the 'loudest case' and the 'realistic case' are below the significance threshold even for the closest FFH protected areas.

Specific **noise mitigation measures for pile driving** will be developed in a **noise mitigation concept** to comply with the given noise protection values. The concept will be handed to the approval authority in due time before construction starts. It will include measures assuring the compliance with the demanded protection values and safely prevent specially defined offences in terms of species protection. To be able to prove, control and monitor the effect of the applied reduction measures, under water sound measurements will be taken simultaneous to pile driving.

The expected underwater **noise emissions from the operation** of the Gennaker OWF were also presented in a forecast. For maximum possible sound propagation, all 63 wind turbines were considered simultaneously in operation at nominal power ('worst-case'). A comparison of the resulting sound pressure level with a published background sound pressure level at the Arkona Basin measuring station shows that

from 5 km from the wind farm, the sound emissions from the OWF Gennaker in the 'high' power range are masked by background noise (primarily shipping traffic). In the medium power range (50 % rated power), the operational noise emissions are masked at between 1 km and 5 km. For the 'low' power range (5 % rated power), no relevant underwater noise emissions are expected from the operation of the Gennaker OWF in the Baltic Sea.

7 Summary of the Environmental Impact Study

The environmental impact assessment (EIA) is carried out in accordance with the regulations of the German Environmental Impact Assessment Act (UVPG) in connection with the 9. BImSchV.

In an environmental impact assessment (EIA), all information on possible impacts of the project on humans, in particular on human health, on animals, plants, biodiversity, soil, water, air, the climate, the landscape and cultural assets is collected. Based on the EIA report, the authority responsible for approving the project carries out an environmental impact assessment (EIA) as part of the approval process according to BImSchG (German Immission Control Act).

7.1 Methodology of the Environmental Impact Assessment

In accordance with § 1 of the 9. BImSchV and with respect to licensing prerequisites and to aspects of environmental protection and landscape preservation, the EIA identifies, describes and evaluates the environmental effects of the OWF Gennaker on

- humans, in particular human health,
- animals, plants and biodiversity,
- land and soil, water, air, climate and landscape,

- cultural heritage and other material assets as well as
- interactions between the before mentioned protected assets.

Based on the concept of the **ecological risk assessment (ERA)**, the EIA covers all information essential for the evaluation of the environmental impacts of the project, determining its most significant effects.

The EIA starts with a **project description**, followed by the expected **project effects** caused during construction (and dismantling), by the facility itself and during operation, and its **environmental impacts**.

The presence of protected goods and environmental resources and the expected impacts of the project on them determine the spatial **area of investigation** for the EIA.

Furthermore, the study analyses the current environmental situation (inventory and **analysis of the status quo**) in the investigation area.

The ecological risk analysis then confronts the project effects with the analysed status quo, resulting in an **evaluation of environmental impacts**.

The evaluation focuses on the **eligibility for granting permit** based on legal evaluation standards, the state of the art and commonly accepted rules.

Subsequently, the **environmental evaluation with respect to the significance of the negative effects** is performed.

Hereby, the magnitude and the risk of interferences to the protected goods are a measure for the significance of the determined environmental effects. Additionally, to the above mentioned, evaluative standards discipline specific standards, which are oriented on scientific knowledge, and expert experiences are considered.

The **expert evaluation** of the environmental impacts of the planned project finalises

the environmental impact assessment. The effects are evaluated by criteria specific for each protected good and are classified in five categories ('Beurteilungsklassen' - BK).

The classification in the evaluative categories is not the primary objective of the environmental impact assessment, but a tool to simplify the presentation of the performed evaluation.

| Category (BK) | Definition |
|---------------|---|
| BK I | <u>positive</u> effects of the project on the environment |
| BK II | <u>no or only theoretically expected negative</u> effects on the environment (e.g. smaller than the measurement accuracy) |
| BK III | <u>no significant negative</u> effects on the environment |
| BK IV | <u>significant negative</u> effects on the environment |
| BK V | <u>significant negative</u> effects on the environment, which should <u>not be tolerated</u> (e.g. exceedance of limits) |

7.2 Project Effects

The following table presents the overall potential effects resulting from the project. Project effects, that the evaluation process of the EIA identified as relevant, are highlighted and further examined in detail.

During **construction**, environmental effects result from noise emissions and vibrations (caused by the installation of the monopiles), and from barrier effects (caused by construction traffic and general construction works in the project area). Beside these effects, scare impacts on animals and water turbidity due to resuspension of sediments must be considered.

Effects caused by **the facility itself** trace back to the cubage of the OWTG as well as

to light emissions (caused by visual identification devices for shipping and air traffic safety).

With the **beginning of operation**, the facility causes emissions of noise, vibrations and the casting of shadows.

To prevent **accidents and other hazardous incidents**, construction and operation of the OWF Gennaker complies with current environmental and other danger prevention regulations. Due to the extensive safety measures, significant environmental effects during operational malfunctions can reasonably be excluded.

| | | Relevant project effects of the OWF Gennaker (marked in blue) | | | | | | | | |
|------------------------------------|--|---|----------------------------------|------------------|------|-------|-----|---------|-----------|----------------------------------|
| protected resources or goods | | humans including human health | animals, plants and biodiversity | soil / sediments | land | water | air | climate | landscape | cultural / other material assets |
| type of effect | | | | | | | | | | |
| construction related | increase of traffic and number of ships | | | | | | | | | |
| | emission of air pollutants | | | | | | | | | |
| | noise emissions | | | | | | | | | |
| | temporary land consumption / space use | | | | | | | | | |
| | light emissions | | | | | | | | | |
| | vibrations | | | | | | | | | |
| | temporary closure / prohibition of use | | | | | | | | | |
| | disturbance of near surface sediments | | | | | | | | | |
| | turbidity of waters | | | | | | | | | |
| facility related | handling losses (loss of packing material, construction waste, etc.) | | | | | | | | | |
| | permanent land consumption / land use | | | | | | | | | |
| | cubage of the facility | | | | | | | | | |
| | light emissions | | | | | | | | | |
| | spatial use restrictions | | | | | | | | | |
| operation related | introduction of underwater structures | | | | | | | | | |
| | shadow casting | | | | | | | | | |
| | noise emission | | | | | | | | | |
| | vibrations | | | | | | | | | |
| | rotor movements | | | | | | | | | |
| | change of wind field | | | | | | | | | |
| | generation of electrical and magnetic fields | | | | | | | | | |
| | heat generation | | | | | | | | | |
| | traffic increase | | | | | | | | | |
| handling losses during maintenance | | | | | | | | | | |
| operational mal-functions | leakage | | | | | | | | | |
| | fire | | | | | | | | | |
| | collision (ships) | | | | | | | | | |
| | cable break / exposure of cables due to submarine currents | | | | | | | | | |

7.3 Effects on Humans, in particular on Human Health

The following project effects affect the protection of the asset *humans, in particular of human health*:

- Noise emissions,
- Spatial use restrictions.

Further effects on *humans, in particular on human health* (e.g. cubage of the technical facilities) occur in relation to the protected resource landscape (⇒chapter 7.9). Air emissions are considered under ⇒chapter 7.7 Air.

To record the effects of the project on *humans, in particular on human health* as a protected asset, an investigation area of 500 m around the project area is considered with regard to the ban on use and the restrictions on other types of use. The noise immissions are assessed for [selected immission points](#) on the Fischland-Darß-Zingst peninsula.

As the project area itself is not suitable for living or residential use, the protected asset *humans, in particular on human health*, is considered with regard to its economic function as well as its recreational and leisure functions.

Analysis of the Status Quo

Marine use and claims for use arise from various aspects. The following types of human uses are relevant in the area of the planned OWF Gennaker:

- fishing,
- (sand) mining activities and
- shipping (traffic).

Besides, two energy cable routes cross the project area from southwest to northeast.

According to the State Spatial Development Program (LEP MV), south of the planned

OWF, a priority area for commercial and recreational **fishing** is designated (outside of protected areas). Next to fishing zones, spawning and nursery areas are important resources to guarantee sustainable fishing. The project area of the OWF Gennaker is not situated in a main spawning area of herring and cod.

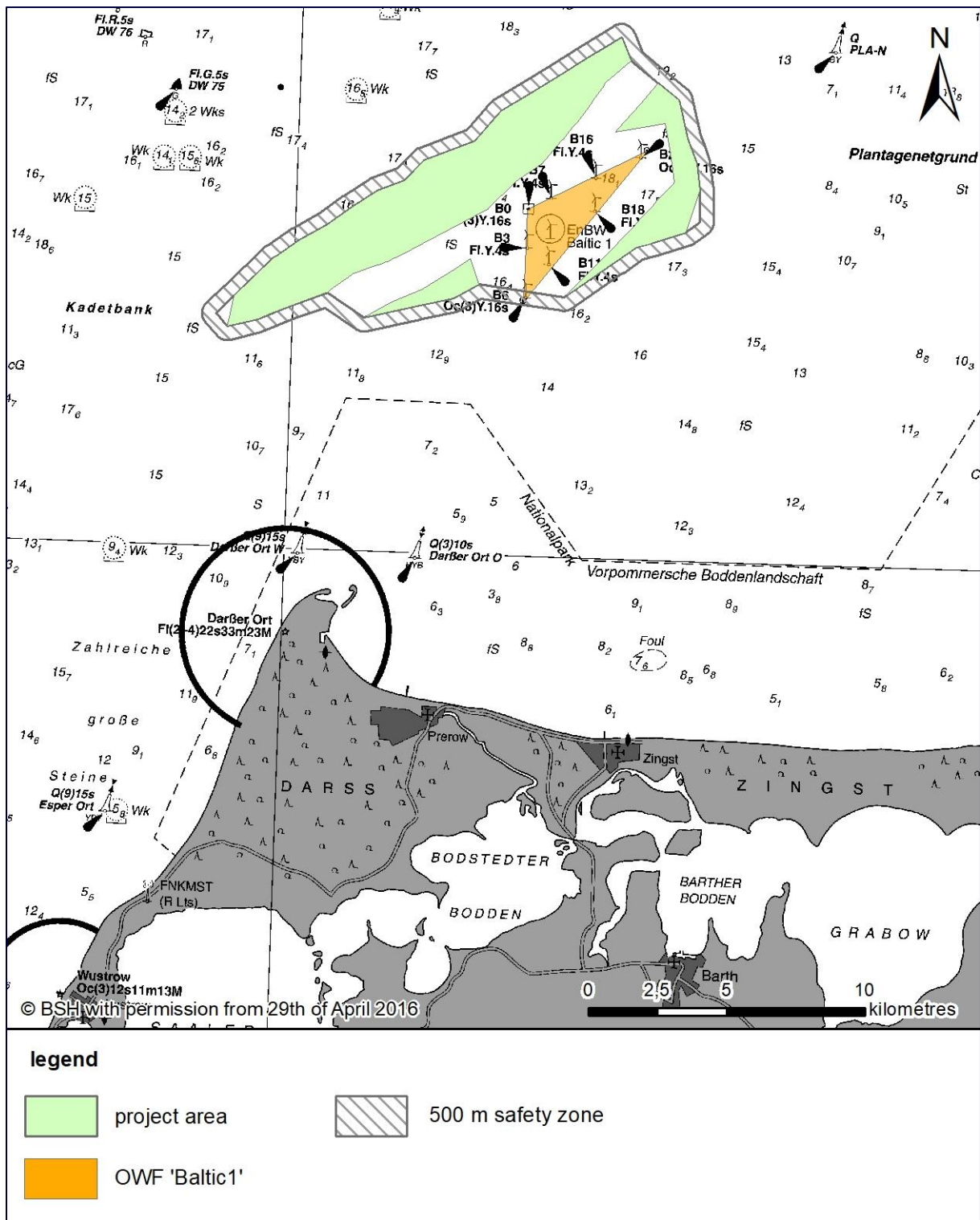
According to a statement of the **mining** authority Stralsund, within the project area or the designated marine area for wind energy no licences for underwater mining exist. East of the project area border designated areas for mining incorporating the closest mining rights 'Plantagenetgrund Nord' and 'Plantagenetgrund NW'.

Ships can generally access and cross the project area. [The DW 16.5 deep waterway runs to the north of the planned site, while the Kadet channel and the South of Gedser traffic separation scheme run to the west.](#) Within the 12 nautical mile zone, the waterway is marked as restricted area for **shipping**. [The restricted area for shipping is at least 500 metres away from the project area.](#)

The closest **residential area** is about 14 km south in the settlement Prerow on the peninsula Fischland-Darß-Zingst.

In the inner investigation area, neither **leisure facilities** nor tourist attractions are present. The closest point of interest, the viewpoint 'Darßer Ort' with a lighthouse and a visitor centre, is situated about 11 km south of the project area.

