

1 Non-technical summary

Benthos

The North Sea EEZ is not of outstanding importance with regard to the species inventory of benthic organisms. Moreover, the benthic communities identified have no special features as they are typical for the North Sea EEZ due to the predominant sediments. Studies of macro-zoobenthos within the framework of the approval procedures for offshore wind farms and from AWI projects from 1997 to 2014 have revealed typical communities in the German North Sea. The species inventory previously found and the number of Red List species indicate that the study area for benthic organisms is of average importance.

The deep foundation work for wind turbines and platforms will result in disturbances of the seabed, sediment turbulence and formation of turbidity plumes. The re suspension of sediment and subsequent sedimentation may lead to impairment or damage to the benthos in the immediate vicinity of the foundations for the duration of the construction activities. Due to the predominant sediment composition, however, these impairments will be only small-scale and short-term. The concentration of the suspended material generally decreases very rapidly with distance. Local land sealing and the introduction of hard substrates in the immediate vicinity of the structures as a result of construction work may lead to changes in the species composition.

Due to the laying of the subsea cable systems, only small-scale and short-term disturbances of the benthos due to sediment turbulence and turbidity plumes in the area of the cable route can be expected. Possible effects on the benthos depend on the laying methods used. With comparatively unobtrusive laying using the injection method, only minor disturbances of the benthos in the vicinity of the cable route are to be expected. Local sediment shifts and turbidity plumes are to be expected while the subsea cable systems are being laid. The predominant sediment composition in the North Sea EEZ means that most of the released sediment will settle directly at the construction site or in its immediate vicinity.

Benthic habitats will be built over directly in the vicinity of rockfills required for cable crossings. The resulting loss of habitat is permanent, but small in scale. This will result in a non-native hard substrate that may cause small-scale changes to the species composition.

For operational reasons, warming of the top seabed sediment layer may occur directly above the cable system. With sufficient installation depth and taking into account the fact that the effects will occur on a small scale, no significant effects on benthic communities are expected on the basis of current knowledge. With the planning principle for sediment warming, the Site Development Plan specifies that the 2K criterion must be adhered to. According to the assessment by the Federal Agency for Nature Conservation, this precautionary value ensures, with sufficient probability, that significant negative effects of cable warming on the marine environment will be prevented.

As things stand at present, the planned converter platforms and subsea cable routes are not expected to have any significant effects on the factor Benthos if the 2K criterion is met. The ecological effects are small-scale and mostly short-term.

Biotopes

Converter platforms and subsea cables may possibly affect protected biotopes due to direct use of these biotopes, their covering by sedimentation of material released during construction or potential habitat changes.

Given the predominant sediment composition, impairments due to coverage are likely to be small-scale and temporary as the released sediment will settle quickly. Permanent habitat changes are limited to the immediate region of the foundations and cable intersections. Required cable crossings will be secured with rockfill, which is a permanent, non-native hard substrate. This will offer a new habitat for benthic organisms that thrive on a hard substrate and may lead to a change in the species composition. Significant effects on the factor Biotopes due to these small-scale habitat changes are not to be expected. Moreover, the risk of negative impact on the benthic sediment community due to species atypical for the area is low, as recruitment of the species is very likely to take place from the natural hard substrate habitats.

Permanent habitat changes are limited to the immediate area of the foundations and rockfills required for cable crossings and when laying cables on the seabed. These rockfills will permanently provide a hard, non-native substrate. This will offer a new habitat for benthic organisms and may lead to a change in the species composition. Significant effects on the factor Biotopes due to these small-scale regions are not to be expected. Moreover, the risk of negative impact on the benthic sediment community due to species atypical for the area is low, as recruitment of the species is very likely to take place from the natural hard substrate habitats.

