Fehmarnbelt Fixed Link

Screening Report for the Danish Natura 2000 sites

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FOREWORD

In connection to the Danish Ministry of Transports´ preparation of the draft construction act on the Fehmarnbelt Fixed Link project, relevant background documentation has been scrutinized.

As part of the background documentation, the overall Natura 2000 assessments include a pre-screening and a screening phase, which took place in 2011-2012, and which was subsequently documented in a Natura 2000 screening report: Fehmarnbelt Fixed Link – Screening Report for the Danish Natura 2000 sites (FeBEC, 2013c).

The scrutinizing has shown that, the above-mentioned screening report would benefit from an editorial review. The review has been carried out in order to make the appearance of the report clear and precise, taking all relevant results from the Danish EIA-process into consideration, and to ensure a status as a fully updated reference with regard to the Danish Natura 2000 reporting practice. It should be emphasized, that the editorial processing and update does not influence on any of the legal or technical statements and conclusions in the original report.

The present report: Fehmarnbelt Fixed Link - Screening Report for the Danish Natura 2000 sites (FEMO, 2015) has been prepared by the recently established FEMO consultancy consortium, which Femern A/S in October 2014 following an EU-tender procedure awarded a contract on environmental consultancy during coming project activities. The FEMO consortium is a Joint Venture between several German and Danish consultancy companies, which have also been involved as environmental consultants during project planning, e.g. dealing with baseline studies, environmental project impact assessments, and assessments related to Natura 2000 sites and strictly protected species. The company responsible for the original screening report is part of the FEMO consortium.

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1 Summary

Femern A/S is investigating the environmental impacts of the construction and operation of a fixed link across Fehmarnbelt. Assessment of the impact on the protected Natura 2000 sites in the area is of special importance to these investigations. According to the habitat directive the assessment in relation to designated sites in Denmark and Germany, whether designated under the Habitats or Birds directives, is conducted in three phases. First an initial selection, a pre-screening of Natura 2000 sites that should be covered by the assessments takes place (phase one). The approach and result of this selection is described in the present reporting.

Next, a screening of the potential impact on each designated site, to assess whether a "significant impact" on the conservation status of habitats and/or species that are reasons for designation of the site can be excluded (phase two). If such an impact cannot be excluded an appropriate Natura 2000 assessment of that site should be carried out (phase three).

This report describes the results of the screening (phase two) on eight designated Natura 2000 sites in Denmark. The screening covers assessment of possible significant impact for an immersed tunnel, a bored tunnel, and a bridge alternative. It should be emphasized that the term "significant" is used where the result of the screening shows that a significant impact cannot be excluded.

Section 3 and 4 of the report contain an introduction to the screening procedure and the method used to assess potential impacts. It further contains an introduction to the main pressures and potential impacts and an introduction to habitat types, which could be influenced by the project. The overall main negative impact concerns pressures related to sediment spill from construction work. In section 5 and 6 an overall description of the Natura 2000 sites included in the evaluation and a technical description of the different technical solutions for a fixed link are provided. The sites assessed in relation to different taxonomical groups and hydrography is described in detail in section 5.1.

Sections 7 to14 contain description, assessment and conclusions in relation to five sites of community importance (SCI, designated under the Habitats Directive), and three special protection areas (SPA, designated under the Birds Directive).

Finally, in section 15 overall conclusions from the screening are provided. From the conclusions, the following can be emphasized.

For six of the eight assessed Natura 2000 sites the conclusion from the screening is that an appropriate Natura 2000 assessment should not be conducted, as significant impact on any habitats and species that are reasons for designation of the sites can be excluded.

For the remaining two areas, "SCI 006X238 Hyllekrog-Rødsand et al" (Smålandsfarvandet North of ...) and "SPA DK 006X083 Coastal Zone Hyllekrog-Rødsand", the conclusion is however different, and the screening indicates that an appropriate Natura 2000 assessment should be conducted for an immersed tunnel and a bored tunnel alternative. The SPA DK 006X083 forms part of the SCI 006X238, hence the two areas are dealt with together. In Table 1.1, these conclusions are shown. Similar tables presenting the screening result regarding the other six areas are shown in the final conclusive section 13.

Table 1.1 SCI DK 006X238 Hyllekrog-Rødsand et al (Smålandsfarvandet north of Lolland, Guldborgsund, Bøtø Nor and Hyllekrog-Rødsand) and SPA DK 006X083 Coastal Zone Hyllekrog Rødsand. Summary of conclusions for bridge, bored and immersed tunnel alternatives from the screening. The table covers the likely impact on both a short term and a long-term basis. Explanation to the table: N-S = Not significant; S = Significant impact cannot be excluded; N-R = not relevant. The results in the table are further described in the text.

	Bridge alternative impacts in construction period	Immersed tunnel alternative impacts in construction period	Bored tunnel alternative impacts in construction period	Bridge alternative impacts in operation period	Immersed tunnel alternative impacts in operation period	Bored tunnel alternative impacts in operation period
1110 Sandbanks						
Marine biology	N-S	N-S	N-S	N-S	N-S	N-S
Fish species	N-S	N-S	N-S	N-S	N-S	N-S
1140 Mudflats						
Marine biology	N-S	N-S	N-S	N-S	N-S	N-S
Fish species	N-S	N-S	N-S	N-S	N-S	N-S
1150 Lagoons						
Marine biology	N-R	N-R	N-R	N-R	N-R	N-R
1160 Inlets and bays						
Marine biology	N-S	S	S	N-S	N-S	N-S
Fish species	N-S	N-S	N-S	N-S	N-S	N-S
1170 Reefs						
Marine biology	N-S	S	S	N-S	N-S	N-S
Fish species	N-S	N-S	N-S	N-S	N-S	N-S
1364 Grey seal						
Mammals	N-S	N-S	N-S	N-S	N-S	N-S
1365 Harbour seal						
Mammals	N-S	N-S	N-S	N-S	N-S	N-S
1351 Harbour porpoise						
Mammals	N-S	N-S	N-S	N-S	N-S	N-S
Bird species	N-S	S	S	N- S	N-S	N-S
Fish species	N-S	N-S	N-S	N-S	N-S	N-S

The assessment is divided into impact on short term and long-term basis. In the present screening, the term short term is understood as the construction phase. What is meant with short term and long term is further described in the screening.

For the **bridge** alternative, **no** potentially significant **short-term** impacts have been identified in the assessment for this specific site. For the **bored** and **immersed tunnel** alternatives, a significant impact **cannot be excluded** in the **short term** for a number of habitats and bird species. It is concluded for both the **bridge** and the **bored** and **immersed tunnel** alternatives that a significant impact **can be excluded** on the **long term**.

The main potential impact that cannot be excluded during the construction phase is caused by the sediment spill. The sediment spill temporarily increases the turbidity and hereby potentially reduces the growth of eelgrass and macroalgae.

The impacts on eelgrass and macroalgae caused by reduced light penetration (increased turbidity) have been modelled and assessed for the three alternatives. There are only very limited and short term flora biomass reductions caused by the **bridge** alternative. For the **immersed tunnel**, it has been predicted that the eelgrass biomass at the end of the growth

season in the first and second year of the tunnel constructions (2015 and 2016) could be reduced up to >50 % in small areas of the Rødsand Lagoon (part of N2000 site; Smålandsfarvandet…). In most areas, the reduction is 0 - 30 %. In the following growth seasons (2017-2019), the eelgrass biomass will recover. For the **bored tunnel** alternative there is a potential impact in 2015, with the highest reduction of eelgrass on 20 to 30 % compared to the reference situation. In 2020 the reduction of eelgrass is predicted to be 0 - 10 % compared to the reference situation. It is expected for both alternatives that full recovery will take place within two years after construction has ended. For macroalgae on reefs, the reduction is up to 30 %. Recovery will here take place within few years.

The **habitats** affected for both tunnel alternatives are 1160 Inlets and bays and 1170 Reefs, and for the **immersed tunnel** the following **bird species** that are included in the reasons for designation of the SPA DK 006X083 Coastal Zone Hyllekrog Rødsand: A036 Mute Swan (*Cygnus olor)*, A038 Whooper Swan (*Cygnus cygnus),* A068 Smew (*Mergus albellus)*, A191 Sandwich Tern (*Sterna sandvicensis)*, A193 Common Tern (*Sterna hirundo)*, A194 Arctic Tern (*Sterna paradisea)*, A195 Little Tern (*Sterna albifrons),* A039 Bean Goose (*Anser fabalis)*, A046 Brent Goose *(Branta bernicla)*, A067 Common Goldeneye (*Bucephala clangula)*, A125 Common Coot (*Fulica atra)*, and A214 Great Cormorant (*Phalacrocorax carbo*). For the **bored tunnel** alternative the affected bird species, that are included in reasons for designation are: A036 Mute Swan (*Cygnus olor*), A038 Whooper Swan (*Cygnus cygnus*), and A067 Common Goldeneye (*Bucephala clangula*).

Further bird species concerned are for the **immersed tunnel**: A069 Red-breasted Merganser (*Mergus serrator)*, A070 Goosander *(Mergus merganser),* A043 Greylag Goose *(Anser anser)*, A045 Barnacle Goose (*Branta leucopsis)*, A061 Tufted Duck (*Aythya fuligula)*, and A059 Common Pochard (*Aythya ferina*), These six bird species are included in the reasons for designation of other SPAs situated inside the larger Natura 2000 site 173 “Smålandsfarvandet North of Lolland…”. For the **bored tunnel** two additional species concerned are A061 Tufted Duck (Aythya fuligula) and A059 Common Pochard (Aythya ferina). They are likewise included in the reasons for designation of other SPAs situated inside the larger Natura 2000 site 173 “Smålandsfarvandet north of Lolland, Guldborgsund, Bøtø Nor and Hyllekrog-Rødsand”.

Based on the screening an appropriate Nature 2000 assessment shall be conducted for these two sites for the immersed tunnel alternative and for the bored tunnel alternative. The conclusion is further described in the text. It should be emphasized that for priority habitats or priority species listed in the annexes of the Habitats Directive and with occurrence in the assessed sites, the screening has not identified impacts that are likely to be significant.

2 Danish summary

Femern A/S er ansvarlig for en vurdering af de miljømæssige påvirkninger ved etablering og drift af en fast forbindelse over Femern Bælt. Vurdering af konsekvenserne af påvirkningerne for de udpegede Natura 2000 områder er af særlig betydning i denne forbindelse. Vurderingen i relation til de udpegede områder gennemføres i tre faser, uanset om udpegningen er sket under Habitat- eller Fuglebeskyttelsesdirektivet. Først gennemføres en afgrænsning af de Natura 2000 områder, der omfattes af vurderingerne (første fase). Den metodiske tilgang til dette og resultatet er beskrevet i nærværende rapport.

Herefter følger anden fase af Natura 2000 vurderingen, som omfatter en vurdering af, hvorvidt et givet Natura 2000 område skal underkastes en nærmere vurdering – en egentlig Natura 2000 konsekvensanalyse. I anden fase underkastes påvirkningerne af hvert område en analyse. Formålet er at vurdere, hvorvidt en væsentlig påvirkning af bevaringsstatus for habitater eller arter, der er årsag til, at området er udpeget, kan udelukkes. Hvis en væsentlig påvirkning ikke kan udelukkes, følger en tredje fase, der omfatter en egentlig Natura 2000 konsekvensvurdering for det pågældende beskyttelsesområde.

Rapporten beskriver resultatet af en foreløbig vurdering (anden fase) af otte udpegede Natura 2000 områder i Danmark, der vurderes potentielt at kunne blive påvirket af forbindelsen. Rapporten dækker vurdering af en væsentlig påvirkning i forhold til såvel en sænketunnel, en boret tunnel og en broløsning. Det skal understreges, at betegnelsen ”væsentlig” alene anvendes, hvor resultatet af den foreløbige vurdering viser, at det ikke kan udelukkes, at virkningen ville kunne føre til en skade på det pågældende Natura 2000 områdes bevaringsstatus.

Kapitel 3 og 4 i rapporten beskriver den metodiske tilgang til vurdering af påvirkningerne. Kapitel 5 og 6 indeholder en beskrivelse af beskyttelsesområderne og en teknisk beskrivelse af de forskellige tekniske løsninger for den faste forbindelse. De relevante Natura 2000 områder, der indgår i den foreløbige vurdering, er beskrevet i detaljer i afsnit 5.1.

Kapitel 7 beskriver de væsentligste potentielle påvirkninger fra den faste forbindelse, der indgår i den foreløbige vurdering. Der er ligeledes indeholdt en introduktion til naturtyperne, der kan blive påvirket af projektets gennemførelse. Den væsentligste negative potentielle påvirkning for naturtyperne vedrører sedimentspild fra anlægsfasen.

Kapitel 8 til 15 indeholder beskrivelser, vurdering og konklusioner i relation til 5 områder udpeget under Habitatdirektivet og 3 områder udpeget under Fuglebeskyttelsesdirektivet.

Endelig er konklusionerne fra den foreløbige vurdering beskrevet i kapitel 16. Fra disse konklusioner kan følgende fremhæves.

For 6 af de 8 nævnte internationale beskyttelsesområder er konklusionen fra den foreløbige vurdering, at en Natura 2000 konsekvensvurdering ikke skal gennemføres. Det er for alle udpegede naturtyper og arter, der indgår i udpegningsgrundlaget for disse områder, vurderet, at en væsentlig påvirkning kan udelukkes.

For de resterende to områder, SCI 006X238 Hyllekrog-Rødsand m.m. (Smålandsfarvandet nord for Lolland, Guldborg Sund, Bøtø Nor og Hyllekrog-Rødsand) og SPA DK 006X083 Kystzonen Hyllekrog-Rødsand, er konklusionen derimod, at en konsekvensvurdering skal gennemføres for en sænketunnel og en boret tunnel. De to områder har en overlappende afgrænsning, og behandles under ét. I nedenstående tabel 2.1 er konklusionerne sammenfattet. Tilsvarende tabeller i afsnit 1 viser konklusioner af screeningen for de øvrige seks områder.

Table 2.1 SCI DK 006X238 Hyllekrog-Rødsand m.m. (Smålandsfarvandet nord for Lolland, Guldborg Sund, Bøtø Nor og Hyllekrog-Rødsand) og SPA DK 006X083 Kystzonen Hyllekrog Rødsand. Tabellen summerer resultaterne af den foreløbige vurdering for bro- og tunnelløsningerne. Tabellen dækker den sandsynlige påvirkning i anlægs- og driftsfasen. Forklaring til tabellen: N-S = ikke signifikant, S = signifikant påvirkning kan ikke udelukkes, N-R = ikke relevant. Angivelser i tabellen er yderligere beskrevet i teksten.

	Broløsning påvirkninger i anlægsfasen	Sænke tunnel-løsning påvirkninger i anlægsfasen	Boret tunnel løsning påvirkninger i anlægs-fasen	Broløsning påvirknin-ger i driftsfasen	Sænke tunnel-løsning påvirkninger i driftsfasen	Boret tunnel løsning påvirkninger i driftsfasen
1110 Sandbanker						
Marinbiologi	N-S	N-S	N-S	N-S	N-S	N-S
Fisk	N-S	N-S	N-S	N-S	N-S	N-S
1140 Mudderf.						
Marinbiologi	N-S	N-S	N-S	N-S	N-S	N-S
Fisk	N-S	N-S	N-S	N-S	N-S	N-S
1150 Kystlaguner						
Marinbiologi	N-R	N-R	N-R	N-R	N-R	N-R
1160 Lavvandede bugter og vige						
Marinbiologi	N-S	S	S	N-S	N-S	N-S
Fisk	N-S	N-S	N-S	N-S	N-S	N-S
1170 Rev						
Marinbiologi	N-S	S	S	N-S	N-S	N-S
Fisk	N-S	N-S	N-S	N-S	N-S	N-S
1364 Gråsæl						
Pattedyr	N-S	N-S	N-S	N-S	N-S	N-S
1365 Spættet sæl						
Pattedyr	N-S	N-S	N-S	N-S	N-S	N-S
1351 Marsvin						
Pattedyr	N-S	N-S	N-S	N-S	N-S	N-S
Fugle	N-S	S	S	N-S	N-S	N-S
Fisk	N-S	N-S	N-S	N-S	N-S	N-S

Konklusionerne vedrørende påvirkning er opdelt i påvirkninger i anlægs- og driftsfasen. I rapporten er anlægsfasen visse steder beskrevet som ”kort sigt” og driftsfasen ”langt sigt”. Hvordan anlægs- og driftsfasen er afgrænset tidsmæssigt er yderligere beskrevet i rapporten.

For broløsningen er der ikke fundet væsentlige påvirkninger for området i anlægsfasen. For sænketunnelløsningen og den borede tunnel kan væsentlige påvirkninger for flere habitater og arter i anlægsfasen ikke udelukkes. Det konkluderes derimod for både bro- og tunnelløsningerne, at en væsentlig påvirkning i driftsfasen kan udelukkes.

Det skal understreges, at den væsentligste miljøpåvirkning fra projektets gennemførelse er sediment spild. Spildet reducerer vandets klarhed og kan reducere vækst af ålegræs og alger.

Påvirkningen af ålegræs og makroalger pga. reduktionen af lys fra sedimentspild er blevet modelberegnet og vurderet for de tre alternativer. Der er kun vurderet meget begrænset og midlertidig reduktion i floraens biomasse ved broalternativet. For sænketunnelen er det vurderet, at biomassen af ålegræs ved slutningen af vækstsæsonen i det første og andet år af anlægsfasen (2015 og 2016) kan være reduceret med op til 50 % i Rødsand Lagunen (del af Natura 2000 området: Smålandsfarvandet…). I de fleste delområder er reduktionen 0-30 %. I de

følgende vækstsæsoner (2017-2019) vil ålegræsset retableres. For den borede tunnel vil der være en påvirkning i 2015 med en reduktion af ålegræsset på 20-30 % i forhold til referencesituationen. I 2020 er reduktionen af ålegræs beregnet til at være 0 - 10 % sammenlignet med referencesituationen. For begge alternativer er det vurderet at fuld retablering vil ske indenfor 2 år efter anlægsfasen er afsluttet. For makroalger på naturtypen rev, vil reduktionen være op til 30 %. Der vil ligeledes her ske regenerering inden for få år.

De berørte habitater er for begge tunnelløsninger 1160 Større lavvandede bugter og vige og 1170 Rev. Desuden berøres følgende fuglearter, der indgår i udpegningsgrundlaget for SPA DK 006X083 Kystzonen Hyllekrog Rødsand ved sænketunnelløsningen: A036 Knopsvane (Cygnus olor), A038 Sangsvane (Cygnus cygnus), A068 Lille Skallesluger (Mergus albellus), A191 Splitterne (Sterna sandvicensis), A193 Fjordterne (Sterna hirundo), A194 Havterne (Sterna paradisaea), A195 Dværgterne (Sterna albifrons), A039 Sædgås (Anser fabalis), A046 Knortegås (Branta bernicla), A067 Hvinand (Bucephala clangula), A125 Blishøne (Fulica atra) og A214 Skarv (Phalacrocorax carbo). Det gælder endvidere A069 Toppet Skallesluger (Mergus serrator), A070 Stor Skallesluger (Mergus merganser), A043 Grågås (Anser anser), A045 Bramgås (Branta leucopsis), A061 Troldand (Aythya fuligula) og A059 Taffeland (Aythya ferina). Disse sidstnævnte seks fuglearter indgår i udpegningsgrundlaget for andre fuglebeskyttelsesområder, der er udpeget inden for det større Natura 2000 område 173, ”Smålandsfarvandet nord for Lolland… ”.

For boret tunnel løsningen berøres tilsvarende følgende fuglearter, der indgår i udpegningsgrundlaget for SPA DK 006X083 Kystzonen Hyllekrog Rødsand: A036 Knopsvane (Cygnus olor), A038 Sangsvane (Cygnus cygnus), og A067 Hvinand (Bucephala clangula). Det gælder endvidere A061 Troldand (Aythya fuligula) og A059 Taffeland (Aythya ferina). Disse sidstnævnte to fuglearter indgår i udpegningsgrundlaget for andre fuglebeskyttelsesområder, der er udpeget inden for det større Natura 2000 område 173, ”Smålandsfarvandet nord for Lolland, Guldborgsund, Bøtø Nor og Hyllekrog-Rødsand”.

På baggrund af den foreløbige vurdering konkluderes det derfor, at en Natura 2000 konsekvensvurdering skal gennemføres for sænke-tunnelløsningen og for den borede tunnel løsning for de to nævnte områder. Det skal bemærkes, at der ikke ved den foreløbige vurdering er fundet en sandsynlig, væsentligt negativ påvirkning af nogen prioriterede naturtyper eller arter fra habitatdirektivets lister, dvs. naturtyper eller arter for hvilke medlemslandene har et særligt stort beskyttelsesansvar.

3 Introduction

Natura 2000 is a network of protected areas designated under the Habitats and Birds Directives. The aim of the network is to ensure favourable conservation status for the habitats and species that are reasons for designation of the site. Areas designated under the Habitats Directive are SACs (Special Areas of Conservation) and areas under the Birds Directive Special Protection Areas (SPA's). The procedure for designation of sites are somewhat different between the directives and before final designation, the SACs are named SCIs (Sites of Community Importance).

In accordance with Article 6 in the directives an objective screening of the likely effects on Natura 2000 areas must be carried out before a project can be approved, Table 3.1.

Table 3.1 The text in the Article 6(3) of the EU Habitat Directive.

Article 6(3)
Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives. In the light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public.

Helpful and very important for the assessment is guidance from the European Commission in the form of "*Managing Natura 2000 sites. The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC,* Luxemburg: European Communities" (EU, 2000) and "Assessment of plans and projects significantly affecting Natura 2000 sites" (EU, 2001). The guidance has been followed strictly in the present report.

The directives has been implemented in Danish law and is administered through the departmental order "Bekendtgørelse om udpegning og administration af internationale naturbeskyttelsesområder samt beskyttelse af visse arter (Order no. 408 of 01/05/2007 on "Designation and administration of internationally designated protection areas and protection of selected species").

Assessment of the possible impact on Natura 2000 sites from the construction, structure and operation of a fixed link across Fehmarnbelt is of special importance for the overall assessment of the project. In accordance with the mentioned EU guidance and Danish legislation, the Natura 2000 assessment is divided into (a) an introductory screening of all Natura 2000 sites where potentially the project could have a significant impact, and (b) a subsequent thorough appropriate assessment of the conservation areas where the screening cannot exclude significant impacts. According to the application of the precautionary principle in the directive, which requires that the conservative objectives of Natura 2000 should prevail where there is an uncertainty, the emphasis for the assessment in the screening process should be on objectively demonstrating, with supporting evidence, that there will be no significant effects on Natura 2000 sites. If impacts arising from the project are considered potentially significant, an appropriate assessment must be prepared subsequent to the screening.

The screening will assess information on the project and its potential pressures, as well as information on relevant Natura 2000 sites to ascertain, whether it is likely that there will be potential significant effects. The decision-making approach underpinning this screening assessment is also recognizing the application of the precautionary principle in proportion to the

project and Natura 2000 site in question. This means that when not only a potential significant impact has been assessed, but also where there is not enough information to rule out any significant effect, it will be concluded that an appropriate assessment should be undertaken.

The screening is based on a “pre-screening” from 2011/2012 where the selection of Natura 2000 sites that should be included in the screening was done. Here the Natura 2000 areas that could potentially be affected by the project and which therefore have to be considered in the first Natura 2000 assessment step, a Natura 2000 screening, were selected.

The delimitation or exclusion of Natura 2000, which is not considered in the presented screening process here, takes into account all relevant pressures that arises from project construction and operation. Precautionary assumptions regarding range, intensity and duration of all relevant pressures from all considered project alternatives have been used to conclude, if impacts are possible on Natura 2000 areas and on area specific conservation objectives. Natura 2000 areas are not considered for a screening-process, if recognizable pressures do not reach the Natura 2000 area under consideration, or if theoretically based direct and indirect pressures, considering the sensitivity and natural dynamics of the a Natura 2000 area, objectively excludes any likely effects.

The results of the pre-screening has been part of the EIA process and associated public hearing, and has as part of this process specifically been checked against all relevant updated knowledge and results from the environmental investigations and assessments made in the EIA concerning potential project pressures and potentially affected receptors relevant for the Natura 2000 areas of concern. The conclusions regarding the pre-screening has thus been verified in the EIA (Femern A/S, 2013)

The criteria used for this preselection have later been checked with the latest information used in relation to the Environmental Impact Assessment (EIA) reporting The information obtained in the EIA has neither given rise to indications on additional sites that should be considered for the screening, nor has it indicated that the conclusions in the screening report should be revised.

This report presents the results of the screening including descriptions of potential impact on all habitats and species that form designation basis for the relevant Natura 2000 sites. The detailed distribution of habitats and species inside the designated Natura 2000 sites is shown and described in the following sections

4 Methods

The methodology used for the assessment of the Femern Belt project which may give rise to significant effects upon Natura 2000 sites follows the EU guideline for assessment required under Article 6(3) and (4) of the habitat directive (EU, 2001),

Based on the technical description of the project elements and pressures likely to affect selected Natura 2000, sites are described and evaluated, whether the impact are likely to significantly affecting the integrity of the Natura 2000 site.

The screening report takes departure in the interim screening process covering all potentially affected Natura 2000 sites from all three considered technical fixed link solutions – an immersed tunnel, a cable stayed bridge and a bored tunnel.

The screening methodology and terminology are shown in Figure 4.1.

Figure 4.1 General stepwise methodology used in the screening process.

4.1 Definition of boundaries

The SCIs and SPAs in the Natura 2000 network in the region around the planned Fehmarn Fixed Link are shown in Figure 4.2 and Figure 4.3.

The defined boundaries for the potentially affected Natura 2000 sites designated under the Habitats and Birds Directives in the Danish EEZ around the planned Fehmarnbelt Fixed Link covered in this assessment are shown in Table 4.1 and Figure 4.4.

Table 4.1 Table listing the Natura 2000 sites covered by the screening. It consists of 5 SCIs and 3 SPAs inside 5 Natura 2000 areas in DK.

Natura 2000 site	SCI code	SPA code
173 Smålandsfarvandet north of Lolland, Guldborg Sund, Bøtø Nor and Hyllekrog-Rødsand.	SCI DK006X238	SPA DK 006X083
177 Maribosøerne	SCI DK 006X87	SPA DK 006X87
179 Nakskov Fjord and inderfjord	SCI DK 006X242	SPA DK 006X88
251 Femern Belt	SCI DK 00VA260	---
126 Reef Southeast of Langeland	SCI DK 00VA200	---

The boundaries are in general terms defined according to a combined consideration of the potential pressures from the project and the distance to the Natura 2000 sites, taking the conservation objectives into consideration.

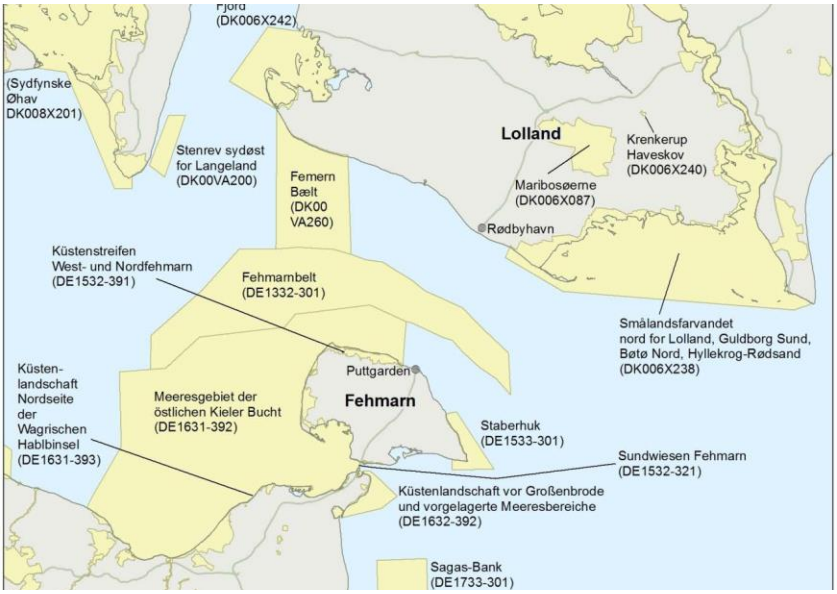

Figure 4.2 German and Danish SCIs in the region around the planned Fehmarnbelt Fixed Link.

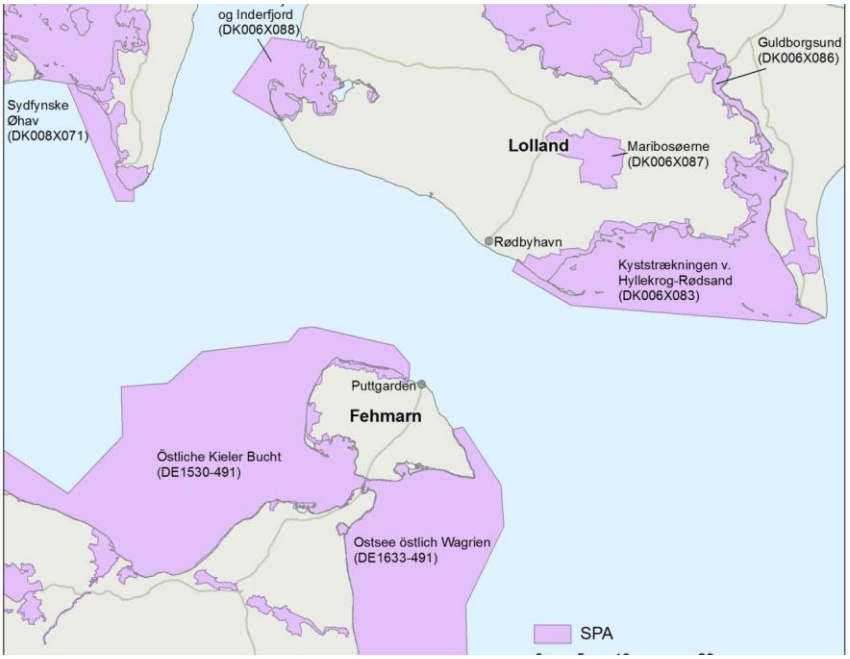

Figure 4.3 German and Danish SPAs in the region around the planned Fehmarnbelt Fixed Link.

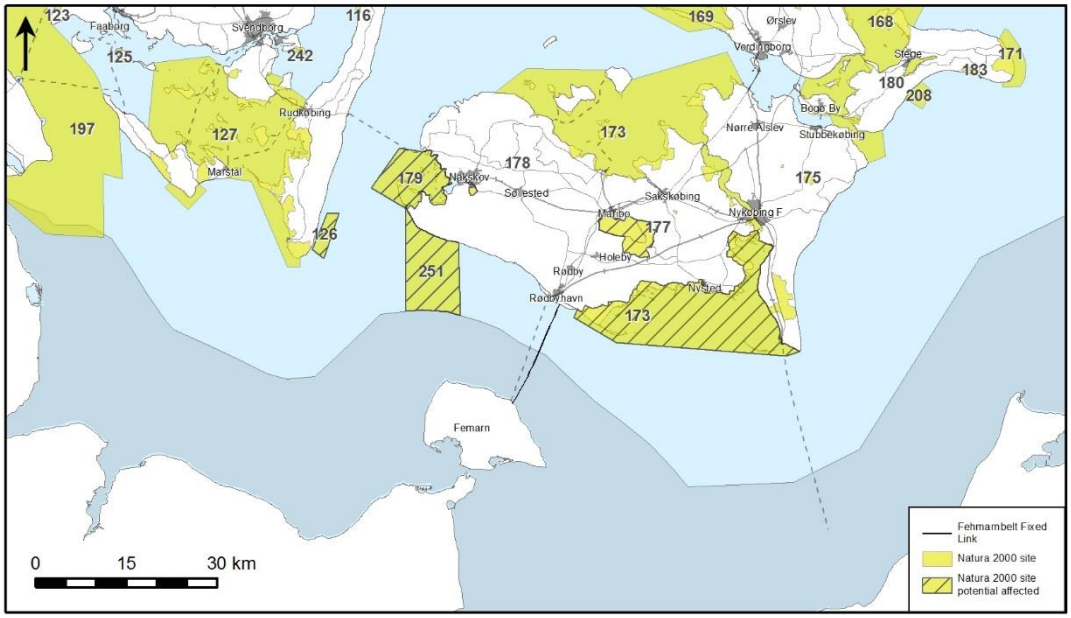

Figure 4.4 Natura 20000 sites potentially affected of the Fehmernbelt Fixed Link.

Before the final selection of sites potential affected, which are included in the present screening, the Danish Natura 2000 sites in the region of the Femern Belt were considered for inclusion in the screening, Figure 4.4. For several sites (in Figure 4.4 shown as not potential affected) a significant impact could be excluded on any habitats or species that are reasons for designation of the sites in question due to the potential range, intensity and duration of any project pressures. The main pressures resulting from sediment spillage from construction work was modelled and assessed for the pre-screening, which showed no noticeable or measurable sedimentation in any of the Natura 2000 sites not potential affected, at the end of construction work.

However, during the EIA process, further considerations were needed to verify the pre-screening for one specific Natura 2000 site: No. 197 ”Flensborg Fjord, Bredgrund og farvandet omkring Als” – concerning the pressures from the modelled sediment spill, see section 7.1.

The relevant standard data form for the Natura 2000 site 197 includes code 1110 “Sandbanks which are slightly covered by sea water all the time”, code 1170 "Reefs”, code 1351 Harbour porpoise (*Phocoena phocoena*) (Naturstyrelsen, 2011) and the resting birds Tufted Duck (*Aythya fuligula*), Common Goldeneye (*Bucephala clangula*), Greater Scaup (*Aythya marila*) and Red-breasted Merganser (*Mergus serrator*) (Naturstyrelsen, 2011).

The modelling shoved, that small amounts - less than 0.50 mm in total for the majority of the area and maximum 0.75 mm - of fine-grained sediment during the construction of the Femernbelt Fixed Link could deposit inside the Natura 2000 site. The natural sedimentation is much larger, and the additional sedimentation from the project would be so comparable small and amount of approximately 7 % of the natural deposit rate of minimum 1.6 mm per year in the southern Lillebælt (Lundqvist, et al., 2003). The potential contribution of fines from project works, which are similar to materials naturally transported and depositing in the western Baltic basin will not be detectable and lie far within the natural variation in the area. Any significant effects on the ecosystem can be excluded. Furthermore, the main deposition will be in deeper waters outside the registered habitat types within the Natura 2000 site and the deposit will not affect neither the resting birds nor the integrity of the habitats or the Natura 2000 site.

The conclusion drawn in the pre-screening was therefore verified, that it could be rejected that there could be a significant impact on habitats and species reasoned for designation of the Natura 2000 site.

4.2 Sources used

For the evaluation of the potential impacts on Natura 2000 sites, environmental impact assessments of potential project impacts on hydrography, marine biology, fish species, birds and mammals have been taken into account. A potential impact on habitat integrity is regarded as an impact on the flora, fauna and physical conditions for which the habitats are defined.

Therefore, inputs from working groups on marine biology (benthic flora and fauna), hydrography, fish ecology, birds, and mammals (table 4.1) has been a substantial basis for the screening of likely potential effects on Natura 2000 sites.

Table 4.2 Description of the coverage/content of specific background screening reports in relation to Natura 2000 sites in Denmark. X means that the report is covering the specific site, (X) means that the report is covering the Bird Protection Area (SPA) and thereby the coinciding Habitat Site of Community Importance (SCI) or the opposite.

Area/file	Marine mammals	Birds	Fish	Marine biology Hydrographic services
SCI DK 006X238 Smålandsfarvandet North Of Lo lland, Guldborg Sund, Bøtø Nord and Hyllekrog-Rødsand	X	(X)	X	X
SCI DK 006X238 Maribo Lakes		(X)	X	
SCI DK 00VA200 Stone reef Southeast of Langeland	X		X	X
SCI DK 00VA260 Fehmarn Belt	X		X	X
SCI DK 006X242 Nakskov Fjord	X	(X)	X	X
SPA DK 006X088 Nakskov Fjord and Inner Fjord	(X)	X	X	(X)
SPA DK 006X087 Maribo Lakes		X	X	
SPA DK 006X083 Coastal Zone Hyllekrog-Rødsand	(X)	X	X	(X)

Standard data forms for the relevant Natura 2000 sites were obtained from existing Natura 2000 management plans (Naturstyrelsen, 2014).

4.3 Fehmarn investigations forming basis for the assessment

The screening assessment is based on the comprehensive information provided during the baseline investigations on hydrography, benthic flora and fauna, marine mammals, birds and fish ecology and the pressures identified for the impact assessment from the Fehmarn project. The assessment is made for both the bridge, the immersed tunnel and the bored tunnel alternative. The main baseline studies have been carried out during 2008-2010 while the impact assessments have been made during 2010-2013. The results from the impact assessments have where relevant been used for revision of the present screening report and to confirm the conclusions in the report.

4.3.1 Hydrography

The screening is in relation to hydrography and water quality based on the results of the spill modelling and subsequent ecological modelling. The modelled scenarios represent potential effects from the construction and operation all three mentioned alternatives of the Fehmarnbelt fixed link.

The earth handling budgets have been interpreted into time series of spill based on the actual geological conditions, construction work, and dredging methods in such a way that the spill at all times consists of the actual material found at the location and depth where the construction activities take place. The report is therefore based on a description of the spill scenario (location, timing, intensity) and key results from the spill simulation as well as from the ecological modelling (FEHY, 2013). The screening of the indirect impact from the pressure from changed coastal morphology is based on information on hydrography.

4.3.2 Marine biology

The main basis for the screening is the described sediment spill modelling combined with community maps for the vegetation and for the benthic fauna and habitat mapping (FEMA, 2013b). The community and habitat maps have been developed in connection to the baseline descriptions for the Fehmarnbelt project conducted in 2009-2010. Impacts on the benthic vegetation from suspended sediment are based on dynamic ecological modelling (FEMA, 2013d). The information derived from this is assessed and compared with expected impact on conservation status for habitats included in reasons for designation for Natura 2000 sites, where there might be a possible impact in relation to the Fehmarn project.

4.3.3 Fish species

For fish species, the screening covers five species from Annex II of the Habitats Directive, which are included in the reasons for designation of Nature 2000 sites covered by the present screening. The majority of species on Annex II are anadromous species spawning in freshwater rivers and lakes, and which because of their occurrence in sea water during part of their life cycle may be impacted by construction activities and operation of the fixed link, (FeBEC, 2013b).

Annex II fish species

The relevant protected Annex 2 species of potential occurrence in the Fehmarnbelt area, listed in table 4.2, are mainly anadromous species (i.e., migrating from marine environments to freshwater to spawn). Only one strict freshwater species listed, the Spined Loach (*Cobitis taenia*), has a known distribution close to the alignment corridor.

Table 4.3 Protected Annex II species of potential relevance for the Fehmarnbelt area. FB: Fehmarnbelt, WB Western Baltic, MB: Mecklenburg Bight, KB: Kiel Bight, GB: Great Belt. Possible occurrence in Fehmarnbelt is marked with - no known or supposed occurrence, (-) no likely occurrence, (+) likely occurrence, + known occurrence after (FeBEC, 2013b).