Within the designated priority area lies the operating Offshore Wind Farm (OWF) *Baltic I*, which will be enclosed by the OWF Gennaker [as well as the already authorised OSS of the Gennaker OWF \(no subject to the present application\).](#)



Area of investigation for the assessment humans, in particular human health

Sensitivity and Worthiness of Protection

The assessment of sensitivity and worthiness of protection shows that for most use claims a **low sensitivity** to project related

effects is determined within the investigation area. Only for living and housing, sensitivity to noise emissions ranges from **medium to high** (depending on the designation of the area).

Impact Analysis

The impact analysis of project effects on *human, in particular on human health* looks at impacts on economic uses as well as on recreational and leisure use.

Spatial use restrictions are most relevant for fishing (medium sensitivity to project related effects). A fishing ban is applied to the project area plus a safety zone of 500 m. In adjacent areas, fishing activity is still permitted. In return, the area of the OWF Gennaker could possibly provide shelter for fish species that suffer from economic pressure and might therefore also have positive effects on overall fishery uses.

The construction and operation of the OWF will not cause any relevant loss of function of the neighbouring or overlapping raw material deposits.

On safety and efficiency of maritime traffic, the OWF Gennaker as projected does not have negative effects, even if traffic increases by 25 %.

Due to its small effect intensity and the low to medium sensitivity of the protected asset *humans, in particular of human health*, **spatial use restrictions** can be rated as a **non-significant** project effect. The effect is therefore classified in the assessment category **(BK) II - III**.

Noise emissions and immissions due to construction and operation were evaluated in a sound survey.

The assessment levels for the relevant immission locations were determined accordingly in the study. The noise immission levels for the day and night periods are identical, which is why the assessment was carried out for the night period, which is decisive due to the lower immission guide values. The calculated assessment levels of the most distant pile-driving works comply with the immission guide values at all immission locations. If the pile-driving work is

carried out at the immission points at closer locations, exceedances of the night-time immission guide value of 35 dB (A) at IO 2 (Bernsteinweg) by up to 4 dB cannot be ruled out.

The effects of **construction-related noise immissions** are to be classified as non-significant, considering suitable noise protection measures (average duration of pile-driving work at night less than two hours, use of a noise-reducing pile-driving method).

For the **operation** of the Gennaker OWF, assessment levels were calculated for the northern coast of the Darß peninsula during the night period, which is critical in terms of noise immission control, considering existing noise pollution (Baltic 1 and the two USP). The immission guide values of TA Lärm are complied with at all immission locations under consideration, resulting in a low impact intensity.

In consequence, provided sound protection measures during the construction phase, **sound emissions** during construction and operation are rated as **non-significant** project effect, being classified in the assessment category **(BK) III**.

7.4 Animals, Plants and Biodiversity

The environmental resource *animals, plants and biodiversity* is affected in a way relevant for the investigation by the following factors:

- related to construction/dismantling:
 - increase of traffic and number of ships,
 - noise emissions,
 - land use,
 - vibrations,
 - temporary closure / prohibition of use,
 - disturbance of near surface sediments,
 - sedimentation, resuspension and turbidity of waters.

- related to the facility:
 - permanent land use,
 - cubage of the facility,
 - light emissions,
 - prohibition of use, limitation of other types of use,
 - introduction of underwater structures.

- related to operation:
 - noise emissions,
 - vibrations,
 - rotor movement
 - heat generation.

Analysis of the Status Quo

In the context of the analysis of the status quo, the Institute of Applied Ecology (IfAÖ) undertook an inventory for *biotopes* and the species groups *benthos* (including macrophytes), fish, marine mammals, bats and birds (migratory and sea birds) for the period 2012 to 2016. For the species group fish, updated catch data was analysed also for the period 2020-2021. *These studies were updated in 2023 to 2024 by a further annual cycle. They form the basis for the environmental impact assessment of the amended current project.*

The description of the biotope type setting gives information on the ecological value of *individual areas within the Gennaker OWF*. With its location in the coastal sea of Mecklenburg-Western Pomerania, the *OWF Gennaker* consists of the seabed, the water column and the sea surface in the respective section. The water depths range from 12.5 m up to 20 m MSL. In sum, the surface of the seabed is a homogenous area with minor changes in depth.

According to the statements in the report on *benthos*, the sediment in the project area is dominated by fine sand (grain size 0.063 to 0.20 mm). Less frequently medium sand (grain size 0.20 to 0.63 mm) and even more rarely silt (grain size < 0.063 mm) was described. The proportion of medium sand decreases and the proportion of silt increases from southwest to northeast.

This results in the following assignment (translated from the survey of IfAÖ): 'In the southwestern section the investigation area is assigned to *the biotope type* 'seabed with fine to medium sands of the outer coastal sea of the Baltic Sea east of the Darßer Schwelle (NOF)'. It can be described as flat seabed with fine to medium sands poor in silt (< 5 percentage) on ridges of moraines. The sandy bottoms are free of macrophytes and are populated by a less diverse biocoenosis of marine invertebrates, *that are adapted to fluctuating salinity levels*. This type of biotope is characterized by the species Baltic tellin (*Macoma balthica*), soft-shell clam (*Mya arenaria*), *Pygospio elegans* (marine worm of the family Spionidae) and bristleworm (*Scoloplos armiger*), which were frequently found in the investigation area.

In the northeastern section of the investigation area, silt ratios between 5 to 12 % were determined. These sections are classified as biotope type 'seabed with fine sands rich in silt of the outer coastal sea of the Baltic

Sea east of the Darßer Schwelle (NOS)'. The sediments are muddy sands (silt proportion 5 to 25 %). The sandy bottoms are at a water depth of about 10 to 20 m and are free of macrophytes. The macrozoobenthos is a less diverse biocoenosis as well. Here the typical species for this biotope type soft-shell clam (*Mya arenaria*), barrel-bubble snail (*Retusa truncatula*), *Pygospio elegans* (marine worm of the family Spionidae) and bristleworm (*Scoloplos armiger*) were found very frequently."

The benthos survey did not reveal any evidence of solid macrophyte stocks [or the presence of sandbanks](#) in the Gennaker OWF. [The biotope protection assessment revealed no legally protected biotopes and no habitat types protected by the Flora-Fauna-Habitat Directive within the area of the Gennaker OWF.](#)

For the macrozoobenthos, [87 species and 34 supraspecific taxa](#) (classification of a group of organisms above a species) were detected [in soil samples](#) (van Veen grab), [69 taxa](#) were detected using [a bottom trawl](#) (2 m beam trawl). The dominant species were the common mussel, various other mussels, the gill worm and the common starfish. Of the species recorded, [17](#) are listed in the Red Lists ([one](#) of them is considered endangered, [7](#) are on the early warning list).

The observed community of macrozoobenthos is seen as typical for this region of the Rügen-Falster-plate. It was classified *medium* regarding its diversity and uniqueness as well as its naturalness. The community is of regional importance.



Typical sieve residue from the project area on board (spring 2015; source: IfAÖ)

Within the survey of **fish**, [38 fish species](#) (29 species from 18 families) were detected over the entire study period (2012-2024). Regarding the ecological characterisation of the species detected, it was found that their abundance, total biomass, number of species and species diversity, the distribution of individuals across the various species and the abundance of the character species varied significantly from year to year during the study period. The community analysis also revealed a clear seasonal influence. The species cod, flounder, dab, sand goby, plaice, turbot and whiting were the most dominant species. None of the character species mentioned showed a change in utilisation requirements between the survey years.

The fish community found reflects the typical structure of pelagic (living in open water) and demersal (living close to the seabed) fish communities on sandy bottoms in the southern Baltic Sea. The 'diversity and uniqueness' of the fish community around the Gennaker OWF is assessed as high, as habitat-typical species communities and an established dominance structure prevail. In terms of 'rarity and endangerment', the fish community in the project area is categorised as medium to high due to the absence

of Red List species (no multiple records) and the otherwise typical characteristics. The 'naturalness' of the fish community is rated as medium due to the (temporary) fishing pressure. In the overall assessment, the fish population of the project area is rated as medium to high.

Three **marine mammal** species regularly occur in the German Baltic Sea: the harbour porpoise, the grey seal and the harbour seal. The studies on the group of marine mammals from 2012 to 2016 were supplemented by an update in 2023 to 2024. The counts were carried out using transect trips by ship, digital aerial surveys and acoustic monitoring (C-PODs).

The aerial transects recorded 146 marine mammals (113 harbour porpoises, one unidentified cetacean, seven harbour seals, six grey seals and 19 seals that could not be further identified). A total of 50 marine mammals were sighted during the ship surveys, including 38 harbour porpoises (including one pup), one undetermined dolphin species, three harbour seals, seven grey seals and one unspecified seal.

The areas around the two POD stations were used almost daily by harbour porpoises during the survey period (acoustic presence: 96.4 % and 88.2 % respectively).

The species group of marine mammals was classified as medium to high (harbour porpoise) or high (seals) regarding the criteria 'rarity and endangerment' due to the occurrence of two highly endangered species listed in Annex II of the Habitats Directive (harbour porpoise and grey seal) and another species listed in Annex II of the Habitats Directive (harbour seal). The diversity and individuality of the marine mammal community in the area of the Gennaker project site is classified as 'low' to 'medium', as the project site and its immediate surroundings function exclusively as a feeding habi-

tat for relatively few animals, and the species use large areas of the Baltic Sea due to their behaviour.



Adult harbour porpoise while surfacing (photo: Lutz von der Heyde).

The naturalness of the marine mammal communities is to be assessed as 'low' to 'medium', as the area around the project site, as in large parts of the Baltic Sea, is subject to pre-existing human activities, including increased noise pollution, which is very relevant for marine mammals and thus significantly influences the natural behaviour and length of stay of the animals in the project area. Based on these criteria, the overall stock assessment was given the rating 'medium'.

The **bat** investigations showed a low use of the project area by this group. The results indicate a main activity period for the project area from mid-August to mid-September. A concentration of migratory activity in so-called migratory corridors was not confirmed by the present study. The data indicate a rather uniform activity across the entire Baltic Sea region. The project area is of minor importance for bats as a migration area.

Surveys of the **seabird** population were carried out between September 2023 and August 2024. The seabirds were recorded by means of aircraft and ship-based counts. In total, an area of 905 km² was surveyed by ship and 2,409 km² by aeroplane.

A total of 259,083 birds (26 seabird species of 7 bird species groups) were recorded during transect counts from ships during the study period. Using digital aeroplane transects, a total of 113,044 birds (21 species of 19 bird species groups) were identified as resting birds.

The common scoter is a species that is particularly regularly encountered by boat within the study area. It is followed at a considerable distance by other sea duck species such as common eider, velvet scoter and long-tailed duck. Sea ducks accounted for over 95 % of all resting bird individuals recorded, followed by auks, gulls and grebes. Also, by aeroplane, the most common species recorded in the project area was the common scoter. It was followed at a considerable distance by other sea duck species (long-tailed duck, common eider, velvet scoter). Sea ducks accounted for over 95 % of all resting bird individuals recorded, followed by gulls, divers and auks.

The abundances of all species encountered were significantly higher in the area close to the coast (towards Darß/Zingst) or in the Plantagenetgrund and thus in the shallower stretches of water than in the project area itself. Here, however, the 2 km buffer to the south and west around the project area already represented an area of increased importance for seabirds, while the project area itself was of lesser importance for seabirds. Seven species listed in Annex I of the Birds Directive (VSRL) were identified in the study area. A further 15 species are categorised as particularly relevant for consideration. This means that the entire study area is assigned a high significance, rarity and endangerment rating for seabirds. The diversity and individuality of the seabird population identified can be categorised as high. However, the project area and the 2 km buffer are either of low to medium importance for specific species due to the densities and frequencies observed over

the course of the year. In view of the existing pressures, the overall significance of the project area for seabirds is low. Overall, the project area plus a 2 km buffer is of high importance for seabirds.

In the period from September 2023 to August 2024, further investigations (radar analyses, visual observations, night migration interrogations) were carried out on bird migration.

A total of 125 bird species were recorded during the study period, 93 of which were exclusively diurnal, 4 exclusively nocturnal and 28 species both diurnal and nocturnal.

The visual observations and radar measurements of seasonal migration intensity confirm the well-known phenomenon that bird migration is not continuous. The main migration events concentrate on a few days/nights with good migration conditions.

Among waterbirds with special protection or endangered status, the common tern and Arctic tern were detected in nationally significant numbers in the 2023/24 survey year (autumn 2024).

Overall, the Gennaker project area is of high importance for bird migration.