Fish

There is a typical species composition for fish fauna in the region of the areas and sites, converter platforms and subsea cable routes. In all regions, the demersal fish community is dominated by flatfish, as is typical for the German Bight. According to current knowledge, the areas and sites are not a preferred habitat for any of the protected fish species. Consequently, fish stocks in the planning area are of no overriding ecological importance compared to adjacent marine areas. According to the current state of knowledge, the planned construction of wind farms and the associated converter platforms and subsea cable routes is not expected to significantly effect the factor Fish. The effects of the construction of wind farms, converter platforms and subsea cable systems on fish fauna are limited both spatially and temporally. Sediment turbulence and the formation of turbidity plumes during the construction phase for the foundations and converter platforms and the laying of the subsea cable systems may lead to small-scale and temporary impairments of fish fauna. The turbidity of the water is expected to decrease rapidly due to the prevailing sediment and flow conditions. Thus, according to the current state of knowledge, the impairments will remain small-scale and temporary. Overall, small-scale impairments can be assumed for adult fish. Moreover, the fish fauna is adapted to the natural sediment turbulence caused by storms that are typical here. During the construction phase, fish may also be temporarily scared away by noise and vibrations. Noises from the construction phase are to be reduced by means of suitable measures. Further local effects on fish fauna may be due to the additional hard substrates introduced owing to a possible change in the benthos. Likewise, sediment warming and the magnetic fields that could emanate from subsea cables are not expected to have any permanent effects on the mobile fish fauna.

Seabirds and resting birds

The individual areas for offshore wind energy in the North Sea EEZ are of differing significance to seabirds and resting birds. For breeding birds, the areas are of no particular importance due to the distance from the coast and the islands, with the breeding colonies as feeding grounds. Protected bird species listed in Annex I of the Birds Directive occur in varying numbers in the vicinity of the areas. All the information available so far indicates

medium importance of areas N-1, N-2 and N-3 for seabirds, including species listed in Annex I of the Birds Directive. Area N-4 is actually only of medium importance for most seabird and resting bird types; that said, in spring divers turn up in large numbers in the north-west of the area. Area N-4 is located in the southernmost part of the main springtime distribution area for divers in the German Bight and is therefore of generally high importance for seabirds and resting birds. The sub-sites of area N-5 demonstrate a high occurrence of seabird species, in particular protected species listed in Annex I of the Birds Directive, such as disturbance-sensitive divers. All three sub-sites of area N-5 are located in the main distribution area for divers in the German Bight and are therefore very important for seabirds (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, 2009). The area of areas N-6 to N-13 is outside the concentration centres for various bird species in Annex I of the Birds Directive, such as divers, terns, little gulls and common gulls.

Direct disturbances during the construction phase due to deterrence are only to be expected very locally and for a limited time. Significant effects can be excluded with a high degree of certainty due to the high mobility of birds. Wind turbines will cause permanent disturbance and deterrence among disturbance-sensitive species, such as red-throated divers and black-throated divers. New findings show large-scale prevention behaviour among divers with regard to existing wind farms in the North Sea EEZ. Knowledge of habituation effects, causes of prevention behaviour and physiological effects of habitat loss is not available as yet. Monitoring during the operating phase of offshore wind farms in the German EEZ has not yet been completed, especially in the areas of importance for divers.

The exclusionary effect of wind turbines and platforms in nature conservation areas means that habitat losses in important habitats are reduced.

Laying, construction-related and operational effects of the planned subsea cable systems on seabirds and resting birds can be excluded with the necessary certainty. A possible collision risk due to construction vehicles can be classified as very low due to the short-term nature of the construction phase.

Bats

Migration movements of bats across the North Sea are still scarcely documented and largely unexplored. There is a lack of specific information on migratory species, migration corridors, migration heights and migration concentrations. Information available to date confirms merely that bats, especially species that travel long distances, fly over the North Sea.

Dangers to individuals due to collisions with wind turbines and platforms cannot be ruled out. According to the current state of knowledge, there are no findings on possible substantial impairments of bat migration over the North Sea EEZ. It can also be expected that any negative effects on bats can be prevented by using the same prevention and mitigation measures devised to protect bird migration. Effects on bats due to the laying and operation of the planned subsea cable systems can be ruled out with certainty.

Air quality

The construction and operation of the platforms and the laying of subsea cable systems as part of the implementation of the Site Development Plan will have no measurable impact on air quality.

Biodiversity

Biodiversity involves the diversity of habitats and communities, the diversity of species and the genetic diversity within species (Art. 2 of the Convention on Biological Diversity, 1992). Public attention is focused on biodiversity.