Common name	Scientific name	FB	Nearby Findings	Possible impacted life stages
Sturgeon	*Acipenser sturio*	–	Considered extinct in DK and DE	Adults
North Sea houting	*Coregonus oxyrinchus*	-	Marine stocks may be extinct	
Allis shad	*Alosa alosa*	(-)	WB, Guldborg Sound (1990) single specimen	Adults
Twaite shad	*Alosa fallax*	+	MB (2004), single specimen FB (2008) 2 specimen FB(2004) 1 specimen	Adults
River lamprey	*Lampetra fluviatilis*	+	WB (1980, 1997) single specimens. A spawning site is known near Lübeck GB (1999) single specimen FB (2004 and 2003) 2 specimen and 10 specimens registered during baseline investigations (2009)	Adults
Sea lamprey	*Petromyzon marinus*	(-)	WB (1989) single specimen KB (after 2000) single specimen Lübeck (after 2000) single specimens FB (2008) single specimens	Adults
European brook lamprey	*Lampetra planeri*	–		Adults
Atlantic salmon	*Salmo salar*	+	Only protected in freshwater.	Adults
North sea houting	*Coregonus oxyrinchus*	-	Very restricted distribution in DK/DE. Marine stocks may be extinct	Adults
Spined loach	*Cobitis taenia*	-	Maribo lakes	Adults
Asp	*Aspius aspius*	-	Not found in DK	Adults
Bullhead	*Cottus gobio*	-	Considered extinct in DK	Adults
Weatherfish	*Misgurnus fossilis*	-	Very restricted distribution in DK	Adults
White-finned gudgeon	*Gobio albipinnatus*	-	Distribution in East-Central and Eastern Europe	Adults
Bitterling	*Rhodeus amarus*	-	No actual populations in DK	Adults
Sichel	*Pelecus cultratus*	(+)	Very rare visitor in DK	Adults

Baseline investigations carried out in the Fehmarnbelt mainly during 2009 and 2010 (FeBEC, 2013a). Some of the investigations, concerning migration of eel, were initiated already in autumn 2008 as described in Table 4.4. It is assessed that the information from these investigations is adequate and sufficient to draw conclusions on the impact on fish populations from the different alternatives of the Fehmern project. It should be underlined that the mentioned investigations were very thorough and detailed.

Table 4.4 Investigations on fish communities carried out in the Fehmarnbelt during 2008-2010.

Part/content of investigation	Duration	Effort
Migration	Two years	- monthly surveys in the alignment corridor - periodic surveys in all of Fehmarnbelt
Eel	Two years	- seasonal surveys, tagging experiments
Fish communities	One year	- monthly surveys in the shallow waters of Lolland and Fehmarn at 59 stations - monthly surveys in central parts of Fehmarnbelt at 4 stations
Eggs & larvae	Two years	- 6 surveys in autumn and spring at 54 stations - specific seasonal investigations
Spawning herring	Two years	- surveys in spring and autumn at 120 stations and 200 transects (Video / Diving)

4.3.4 Birds

The screening report describes the evaluation of the potential impact on relevant bird species (FEBI, 2013a). Especially for birds, a high number of species are reasons for designation of the SPA areas.

Birdlife is described and is depicted cartographically on a local scale, covering the alignment corridor, and on a regional scale based on investigations and data shown in Table 4.5 and Figure 4.5.

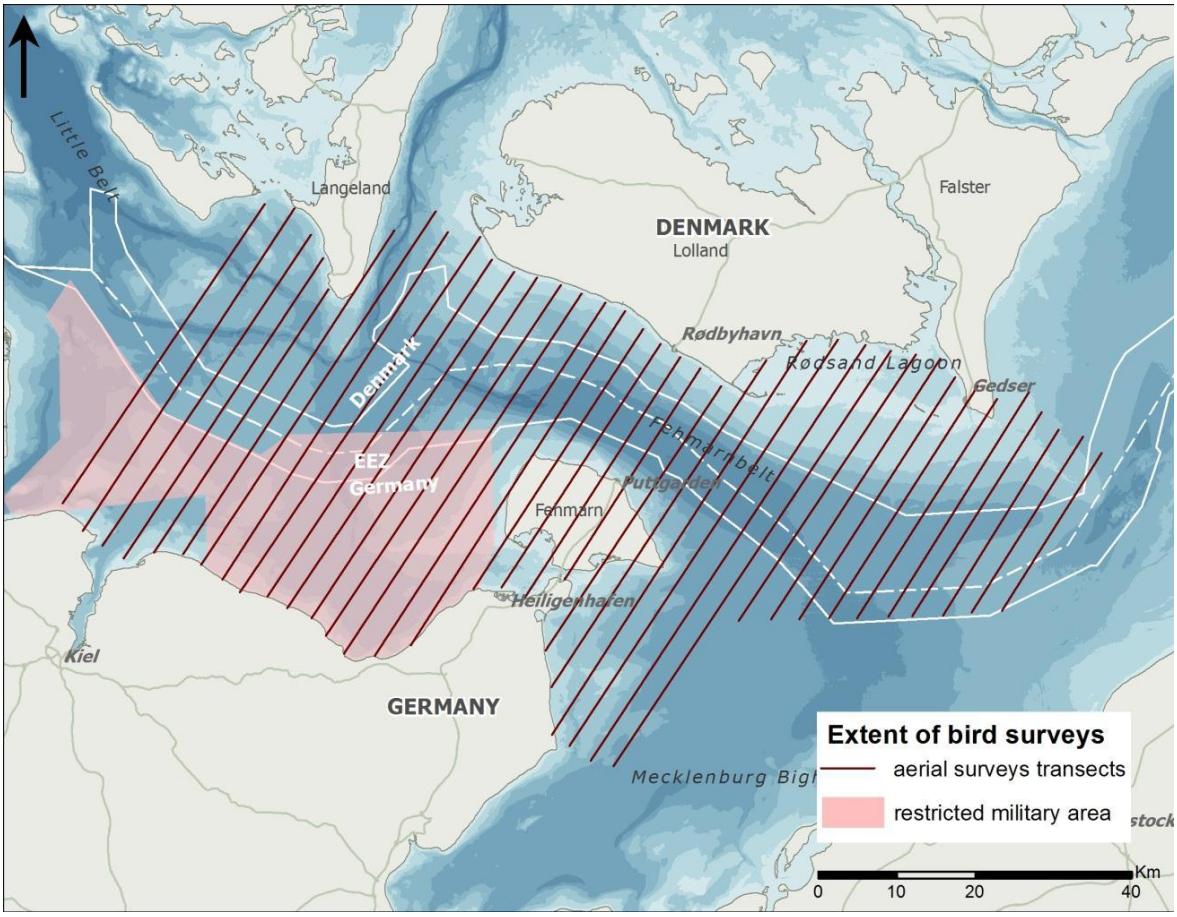

Figure 4.5 Area covered by aerial bird surveys in the Fehmarnbelt area during baseline investigations (FEBI, 2013a).

Table 4.5 Baseline investigations and data used in the baseline descrption of birds in the Fehmarn Belt area.

Investigations
Abundance, distribution and trends (from historical data) of birds in the approach and ramp areas and the surroundings on Fehmarn and Lolland, as well as waterbirds and seabirds in the Fehmarnbelt area;
Feeding grounds for seabirds and waterbirds in the marine area;
Local flight patterns of land birds, seabirds and waterbirds; and
Migration of land birds, seabirds and waterbirds
Data
Data from surveys on land bird breeding numbers in the ramp area
Data from monthly aerial and ship-based surveys of non-breeding birds along transects;
Data from waterbird population density assessments
Data about bird migration from studies using radar and visual observation as well as acoustic surveys
Radio, satellite and GPS telemetric data about the foraging patterns and local movements of specific waterbird species;
Analysis of ringing data regarding bird species originating from populations in the Fehmarnbelt
Other historical data from monitoring and scientific studies which have been carried out in Denmark, Germany and Baltic Sea countries and which contain information necessary for abundance analysis and for ascertaining population trends

4.3.5 Mammals

The screening report describes the evaluation of the potential impact on Harbour Porpoise *(Phocoena phocoena*) and seals – Harbour Seal (*Phoca vitulina*) and Grey Seal (*Halichoerus grypus*) are the only conservation objects included in the designation reasons for Natura 2000 sites in Denmark.

For the Harbour Porpoise, baseline investigations on the abundance, distribution and habitat use in the construction area and in the Fehmarn Belt were undertaken.

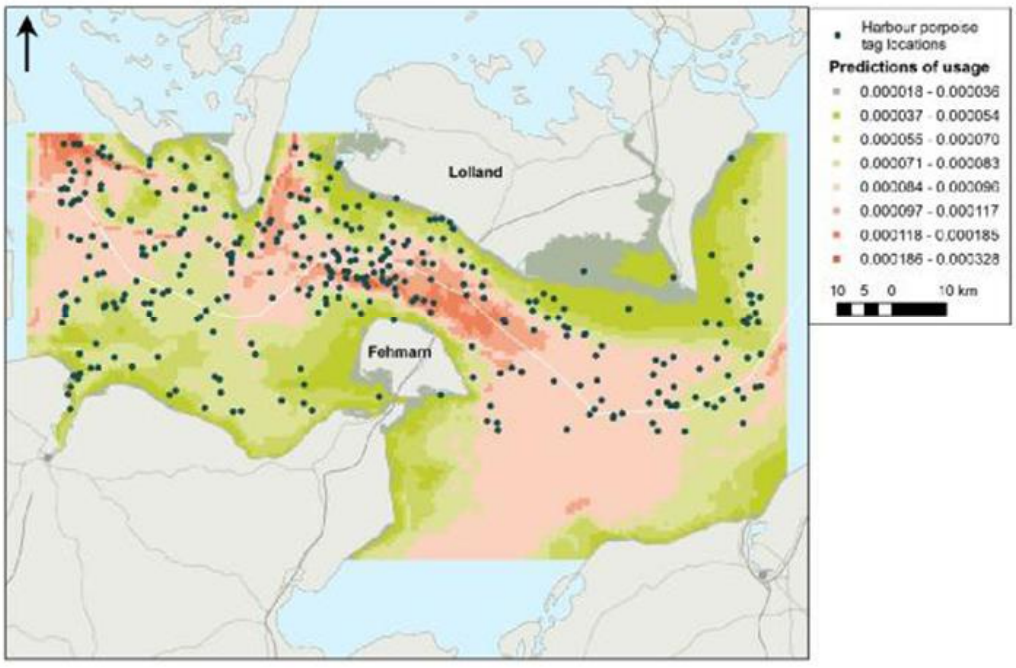

Figure 4.6 Evaluated usage of Harbour Porpoise locations in the Fehmarnbelt focal study area (FEMM, 2013a).

Table 4.6 Investigations performed during the baseline studies on marine mammals (FEMM, 2013a).

Investigations on Harbour Porpoise
Abundance and distribution: Aerial line-transect surveys covering Fehmarnbelt and adjacent waters; 36 transects each 3 km apart; altitude 600 m for marine mammals only and 250m for birds and marine mammals combined; calculation of absolute densities. Average summer densities were modelled in relation to environmental variables.
Abundance estimates were extracted from the modelled distribution for each Natura 2000 site. Some care is needed when extracting abundance estimates for sub-areas within a prediction grid. This is because the resolution of the survey data does not necessarily match the resolution of the desired estimates. In this case, there are four Natura 2000 areas, which are very small in relation to the overall survey area; and thus contain few sightings and little survey effort. In Denmark, this concerns only the SCI, Stone reef southeast of Langeland.
Habitat use: Passive acoustic monitoring using 27 porpoise click detectors (C-PODs), which were evenly distributed over the impact area. Porpoise relative abundance is analysed using indices of porpoise acoustic activity on a daily resolution.
Habitat use: Telemetry study; satellite transmitters placed on individual porpoises; data on movements of porpoises in the vicinity of Fehmarnbelt and beyond; assessment of area coverage, home ranges, distances travelled per day.
Barrier effect: Land-based observations, acoustic monitoring and analysis of satellite tagged Harbour Porpoises around the Great Belt Bridge were conducted to analyse a possible barrier effect.

For the seal species, (Harbour and Grey Seal) investigations on abundance, distribution and habitat use in the construction area and adjacent waters were conducted covering the Fehmarn Belt area and known haul out sites in this region, Figure 4.7, Table 4.7.

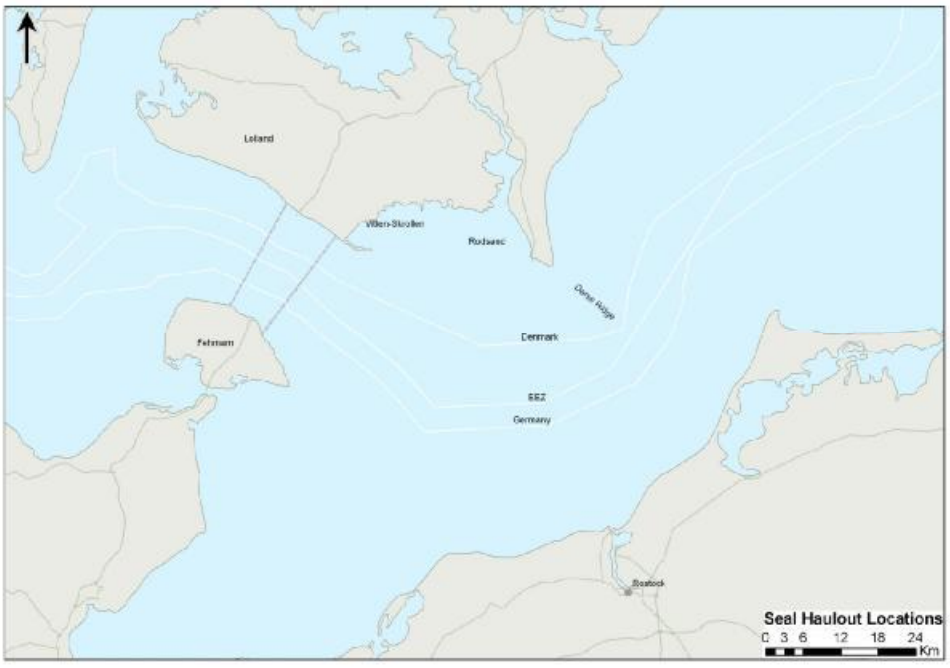

Figure 4.7 Map of study area on seals, showing haul-out locations Rødsand and Vitten-Skrollen, (FEMM, 2013a).

Table 4.7 Baseline investigations carried out on seals.

Investigations on seals
Habitat use: Telemetry study using GPS phone tags; Analysis of the movements of Harbour Seal in relation to the intended location of the proposed fixed link
Abundance and distribution: Aerial surveys covering known Harbour Seal haul outs in the study area of Fehmarnbelt. Since 1990, NERI has been undertaking haul out and moult counts of these species at several locations within Baltic Management Area 4, which includes the area of the Fehmarnbelt Fixed Link. These surveys are performed as part of a regular Danish monitoring program, but have also been supplemented at times for specific EIA purposes (e.g. construction of the Rødsand wind farm).
Health status: Provision of baseline information of the health status of seals before the onset of construction and operation. Collection of faecal samples during tagging and screening for cortisol in the laboratory. Investigation of body condition using morphometric variables; collection of blood samples for further tests.

4.4 Gaps in knowledge

The gaps in knowledge concern the following:

Calculations of light reduction are based on average sediment spill over the growth season. If the distribution of sediment spill is very unequally distributed over the season, the effect on benthic vegetation may be smaller than evaluated in this assessment.

Worst-case scenarios have been used for the assessment of possible effects on Natura 2000 sites, which include variations in light reductions due to sediment spill. Hence, the conclusions in the screening are not influenced by the described gaps in knowledge.

4.5 Description of the assessment method

The screening of the planned fixed link is conducted to assess whether a “significant impact” on the conservation status of habitats and/or species that are reasons for designation of the site can be excluded. If such an impact cannot be excluded an appropriate Natura 2000 assessment of that site should be carried out. If on the other hand a significant impact can be excluded, there is not in accordance with the habitats and birds directives an obligation to conduct an appropriate assessment.

The key issue in relation to the methodological approach is therefore to define favourable conservation status for each habitat and species under concern and to assess when an impact could be considered significant.

The screening assessment is based on the distribution of habitat types and species from the updated baseline descriptions (FEBI, 2013a; FEMA, 2013b; FEMM, 2013a; FeBEC, 2013b).

The approach and methodology in relation to the screening shall also include identification of all sources for impact identification and all possible pressures identified. Pressures and magnitude of the pressures identified are described for key elements of the sites during the EIA reporting (FEHY, 2013; FEMA, 2013d; FEBI, 2013b; FEMM, 2013b; FeBEC, 2013a)

The information and results from these reports have been used as a key basis for the comprehensive evaluation of a possible impact for specific habitats and species in the Natura 2000 sites covered by the screening.

Following the directive, there is an obligation to maintain or, where appropriate, to restore favourable conservation status for the habitats and species that are reason for designation of the sites constituting the Natura 2000 network. Favourable conservation status for habitats and species is defined in the directive as follows:

For habitats:

The conservation status of a natural habitat will be taken as favourable when:

- its natural range and areas it covers within that range are stable or increasing, and
- the specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future, and
- the conservation status of its typical species is favourable as defined below

For species:

The conservation status will be taken as favourable when:

- data on population dynamics for the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and
- the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

4.5.1 Criteria

In the screening, criteria for thresholds key indicators have been used in the assessment of significance for impact from the construction works and operation of the Fehmarnbelt Fixed Link on Natura 2000 sites. The identification of key indicators and threshold criteria are based on the baseline and EIA reports. The key indicators, and cross-references to documents, are presented in detail in the section here.

The assessment of the impact on habitats and species are in this screening divided into:

- Not significant; significant impacts can be excluded
- Significant impact cannot be excluded; there is a need for an appropriate assessment for the site in question.
- Not relevant. A significant impact on conservation status of specific habitats and species can be excluded.

Generally, in relation to the assessment, apart from the described methodology, a conservative approach has been used in the screening, following the precautionary principle. This means that if there is uncertainty whether a certain impact will lead to a significant impact the conclusion has been that the significant impact cannot be excluded.

The assessment of possible impact on key elements is based on distribution of habitats types in the selected Natura 2000 sites and the assessment of habitat and morphological changes due to identified pressures from the Fehmarn Belt project.

Unlike impacts on habitats, where area loss can be related to area available, impacts on species have to be assessed against local populations. For more general conservation targets (key elements), such as maintaining a favourable conservation status of a species, the degree of impacts has to be balanced against the importance and the function of the area – which are of specific concerns for migrating species of mammals, birds and fish.

4.5.1.1 Benthic flora and fauna

The benthic flora and fauna are the main key indicators in the assessment of the impacts on the marine habitat types.

The importance of benthic vegetation and fauna is defined by their functional value for the ecosystem or the protection status, Table 4.8 and Table 4.9. Benthic vegetation and fauna are

valuable parts of the ecosystem due to their function partly as a three-dimensional habitat and as well as nursery, breeding or feeding ground for invertebrates, fish, birds and to a less extent for marine mammals. The habitat function of benthic communities is dependent on the complexity and longevity of their key species as well as the size and coverage of the habitat itself.

Table 4.8 Importance levels for the characteristic vegetation communities of different area cover within the assessment area. The classification is based on ecological values used for monitoring of the ecological conditions in German and Danish waters (FEMA, 2013d).

Importance level	DE		DK	
	Community	Coverage	Community	Coverage
Very high	All (beside filamentous algae)	≥ 50 %	Eelgrass Eelgrass/ algae Tasselweed/ dwarf eelgrass *Fucus*	≥ 50 %
High	All (beside filamentous algae)	25–50 %	*Furcellaria* *Phycodrys/ Delesseria* *Saccharina*	≥ 50 %
			Communities listed in very high	25–50 %
Medium	All (beside filamentous algae)	10–25 %,	Communities listed in very high	10–25 %
			Communities listed in high	10–50 %
Minor	Filamentous algae	Independent of density	Filamentous algae	Independent of density
	Vegetation stands	1–10 %	Vegetation stands	1–10 %

Table 4.9 Importance classification of benthic fauna communities (FEMA, 2013a).

Importance level	Description
Very high	Benthic fauna communities that are determined by indicative or discriminate species which are protected under international conventions, like the FFH-guideline and/or HELCOM guidelines. The communities act on a between-regional scale with regard to ecosystem functioning. Community: Rissoa, Arctica
High	Benthic fauna communities that are determined by indicative or discriminate species which are protected under national legislation (BNatSchG and LNatSchG in Germany) and/or which appear on Red Lists. The communities act on a regional scale with regard to ecosystem functioning. Community: Mytilus, Dendrodoa, Tanaissus
Medium	Benthic fauna communities that are characteristic for the greater Fehmarnbelt area, and of importance for local ecosystem functioning. Community: Gammarus, Cerastoderma
Minor	Benthic fauna communities with a temporary character, e.g. subject to high environmental disturbance on short time-scales. Community: Corbula, Bathyporeia

Because the benthic fauna, as mentioned, is a key indicator in the assessment of impact on marine habitat types and because of the classification developed provide a good toll the potential impacts on the benthic flora and fauna has been assessed. The assessment of the impacts in Natura 2000 areas for the flora and fauna is based on

- Sediment spill scenarios
- Baseline data

- Assessment results

Quantitative and standardised criteria and threshold levels for impacts on benthic flora and fauna are established in the EIA-study using criteria for impact on these two key indicators, Table 4.10 and Table 4.11.

Table 4.10 Criteria for assessing the impact affecting benthic flora. After (FEMA, 2013d).

Construction-, structure- or operation-related pressures of the project	Impact	Description
Suspended sediment	Very high	High to very high reduction in biomass
	High	Medium to high reduction in biomass
	Medium	Minor to medium reduction in biomass
	Minor	Negligible to minor reduction in biomass
Sedimentation	Very high	High to very high reduction in growth. Increased mortality in relation to mean plant height and high to very high sedimentation thickness. Reduction in recruitment area compared to other criteria negligible
	High	Medium to high reduction in growth. Increased mortality in relation to mean plant height and medium to high sedimentation thickness Reduction in recruitment area compared to other criteria negligible
	Medium	Minor to medium reduction in growth. Increased mortality in relation to mean plant height and minor to medium sedimentation thickness. Reduction in recruitment area compared to other criteria negligible
	Minor	Reduction of recruitment area for macroalgae caused by coverage of hard substrates
Footprint	Very high	Habitat loss. Criteria correspond to the importance levels of the different communities
Solid substrate	Case-by case related	Case-by-case, qualitative criteria on the relation between new artificial substrate and the available hard substrate area
Seabed and coastal morphology	Very high	Habitat loss. Criteria correspond to the importance levels of the different communities

Table 4.11 Criteria for assessing the impact affecting benthic fauna. After (FEMA, 2013c).

Construction-, structure- or operation-related pressures of the project	Impact	Description
Suspended sediment	Very high	Very high change of viability and food availability, high mortality
	High	High change of viability and food availability, low mortality
	Medium	Minor to medium change of viability and food availability
	Minor	Minor change of viability and food availability
Sedimentation	Very high	Very high change of viability and food availability, high mortality
	High	High change of viability and food availability, low mortality
	Medium	Minor to medium change of viability and food availability
	Minor	Minor change of viability and food availability
Footprint	Very high	Habitat loss. The criteria correspond to the importance of the communities
Solid substrate	Case-by case related	Case-specific criteria based on - the amount on existing solid substrate in a specific distance from the structure - water depth - local change of currents suitability of the solid substrate - potential for nonindigenous species
Seabed and coastal morphology	case-specific	Habitat loss. The criteria correspond to the importance of the communities
Hydrographic regime and water quality	case-specific	case-specific criteria: - baseline situation of communities - predicted changes in salinity, temperature, oxygen and currents - sensitivity of the communities against changes in these parameters

Furthermore, impact assessments were addressing the following key elements in the benthic communities, Table 4.12 and Table 4.13.

Table 4.12 Key elements of benthic vegetation communities assessed during the impact study (FEMA, 2013b).

Benthic flora communities
Eelgrass
Eelgrass/algae
Filamentous algae
Fucus
Furcellaria
Phycodrys/ Delesseria
Saccharina
Tasselweed/ dwarf eelgrass

Table 4.13 Degree of impact of the blue mussel population in the assessment area as function of the reduction in biomass due to suspended sediments (FEMA, 2013c).

Reduction in mussel biomass	Impact
> 50%	Very high
33<50%	High
25<33%	Medium
13–<25%	Minor

The impacts on habitats are divided into impairment of the habitats and loss of habitats. Loss caused by physical area loss due to footprint of project constructions and impairment caused by impacts due to temporary pressures from construction activities.

The significance of the impacts in the specific Natura 2000 context including the significance for the survival and function of the ecosystem depends on the impacted area, the intensity and duration of the impact as well as on the importance of the impacted communities for the local, regional or larger scale ecosystems.

The significance assessment is consequently carried out in a stepwise approach with the following steps: If the impacted area per community is below 1% of the reference area, the impact is as a rule regarded insignificant (regardless of the duration and recovery time), if no specific concerns are related to the future status of the community as part of the Natura 2000 network. The 1% rule is adopted from the strict objectives for habitat loss/impact of Natura 2000 areas and their protected habitats, and as part of the comprehensive expert judgement generally used to screen out all minor impacts with no significance to ecological function.

For impacted areas ≥ 1 % further considerations are necessary: If the impacted area is ≥ 1%, the duration of the impact (recovery time of the community and recovery time for seabed or other physical factors) is taken into account. If the community is recovered within two years after end of construction (named "construction phase +"), the expert judgement generally will regard the impact as insignificant.

If the impacted area is ≥ 1% and the community recovers later during the operation phase, further aspects have to be considered as part of an expert judgement to conclude on the impact significance. Important aspects are related to the assessment of the specific extent and level of severity of the impact, which reflect the actual magnitude of the pressure and the ecological importance of the impacted community on a local to regional scale.

4.5.1.2 Fish

In the Natura 2000 context, the definition of significant impact on the conservation objectives, the Annex II fish species and the integrity of habitats concerning fish, is following the assessment criteria used in the EIA report (FEMM, 2013b). Here a two-level impact scale is applied. Based on an expert judgement, none or minor temporary impacts on population size of specific fish species or fish communities according to the criteria, Table 4.14 are generally regarded as insignificant. Medium to very high degree of impact is generally regarded as

possible significant or significant. The criteria are based on reduction in percentage of natural variation in population size. The threshold values between possible/significant and not significant, based on the mentioned expert judgement, are the same for a larger group of fish species including different life stages of the species. As can be seen, the threshold value is somewhat lower for cod, herring, and whiting and generally legally protected species during migration.

However, none of the fish species or fish communities are identified as key indicators for habitat changes or for the integrity of the Natura 2000 sites under concern, and potential significant impacts on Natura 2000 areas are therefore dependent on changes in the identified key indicators.

Table 4.14 Criteria for significant impact on fish species and communities after (FeBEC, 2013b).

Environmental component		Reduction in % of natural variation in population size			Significance of impact
		Construction 1 year	Construction 3 years	Operation	
Cod, herring, silver eel, whiting, legally protected species	Migration	>10	>5	>5	Possible/significant
		≤10	≤5	≤2	Not significant
	Spawning, eggs and larvae, nursery and feeding	>15	>8	>4	Possible/significant
		≤15	≤8	≤4	Not significant
Shallow water communities, flatfish, sprat, sea stickleback, snake blenny	General	>15	>8	>4	Possible/significant
		≤15	≤8	≤4	Not significant

4.5.1.3 Mammals

Assessment of the importance of an area for each conservation objective has been based on information provided in the standard data form and further official documents of the Natura 2000 sites and on studies about abundance (FEMM, 2013a), Table 4.15, Table 4.16.

Table 4.15 Criteria for the assessment of importance levels of sites for seals.

Importance level	Environmental component Harbour Seal and Grey Seal
Very high	Breeding or pupping ground of importance for the Baltic population.
High	Breeding and/or pupping ground of importance for the population in the area.
Medium	Breeding ground, but pupping rates not consistently higher than in other areas.
Minor	Area is of minor importance for seals in the Western Baltic and beyond.

Table 4.16 Criteria for the assessment of importance levels of Harbour Porpoise.

Importance level	Staging (abundance)	Nursing	Migration corridor
Very high	> 1/ km^2	Exceptionally high calf ratio, highest abundance during nursing time	Essential corridor between important staging or nursing areas, connection between subpopulations
High	> 0.5/ km^2	High calf ratio, High abundance during nursing time	One or more corridors between important staging or nursing areas, connection between subpopulations
Medium	> 0.25/ km^2	Medium calf ratio, no special function as nursing ground	Corridor between medium important staging or nursing areas
Minor	< 0.25/ km^2	Lower calf ration than average, lower numbers in the nursing period	Minor function as corridor between medium important staging or nursing areas

Impacts on certain functions of an area, such as its function as breeding or pupping ground, staging or nursing area or migration corridor are assessed quantitatively as function of habitat loss (FEMM, 2013b). The criteria for impact on marine mammals are thus defined indirectly as function of habitat loss, Table 4.17. Here the assumption has been made that a certain percentage of habitat loss equates an equal percentage of mammal removal from the population in the defined area. However, this relation is only real in the case that the mammals are unable to move or avoid pressures, which is not the true. The 1.7% criterion has been set as the precautionary limit above the 1% limit considered as the critical limit for percentage removal of individuals in sustainable mammal populations (FEMM, 2013b).

The impact assessment is only qualitative on local populations (population of SCI) and considers specific conservation targets related to the worst-case impact assessed for Fehmarnbelt. This assessment is based on a comprehensive expert judgment taking the duration of pressures into consideration, and the ability of marine mammals to avoid these pressures.

Barrier effects during operation have been assessed based on studies on existing fixed links for mammals (FEMM, 2013b).

Table 4.17 Criteria for significant impact on marine mammals (FEMM, 2013b).

Overall assessment of Significance	Description of Impact
Significant	Impacts due to the Fixed Link lead to loss of 'habitat' of more than 1.7% of the best population estimate for Harbour Porpoise and 10% of harbour and Grey Seals in the Fehmarnbelt study area
Insignificant	Impacts due to the Fixed Link lead to loss of 'habitat' of less than 1.7% of the best population estimate for Harbour Porpoises and 10% of Harbour and Grey Seals in the Fehmarnbelt study area

In the assessment for each Natura 2000 site screened, data on marine mammals are presented in tables. The abbreviations in the tables extracted from the standard data forms are explained in the following.

Mammal populations

A site may be important for different stages of the life cycle of species (migration of species). These are categorised as follows:

- **Resident**: to be found throughout the year on the site
- **Breeding/reproducing**: uses the site for raising young
- **Wintering**: uses the site during the winter

As regards abundance, the exact population data are entered if known. If an exact number is not known the following intervals are used: 1-5, 6-10, 11-50, 51-100, 101-250, 251-500, 501-1,000, 1,001-10,000, > 10,000. Where a population range is not known but information exists on

minimum or maximum population size, abundance is indicated by < (less than) or > (greater than).

A suffix indicates whether the population size is given in pairs (**p**) or individuals (**i**). In case no numeric information is available it is indicated whether the species is common (**C**), rare (**R**) or very rare (**V**). In the absence of any population data, the species may just be indicated as being present (**P**).

Site assessment for mammals

Population size: The size of the population of the species present on the site in relation to the total population present within the national territory is classified as follows:

A: > 15% of national population
B: > 2% but ≤ 15 % of national population
C: ≤ 2% of national population (regular occurrence)
D: irregular occurrence

Conservation: The degree of conservation of the features of the habitat, which are important for the species concerned, and the possibilities for restoration are classified as follows:

A: conservation excellent
B: good conservation
C: average or reduced conservation

Isolation: The degree of isolation of the population present on the site in relation to the natural range of the species is classified as follows:

A: population (almost) isolated
B: population not isolated, but marginal within the area of distribution
C: population not isolated within extended distribution range

Global importance: Global assessment of the value of the site for conservation of the species concerned:

A: excellent value
B: good value
C: significant value

4.5.1.4 Birds

The importance of the area for each conservation objective is based on information provided in the standard data form and further official documents of the Natura 2000 sites and about abundance (FEBI, 2013a), Table 4.18. The assessment of habitat changes associated with construction and operation of a fixed link is based on information on changes in key indicators.

Table 4.18 Criteria for the assessment of importance levels of birds. * A biogeographic population can be defined as a distinct assemblage of individuals who does not experience significant emigration or immigration.** For landbirds, for which no biogeographic reference population is given, the breeding populations of Sweden and Finland (breeding pair number multiplied by 4) were defined as relevant reference population according to numbers (FEBI, 2013a). Explanation and definition of SPEC see Table 4.19.

Environmental factor	Criteria	Importance	Explanation
Non-breeding waterbirds	International conservation status Proportion of the bio-geographic population* Numbers of individuals	very high	• Areas containing regularly more than 1.0% of the biogeographic population of a species • Areas containing regularly between 0.5 and 1% of the biogeographic population of a species of very high international protection status (Annex I Bird Directive) or species of global or European conservation concern (SPEC 1 or SPEC 2) • Areas containing more than 20,000 individuals of a species
		high	• Areas containing regularly between 0.5 and 1.0% of the biogeographic population of a species of high international conservation status (SPEC 3) • Areas containing regularly between 0.1 and 0.5% of the biogeographic population of a species of very high or high international conservation status or species of global or European conservation concern (Annex I Birds-Directive or SPEC 1 or SPEC 2 or SPEC 3)
		medium	• Areas containing regularly between 0.5 and 1.0% of the biogeographic population of a species with medium or no international conservation status (NON-SPEC® or NON-SPEC) • Areas containing regularly between 0.1 and 0.5% of the biogeographic population of a species with medium international conservation status (NON-SPEC®)
		minor	• All other areas
Migrating birds (waterbirds and landbirds)	International protection status Proportion of the bio-geographic * or the respective relevant reference population**	very high	• Flight corridors being used by more than 1.0% of the biogeographic/relevant reference population of a species • Flight corridors being used by 0.5 to 1.0% of the biogeographic /relevant reference population of a species of very high international conservation status (Annex I Bird Directive) or species of global or European conservation concern (SPEC 1 or SPEC 2)
		high	• Flight corridors being used by 0.5 to 1.0% of the biogeographic /relevant reference population of a species of high international conservation status (SPEC 3) • Flight corridors being used by 0.1 to 0.5% of the biogeographic/relevant reference population of a species of very high or high international conservation status or species of global or European conservation concern (Annex I Birds-Directive or SPEC 1 or SPEC 2 or SPEC 3)

Environmental factor	Criteria	Importance	Explanation
		medium	• Flight corridors being used by 0.5 to 1.0% of the biogeographic/relevant reference population of a species with medium or no international conservation status (NON-SPEC^{E} or NON-SPEC) • Flight corridors being used by 0.1 to 0.5% of the biogeographic/relevant refeference population of a species with medium international conservation status (NON-SPEC^{E})
		minor	• All other areas

Table 4.19 Importance classification of an area based on the protection/conservation status of the species according to the EU Bird Directive and the SPEC status of a species according to BirdLife International (FEBI, 2013a). Used in Table 4.18. Explanation to species protection/conservation status below.

Criterion	EU Bird Directive	SPEC Status
Very high	Listed in Annex I	SPEC 1 or 2
High		SPEC 3
Medium		Non-SPEC^{E}
Minor		Non-SPEC

Explanation to SPEC	
SPEC 1	European species of global conservation concern, i. e. classified as Critically Endangered, Endangered, Vulnerable, Near Threatened or Data Deficient under the IUCN Red List Criteria at a global level.
SPEC 2	Species whose global populations are concentrated in Europe, and which have an Unfavourable Conservation Status in Europe
SPEC 3	Species whose global populations are not concentrated in Europe, but which have an Unfavourable conservation status in Europe.
Non-SPEC^{E}	Species whose global populations are concentrated in Europe, but which have a Favourable conservation status in Europe
Non-SPEC	Species whose global populations are not concentrated in Europe, and which have a Favourable conservation status in Europe.

Quantitative and standardised criteria and threshold levels for significant impacts on birds are established using criteria for impact on breeding waterbirds, non-breeding waterbirds and migrating birds, Table 4.20. Unlike impacts on habitats, where area loss can be related to area available, impacts on animals have to be assessed against local populations and specific conservation targets for each SPA.

Impacts on certain functions of an area, such as the function as migration corridor, are assessed quantitatively for the Fehmarnbelt Link corridor. The assessments are based on the described technical projects descriptions for tunnel and bridge. It covers both daytime and nocturnally flying birds. Basis for the assessment has been effect studies from the Baltic Sea bridges, model calculations, data from the Øresund Bridge, and different weather and light conditions. The approach and assessment methodology is further described in the Environmental Impact Assessment prepared for the Fehmarnbelt Fixed Link. This approach and methodology has been used as further basis for the assessments in the present screening. (FEBI, 2013a)

Based on the results using the standardised criteria, the potential Natura 2000 conflict is concluded carrying out a comprehensive and substantiated expert assessment considering all relevant pressure aspects in relation to possible impacts on local populations (population of SPA) and specific conservation targets.

Table 4.20 Criteria for assessing the impact affecting breeding waterbirds, non-breeding waterbirds and migrating birds (incl. waterbirds and birds (incl. waterbirds and landbirds) based on the sensitivity of a species to a pressure. * Adverse weather conditions, when considering collision risk, refer to bad visibility, fog, strong rain, strong head winds. After (FEBI, 2013b).

Construction-, structure- or operation-related pressures of the project	Impact	Description
Barrier effect	Very high	Barrier is complete for a large proportion of a population or a complete population concerning migration routes (migrating birds) and exchange flights (breeding and non-breeding waterbirds). There are no alternative flight routes since birds do not fly over land. No connectivity between resting and foraging areas at both sides of the barrier.
	High	Barrier is not complete, but migrating birds show strong reactions to the barrier, e.g. modification of migration routes. Reduced connectivity between breeding, resting and foraging areas at both sides of the barrier for breeding and non-breeding waterbirds
	Medium	Barrier effects results in additional reactions, but will be crossed eventually (migrating birds, breeding and nonbreeding waterbirds).
	Minor	Minor barrier effect; birds show minor reactions and fly above or below the structure (migrating birds, breeding and non-breeding waterbirds).
Collision risk	Very high	A high proportion of birds migrating through or breeding/resting/wintering in the Fehmarnbelt is expected to collide with the structure on a regular basis.
	High	A small proportion of birds migrating through or breeding/resting/wintering in the Fehmarnbelt is expected to collide with the structure on a regular basis. Adverse weather conditions* are expected to increase collision rates.
	Medium	Collisions are unlikely, but adverse weather conditions may result in collision incidents (migrating birds, breeding and non-breeding waterbirds).
	Minor	Collisions are unlikely. Only single birds are expected to collide with the structure (migrating birds, breeding and non-breeding waterbirds).
Disturbance	Very high	50–100% of breeding or non-breeding waterbirds are expected to be displaced from the impact zone, or the degree of displacement is not assessable.
	High	25–50% of breeding or non-breeding waterbirds are expected to get displaced from the impact zone.
	Medium	5–25% of breeding or non-breeding waterbirds are expected to get displaced from the impact zone.
	Minor	Disturbance does not lead to a detectable displacement of breeding or non-breeding waterbirds (<5% displacement).
Habitat change	Very high	Habitat changes result in 50–100% reduction in bird numbers within the impact zone, or the degree of reduction in bird numbers in not assessable
	High	Habitat changes result in 25–50% reduction in breeding or non-breeding waterbird numbers within the impact zone.
	Medium	Habitat changes result in 5–25% reduction in breeding or non-breeding bird numbers in the impact zone.
	Minor	Habitat changes result in 5–25% reduction in breeding or non-breeding bird numbers in the impact zone.

For more general conservation targets, as maintaining a good population status of a species, the degree of impacts have to be balanced against the importance and the function of the area. A significant impact on general conservation targets of the SPAs in the Fehmarnbelt area cannot be excluded, if a substantial and persisting deviation to importance levels will take place.