The **biological diversity** (ecosystem diversity) in the study area can be considered comparatively low due to its relatively homogeneous structure (compared to other marine areas or terrestrial areas of a similar size). Anthropogenic influences exist primarily in fishing and shipping. The extended study area includes areas used for mining purposes.

The diversity within the species (genetic diversity) is essentially determined by the presence of sufficiently large biotope structures in which they can occur and the connectivity of these structures. This is the case in the narrower study area. There are only minor impairments due to existing uses (submarine cable, OWF Baltic 1, etc.).

Fishing is more decisive, as this not only causes disturbance but also interferes with the abundance of the species community.

The biodiversity of the narrower study area is categorised as being of medium importance overall.

Sensitivity and Worthiness of Protection

Biotope types are a typecasting abstraction of existing biotopes and are adapted to abiotic and biotic characteristics as well as to anthropogenic uses. The basis for the typecasting is usually comparable conditions, which differentiate one type from another.

There is a close reciprocal relationship between the biotope types and the inventory of species regarding the estimation of the significance of the biotope types. Therefore, the importance of the biotope type relates to a faunistic importance. In the marine area, this close reciprocal relationship should be understood mainly in a larger scale, as the exchange between non sessile species takes place on a large scale and also species, which are bound to small habitats like the macrozoobenthos, have long-ranging options for dispersal due to their reproductive strategies. Usually, there is a close connection between the importance and the sensitivity of a biotope type. Due to the close interactions, this is also valid for species. The higher the importance is assessed, the greater the susceptibility to stress or to a devaluation. The categories of value of the sensitivity are therefore identical with the ones for the assessment of the importance.

In the mapping, two classified types of biotopes were identified in the narrower study area (mostly 'seabed with fine to medium sands of the outer coastal sea of the Baltic Sea east of the Darßer Schwelle (NOF)' and partly also 'seabed with fine sands rich in silt of the outer coastal sea of the Baltic Sea east of the Darßer Schwelle (NOS)'),

both not being specially in worthy of protection. They do not represent protected biotopes according to § 30 BNatSchG or SAC habitat types and are common in the region of the southwestern Baltic Sea. The **worthiness of protection** as well as the **importance and sensitivity of the biotopes** in the project area is therefore classified as **medium**.

The **macrozoobenthos** is classified in its **importance and sensitivity** as **high** due to the high number of endangered species in connection with its regional significance, the small occurrence of Neobiota (non-indigenous species) and an existing preload due to trawl fishing.

Representatives of the **macrophytobenthos** (plants that are visible with the human eye and live at the bottom of the water column) in the project area are only rarely encountered as drifting algae. Thus, a classification is not necessary.

The species groups of **fish and cyclostomata** are classified as **high** with respect to their **importance and sensitivity**, because the community of species in the project area, which is affected by fishing, is mostly typical and common in the central and whole Baltic Sea. Over the years, at least individual findings of Red List species (categories 1, 3) have been recorded. There is also a clear influence of fishing in the area (e.g. traces of trawling, shifts in age compositions and relative abundances).

The **importance and sensitivity** of the species group **marine mammals** is classified as **low** as only a small number of sightings was reported in the surveys and as a result a low density of the three examined species must be assumed. For all three species, the inner investigation area is not an area of reproduction and does not provide any habitat function apart from its function as feeding habitat.

The **importance and sensitivity** of the species group **bats** is classified as **medium**, as only a small number of contacts took place. However, at least five different species were registered. Based on current knowledge, it is unlikely that the location of Gennaker OWF is in a more heavily frequented area of bat migration.

Seabirds are classified **high** regarding their **importance and sensitivity**. The community of species and the total number of species in the project area is rated as typical. The presence of some species indicates that the lake area is of regional or supra-regional importance. In addition, occurrences of several species protected under the Birds Directive have been identified and many species are in decline.

The species group **migratory birds** is classified as **high** with respect to their **importance and sensitivity**. The community of species in the project area can be considered as typical and the population size can be considered as medium while the area is highly significant for individual groups of species (e.g. waterfowl). A larger number of endangered species was mapped. It was also found to be of regional and supra-regional importance for migratory birds in conjunction with the rest of the lake area.

Impact Analysis

The **traffic noise during construction** due to increased shipping traffic is subordinate to the noise from the pile-driving work and is estimated to have a **low impact intensity** on the relevant species.

Noise emissions during the operating period are estimated to have a **low impact intensity** (due to existing pre-existing pollution, familiarisation effects, lack of sensitivity of potentially relevant species).

Due to the low impact intensity, traffic-related noise emissions during construction

and operational noise emissions will not have a significant impact on species in the vicinity of the Gennaker OWF. **Project-related significant impacts are therefore not to be expected (BK III).**

The **pile-driving work** for the Gennaker offshore wind farm **during construction** will result in high sound pressure levels. This potentially results in a **high impact intensity** for relevant species (marine mammals, fish). By applying suitable noise reduction measures, the noise protection values required by the BMU will be complied with. **There will therefore be no significant project-related impacts (BK III).** The mitigation measures will be presented in a noise protection concept to be developed separately.

Changes of the flow regime caused by the planned facility do **not** lead to **significant impacts** regarding the protected resource animals, plants and biodiversity (**BK III**). The corresponding project effect has only a low intensity, due to its small spatial extent and its overlap with the insertion of hard substrate.

Equally, the **shading of sight** leads to **no significant effects** on the protected resource animals, plants and biodiversity (**BK III**), due to its low effect intensity.

Due to their small effect intensity, the following project effects also **have no significant impacts** on the protected good animals, plants and biodiversity (**BK III**): **visual disturbance of nautical traffic, optical stimuli of the facilities and the rotor movement**, and their resulting barrier or fragmentation effects.

The loss of biotopes and habitats due to the construction and the facility itself affects 138,7 ha of a medium (biotopes) to high (macrozoobenthos) sensitivity, of which 10,58 ha will be used permanently by the facility. In the two biotope types 'seabed with fine to medium sands of the outer coastal

sea of the Baltic Sea east of the Darßer Schwelle (NOF)' and 'seabed with fine sands rich in silt of the outer coastal sea of the Baltic Sea east of the Darßer Schwelle (NOS)', macrozoobenthos will be affected. Still, special habitat functions like places for reproduction or recovery will not be used.

The **construction related use of habitats on a total area of 138,7 ha** shows a medium effect intensity, due to its short time span and medium extent in space. It is therefore to be classified as a **significant impact resulting from the project (BK IV)**.

The **permanent use of habitats** for animals, plants and the biodiversity and the **permanent loss of areas on a total area of 10,58 ha** are classified as **significant impacts resulting from the project (BK IV)**, due to the above-mentioned **medium** sensitivities and the very high effect intensities.

As **disturbances from the vibrations** are expected to be minor, this project effect causes **no significant impacts** during the construction or the operation phase on the protected resource animals, plants and biodiversity (**BK III**).

The **disturbance of near surface sediments** and the **turbidity of waters** only have minor effect intensities. The protected resource animals, plants and biodiversity shows low to medium sensitivity. Thus, **no significant impacts** result from these project effects (**BK III**).

Spatial use restrictions from the start of construction to the dismantling phase will reduce anthropogenic destruction and disturbances. This project effect will thus upgrade the habitat. Correspondingly, **impacts** on the protected resource animals, plants and the biodiversity will be **positive (BK I)**.

The low effect intensity of the facility's light emissions causes **no significant impacts** on the protected resource animals, plants and biodiversity (**BK III**).

The **heat** that is generated during operation might have different impacts on different species and groups of species. The chosen height of the inner park cable covering will guarantee a maximum temperature increase in the sediment of 2 K in 20 cm depth. With this measure, the project intensity will remain low, and **no relevant impacts** on the benthic flora and fauna as part of the protected resource animals, plants and biodiversity are expected (**BK III**).

The **risk of collision with the facility** itself is classified with **no significant impacts** on the protected resource animals, plants and biodiversity (**BK III**). Even though certain animal species have a higher sensitivity to collisions, these collisions are expected to be rare and therefore the overall effect intensity of the risk of collision remains low.

During the operational phase, the movement of the rotor blades will probably elevate the risk of collisions for flying species. Evaluated comparative values and study results indicate, that the rate of collision for bats as well as for migratory and seabirds will be low. Due to this low project effect intensity **no significant impacts** on the protected resource animals, plants and biodiversity result from the rotor movement and the potentially elevated risk of collision (**BK III**).

The **insertion of hard substrate** for the foundations and the scouring protection as well as **in the crossing corridors**, probably leads to an enhancement of the habitat structures and as a result to an adaptation and addition of the benthos communities in the project area. Hereby, more changes to the fauna and flora are possible. This effect will be reversed during the dismantling of the OWF. The intensity of the changes is in total estimated as low, as there will be a change of the fauna, but it will only occur locally and primarily in addition to the already existing fauna of the sandy bottoms.

Due to the low effect intensity, **no significant impacts** on the protected resource animals, plants and biodiversity result from the insertion of hard substrates in the project area (**BK II**).

Thus, from a nature conservation and environmental point of view, due to its **land consumption caused by construction and installation**, the project will have a **significant project-related impact on animals, plants and biodiversity**. It totals **149.28 ha**, in consideration of the planned or deemed necessary avoidance and mitigation measures.

Review of the Protection of Species

The regulations on species protection in § 44 of the Federal Nature Conservation Act (BNatSchG) are considered in the species protection report. The report comes to the following conclusions:

In the area of investigation are no strictly **protected plants** of the appendix IV of the Habitats Directive. As this group of species is not relevant for the investigation, **no further consideration** is required.

Of the three species of **marine mammals** identified during the data collection, the **harbour porpoise** is classified as a **strictly protected species** and must therefore be considered in the species conservation report. There is a danger of a significantly elevated risk of injuries, fatalities and disturbance in the construction phase of the project. Therefore, **action will be taken** to prevent and reduce significant effects (fatalities, injuries, disturbances) for the harbour porpoise. These include the deterrence of harbour porpoises present in the construction area or the immediate impact area of the pile-driving noise, the use of noise-reducing measures during the pile-driving work, the slower increase in pile-driving performance ('soft-start procedure') and compliance with the noise protection values of 160 dB SEL

and 190 dB SPL at a distance of 750 m determined by the Federal Environment Agency (UBA). Further, an efficiency check is carried out. Significant impacts caused by electromagnetic fields due to the inner park cabling are effectively eliminated by the compliance with the 2-K-criterion. Further project effects with a negative impact on harbour porpoises with respect to the prevention of species are not expected. By complying with the above-mentioned specifications, there is no conflict with the prohibitions of § 44 (1) BNatSchG.

The only species relevant for the investigation of **fish** in the context of the report of the protection of species is the Atlantic sturgeon (*Acipenser oxyrinchus*). No evidence for this species was found during the mapping, but a potential use of the project area or its surroundings cannot be excluded. No specific measures for this species are required. The reduction of underwater noise and the application of the 2-K-criterion is also beneficial for the species group fish.

Breeding birds were not examined as no breeding takes place in offshore areas and no evidence was found for the use of the project area as feeding habitat during the breeding season. Potentially affected species are examined as resting birds. The examination includes sea birds, that permanently use the area of the OWF as well as resting birds that use the OWF as stopover on their migration. The results are completely transferable to breeding birds of adjacent nesting colonies that potentially use the OWF in search for food.

The report on the protection of species analysed whether the project could cause conflicts with the prohibitions of § 44 (1) BNatSchG for **nesting and migratory bird species**, and whether potential conflicts could be eliminated by specific reduction measures. **For most species, only a small proportion of the individuals recorded in the entire survey area were detected, and**

some were not detected at all in the project area or the 2 km buffer zone. Furthermore, a clear preference of most species for the shallow water areas of the bird sanctuaries 'Plantagenetgrund' and 'Vorpommersche Boddenlandschaft und nördlicher Strelasund' or away from the project area can be recognised. Many of the registered species show a pronounced avoidance behaviour with the result that a contact with the OWF or with related ship traffic will happen only in rare cases. For species avoiding the project area, a possible loss of habitat occurs. Other species however can fly low or very high outside the area of the rotor or they have a high manoeuvrability and are able to evade collisions so that they can still use the area of the OWF.

Among the migratory birds, there are groups that are under potentially unfavourable weather conditions (bad visibility) individually more endangered, such as migratory songbirds at night, even though starlight is sufficient for most species to recognize obstacles. Birds migrating during daytime are generally less endangered as they can detect the OWTG from far and can evade it or fly higher. The potential energy loss caused by flying around the OWF was assessed as irrelevant as migratory birds are generally prepared for such events or more strenuous phases of the migration. An additional flight distance of a few kilometres does not represent an exceptional situation. The risk of collision increases in bad weather conditions, although apart from random events where the migration starts in good weather and bad weather sets in during the migration, there is hardly any bird migration.