With regard to the current state of biodiversity in the North Sea, there is a wealth of evidence of changes in biodiversity and species patterns at all systematic and trophic levels in the North Sea. These are mainly due to human activities, such as fishing and marine pollution, or to climate change. In this regard, Red Lists of endangered animal and plant species have an important control and warning function as they indicate the state of populations of species and biotopes in a region. Possible effects on biodiversity are discussed for the individual factors in the environmental report. In summary, it can be stated that according to current knowledge, the planned expansion of offshore wind energy and the corresponding grid connections are not expected to have any significant effects on biodiversity.

Interrelationships

In general, effects on a factor lead to various consequences and interrelationships between the factors. The essential interdependence of the biotic factors results from the food chains. Possible interactions during the construction phase will result from sediment shifts and turbidity plumes, as well as noise emissions. However, these interrelationships will occur only very briefly and be limited to a few days or weeks.

Construction-related interrelationships, e.g. due to introduction of hard substrate, will indeed be permanent but are only to be expected locally. This could lead to a small-scale change in the food supply.

Interrelationships can only be described very imprecisely due to the variability of the habitat. In principle, it can be stated that according to the current state of knowledge, no interrelationships are discernible that could endanger the marine environment.

Cumulative effects

Soil, benthos and biotopes

A significant proportion of environmental effects on the factors Soil, Benthos and Biotopes due to the areas and sites, platforms and subsea cable systems will take place solely during the construction period (formation of turbidity plumes, sediment shifts, etc.) and over a limited area. Cumulative environmental effects due to construction are unlikely, particularly due to the step-by-step implementation of the construction projects. Possible cumulative effects on the seabed, which could also have a direct impact on the factor Benthos and specially protected biotopes, result from permanent direct area use due to the foundations of the wind turbines and platforms, as well as from the installed cable systems. The individual effects are essentially small-scale and local.

In order to estimate the direct area use, a rough calculation is made on the basis of the areas and sites, platforms and subsea cable systems planned in the Site Development Plan in conjunction with existing installations and planning within the framework of the transitional system. The calculated area use is based on ecological aspects; in other words, the calculation is based on the direct ecological loss of function or the possible structural change of the site due to the installation of foundations and cable systems. In the area of the

cable trench, however, the impairment of the sediment and benthic organisms will essentially be temporary. Permanent impairment could be assumed when crossing particularly sensitive biotopes such as reefs or species-rich gravel, coarse sand and shell layers.

According to a model assumption, there will be a mostly temporary loss of function over a site of around 335 ha due to existing cables, cables in the transitional system and the subsea cable systems provided for in the Site Development Plan. The calculation is based on the assumption of a cable trench 1 m wide. The necessary intersections also have to be taken into account here. Based on an area per intersection of approx. 900 m², the direct area use for approx. 400 intersections amounts to a total of approx. 36 ha. In addition to this, a total of 0.96 ha of area used will be taken up by 16 converter platforms with associated scour protection (600 m² per platform). For the Site Development Plan rules in the areas, the parameters of scenario 2 of the model wind farm were used as a basis for a conservative estimate (number of installations calculated in accordance with the stated capacity, diameter of the foundation and diameter of any scour protection required, number of platforms). In contrast, the model wind farm parameters of scenario 1 were used to calculate area use within the framework of the transitional system, assuming that no installations in the dimension of scenario 2 will be implemented in the transitional system. The functional loss due to the cabling within the wind farm was calculated in accordance with the capacity shown, assuming a cable trench 1 m wide. On the basis of this conservative estimate, approx. 315 ha of land will be used for the areas and sites by means of the Site Development Plan rules, planning within the framework of the transitional system and the existing systems, or temporarily impaired in the case of the farm's internal cabling.

On the basis of a model assumption, the planning of the Site Development Plan and the transitional system as well as the actual inventory of wind turbines, subsea cables, rockfills and platforms mean that a total site of approx. 686 ha will be taken up or, in the case of subsea cables, will be temporarily impaired, corresponding to approx. 0.25‰ of the total EEZ site. The nature conservation sites account for a total area of around 27% of the North Sea EEZ. As construction of wind turbines and converter platforms is generally not permitted in nature conservation areas, use of the protected areas is limited to subsea cable routes and intersections, as well as the exceptional case of Butendiek. No statement can be made on the use of specially protected biotopes according to section 30 of the Federal Nature Conservation Act due to the absence of a sound scientific basis. Detailed area-wide sediment and biotope mapping of the EEZ currently being carried out will provide a more reliable basis for evaluation in the future.