Impacts have been classified as being significant, since significant impacts cannot be excluded if at least one of the following criteria was met (FEBI, 2013b):

- the total number of displaced individuals (resulting from different pressures) corresponds to more than 1% of the biogeographic population, unless it can be excluded that the displacement of >1% of the biogeographic population would result in a population effect for a species;
- the impact from barrier effect is assessed as being very high and leading to an interruption of migration flyways (migrating birds) or ecologically functional connections between breeding, resting and foraging habitats (breeding and non-breeding waterbirds);
- the number of birds predicted to collide with the project structures (i.e. be killed) exceeds the threshold of Potential Biological Removal (PBR). The PBR is a threshold of additional

annual mortality, which could be sustained by a population, of >1% of the biogeographic/relevant reference population, which potentially lead to population effects.

Impact levels below the mentioned standardised criteria are always assessed specifically to exclude any significant Natura 2000 related impacts by carrying out a comprehensive and substantiated expert judgement considering all relevant pressure aspects in relation to possible impacts populations and specific conservation targets.

Source for information on the SPAs/SCIs are the standard data forms and for each SPA/SCI, the relevant data are presented in the following sections.

5 Natura 2000 sites and general baseline descriptions

Below is given an overview of the conservations areas in question and a brief baseline description of the marine communities present. Further, the main results from the baseline investigation on birds and marine mammals are presented. The baseline descriptions are based on the investigations in the Fehmarnbelt area during 2009-2010.

5.1 Overview of the conservation areas

Figure 5.1 and Figure 5.2 below show the Sites of Community Interest (SCIs) designated under the Habitats Directive and the Special Protection Areas (SPAs) designated under the Birds Directive in the region of the Fixed Link in Denmark. In Table 5.1 the official numbers of the SCI's and SPA's in the Natura 2000 sites are listed.

Figure 5.1 Map showing sites designated as Sites of Community Interest (SCIs) under the Habitats Directive.

Figure 5.2 Map showing sites designated as Special Protection Areas (SPAs) under the Birds Directive.

Table 5.1 Official numbers, names and codes for the Natura 2000 sites, Figure 4.4 covered by the screening reporting (in accordance with standard data forms used for the Natura 2000 database).

ID	SCI SPA	Description
126	SCI DK 00VA200	Stone reef Southeast of Langeland
179	SCI DK 006X242 SPA DK 006X088	Nakskov Fjord Nakskov Fjord and Inner Fjord
251	SCI DK 00VA260	Fehmarn Belt
173	SCI DK 006X238 SPA DK 006X083	Smålandsfarvandet North of Lolland, Guldborg Sund, Bøtø Nord and Hyllekrog-Rødsand Coastal Zone Hyllekrog-Rødsand
177	SCI DK 006X238 SPA DK 006X087	Maribo Lakes Maribo Lakes

According to the Habitat Directive, baseline reports and Natura 2000 plans are prepared by county administrations and environmental centres for each Natura 2000 site. The reports are available (Naturstyrelsen, 2014) and show the more detailed distribution of habitats and species that are reason for designation of the sites. In many cases, information is also provided on the conservation status of the habitat or species in question. This is further described in the text below under the assessment of each individual Natura 2000 site (Cpt. 8-12).

5.1.1 Habitats

5.1.1.1 Sandbanks (code 1110)

Sandbanks are elevated, elongated, rounded or irregular topographic features, permanently submerged and predominantly surrounded by deeper water. They consist mainly of sandy sediments, but larger grain sizes, including boulders and cobbles, or smaller grain sizes including mud may also be present on a sandbank. Banks where sandy sediments occur in a layer over hard substrata are classed as sandbanks if the associated biota are dependent on the sand rather than on the underlying hard substrata. “Slightly covered by sea water all the time” means that above a sandbank the water depth is seldom more than 20 m below chart datum. Sandbanks can however extend beneath 20 m below chart datum. It can therefore, be appropriate to include in designations such areas where they are part of the feature and host its biological assemblages. On many sandbanks vegetation do not occur but rooted vegetation of eelgrass and tasselweeds can be found on sandbanks.

Sandbanks are important feeding areas for in particular different species of flatfish and seaducks such Common Scoter. The mega ripples, often a characteristic structure of sandbanks at greater water depths are of high importance as spawning grounds for sandeels (*Ammodytidae*) and spawning and feeding grounds for flatfish. The sandeels are very important food items for some fish eating seabirds as Divers listed in Annex I of the Birds Directive and Annex II listed mammals.

5.1.1.2 Estuaries (code 1130)

River estuaries are coastal inlets where, unlike 'large shallow inlets and bays' there is generally a substantial freshwater influence. The mixing of freshwater and seawater and the reduced current flows in the shelter of the estuary lead to deposition of fine sediments, often forming

extensive intertidal sand and mud flats. Where the tidal currents are faster than flood tides, most sediments deposit to form a delta at the mouth of the estuary. Baltic river mouths, considered as an estuary subtype, have brackish water and no tide, with large wetland vegetation (helophytic) and luxurious aquatic vegetation in shallow water areas.

Estuaries are among the most productive ecosystems, and the extreme hydrodynamic and sedimentary conditions determine the type of habitats and species present and result in characteristic animal and plant communities. Although mudflats and sandflats often dominates and have a low diversity of species, these habitat elements support dense vegetated areas of rooted vegetation of especially eelgraas and taselweed, algal communities and populations of invertebrates, which provides a food source for many species of fish and various species of waterbirds. The fish fauna of estuaries is often very diverse and normally includes anadromous species such as the river lamprey (*Lampetra fluviatilis*), sea lamprey (*Petromyzon marinus*) and twaite shad (*Alosa fallax*). The anadromous fish use the estuaries as a migratory passage to and from their spawning and nursery grounds in the rivers.

5.1.1.3 Mudflats and sandflats not covered by seawater at low tide (code 1140)

Sands and muds of the coasts of the oceans, their connected seas and associated lagoons, not covered by sea water at low tide, devoid of vascular plants, usually coated by blue algae and diatoms. They are of particular importance as feeding grounds for wildfowl and waders due to their diverse intertidal communities of benthic flora and fauna. The diverse intertidal communities of invertebrates and algae that occupy them can be used to define subdivisions of different communities e.g. eelgrass and brackish water vegetation.

These mudflats and sandflats are also of importance as nursery grounds for fish, especially flatfish, and as a habitat for several species of shallow water fish and fish eating waterbirds.

5.1.1.4 Coastal lagoons (code 1150 – prioritised habitat)

Lagoons are expanses of shallow coastal salt water, of varying salinity and water volume, wholly or partially separated from the sea by sand banks or shingle, or, less frequently, by rocks. Salinity may vary from brackish water to hypersalinity depending on rainfall, evaporation and through the addition of fresh seawater from storms, temporary flooding of the sea in winter or tidal exchange. With or without vegetation from tasselweeds, pondweeds, eelgrass and characeans often rich in species diversity of freshwater and brackish water plants.

Lagoons are one of the prioritised habitat types and are in general biodiversity hotspots. Their physiographic features provide important habitats for adult and juvenile fish. A large number of small fish are associated with structural elements of lagoons such as eelgrass and other plant communities or stones. These habitats are important as spawning or nursery areas for a number of fish, which are more frequently found as adults outside the lagoons. The lagoons are important nursery areas for the European flounder (*Platichthys flesus*) and important feeding grounds for smolts of salmon and whitefish. Juvenile fish and smaller fish typical for lagoons are important food items for Annex I listed fish eating bird species and the rich flora and fauna communities support a wide range of waterbirds.

5.1.1.5 Large shallow inlets and bays (code 1160)

Large indentations of the coast where, in contrast to estuaries, the influence of freshwater is generally limited. These shallow indentations are generally sheltered from wave action and contain a great diversity of sediments and substrates with a well-developed zonation of benthic communities. These communities have generally a high biodiversity. The limit of shallow water is sometimes defined by the distribution of the eelgrass and pondweed associations.

Large shallow inlets and bays often have similarities to lagoons in their structural complexity and function. Salinity and wave exposure are often higher in inlets and bays than in lagoons; but in

general, inlets and bays provide suitable and important habitats for adult and juvenile fish, which are important food items for fish eating mammals and birds. The high diversity in the rooted and attached vegetation of plants and algae and fauna communities support a wide range of waterbirds.

5.1.1.6 Reefs (code 1170)

Reefs can be either biogenic concretions or of geogenic origin. They are hard compact substrata on solid and soft bottoms, which arise from the sea floor in the sublittoral and littoral zone. Reefs may support a zonation of benthic communities of algae and animal species as well as concretions and corallogenic concretions.

Reefs are very important feeding areas, refuge areas and nursery grounds for many species of fish. Reefs are important foraging habitats for a wide range of seabirds and marine mammals including Annex I and II listed species.

5.2 Benthic flora and fauna communities

5.2.1 Benthic flora

The benthic coastal vegetation in the Fehmarnbelt area consist of key elements of five hard bottom macroalgae communities and two soft bottom communities constituted of flowering plants and one mixed algae-flowering plant community, presented in Table 4.12.

The distribution, coverage and biomass of the benthic flora communities are species specific dependent on suitable substrates and varies within different depth regimes, Figure 5.3 and Figure 5.4.

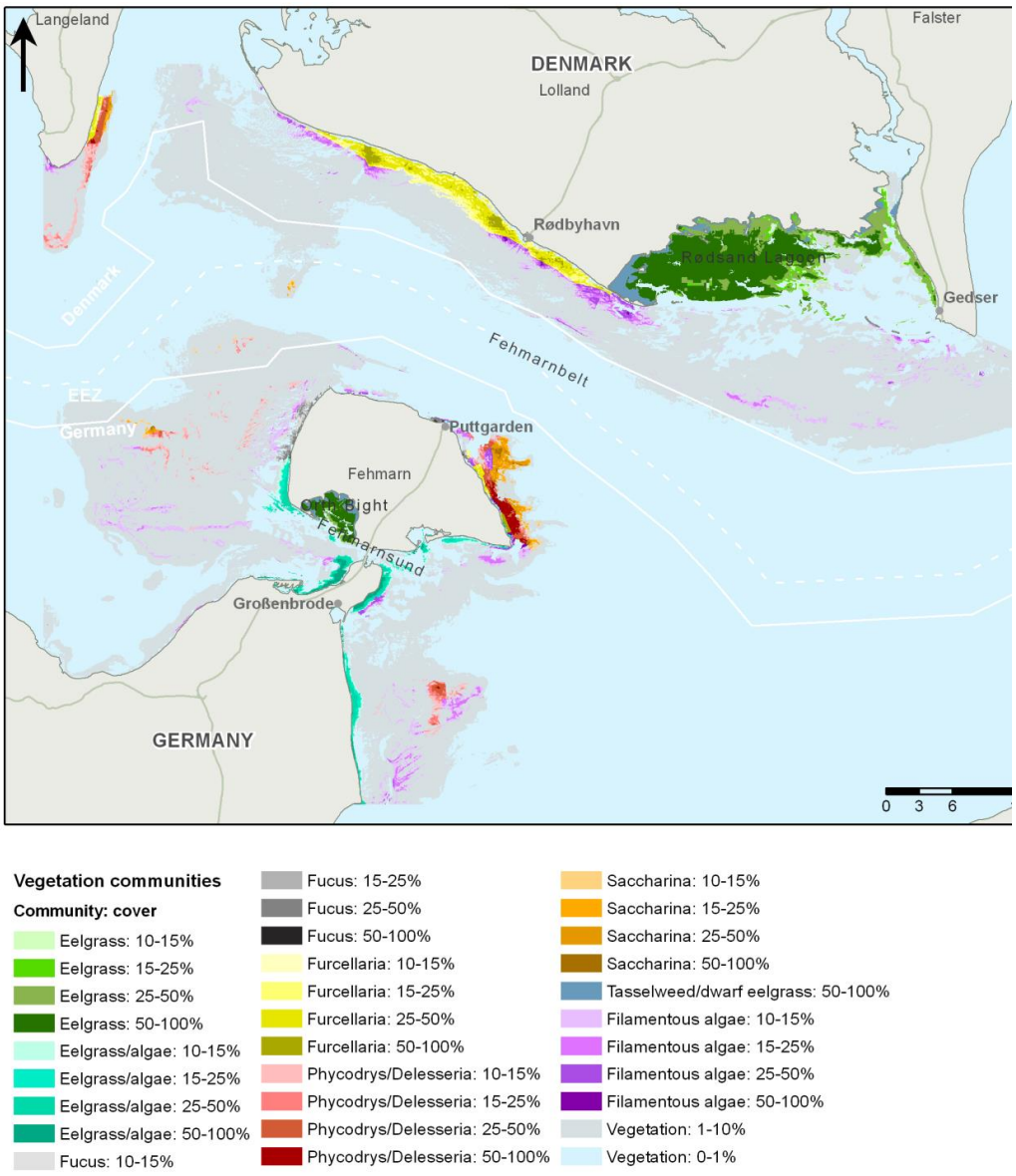

Figure 5.3 Distribution and coverage of the different vegetation communities within the investigated area. Based on predicted mapping of macroalgae and eelgrass and the distribution of key-communities in the area.

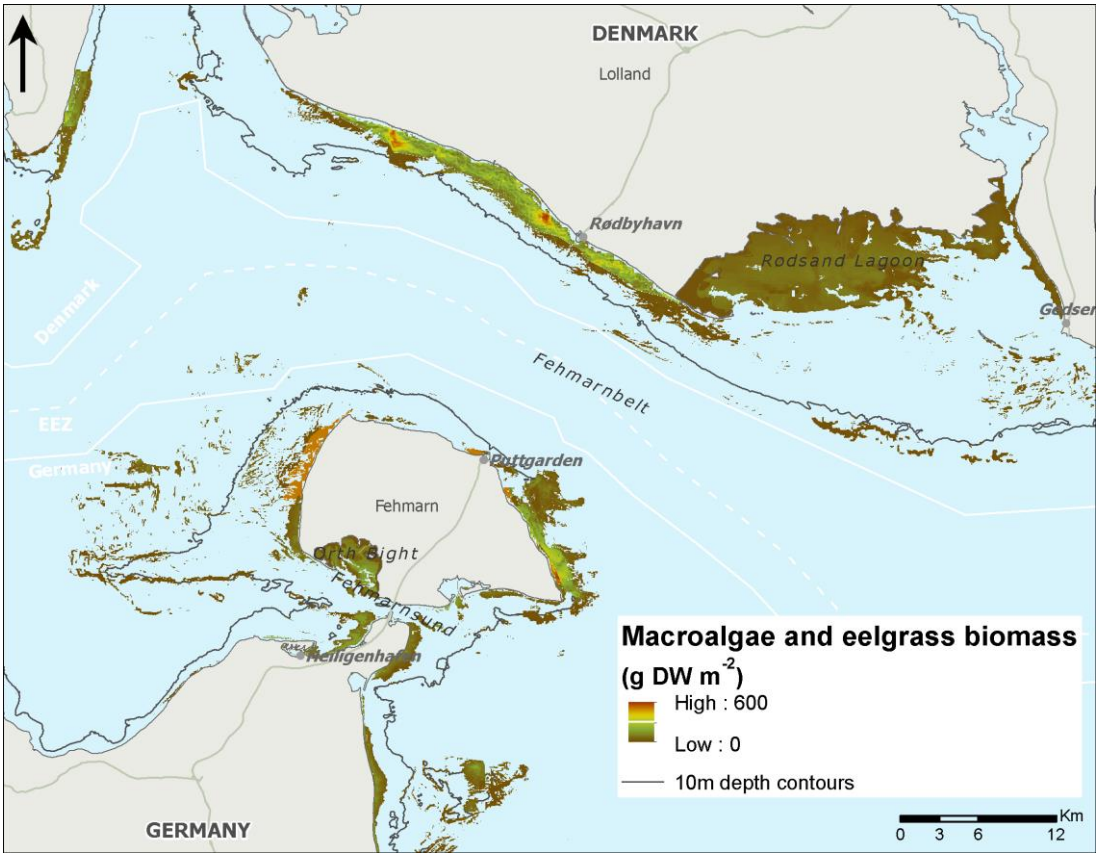

Figure 5.4 Cover-corrected biomass (g DW m^{-2}) of the benthic vegetation (macroalgae and eelgrass) in Fehmarnbelt area in the summer of 2009.

The importance of the benthic vegetation show differences between different areas and communities along the coasts in the Fehmarnbelt area reflecting the distribution of key species of high importance e.g. the eelgrass community, Figure 5.5, which is an important element in the structure and function in many Natura 2000 sites.

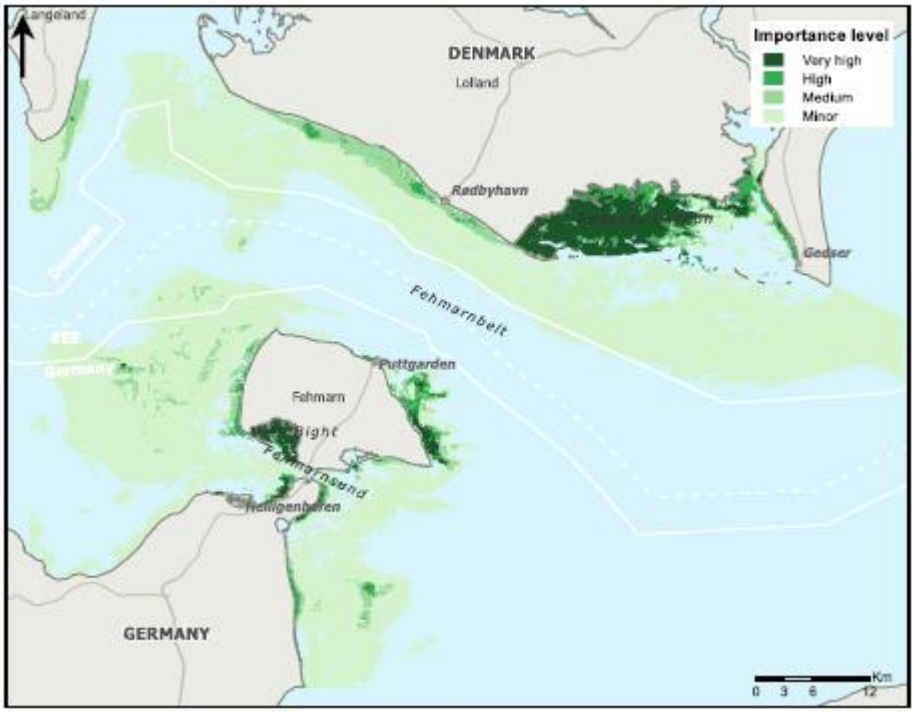

Figure 5.5 Importance of benthic vegetation in the investigated area.

5.2.2 Benthic fauna

The blue mussels (*Mytilus edulis*) constitute a key element in the shallow water communities and dominates the biomass in the shallow waters of the Fehmarn, Figure 5.6.

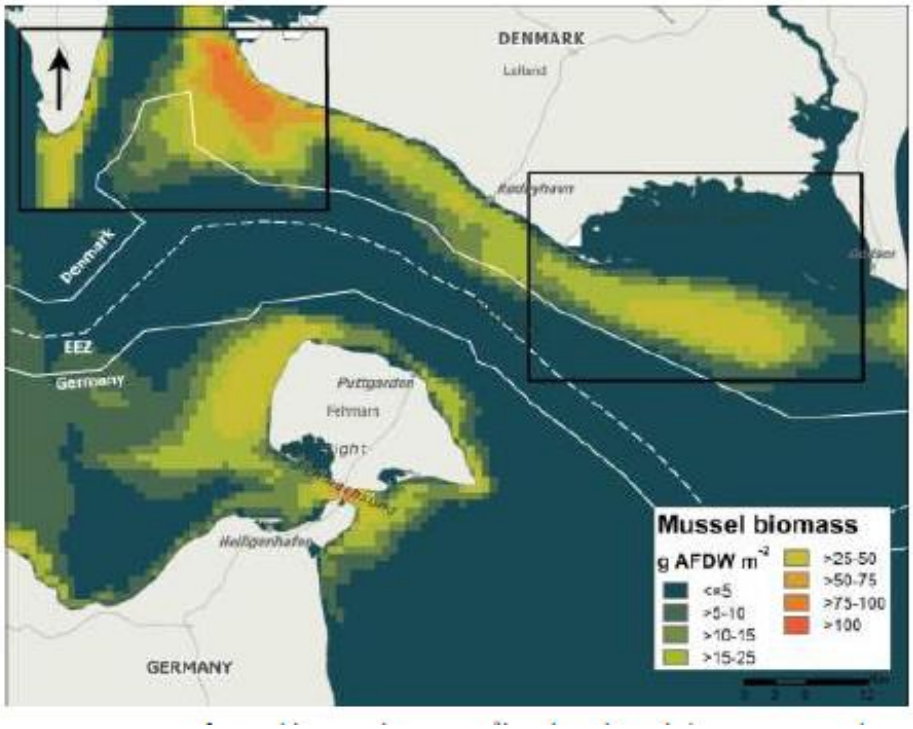

Figure 5.6 Distribution of biomass of blue mussels (g AFDW m-2) in the Fehmarnbelt region. Rectangles inserted delineate areas where biomass was corrected for mussel condition

Other key elements in the benthic fauna communities are mainly distributed according to substrate availability salinity and depth regimes. Nine different benthic communities were defined, Table 4.9, distributed in different depth zones and associated to different substrates, Figure 5.7 and Table 5.2.

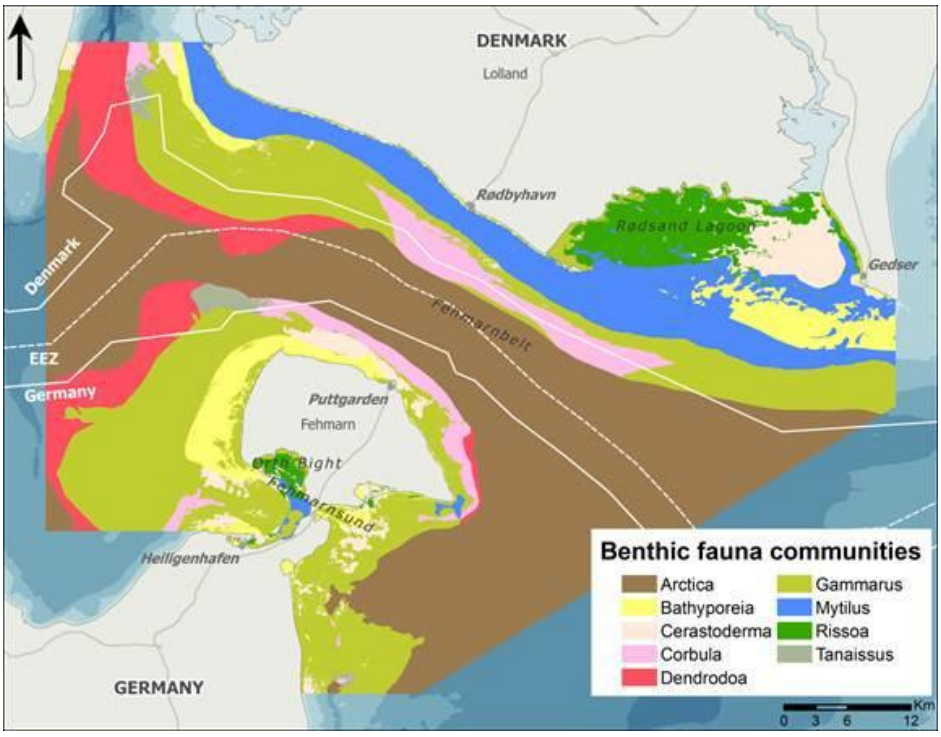

Figure 5.7 Distribution of benthic fauna communities in the investigated area.

Table 5.2 Summary characteristics of benthic fauna communities identified in the Fehmarnbelt. After (FEMA, 2013a).

Community	Depth zone	Key features
Arctica	Deep	Muddy sediments
Bathyporeia	Shallow	Exposed sand
Cerastoderma	Shallow	Sheltered immobile soft bottom
Corbula	Deep	Mixed sediments
Dendrodoa	Deep	Hard substrate/algae
Gammarus	Shallow/deep	Hard substrate/algae
Mytilus	Shallow/deep	Hard substrate
Rissoa	Shallow	Eelgrass
Tanaissus	Deep	Exposed sand/gravel

The importance of the benthic fauna show differences between different areas and communities in the Fehmarnbelt area, Figure 5.8. The communities with the key elements *Arctica* and *Rissoa* are considered at the highest level of importance, Table 4.9. Of these, only the Rissoa community is of relevance for the structure and functionality of habitats in Natura 2000 sites.

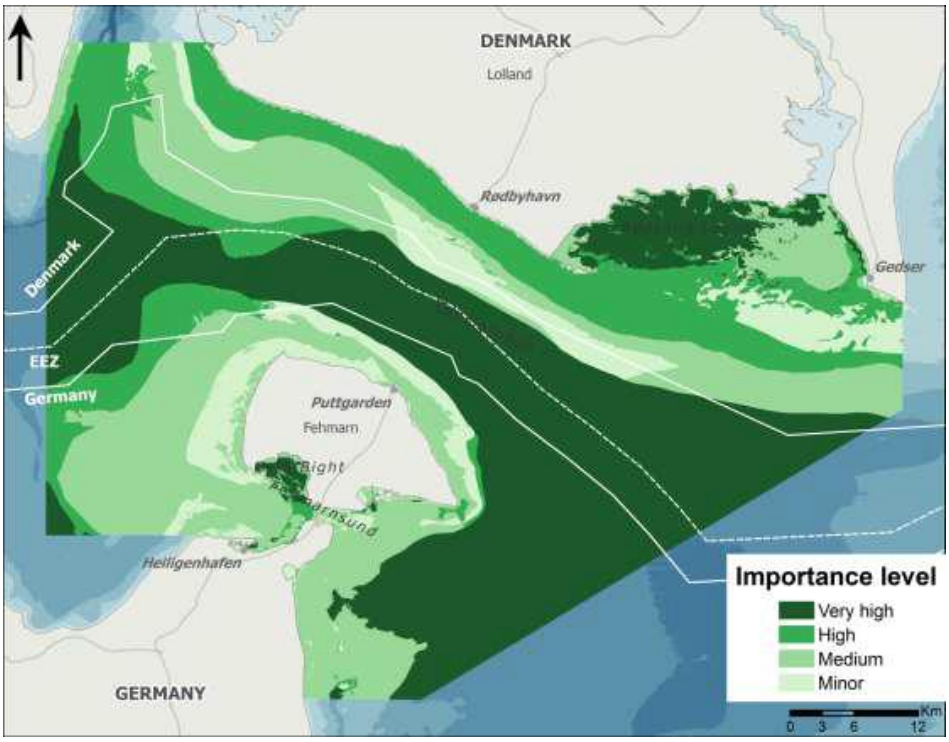

Figure 5.8 Benthic fauna community Importance map.

5.2.3 Fish

The shallow water fish communities is of specific importance for the integrity of the Natura 2000 sites due to the importance as food sources for a number of the bird species listed in the standard data forms for a number of the protected sites, Figure 5.9. However, the whole Fehmarnbelt area important for pelagic fish communities – like herring - are also important as foraging areas for marine mammals too.

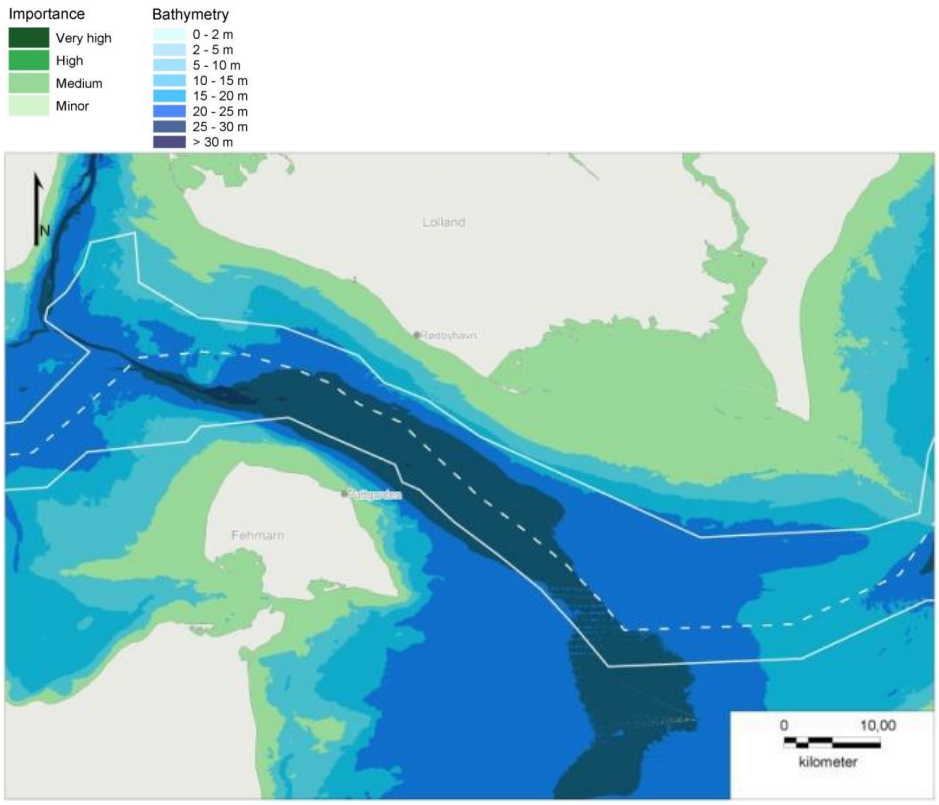

Figure 5.9 Areas of importance for the shallow water fish communities.

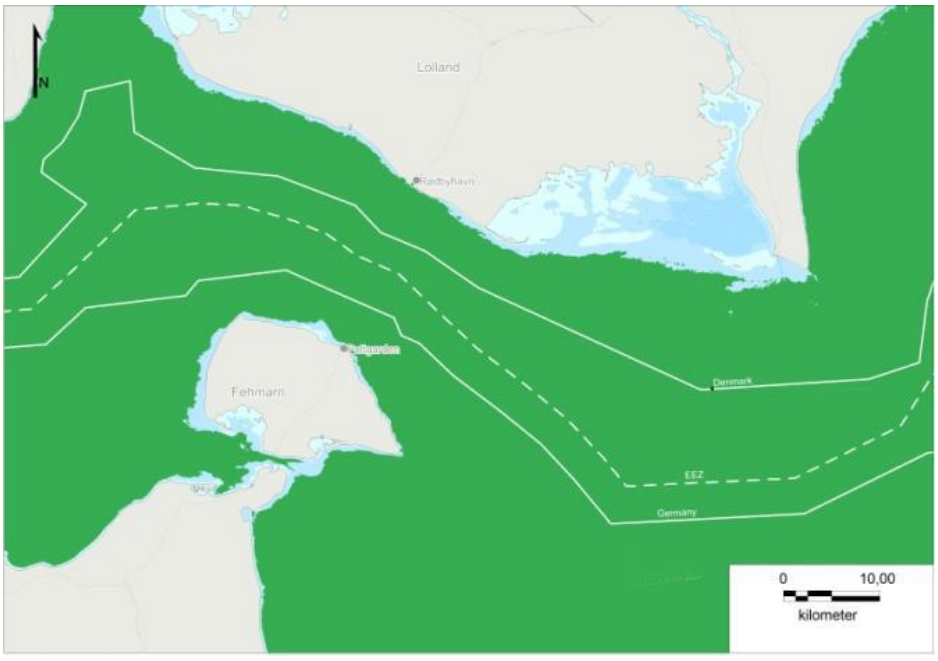

Figure 5.10 Important areas for migrating herring.

5.2.4 Birds

Special Protection Areas (SPAs) have been established in Denmark and (Germany) because of the importance of the bird fauna. Although these areas are of high importance for birds to differentiate between the sites a two-scale approach for breeding birds has been applied Table 5.3.

Table 5.3 Importance criteria for Natura 2000 sites according to protection levels of breeding birds.

Importance	Criteria
Special importance	Areas in which more than 2 species of birds listed in the Annex I of Birds Directive are breeding with several or many pairs regularly.
General importance	Areas in which single species of birds listed in the Annex I of Birds Directive are breeding with few or several pairs regularly.

A list of 43 species of non-breeding birds and 104 species of migrating birds are ranked with importance levels according to conservation status and abundance in the Fehmarnbelt area (FEBI, 2013a). Of these respectively, 15 and 18 species are of relevance for the Danish SPA's Table 5.4. For some of these modelling of importance maps were possible, Figure 5.11.

Table 5.4 Importance levels based on the combination of the conservations status of a species with its abundance in the Fehmarnbelt (FEBI, 2013a). Species of relevance for Danish SPA's in question.

Common name	Scientific name	Importance level Resting	Importance level Migration
Great Cormorant	*Phalacrocorax carbo*	Very high	Very high
Mute Swan	*Cygnus olor*	Very high	Medium
Whooper Swan	*Cygnus cygnus*	Very high	High
Bean Goose	*Anser fabalis*	Medium	Medium
Greylag Goose	*Anser anser*	Very high	Very high
Brent Goose	*Branta bernicla*	High	Very high
Tufted Duck	*Aythya fuligula*	Very high	Minor
Common Goldeneye	*Bucephala clangula*	Medium	Minor
Smew	*Mergus albellus*	Very high	
Red-breasted Merganser	*Mergus serrator*	Very high	Very high
Red Kite	*Milvus milvus*		Very high
White-tailed Eagle	*Haliaeetus albicilla*	High	Very high
Marsh Harrier	*Circus aeruginosus*		Very high
Common Coot	*Fulica atra*	Medium	
Avocet	*Recurvirostra avosetta*		High
Dunlin	*Calidris alpina*		Very high
Sandwich Tern	*Sterna sandvicensis*	High	Very high
Common Tern	*Sterna hirundo*	Minor	High
Arctic Tern	*Sterna paradisaea*	Minor	High
Little Tern	*Sterna albifrons*		High

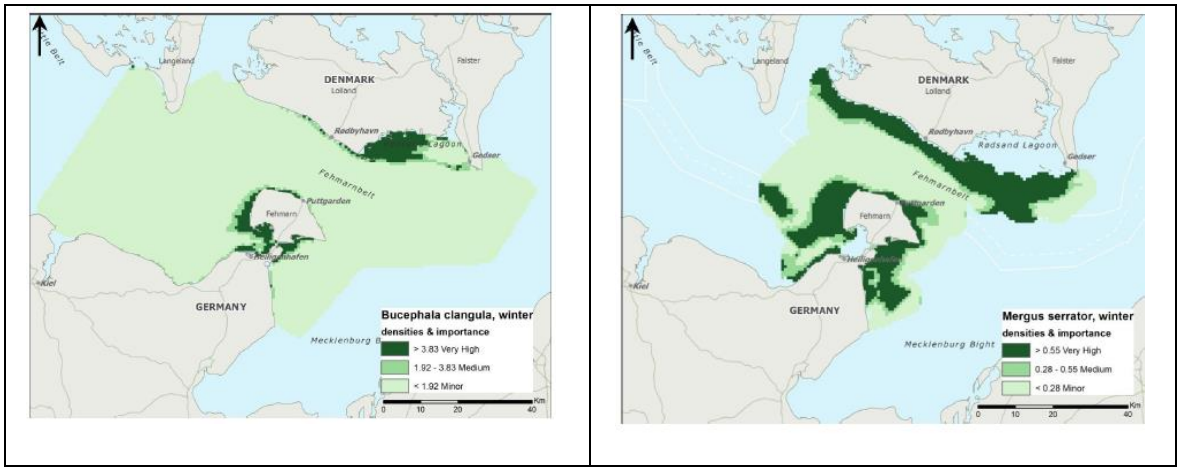

Figure 5.11 Classification of the importance of Fehmarnbelt to Common Goldeneye and Red-breasted Merganser during wintering season (November – April), based on modelled densities (FEBI, 2013a).

5.2.5 Marine mammals

The Harbour Porpoise and the seals – Harbour Seal and Grey Seal are included in the standard data form for three Natura 2000 sites in the Femernbelt area. The distribution and abundance of these animals are dependent on the structural function and food availability in the areas of concern.

The Femernbelt area is regularly populated by Harbour Porpoises, but considerable variations in the distribution and abundances are found with the highest densities during summer, Figure 5.12 and Figure 5.13. The importance of the area for harbour porpoise shows similar variation between summer and winter, Figure 5.14.

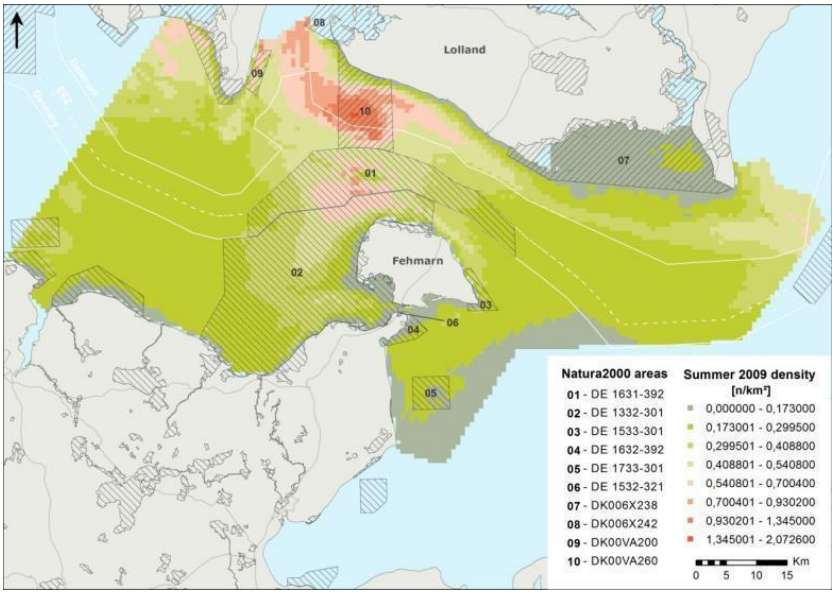

Figure 5.12 Estimated density of Harbour Porpoise (animals per km²) for summer 2009 and Natura 2000 sites.

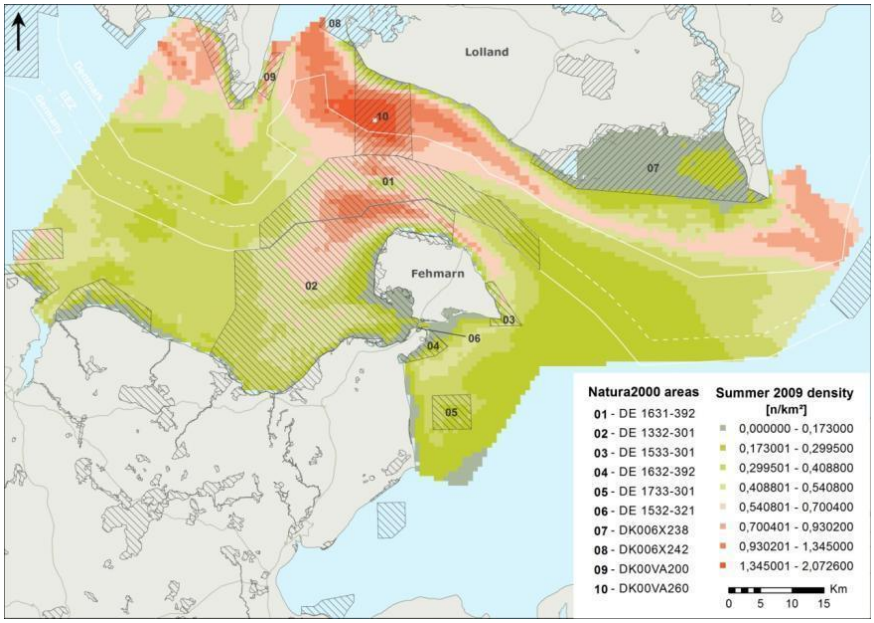

Figure 5.13 Estimated density of Harbour Porpoise (animals per km²) for summer 2010 and Natura 2000 sites. Figure covering both Danish and German marine area.