Based on available studies and data, a theoretical collision risk (expected proportion of colliding individuals in the total number of bird migration around the OWF Gennaker) was calculated in the species conservation report. A distinction was made between day

and night migration as well as spring and autumn migration. A collision risk of 0.05-0.11 % was calculated for nocturnal migrants during autumn migration and 0.03-0.06 % during spring migration. The collision risk for each individual season is therefore in the lower range of the daily mortality calculated for many nocturnal migratory bird species in the Baltic Sea region. Reaching a proportion of 1 %, which could potentially be regarded as a 'significant increase', is not to be expected even if one assumes uncertainties in the input parameters.

The collision risk calculated for diurnal migrants totals 0.14 % for both relevant migration periods (spring, autumn). The values are thus within the range calculated for the collision risk of night migrants and well below the value of 1 % assumed as the threshold for a significant increase.

On an individual basis, losses due to bird collision cannot be totally excluded. According to a judgement of the German Federal Administrative Court (BVerwG), the individual risk of collision is considered lower than the general risk of life. Systematic losses of individuals by killing or injuring due to collisions during construction (with the construction machinery, e.g. cable laying ships), operation or the facilities of the OWTG are not predicted.

Disturbances due to increased shipping compared to the status quo are mostly relevant for the construction phase and are thus temporary and spatially constrained.

Reproduction and resting areas are not affected by the project. According to a corresponding judgement of the German BVerwG, larger marine areas do not count as resting areas. The application of a need-based lighting control system at night (BNK) will minimise possible attracting effects of the OWTG on migrating birds considerably. Significant disturbances of individual species can be excluded as no bird

species will be affected with respect to a decrease of its biogeographic population by one or more percent. Therefore, no deterioration of the conservation status of local populations occurs.

There is no conflict with the prohibitions of § 44 (1) BNatSchG for the species group **birds**.

Evidence for singular species of **bats** was found in the area and more species were considered due to their potential use of the investigation area as feeding habitat or for migration. For all examined species equally applies, that no areas of concentration are known in the investigated marine space, and it is not yet known that this region is used for migration. Thus, the importance of the project area is considered low. [The StUK4-compliant baseline study did not reveal any increased activity and therefore no increased collision risk for the bat species group at the investigated site.](#) Additionally, the overall danger of collision is low as the periods of flight times with low wind velocities or still air, which are usually used by bats do overlap only little with the operational phases of the OWTG with higher wind velocities. Furthermore, disturbances are classified as not significant due to the low frequenting.

There is no conflict for the species group of **bats** with the prohibitions of § 44 (1) BNatSchG.

Conclusion of the Report on Species Protection

After analysing the effects of the project on strictly protected species and species listed in Annex IV of the Habitats Directive and the EU Bird Directive respectively, **a permanent threat to local populations can be ruled out**, considering the current state of knowledge and the avoidance and mitigation measures

Thus, the conservation status of the populations (the biogeographical populations with respect to birds) does not deteriorate in their natural distribution area.

There is **no conflict with the prohibitions on access of the § 44 (1) BNatSchG** considering the above-mentioned **measures of prevention**. Thus, there is no requirement for an exception according to § 45 (7) BNatSchG for the examined species.

Natura 2000 Sites

The sites in the Natura 2000 network are designated under the Birds and the Habitats Directives.

When a project is likely to have a significant negative effect on a Natura 2000 site, it has to follow specific approval procedures that are laid down in Articles 6(3) and 6(4) of the Habitats Directive, as well as in § 34 BNatSchG and § 21 of the nature conservation implementing law of Mecklenburg-Western Pomerania ('Naturschutz-Ausführungsgesetz M-V'). If significant effects of a project (by itself or in connection with other projects or plans) are likely, or there is any doubt as to whether there are any effects, an 'appropriate assessment' must be undertaken. In accordance with § 34(2) BNatSchG, a project is inadmissible, if it significantly impairs the conservation objectives of a Natura 2000 site.

There are several Natura 2000 sites designated in the investigation area. Regarding the compatibility of the project with the conservation objectives of the Natura 2000 sites, appropriate assessments on the compatibility with the Habitats Directive are available. In these studies, experts determined possible effects on the conservation objectives of the Natura 2000 sites, which are related to construction and operation of the OWF. In the preliminary study on compatibility with the Habitats Directive (German: FFH-VVU), the area of investigation is

set to a radius of 30 km around the project site. This is justified by the expert 'IfAÖ' with the maximum extent of hydro sound caused by the pile driving of the monopiles, which is the most far-reaching effective factor.

Possible adverse effects cannot be ruled out from the outset for the conservation objectives of marine mammals (construction-related noise immissions), fish and cyclostomes (construction-related noise immissions) and resting and migratory birds (installation- and operation-related barrier effect and habitat loss, risk of collision).

With respect to SPAs (Special Protection Areas for particularly threatened bird species and for all migratory birds) in other littoral states, the study on the compatibility with the Habitats Directive concludes, that a partly existing barrier effect of the OWF Gennaker does not cut off exchange of migratory bird population between the SPAs of neighboring littoral countries and German SPAs. Impairment of neighboring SPAs is thus to be excluded.

Precise considerations were undertaken for the following Natura 2000 sites:

- SAC 'Darßer Schwelle' (DE 1540-302)
- SAC 'Plantagenetgrund' (DE 1343-301)
- SCI 'Kadetrinne' (DE 1339-301)
- SAC 'Darß' (DE 1541-301)
- SAC 'Westrügensche Boddenlandschaft mit Hiddensee' (DE 1544-302)
- SAC 'Erweiterung Libben, Steilküste und Blockgründe Wittow und Arkona' (DE 1345-301)
- SAC 'Recknitz-Ästuar und Halbinsel Zingst' (DE 1542-302)
- SPA 'Plantagenetgrund' (DE 1343-401)
- SPA 'Vorpommersche Boddenlandschaft und nördlicher Strelasund' (DE 1542-401)
- SPA 'Binnenbodden von Rügen' (DE 1446-401)

For the following Natura 2000 areas, a disturbance due to the sound emissions during construction works could not be ruled out. Thus, individual compatibility studies were carried out:

- SAC 'Darßer Schwelle' (DE 1540-302)
- SAC 'Plantagenetgrund' (DE 1343-301)
- SCI 'Kadetrinne' (DE 1339-301)
- SAC 'Darß' (DE 1541-301)
- SAC 'Erweiterung Libben, Steilküste und Blockgründe Wittow und Arkona' (DE 1345-301)
- SAC 'Recknitz-Ästuar und Halbinsel Zingst' (DE 1542-302)

Due to the proximity to the OWTG, for some sites a barrier effect, i.e. changes of the migration path or dangers of collisions, could not be ruled out. Therefore, an individual compatibility study was carried out for the following SPA:

- SPA 'Plantagenetgrund' (DE 1343-401)
- SPA 'Vorpommersche Boddenlandschaft und nördlicher Strelasund' (DE 1542-401)

For the SAC 'Westrügensche Boddenlandschaft mit Hiddensee' (DE 1544-302), compatibility with the Habitats Directive is given as the site covers the marine areas east of Hiddensee and is therefore shielded from the noise emissions of the project.

For the SPA site 'Binnenbodden von Rügen' (DE 1446-401), compatibility with the Habitats Directive is given as the distance of 28 km to the project area is sufficiently long enough and with its eastern location it is not in the main direction of bird migration.

For the SCI/SAC sites examined in detail, disturbances of habitat types could be excluded.

The SACs 'Darßer Schwelle' (DE 1540-302) and 'Plantagenetgrund' (DE 1343-301) as well as the SCI 'Kadetrinne' (DE 1339-301) are affected by the impact of pile-driving noise. It is assumed for the sites that the noise event level of 160 dB re 1 µPa and the peak sound pressure level of 190 dB re 1 µPa specified by the BfN will be complied with at 750 m through noise mitigation measures. In addition, marine mammals will be deterred from the immediate vicinity of the areas with higher sound pressure levels.

Due to the distance between the protected areas and the Gennaker wind farm, there is no overlap of the officially defined 8 km disturbance radius (see BMU) with the Gennaker wind farm with regard to the conservation objective harbour porpoise for the SACs 'Erweiterung Libben, Steilküste und Blockgründe Wittow und Arkona' (DE 1345-301), 'Darß' (DE 1541-301) and 'Recknitz-Ästuar und Halbinsel Zingst' (DE 1542-302). Subject to noise mitigation measures, the project is not expected to have any significant adverse effects on habitat types or species of the Habitats Directive, either individually or in combination with other projects.

As part of an in-depth project and site-specific examination of the topic of area protection to assess the disruptive effect of impulse pile driving in the surrounding FFH areas, the sound propagation under water was determined in a sound engineering expert report (itap GmbH) based on the actual on-site conditions. The project-specific ranges of sound propagation determined in a complex model were accordingly incorporated into the methodology specified by the authorities for determining sound-impacting

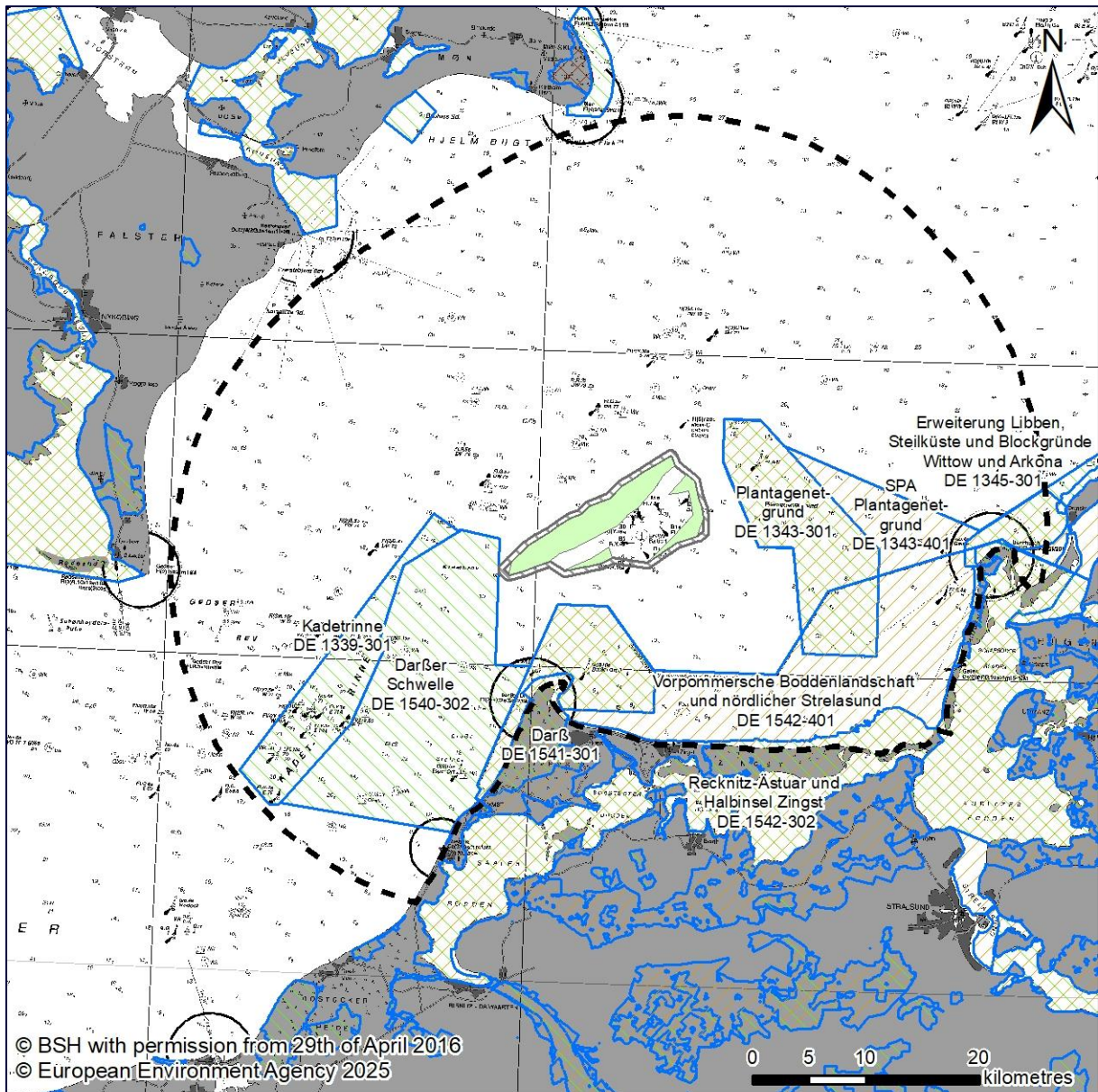
areas in protected areas. Starting from the boundaries of the protected areas, the ranges determined for specific locations were subtracted in a first step to determine the respective intersections with the project area and in a second step from the respective centres of the determined intersections. Subsequently, it was checked whether and to what extent a noise input into the surrounding protected areas was recorded.