Besides the direct use of the seabed and hence the habitat of the organisms living there, the foundations and intersections will lead to an additional supply of hard substrate. The benthic fauna adapted to soft substrates will also lose habitat on account of the hard substrate. However, as the area use for both the grid infrastructure and the wind farms will be in the ‰ (per-mille) range, according to current knowledge, no significant impairments are to be expected in the cumulation that would endanger the marine environment with regard to the seabed and the benthos.

Seabirds and resting birds

Vertical structures such as platforms or offshore wind turbines may have different effects on resting birds, such as habitat loss, an increased risk of collision or deterrence and barrier effects. These effects are considered specifically for each location and project within the scope of the EIA. For resting birds, habitat loss due to the construction of several structures may be particularly significant.

A cross-area assessment of the cumulative effects of offshore wind farms and platforms on seabirds and resting birds may be carried out on the basis of previous results and observations from offshore wind farm projects that have already been implemented. For example, findings from offshore wind farms in Denmark and Great Britain can be used to draw conclusions about changes in habitat use by seabirds.

In particular, vulnerable and disturbance-sensitive seabird species such as divers are to be taken into account with regard to cumulative effects due to the implementation of offshore wind farms and grid connection projects. GARTHE & HÜPPOP (2004) attest that divers are very sensitive to structures, as confirmed by the relevant results from the monitoring of construction and operation according to StUK. In view of the cumulative consideration of the hazard risk for divers, the effects of shipping traffic (and for the operation and maintenance of cables and platforms as well) must be included in addition to the structures themselves.

Possible effects must be assessed on a species-specific basis in order to assess the significance of cumulative effects in seabirds. In particular, species listed in Annex I of the Birds Directive, species of sub-area II of the nature conservation area "Sylt Outer Reef – Eastern German Bight" and species for which prevention behaviour with regard to structures has already been established (such as divers) are to be considered with regard to cumulative effects. This raises the question of biological limit values in terms of population and the relevant reference for a limit value of this kind. In the literature, it is proposed for resting birds that an intervention be considered inadmissible if 1% of the biogeographical population is affected by habitat loss. Reference is made to criteria of the 1971 Ramsar Convention on Wetlands of International Importance, according to which a resting area is of international importance if it accommodates at least 1% of the biogeographical population of a waterbird species at least once a year. (DIERSCHKE et al., 2003).

This 1% criterion can also be found in the classification of Important Bird Areas (IBA). An area is designated an IBA by Birdlife International if it is home to more than 1% of the biogeographical population. (HEATH AND EVANS, 2000). However, this 1% Ramsar Convention threshold cannot currently be transferred in terms of population biology for the assessment of the significance of interventions or disturbances (DIERSCHKE et al., 2003). Since the Ramsar Convention uses the 1% criterion to assess the significance of wetlands, the very different intentions mean that it does not appear technically and scientifically justifiable to apply this criterion to the assessment of an intervention. The functional significance of a planning area and its environs is decisive for the evaluation of possible effects on resting bird species. The reference value or the relevant reference population is therefore defined specifically for different species in cumulative considerations of effects.

Investigations at the offshore wind farms "alpha ventus", "Horns Rev I" and "Horn Rev II", "Nysted" and individual British wind farms provide indications of adverse effects due to habitat loss for disturbance-sensitive species. Research into other effects, in particular at population level, is still needed. Moreover, enrichment of the species inventory and thus the food resources for seabirds in the vicinity of offshore platforms can be determined and predicted. This firstly applies to the benthos due to the introduction of hard substrate, and secondly the factor Fish due to the enrichment of the benthos (FABI et al., 2004, LOKKEBORG et al., 2002).

A "main concentration area" of divers was identified and demarcated in the German North Sea EEZ on the basis of findings from environmental impact studies, research and monitoring. The "main concentration area" takes into account spring, the most important period for the species. In spring, this is home to 66% of the population of divers in the

German North Sea and 83% of the population in the North Sea EEZ, making it particularly important in terms of population biology. The demarcation of the main concentration area of divers is based on a data availability defined as very good and on technical analyses for which there is broad scientific acceptance. The area includes all regions in the German Bight with very high diver numbers and most of the areas with high diver numbers. For many years, the area has replaced the quantitative approach based on the 1% criterion with a qualitative approach in the assessment of cumulative effects on diver populations. Hence the main concentration area is to be used as a benchmark for cumulative assessment of diver habitat loss in such a way that no further offshore wind farms may be approved within this area (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, 2009).