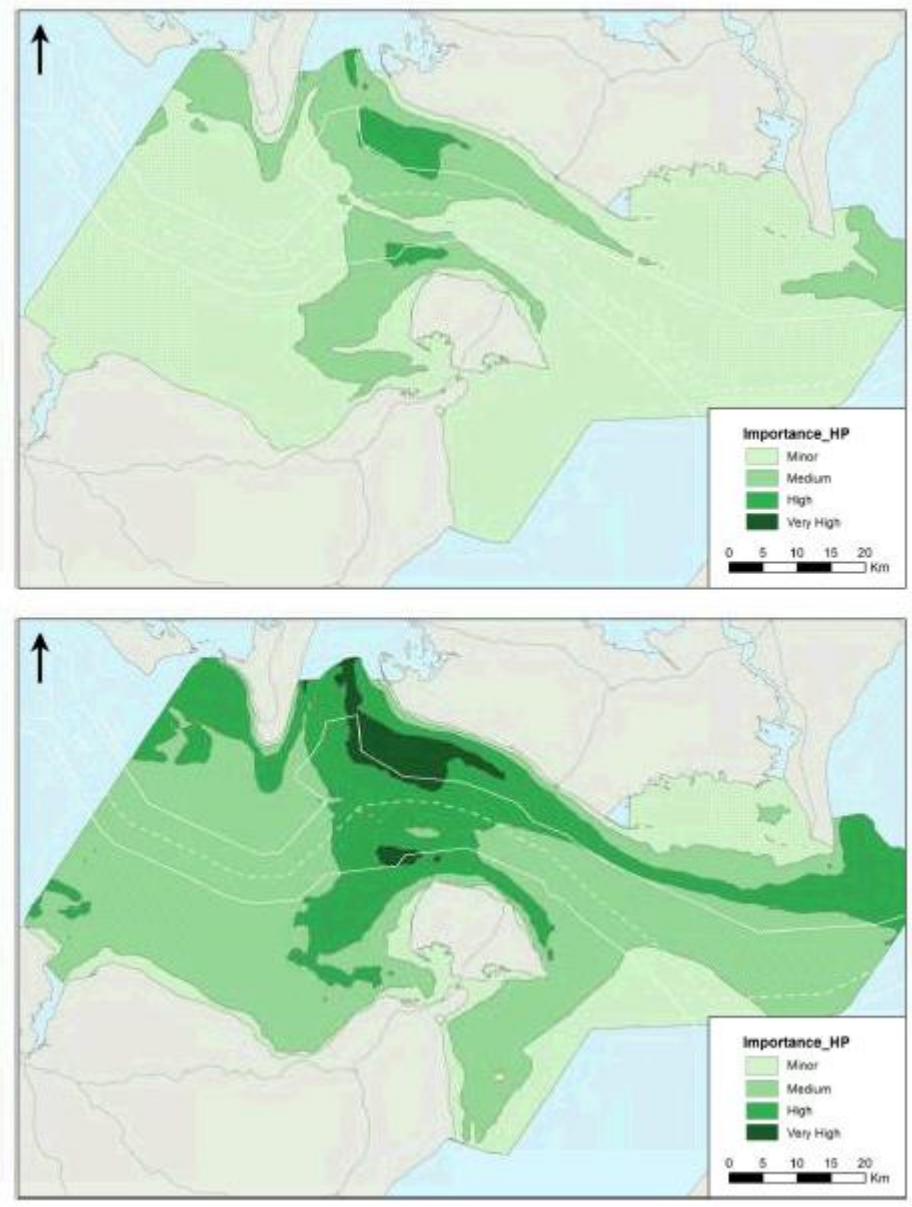

Figure 5.14 Importance of the study region to Harbour Porpoise in: A (top) - winter and B (bottom) (FEMM, 2013b).

The entire study area are important for seals for feeding the nearest observed haul-out site (Harbour Seal only) is approximately 8.5 km away from the closest extent of the construction works, Figure 5.15. Rødsand lagoon is thought to be the most important haul-out and breeding site for Harbour Seals in the western Baltic Sea, with about half of the population in Denmark found there, (FEMM, 2013b).

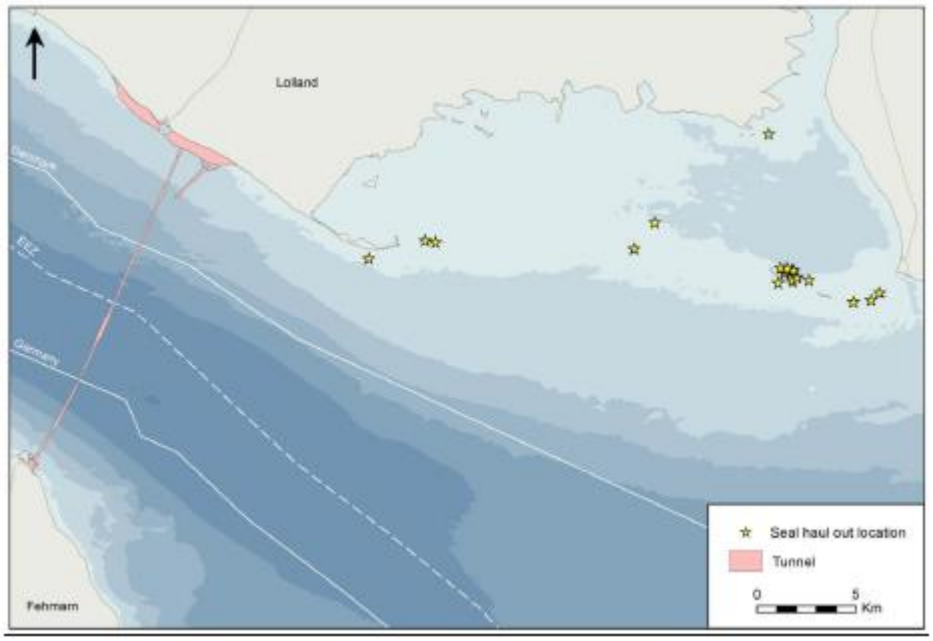

Figure 5.15 Haul out sites for seals in the Rødsand area and the areas for the tunnel works.

6 Technical project description

6.1 The Immersed Tunnel

The alignment for the immersed tunnel passes east of Puttgarden, crosses the Fehmarnbelt in a soft curve and reaches Lolland east of Rødbyhavn as shown in Figure 6.1 along with near-by NATURA 2000 sites.

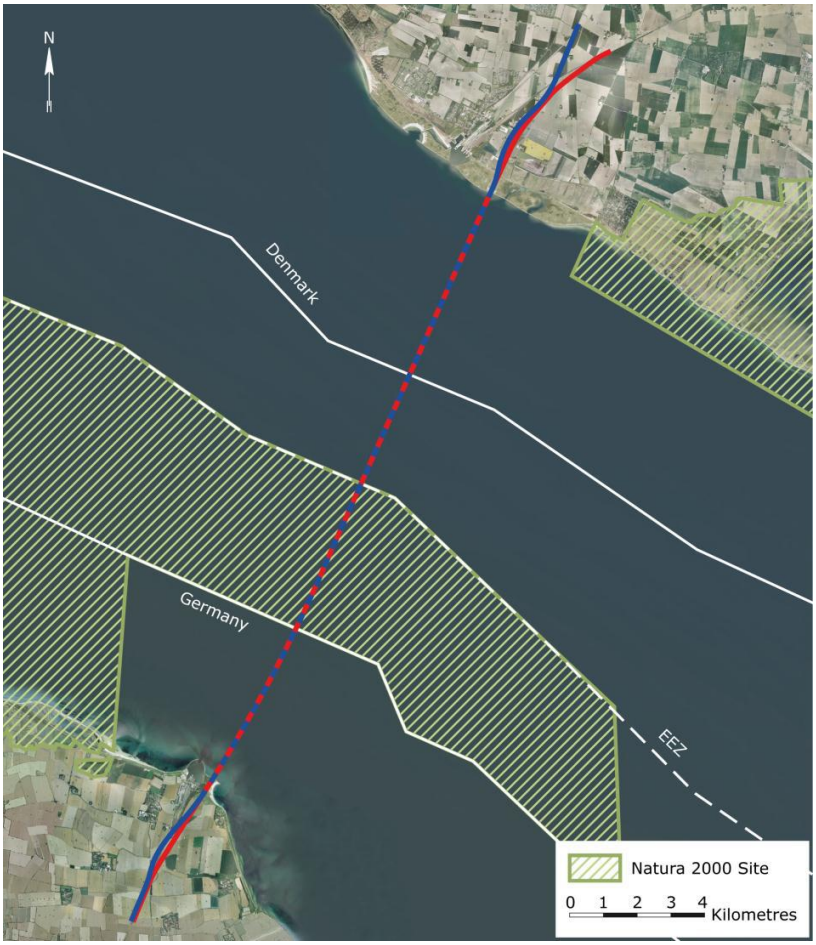

Figure 6.1 Conceptual design alignment.

6.1.1 Tunnel trench

The immersed tunnel is constructed by placing tunnel elements in a trench dredged in the seabed. The proposed methodology for trench dredging comprises mechanical dredging using Backhoe Dredgers (BHD) up to 25 meters and Grab Dredgers (GD) in deeper waters. A Trailing Suction Hopper Dredger (TSHD) will be used to rip the clay before dredging with GD. The material will be loaded into barges and transported to the near-shore reclamation areas where the soil will be unloaded from the barges by small BHDs. A volume of approx. 14.5 mio m^3 sediment is handled.

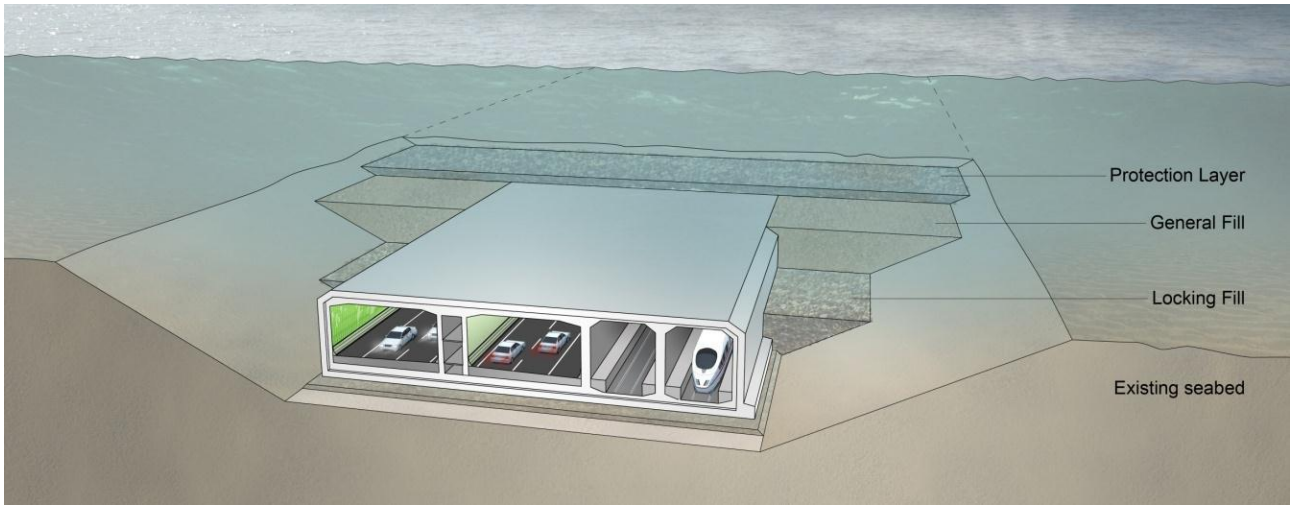

Figure 6.2 Cross section of dredged trench with tunnel element and backfilling.

A bedding layer of gravel forms the foundation for the elements. The element is initially kept in place by placing locking fill followed by general fill, while on top there is a stone layer protecting against damage from grounded ships or dragging anchors. The protection layer and the top of the structure are below the existing seabed level except near the shore. At these locations, the seabed is locally raised to incorporate the protection layer over a distance of approximately 250 m from the proposed coastline. Here the protection layer is thinner and made from concrete and a rock layer.

6.1.2 Tunnel elements

There are two types of tunnel elements: standard elements and special elements. There are 79 standard elements. Each standard element is approximately 217 m long, 42 meters wide and 9 meters tall. Special elements are located approximately every 1.8 km providing additional space for technical installations and maintenance access. There are 10 special elements. Each special element is approximately 46 m long, 45 meters wide and 13 meters tall.

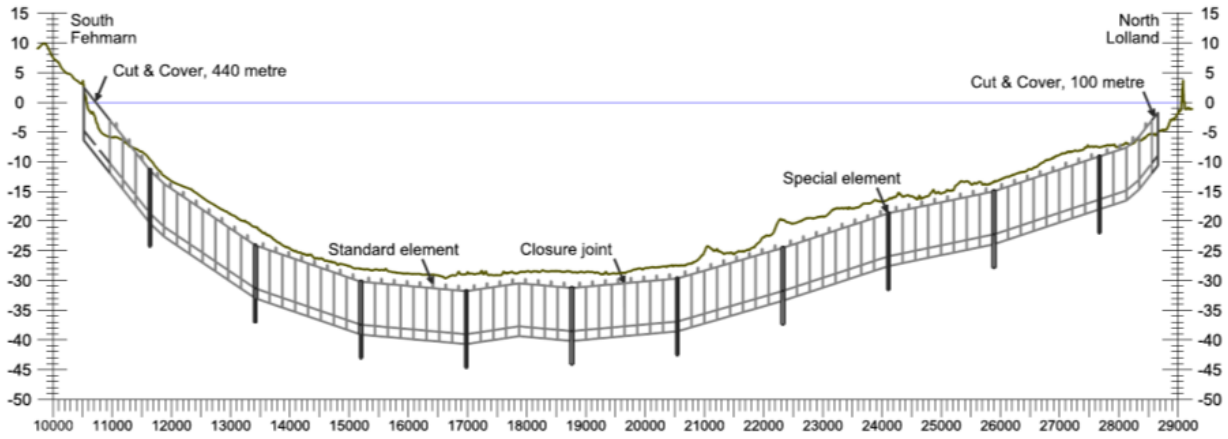

Figure 6.3 Vertical tunnel alignment showing depth below sea level.

The cut and cover tunnel section beyond the light screens is approximately 440 m long on Lolland and 100 m long on Fehmarn. The foundation, walls, and roof are constructed from cast in-situ reinforced concrete.

6.1.3 Tunnel drainage

The tunnel drainage system will remove rainwater and water used for cleaning the tunnel. Rainwater entering the tunnel will be limited by drainage systems on the approach ramps. Firefighting water can be collected and contained by the system for subsequent handling. A series of pumping stations and sump tanks will transport the water from the tunnel to the portals where it will be treated as required by environmental regulations before being discharged into the Fehmarnbelt.

6.1.4 Reclamation areas

Reclamation areas are planned along both the German and Danish coastlines to accommodate the dredged material from the excavation of the tunnel trench. The size of the reclamation area on the German coastline has been minimized. Two larger reclamations are planned on the Danish coastline. Before the reclamation takes place, containment dikes are to be constructed some 600m out from the coastline.

The landfall of the immersed tunnel passes through the shoreline reclamation areas on both the Danish and German sides

Fehmarn

The proposed reclamation at the Fehmarn coast does not extend towards north beyond the existing ferry harbour at Puttgarden. The extent of the Fehmarn reclamation is shown in Figure 6.4. The reclamation area is designed as an extension of the existing terrain with the natural hill turning into a plateau behind a coastal protection dike 3.5 m high. The shape of the dike is designed to accommodate a new beach close to the settlement of Marienleuchte.

Figure 6.4 Reclamation area at Fehmarn.

The reclaimed land behind the dike will be landscaped to create an enclosed pasture and grassland habitat. New public paths will be provided through this area leading to a vantage point at the top of the hill, offering views towards the coastline and the sea.

The Fehmarn tunnel portal is located behind the existing coastline. The portal building on Fehmarn houses a limited number of facilities associated with essential equipment for operation and maintenance of the tunnel and is situated below ground level west of the tunnel.

A new dual carriageway is to be constructed on Fehmarn for approximately 3.5 km south of the tunnel portal. This new highway rises out of the tunnel and passes onto an embankment next to the existing harbour railway. The remainder of the route of the highway is approximately at level. A new electrified twin track railway is to be constructed on Fehmarn for approximately 3.5 km south of the tunnel portal. A lay-by is provided on both sides of the proposed highway for use by German customs officials.

Lolland

There are two reclamation areas on Lolland, located either side of the existing harbour. The reclamation areas extend approximately 3.7 km east and 3.4 km west of the harbour and project approximately 500 m beyond the existing coastline into the Fehmarnbelt. The proposed reclamation areas at the Lolland coast do not extend beyond the existing ferry harbour at Rødbyhavn.

The sea dike along the existing coastline will be retained or reconstructed, if temporarily removed. A new dike to a level of +3 m protects the reclamation areas against the sea. To the eastern end of the reclamation, this dike rises as a till cliff to a level of +7 m. Two new beaches will be established within the reclamations. There will also be a lagoon with two openings towards Fehmarnbelt, and revetments at the openings. In its final form the reclamation area will appear as three types of landscapes: recreation area, wetland, and grassland - each with different natural features and use.

The Lolland tunnel portal is located within the reclamation area and contained within protective dikes. The main control centre for the operation and maintenance of the Fehmarnbelt Fixed Link tunnel is housed in a building located over the Danish portal. The areas at the top of the perimeter wall, and above the portal building itself, are covered with large stones as part of the landscape design. A path is provided on the seaside of the proposed dike to serve as recreation access within the reclamation area.

A new dual carriageway is to be constructed on Lolland for approximately 4.5 km north of the tunnel portal. This new motorway rises out of the tunnel and passes onto an embankment. The remainder of the route of the motorway is approximately at level. A new electrified twin track railway is to be constructed on Lolland for approximately 4.5 km north of the tunnel portal. A lay-by is provided in each direction off the landside highway on the approach to the tunnel for use by Danish customs officials.

Figure 6.5 A facility for motorway toll collection will be provided on the Danish landside.

6.1.5 Marine construction works

The temporary works comprises the construction of two temporary work harbours, the dredging of the portal area and the construction of the containment dikes. For the harbour on Lolland, an access channel is also provided. These harbours will be integrated into the planned reclamation areas and upon completion of the tunnel construction works, they will be dismantled/removed and backfilled.

6.1.6 Production site

The current design envisages the tunnel element production site to be located in the Lolland east area in Denmark. The figure below, Figure 6.6, shows one production facility consisting of two production lines. For the construction of the standard tunnel, elements for the Fehmarn tunnel four facilities with in total eight production lines are anticipated.

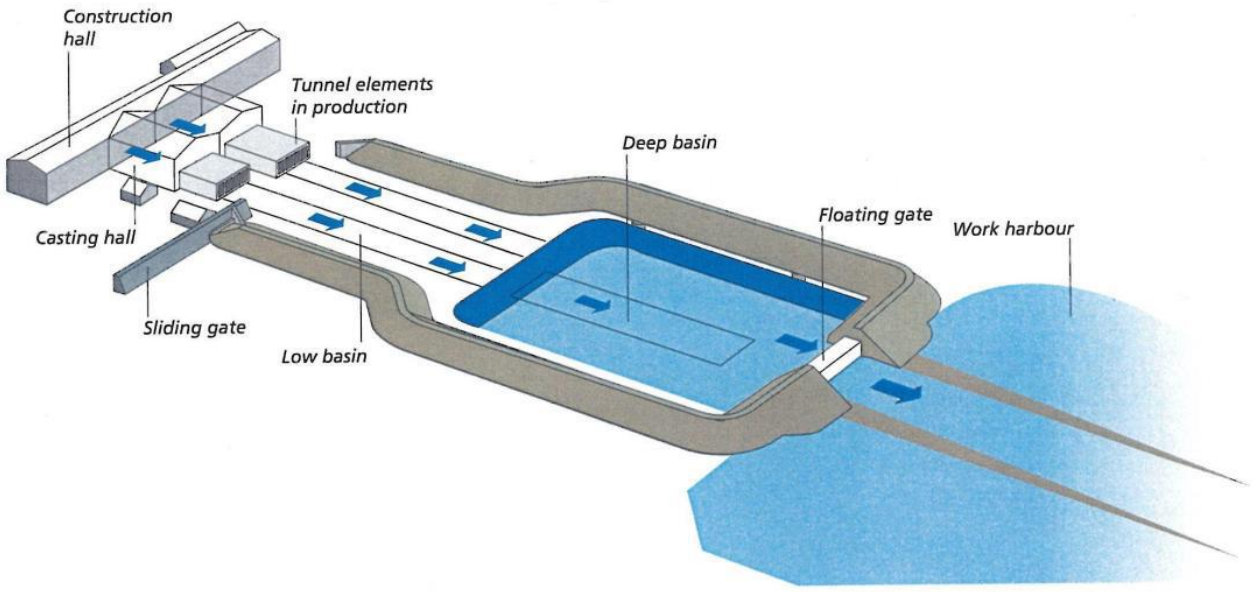

Figure 6.6 Production facility with two production lines.

In the construction hall, which is located behind the casting and curing hall, the reinforcement is handled and put together to a complete reinforcement cage for one tunnel segment. The casting of the concrete for the segments is taking place at a fixed location in the casting and curing hall. After the concrete of the segments is cast and hardened enough the formwork is taken down and the segment is pushed forward to make space for the next segment to be cast. This process continues until one complete tunnel element is cast. After that, the tunnel element is pushed into the launching basin. The launching basin consists of an upper basin, which is located at ground level and a deep basin where the tunnel elements can float. In the upper basin the marine outfitting for the subsequent towing and immersion of the element takes place. When the element is outfitted, the sliding gate and floating gate are closed and seawater is pumped into the launching basin until the elements are floating. When the elements are floating, they are transferred from the low basin to the deep basin. Finally, the water level is lowered to normal sea level, the floating gate opened and the element towed to sea. The proposed layout of the production site is shown in 6.7.

Dredging of approximately 4 mio. m^3 soil is required to create sufficient depth for temporary harbours, access channels and production site basins.

Figure 6.7 Proposed lay-out of the production site.

6.2 The Cable Stayed Bridge

The alignment for the marine section passes east of Puttgarden harbour, crosses the belt in a soft S-curve and reaches Lolland east of Rødbyhavn.

6.2.1 Bridge concept

The main bridge is a twin cable stayed bridge with three pylons and two main spans of 724 m each. The superstructure of the cable-stayed bridge consists of a double deck girder with the dual carriageway road traffic running on the upper deck and the dual track railway traffic running on the lower deck. The pylons have a height of 272 m above sea level and are V-shaped in transverse direction. The main bridge girders are made up of 20 m long sections with a weight of 500 to 600 t. The standard approach bridge girders are 200 m long and their weight is estimated to ~ 8,000 t.

Caissons provide the foundation for the pylons and piers of the bridge. Caissons are prefabricated placed 4 m below the seabed. If necessary, soils are improved with 15 m long bored concrete piles. The caissons in their final positions end 4 m above sea level. Prefabricated pier shafts are placed on top of the approach bridge caissons. The pylons are cast in situ on top of the pylon caissons Pier Protection Works are prefabricated and installed around the pylons and around two piers on both sides of the pylons. These works protrudes above the water surface. The main bridge is connected to the coasts by two approach bridges. The southern approach bridge is 5,748 m long and consists of 29 spans and 28 piers. The northern approach bridge is 9,412 m long and has 47 spans and 46 piers.

Figure 6.8 Cable Stayed Bridge.

6.2.2 Land works

A peninsula is constructed both at Fehmarn and at Lolland to use the shallow waters east of the ferry harbours breakwater to shorten the Fixed Link Bridge between its abutments. The peninsulas consist partly of a quarry run bund and partly of dredged material and are protected towards the sea by revetments of armour stones.

Fehmarn

The peninsula on Fehmarn is approximately 580m long, measured from the coastline. The gallery structure on Fehmarn is 320 m long and enables a separation of the road and railway alignments. A 400 m long ramp viaduct bridge connects the road from the end of the gallery section to the motorway embankment. The embankments for the motorway are 490 m long. The motorway passes over the existing railway tracks to Puttgarden Harbour on a bridge. The profile of the railway and motorway then descend to the existing terrain surface.

Lolland

The peninsula on Lolland is approximately 480m long, measured from the coastline. The gallery structure on Lolland is 320 m long. The existing railway tracks to Rødbyhavn will be decommissioned, so no overpass will be required. The viaduct bridge for the road is 400m long; the embankments for the motorway are 465 m long and for railway 680 m long. The profile of the railway and motorway descend to the natural terrain surface.

Figure 6.9 Approach bridge.

6.2.3 Drainage on main and approach bridges

On the approach bridges the roadway deck is furnished with gullies leading the drain water down to combined oil separators and sand traps located inside the pier head before discharge into the sea. On the main bridge, the roadway deck is furnished with gullies with sand traps. The drain water passes an oil separator before it is discharged into the sea through the railway deck.

6.2.4 Marine construction work

The marine works comprises soil improvement with bored concrete piles, excavation for and the placing of backfill around caissons, grouting as well as scour protection. The marine works also include the placing of crushed stone filling below and inside the Pier Protection Works at the main bridge.

Soil improvement will be required for the foundations for the main bridge and for most of the foundations for the Fehmarn approach bridge. A steel pile or reinforcement cage could be placed in the bored holes and thereafter filled with concrete.

The dredging works are one of the most important construction operations with respect to the environment, due to the spill of fine sediments. It is recommended that a grab hopper dredger with a hydraulic grab be employed to excavate for the caissons both for practical reasons and because such a dredger minimises the sediment spill. If the dredged soil cannot be backfilled, it must be relocated or disposed of.

6.2.5 Production sites

The temporary works comprises the construction of two temporary work harbours with access channels. A work yard will be established in the immediate vicinity of the harbours, with facilities such as concrete mixing plant, stockpile of materials, storage of equipment, preassembly areas, workshops, offices and labour camps.

The proposed layout of the production site is shown in Figure 6.10.

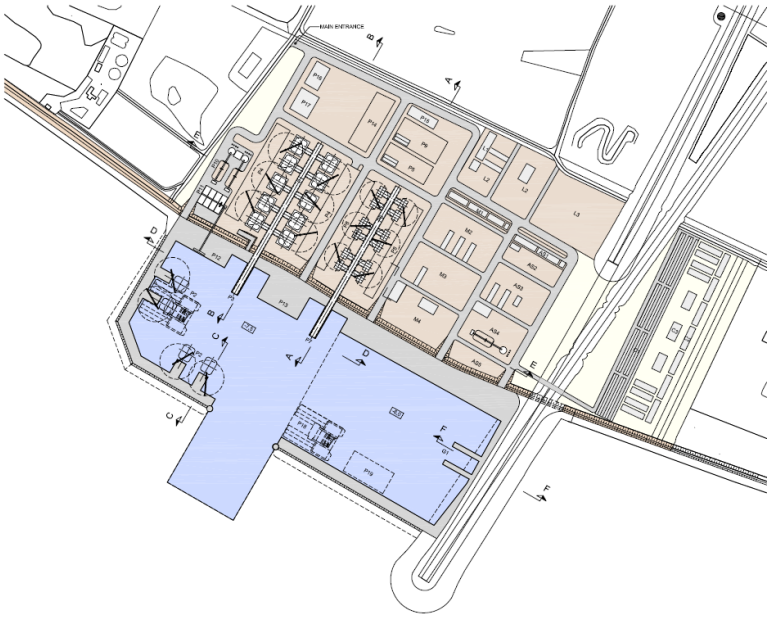

Figure 6.10 Proposed lay-out of the production site

6.3 The Bored Tunnel

The alignment for the bored tunnel is identical to the alignment for the immersed tunnel.

Figure 6.11 Conceptual design of bored tunnel

6.3.1 Tunnel concept

The major features of the bored tunnel alternative include three circular tunnels, each approximately 20 km in length - a single tunnel with space for both rail lines and two tunnels that each accommodates a uni-directional motorway link with emergency lanes in each direction.

There will be land reclamation areas at both coasts (the majority off the coast of Lolland) for deposition of the materials excavated by the boring machines

Each tunnel tube is bored with two tunnel boring machines (TBM), each of which starts from excavations on land from Denmark and Germany, respectively, to meet halfway below the Fehmarnbelt.

The railway tunnel has a total length of 21.2 km and the motorway tunnels are 19.6 km long. The motorway's physical interface with the existing infrastructure on land is identical to that of the immersed tunnel project on Fehmarn, but geographically approximately 250 m further inland on Lolland, while the railway interface is 2 km further inland on Fehmarn and 700 m on Lolland relative to the immersed tunnel project. This is because the portal structures are deeper than for the immersed tunnel project and also located further inland.

Various thicknesses of concrete lining are used, depending on the varying load and soil conditions along the alignment.

6.3.2 Tunnel structures

The tunnel structures are made up of pre-cast, segmented, circular concrete lining, consisting of a number of short rings, each of which is approximately 2 m long. Each ring consists of up to 11 individual segments. The internal structural components, consisting of a number of pre-cast or in-situ cast concrete elements that are used for road or rail decks, including supporting structures, and for walls in access roads and plant rooms, among other things.

The railway tunnel has a nominal internal diameter of 15.2 m, while the two road tunnels have an internal diameter of 14.2 m.

Figure 6.12 Portal buildings and ramps on the Lolland side.

6.3.3 Portal buildings

The portal buildings contain technical equipment used for the daily operation of the respective tunnels and their separate control rooms. As the road and rail tunnels are entirely separate, this also applies to the appropriate separate portal buildings.

Similarly to the immersed tunnel project on Lolland, the portal buildings on Lolland are placed on top of the cut and cover part of the tunnels. On Fehmarn the portal buildings are placed underground so that the buildings are not visible in the open landscape - also similar to the immersed tunnel alternative.

To counteract for buoyancy and secure a stable boring front, the depth of the bored tunnel must be sufficient to leave some soil cover over the tunnel that is at least equal to the diameter of the tunnel tube. Therefore, the tunnel ramps and portal buildings are located relatively deep and they must, therefore, be located further inland than for the immersed tunnel alternative, where these buildings can be constructed within the new land reclamation areas in front of the existing coast.

Figure 6.13 Portal buildings and ramps on the Fehmarn side.

6.3.4 Boring method

The tunnels are bored and lined with concrete rings by six tunnel boring machines, each of which must carry out the almost 10 km of boring from land to the connection point below the Fehmarnbelt.

A bored tunnel is created with a tunnel-boring machine, which in principle is a mobile factory.

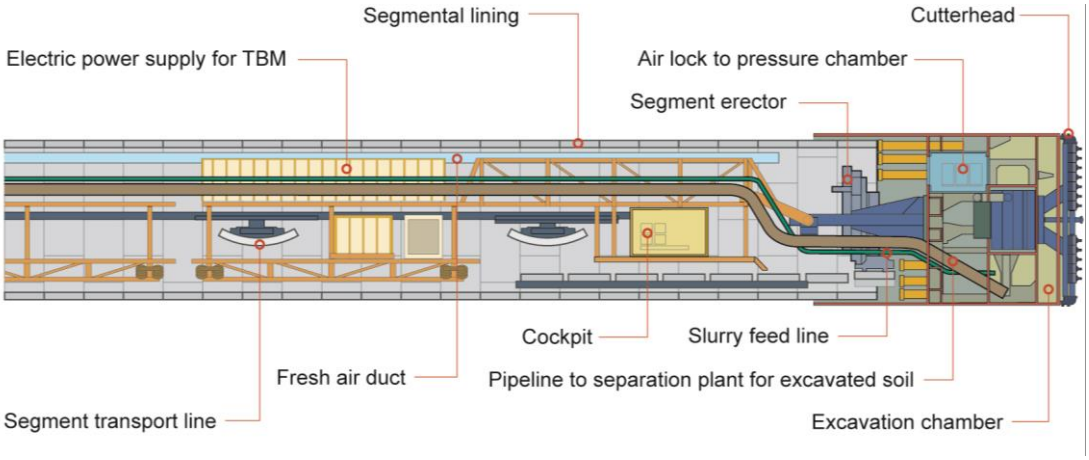

Figure 6.14 Tunnel boring machine.

The boring operation takes place by the soil ahead of the machine being loosened by using a number of cutting discs and teeth fitted in the rotating cutter head at the front end of the tunnel-boring machine. The hardened teeth are used to cut/loosen the softer materials, while the circular discs break down stones and boulders. The cutter head rotates slowly (typically 3-5 RPM) while being pressed forwards. The bored soil is transported into a collection chamber via holes in the cutter head.

The cutter head is enclosed in a steel shield, which protects against any soil ingress until the permanent concrete lining (concrete rings) can be installed.

The cutter head is specially manufactured to match the specific soil conditions and the size and length of the bored tunnel. In the Fehmarn project, all six boring machines are expected to be slurry-shield TBMs that operate using a special mixture of slurry containing bentonite. This stabilises the boring front (the soil) in front of the cutter head and is further mixed with the bored materials so that they can be pumped through a pipeline to the respective separation plants on land.

6.3.5 Separation plant and storage area for bored materials

A total of 19,200,000 m³ (incl. a bulking factor of 1.3) of bored clay and other excavated materials is expected with approximately 50% on either side – Fehmarn and Lolland. It is difficult to predict the form and volume of the excavated clay going into the separation plant. In the worst-case scenario, some of the clay will have been dissolved in the slurry, which means that even a large separation plant will have difficulties with separating the clay from the slurry in order to reuse it for land reclamation.

The separation plant consists of 1) Sieves and screens 2) Hydrocyclones and 3) Decanter centrifuges or chamber filter presses (to extract water from the waste slurry). The plant grades the materials into various and the water used is processed in a water treatment plant on site to a suitable level for direct discharging into the sea, or into a local watercourse.

The potential for reuse of the various solid materials will depend largely on the water content, and the resulting strength of the material. The project assumes that all material from the separation plants to some extent can be used for land reclamation.

Approximately one third of the materials is expected to be fine-grained - less than 0.01 mm. It may be difficult to reuse this fraction of very fine material, but it is assumed that it also can be handled as part of the reclamation works. The proposed separation method is expected to reduce the water content to an acceptable level. However, the strength properties will be weaker than the original in situ properties of the soil in front of the boring machine.

It is proposed that the most fine-grained materials be deposited into small basins to prevent them being washed away over time (driving with vehicles on top of these materials is considered to be doubtful, even in the long term, due to the material's reduced structural strength properties).

The total area proposed for the land reclamation is approximately 270 hectares. It is planned that a large part of the area being established as a network of basins surrounded by dikes that also constitute the necessary access roads for dumpers.

In addition to the fresh water required for the production of concrete and for staff welfare facilities, there is also a demand for a large volume of water for the production of slurry, which may alternatively be produced by using the brackish water from Fehmarnbelt.

6.3.6 Work site arrangement

In addition to the new land reclamation areas, the temporary construction sites required for the construction of the tunnels and portal buildings constitute the largest construction areas in the project.

Figure 6.15 Fehmarn construction site.

A total of 330,000 segments will be produced for the concrete lining within a period of approximately 3.5 years, which will require high-capacity concrete casting facilities with appropriate storage areas for hardening and storage. Elements will also be produced for the motorway and railway decks and partition walls. It is proposed that both the segment and element production sites be located close to the individual tunnel portal buildings.

The storage area must have a hard base and it will also be necessary to establish a temporary pavement on the roads to allow working vehicles to drive on them.

The total area for each separation plant is approximately 3.6 ha, including storage area for temporary storage of the filtered materials (there will be a need for an area of approximately 1.5 ha (100 m x 150 m) for the installation of the components of the separation plant, while the need for additional space for temporary storage depends on the adjoining logistics chain for further transport by truck, train and/or barge).

The storage area must typically have space for spoil equivalent to approximately 5 days of production, i.e. approximately 44,000 tonnes or 22,000 m³.

The construction site does not have a readily available supply of fresh water in the quantities required, and it is therefore expected that all fresh water to the site will be delivered by tanker by sea.

Figure 6.16 Lolland construction site.

6.3.7 Dredging and reclamation methods

Dredging is necessary at Lolland to create sufficient depth for temporary work harbours to receive bored materials from Fehmarn. Mechanical excavators such as backhoe or grab excavators will be used for this work.

The water depth at Fehmarn is already sufficient for this purpose and no additional dredging is required.

6.3.8 Slurry separation and soil re-use for land reclamation

The principal strategy of the soil reuse is that as much soil as possible will be used for the cut and cover, additional cover, and landscaping requirements, with residual soil being used for land reclamation.

The bored tunnel requires transport of the excavated soil from the tunnel face by pumping it as slurry to the portal locations, where it is processed to separate it from the slurry, allowing it to be taken by truck or ship to the required final destination. Once the spoil has been received at the portal, it may be subject to potential (legal) restrictions in relation to transferring it between Germany and Denmark.

The excavated soil from the bored tunnels (totalling about 12 million m^3 for the TBM driven section, before bulking) has to be re-used. Any added Bentonite and as much additional water as possible will be separated from the spoil to improve the stability of the material to be re-used. The level of dewatering and separation depends on the ability of the slurry treatment plant to separate the fines from the liquid. The separation process splits the soil into various fractions, based on their particle size.

All fractions are re-usable for land reclamation but with some uncertainty. Nevertheless, after treatment some fractions of the soil may be considered slightly contaminated and classified in accordance with the EU Waste Framework Directive, which will require in Denmark and Germany permits for recovery measures and a notification procedure in case of cross border

shipment (Waste Shipment Regulation). Because the quantity and level of contamination in the various fractions of the ground is uncertain, the approval for re-use of it in reclamation areas is uncertain.

As the larger area of land reclamation is proposed on the Danish coast, there will be a requirement to transfer a large proportion of spoil from Germany to the Danish coast. This will require spoil treatment before shipment to Denmark.

It is expected that all of the spoil can be used, however, due to the engineering properties of the materials; the fines from the bored tunnel will have to be placed in between a matrix of closely spaced containment dikes as shown in Figure 6.16 and temporary (but possibly long lasting) restrictions to the use of a part of the reclaimed material must be foreseen. There is a potential risk that the spoil treatment will not be able to remove all water from the fines and thereby leave a large portion of the soil as slurry with a high content of water. Areas filled up with such slurry cannot be readily accessed by either vehicle, or by pedestrians.

7 Impact Assessment

Project pressures change during construction and operation, and the potential impacts on habitats and species consequently vary during the different phases of the project. In the following section potential general pressure driven impacts on the key indicators – the benthic flora and fauna - and seabed forms, fish communities, marine mammals and birds due to construction, structures and operation are shortly described.

The main pressures on benthic flora, fauna and fish communities results from dredging activities during construction due to effects from the spreading of spilled sediments, whereas the impacts on birds and marine mammals from project activities mainly are secondary effects caused by a reduced availability of food.

Noise and disturbances adds to the pressures on birds and marine mammals during construction, whereas during operation pressures could appear as barrier effects for migrating birds.

7.1 Sediment spill

Sediment spill from dredging activities during the construction phase is the most important key pressure from the project as it potentially may cause temporary adverse effects on key indicators due to shading of benthic vegetation and increase sedimentation potentially smothering benthic vegetation and fauna, which can result in reduced food supply for fish, seabirds and marine mammals. The earth handling budgets have been interpreted into time series of spill based on the actual geological conditions and dredging methods in such a way that the spill at all times consist of the actual material found at the location and depth where dredging takes place. The spill derives from dredging of work harbour, access channel, and removal and replacing of seabed material depending on which alternative (bridge, immersed tunnel, and bored tunnel) is chosen.