The scientific analysis carried out on the basis of comprehensive data showed that for the SAC 'Plantagenetgrund' (DE 1343-301) an overlap of 4.23 % ('loudest case to be assumed') or 0.71 % ('realistic case'), for the SAC 'Darßer Schwelle' (DE 1540-302) an overlap of 0.72 % ('loudest case to be assumed') or 0.03 % ('realistic case') and for the SCI 'Kadetrinne' (DE 1339-301) no overlap.

For the SPAs 'Vorpommersche Boddenlandschaft und nördlicher Strelasund' (DE 1542-401) and 'Plantagenetgrund' (DE 1343-401), it was determined that no adverse effects are to be expected because of the project. Both sites are located more than 2 km away from the project area, so no habitat losses within the SPAs can be assumed, no exchange relationships between the SPAs are impeded and the overall risk of collision can be assessed as not significant. Significant adverse effects can be ruled out, also in combination with other projects.

As a result, for none of the above-mentioned sites of the Natura 2000 network summation effects of the project with other projects are to be considered.

The project is therefore compatible with the Habitats Directive.



legend

inner area of investigation



project area



500 m safety zone



outer area of investigation
(project area plus 30 km)

NATURA 2000 areas



SPA (Special Protection Area)



SAC (Special Area of Conservation)

SCI (Site of Community Importance)

Natura 2000 sites in the investigation area

7.5 Land and Soil / Sediments

The following project effects affect the protected resources *land and soil / sediments*:

- Temporary and permanent land use (due to construction works and the wind farm as industrial plant),
- Disturbance of surface sediments (during construction works),
- Cubage of the facility (OWF) and
- Insertion of substances and building structures (of the wind farm as industrial plant).

Analysis of the Status Quo

In terms of geology, relief forms of the seabed and the bedding conditions of the Quaternary sediments in the project area are significantly influenced by late glacial advances and the subsequent melting of the ice. The oscillation between transgression and regression in the Holocene (geological epoch of the last 12,000 years) during the developmental phases of the Baltic Sea was crucial for the formation of the morphological structures and the sediment facies.

The project area is situated in the region of the 'Falster-Rügen sand plate' on the eastern border and on the 'Darßer Schwelle'. The bathymetric surveys show that the area is mostly flat and without distinct structures with increasing water depth from southwest to northeast in the range from 12.5 m to 20.0 m. The total project area is covered by fine sand (grain size: 0.1 to 0.2 mm), which contains a higher proportion of the side fraction 'very fine sand' (0.05 to 0.1) mm with increasing water depth from south to north.

The transport processes of sandy abrasive material in the marine space is influenced by the prevailing wind direction in the project area, by the significant narrowing of the volume and partly the cross section around

the 'Darßer Schwelle' and by the distinct direction change of the shoreline around the 'Darßer Ort'.

The above mentioned mainly (north-)east oriented transport processes are especially visible in the surrounding of 'Darßer Ort' and 'Prerowbank', an area of shallow waters with water depths of up to 10 m. Ripple marks west of the 'Prerowbank' up to water depths of > 6 m and the rapidly progressing formation of hooks are an indicator for the profound transport of sediments.

The project area of the OWF Gennaker is situated in an area with great sediment dynamics. The sediment is transported towards east-northeast. Due to the water depths and the stability of the bedding of the well and very well sorted fine sands high rates of redistribution are not to be expected. This statement is supported by the Side-Scan-Sonar images of the surface of the seabed. There was evidence found for current ripples at the seabed, but they were only of a small local extent. The ripple crests were low, so that a relatively low current velocity can be assumed.

The areas influenced by construction and physical windfarm facilities are unaffected and not sealed. The OWF Gennaker project is located in a designated priority area for wind energy in accordance with the State Spatial Development Program (LEP 2016).

Sensitivity and Worthiness of Protection

The results of the biotope mapping were considered regarding habitat functions. Two biotope types were found in the investigation area (mostly 'seabed with fine to medium sands of the outer coastal sea of the Baltic Sea east of the Darßer Schwelle (NOF)' and partly also 'seabed with fine sands rich in silt of the outer coastal sea of the Baltic Sea east of the Darßer Schwelle (NOS)'). [The occurrence of legally protected biotopes according to § 30 BNatSchG and FFH habitat types in the](#)

project area of the Gennaker OWF was ruled out.

The sensitivity of a soil towards contaminant influx is basically a result of its binding capacity for contaminants. This binding capacity characterises the level of accumulation in the soil. It is essentially dependent on the amount of clay, humus, oxides and carbonates in the soil. One can assume a low binding capacity in the project area due to the soil cover of predominantly fine sands. Therefore the danger of spreading of the contaminants through the soil (sediments) is low due to its resuspension. Also the already existing burden of the soil by substances is low corresponding to its low capacity.

The land use resulting from the facility of the OWF leads to a permanent loss of functional capability of the soil and sediments and to a permanent loss of land. Thus, land and all soils are to be classified as very high with respect to their sensitivity to buildings and soil sealing .

Compactions due to the construction are caused by pressure load during the driving of the monopiles or by bearings on the soil. Soils/sediments with sand and gravel are not as easily compacted as cohesive soils/sediments. Additionally, habitat functions are cut back in areas that are used temporarily and face relocation of soil. However, habitat functions can be restored after construction. Therefore, for the protected resource **soils/sediments** in the project area a **medium sensitivity** to compaction can be assumed.

For the protected resource **land**, for those areas that have not yet claimed by human uses and will be used permanently by the project, a **very high importance and sensitivity** can be assumed. For areas, only being used temporarily during construction, **importance and sensitivity** can be assumed as **medium** due to the fact that after construction no further land use is

taking place making only the period of operation (minimum 35 years) relevant for the assessment.

Impact analysis

The construction-based **temporary land use** is mostly caused by the jack-up of the installation vessel (extension of the legs) and the cable laying within the OWF Gennaker. When jacking up, the feet of the installation vessel are expected to take up approx. 728 m² per site (totalling approx. 45,864 m²) for the foundation installation and approx. 660 m² per site (totalling approx. 41,580 m²) for the OWTG installation. This means that a total area of approx. 87,444 m² will be utilised in the short term. Laying the cables requires temporary land utilisation of approx. 1,300,000 m² (inner park cabling max. 130 km). Due to its temporary character, this results in a medium impact intensity.

Due to a medium sensitivity and a medium impact intensity with **significant negative effects on the environment**, the **temporary use of land and soil/sediments** is classified in the **assessment category (BK) IV**.

During the construction phase, sediments are temporarily disturbed close to the construction site and along the cable route of the cables within the wind farm at a width of about 10 m. This results in a local turbidity of sediments. As the upper layer of sediments consists mostly of sand, which settles fast and does not drift far, only a small impact is expected. Thus, from the disturbance of near surface sediments results only a low impact intensity.

Due to a medium sensitivity and a low impact intensity with **no significant adverse impact**, the **temporary disturbance of sediments** is classified in the **assessment category (BK) III**.

In connection with the planned construction and operation of the OWF Gennaker, a sediment report was prepared to assess possible changes in sediment dynamics.

According to the report, the flow of water against the foundations of the OWTG leads to a shear of currents and friction along the facilities. Due to these effects, small scale vortices are generated, that drift and are again being 'sucked in' by the main current. Changes of the velocity of the currents are concentrated on the immediate surroundings of the facilities. Superposition and interactions with facilities further downstream are very weak and can only be observed in simulations and not in measurements.

The installation of the OWF Gennaker results in small-scale changes to the current field and the formation of eddies. Due to these changes, scouring occurs in the direct surrounding of the facilities on the seabed. The extent of the scouring structures depends on the intensity of the current, the characteristic of the seabed and the characteristic of the building.

Scouring preventions in the form of rocks around the foundations are planned to avoid erosions and scouring at the site. According to the scour protection concept, the diameter of the scour protection on the foundations of the wind turbines is approx. 44 metres. The height of the scour protection is up to approx. 2 m in each case. The scour protection is described in detail in the concept with respect to dimension, structure, dimensions of the rock fills, grain distribution, etc. and will be further developed during design optimisation. From the change of sediment dynamics results a low impact intensity.

Due to the small-scale changes of the current field at the OWTG as well as to the fact that scouring protection counteracts this process, **changes in the sediment dynamic due to the facility** of the OWF are assigned with a low impact intensity. They

are therefore classified in the **assessment category (BK) III**.

The area that is permanently used by the foundations for the OWTG in terms of sealing with hard substrate on the seabed, amounts to approx. 4 m² (about 64 m² per OWTG), which is a very small section (around 0.01 %) of the overall project area (around 44,3 km²). The required area for the insertion of scouring protection amounts to around 91,8 m² (about 1,46 m² per OWTG). Here, a permanent change takes place from sandy substrate to hard substrate respectively fundaments.

For the grid connection of the Baltic 1 and Baltic 2 OWTGs, cables already run through the project area. To connect the 63 Gennaker OWTGs to one of the two transformer platforms, crossing corridors will be necessary. It is therefore planned to lay concrete mats or riprap to protect the underlying cables or the parts of the park's internal cabling that do not reach the target depth of approx. 1 metre. This will result in the permanent use of a total area of approx. 10,000 m² (crossings east 3 x (20 x 100 m), crossing west 2 x (20 x 100 m)).

The **permanent use of land and soil / sediment** is classified as a **significant effect resulting from the project (BK IV)** due to the above-mentioned sensitivities and the very high impact intensities.

7.6 Water

The following project effects caused by construction and operation of the OWF Gennaker affect territorial waters (12 nautical mile zone):

- Disturbance of surface sediments (during construction and dismantling),
- Turbidity of waters (during construction and dismantling) and
- Cubage of the facility (OWF).

The relevant guidelines for assessing and evaluating possible environmental impacts of the project on territorial waters are the **EU Water Framework Directive (WFD)** and the **EU Marine Strategy Framework Directive (MSFD)**. The purpose of the WFD is to 'establish a framework for the protection of inland surface waters, transitional waters, coastal waters and ground waters' (Article 1). The scope of the WFD includes coastal waters of the 1-nautical-mile zone with respect to the ecological status and the 12-nautical-mile zone with respect to the chemical status. The Directive was transposed into national law via amendments to the **Federal Water Act (WHG)** and water legislation of the federal states (e.g. M-V). The management objectives for territorial waters are defined in § 44 WHG. Accordingly, territorial waters should be managed to

1. avoid deterioration of its ecological and chemical status ('no deterioration') and to
2. preserve or reach a *good* ecological and chemical status ('requirement for improvement').

The aim of the MSFD is to protect marine environment across Europe. By understanding the pressures and impacts of human activities on the sea, and their implications for marine biodiversity, their habitats, and the ecosystems they sustain, it aims at

achieving a *good environmental status of Europe's seas*, including the Baltic Sea.

Analysis of the Status Quo

Hydrologically, the Baltic Sea can be considered a very large fjord with a characteristic length of 1,000 km, a typical width of 300 km and a mean water depth of 53 m.

Hydrographically, the Baltic Sea is like a large estuary with the main influx of freshwater (< 70%) in the north and northeast from the Gulf of Bothnia, Gulf of Finland and the Gulf of Riga, which have a low salt content, and a saltwater boundary in the region of the Kattegat and Skagerrak. The considerable influx of freshwater of 479 km³ p.a. for a long-term average causes a positive balance, which also covers precipitation and evaporation (each about 183 km³ p.a.), the near ground influx of salt rich water (737 km³ p.a.) and finally the outflow of water with lower salt content (1,216 km³ p.a.).

Geographically, the Baltic Sea is a subsea of the Northeast Atlantic being widely secluded from the ocean. The exchange of water with the North Sea (as marginal sea) and consequently with the ocean takes place over the Belts (about 70 %) and the Öresund (about 30 %). Water from the North Sea with high salinity mixes in the Belt Sea and in the Kattegat with the outflowing low-salinity water from the Baltic Sea and, due to its higher density, moves along the bottom towards the central Baltic Sea. There, it replaces deep waters, which are poor in oxygen or show ecotoxic hydrogen sulphide due to oxygen consuming phases during periods of stagnation.