The results from monitoring, as well as research projects, show that the prevention behaviour of divers in respect of wind farms is much more pronounced than was previously assumed (see chapter 4.6.1). Taking these new findings into account, cumulative effects on diver populations due to the implementation of further wind farm projects in the main distribution area cannot be excluded with the necessary certainty at this time.

Assessment of the implications

Assessment of the FFH compatibility of the planned cable routes and gates

Possible effects of subsea cables are usually limited to the laying phase and are therefore limited both temporally and spatially. Effects on the nature conservation areas in their component parts relevant to the conservation objectives or conservation objective are only to be expected if the cable routes run through or in the immediate vicinity of a protected area; according to the current state of knowledge, no remote effects are assumed. Therefore, following a detailed preliminary assessment for the FFH assessment of the implications, only cable routes that cross nature conservation areas or run in the immediate vicinity, e.g. directly parallel to the edge of nature conservation areas, are taken into consideration.

Considerable impairment of marine mammals can be ruled out, particularly due to the small size of the area and the short duration of the installation work. With regard to possible operational effects, such as sediment warming or magnetic fields, no significant effects are to be expected on the basis of the cable configurations and installation depths specified in the Site Development Plan and on the basis of the planning principle for sediment warming. Possible significant adverse effects on bird sanctuaries in their constituent parts significant to the conservation objective from the installation and operation of subsea cable systems should also be excluded. Short-term deterrence can only be expected in the case of disturbance-sensitive species during the installation phase and any necessary repairs to the cable systems. Cable laying and repair work usually only takes a few days and is only associated with noise and scare impacts typical for ships.

Occurrences of FFH habitat types "reefs" and "sandbanks" or other protected biotopes according to section 30 may be present on individual routes. If the site investigations or the specific approval procedure reveal the presence of particularly sensitive biotopes, efforts should be made to bypass these biotopes. Experiences from the approved projects "NordLink", "AC Connection Butendiek" or "SylWin1 and SylWin alpha" show that small-scale bypassing of reef occurrences, for example, is at least partially possible within the framework of fine routing in the individual approval procedure.

If it does not appear possible to bypass sensitive biotopes, considerable impairment of these biotopes cannot be ruled out at present. It is necessary in the specific individual procedure to check, on the basis of available data from the route surveys, whether there is significant

impairment. If new findings are available from route investigations, the routing will be adjusted accordingly when the Site Development Plan is updated.

In order to prevent impairing protected biotopes, an alternative assessment – where appropriate in the light of the principle of proportionality – has been carried out for all routes that make use of nature conservation areas and for which it is possible to bypass the protected area.

Measures to prevent, mitigate and offset significant negative effects of the Site Development Plan on the marine environment

The measures planned in order to prevent, mitigate and – as far as possible – offset significant negative environmental effects resulting from the implementation of the Site Development Plan are presented in accordance with the requirements of the SEA Directive.

Essentially, the rules of the Site Development Plan will prevent negative effects on the development of the state of the environment of the North Sea EEZ. If the plan were not implemented, the uses would develop without the space-saving and resource-conserving steering and coordination effect of the Site Development Plan.

In specific terms, the Site Development Plan defines spatial and textual rules which, according to the environmental protection objectives set out in chapter 1.4 of the environmental report, serve to prevent or mitigate significant negative effects in the marine environment due to implementation of the Site Development Plan. This essentially concerns textual rules in respect of space-saving planning, preventing the use of protected areas and legally protected biotopes in accordance with section 30 of the Federal Nature Conservation Act, noise mitigation, compliance with the 2K criterion, dismantling of structures and consideration of best environmental practice, as well as the relevant state of the art.

Mitigation and prevention measures are specified and ordered by the competent licensing authority at project level for the planning, construction and operation phases. With regard to the planned sites for wind turbines and platforms, this applies in particular to noise mitigation and noise prevention measures, as well as eco-friendly lighting during operation of the structures. Measures for prevention and mitigation of possible effects of subsea cable systems must be taken into account during the route planning and technical design stages. The Site Development Plan includes a planning principle relating to sediment warming so as to prevent considerable negative effects of cable warming on the benthos.