To carry out a proper impact assessment for the present Natura 2000 screening potential impacts have been assessed based on detailed spill time series for all technical project alternatives and the different construction activities. The series have been developed to indicate mass of spill versus time for the different construction activities. The maximum pressure from sediment spill result from the construction of the immersed tunnel, Figure 7.1- 7.3. Figure 7.3 and Figure 7.5 indicate sedimentation pressures from the bridge and bored tunnel project alternatives, respectively.

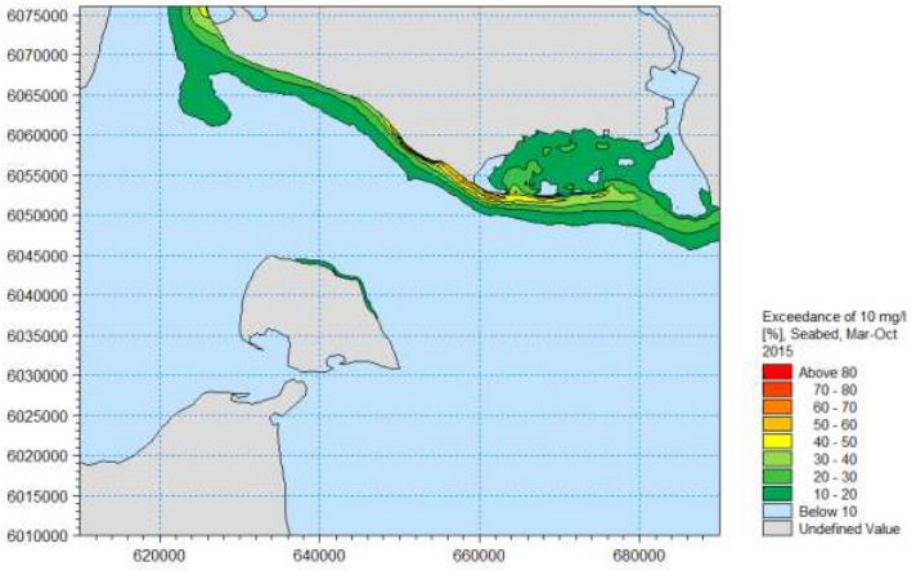

Figure 7.1 Exceedance time of 10 mg/l spilled sediment concentration for the lower part of the water column for the period March – October 2015. Immersed tunnel E-ME (FEHY, 2013).

The sediment spill result in increased sedimentation in mainly deeper parts of the Fehmarnbelt area, Figure 7.2, Figure 7.3, Figure 7.4 and Figure 7.5.

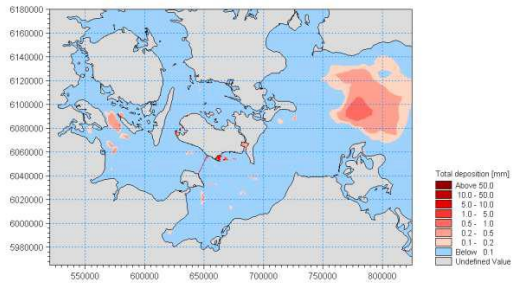

Figure 7.2 Deposition pattern of maximum sedimentation at the end of 2019 for the immersed tunnel alternative. Full modelling area (FEHY, 2013).

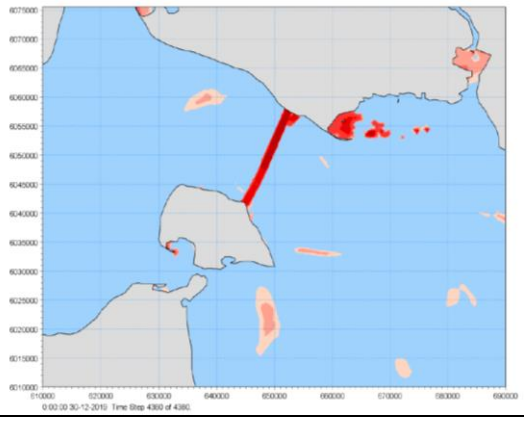

Figure 7.3 Deposition after 2019 (end of simulation) – Immersed tunnel scenario – local zoom.

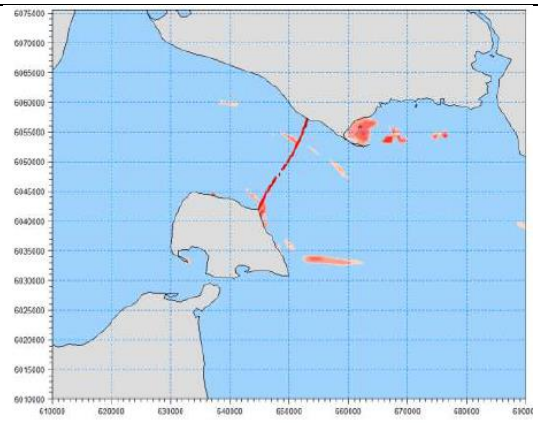

Figure 7.4 Deposition after 2019 - Bridge solution - local zoom.

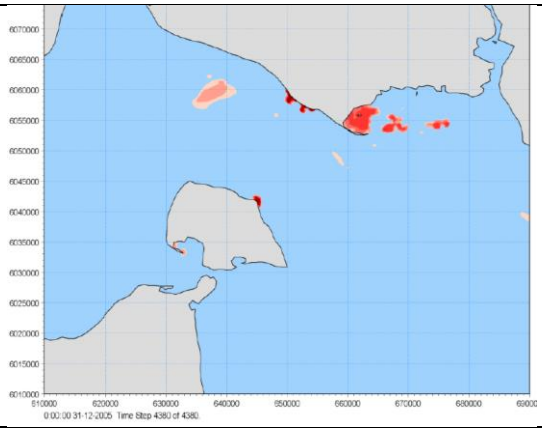

Figure 7.5 Deposition after 2020 (end of simulation) – Bored tunnel scenario. Local zoom.

7.1.1 Effects on benthic flora and fauna

The different types of impact on the flora and fauna in Danish Natura 2000 areas are all related to the sediment spill. During the construction phase various dredging activities (e.g. dredging, backfilling, establishment and decommissioning of work harbours and access channels, etc.) will cause spill of seabed sediment. The pressure from spilled sediment is highest for the immersed tunnel alternative and of lower magnitude for the bridge and bored tunnel alternatives. Furthermore, the highest pressure will occur in the first two years of the construction period dependent on the alternative. The spill can potentially have an impact on the habitat types “Sandbanks, code 1110”, “Mudflats and sandflats not covered by seawater at low tide, code 1140”, “ Coastal lagoons, code 1150”, “Large shallow inlets and bays, code 1160” and “ Reefs, code1170”.

The spilled sediment causes an increase of the concentration of suspended sediments in the surrounding waters and thereby the turbidity. The increased turbidity will reduce the light

availability for the photosynthesis and growth of benthic flora and potentially impact the fauna by diluting the food resource or clogging feeding organs.

In the worst case scenario with maximum concentrations of suspended sediments in the bottom layers and consequently a reduction of light availability during the dredging of the trench for the immersed tunnel, the modelled reduction in light availability at the seabed during the growth season (March –September) shown reductions up to 40%, locally slightly higher in parts of the Natura 2000 site at Rødsand, Figure 7.6.

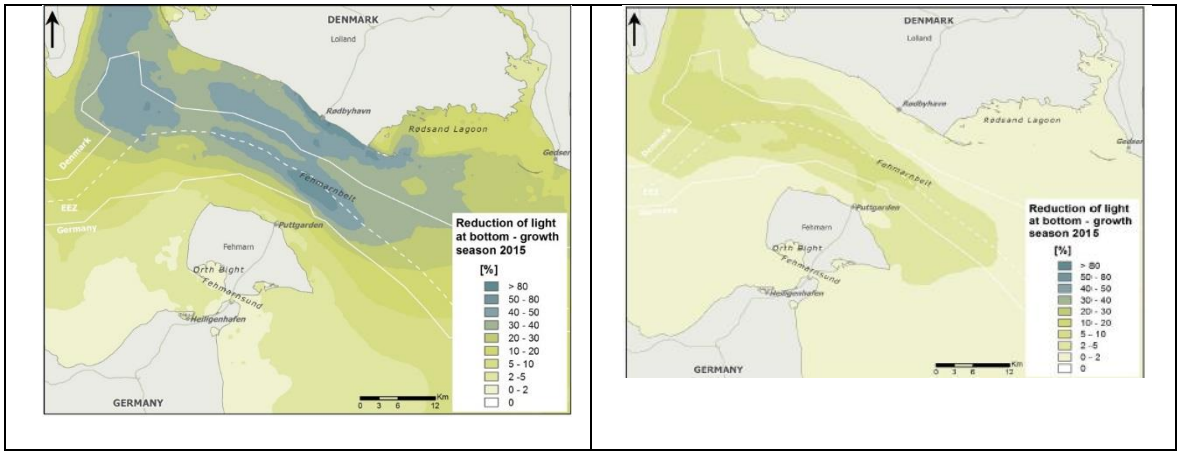

Figure 7.6 Reduction of light availability (%) for benthic flora of the Fehmarnbelt area during the growth season (May-September). Only the year with the highest reductions are shown; for immersed tunnel (left) and bridge (right) alternative (FEMA, 2013d).

The reduction in light availability at the seabed has resulted in a modelled reduction in biomass of vegetated areas in the shallow water communities during the construction period – worst during the first year of construction, and least for the bridge solution, Figure 7.7. The impacts on the benthic flora biomass due to reduced light availability are temporary and in combination with a fast recovery, no long-term effects on biomasses and the function of the local or regional ecosystem will appear.

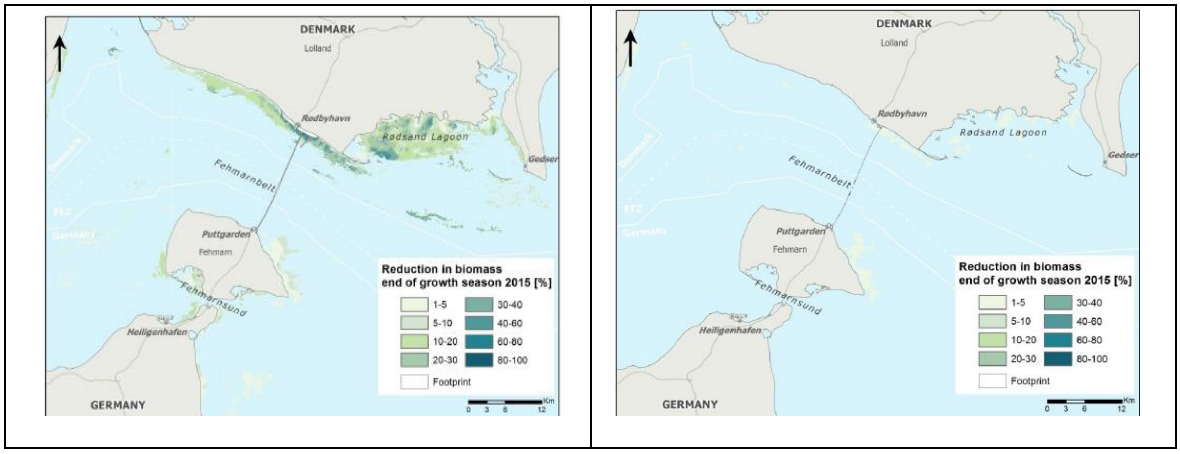

Figure 7.7 Reduction in biomass of benthic vegetation (%) in the Fehmarnbelt area during the growth season (May-September). Only the year with the highest reductions is shown; for immersed tunnel (left) and bridge (right) alternative (FEMA, 2013d).

The estimated magnitude of pressure for fauna of excess suspended sediments is shown in Figure 7.8 for the immersed tunnel. As the fauna is both influenced by the amount of sedimentation and the duration, the magnitude of pressure is based on concentrations in mg/l and the duration in days. No magnitude of pressure is expected if concentrations are below the

threshold of 10 mg/l. For the bridge and the bored tunnel alternatives, model results of the suspended sediments show that the magnitude of pressure is below the threshold values (10 mg/l) (FEMA, 2013c). The increased level of suspended sediments will indirectly affect the biomass of benthic mussels – the Mytilus community, Figure 7.9. The maximum reduction is estimated at 10% in some areas, but only minor and insignificant changes are modelled in most of the impacted area (FEMA, 2013c).

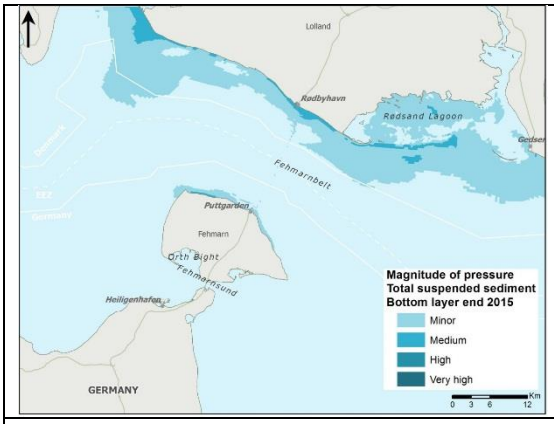

Figure 7.8 Magnitude of pressure for suspended sediments in the near-bed layer for the dredging period October in year 1 to end year 2 of the immersed tunnel construction. The magnitude is minor in most areas where the pressure occurs. Magnitude of pressure is based on concentrations in mg/l and the duration in days No magnitude of pressure is expected where concentrations are below 10 mg/l.

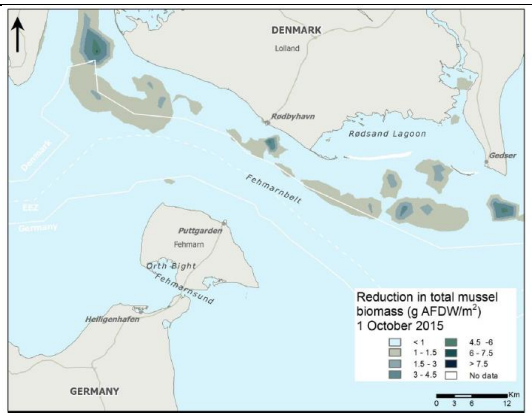

Figure 7.9. Change in total mussel biomass in Fehmarnbelt caused indirectly by the increased concentration of suspended sediments for the tunnel alternative.

The suspended sediments will deposit on the seabed (sedimentation) and can potentially smother the flora and fauna. The magnitude of pressures is highest for the immersed tunnel solutions and is based on a combination of sedimentation thickness and duration of the sedimentation, Figure 7.10 and Figure 7.11.

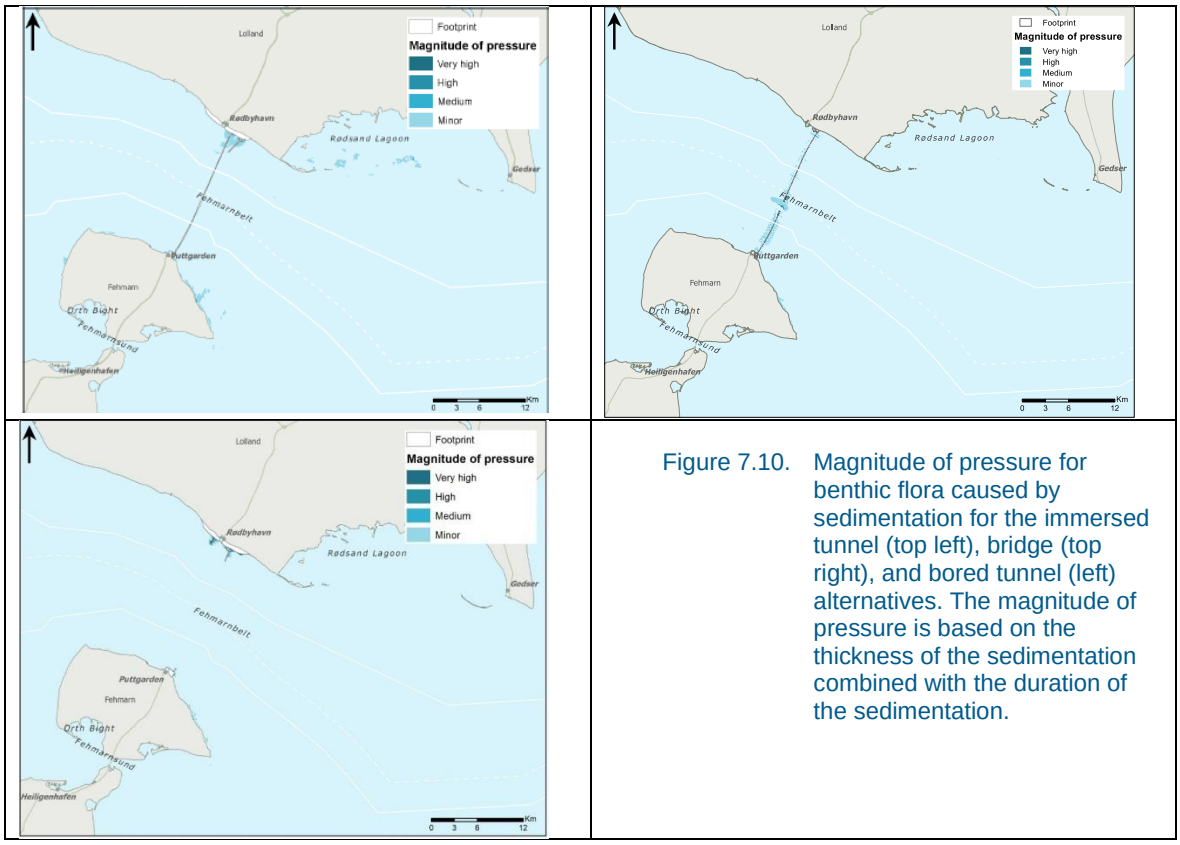

Figure 7.10. Magnitude of pressure for benthic flora caused by sedimentation for the immersed tunnel (top left), bridge (top right), and bored tunnel (left) alternatives. The magnitude of pressure is based on the thickness of the sedimentation combined with the duration of the sedimentation.

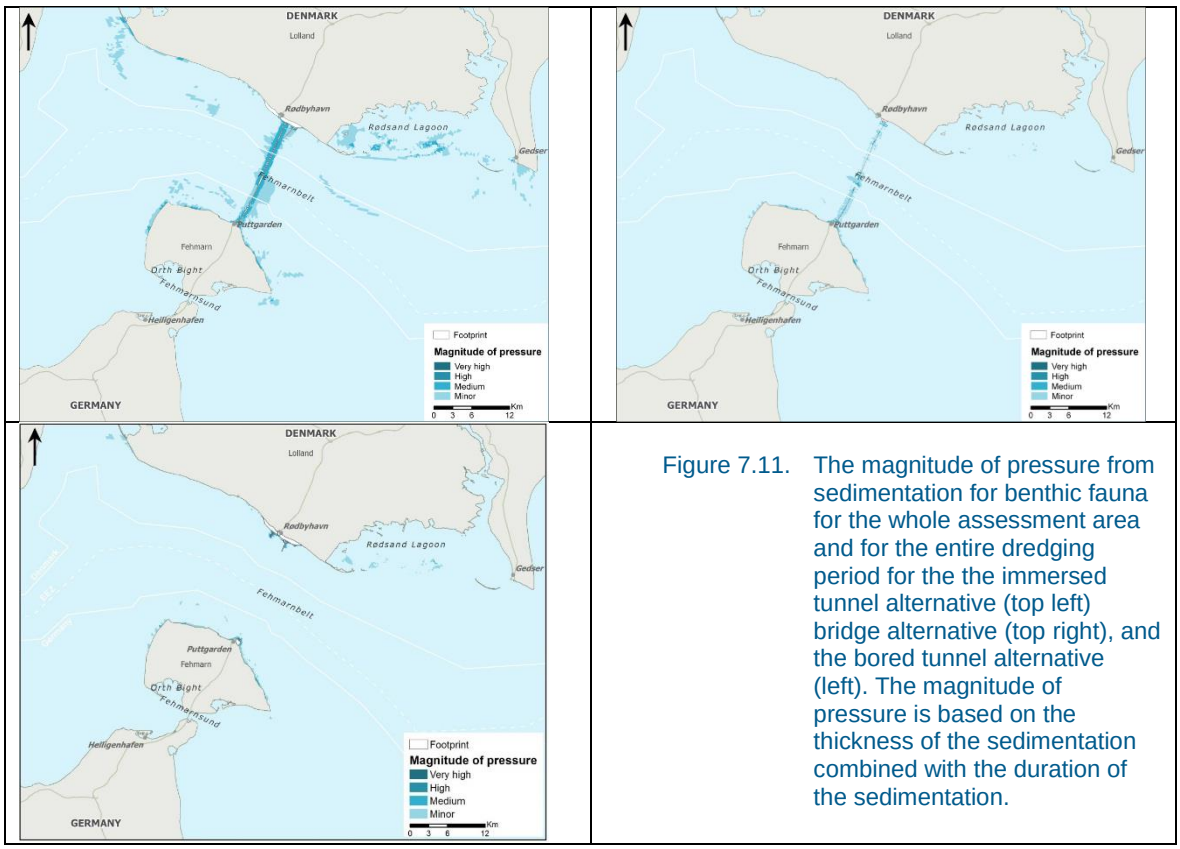

Figure 7.11. The magnitude of pressure from sedimentation for benthic fauna for the whole assessment area and for the entire dredging period for the the immersed tunnel alternative (top left) bridge alternative (top right), and the bored tunnel alternative (left). The magnitude of pressure is based on the thickness of the sedimentation combined with the duration of the sedimentation.

The deterioration due to sedimentation will only have insignificant effects on the benthic flora and fauna communities even in the worst-case scenario with maximum pressures during the construction of the immersed tunnel, Figure 7.12.

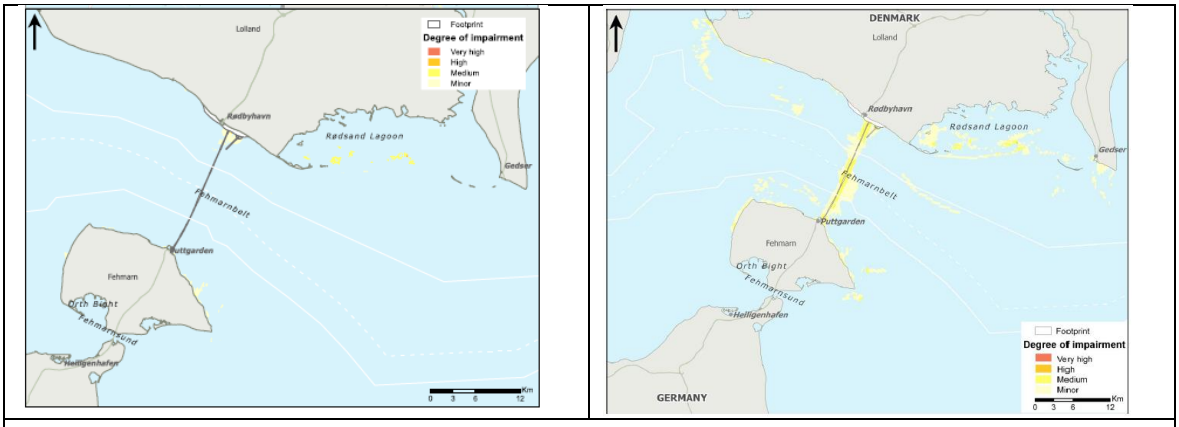

Figure 7.12 The modelled impact for the whole study area resulting from the overlay of sensitivity of benthic flora (left) and fauna (right) with maximum magnitude of pressure levels determined for the entire dredging/backfilling period of immersed tunnel construction.

7.1.2 Effects on fish communities

The indirect pressures of reduction in benthic vegetation and fauna result in a deterioration of the habitat suitability for some species in the shallow water fish communities.

The potential impacts concerns temporary and reversible deterioration of spawning, nursery and feeding grounds due to sedimentation of particles from the sediment spill.

The shallow water fish communities are dominated by small fish like sticklebacks, gobies and sandeels but also juvenile fish like cod, whiting and flatfish are abundant and important in shallow waters. Only species more or less associated to vegetation are affected by decrease in biomass and distribution of the benthic vegetation. Only minor and insignificant changes in habitat suitability were modelled for these species in the worst-case scenario with maximum pressures from spilled sediments during the construction of the immersed tunnel.

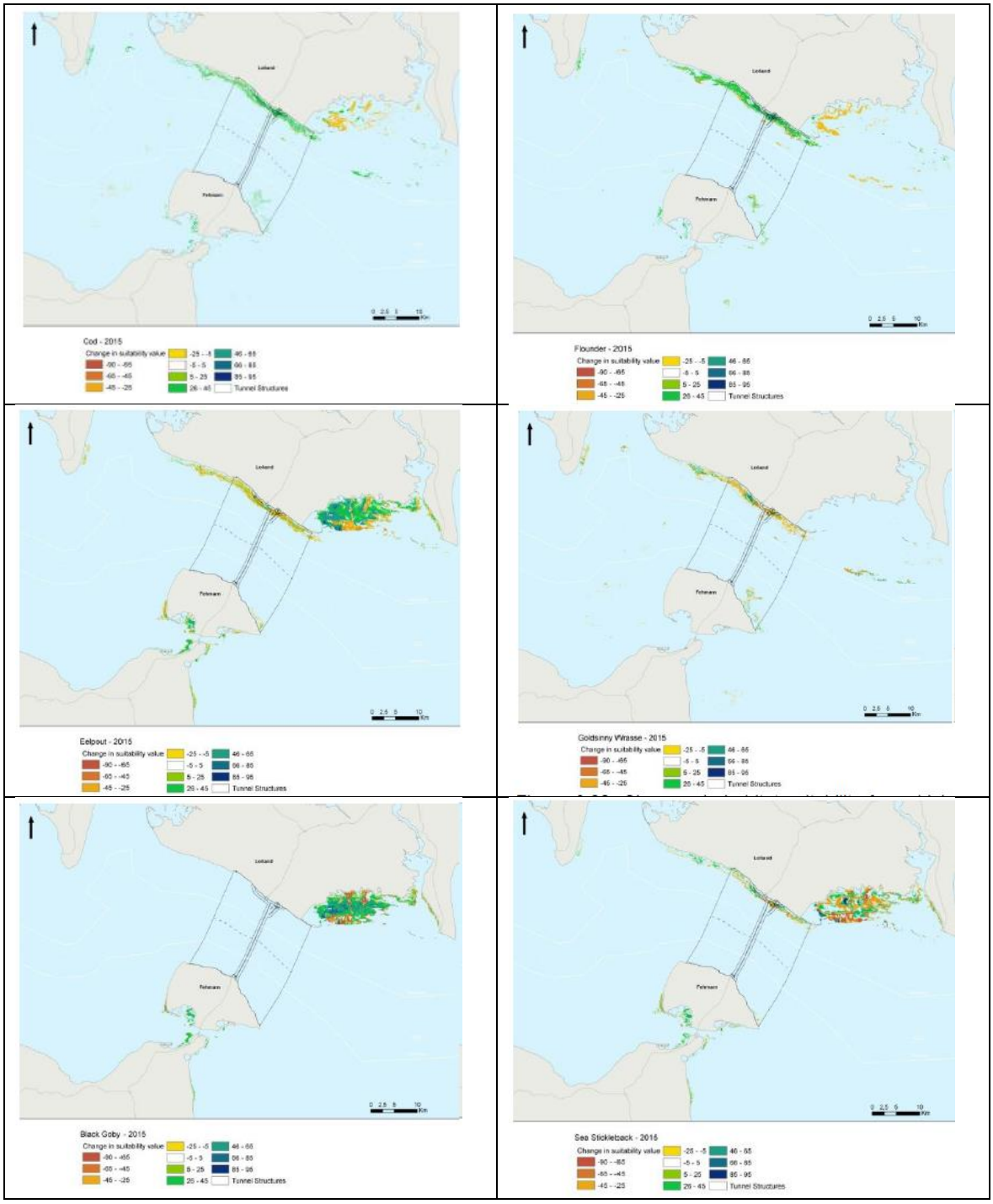

Figure 7.13. Changes in habitat suitability for key elements in the shallow water fish community during first year of construction of the immersed tunnel (FeBEC, 2013b).

Impact pressures from the construction works of the Fehmarnbelt Fixed Link on fish species listed in Annex II, IV, and/or V of the Habitats Directive will in general terms be identical to the impact pressures identified for fish communities and other more common fish species in the Fehmarnbelt area.

7.1.3 Effects on birds

As a direct impact from sediment spill during construction, resulting in reduced water transparency will result in displacement of foraging water birds from areas above a certain

thresholds for suspended sediments. Foraging birds will be displaced from areas impacted by sedimentation or suspended sediments resulting in reduced food availability of relevant food organisms – benthic fauna, benthic flora and fish

A number of breeding and resting waterbird species are identified as being potentially sensitive to pressures from habitat changes due to sediment spill and these species are potential affected in areas impacted by spilled sediments.

For one of the listed species in the standard data forms for Natura 2000 areas the Common Goldeneye - only minor impact are assessed as a result of habitat changes from sediment spill, Figure 7.14.

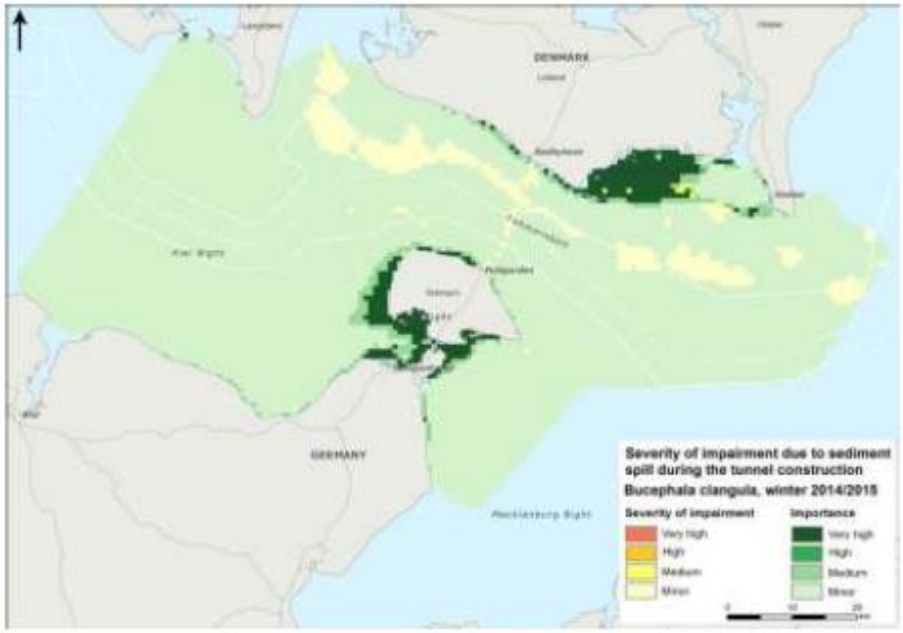

Figure 7.14. Impact (severity of impairment) on Common Goldeneye from reduction in mussel biomass due to sediment spill in the worst-case scenario during construction of the immersed tunnel (FEBI, 2013b).

Effects of reduced water transparency are assessed to have medium impact on one of the fish eating species the Red-breasted Merganser in the Fehmarn Belt area, Figure 7.15.

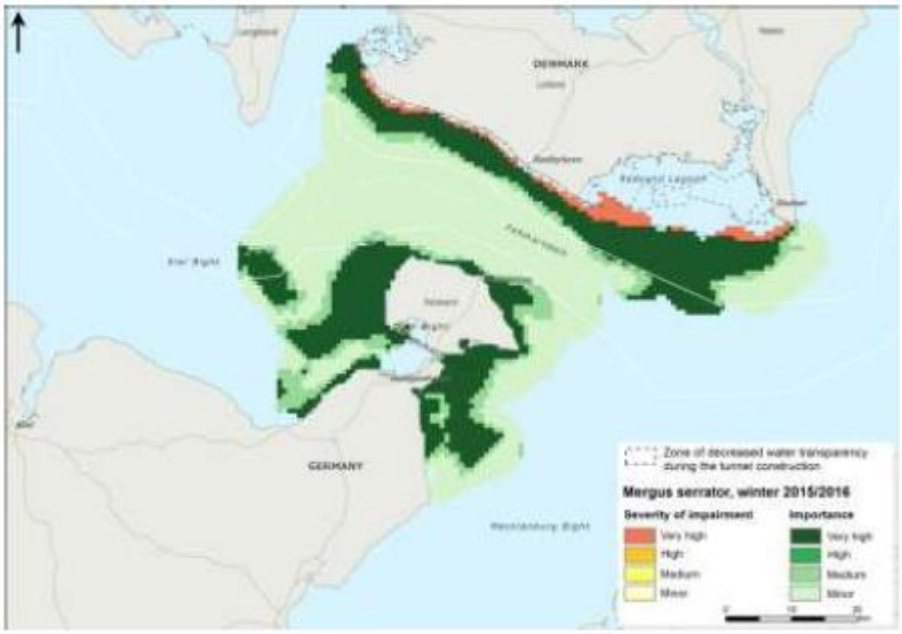

Figure 7.15. Impact (severity of impairment) on Red-breasted Merganser from decreased water transparency in the worst-case scenario during construction of the immersed tunnel (FEBI, 2013b).

7.1.4 Marine mammals

Suspended sediment and sedimentation resulting in habitat change may indirectly impact marine mammals through reduction in food availability. Suspended sediments may also affect the visual capacity of marine mammals and thereby reduce their catch ability.

Impacts of sediment spill on Harbour Porpoise due to reduced food availability are considered to be of minor importance in the Fehmarnbelt area (FEMA, 2013d).

7.2 Noise and traffic

Noise from construction activities and vessels and disturbances and barriers from construction vessels are the pressures, which could potentially affect marine mammals and birds in marine areas.

7.2.1 Effects on marine mammals

Underwater noise emissions from construction activities connected to dredging and backfilling work, drilling and piling operations and traffic are the main pressures affecting marine mammals.

The impact from underwater noise can result in permanent (PTS Permanent Threshold Shift) or temporary (TTS Temporary Threshold Shift) hearing loss or behavioural reactions of both Harbour Porpoise and seals depending on different thresholds of pressure or sound levels (SEL measured in dB re1µPa^{2}s). Seals can also be affected by airborne noise.

The lowest threshold for underwater noise of 160 dB re1µPa^{2}s SEL 750 m from the source resulting in behavioural reactions of marine mammals were not exceeded for any noise related activities during construction (FEMM, 2013b). The impact from underwater noise on marine mammals is modelled to be insignificant at the population level for staging and nursery areas.

There is no overlap between the haul-out zones for seals and the noise emission during construction.

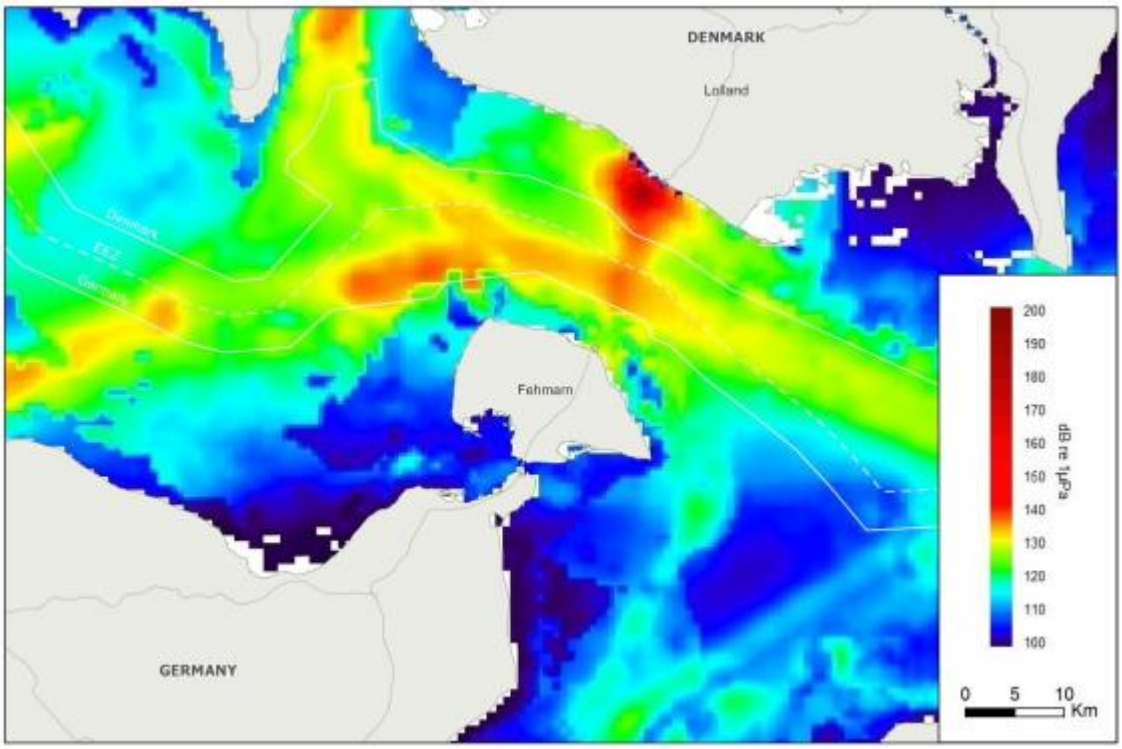

Figure 7.16. Worst-case scenario for sound pressure levels in Fehmarnbelt during simultaneous dredging and pile driving combined with baseline shipping noise present in the area.

Either habitat loss, habitat changes or changes in food availability affect marine mammals significantly during construction of the immersed tunnel, bridge or bored tunnel.

7.2.2 Effects on birds

Traffic during construction and operation and disturbances from other construction activities and traffic crossing the bridge during operation will cause disturbance to a number of waterbird species especially high sensitive species like Divers, Welvet and Common Scoter and breeding waterbirds. The disturbance zone is defined as a 3 km buffer around the alignment and in this zone, some waterbirds will be impacted. Including some listed in the standard data formats for the Natura 2000 sites in question, Figure 7.17 and Figure 7.18. For Common Goldeneye and Red-breasted Merganser it is evaluated that insignificant parts - on average 0.01 and 0.12% respectively of the biogeographic populations - will locally be displaced.

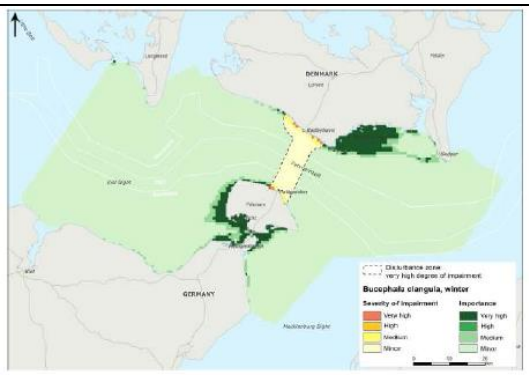

Figure 7.17 Impact (severity of impairment) on Common Goldeneye in winter due to disturbance from construction vessels (FEBI, 2013b).

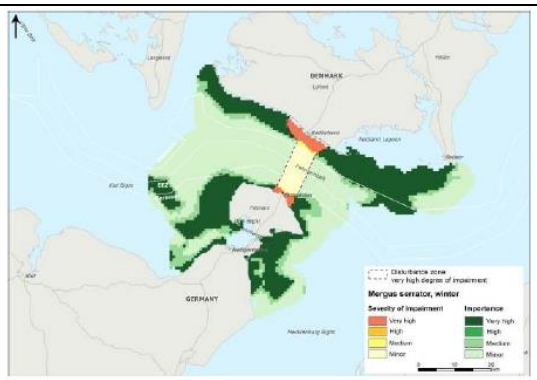

Figure 7.18. Impact (severity of impairment) on Red breasted Merganser in winter due to disturbance from construction vessels (FEBI, 2013b).