The **chemical status** of the water body 'territorial waters' in the Baltic Sea has been classified *not good* in the latest **report for the WFD management plan 2022-2027**. Determining reason for this classification was the exceedance of the environmental

quality standard for polybrominated diether (PBDE) and mercury/mercury compounds. [Achievement of good chemical status is forecasted after 2045.](#)

The status of **marine biodiversity and ecosystems** as well as of the most relevant **anthropogenic pressures** in the Baltic Sea has been outlined [2024](#) in the [second updated status report](#). The report follows the initial assessment of 2012 [and the first update 2018](#) and states:

- **Eutrophication** is still one of the major environmental problems for marine biodiversity in the Baltic Sea. Between [2016 and 2021](#) coastal waters and the open Baltic Sea were declared *eutrophic*.
- There was no significant change of the **hydrographic, sedimentological and geomorphological conditions** between 2012 and 2018. [At around 17 km², permanent changes in hydrographic conditions affected less than 0.2 % of German Baltic Sea waters in 2016-2021.](#)
- **Pollutants** can still be determined in environmentally harmful concentrations in the Baltic Sea. PDBAs and mercury are the most relevant factors contributing to a non-achievement of the good environmental status.

Sensitivity and Worthiness of Protection

The Baltic Sea – and with it the territorial waters of the project area – are, with respect to its hydrographical and chemical conditions, exposed to anthropogenic pollution by the littoral states.

The salt concentration of the inflowing waters from the North Sea is, due to its dominating effect on the density, the central factor for a very strong aeration of the deep waters of the Arkona Basin. Thus, special attention should be paid to a potential influence of the OWF Gennaker on the vertical

mixing in the water column, as it could reduce the penetration depth of salt wedges during influx events into the inner Baltic Sea, if a negative prediction is given.

The **high ecological sensitivity** of the Baltic Sea as subsea of the Atlantic results from two facts. On the one hand, the exchange of water with the ocean over the North Sea and Skagerrak / Kattegat only takes place over narrow and shallow ingresses, and on the other hand, the depths of the ridges between the individual Baltic Sea basins govern the water circulation. Additionally, the thermohaline layering (dominated by temperature and saline conditions) impedes and prohibits the vertical exchange of water.

Impact Analysis for Surface Waters

Project effects resulting from construction works are of a low intensity, duration and/or extent. Negative influences on the amount of oxygen of the deep waters can be excluded due to the characteristic of the sediments (mainly sand). There are **no significant effects resulting from the project** expected (**BK III**).

In connection with the planned construction and operation of the OWF Gennaker, an expert report on hydrodynamics was carried out. It illustrated that the cubage of the facilities has no relevant influence on the vertical mixing and therefore only a low effect intensity. **Significant effects resulting from the project can be excluded (BK III)**.

With respect to the MSFD, the planned OWF does evolve project effects that neither deteriorate the status of marine biodiversity, habitats or ecosystems, nor the most important anthropogenic pressures in the Baltic Sea. In addition, the project does not compromise the determined environmental objectives for the Baltic Sea and is thereby consistent with the overall aims of the MSFD.

Groundwater

The submarine groundwater conditions are characterised by a high amount of pore water in the subrecent (before the beginning of the Holocene 12,000 years ago) and Holocene sediment horizons (sand, silt) close to the seabed. As this pore water interacts with the overlying seawater, it contains corresponding amounts of salt. Only under the till layer from the last glaciation layers of interstadial (short warm periods between glacial periods) sands carrying groundwater can be developed. No such groundwater layers were found in the project area of OWF Gennaker in the seismic observations, as chalk is present under the till. For these depths, no effects are expected so that **no further consideration is needed**.

7.7 Air

The protected resource *air* is affected in a way relevant for the investigation by the following project effects:

- Air pollutants due to construction works (and dismantling).

Analysis of the Status Quo

Immission levels of air pollutants in the north-east of Germany, especially in rural areas, are characterised by low levels of pollution. According to the assessment of the air quality data of the State Office for the Environment, Nature Conservation and Geology (LUNG) for [the year 2023](#), carried out on the basis of the 39th BImSchV, the limit values for the parameters sulphur dioxide, particulate matter (PM10, PM2.5), nitrogen oxides, ozone, benzene, carbon monoxide and various heavy metals in particulate matter are complied with.

Sensitivity and Worthiness of Protection

Areas with a protective state (e.g. clean air areas) do not exist in the investigation area. The sensitivity of the protected resource *air* to the effects of an increase of air pollutants

is mostly defined by the acceptor 'humans'. Due to the distance to the next residential areas, the **sensitivity** is classified as **low**.

Impact Analysis

For the construction for the OWF Gennaker, construction machinery is used, which is generally powered by diesel engines. During the construction works, mostly nitrogen dioxide and diesel soot are emitted with respect to air pollutants. As the construction works are carried out for individual sections in different phases, elevated immission loads are expected for small areas. Due to the emissions of the construction machinery and the vehicles being limited to short time spans and limited areas, no deterioration of the air quality is expected. This also applies to the period of dismantling and for those resources (e.g. *humans, in particular human health, animals, plants and biodiversity, and water*) being related to the protected resource *air*.

Thus, **no significant effects resulting from the project** are expected on the protected good air (**BK II**).

7.8 Climate

The protected resource *climate* is affected in a way relevant for the investigation by the following project effects:

- Cubage of the facility (OWF)
- Change of wind field due to rotor movements (in operation)

Analysis of the Status Quo

Within the subdivision of the climatic zones of the Baltic Sea, the area of the OWF Gennaker is classified as predominantly maritime zone. Compared to the inner lowlands, this zone shows due to its proximity to the Baltic Sea a more balanced course of air temperature and relative humidity, stronger air movements, more clouds in winter and often misty air. While the slow cooling of the

Baltic Sea in late summer and autumn in coastal waters causes a noticeably milder climate, spring on the other hand is delayed due to the slow warming of the Baltic Sea, it is therefore rather cold and rough. This temperature effect is enhanced, as during spring, next to the normally dominating westerly winds, often northerly and north-easterly winds are present.

In the area of the planned OWF Gennaker, the atmosphere and the sea are in an active interchange across various scales and can be considered as a coupled system.

Sensitivity and Worthiness of Protection

Areas with high protection status are not present in the area of investigation. The Baltic Sea as such does not have an influence on the regional climate. As the project (OWF Gennaker) does not have influence on the climatic processes in a large scale, the EIA focuses on evaluations of the local characteristics of the climate with respect to the air layer near to the water surface, as this layer is the zone in which climate and weather are effective.

The predominant area of investigation represents a natural and sparsely affected area in a climatic context. Compared to other marine areas, the project site is not characterised by special climatic qualities so that its **sensitivity is low**.

Due to the general characteristics of large waters as zones of formation of fresh air, areas with an air cleaning and climate protecting effect, the project area is considered as highly important.

Impact Analysis

The planned OWF Gennaker leads in its surroundings to **changes of the wind conditions close to the surface** (local climate). Depending on the direction of wind flow, the wind velocities will change in the windward and especially the leeward side of the OWTG.

Hereby, the rotor blade represents a moving obstacle, which decelerates wind flow and causes small scale vortices. This affected zone is called trailing zone. The air striking on the rotor blade mostly flows around its profile on the leeward side and therefore encounters an offset (an upward offset for the downward rotating blade and a downward offset for the upward rotating blade). In the leeward side of the rotor blades, this results in the correspondingly reduced wind velocities and higher turbulences.

The changes of the local wind field can lead temporarily and on a small scale to changes of the distribution of temperature, clouds and precipitation depending on air temperature and the properties of the sea surface. A quantification of this effect is not yet possible.

As the described changes of the wind field are predicted in an area of low sensitivity, the effects are locally constrained with respect to the size of the whole climatope. There is only a minor secondary impact for the protected resource *animals, plants and biotopes* (bats and migratory birds and seabirds ⇒ chapter 6.2) (low effective intensity). Thus, the corresponding effects can be assessed from a conservative viewpoint (with regards to uncertainties of the prediction) as **not significant (BK III)**.

7.9 Landscape

The protected resource *landscape* is affected in a way relevant for the investigation by the following project effects:

- Permanent land use,
- Cubage of the facility (OWF) and
- Light emissions

Effects from the facility itself (e.g. cubage) and from its operation (e.g. rotor movement) are not differentiated for the assessment of wind farms and are considered in

one process. Therefore, they were also joined in the EIA.

Due to the initially planned building height of **maximum 261 m** and the minimum distance of approx. **11 km** to the closest point on land ('Darßer Ort'), the scoping determined the area of investigation with 20 km around the outer borders of the **approved** OWF Gennaker. Also, distinct coastal viewpoints close to the project were considered (in individual cases also outside of the 20 km border of the area of investigation).

According to the study on landscape analysis and landscape assessment, the distance to the windfarm is a highly relevant assessment factor. The maximum distance that is to be considered is **35 km** to the **projected** OWF Gennaker. Selected coastal sites could exceptionally be at larger distances.

The consideration of **35 km** for the area of investigation and selected places even further away is a conservative approach and is sufficient to the fact that offshore wind farms can be seen from more visual points than onshore wind farms.

Analysis of the Status Quo

The planned location of the OWF Gennaker is off the coast of Mecklenburg-Western Pomerania. It lies in the Baltic Sea with water depths between 12.5 to 20 m. The shortest distance between the project area and the shoreline is about **11 km** at 'Darßer Ort'. A number of coastal communities are located at a distance of approx. **14 to approx. 39 km**, from which the OWF will be visible if visibility is good.

The coast of the peninsula Darß-Zingst and the southern half of the island Hiddensee (Gellen) are characterised by flat coastal sections with cliffs and dunes. Behind the beach line, often a dune wall is present and

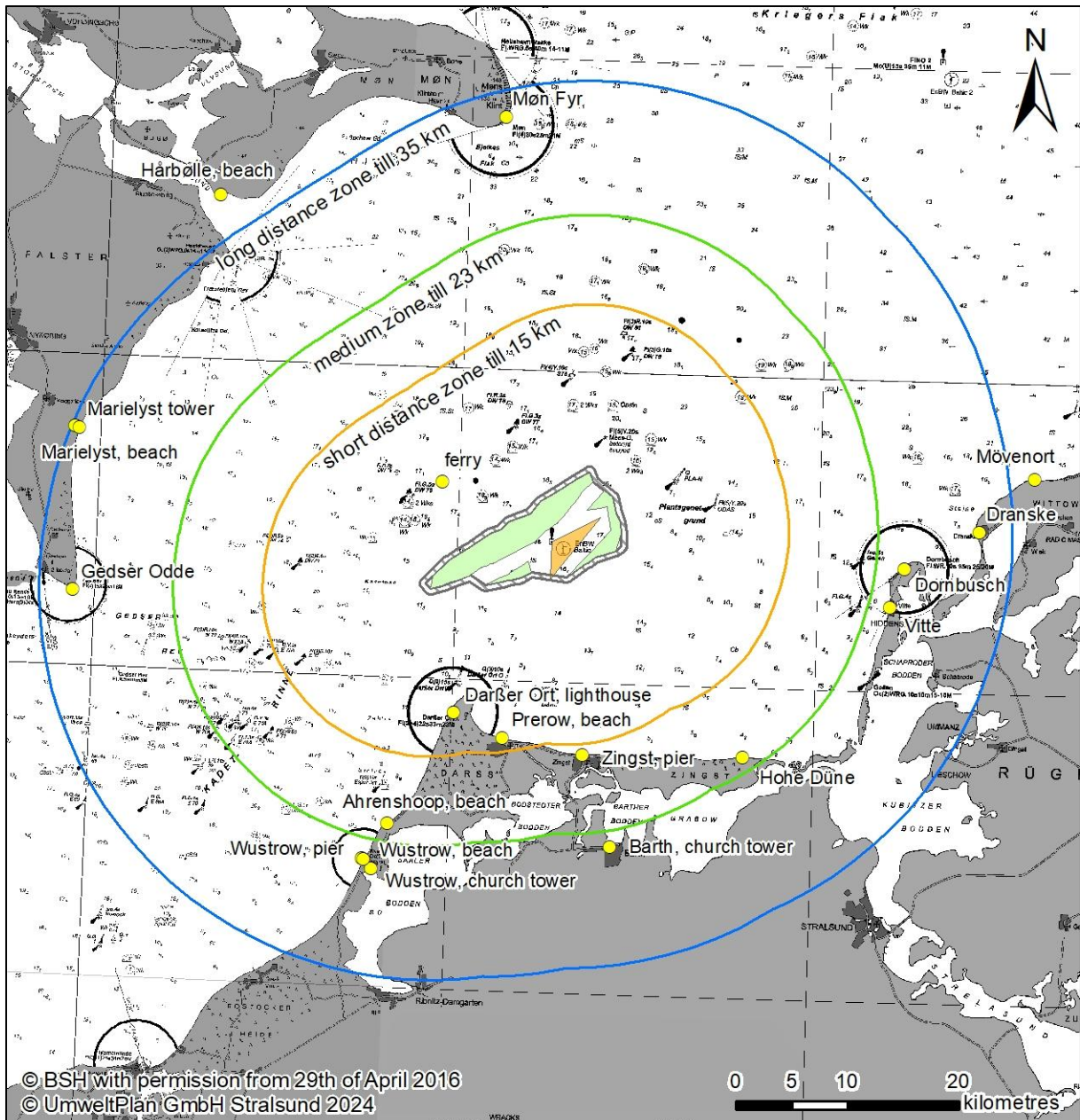
there are groves and sea walls. Shore areas with elevations above 10 m are found in 'Darßer Ort' and 'Hohe Düne (Zingst)'.