7.3 Habitat loss

No physical habitat loss due to construction (excavation and dredging) and food prints of structures (base of pylons and tunnel elements including protection layers) appear or have any effects on Danish Natura 2000 sites, Figure 6.1.

7.4 Barrier effects and collision

Barrier effects due to construction activities and permanent structures during operation are considered relevant for some fish species, marine mammals and birds. Besides, vessel traffic can result in a local and temporary barrier effect or collision risk for migrating birds and changes in habitat use for local waterbirds.

7.4.1 Effects on fish migration

Temporary effects of suspended sediments and permanent structures are pressures affecting the migration of some fish species. However, for thresholds of 10 mg/l resulting in avoidance behaviour in the migrating period for cod, sprat, whiting, flatfish, herring, and 50 mg/l for migrating eel there will be no significant effect on migration in the worst-case scenario during construction of the immersed tunnel (FeBEC, 2013b). The risk of permanently hampered migration of migrating fish species due to the physical structures is considered as insignificant (FeBEC, 2013b).

7.4.2 Effects on migrating and resting birds

Temporary barrier effects from construction vessels or permanent barrier effects from bridge structure will be dependent on species sensitivity and result in minor reactions, detour flights around or above barriers to birds not crossing the barrier. Changes in habitat use of local waterbirds can also be a result of barriers.

The bridge presents a permanent risk of collision and acts as a possible barrier for flying birds, both migrating and those conducting short distance movements. Birds can collide with bridge

structures either accidentally or attracted by lights and they can even collide with car or train traffic on the bridge. In the sensitivity, assessment conclusions from migration behaviour and avoidance reactions from a number of studies on offshore wind farms and the Great Belt Link has been used (FEBI, 2013b). Species flying at low altitude, flying perpendicular to the alignment, preferring to fly over water, being daytime active and being sensitive to anthropogenic disturbance are most likely to be affected by bridge structures.

The tunnel consist a risk only in the construction phase. In conclusion the impact in relation to a tunnel alternative has been insignificant, though for a few bird species negligible (FEBI, 2013b) and thus no significant impact.

In the bridge alternative, no significant barrier effects for any of the breeding waterbirds, non-breeding waterbirds or daytime and nocturnal migratory species included in reasons for designation of nearby Natura 2000 sites were found (FEBI, 2013b). However, for only three migratory waterbirds species (Black- and Common Guillemots and Razorbill), not included in the reasons for designation in any of the Natura 2000 sites considered, the barrier effect from the bridge structures has though been estimated as significant (FEBI, 2013b). For this reason, the overall assessment of barrier effects and collision risk for relevant bird species for this Natura 2000 screening for both a tunnel and a bridge alternative show that significant effects can be excluded, and the impact are not considered in further detail in the present reporting.

7.4.3 Effects on marine mammals

A large amount of data was generated with the use of different approaches to study a potential barrier effect of the Great Belt Bridge on Harbour Porpoises, (FEMM, 2013a) .

Harbour porpoises have been observed and recorded crossing under the bridge across the Great Belt. The studies undertaken by (FEMM, 2013a) show the presence of Harbour Porpoises in the proximity of the bridge and with no evidence for changed behaviour due to the bridge. There was no indication from any of the results that Harbour Porpoises perceived the bridge as a barrier to movement. Consequently, for the Harbour Porpoise, the function as a migration corridor will not be negatively affected. Harbour Seals and Grey Seals have been documented travelling and feeding under the bridge. Telemetry data from the Fehmarnbelt area has also shown seals covering large passages crossing several fixed links. Movements of seals between distant haul-out sites are documented showing them swimming under bridges. Neither Harbour Seals nor Grey Seals will experience a significant impact from the bridge as a barrier. Therefore, any significant impact from the bridge footprint in Fehmarnbelt as a barrier to either porpoise or seals can be excluded.

The function as a nursing area is assessed to be of medium importance. Furthermore, the function of the Fehmarnbelt as a feeding area and migration corridor has also been assessed as being of medium importance. This evaluation is based on the present understanding that no discrete population in the eastern part of the Baltic Sea is dependent on migration through the Fehmarnbelt.

The function of the area as a migration corridor and nursing area cannot be spatially defined. Therefore, the loss of this function through habitat loss in the worst-case scenario for the tunnel alternative may apply to the total number of porpoises affected during construction and operation of less than two individuals. The total proportion of porpoises impacted equates less than 0.1% of the local summer population and the effect of habitat loss is therefore considered insignificant at the population level for both Harbour Porpoise and seals (FEMM, 2013b).

7.4.4 General potential impacts on Natura 2000 sites and habitats

The Natura 2000 sites in Denmark will not be influenced directly by physical structures (landfill areas, bridge piers etc. as is the case in the German part).

Pressures potentially affecting the protected habitat types in the Natura 2000 areas are identical with pressures general affecting flora and/or fauna (see Cpt. 7.1): These pressures include the effects of increased concentration of suspended sediments and sedimentation.

The modelled results for the immersed and bored tunnel show that the impact areas from the sediment spill on marine benthic flora and fauna are primarily located near alignment (immersed tunnel) and along the coasts of Lolland and Fehmarn outside the borders of most Natura 2000 sites in question, Figure 7.1, Figure 7.2, Figure 7.3, Figure 7.4 and Figure 7.5.

For the two tunnel alternatives, the overall sediment spill from the bored tunnel will approximately be 5 times lower than the sediment spill from the immersed tunnel in the first year of the construction phase and 7 times lower in the last year of the construction (one year later for the bored tunnel than for the immersed tunnel, as described in Cpt. 6).

The result from these model based assessment and the detailed assessments of general impacts on benthic flora and fauna communities, fish communities, birds and marine mammals has been used as basis for the assessments on impacts in the Natura 2000 sites and habitats.

Maps on i.e. distribution of habitats that are included in reason for designation of Natura 2000 sites are inserted in the sections on assessment of single sites in Cpt. 1-12.

7.4.4.1 Sandbanks (code 1110)

An impact of the structural functionality of sandbanks by sedimentation may impact fish abundance and diversity. The impact on sandbanks will be similar to impacts on the Bathyporeia and Tanaissus communities. These fauna communities are typical for exposed sand and gravel, Table 5.2. The overall significance of the impact is shown in Figure 7.12.

7.4.4.2 Estuaries (code 1130)

The impact on estuaries will be a result of the impact on different benthic communities including flora and fauna and fish communities, see Cpt. 7.1.1 and 7.1.2 and impacts on birds and marine mammals see Cpt. 7.1.3 and 7.1.4 as a result of the impact on the structural function of the habitat.

7.4.4.3 Mudflats and sandflats not covered by seawater at low tide (code 1140)

The impact on estuaries will be a result of impact on different benthic communities including flora and fauna and fish communities, see Cpt. 7.1.1 and 7.1.2.

7.4.4.4 Coastal lagoons (code 1150)

The impact on estuaries will be a result of impact on different benthic communities including flora and fauna and fish communities, see Cpt. 7.1.1 and 7.1.2 as a result of the impact on the structural function of the habitat.

7.4.4.5 Large shallow inlets and bays (code 1160)

The impact on estuaries will be a result of impact on different benthic communities including flora and fauna and fish communities, see Cpt. 7.1.1 and 7.1.2 and impacts on birds and marine mammals see Cpt. 7.1.3 and 7.1.4 as a result of the impact on the structural function of the habitat.

7.4.4.6 Reefs (code 1170)

An impact of the structural functionality of reefs by sedimentation will be similar to impacts on benthic macroalgae communities (*Saccharina*), Figure 5.3 and benthic fauna communities of Dendrodoa, *Gammarus* and *Mytilus*, Figure 5.7 and Table 5.2. The overall significance of impact is shown in Figure 7.12. An impact of the structural functionality of reefs may affect fish abundance and diversity, which may affect Annex II listed mammals and Annex I listed fish eating birds.

8 Natura 2000 site nr. 173 Smålandsfarvandet nord for Lolland, Guldborgsund, Bøtø Nor og Hyllekrog-Rødsand

The Natura 2000 site no 173 Smålandsfarvandet is a very large marine area along the coast of Lolland and Falster. It contains a long sinuous coastline. The site covers a large part of the marine area Smålandsfarvandet North of Lolland and Falster and is by Guldborgsund connected with the marine area with the sandbanks; Rødsand and Hyllekrog in south. There are a number of larger and smaller islands inside the site, the largest islands are Fejø and Femø are only included with their coastline.

Generally, the marine part of the site is characterised by sand bottom with scattered stones, but there is also a mosaic with other marine nature types.

In many places, the coastline is modified with artificial dikes, especially around Saksfjed and Botø Nor. There are also parts of the coastline where there is a more undisturbed coastline as is the case at Rødsand and Hyllekrog. Inside the site are seven reserves for birds and one seal reserve, all with restrictions in access to the areas.

The total area of the site is 79,069 ha, mainly marine. The Natura site covers one SCI and several SPAs. As described previously only the southern part of the Natura 2000 sites corresponding to the SPA Hyllekrog and Rødsand is covered by the screening.

The most important nature values of the site constitutes a number of coastal nature types, waterbirds and seals. The habitat types and species dominates also the reasons for designation of the site.

8.1 SCI DK 006X238 Smålandsfarvandet.

The site is designated under the Habitats Directive as “SCI DK 006X238 Smålandsfarvandet, North of Lolland, Guldborg Sound, Bøtø Nor and Hyllekrog-Rødsand” (In Danish: Smålandsfarvandet nord for Lolland, Guldborg Sund, Bøtø Nor og Hyllekrog-Rødsand). It is also designated under the Birds Directive, but is here divided into several sites. The relevant parts of the Natura 2000 sites designated under both directives (Hyllekrog-Rødsand) have the same demarcation.

The site is a large shallow-water area with dense macrophyte vegetation (sea grasses, tasselweeds and pondweeds). The site is an important resting area for numerous internationally protected birds. Harbour Seals and Grey Seals mate in this area. The area of the Saksfjed embankment is the result of a land reclamation project. Relatively large areas are species-rich Nardus grasslands, on siliceous substrates in mountain areas (natural habitat type 6230*) and molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) (natural habitat type 6410 in a non-calcareous form). In 2003, European green toads were found in this area. The area is threatened by dehydration, which constitutes a potential impact of bird life. Due to the small number of local springs, nitrogen depositions pose less of a problem.

Five marine habitat types are included in reasons for designation of SCI DK 006X238, as shown in Table 8.1. The areal extends of the marine habitat types as shown on the web page of Nature Agency, Denmark (www.nst.dk), and shown on Figure 8.1. The nature type 1150* Coastal lagoons are regarded as a marine habitat type In the site Smålandsfarvandet none of the lagoons inside the site are however with open connection to the sea, and sediment spill will under these circumstances not be a pressure on the lagoons in this site. Therefore, no further screening of potential project impacts on this marine habitat type takes place here.

Table 8.1 Areas of marine habitat types in the whole Natura 2000 area as calculated by Agency for Environmental Spatial Planning, Denmark.

Object (habitat type)	Total area (km2)
1110 Sandbanks which are slightly covered by sea water all the time	309
1140 Mudflats and sandflats not covered by seawater at low tide	7.64
1150* Coastal lagoons	21
1160 Large shallow inlets and bays	184
1170 Reefs	183

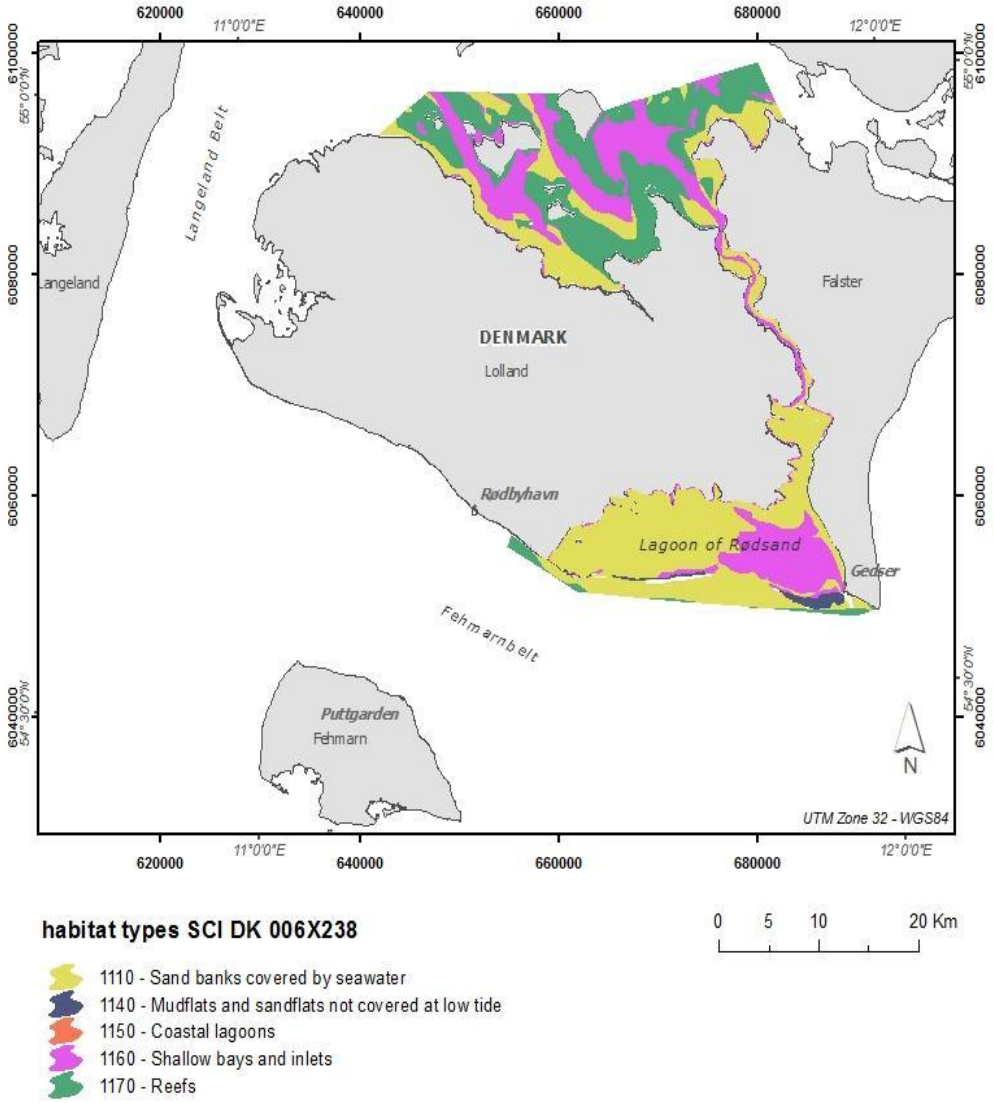

Figure 8.1 The geographic position of the site SCI DK 006X238, with its characteristic habitat types. Four marine habitat types are present in SCI DK 006X238. In the figure a "terrestrial nature type" Coastal lagoons are also shown. The area extend of the marine habitat types as shown on the web page of Agency for environmental spatial planning, Denmark (NST). http://www.nst.dk/NATUREN/Natura2000plan/Natura2000omraader/Habitat/Marine_habitater/Marine_gisfiler.htm)

The general conservation objective for the NATURA 2000 site SCI DK 006X238 is that:

- the large marine areas have a good water quality and a diverse flora and fauna that form a sufficient food basis for internationally important numbers of migratory water birds such as

Mute Swan, Whooper Swan, Greylag Goose and Tufted Duck, for which Denmark has a special responsibility;
- free landscape formation and coastal dynamics are safeguarded or re-established where it is deemed appropriate from an overall viewpoint for the benefit of a large number of habitat types and species; and
- in regard to appropriate management and hydrography, low nutrient load and establishment and dispersal conditions for the species. All nature types and species listed as objects shall achieve favourable conservation status within the area.

Important Remark

It should be noted that the site SCI DK 006X238 is a very large area, stretching from the so-called “Lagoon of Rødsand” in the south, through the Guldborg Sound between the two Danish islands of Lolland and Falster, to the Smålandsfarvandet in the north, located between the north coasts of Lolland and Falster and the south coast of Zealand.

Although SCI DK 006X238 comprises the entire Natura 2000 site according to national legislation, both the northern part of the described area (Smålandsfarvandet) and the central part (Guldborg Sound) are not subject to the same environmental conditions as the Rødsand Lagoon. Ecologically and environmentally, the Rødsand Lagoon comprises the large southern embayment, including the southern mouth of the Guldborg Sound.

I connections to the FEMA habitat mapping for the baseline investigations a more thorough and detailed habitat mapping was executed (FEMA 2013a). To fulfil the Danish legislation (“Bekendtgørelse 408”) the best scientific knowledge should be used at any time for the assessments. This data set has therefore replaced the habitat maps from Naturstyrelsen for the Rødsand Lagoon. In Figure 8.2 the Southern part of the Natura 2000 Site is presented. The screening is based on this, and not the official map in Figure 8.1. The two maps illustrate that the project has provided more detailed and accurate information on habitat distribution.

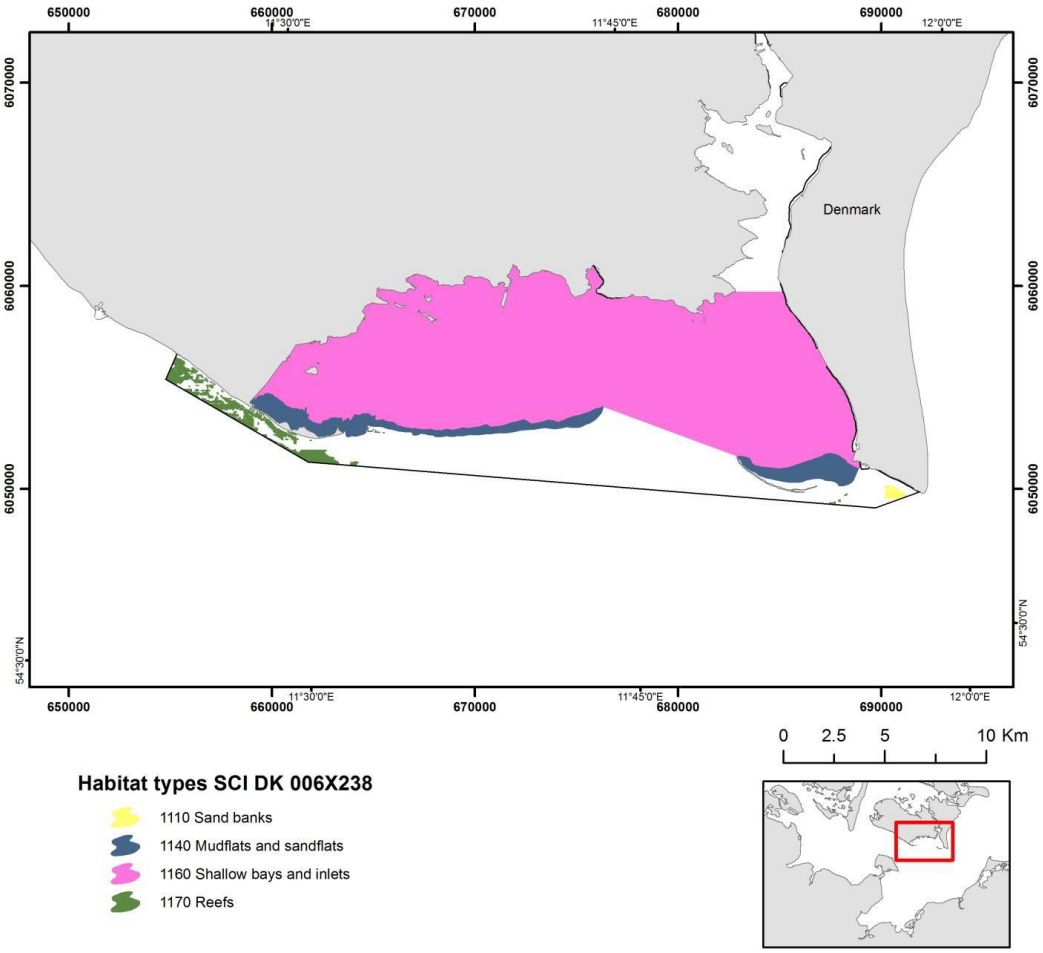

Figure 8.2 Marine habitat types in part of the area SCI DK 006X238 (FEMA, 2013e).

Along the south coast of Lolland, Hyllekrog and Western and Eastern Rødsand there is a littoral zone, where transport of sand takes place. There is no flora present on the seabed in the littoral zone due to the wave action and sand transport.

The seabed seaward of the littoral zone consists of moraine till or boulder clay (moræneler in Danish), which has been exposed to the action of waves and currents whereby it has been somewhat eroded and silt and sand fractions have been transported away. This type of seabed is a so-called residual seabed, which is characterized by hard clay with scattered exposed boulders and stones and patches of gravel and coarse sand.

Characteristic infauna at sandbanks: Invertebrate communities of sandy sublittoral (fine and medium grained sands, coarse sands, gravely sands) may contain e.g. polychaetes: *Scoloplus armiger, Pygospio elegans, Nereis diversicolor, Travisia sp.,* e.g. bivalves: *Macoma balthica, Mya arenaria, Cerastoderma sp.,* e.g. crustaceans*: Crangon.* The Blue mussel or common mussel (*Mytilus edulis)* biomass is low in Rødsand Lagoon. Exposed sandbank shallow water communities is characterised as *Bathyporeia* community, Table 5.2.

Characteristic flora: Two soft bottom communities were identified during the baseline investigation: an eelgrass- and a tasselweed/dwarf eelgrass community. Eelgrass was the dominating plant in the soft bottom areas of Rødsand. The highest coverage is found in the depth interval 1 to 4 m. Other characteristic species of flowering plants in these areas were tasselweed (*Ruppia*) and pondweed (*Potamogeton*). These species were most abundant in the shallow water. Other more rarely occurring species are *Zostera noltii*, *Zannichellia palustris,*

Chara sp., *Tolypella nidifica* and *Lamprothamnium papulosum*. Other macro algae that occurred in the lagoon and bight were mainly free-floating or epiphytic.

Cumulative impacts together with other plans and projects

Rødsand II Offshore Wind Farm. Based on the EIA for Rødsand II impacts during the operation phase of the wind farm is associated with changes in waves, long-shore sediment transport and the permanent loss of soft bottom habitats affecting a very small area. The resulting impact on the structures and impact on the benthic community in the Lagoon of Rødsand is assessed to be insignificant. Fouling community on the additional solid substrate is likely to be dominated by common mussels. Attraction of fish and increased predation may have a local and limited impact on the surrounding soft bottom community. However, the structural complexity and the high biomass of invertebrates developed on the foundations may have an overall beneficial ("reef") effect on local populations of especially fish.

Magnetic fields and increased sediment temperature declines rapidly around the cables and the impacts on benthic communities is insignificant due to a low sensitivity of benthic organisms. The environmental impact assessment of the Rødsand II Offshore Wind Farm concludes that the magnitude of impacts on benthic communities of invertebrates, flowering plants and macroalgae during operation are insignificant, and, hence, cumulative impacts arising due to the Rødsand II Offshore Wind Farm will not be significant.

In studies of the impact of the Nysted Offshore Wind Farm on the littoral transport and coastal morphology, it was found that the foundations of the wind turbines dampen the waves and reduce the natural (net) eastward littoral transport along Hyllekrog and Rødsand slightly by the order of 5%. This effect was expected to cause the tip of the Western Rødsand formation to grow at a slightly lower speed and reduce the overflow and sediment transport across the eastern Rødsand (Lumborg (2007) and Drønen, Gro Jensen and Bundgaard (2007)). The impacts from the Fehmarnbelt Fixed link to the Hyllekrog/Rødsand area is evaluated to be smaller than the impacts from the wind farm, but potential impacts may add to the effect of reducing the eastward littoral drift along the barriers.

8.1.1 General description of impact on morphology

The impacts from the bridge and tunnel alternatives to the Lolland shoreline are described here. New structures will influence the sediment transport along the coast of Lolland in the same way as Rødby Harbour: No sediment will be able to pass the new structures, if these extend more than approximately 300 m from the existing mean water line. The seabed east of Rødby Harbour is starved of sand because the coast and shoreface have been under continuous erosion since the sediment supply to this area was blocked by the construction of Rødby Harbour. New structures are expected to influence the shoreline east of the fixed link in a similar way. Furthermore, new structures will have an impact on the incoming waves. Since the littoral transport is related closely to the near-shore waves, this will also modify the littoral drift in the affected areas. Potentially new structures could in this way reduce the contribution of finer sediments (silt, sand, gravel) to the Rødsand Lagoon area, which would have an impact on the coastal morphology of the barrier islands, sandpits, and the mudflats/sandflats located on the lagoon side of Hyllekrog and Rødsand Barrier Islands. A potential impact on the sea bed morphology of Rødsand Lagoon is possible if the barrier islands and sand spits are reduced/increased in their extent (length) allowing for increases/decreases of the current velocities in and out of the lagoon and the wave action in the lagoon.

Bridge

The planned work harbour of the bridge will block the sediment transport along the coast of Lolland in the same way as Rødby Harbour described above. No sediment will be able to pass the work harbour during construction period, as the work harbour will cover the entire littoral zone. Due to the limited time period for the existence of the work harbour this will have a non-

significant influence on the coastal zone and on the morphology of the area of the Hyllekrog and Rødsand Barrier Islands and sand spits and the lagoon.

The planned peninsula approximately 1.2 km east of Rødby Harbour will influence the sediment transport along the coast of Lolland in the same way as the present Rødby Harbour: No sediment will be able to pass the peninsula in the operation period, as the peninsula extending to 400 m from the shoreline will cover the entire littoral zone thereby totally blocking the littoral drift. The impact from the peninsula will similarly to the impact of Rødby Harbour to cause additional erosion in the coastal profile thereby causing recession of the shoreline and gradually exhausting the seabed for sand and gravel. Compared with the present situation (baseline), the impact will shift eastwards with about the distance between Rødby Harbour and the peninsula (1.2 km). The impact will be small being far away from the Rødsand Lagoon therefore having only a small impact on the morphology of the Hyllekrog and Rødsand area and the lagoon.

The bridge piers will dampen the waves since the piers reflect and diffract (spread) the wave energy. Near the landfall, the changes to the incoming waves are expected to modify the littoral drift along the coast slightly. The impact will be too small to be felt as far away as the Rødsand Lagoon, thus having only a small impact on the morphology of the Hyllekrog and Rødsand area and hence on the lagoon itself.

Immersed tunnel

The planned work harbour east of Rødby will influence the sediment transport along the coast of Lolland in the same way as Rødby Harbour: No sediment will be able to pass the work harbour during construction period, as the work harbour will cover the entire littoral zone thereby totally blocking for the littoral drift. Due to the limited time period for the existence of the work harbour will have a non-significant influence on the coastal zone and on the morphology of the area of the Hyllekrog and Rødsand Barrier islands and sand spits and the lagoon.

The large land reclamation extends approximately 400-500 m from the shoreline and will cover the entire littoral zone thereby totally blocking for the littoral drift. The impact from the reclamation area will have a similar impact on the seabed along the coast east of the land reclamation as Rødby Harbour has on the coast east of the harbour today. The reclamation is planned to extend approximately 4 km east of Rødby Harbour to Hylletoft Østersøbad and the present-day erosion pressure on the near-shore zone will shift towards the east with about the same distance. Additional erosion pressure along the shoreline will occur east of Hylletofte Østersøbad, and the seabed will gradually change to consist of coarser sediment in that area. However, the introduction of the active cliff in the eastern part of the reclamation will compensate for the deficit in the littoral budget. It is considered that impact will be non-significant on the morphology of the Rødsand mudflats/sandflats between Fehmarnbelt and the lagoon.

Bored tunnel

The basic effects from the bored tunnel alternative on the coastal morphology on the Danish side west of the reclamation area will be about the same as for the immersed tunnel alternative, both for construction period and due to the permanent reclamation. The net impacts east of the reclamation area will be larger for the bored tunnel alternative as there is no active cliff to deliver material to the down drift coast. However, this extra impact will be compensated by beach nourishment by Fehmarn, which compensates for the additional erosion imposed by the reclamation along the coast east of the project area. Therefore, there will not be any net effect to the coastal morphology east of Rødbyhavn for the bored tunnel alternative.

8.1.2 Noise, light, pollution, and barrier effects

In addition to construction and operation of the part of the fixed link that will be situated in marine areas construction work will also, depending on the final decision on this, be situated at

the coastline. A large area will be reclaimed and filled with sea sediments and turned into a recreational park and nature areas. The work area will consist of a large temporary harbour, production facilities for the tunnel elements, areas for temporary earth deposits, parking lots, buildings, cranes etc. The work area will be a big industrial plant of the size of several hundred hectares, employing a large number of people and emitting noise, artificial light, dust etc. Part of the area is within an existing wind turbine park, which will have to be demolished. In addition, a small lake near the sea, fields and natural habitat will vanish under the work area.

After completion of the fixed link, the industrial harbour will be demolished, and the seaside part of the area will be included in a large land reclamation set aside as nature areas and for recreation. The landside part is designated as a future industrial area. A detailed plan will be elaborated for the land reclamation area and will include possible compensatory habitat for species affected by the fixed link. It is anticipated that the land reclamation will be finalised in six years.

The screening for possible impacts from the fixed link in relation to noise, light, pollution and barrier effects is described in the following section. It should here be underlined that barrier effects on birds and mammals from a bridge alternative is further assessed in the Environmental Impact Assessment reporting (FEBI, 2013b; FEMM, 2013b). The evaluation covers also next chapter related to the SPA DK 006X083 Coastal and marine area Hyllekrog-Rødsand.

As the SCI is not in direct contact with the construction area, the possible impacts with relevance for marine habitats and species will be:

- Disturbances (noise and light during the whole construction period);
- water- or air-borne contamination (from accidents during construction) that travels from the work area to the SCI; and
- barrier-effects from roads, towers etc.

Noise

The construction activities in the work area will produce noise. At times, it will be very noisy, and noise will also at least occasionally occur at night. Negative impacts from noise at nature especially affect mammals and birds. Depending on the noise pattern, different impacts can be observed. Some birds get accustomed to regular and constant noise, but are scared away from loud irregular noise. In very noisy environments, birds can have difficulties hearing the territorial song of each other, and tend to breed at a lower density. Such impacts might also be seen on mammals. From experience disturbance of some of the bird species for which Natura 2000 areas are designated must be avoided up to 500 m away (DMU 2003). Noise is the most likely candidate for negative impacts on species for which the Natura 2000 area is designated and will be dealt with in depth under the individual species below.

Light

There will be artificial light at the work area at nighttime. Migrating birds - especially young birds on their first migration - deviate from their normal flight routes and are more or less deviated or delayed by artificial lights. Particularly lights that point up in the air are harmful to the birds. Lightning up tall buildings is particularly harmful to migrating birds. Especially in poor weather, condition they even collide with the structures and get killed (Rich 2009). Artificial light will negatively affect especially migrating birds. Illumination of buildings and lights pointing up in the open air must be avoided. The anticipated negative impact will be insignificant for the migrating birds in the Natura 2000 area, as the preferred roosting areas are several kilometres from the work area.

Air pollution

Emissions from the heavy vehicles and machinery will occur at the work area. It is assumed that potential air pollution will be mixed in the atmosphere and will not affect the species and habitats for which the Natura 2000 areas have been designated (at some distance from the work area). Emission of nitrate (NOx) from the tunnel mouth in relation to the operation phase has been evaluated. It has been found that impact will be limited to a more restricted area around the tunnel, and that impact from the emission further away in Natura 2000 areas (including Hyllekrog-Rødsand) will not be significant.

Water borne pollution

In the event of a larger spill e.g. of a tank with poisonous substances there is a hypothetical risk (given the right weather and sea conditions) that the pollution could enter the Natura 2000 area to the southeast. However, the risk will not be higher than at present where the ferries carry fuel and chemical transports etc.

Barrier effect

Barrier effect of large cranes and tall buildings will block the unhindered passage of migrating birds. However, a large wind turbine plant is to be demolished, and the net amount of obstacles will be smaller than at present.

8.2 Sandbanks code 1110

8.2.1 Description of detailed Conservation subject/ objective: 1110 Sandbanks

All natural habitat types and species, which are listed as conservation objects, are, as described in introductory section, to achieve a favourable conservation status in the area.

Detailed conservation objectives for all habitat types where unfavourable status are described (e.g. the habitat types 1110 Sandbanks which are slightly covered by sea water all the time, 1160 Large shallow inlets and bays and 1170 Reefs): “Development in the environmental conditions must be in progress so that favourable conservation status can be obtained, if natural environmental conditions allows this the area of the habitat type must be stable or in progress, if natural environmental conditions allows this".

As according to the revised habitat definition 1110 Sandbanks are very poorly represented in Rødsand. Additionally, they are situated outside the main sedimentation areas.

It has been assessed that none of the listed Annex II fish species in this specified SCI are associated with the protected habitat.

Conclusion

The impact on the flora and fauna on this habitat type is considered to be non-significant.

8.2.1.1 Impacts on 1110 Sandbanks, caused by the bridge alternative

Benthic flora and fauna

The habitat is very poorly represented in Rødsand and vegetation is sparse. Material will not deposit on the habitat type and model results predict that there will be no reductions in flora biomass. Benthic flora and fauna will not be impacted significantly.

8.2.1.2 Impacts on 1110 Sandbanks caused by immersed tunnel

Benthic flora and fauna

The habitat is very poorly represented in Rødsand and vegetation is sparse. Additionally, they are situated outside the main sedimentation areas, and model results predict that there will be no reductions in flora biomass in this area. Benthic flora and fauna will not be impacted significantly.

8.2.1.3 Impacts on 1110 Sandbanks, flora and fauna caused by the bored tunnel

Benthic flora and fauna

The sediment spill for the bored tunnel will, as described previously, be much lower compared to the spill foreseen for the immersed tunnel. As indicated, the habitat is situated outside the main sedimentation areas. The impact is therefore considered to be non-significant.

8.2.1.4 Impacts on 1110 Sandbanks, fish species

Impacts of sediment spill from the construction works on fish species and fish communities are mainly related to functional impacts on structural habitat elements, Table 8.2.

Eelgrass meadows are found in sandbank areas along the south coast of Lolland and in the Rødsand lagoon. Only minor impact on structural habitat elements of the sandbanks, important for specific fish species of fish communities, will take place.

Sandbank areas are of importance for sandeels (*Ammodytidae*), which is an important food source for fish eating seabirds.

Table 8.2 Potential impacts on habitat type 1110 Sandbanks concerning fish.

1110 Sandbanks	Bridge alternative	Immersed tunnel alternative	Bored tunnel alternative
Degree of impact	No impact. The net sedimentation of less than 1 mm is far below the indicative threshold limit for affecting vegetation and benthic fauna. Vegetation is used for spawning, breeding by shallow water fishes and as a nursery ground by juvenile fish. Benthic fauna is of importance as food items for fish. The sedimentation is not supposed to change seabed structure (sediment) impacting sandeel assemblages. The maximum average concentration of suspended sediment will only exceed 5 mg/l in less than 5% of the time. This is far below the indicative threshold limit of 10 mg/l impacting fish migration. Only insignificant and temporary impact on eelgrass meadows due to sediment spill will take place, which will not affect spawning, breeding or juvenile fish.	Low degree of impact. The annual net deposition of spilled sediment will not exceed 50 mm in any habitat type defined for the lagoon. The sedimentation does not exceed the indicative threshold of a deposit of 50 mm for significant impacts on vegetation. Consequently no impact on shallow water fishes associated with vegetation will take place The sedimentation might change seabed structure (sediment) impacting sandeel assemblages. Eelgrass meadows in sandbank areas (1110) might in part be affected by increased concentration of suspended sediment. Shallow water fishes spawning and breeding in vegetation and vegetated nursery areas for juveniles might be impacted. During some summer months, the concentration of suspended sediment in less than 10% of the time will exceed the indicative threshold limit of 10 mg/l affecting migrating species. Apart from a small population of spring spawning herring, no migratory species are spawning in the Rødsand lagoon.	Low degree of impact. The annual net deposition of spilled sediment will not exceed 10 mm in any habitat type defined for the lagoon. The sedimentation does not exceed the indicative threshold of a deposit of 50 mm for significant impacts on vegetation. Consequently, no impact on shallow water fishes associated with vegetation will take place. Concentration of suspended sediment will not exceed 2 mg/l more than 10 % of the time, and at worst only small areas will show reductions in vegetation biomass of at most 20% at the end of the growth season.
Significance of impact	Non significant for 1110 Sandbanks No significant impact of spawning and breeding grounds for shallow water fishes or nursery grounds will take place.	Non significant for 1110 Sandbanks No significant impact of spawning and breeding grounds for lagoon fishes or nursery grounds is expected, although temporary loss of spawning and nursery grounds due to significant impact of eelgrass meadows, impacted by suspended sediments, cannot be excluded.	Non significant for 1110 Sandbanks No significant impact of spawning and breeding grounds for lagoon fishes or nursery grounds will take place.

8.2.1.5 Overall estimation of impact of the conservation subject/ objective

No significant impact will take place for 1110 Sandbanks, Table 8.3.

Table 8.3 Comparison of the impacts on 1110 Sandbanks caused by bridge and tunnel alternatives, based on impact for benthic flora and fauna.

1110 Sandbanks	Bridge alternative	Immersed tunnel alternative	Bored tunnel alternative
Significance of impact	Impacts are not significant for 1110 Sandbanks.	Impacts are not significant for 1110 Sandbanks.	Impacts are not significant for 1110 Sandbanks.

8.3 Mudflats and sandflats code 1140

8.3.1 Description of detailed conservation objectives 1140 Mudflats and sandflats not covered by seawater at low tide

All natural habitat types and species which are listed as conservation objects are to achieve a favourable conservation status in the area. The present status of all the marine habitat types has not been assessed in the suggested Natura 2000 plan for this site.

The evaluated conservation status is unfavourable for 1140 Mudflats as a consequence of fishery with trawl.

Detailed conservation objectives for all habitat type that have an unknown forecast is to obtain favourable conservation status. Vegetation is poorly represented on this habitat type.

8.3.2 Impacts on 1140 Mudflats and sandflats not covered by seawater at low tide caused by the bridge alternative.

Benthic flora and fauna

Sediment spill from the bridge alternative will not impact Rødsand Lagoon to a degree, which can have significant impact on the flora and fauna. Furthermore, vegetation is sparse on this habitat type. The impact is therefore considered to be non-significant.

8.3.3 Impacts on 1140 Mudflats and sandflats not covered by seawater at low tide caused by the immersed tunnel

Benthic flora and fauna

Vegetation is poorly represented on this habitat type and impact caused by a reduction in light availability or sedimentation is therefore not relevant. Concentrations of suspended sediment or sedimentation layer or duration will not significantly impact the benthic fauna. The impact is therefore considered to be non-significant.

8.3.4 Impacts on 1140 Mudflats and sandflats not covered by seawater at low tide caused by the bored tunnel

Benthic flora and fauna

Benthic flora is very poorly represented on this habitat type. The area can be subject to some deposition up to 1 mm in some areas. It has not been documented that the benthic fauna will be impaired with this low level of sedimentation. The minimum level shown in literature is 3 mm (Gibbs and Hewitt 2004). An impact on the benthic fauna is not likely.

Impact on the benthic flora and fauna is considered to be non-significant.

8.3.5 Impacts on 1140 Mudflats and sandflats – fish species

Impacts of sediment spill from the construction works on fish species and fish communities are mainly related to functional impacts on structural habitat elements, Table 8.4.

Table 8.4 Potential impacts on habitat type 1140 – Mudflats and sandflats, fish species.

1140 Mudflats and sandflats	Bridge alternative	Immersed tunnel alternative	Bored tunnel alternative
Degree of impact	No impact. The net sedimentation of less than 1 mm is far below the indicative threshold limit for affecting benthic fauna. Benthic fauna is of importance as food items for fish. The maximum average concentration of suspended sediment will only exceed 5 mg/l in less than 5% of the time. This is far below the indicative threshold limit of 10 mg/l impacting fish migration.	No impact. The annual net deposition of spilled sediment will not exceed 50 mm in any habitat type defined for the lagoon. The sedimentation is below the indicative threshold impacting benthic fauna, which are important food sources for fish. During some summer months the concentration of suspended sediment in less than 10% of the time will exceed the indicative threshold limit of 10 mg/l affecting migrating species. Apart from a small population of spring spawning herring, no migratory species are spawning in the Rødsand lagoon.	No impact. The annual net deposition of spilled sediment will not exceed 10 mm in any habitat type defined for the lagoon. The sedimentation is below the indicative threshold impacting benthic fauna, which are important food sources for fish. In no periods the concentration of suspended sediment will exceed 2 mg/l in more than 10% of the time and thus no impact on fish communities or fish migration will take place.
Significance of impact	Non significant for 1140 Mudflats and sandflats No significant impact of feeding grounds for shallow water fishes or nursery grounds will take place.	Non significant for 1140 Mudflats and sandflats No significant impact of feeding or nursery grounds for shallow water fishes will take place.	Non significant for 1140 Mudflats and sandflats No significant impact of feeding or nursery grounds for shallow water fishes will take place.

8.3.6 Overall estimation of impact of the conservation subject/ objective

Table 8.5 Comparison of the impacts on 1140 Mudflats caused by bridge and tunnel alternatives, flora and fauna.

1140 Mudflats		Bridge alternative	Immersed tunnel alternative	Bored tunnel alternative
Significance of impact		Impacts not significant for 1140 Mud- and sandflats	Impacts are not significant for 1140 Mud- and sandflats	Impacts are not significant for 1140 Mud- and sandflats

8.4 Large shallow inlets and bays code 1160

8.4.1 Description of detailed conservation subject/ objective: 1160 Large shallow inlets and bays

All natural habitat types and species, which are listed as conservation objects, are to achieve a favourable conservation status in the area. The present status of all the marine habitat types has not been assessed in the suggested Natura 2000 plan for this site.

The evaluated conservation status is unfavourable for 1160 Shallow inlets and bays due to eutrophication and toxic substances.

Benthic vegetation: Two soft bottom communities were identified during the baseline investigation: an eelgrass- and a tasselweed/dwarf eelgrass community. Eelgrass was the dominating plant in the soft bottom areas of Rødsand. The highest coverage is found in the depth interval 1 to 4 m. The Rissoa community, which is closely related to eelgrass, dominates the benthic fauna community.

8.4.2 Description of the impacts on 1160 Large shallow inlets and bays

Benthic flora and fauna, bridge alternative

The impact on the benthic flora and fauna is considered to be non-significant because the impact from the sediment spill for the bridge alternative in Rødsand Lagoon is very low.

Benthic flora and fauna, immersed tunnel alternative

The habitat type 1160 Large shallow inlets and bays are defined in the deeper eastern part of the Rødsand Lagoon. Eelgrass in restricted by light limitation in the deep part and only a smaller part of the habitat type in Rødsand is covered with Eelgrass. Initial analysis of impacts on eelgrass from increased light attenuation due to sediment spill indicates a reduction in eelgrass biomass between 10 – 50 % during the first years dredging activities. Significant impact on the benthic flora on the habitat can therefore not be excluded.

Model results show that there will be some areas with high concentration of suspended sediment and sedimentation in Rødsand Lagoon and significant impact on the benthic fauna cannot be excluded.

The overall conclusion is that significant impact cannot be excluded and an appropriate assessment must be executed.

Benthic flora and fauna, bored tunnel alternative

The model analysis of impacts on the eelgrass from increased light attenuation due to sediment spill indicates a reduction in eelgrass biomass between up to 20% during 2015 and up to 10% in 2020. Additional analysis of the results must determine whether the impact is assessed to be significant according to the Natura 2000 criteria. Furthermore, the total deposition of sediment will be up to 10 mm and an impact on the benthic fauna cannot be excluded.

Significant impact on the benthic flora and fauna cannot be excluded.

8.4.3 Impacts on 1160 Large shallow inlets and bays for fish

Assessments show that impacts of sediment spill from the construction works on fish species and fish communities are mainly related to functional impacts on structural habitat elements, Table 8.7.

8.4.4 Overall estimation of impact of the conservation subject/ objective

For the two tunnel alternatives significant impact on habitat type “Large shallow inlets and bays” cannot be excluded, Table 8.6.

Table 8.6. Comparison of the impacts on 1160 Large shallow inlets and bays caused by bridge and tunnel alternative.

1160 Large shallow inlets and bays	Bridge alternative	Immersed tunnel alternative	Bored tunnel alternative
Significance of impact	Significant impact can be excluded for 1160 Large shallow inlets and bays.	Significant impact cannot be excluded for 1160 Large shallow inlets and bays due to shading on benthic vegetation	Significant impact cannot be excluded for 1160 Large shallow inlets and bays due to shading of benthic vegetation

Table 8.7. Potential impacts on habitat type 1160 Large shallow inlets and bays concerning fish.

1160 Large shallow inlets and bays	Bridge alternative	Immersed tunnel alternative	Bored tunnel alternative
Degree of impact	No impact. The net sedimentation of less than 1 mm is low in relation to affecting vegetation and benthic fauna. Vegetation is used for spawning, breeding by shallow water fishes and used as nursery grounds for juvenile fish. Benthic fauna is of importance as food items for fish. The maximum average concentration of suspended sediment will only exceed 5 mg/l in less than 5% of the time. This is low compared to the assessment that 10 mg/l will impact fish migration. Only insignificant and temporary impact on eelgrass meadows due to sediment spill will take place, which will not affect spawning, breeding or juvenile fish.	Low degree of impact. The annual net deposition of spilled sediment will not exceed 50 mm in any habitat type defined for the lagoon. The sedimentation is low compared to the assessment that deposit of 50 mm or more leads to significant impact on vegetation. Consequently, no impact on shallow water fishes associated with vegetation will take place. Eelgrass meadows in sandbank areas (1110) might in part be affected by increased concentration of suspended sediment. Shallow water fishes spawning and breeding in vegetation and vegetated nursery areas for juveniles might be impacted. Apart from a small population of spring spawning herring no migratory species are spawning in the Rødsand lagoon. A very small part of the area north of Lolland is expected to be impacted by net sedimentation of less than 1 mm, which is not supposed to impact the structural function of the habitat.	Low degree of impact. The annual net deposition of spilled sediment will not exceed 10 mm in any habitat type defined for the lagoon. The sedimentation does not exceed the indicative threshold of a deposit of 50 mm for significant impacts on vegetation. Consequently, no impact on shallow water fishes associated with vegetation will take place. Concentration of suspended sediment will not exceed 2 mg/l more than 10 % of the time, and at worst only small areas will show reductions in vegetation biomass of at most 20% at the end of the growth season.
Significance of impact	Non significant for 1160 Shallow inlets and bays No significant impact of spawning and breeding grounds for shallow water fishes or nursery grounds will take place.	Non significant for 1160 Shallow inlets and bays No significant impact of spawning and breeding grounds for lagoon fishes or nursery grounds is expected, although temporary loss of spawning and nursery grounds due to significant impact of eelgrass meadows, impacted by suspended sediments, cannot be excluded.	Non significant for 1160 Shallow inlets and bays No significant impact of spawning and breeding grounds for lagoon fishes or nursery grounds will take place.

8.5 Reefs code 1170

8.5.1 Description of detailed conservation subject/ objective: 1170 Reefs

All natural habitat types and species, which are listed as conservation objects, are to achieve a favourable conservation status in the area. The present status of all the marine habitat types has not been assessed in the suggested Natura 2000 plan for this site. The evaluated conservation status is unfavourable for 1170 Reefs due to eutrophication, toxic substances, and fishery with trawl.

8.5.2 Impacts on 1170 Reefs

Benthic flora and fauna, bridge alternative

The results from the spill scenario suggest that the sediment spill cause significant reductions in macroalgae biomass at this habitat type or significantly elevated SSC or sedimentation. The impact is hence not significant.

Benthic flora and fauna, immersed tunnel alternative

Only 4.6 % (867 ha) of the total reef area is situated in the Hyllekrog-Rødsand part, a small area to the south-east and a small area to the south-west. The present sediment spill shows a macroalgae biomass reduction of 10 – 47 % in the first year of tunnel construction. Significant impacts on fauna due to elevated SSC is not likely and direct impact on the benthic fauna is not likely since the area is not a main sedimentation area. Significant impact on the benthic flora cannot be excluded.

Benthic flora and fauna, bored tunnel alternative

Only approximately 5% (867 ha) of the total reef area are situated in the Hyllekrog-Rødsand part; a small area to the south-east and a small area to the south-west.

The present sediment spill shows a macroalgae biomass reduction of up to 30% in minor areas in 2015 and again in 2020. Additional analysis of the results must determine whether the impact is assessed to be significant according to the Natura 2000 criteria. Direct impact on the benthic fauna is not likely since the area is not a main sedimentation area. Significant impact on the benthic flora cannot be excluded.

8.5.3 Impacts on 1170 Reefs – fish species

Areas of more or less character of reef with aggregations of stones along the coast outside the Rødsand Lagoon might be impacted, Table 8.8.

Impacts of sediment spill from the construction works on fish species and fish communities are mainly related to functional impacts on structural habitat elements.

Table 8.8 Potential impacts on habitat type 1170 – Reefs, fish species.

1170 Reefs	Bridge alternative	Immersed tunnel alternative	Bored tunnel alternative
Degree of impact	No impact. The net sedimentation of less than 1 mm is far below the indicative threshold limit for affecting vegetation and benthic fauna. Vegetation is used for spawning by several fish species and used as nursery ground for juvenile fish. Benthic fauna is of importance as food items for fish. The maximum average concentration of suspended sediment will only exceed 5 mg/l in less than 5% of the time. This is far below the indicative threshold limit of 10 mg/l impacting fish migration. Only insignificant and temporary impact on vegetation due to sediment spill will take place, which will not affect spawning or affect juvenile fish.	Low degree of impact. The annual net deposition of spilled sediment will not exceed 10 mm. The sediment deposition does not exceed the assessment of 50 mm for significant impacts on benthic vegetation. Consequently, no impact on fishes associated with vegetation will take place. In some areas, the net deposition might exceed an indicative threshold limit of 5-10 mm impacting spawning activity of herring. During some months, the concentration of suspended sediment will in less than 10% of the time, exceed 10 mg/l affecting migrating species. Some migratory species such as herring spawn in areas with reef like structures. Spawning takes place in autumn and spring. Due to the temporary and relatively low pressure, only a low degree and no significant impact on reef associated species or spawning of migratory species will take place. The most important impacts are caused by functional changes due to sediment spill.	Low degree of impact. The annual net deposition of spilled sediment will not exceed 10 mm in any habitat type defined for the lagoon. The sedimentation does not exceed the indicative threshold of a deposit of 50 mm for significant impacts on vegetation. Consequently, no impact on shallow water fishes associated with vegetation will take place. Concentration of suspended sediment will not exceed 2 mg/l more than 10 % of the time, and at worst only small areas will show reductions in vegetation biomass of at most 20% at the end of the growth season.
Significance of impact	Insignificant for 1170 Reef No significant impact of spawning or nursery grounds will take place along the coast of Lolland.	Insignificant for 1170 Reef No significant impact of spawning or nursery grounds will take place, although temporary impact on spawning activity of herring due to deposition of sediment cannot be excluded.	Insignificant for 1170 Reef No significant impact of spawning or nursery grounds will take place.

8.5.4 Overall estimation of impact of the conservation subject/ objective

For the two tunnel alternatives significant impact on the habitat type “Reefs” cannot be excluded, Table 8.9.

Table 8.9 Comparison of the impacts on 1170 Reefs caused by bridge and tunnel alternatives

1170 Reefs	Bridge alternative	Immersed tunnel alternative	Bored tunnel alternative
Significance of impact	Impact is not significant for 1170 Reefs, although pressures due to elevated SSC are high	Significant impact cannot be excluded for 1170 Reefs due to impact of flora and fauna	Significant impact cannot be excluded for 1170 Reefs due to impact of flora and fauna

8.6 Marine mammals

8.6.1 Overall description of the site – Marine mammals

Three species of marine mammals are listed in the standard data forms for the SCI, Table 8.10.

Table 8.10 Extracted table from the standard data forms for mammals. For explanation of abbreviations see above

Code	Name	Population				Site assessment			
		Resi-dent	Migratory			Population	Conservation	Isolation	Global
			Breed	Winter	Stage				
1364	*Halichoerus grypus*	5-15 i				A	B	B	A
1365	*Phoca vitulina*	167 i				B	B	C	A
1351	*Phocoena*	P				D			

Grey Seal

Numbers of Grey Seal are still relatively low in the Baltic where the population was drastically reduced by human exploitation and reproductive failure (probably due to pollution; SCOS, 2009). This site is regarded as a potential site for re-colonisation of Grey Seal within the Baltic Sea.

The Rødsand Lagoon is at the southern-most breeding range of the Baltic Grey Seal population, and in recent years, a handful of pups have been born there. Breeding occurs during the winter months when surveys are limited due to poor weather so no pup counts are available. During the baseline surveys, up to 57 Grey Seals have been recorded in the SCI.

Harbour Seal

The Rødsand lagoon is one of the most important haul out sites for Harbour Seal within the Baltic Sea, Figure 4.7. Harbour Seals are resident in this area all year round, although numbers counted ashore are lower during the winter months.

Because of its importance for Harbour Seals, the haul out site at Rødsand was designated as a seal sanctuary in the late 1970s. It is protected from public access during the main period when the site is used by seals (March to September).According to the national monitoring program, up to 200 Harbour Seals have been recorded in the SCI.

Harbour Porpoise

Harbour Porpoise are present in the area year round, but most animals stay outside the lagoon and thus at the border of the SCI, Figure 4.6. Our abundance estimate for the southern lagoon is 0.06 individuals per km². This is rather low in comparison to the other Natura 2000 areas. Gilles et al. (2006, 2007) show a moderate presence of porpoises in this area.

8.6.2 Grey Seal

8.6.2.1 Description of detailed conservation subject/ objective: 1364 Grey Seal (*Halichoerus grypus*)

The conservation objectives can be stated as:

- Maintenance of a population size on at least the current present size.
- Haul-out and reproduction site for Grey Seals.
- Protection of Grey Seals against human disturbance.
- Achievement of a good conservation status of the Grey Seal based on an appropriate site management, low nutrient input and the assurance of good reproduction possibilities.

8.6.2.2 Description of impact factors of bridge and tunnel alternatives (caused by construction and structure) affecting 1364 Grey Seal

Potential impacts affecting grey seal have been identified, Table 8.11**Error! Reference source not found.**, Table 8.12.

Table 8.11 Potential impact factors from bridge construction – Grey Seal.

BRIDGE	Construction	Structure
Potential impact factors	Temporary reduction due to dredging /sediment spillage	Permanent change in density due to permanent changes in food supply or habitats due to changed hydrographical regime
Level of impact	Low degree	Low degree
Potential impact factors	Possible barrier effect due to construction works	Permanent change in density due to barrier effect
Level of impact	Low degree	Low degree
Potential impact factors	Temporary reduction in density or injuries due to piling during construction works	
Level of impact	Low degree	

Table 8.12 Potential impact factors from tunnel construction –Grey Seal

TUNNEL	Immersed tunnel construction	Bored tunnel construction
Potential impact factors	Temporary reduction due to dredging /sediment spillage	Temporary reduction due to dredging/sediment spillage
Level of impact	Low degree	Low degree
Potential impact factors	Possible barrier effect due to construction works	-
Level of impact	Low degree	-
Potential impact factors	Temporary reduction in density or injuries due to piling during construction works	Temporary reduction in density or injuries due to piling for construction harbours
Level of impact	Low degree	Low degree

8.6.2.3 Impacts on 1364 Grey Seal caused by bridge alternative

Construction related impacts – Grey Seal

Habitat changes may result from sediment spill, which can affect the benthic communities and fish. Dredging operation may alter the structure of the seabed and thus lead to habitat changes and changes in food web structures. However, according to the spill scenario developed the area is outside the main impact zone. Habitat changes will only affect seals on their foraging grounds, at a distance from the SCI, if any. We therefore assume effects to be of low degree.

The construction of the ports on Lolland and Fehmarn, which are planned to host the construction operations, will be associated with sheet piling. Though noise emissions may be efficiently mitigated by various measures it is assumed at this stage that these emissions could lead to temporal disturbance at large ranges (up to 10 km, Thomsen et al., 2006) over the construction period of 4 – 6 weeks and affect Harbour Seals in the western part of the SCI.

Structure related impacts

The structures of a bridge could alter the hydrographical regime permanently and thus result in changed food supply and/or habitat changes, which would also affect the Rødsand lagoon.

The frequent use of the seal haul out sites Saltholm and Peberholm close to the Øresund Bridge and increasing population indicate that existing bridges in the Baltic Sea do not result in a barrier effect, which could impair the function of straits as migration corridor.

Overall estimation of impact of the conservation subject/ objective

Construction works, especially if high noise levels from piling operations may occur, are likely to lead to some disturbance in the western part of the SCI. Impacts are ranked to be low as the impact are area is of low importance for Grey Seal and the main haul out sites will not be affected. The western part of the SCI and the lagoon itself are likely to become affected by sediment spill from dredging but little impacts are expected on Grey Seal. A barrier effect of bridge structures will not be of significance to Grey Seal.

Conclusion

Significant impacts on Grey Seals from construction and operation of a bridge over Fehmarnbelt will not occur for this SCI. Possible impacts will only affect the western part of the site, which is of low importance for the species.

Estimation of the relevance of other plans and projects

Two offshore wind farms are already in operation: Rødsand I also known as Nysted with 72 turbines and Rødsand II, with 90 turbines. Five other wind farms are planned or under construction (Arkona Becken Südost, EnBW Windpark Baltic II, Wikinger, Kriegers Flak II, GEOFReE) for in the area east of Fehmarn, Figure 10.2. If founded on steel piles, pile driving during the construction phase would lead to large-scale - though temporal - disturbance of marine mammals. Foundation type and construction periods for these projects are not known. In case of simultaneous construction periods of a fixed link and wind farm(s), cumulative impacts from noise emissions need to be assessed. The operation of the wind farms is not considered to affect the population of marine mammals.

As the degree of impacts from a bridge alternative are assessed as being low and no more wind farms are planned in the direct vicinity of the SCI, no significant impacts on Grey Seal could arise from cumulative impacts from other projects.

8.6.2.4 Impacts on 1364 Grey Seal caused by immersed tunnel alternative

Construction related impacts

Habitat changes may result from sediment spill, which can affect the benthic communities and fish. Dredging operation may alter the structure of the seabed and thus lead to habitat changes and changes in food web structures.

A high intensity of activities during the construction phase might cause a barrier effect and impair the function of the Fehmarnbelt as part of a migration corridor and feeding ground.

The construction of the ports on Lolland and Fehmarn, which are planned to host the construction operations, will be associated with sheet piling. Though noise emissions may be efficiently mitigated by various measures it is assumed at this stage that noise emissions lead to temporal disturbance at a large range (10 – 20 km) over the construction period of 4 – 6 weeks and effect marine mammals in the western part of the SCI.

Overall estimation of impact of the conservation subject/ objective

Construction works, especially if high noise levels from piling operations may occur, are likely to lead to some disturbance in the western part of the SCI. Impacts are ranked to be low as this area is of low importance for Grey Seal and the main haul out sites will not be affected.

The western part of the SCI and the lagoon itself are likely to become affected by sediment spill from dredging but little impacts will take place for Grey Seal.

Conclusion

Significant impacts on Grey Seal from construction and operation of a tunnel over Fehmarnbelt will not occur for this SCI as possible impacts will only affect the western part of the site, which is of low importance for this species.

8.6.2.5 Description of the impacts on 1364 Grey Seal caused by bored tunnel alternative

Construction related impacts

Habitat changes may result from sediment spill, which can affect the benthic communities and fish. (FEBEC 2013b), however, describes only minor alteration of the habitat, thus only little impact on specific fish species will take place.

The construction of the ports on Lolland and Fehmarn, which are planned to host the construction operations, will be associated with sheet piling. Noise emissions are evaluated to be rather low and might be efficiently mitigated by various measures. Based on FEMM (2013b) it is assumed that noise emissions lead to temporal disturbance at a maximum range of 10 km over the construction period of 4 – 6 weeks and will not affect marine mammals significantly in the western part of the SCI.

Structure and operation related impacts

No impacts will take place.

Overall estimation of impact of the conservation subject/ objective

Construction works are not likely to lead to some disturbance in the western part of the SCI. Impacts are ranked to be low as this area is of low importance for grey seal and the main haul out sites will not be affected.

The western part of the SCI and the lagoon itself are likely to become affected by sediment spill from dredging but little impacts are expected on Grey Seal.

Conclusion

Significant impacts on grey seal from construction and operation of a bored tunnel over Fehmarnbelt will not occur for this SCI as possible impacts would only affect the western part of it, which is of low importance for this species.

Estimation of the relevance of other plans and projects

Two offshore wind farms are already in operation: Rødsand I also known as Nysted with 72 turbines and Rødsand II, which was recently finished, with 90 turbines. Five other wind farms are planned or under construction (Arkona Becken Südost, EnBW Windpark Baltic II, Wikinger, Krieger's Flak II, GEOFReE) for in the area east of Fehmarn, Figure 10.2. If founded on steel piles, pile driving during the construction phase would lead to large-scale - though temporal - disturbance of marine mammals. Foundation type and construction periods for these projects are not known. In case of simultaneous construction periods of a fixed link and wind farms(s), cumulative impacts from noise emissions need to be assessed. The operation of the wind farms is not considered to affect the population of marine mammals.

As the degree of impacts from a tunnel alternative are assessed as being low and no more wind farms are planned in the direct vicinity of the SCI, no significant impacts on Grey Seal could arise from cumulative impacts from other projects.

8.6.2.6 Overall estimation of impact of the conservation subject/ objective

Both, a bridge and tunnel alternatives for a fixed link would only result in minor effects on marine mammals in this SCI, Table 8.13. Due to the high distance to the alignment, low direct impacts from construction works will take place. As little to no impacts from a bridge as barrier will take place, this would not affect the marine mammal populations in this SCI. From a tunnel alternative, sediment spill into the Rødsand lagoon would be higher as compared to a bridge alternative but no significant impacts on marine mammals will take place.

Table 8.13 Comparison of the impacts on 1364 Grey Seal caused by bridge and tunnel alternatives.

1364 Grey Seal	Bridge alternative	Immersed tunnel alternative	Bored tunnel alternative
Degree of impact	Low degree	Low degree	Low degree
Significance of impact	No significance	No significance	No significance

8.6.3 Harbour Seal

8.6.3.1 Description of detailed conservation subject/ objective: 1365 Harbour Seal (*Phoca vitulina*)

- Secure protection of haul out and reproduction sites for Harbour Seals;
- Secure generally protection of Harbour Seals against any human disturbance; and
- Secure maintenance of population size at least in their present size.

Achievement of a good conservation status of the Harbour Seal is based on fulfilling these objectives and to have an appropriate site management, low nutrition input at a level where feeding possibilities is not impaired, and in this way to secure good reproduction possibilities.

8.6.3.2 Description of potential impact factors of bridge and tunnel alternative (caused by construction and structure) affecting 1365 Harbour Seal

Potential impacts affecting grey seal have been identified, Table 8.14, Table 8.15.

Table 8.14 Bridge, impact on Harbour Seal.

BRIDGE	Construction	Structure
Potential impact factors	Temporary reduction due to dredging /sediment spillage	Permanent change in density due to permanent changes in food supply or habitats due to changed hydrographical regime
Level of impact	Low degree – no significant impact	Low degree – no significant impact
Potential impact factors	Possible barrier effect due to construction works	Permanent change in density due to barrier effect
Level of impact	Low degree – not significant	Low degree – not significant
Potential impact factors	Temporary reduction in density or injuries due to piling during construction works	
Level of impact	Low degree – not significant	

Table 8.15 Immersed and bored tunnel, impact on Harbour Seal.

	Immersed tunnel construction	Bored tunnel construction
Potential impact factors	Temporary reduction due to dredging /sediment spillage	Temporary reduction due to dredging /sediment spillage
Level of impact	Low degree	Low degree
Potential impact factors	Possible barrier effect due to construction works	Temporary reduction in density or injuries due to piling for construction harbours
Level of impact	Low degree	Low degree
Potential impact factors	Temporary reduction in density or injuries due to piling during construction works	
Level of impact	Low degree	

8.6.3.3 Impacts on 1365 Harbour Seal caused by bridge alternative

Construction related impacts

Habitat changes may result from sediment spill, which can affect the benthic communities and fish. Dredging operation may alter the structure of the seabed and thus lead to habitat changes and changes in food web structures. However, according to the spill scenario developed the area is outside the main impact zone. Habitat changes will only affect seals on their foraging grounds, at a distance from the SCI, if any. We therefore assume effects to be of low degree.

The construction of the ports on Lolland and Fehmarn, which are planned to host the construction operations, will be associated with sheet piling. Though noise emissions may be efficiently mitigated by various measures it is assumed at this stage that these emissions could lead to temporal disturbance at large ranges (up to 10 km, Thomsen et al., 2006) over the construction period of 4 – 6 weeks and affect Harbour Seals in the western part of the SCI.

Structure related impacts

The superstructures of the fixed link might alter the hydrographical regime permanently and thus result in reduced food supply and/ or habitat changes, which would also affect the Rødsand lagoon.

The frequent use of the seal haul out sites Saltholm and the artificial island Peberholm close to the Øresund bridge and a population increase give an indication, that existing bridges in the Baltic Sea do not result in a barrier effect which will impair the function of straits as migration corridor.

Overall estimation of impact of the conservation subject/ objective

Construction works, especially if high noise levels from piling operations may occur, are likely to lead to some disturbance in the western part of the SCI. Impacts are ranked to be low as this area is of low importance for Grey Seal and the main haul out sites will not be affected. The western part of the SCI and the lagoon itself are likely to become affected by sediment spill from dredging but little impacts will take place for Harbour Seal.

Conclusion

Significant impacts on Harbour Seal from construction and operation of a bridge over Fehmarnbelt will not occur for this SCI as possible impacts will only affect the western part of the site, which is of low importance for the species.

Estimation of the relevance of other plans and projects

Two offshore wind farms are already in operation: Rødsand I also known as Nysted with 72 turbines and Rødsand II, which was recently finished, with 90 turbines. Five other wind farms are planned or under construction (Arkona Becken Südost, EnBW Windpark Baltic II, Wikinger, Kriegers Flak II, GEOFReE) for in the area east of Fehmarn, Figure 10.2. If founded on steel piles, pile driving during the construction phase would lead to large-scale - though temporal - disturbance of marine mammals. Foundation type and construction periods for these projects are not known. In case of simultaneous construction periods of a fixed link and wind farms(s), cumulative impacts from noise emissions need to be assessed. The operation of the wind farms is not considered to affect the population of marine mammals.

As the degree of impacts from a bridge alternative are assessed as being low and no more wind farms are planned in the direct vicinity of the SCI, no significant impacts on Harbour Seal could arise from cumulative impacts from other projects.

8.6.3.4 Impacts on 1365 Harbour Seal caused by immersed tunnel alternative

Construction related impacts

Habitat changes may result from sediment spill, which can affect the benthic communities and fish. Dredging operation may alter the structure of the seabed and thus lead to habitat changes and changes in food web structures. However, according to the spill scenario developed the area is outside the main impact zone. Habitat changes will only affect seals on their foraging grounds, at a distance from the SCI, if any. We therefore assume effects to be of low degree.

The construction of the ports on Lolland and Fehmarn, which are planned to host the construction operations, will be associated with sheet piling. Though noise emissions may be efficiently mitigated by various measures it is assumed at this stage that these emissions could lead to temporal disturbance at large ranges (up to 10 km, Thomsen et al., 2006) over the construction period of 4 – 6 weeks and affect Harbour Seals in the western part of the SCI.

Overall estimation of impact of the conservation subject/ objective

Construction works, especially if high noise levels from piling operations may occur, are likely to lead to some disturbance in the western part of the SCI. Impacts are ranked to be low as this area is of low importance for Harbour Seal and the main haul out sites will not be affected. The western part of the SCI and the lagoon itself are likely to become affected by sediment spill from dredging but little impacts will take place for Harbour Seal.

Conclusion

Significant impacts on Harbour Seal from construction and operation of a bridge over Fehmarnbelt will not occur for this SCI as possible impacts would only affect the western part of it, which is of low importance for this species.

8.6.3.5 Impacts on 1365 Harbour Seal caused by bored tunnel alternative

Construction related impacts

Habitat changes may result from sediment spill, which can affect the benthic communities and fish. However, according to the spill scenario developed by FEHY only the western part of the SCI will be impacted by sediment spill. It is therefore assume that impacts will be low.

The construction of the ports on Lolland and Fehmarn, which are planned to host the construction operations, will be associated with sheet piling. Noise emissions are evaluated to be rather low and can be efficiently mitigated by various measures. Based on FEMM (2012) it is assumed that noise emissions lead to temporal disturbance at a maximum range of 10 km over the construction period of 4 – 6 weeks and will not affect marine mammals significantly in the western part of the SCI.

Structure and operation related impacts

No impacts will take place.

Overall estimation of impact of the conservation subject/ objective

Construction works are not likely to lead to some disturbance in the western part of the SCI. Impacts are ranked to be low as this area is of low importance for Harbour Seals and the main haul out sites will not be affected.

The western part of the SCI and the lagoon itself are likely to become affected by sediment spill from dredging but little impacts will take place for Harbour Seals, since assessments shows no impact on relevant fish species.

Conclusion

Significant impacts on Harbour Seals from construction of a tunnel over Fehmarnbelt will not occur for this SCI as possible impacts would only affect the western part of it, which is of low importance for this species. As the impacts from the bored tunnel alternative are assessed to be low and no more wind farms are planned in the direct vicinity of the SCI, no significant impacts on seals or Harbour Porpoises arise from cumulative impacts from other projects.

Estimation of the relevance of other plans and projects

Two offshore wind farms are already in operation: Rødsand I also known as Nysted with 72 turbines and Rødsand II, which was recently finished, with 90 turbines. Five other wind farms are planned or under construction (Arkona Becken Südost, EnBW Windpark Baltic II, Wikinger, Kriegers Flak II, GEOFReE) for in the area east of Fehmarn, Figure 10.2. If founded on steel piles, pile driving during the construction phase would lead to large-scale - though temporal - disturbance of marine mammals. Foundation type and construction periods for these projects are not known. In case of simultaneous construction periods of a fixed link and wind farms(s), cumulative impacts from noise emissions need to be assessed. The operation of the wind farms is not considered to affect the population of marine mammals. As the degree of impacts from a bridge alternative are assessed as being low and no more wind farms are planned in the direct vicinity of the SCI, no significant impacts on Harbour Seal could arise from cumulative impacts from other projects.

8.6.3.6 Overall estimation of impact of the conservation subject/ objective

Both, a bridge and a tunnel alternative for a fixed link would only result in minor effects on seal species in this SCI, Table 8.16. Due to the high distance to the alignment, no direct impacts from construction work will take place. As little to no impacts from a bridge as barrier will take place, this would not have impact on the marine mammal populations in this SCI. From a tunnel alternative, sediment spill into the Rødsand lagoon would be higher as compared to a bridge alternative, but still with no significant impacts on seals.

Table 8.16 Comparison of the impacts on 1365 Harbour Seal caused by bridge and tunnel alternatives.

1364 Harbour Seal	Bridge alternative	Immersed tunnel alternative	Bored tunnel alternative
Degree of impact	Still tolerable degree	Still tolerable degree	Still tolerable degree
Significance of impact	No significance	No significance	No significance

8.6.4 Harbour Porpoise

8.6.4.1 Description of potential impact factors of bridge and tunnel alternative (caused by construction and structure) affecting 1351 Harbour Porpoise

Potential impacts affecting grey seal have been identified, Table 8.17, Table 8.18.

Table 8.17 Bridge, impact on Harbour Porpoise.

BRIDGE	Construction	Structure
Potential impact factors	Temporary reduction due to dredging /sediment spillage	Permanent change in density due to permanent changes in food supply or habitats due to changed hydrographical regime
Level of impact	Low degree – not significant	Low degree – not significant
Potential impact factors	Possible barrier effect due to construction works	Permanent change in density due to barrier effect
Level of impact	Needs to be determined – lack of sufficient data	Low degree – not significant
Potential impact factors	Temporary reduction in density or injuries due to piling during construction works	
Level of impact	Low degree – not significant	

Table 8.18 Immersed and bored tunnel, impact on Harbour Porpoise.

	Immersed tunnel construction	Bored tunnel construction
Potential impact factors	Temporary reduction due to dredging /sediment spillage	Temporary reduction due to dredging /sediment spillage
Level of impact	Low degree – not significant	Low degree – not significant
Potential impact factors	Possible barrier effect due to construction works	Temporary reduction in density or injuries due to piling for construction harbours
Level of impact	Low degree - not significant	Low degree still tolerable
Potential impact factors	Temporary reduction in density or injuries due to piling during construction works	
Level of impact	Low degree – not significant	

8.6.4.2 Impacts on 1351 Harbour Porpoises caused by bridge alternative

Construction related impacts

Habitat changes may result from sediment spill, which can affect the benthic communities and fish. Dredging operation may alter the structure of the seabed and thus lead to habitat changes and changes in food web structures.

A high intensity of activities during the construction phase could cause a barrier effect and impair the function of the Fehmarnbelt as part of a migration corridor and would lead to a reduced density of Harbour Porpoises also in this particular area.

The construction of the ports on Lolland and Fehmarn, which are planned to host the construction operations, will be associated with sheet piling. Though noise emissions may be

efficiently mitigated by various measures it is assumed at this stage that noise emissions lead to temporal disturbance at a large range (10 – 20 km) over the construction period of 4 – 6 weeks and effect marine mammals in the western part of the SCI.

Structure related impacts

The superstructures of the fixed link could alter the hydrographical regime permanently and thus result in a change of food supply and/ or habitat, which would also affect the Rødsand lagoon.

Studies on the behaviour of Harbour Porpoises at the Great Belt Bridge and an analysis of porpoise movements based on data from satellite telemetry did not provide an indication that existing bridges in the Baltic Sea result in a barrier effect, which could impair the function of straits as migration corridor. However, in case a barrier effect occurs, Harbour Porpoises would be isolated from the main population, since this Natura 2000 site is situated at the eastern parts of the fixed link. Contact with the main population is important in terms of genetic exchange.

Overall estimation of impact of the conservation subject/ objective

Construction works, especially if high noise levels from piling operations may occur, are likely to lead to some disturbance in the western part of the SCI. Some caution is required when assessing impacts from noise emissions at this stage, as their extent is not known yet. It is considered to be highly likely, however, that significant impacts on the SCI can be avoided by application of mitigation measures to reduce underwater noise levels.

The western part of the SCI and the lagoon itself are likely to become affected by sediment spill from dredging but little impacts will take place for Harbour Porpoise.

Conclusion

Significant impacts on Harbour Porpoise from construction and operation of a bridge over Fehmarnbelt will not occur for this SCI as possible impacts will only affect the western part of the site, and mitigation measures, if necessary, could be applied to reduce impacts.

Estimation of the relevance of other plans and projects

Two offshore wind farms are already in operation: Rødsand I also known as Nysted with 72 turbines and Rødsand II, which was recently finished, with 90 turbines. Five other wind farms are planned or under construction (Arkona Becken Südost, EnBW Windpark Baltic II, Wikinger, Kriegers Flak II, GEOFReE) for in the area east of Fehmarn, Figure 10.2. If founded on steel piles, pile driving during the construction phase would lead to large-scale - though temporal - disturbance of marine mammals. Foundation type and construction periods for these projects are not known. In case of simultaneous construction periods of a fixed link and wind farms(s), cumulative impacts from noise emissions need to be assessed. The operation of the wind farms is not considered to affect the population of marine mammals.

As the degree of impacts from a bridge alternative are assessed as being low and no more wind farms are planned in the direct vicinity of the SCI, no significant impacts on Harbour Porpoise are likely arise from cumulative impacts from other projects. Some caution is required, however, in this respect as duration and extent of noise emissions from future wind farm constructions cannot be fully assessed at this stage.

8.6.4.3 Impacts on 1351 Harbour Porpoises caused by immersed tunnel alternative

Construction related impacts

Habitat changes may result from sediment spill, which can affect the benthic communities and fish. Dredging operation may alter the structure of the seabed and thus lead to habitat changes and changes in food web structures.

A high intensity of activities during the construction phase could cause a barrier effect and impair the function of the Fehmarnbelt as part of a migration corridor and would lead to a reduced density of Harbour Porpoises also in this particular area.

Overall estimation of impact of the conservation subject/ objective

Construction works, especially if high noise levels from piling operations may occur, are likely to lead to some disturbance in the western part of the SCI. Some caution is required when assessing impacts from noise emissions at this stage, as their extent is not known yet. It is considered to be highly likely, however that significant impacts on the SCI can be avoided by application of mitigation measures to reduce underwater noise levels.

The western part of the SCI and the lagoon itself are likely to become affected by sediment spill from dredging but little impacts will take place for Harbour Porpoise.

Conclusion

Significant impacts on Harbour Porpoise from construction and operation of a tunnel over Fehmarnbelt will not occur for this SCI as possible impacts would only affect the western part of it and mitigation measures, if necessary, could be applied to reduce impacts.

Estimation of the relevance of other plans and projects

Two offshore wind farms are already in operation: Rødsand I also known as Nysted with 72 turbines and Rødsand II, which was recently finished, with 90 turbines. Five other wind farms are planned or under construction (Arkona Becken Südost, EnBW Windpark Baltic II, Wikinger, Kriegers Flak II, GEOFReE) for in the area east of Fehmarn, Figure 10.2. If founded on steel piles, pile driving during the construction phase would lead to large-scale - though temporal - disturbance of marine mammals. Foundation type and construction periods for these projects are not known. In case of simultaneous construction periods of a fixed link and wind farms(s), cumulative impacts from noise emissions need to be assessed. The operation of the wind farms is not considered to affect the population of marine mammals.

As the degree of impacts from a bridge alternative are assessed as being low and no more wind farms are planned in the direct vicinity of the SCI, no significant impacts on Harbour Porpoise are likely arise from cumulative impacts from other projects. Some caution is required, however, in this respect as duration and extent of noise emissions from future wind farm constructions cannot be fully assessed at this stage.

8.6.4.4 Impacts on 1351 Harbour Porpoises caused by bored tunnel alternative

Construction related impacts

Habitat changes may result from sediment spill, which can affect the benthic communities and fish. However, according to the spill scenario developed, only the western part of the SCI will be impacted by sediment spill. No impacts on relevant fish species will take place, which leads to the conclusion that impacts will be non-significant.