The hinterland is flat and thus sea walls and coastal forests prevent a clear view on the Baltic Sea. In the area of investigation of 20 km around the planned OWF Gennaker, large parts of the Darß and Zingst are located. Due to the flat terrain and the vast forest covering of the mentioned areas, a visibility on the OWF is only given from the coastline (beach, sections close to beach like sea walls, paths and possibly individual buildings) but not from the remaining part of the land areas within the area of investigation. Thus, the consideration can be limited to these areas.

The coastal regions of Mecklenburg-Western Pomerania are characterised by natural and cultural landscapes with a large diversity of beaches, forests, fields, grasslands, heathlands, hills, villages and small towns. It is a landscape predestined for tourism, which also has a high number of hours of sunshine. Conservation areas for nature and landscape are often protected due to their rarity, uniqueness and their undisturbed properties or their scenic beauty. In places attractive for recreation, the danger of aesthetic interferences is large. This applies for coastal areas that are especially close to nature but not protected.

Another part of the landscape are areas used for agricultural purposes. They are part of the inventory of a recreational landscape close to nature. However, they generally have a very low aesthetic value on their own compared to protected areas for recreation and nature conservation.

The effects of the OWF on the landscape can also be considered from the viewpoint of the ferry connection Rostock-Trelleborg, as a high number of passengers is transported, and the experience of landscape is part of the ferry passage.



Area of investigation for the landscape assessment

The distance to Denmark is at least 30 kilometres. A potential impact could not be ruled out due to the significantly higher construction height and was integrated into the analyses (visibility, landscape, etc.).

Sensitivity and Worthiness of Protection

To put the mostly subjective perception of the landscape in a transparent evaluation process, objectively perceptible elements of the landscape are considered, which correspond to the criteria diversity, uniqueness

and beauty from § 1 (1) BNatSchG. To depict and evaluate the landscape in the area under investigation around the OWF, individual landscape areas were delineated, which serve to characterise the landscape and its typical characteristics, as well as to highlight special landscape features. In this context, urban areas are assumed to be of low conservation value, as they are generally already burdened by buildings, even if they blend in well with the landscape from a cultural-historical perspective or characterise the urban area in its landscape.

The actual project area including the 500 m safety zone is part of the open Baltic Sea. It is therefore in need of protection as typical part of the *marine landscape*. Thus, a high worthiness of protection can be assessed for this area.

The sensitivity of the landscape or the considered coastal locations results mostly from their visual vulnerability due to the interaction of relief, structural diversity, species and density of the vegetation as well as their exposure to the project and the expected project effects. Locations or landscape sites, which are mostly hidden or have no visibility to the project at all, are correspondingly classified as not sensitive. Locations or landscapes, which are largely exposed to projects relevant for the landscape and which enable more sight-relations to the project, are thus significantly more sensitive.

From the 44 investigated landscape sites, 30 have been classified with a high to very high sensitivity, 8 with a medium sensitivity, and 6 are considered with a low sensitivity.

Impact Analysis

The OWF Gennaker will be constructed on a total area of 44.3 km². In the project area, the size of the OWTGs in conjunction with the number of turbines and their distribution

over a large area of approx. 44.3 km² results in a high impact intensity in terms of *land use*.

In terms of the *cubature of their structures*, the OWTGs form the typical strongly vertically orientated shape of wind turbines and the rotor, which describes a circular surface. In addition to their design, their visibility is determined by a specified colour scheme (day marking as an obstacle to shipping and air traffic). The planned turbines of the Gennaker OWF are more than twice the height of the existing turbines of the Baltic 1 OWF. A light grey colour is planned as the base colour to reduce the high visibility.

Due to the division of the OWF Gennaker into three individual areas, the open areas through cable corridors, the uneven distribution of the number of OWTGs between west and east and the existing Baltic 1 OWF, the OWF Gennaker appears differently dense, clustered or interrupted in places when viewed from different directions. From the locations at shorter distances (Wustrow to Hohe Düne), the OWTGs can be perceived as an arrangement in a row. However, the OWF Gennaker predominantly appears as a band of vertical elements in irregular arrangements and densities. In the frontal view of the long side (e.g. from Darßer Ort, Prerow, Zingst, Barth church tower, ferry), the band of the OWF appears denser in the eastern area, with individual gaps in the clear corridors. Towards the west, the density decreases further and further, the perceived band dissolves and individual installations become more clearly recognisable.

The visual impact of the rotors of the OWF Gennaker is comparatively greater than that of the rotors of Baltic 1 due to the higher centre of rotation, the larger rotors, the clustering and densities in the arrangement patterns (higher densities due to the

overlapping of the rotors and their movements result in better visibility). The visual impact is likely to consist of the perception of a flicker effect, which varies in intensity depending on the weather-related visibility and distance.

In the project area, the cubage of the facility in connection with the rotor movement is clearly visible. The intensity of project effects must be classified as high due to the directly affected area.

For the terrestrial part of the area of investigation, in particular the distance of more than 10 km is relevant. All terrestrial parts of the area of investigation and the considered locations beyond it are located **at least in the middle zone**, the majority **within the far zone** or outside it.

In the terrestrial area of the study region, the impact intensity **must be clearly differentiated** for the reasons mentioned above (cf. expert report on landscape analysis). **While the impact intensity at the Danish locations and individual locations in M-V can be regarded as certainly non-existent**, a low (Wustrow pier, Höhe Düne, Vitte, Dornbusch, Barth), medium (Ahrenshoop, Prerow, Zingst) to high (Darßer Ort) impact intensity is predicted at other locations.

Light emissions of the OWF Gennaker are determined by the safety requirements of the aviation and shipping authorities. The results of the visibility study show, that the intensity of this project effect is low, also for the nearest coastal sites. Due to a low presence of persons at night at the coastal sites Darßer Ort and partly also in Prerow (the town lies behind coastal vegetation), there is – in addition to the low visibility – also a low concern.

Within the actual project area, lighting is clearly visible (even when visibility conditions are poor) corresponding with the purpose of the lighting for aviation and shipping security. However, obstruction lights

will only be switched on when an aircraft approaches the OWF. Otherwise, obstruction lighting will be switched off. As a result, the OWF will only temporarily become visible. The intensity of this project effect is therefore also be rated as low.

Due to changes of the local landscape by high vertical project structures on the open sea surface and the mentioned light emissions, there are significant interferences on the protected resource *landscape* in the actual project area even though pre-existing burdens exist from the OWF Baltic 1 and the shipping traffic. As the intensity of the project effects is high and the protected resource has a high sensitivity on a local scale, the effects resulting from the project are classified as **significant on the protected resource landscape (BK IV)**.

The landscape interference fulfils the element of encroachment in the sense of § 14 (1) BNatSchG in connection with § 12 (1) NatSchAG M-V. Corresponding compensatory measures are developed in the landscape management plan (LBP).

The permanent installation-related change to the local landscape due to light emissions results in a low impact intensity due to the low impact intensity, even with a high sensitivity to protected assets. The local landscape changes caused by the project effect 'light emissions of the facility' are classified as **not significant for the protected resource landscape (BK III)**.

The large-scale project effects of the cubage of the facility on the protected resource *landscape* are determined by a very different visibility of the OWF from different coastal viewpoints, which strongly depends on the specific distance to the OWF and on visibility conditions. Still, the view is at no point dominated by the OWF. Due to the low intensity of the project effect, even with a high worthiness for protection, the environmental impact intensity is rated low. Therefore, the large-scale project effects,

such as cubage of the facility, rotor movements and light emissions, are classified as **not significant for the protected resource landscape (BK III)**.

7.10 Cultural Heritage and Other Material Goods

The protected resource *cultural heritage* and *other material goods* is affected in a way relevant for the investigation by the following project effects:

- Temporary and permanent land use (due to construction works and the wind farm as industrial plant),
- Vibrations (due to construction).

Analysis of the Status Quo

There are no listed **monuments** in the project area of the OWF Gennaker. In previous authorisation procedures, three suspected archaeological sites were named by the State Office for Culture and Monument Preservation M-V. [Project-related geophysical investigations were carried out in the project area in 2016 and 2022. No evidence of the presence of ground monuments was found. As a precaution, the three suspected points were specified by the project developer as a "restricted area" with a radius of 100 m for all relevant contractual partners.](#) An impact can be ruled out and no further consideration is relevant in the [EIA report](#).

Other **objects of archaeological importance** to be considered are wrecks of historico-cultural interest. Currently, no wrecks are noted in the investigation area ([Geoseaportal](#)). In connection with the projected OWF Gennaker, [the known statements were confirmed](#) by the ‘Bundesamt für Seeschifffahrt und Hydrographie’ (Federal Maritime and Hydrographic Agency) (BSH) by a written notice on the 14th of July 2016. [Due to the location of the OWF](#), the statements remain valid also for the application for alteration approval.

Material goods in the investigation area are also the cable routes running from northeast to southwest in the project area.

Sensitivity and Worthiness of Protection

Potential sensitivities of *cultural heritage* and *other material goods* result mostly from interferences and destructions due to direct land use. In addition, vibrations during construction works can lead to interferences.

The construction of the foundations for the OWF leads to a punctual land use. Furthermore, the laying of the electricity cables involves a land use along lines and relatively close to the surface (up to 1 m below the upper surface of the sediments).

As objects of cultural-historical significance may be recovered (magnetic suspected sites), the **worthiness of protection and sensitivity** of *cultural heritage* and *other material goods* are classified as **medium**.

Impact Analysis

Land use due to construction (and dismantling) and the erected facility itself are not connected with significant project effects. Taking into consideration the reporting obligation for objects of cultural-historical interest and referring to a potential loss of other material goods or cultural monuments, the effects can be **classified in the category BK II**.

Likewise, the vibrations do not involve **significant adverse effects**.

7.11 Interactions

All environmental fields are connected by strong interactions. In addition to the direct effects also consequential effects were considered for the evaluation of the individual protected goods (analysis of conflicts).

The interactions with respect to the ecosystems between the protected goods, within the protected goods and between and within ecosystems of a landscape were

comprehensively considered for the registration of protected goods and their assessments.

7.12 Tested Technical Alternatives

Alternatives for the monopile foundation like jackets, suction buckets and the gravity foundation are characterised by a higher consumption of space. The suction bucket foundation and the SOF (swimming offshore foundation) are not yet well established. The gravity foundation has only been applied so far for water depths up to 7 m. The project developer decided in favour of the monopile foundation as an environmentally friendly foundation method. It is also a tried and tested method with low risks for construction and operation.

7.13 Measures for Environmental Precaution

Comprehensive measures for prevention and minimisation as well as for compensation of environmental impacts are planned and presented as follows.

With respect to **prevention and reduction of land use**, the chosen type of foundation requires the smallest consumption of land of all currently available alternatives.

While planning the OWF, the foundations selected for the individual OWTGs **or the OSS not covered by the application** will be adapted to the conditions in the natural area, in particular the building site, water depths and the situation of wind and waves as well as the resulting requirements for the structural stability. By the date of the application of approval, calculations are based on worst-case scenarios to technically represent even the most adverse case. Apart from that, an efficient, economic and resource friendly solution is pursued. **After approval and during further project implementation, the focus of planning will no longer be on the worst-case scenario, but on optimising the technical solutions.**

The scour protection prevents scouring around the foundations and thus serves the stability of the OWTG. It is usually planned with the **fivefold** radius of the pile foundation. This is considered the worst-case scenario in the present case. It is thinkable and possible to further reduce the scour protection and thus the consumed seabed, which always corresponds with the cross section of the foundations.

By erecting the OWF Gennaker within a designated priority area for wind energy that comprises already the **existing** OWF 'Baltic 1', the project follows the principle of concentration. This also allows the positioning of cables within existing cable corridors and further reduces land use and minimises intervention in nature and landscape.

For the prevention and reduction of emissions and immission **of noise, light and pollutants** to the environment every available technical measure is undertaken. The marking and lighting for aviation and navigation will be realised according to corresponding authority regulations. A minimisation of light emissions is realised by a mandatory need-based lighting control system for aviation at night. The control system for aviation is also harmonised with the lighting systems for navigation. To guarantee the safety of submarine traffic, sonar transponders will be applied as passive safety equipment. To reduce underwater noise emissions, the transponders will only be applied in the periphery of the OWF (corners) and will only be activated by a specific signal of naval submarines.

To prevent animals (e.g. insects) from being attracted to the OWTGs and entering light sources, only light sources that are closed and sealed on all sides are used. In addition, directional lighting is used to prevent unnecessary illumination of the natural environment.

Certain design features ensure that roosting opportunities in or on the structures,

e.g. for birds and bats in the nacelles of the OWTGs, are avoided as far as possible. All large parts of the structures are also encapsulated or sealed to protect them from the weather. This effectively prevents intrusion and reduces the risk of birds and bats being killed or injured.

In general, in addition to the formation of a negligible electromagnetic field in the direct vicinity of the submarine cables in operation, a permanent increase in the temperature of the soil and the pore water can be assumed. Complying with the 2-K-criterion ensures that in a depth of 20 cm, the increase of sediment temperature will not exceed 2 Kelvin, and the benthic community will not be harmed. The chosen cover height for the inner wind park cabling will be at 0.5 to 1.5 m. Consequently, structural and functional changes will be local and will only affect the proximity of the cables.

During the construction phase of the OWF Gennaker, there is a possibility of disturbance and/or injury to marine individuals due to pile-driving noise. By slowly increasing the pile-driving intensity (soft start) and acoustic deterrence measures (e.g. pingers, Fauna-Guard system), injuries to harbour porpoises can be avoided and the intensity of disturbance can be reduced or avoided altogether. In addition, the use of suitable noise protection measures, such as bubble curtains, will effectively reduce the intensity of disturbance both for the harbour porpoise and for other underwater inhabitants capable of hearing (other marine mammals, fish) and comply with the BMU's required limit values (cf. noise protection concept still to be developed). Further reductions in the disturbance effect will be achieved by adapting the organisation of the construction process to the seasonality of the harbour porpoise occurrence as well as efficiency monitoring.

A review of the possibility of simultaneous pile-driving in other construction projects in

the marine area (surrounding area of approx. 30 km) showed that cross-project construction coordination is not necessary. Based on current knowledge, cumulative effects due to noise pollution can be safely ruled out due to the distances of the project backdrop and the availability of sufficient alternative areas.

With respect to the protected asset *humans, in particular human health*, the use of a special pile-driving method (e.g. PULSE or comparable method) is planned to minimise the environmental impact of noise according to current planning. Consequently, the impulse of power transmission during the pile-driving process is distributed over a longer period, thereby reducing the average sound power level. Compliance with the sound rating levels calculated in the corresponding acoustic study also presupposes that the average duration of the pile-driving work at night (8 p.m. to 7 a.m.) is less than two hours.

During construction and operation of the OWF Gennaker, water and all substances or materials will be used economically.

The dismantling process will be realised as environmentally friendly as possible, according to the technical possibilities at the time of dismantling. It is to be expected that the upper parts of the OWTG or the OSS not covered by the application will be disassembled in a way similar to construction (with installation jack-up vessels). The foundations will be cut (1 m below sea floor) and removed. The cabling will be carefully stripped from the seafloor, allowing for only minor impacts on flora and fauna of the seafloor, comparable to the impacts of the cable laying process.

The OWF Gennaker complies with the regulations of the German Recycling Act (KrWG) by avoiding waste to preserve the natural resources. Waste, which is unavoidable despite the measures for the prevention and reduction of waste, is brought to

other uses or disposed properly according to legal regulations.

For the species groups of birds and bats, measures are required to monitor the environmental impact of the project. They serve to reliably exclude the prohibition of killing of species in the context of species protection law.

A significant increase of the collision risk for birds could not be determined. However, in line with the overall risk management, a monitoring concept for the assessment of potential bird collision risks on the project site is intended. The monitoring includes recording the intensity of migration in and above the wind farm using radar and recording the occurrence of birds in the rotor area. The system is used to check how often and how many birds fly in a specific sector in the immediate vicinity of the rotor. In addition, so-called bird listening boxes are installed to identify some bird species that fly over the OWF at night. The values serve as input parameters for a collision model, which can be used to calculate and estimate the theoretical frequency of collisions. The detection systems (radar and camera) are operated continuously during the main migration periods (spring migration, autumn migration). In the absence of established assessment criteria, a significantly increased risk of killing is assumed if at least 1 % of the birds migrating through or over the offshore wind farm collide with a OWTG. If this threshold is reached, a temporary switch-off (until the next sunset (daytime drawers) or sunrise (night drawers)) should be initiated. The processes are logged. The aim of the measure is to prevent the loss of individuals of migratory birds due to collisions with OWTGs.

The environmental baseline investigation (compliant with the Standard Investigation of the impacts of offshore wind turbines on the marine environment - StUK 4) did not determine an increased activity of bats in

the project area and thus no increased risk of collisions. In line with the precautionary principle, for bats will also be implemented a monitoring concept (using acoustic height monitoring, camera systems and radars in the rotor area) for the first two years of operation.

The OWF Gennaker will be visible at sea over long distances in line with the characteristics of an OWF. Next to the reduction of lighting, the optical perceptibility of the OWF is reduced by the colouring in matt light grey (RAL 7035), which is only interrupted by the navigation signs for ships and airplanes. The lighting for aviation and navigation security will be reduced to a safety-relevant minimum. All obstruction lights for navigation and aviation will be synchronised and harmonised.

Construction of the OWF Gennaker will not commence until a final maritime traffic regulation (extension of the traffic separation scheme or similar) has been issued.

During the construction phase, the construction site will be marked with cardinal buoys. Monopiles and transition pieces will be marked temporarily with sea lanterns according to the progress of construction. Further details are illustrated in the marking and lightning concepts and HSE plan. During the construction phase, a traffic safety vessel will be on site. Furthermore 24/7 surveillance of Marine Coordination Services will increase traffic safety.

As part of the construction preparations, investigations into possible explosive ordnance contamination are carried out to ensure that there are no dangerous contaminated sites in the vicinity of the offshore locations and the internal park cabling and that safe installation processes are guaranteed. If an explosive ordnance is found, the munitions salvage service must be informed, and further action must be coordinated with the authorities to be involved.

Further potential dangers are fatal accidents, such as fires or system failures. The risk of averages is prevented by a 24/7 manned control centre, safety concepts and regular maintenance activities. Water-polluting and hazard-related substances will be transported and stored properly. [System components containing liquids are professionally drained before dismantling or prepared for transport by ship in such a way that liquid losses are ruled out.](#)

The gondolas will be equipped with winching areas enabling rescue operations of injured persons in cases of emergency.

By using on-site generated energy, an energy-saving mode of operation of the OWF is expected.

[Impact regulation](#)

According to § 12 (1) NatSchAG M-V, the construction of offshore facilities is an encroachment in nature and landscape according to the legislation for the preservation of nature.

The significant and compensatory impacts of the OWF Gennaker, which cannot be sufficiently limited by avoidance and mitigation measures, include the utilisation of the seabed and the impact on the landscape. In addition, a significant impact is assumed regarding special faunistic functions. This includes the construction-related, temporary significant impairment of the habitat function for harbour porpoises due to the construction-related disturbance caused by underwater noise during pile driving as well as the partial loss of habitat for seabirds (common scoter, long-tailed duck, common eider, red-throated diver, black-throated diver, common guillemot, razorbill, black guillemot (auks)).

If possible, a multifunctional compensation should take place, i.e. one or more measures compensate for several affected protected resources.

The required compensation for the OWF Gennaker cannot take place in territorial waters, as potential space for an ecological upgrade of a respective quantity is not available. Thus, in a strict sense, the interference is not compensable. For this reason, the compensation must have the character of a replacement measure, i.e. a measure that does not have to or cannot fulfil all requirements of a functional compensation. Replacement measures must be linked to the affected ecological and aesthetic functions of the affected landscape as much as possible. Unique characteristics of the landscape must be respected.

The proposed measure E1 ('Optimisation of water exchange between Small and Large Jasmund Bodden by means of building activities on Lietzow dam and Pultz dam') results in a complex upgrade of all ecosystem components, including habitat suitability for resting birds. To what extent multifunctional species-specific upgrade potentials will be reached cannot be finally determined. Thus, compensation needs are precautionary also considered at this planning stage. The compensation need of [420.24 ha](#) (interference area equivalent) will be fully covered by the compensation measure E1 with a booking of 906 ha (compensation area equivalent).

Due to the location of the compensation area within the landscape 'Arkona Sea' and thus in the same natural environment as the OWF Gennaker, and a functional focus on an upgrade of coastal waters, the proposed measures are particularly suitable for compensating the loss and interference of marine habitats.

The regulation for environmental interventions in marine areas (HzE marin) gives specific requirements for the approval of measures and reference areas in marine areas. Based on a feasibility study con-

ducted in 2015, measure E1 fulfils the requirements. The study states that 'an enhanced opening of Lietzow dam will result in a better mixing / turbulence of the Small Jasmund Bodden. Consequently, the measure complies with measure type 5.50 according to chapter 6.3 of the regulation for environmental interventions in marine areas (HzE marin)'.

In addition to the provision of compensation measures for the turbine height of 175 m applied for in 2016 and approved in 2019 with an area equivalent of 118.22 ha, an additional compensation payment of € 694,766.16 must be made for the impact on the landscape due to the additional turbine height of 15 m (increase from 175 m to 190 m) permitted in March 2024. An additional compensation payment of € 2,015,974.00 was calculated for the additional turbine height of 71 m currently applied for.

7.14 Summary of the Investigated Environmental Impacts

The starting point of the ecological risk analysis was an inventory and an analysis of the status quo of the environment in the investigation area. It included an assessment of the significance of the protected resources as well as an estimation of the sensitivity to additional loads.

The conflict (impact) analysis combined the results of the analysis of the status quo and the resulting effects of the project on the environment. The environmental impacts were determined (predicted) and described for each protected resource. Environmental effects across borders do not occur.

The study of the environmental compatibility showed: in consideration of the proposed measures for environmental precaution, the (according to § 16 BIm-SchG) amended project proposal does not cause environmental impacts that are opposed to an alteration approval.

8 List of Abbreviations

| | | | |
|-----------|---|--------|--|
| K | Kelvin (SI unit of temperature) | IfAÖ | Institut für Angewandte Ökosystemforschung GmbH (Institute for Applied Ecology) |
| BImSchG | Bundesimmissionsschutzgesetz / Federal Immission Control Act | KrWG | Kreislaufwirtschaftsgesetz / German Recycling Act |
| BImSchV | Bundesimmissionsschutzverordnung / Ordinance on the Implementation of the Federal Immission Control Act | kV | Kilovolts |
| BK | Beurteilungsklasse / Assessment category | LBP | Landschaftspflegerischer Begleitplan / Landscape management plan |
| BMU | Bundesministerium für Umwelt, Naturschutz, nukleare Sicherheit und Verbraucherschutz / Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (at present: BMUV) | LEP MV | Landesraumentwicklungsprogramm Mecklenburg-Vorpommern / Spatial planning program of Mecklenburg Western Pomerania (came into force 2016) |
| BNatSchG | Bundesnaturschutzgesetz / Federal Nature Conservation Act | MP | Monopile |
| BSH | Bundesamt für Seeschifffahrt und Hydrographie / Federal Maritime and Hydrographic Agency | MSFD | EU Marine Strategy Framework Directive |
| BVerwG | Bundesverwaltungsgericht / German Federal Administrative Court | MSL | Mean sea level |
| CEF | Continuous Ecological Function | MW | Megawatt |
| dB | Decibels | OSS | Offshore Substation |
| dB SEL | Sound exposure level | OWF | Offshore Wind Farm |
| EDI | Electronic data interchange | OWTG | Offshore wind turbine generator |
| EIA | Environmental Impact Assessment | PBDE | Polybrominated diethyether |
| ERA | Ecological Risk Assessment | PODs | Porpoise detectors |
| FCS | Favourable Conservation Status | TP | Transition piece |
| HzE marin | Regulation for environmental interventions in marine areas | SAC | Special Area of Conservation (Habitats Directive) |
| | | SCI | Site of Community Importance (Habitats Directive) |
| | | SPA | Special Protection Area (Birds Directive) |
| | | UBA | Umweltbundesamt / Federal Environmental Agency |
| | | UVPG | Umweltverträglichkeitsprüfungsgesetz / Environmental Impact Assessment Act |
| | | UXO | Unexploded ordnance |
| | | WFD | EU Water Framework Directive |
| | | WHG | Wasserhaushaltsgesetz / Federal Water Act |