The construction of the ports on Lolland and Fehmarn, which are planned to host the construction operations, will be associated with sheet piling. Noise emissions are evaluated to be rather low and can be efficiently mitigated by various measures. Based on assessments it is assumed that noise emissions lead to temporal disturbance at a maximum range of 10 km over the construction period of 4 – 6 weeks and will not affect marine mammals significantly in the western part of the SCI.

Structure and operation related impacts

No impacts will take place.

Overall estimation of impact of the conservation subject/ objective

Construction works for harbours are not likely to lead to some disturbance in the western part of the SCI. The western part of the SCI and the lagoon itself are likely to become affected by sediment spill from dredging but little impacts will take place for Harbour Porpoise.

Conclusion

Significant impacts on harbour porpoise from construction and operation of a bored tunnel over Fehmarnbelt will not occur for this SCI.

8.6.4.5 Overall estimation of impact of the conservation subject/ objective

Both, a bridge and tunnel alternatives for a fixed link would only result in minor effects on marine mammals in this SCI, Table 8.19. Due to the high distance to the alignment, there will be no direct impacts from construction work. As little to no impacts from a bridge as barrier will take place, this would not affect the marine mammal populations in this SCI. From an immersed tunnel alternative, sediment spill into the Rødsand lagoon would be higher as compared to a bridge alternative but there will be no impacts on marine mammals.

A bored tunnel alternative for a fixed link would only result in minor effects on Harbour Porpoises in this SCI. Due to the large distance to the alignment; there will be no direct impacts from construction works. There will be sediment spill into the Rødsand Lagoon but there will be no impacts on marine mammals, since the spill is less than the spill produced by construction works for the immersed tunnel scenario.

Overall conclusion is that an appropriate assessment should be conducted for this site based on the fact that significant impact cannot be excluded for two nature types.

Table 8.19. Comparison of the impacts on 1351 Harbour Porpoises caused by bridge and tunnel alternatives.

1351 Harbour Porpoises	Bridge alternative	Immersed tunnel alternative	Bored tunnel alternative
Degree of impact	Low degree	Low degree	Low degree
Significance of impact	No significance	No significance	No significance

8.7 *SPA* DK 006X083 Coastal and marine area Hyllekrog-Rødsand

The SPA coastal zone Hyllekrog-Rødsand overlaps the SCI DK 006X238.

More bird species are included in the standard data form for the SPA, Table 8.20.

Table 8.20. Extracted table with information on Bird Species from Annex I of the BD. Information from the standard data forms on Annex I species with occurrence in the SPA.

Code	Species	Group	Connected to marine habitats?	Breed	Winter	Stage	Birds listed on Annex I?
A021	Eurasian Bittern *Botaurus stellaris*	Herons	No, not assessed	1 – 2 p			Yes
A038	Whooper Swan *Cygnus*	Swans	Yes		< 300 i		Yes
A068	Smew (merganser) *Mergus albellus*	Mergansers	Yes		< 500 i		Yes
A074	Red Kite *Milvus milvus*	Birds of prey	No, not assessed			3 – 7 i	Yes
A075	White-tailed Eagle *Haliaeetus albicilla*	Birds of prey	Yes			< 2 i	Yes
A081	Marsh Harrier *Circus aeruginosus*	Birds of prey	No, not assessed	4 – 5 p			Yes
A132	Avocet *Recurvirostra avosetta*	Waders	Yes	25 – 30 p			Yes
A191	Sandwich Tern *Sterna sandvicensis*	Terns	Yes	50 – 200 p			Yes
A193	Common Tern *Sterna hirundo*	Terns	Yes	75 p			Yes
A194	Arctic Tern *Sterna paradisea*	Terns	Yes	250 p			Yes
A195	Little Tern *Sterna albifrons*	Terns	Yes	6 – 13 p			Yes
A338	Red-backed Shrike *Lanius collurio*	Songbirds	No, not assessed	3 p			Yes
A222	Short-eared Owl *Asio flammeus*	Owls	No, not assessed	0 – 1 p			Yes
A036	Mute Swan *Cygnus olor*	Swans	Yes			< 5,000 i	No
A039	Bean Goose *Anser fabalis*	Geese	Yes		< 3,000 i		No
A043	Greylag Goose *Anser anser*	Geese	Yes			4,000 i	No
A046	Brent Goose *Branta bernicla*	Geese	Yes			< 2,000 i	No
A061	Tufted Duck *Aythya fuligula*	Ducks	Yes		22,000 i		No
A067	Common Goldeneye *Bucephala clangula*	Sea ducks	Yes		< 2,000 i		No
A069	Red-breasted Merganser *Mergus serrator*	Mergansers	Yes			1,060 i	No
A125	Common Coot *Fulica atra*	Rails	Yes			< 15,000 i	No
A214	*Great Cormorant Phalacrocorax carbo*	Cormorants	Yes			2.815 i	No

In the last ten years also the following Annex-I-species were observed in the area by voluntary bird watchers (in brackets sum of individuals, double-sightings cannot be excluded): *Alcedo atthis* (9), *Anthus campestris* (2), *Aquila clanga* (6), *Ardea alba* (4), *Branta leucopsis* (52.779), *Caprimulgus europaeus* (3), *Chlidonias niger* (35), *Ciconia ciconia* (1), *Circus cyaneus* (219), *Circus macrourus* (2), *Circus pygargus* (4), *Egretta garzetta* (19), *Falco columbarius* (56), *Falco peregrinus* (61), *Falco vespertinus* (7), *Gavia arctica* (29), *Gavia stellata* (85), *Grus grus* (40), *Larus melanocephalus* (4), *Limosa lapponica* (205), *Lullula arborea* (8), *Milvus migrans* (3),

Pandion haliaetus (30), *Pelecanus onocrotalus* (1), *Pernis apivorus* (11), *Phalaropus lobatus* (7), *Philomachus pugnax* (200), *Platalea leucorodia* (3), *Pluvialis apricaria* (80.270), *Podiceps auritus* (54), *Sylvia nisora* (2), *Tringa glareola* (737).

Overall conservation objectives:

Some species feed on benthic flora and fauna. 16 water bird species, some of them occur out of breeding period in numbers, which exceed in winter 1% of the European population.

The area is important for herbivore species like Mute Swan or Geese.

8.7.1 Swans

8.7.1.1 Conservation subject/ objective: A036 Mute Swan (*Cygnus olor*) and A038 Whooper Swan (*Cygnus cygnus*)

Up to 5,000 staging Mute Swans and 300 wintering Whooper Swans are listed in the standard data forms. Dedicated search flights and supporting information of DOF database (DOF 2010) indicated that between 10,000 and 16,000 Mute Swans use the SPA Hyllekrog-Rødsand during summer months, corresponding to 4.0-6.5 % of the biogeographic population. For Whooper Swans a total of 886 birds (equal to 1.6 % of the biogeographic population) has been recorded within the SPA Hyllekrog-Rødsand during the mid-winter waterbird census in Denmark in February 2008 (Petersen et al. 2010).Highest numbers of staging Swans in the area occurred in August/September with some thousand individuals, which confirms the importance of the area. The core area of the distribution is the western part of the Rødsand lagoon.

8.7.1.2 Description of detailed conservation objectives

The condition and the total area of the habitat has to be stable or even increase, so that within the area at least 1.450 Whooper Swans and 14,000 Mutes Swans find resting and feeding grounds there.

8.7.1.3 Description of potential impact factors of bridge and tunnel alternative (caused by construction and structure) affecting Swans

Potential impacts affecting swans have been identified, Table 8.21.

Table 8.21 Defining the potential impact factors of bridge and tunnel alternatives (caused by construction, structure, operation) affecting swan species

Bridge	Construction	Structure	Operation
Potential impact factors	Temporary change in density due to changed food supply and reduced visibility due to dredging and sediment spillage		
Level of impact	Low still tolerable degree		
Immersed and bored tunnel	Construction	Structure	Operation
Potential impact factors	Temporary change in density due to changed food supply and reduced visibility due to dredging and sediment spillage		
Level of impact	High degree		

8.7.1.4 Impacts on A036 Mute Swan (*Cygnus olor*) and A038 Whooper Swan (*Cygnus cygnus*) caused by bridge alternative

Construction related impacts

Habitat changes may result from sediment spill, which can affect the benthic communities as this increases light attenuation caused by increase in concentration of suspended matter. Especially eelgrass may be impaired and productivity reduced due to increased light attenuation. Sediment spill is evaluated based on modelling to be highest in the western part of the lagoon. Modelling shows for the Rødsand lagoon temporary losses of *Zostera* for the habitat types sandbank and shallow inlets and bays as below 5 % and non-significant for the bridge alternative. No significant impacts on swans will take place. Swans in the Rødsand lagoon mainly feed on *Zostera* and use the area as moulting site, so any decline in *Zostera* could affect numbers of Swans in the area.

Overall estimation and conclusion on impact of the conservation subject/ objective

We conclude that significant impacts on this SPA due to the construction of a bridge can be excluded for the two species of swans.

Estimation of the relevance of other plans and projects

Two offshore wind farms are already in operation: Rødsand I also known as Nysted with 72 turbines and Rødsand II, which was recently finished, with 90 turbines. Four other wind farms are planned (Beltsee, Beta Baltic, GEOFReE) in the area east of Fehmarn, where GEOFReE is already authorised. If during construction works in these wind farms additional sediment spill would occur, it would lead to additional turbidity and could have cumulative effects on eelgrass. The operation of the wind farms is not considered to affect swans.

8.7.1.5 Impacts on A036 Mute Swan (*Cygnus olor*) and A038 Whooper Swan (*Cygnus cygnus*) caused by immersed tunnel alternative

Construction related impacts

Habitat changes may result from sediment spill, which can affect the benthic communities as this increases light attenuation caused by increase in concentration of suspended matter. Especially eelgrass may be impaired and productivity reduced due to increased light attenuation. Sediment spill is evaluated based on modelling to be highest in the western part of the lagoon. Modelling shows for the Rødsand lagoon non-significant losses of *Zostera* for the type sandbanks, but for shallow inlets and bays modelling predicts significant losses of 10 – 48 % for first and second year of the tunnel construction. Swans in the Rødsand lagoon mainly feed on *Zostera* and use the area as moulting site, so any decline in *Zostera* can affect numbers of Swans in the area. A decline of *Zostera* up to 48 % can result in an equivalent decline in swan numbers As impacts on habitat type shallow inlets and bays are ranked as significant with respect to a reduction of *Zostera*, impacts on swans from reduced food availability are ranked as significant as well.

Overall estimation of impact of the conservation subject/objective

It can be concluded that significant impacts on this SPA due to the construction of a tunnel cannot be excluded. The decline of the main feeding source for Swans, *Zostera*, is of high importance. There will be no significant impacts from other factors.

Conclusion

Significant impacts of swans in the SPA due to the construction works for a tunnel alternative cannot be excluded.

Estimation of the relevance of other plans and projects

Two offshore wind farms are already in operation: Rødsand I also known as Nysted with 72 turbines and Rødsand II, which was recently finished, with 90 turbines. Five other wind farms are planned or under construction (Arkona Becken Südost, EnBW Windpark Baltic II, Wikinger, Kriegers Flak II, GEOFReE) for in the area east of Fehmarn, Figure 10.2, where GEOFReE is already authorised. If during construction works in these wind farms additional sediment spill would occur, it would lead to additional turbidity and could have cumulative effects on eelgrass. The operation of the wind farms is not considered to affect swans.

8.7.1.6 Impacts on *A036 Mute Swan (*Cygnus olor*) and *A038 Whooper Swan (*Cygnus cygnus*) caused by the bored tunnel alternative

Construction related impacts

Habitat changes may result from sediment spill, which can affect the benthic flora communities as this increases light attenuation caused by increase in concentration of suspended matter. Especially eelgrass may be impaired and productivity reduced due to increased light attenuation. Sediment spill is evaluated based on modelling to be highest in the western part of the lagoon. FEMA (2013d) shows for the Rødsand lagoon losses of 20 % of *Zostera* in 2015 and up to 10 % in 2020. Swans in the Rødsand lagoon mainly feed on *Zostera* and use the area as moulting site, so any decline in *Zostera* could affect numbers of Swans in the area. A decline of *Zostera* up to 20 % might result in an equivalent decline in swan numbers. Therefore, impacts on swans from reduced food availability are ranked as high degree of impact.

Structure and operation related impacts

Neither structures nor operation related activities has an impact on conservation objectives.

Overall estimation of impact of the conservation subject/objective

It is concluded that significant impacts on this SPA due to the construction of a bored tunnel cannot be excluded. The decline of the main feeding source for swans, *Zostera*, is of high importance.

No significant impacts will take place from other factors.

Conclusion

Significant impacts of swans in the SPA due to the construction works for a bored tunnel alternative cannot be excluded.

Estimation of the relevance of other plans and projects

One offshore wind farm is located in the direct vicinity of the SPA Hyllekrog-Rødsand: Rødsand II, which was recently finished, with 90 turbines. This wind farm is specifically included, as this is a project that went into operation, while Fehmarn A/S conducted its environmental investigations, whereby a cumulative effect in principle cannot be excluded. As construction works are already finished and the operation of the wind farm is not considered to affect swans, there will be no cumulative effect.

8.7.1.7 Overall estimation of impact of the conservation subject/ objective

Table 8.22 Comparison of the impacts on A036 Mute Swan (*Cygnus olor*) and A038 Whooper Swan (*Cygnus cygnus*) caused by bridge and tunnel alternatives

A036 Mute Swan (*Cygnus olor*) and A038 Whooper Swan (*Cygnus cygnus*)	Bridge alternative	Immersed tunnel alternative	Bored tunnel alternative
Degree of impact	High degree of impact.	High degree of impact.	High degree of impact.
Significance of impact	Impacts non-significant	Impacts significant	Impacts significant

8.7.2 Mergansers

8.7.2.1 Conservation subject/ objective: A068 Smew (*Mergus albellus*), A069 Red-breasted Merganser (*Mergus serrator*) and A070 Goosander (*Mergus merganser*)

In standard data form, 500 wintering Smews and 1,060 staging Red-breasted Mergansers are listed. Goosanders are not listed in standard data form, but are named in the conservation objectives of the site with 3, 500 individuals. High numbers of Smew reported in the DOF database indicate that SPA Hyllekrog-Rødsand is an internationally important site to this species. According to this data source the 1 % threshold of 400 birds was exceeded in three winters since 2000: 453 birds in February 2006 (1.1 % of the biogeographic population), 1,300 birds in January 2009 (3.3 %) and 835 birds in March 2010 (2.1 %; DOF 2010).

Results of distribution modelling for Red-breasted Merganser indicated that the SPA Hyllekrog-Rødsand supported between 100 and 200 birds during winter according to aerial survey data. Numbers of Goosander reported in the DOF database (DOF 2010) indicate that the SPA Hyllekrog-Rødsand does not support internationally important numbers of this species (usually < 0.1 % of the biogeographic population). The maximum reported number of 325 Goosanders in February 2006 (DOF 2010) equals to 0.12 % of the biogeographic population.

8.7.2.2 Description of detailed conservation objectives

- The condition and the total area of the habitat has to be stable or even increase to secure favourable resting and feeding grounds for Smews.
- The condition and the total area of the habitat has to be stable or even increase, so that within the area at least 5,000 Red-breasted Mergansers and 3,500 Goosanders find resting and feeding grounds there.

8.7.2.3 Description of potential impact factors of bridge and tunnel alternative (caused by construction and structure) affecting Mergansers

Table 8.23. Defining the potential impact factors of bridge and tunnel alternatives (caused by construction, structure, operation) affecting A068 Smew (*Mergus albellus*), A069 Red-breasted Merganser (*Mergus serrator*) and A070 Goosander (*Mergus merganser*) and definition of thresholds

Bridge	Construction	Structure
Potential impact factors	Temporary change in density due to changed food supply and reduced visibility due to dredging and sediment spillage	Permanent change in density due to changed distribution of food supply due to changed hydrographical regime
Level of impact	Low degree	No impact
Potential impact factors		Permanent change in density due to changed distribution of food supply due to changed seabed morphology
Level of impact		No impact
Immersed and bored tunnel	Construction	Structure
Potential impact factors	Temporary change in density due to changed food supply and reduced visibility due to dredging and sediment spillage	Permanent change in density due to changed distribution of food supply due to changed hydrographical regime
Level of impact	High degree for immersed tunnel, low degree still tolerable for bored tunnel	No impact
Potential impact factors		Permanent change in density due to changed distribution of food supply due to changed seabed morphology
Level of impact		No impact

8.7.2.4 Impacts on A068 Smew (*Mergus albellus*), A069 Red-breasted Merganser (*Mergus serrator*) and A070 Goosander (*Mergus merganser*) caused by bridge alternative

Construction related impacts

Habitat changes may result from sediment spill, which can affect the benthic communities and fish. Pelagic and semi-pelagic fish will react to water turbidity due to dredging and sediment spillage, but the concentration of suspended sediment will always be below the indicative threshold. No effects on fish species spawning and breeding in vegetation of shallow waters will appear. Therefore, the impact for fishing species like mergansers will be of a low degree.

Overall estimation of impact of the conservation subject/ objective

Sediment spill due to construction work will not affect fish communities; therefore, the impact on mergansers is low for a bridge alternative. Other impacts will not occur.

Conclusion

Significant impacts on mergansers from construction, structure and operation of a bridge over Fehmarnbelt will not occur for this SPA as possible impacts would only affect fish communities temporarily and locally.

Estimation of the relevance of other plans and projects

Two offshore wind farms are already in operation: Rødsand I also known as Nysted with 72 turbines and Rødsand II, which was recently finished, with 90 turbines. Five other wind farms are planned or under construction (Arkona Becken Südost, EnBW Windpark Baltic II, Wikinger, Kriegers Flak II, GEOFReE) for in the area east of Fehmarn, Figure 10.2, where GEOFReE is already authorised. If during construction works in this wind farms additional sediment spill will occur, it would lead to additional turbidity and could have cumulative effects on fish. The operation of the wind farms is not considered to affect mergansers.

8.7.2.5 Impacts on A068 Smew (*Mergus albellus*), A069 Red-breasted Merganser (*Mergus serrator*) and A070 Goosander (*Mergus merganser*) caused by immersed tunnel alternative

Construction related impacts

Habitat changes may result from sediment spill, which can affect the benthic communities and fish. Pelagic and semi-pelagic fish will react to water turbidity due to dredging and sediment spillage, but only temporally and locally, in most cases the concentration of suspended sediment will be below the indicative threshold. Fish species spawning and breeding in vegetation of shallow waters could be affected due to temporary loss of spawning and nursery grounds, but effects are not assessed as significant. As the sediment spill for the tunnel alternative will be of greater extent than for the bridge alternative a significant impact for fishing species like mergansers cannot be excluded for the tunnel alternative.

Overall estimation of impact of the conservation subject/objective

Sediment spill due to construction works will affect fish communities temporarily and locally; therefore a significant impact on mergansers cannot be excluded. Other impacts will not occur.

Conclusion

Significant impacts on mergansers from construction of a tunnel over Fehmarnbelt cannot be excluded for this SPA as possible impacts on fish communities will occur temporarily and locally.

Estimation of the relevance of other plans and projects

Two offshore wind farms are already in operation: Rødsand I also known as Nysted with 72 turbines and Rødsand II, which was recently finished, with 90 turbines. Five other wind farms are planned or under construction (Arkona Becken Südost, EnBW Windpark Baltic II, Wikinger, Kriegers Flak II, GEOFReE) for in the area east of Fehmarn, Figure 10.2, whereof GEOFReE is already authorised. If during construction works in this wind farms additional sediment spill will occur, it would lead to additional turbidity and could have cumulative effects on fish. The operation of the wind farms will not affect mergansers.

8.7.2.6 Impacts on *A068 Smew (*Mergus albellus*), *A069 Red-breasted Merganser (*Mergus serrator*) and*A070 Goosander (*Mergus merganser*) caused by a bored tunnel alternative

Construction related impacts

Habitat changes may result from sediment spill, which can affect the benthic communities and fish. Pelagic and semi-pelagic fish will react to water turbidity due to dredging and sediment

spillage, but according to assessment for fish species there will be no or only very small impact on fish. Thus, the impact on piscivorous species will be low as well.

Structure and operation related impacts

Neither structures nor operation related activities has an impact on conservation objectives.

Overall estimation of impact of the conservation subject/objective

Pressures from construction activities has no significant impact on mergansers, as feeding sources will not be affected.

Conclusion

Significant impacts on mergansers from construction and operation of a bored tunnel over Fehmarnbelt will not occur for this SPA as no possible impacts will occur.

Estimation of the relevance of other plans and projects

One offshore wind farm is located in the direct vicinity of the SPA Hyllekrog-Rødsand: Rødsand II with 90 turbines. This wind farm is specifically included, as this is a project that went into operation, while Fehmarn A/S conducted its environmental investigations, whereby a cumulative effect in principle cannot be excluded. As construction works are already finished and the operation of the wind farm is not considered to affect mergansers, there will be no cumulative effect.

8.7.2.7 Overall estimation of impact of the conservation subject/ objective

As the sediment spill for immersed tunnel alternative will be of greater extent than for the bridge alternative a significant impact for fishing species like mergansers cannot be excluded for the tunnel alternative, Table 8.24. The bored tunnel alternative for a fixed link is on the other hand assessed to have non-significant impact.

Table 8.24. Comparison of the impacts on A068 Smew (Mergus albellus), A069 Red-breasted Merganser (Mergus serrator) and A070 Goosander (Mergus merganser) caused by bridge and tunnel alternative

A068 Smew (*Mergus albellus*), A069 Red-breasted Merganser (*Mergus serrator*) and A070 Goosander (*Mergus merganser*)	Bridge alternative	Immersed tunnel alternative	Bored tunnel alternative
Degree of impact	Low degree	Low degree	Low degree
Significance of impact	Impacts non-significant	Impacts significant	Impacts non-significant

8.7.3 Eagles

8.7.3.1 Conservation subject/ objective: A075 White-tailed Eagle (*Haliaeetus albicilla*)

Two staging White-tailed Eagles are listed in standard data form. This species was not captured during flight surveys. Higher numbers are reported by DOF database with a maximum of 21 White-tailed Eagles recorded in February 2010 (DOF 2010).

Two breeding pairs of White-tailed Eagle are reported for the area (Storstrøms Amt 2006). White-tailed Eagle regularly – though with a few individuals only - use the marine habitats to hunt for fish and waterfowl, especially in winter when inland lakes are frozen.

8.7.3.2 Description of detailed conservation objectives

The condition and the total area of the breeding habitats of White-tailed Eagle have to be stable or even increase to secure favourable breeding and feeding grounds within the site.

8.7.3.3 Overall estimation of impact of the conservation subject/ objective

Both bridge or tunnel alternatives of a fixed link would not lead to significant impacts on White-tailed Eagles in this SPA, Table 8.25. Abundance and availability of food sources (waterfowl, fish) will not change significantly. There will be no impacts on the breeding areas.

Table 8.25 Possible impacts on White-tailed Eagle.

A075 White-tailed Eagle (*Haliaeetus albicilla*)	Bridge alternative	Immersed tunnel alternative	Bored tunnel alternative
Degree of impact	No impact.	No impact.	No impact.
Significance of impact	Impacts non-significant	Impacts non-significant	Impacts non-significant

8.7.4 Waders

8.7.4.1 Conservation subject/ objective: A132 Avocet (*Recurvirostra avosetta*)

In the standard data form, 25 – 30 breeding pairs are listed. During DOF breeding bird examination in 2009 even 41 breeding pairs were recorded (Miljøcenter unpub.).

8.7.4.2 Description of detailed conservation objectives

The condition and the total area of the breeding habitats of Avocets have to be stable or even increase to secure favourable breeding and feeding grounds within the site.

8.7.4.3 Description of potential impact factors of bridge and tunnel alternative (caused by construction and structure) affecting waders.

Table 8.26 Defining the potential impact factors of bridge and tunnel alternatives (caused by construction, structure, operation) affecting A132 Avocet (*Recurvirostra avosetta*).

Bridge	Construction	Structure
Potential impact factors	Temporary change in density due to changed food supply and reduced visibility due to dredging and sediment spillage	Permanent change in density due to changed distribution of food supply due to changed seabed morphology
Level of impact	Low degree	No impact
Immersed and bored tunnel	Construction	Structure
Potential impact factors	Temporary change in density due to changed food supply and reduced visibility due to dredging and sediment spillage	Permanent change in density due to changed distribution of food supply due to changed seabed morphology
Level of impact	Low degree	No impact

The sedimentation of suspended sediments in the Rødsand lagoon could temporary affect habitats and benthic fauna in the area but will not result in significant negative impacts on Avocets, which have a preference for muddy habitats.

8.7.4.4 Impacts on A132 Avocet (*Recurvirostra avosetta*) caused by bridge alternative

Overall estimation of impact of the conservation subject/objective

Pressures from construction activities has no significant impact on Avocets, because feeding sources will not be affected and seabed morphology will not change.

Conclusion

Significant impacts on Avocet from construction, structure and operation of a bridge over Fehmarnbelt will not occur for this SPA as no possible impacts will occur.

Estimation of the relevance of other plans and projects

Two offshore wind farms are already in operation: Rødsand I also known as Nysted with 72 turbines and Rødsand II, with 90 turbines. Five other wind farms are planned or under construction (Arkona Becken Südost, EnBW Windpark Baltic II, Wikinger, Kriegers Flak II, GEOFReE) for in the area east of Fehmarn, Figure 10.2. The operation of the wind farms is not considered to affect Avocets.

8.7.4.5 Impacts on A132 Avocet (*Recurvirostra avosetta*) caused by immersed tunnel alternative

Overall estimation of impact of the conservation subject/objective

Pressures from construction activities has no significant impact on Avocets, because feeding sources will not be affected and seabed morphology will not change.

Conclusion

Significant impacts on Avocet from construction and operation of a tunnel over Fehmarnbelt will not occur for this SPA as no possible impacts will occur.

Estimation of the relevance of other plans and projects

Two offshore wind farms are already in operation: Rødsand I also known as Nysted with 72 turbines and Rødsand II, which was recently finished, with 90 turbines. Three other wind farms are planned (Beltsee, Beta Baltic, GEOFREE) in the area east of Fehmarn. The operation of the wind farms is not considered to affect Avocets.

8.7.4.6 Impacts on *A132 Avocet (*Recurvirostra avosetta*) caused by the bored tunnel alternative

Construction, structure and operation related impacts

No significant impacts are assessed.

Overall estimation of impact of the conservation subject/objective

Pressures from construction activities has no significant impact on Avocets, because feeding sources will not be affected and seabed morphology will not change.

Conclusion

Significant impacts on Avocet from construction and operation of a bored tunnel over Fehmarnbelt will not occur for this SPA as no possible impacts will occur.

Estimation of the relevance of other plans and projects

One offshore wind farm is located in the direct vicinity of the SPA Hyllekrog-Rødsand: Rødsand II, with 90 turbines. This wind farm is specifically included, as this is a project that went into operation, while Fehmarn A/S conducted its environmental investigations, whereby a cumulative effect in principle cannot be excluded. As construction works are already finished and the operation of the wind farm is not considered to affect Avocet, there will be no cumulative effect.

8.7.4.7 Overall estimation of impact of the conservation subject/ objective

Both, a bridge and tunnel alternative for a fixed link would have no effects on Avocet in this SPA, Table 8.27.

Table 8.27. Comparison of the impacts on A132 Avocet (*Recurvirostra avosetta*) caused by bridge and tunnel alternatives

A132 Avocet (Recurvirostra avosetta)	Bridge alternative	Immersed tunnel alternative	Bored tunnel alternative
Degree of impact	Low degree	No impact.	No impact.
Significance of impact	Impacts non-significant	Impacts non-significant	Impacts non-significant

8.7.5 Terns

8.7.5.1 Conservation subject/ objective: A191 Sandwich Tern (*Sterna sandvicensis*), A193 Common Tern (*Sterna hirundo*), A194 Arctic Tern (*Sterna paradisea*) and A195 Little Tern (*Sterna albifrons*)

In standard data form between 50 and 200 breeding pairs of Sandwich Terns, 75 breeding pairs of Common Terns, 250 pairs of Artic Terns and between 6 and thirteen breeding pairs of Little Terns are listed. These numbers were not found in 2009, a strong decrease has taken place, so that only two pairs of Sandwich Terns, no Common Terns and 14 pairs of Arctic Terns were recorded. Only Little Terns were stable and found with 14 breeding pairs within the area (Miljøcenter unpub.). Ship-based surveys and supplementary datasets indicate relatively high numbers of staging Sandwich Terns occurring within the SPA Hyllekrog-Rødsand, however the maximum numbers reported for this area (350 birds in August 2005; DOF 2010) equal to only 0.2 % of the biogeographic population of the species. Baseline investigations as well as supplementary datasets indicate Common Tern and Arctic Tern regularly being present in the study area in the summer season, but no numbers of international importance were reported for Hyllekrog-Rødsand.

8.7.5.2 Description of detailed conservation objectives

The condition and the total area of the breeding habitats of Sandwich, Common, Arctic and Little Terns have to be stable or even increase to secure favourable breeding and feeding grounds within the site.

8.7.5.3 Description of potential impact factors of bridge and tunnel alternative (caused by construction and structure) affecting terns.

Table 8.28 Defining the potential impact factors of bridge and tunnel alternative (caused by construction, structure, operation) affecting A191 Sandwich Tern (Sterna sandvicensis), A193 Common Tern (Sterna hirundo), A194 Arctic Tern (Sterna paradisea) and A195 Little Tern (Sterna albifrons)

Bridge	Construction	Structure
Potential impact factors	Temporary change in density due to changed food supply and reduced visibility due to dredging and sediment spillage	Permanent change in density due to changed distribution of food supply due to changed hydrographical regime
Level of impact	Low degree	No impact
Potential impact factors		Permanent change in density due to changed distribution of food supply due to changed seabed morphology
Level of impact		No impact
Immersed tunnel	Construction	Structure
Potential impact factors	Temporary change in density due to changed food supply and reduced visibility due to dredging and sediment spillage	Permanent change in density due to changed distribution of food supply due to changed hydrographical regime
Level of impact	High degree	No impact
Potential impact factors		Permanent change in density due to changed distribution of food supply due to changed seabed morphology
Level of impact		No impact
Bored tunnel	Construction	Structure
Potential impact factors	Temporary change in density due to changed food supply and reduced visibility due to dredging and sediment spillage	Permanent change in density due to changed distribution of food supply due to changed hydrographical regime
Level of impact	Low still tolerable degree	No impact
Potential impact factors		Permanent change in density due to changed distribution of food supply due to changed seabed morphology
Level of impact		No impact

8.7.5.4 Impacts on A191 Sandwich Tern (*Sterna sandvicensis*), A193 Common Tern (*Sterna hirundo*), A194 Arctic Tern (*Sterna paradisea*) and A195 Little Tern (*Sterna albifrons*) caused by bridge alternative

Construction related impacts

Habitat changes may result from sediment spill, which can affect the benthic communities and fish. Pelagic and semi-pelagic fish will react to water turbidity due to dredging and sediment spillage, but the concentration of suspended sediment will always be below the indicative threshold. No effects on fish species spawning and breeding in vegetation of shallow waters will appear. Therefore, the impact for fishing species like terns will be of a low degree.

Overall estimation of impact of the conservation subject/ objective

Sediment spill due to construction works will not affect fish communities; therefore, the impact on terns is low for a bridge alternative. Pressures from other project related structures or activities has no significant impact on terns.

Conclusion

Significant impacts on terns from construction, structure and operation of a bridge over Fehmarnbelt will not occur for this SPA, as possible impacts would only affect fish communities temporarily and locally.

Estimation of the relevance of other plans and projects

Two offshore wind farms are already in operation: Rødsand I also known as Nysted with 72 turbines and Rødsand II, with 90 turbines. Five other wind farms are planned or under construction (Arkona Becken Südost, EnBW Windpark Baltic II, Wikinger, Kriegers Flak II, GEOFReE) for in the area east of Fehmarn, Figure 10.2. If during construction works in this wind farms additional sediment spill will occur, it would lead to additional turbidity and could have cumulative effects on fish. The operation of the wind farms is not considered to affect terns.

8.7.5.5 Impacts on A191 Sandwich Tern (*Sterna sandvicensis*), A193 Common Tern (*Sterna hirundo*), A194 Arctic Tern (*Sterna paradisea*) and A195 Little Tern (*Sterna albifrons*) caused by immersed tunnel alternative

Construction related impacts

Habitat changes may result from sediment spill, which can affect the benthic communities and fish. Pelagic and semi-pelagic fish will react to water turbidity due to dredging and sediment spillage, but only temporally and locally, in most cases the concentration of suspended sediment will be below the indicative threshold. Fish species spawning and breeding in vegetation of shallow waters could be affected due to temporary loss of spawning and nursery grounds, but effects are not assessed as significant by. However, reduced visibility due to high concentrations of sediment in the water at the southern coast of Lolland and in the Rødsand lagoon during dredging operation and a temporary loss of spawning and nursery grounds could have a significant effect on foraging effort of terns. Thus, a significant impact cannot be excluded.

Overall estimation of impact of the conservation subject/objective

Sediment spill due to construction work will affect fish communities temporarily and locally; therefore terns are only temporary affected during construction of the immersed tunnel. Pressures from other project related activities has no significant impact on terns.

Conclusion

Significant impacts on terns cannot be excluded.

Estimation of the relevance of other plans and projects

Two offshore wind farms are already in operation: Rødsand I also known as Nysted with 72 turbines and Rødsand II, with 90 turbines. If during construction works in this wind farms additional sediment spill will occur, it would lead to additional turbidity and could have cumulative effects on fish. The operation of the wind farms is not considered to affect terns.

8.7.5.6 Impacts on *A191 Sandwich Tern (*Sterna sandvicensis*), *A193 Common Tern (*Sterna hirundo*), *A194 Arctic Tern (*Sterna paradisea*) and *A195 Little Tern (*Sterna albifrons*) caused by a bored tunnel alternative

Construction related impacts

Habitat changes may result from sediment spill, which can affect the benthic communities and fish. Pelagic and semi-pelagic fish will react to water turbidity due to dredging and sediment spillage, but only temporary and locally, but according to assessment for fish species there will be no or only very small impact on fish. However, reduced visibility due to high concentrations of sediment (FEHY 2013) in the water at the southern coast of Lolland and in the Rødsand lagoon during dredging operation can occur, but will not have a significant effect on foraging effort of terns.

Structure and operation related impacts

Neither structures nor operation related activities has an impact on conservation objectives.

Overall estimation of impact of the conservation subject/objective

Pressures from construction activities has no significant impact on terns, because feeding sources will not be affected and turbidity will have only minor extent.

Conclusion

There will be no significant impacts on terns.

Estimation of the relevance of other plans and projects

One offshore wind farm is located in the direct vicinity of the SPA Hyllekrog-Rødsand: Rødsand II, with 90 turbines. This wind farm is specifically included, as this is a project that went into operation, while Fehmarn A/S conducted its environmental investigations, whereby a cumulative effect in principle cannot be excluded. As construction works are already finished and the operation of the wind farm is not considered to affect terns, there will be no cumulative effect.

8.7.5.7 Overall estimation of impact of the conservation subject/ objective

For the immersed tunnel alternative, a significant impact cannot be excluded due to decreased sediment spill and reduced visibility as well as a temporary loss of spawning and nursery grounds of some fish species that serve as feeding sources, Table 8.29.

Table 8.29 Comparison of the impacts on A191 Sandwich Tern (*Sterna sandvicensis*), A193 Common Tern (*Sterna hirundo*), A194 Arctic Tern (*Sterna paradisea*) and A195 Little Tern (*Sterna albifrons*) caused by bridge and tunnel alternative.

A191 Sandwich Tern (Sterna sandvicensis), A193 Common Tern (Sterna hirundo), A194 Arctic Tern (Sterna paradisea) and A195 Little Tern (Sterna albifrons)	Bridge alternative	Immersed tunnel alternative	Bored tunnel alternative
Degree of impact	Low degree	High degree	Temporary change in density due to changed food supply and reduced visibility due to dredging and sediment spillage
Significance of impact	Impacts non-significant	Impacts significant	Low still tolerable degree – so non-significant

8.7.6 Geese

8.7.6.1 Conservation subject/ objective: A039 Bean Goose (*Anser fabalis*), A043 Greylag Goose (*Anser anser*), A046 Brent Goose (*Branta bernicla*) and A045 Barnacle Geese (*Branta leucopsis*)

In standard data form up to 3,000 wintering Bean Geese, 4,000 staging Greylag Geese as well as up to 2,000 staging Brent Geese are listed. Furthermore, there are 3,500 Barnacle Geese mentioned as conservation objectives for the area, but not listed in standard data form.

More than 100 Bean Geese are regularly reported for inland areas of the SPA Hyllekrog-Rødsand (DOF 2010), (Petersen, et al., 2010). A maximum number of 2,100 birds were reported for this area on March 3, 2006 (DOF 2010).

Data available for Greylag Geese suggest maximum numbers of 2,700 birds (equals 0.54 % of the biogeographic population) using this area in late summer (August 27, 2009, DOF 2010). A similar number of 2,425 birds were recorded during the dedicated swan search flight in September 2009. A lower number of 1,728 Greylag Geese was recorded within this SPA during the search flight for mid-winter census of waterbirds in Denmark in February 2008 (Petersen, et al., 2010).

The DOF database contains sightings of up to 1,800 Brent Geese resting in the SPA Hyllekrog-Rødsand (highest record on May 6, 2007; DOF 2010). Usually there are less than 500 birds in this area (< 0.25 % of the biogeographic population), but resting numbers of more than 500 birds have been observed in two spring seasons since the year 2000 (1,800 birds in 2007 and 710 birds in 2010).

During the NOVANA mid-winter survey in January 2008, 300 Barnacle Geese were observed within the SPA Hyllekrog-Rødsand (Petersen, et al., 2010). The DOF database indicates the highest numbers of this species being observed during a short period between mid and end of October. A maximum count of 5,350 Barnacle Geese was reported in autumn 2007 (October 22, 2007; DOF 2010). This was the only entry in DOF database for this SPA since the year 2000 when numbers of Barnacle Geese exceeded the 1 % threshold of international importance (4,200 birds, DOF 2010).

8.7.6.2 Description of detailed conservation objectives

The condition and the total area of the habitat has to be stable or even increase, so that within the area at least 5,000 Bean Geese, 8,600 Greylag Geese, 3,500 Barnacle Geese and 2,000 Dark-bellied Brent Geese find resting and feeding grounds there.

8.7.6.3 Description of potential impact factors of bridge and tunnel alternative (caused by construction and structure) affecting Geese.

Table 8.30. Defining the potential impact factors of bridge and tunnel alternative (caused by construction) affecting A039 Bean Goose (Anser fabalis), A043 Greylag Goose (Anser anser), A046 Brent Goose (Branta bernicla) and A045 Barnacle Geese (Branta leucopsis).

Bridge	Construction
Potential impact factors	Temporary change in density due to changed food supply and reduced visibility due to dredging and sediment spillage
Level of impact	Still tolerable degree
Immersed tunnel	Construction
Potential impact factors	Temporary change in density due to changed food supply and reduced visibility due to dredging and sediment spillage
Level of impact	high degree
Bored tunnel	Construction
Potential impact factors	Temporary change in density due to changed food supply and reduced visibility due to dredging and sediment spillage
Level of impact	Low degree

8.7.6.4 Impacts on A039 Bean Goose (*Anser fabalis*), A043 Greylag Goose (*Anser anser*), A046 Brent Goose (*Branta bernicla*) and A045 Barnacle Geese (*Branta leucopsis*) caused by bridge alternative

Construction related impacts

Habitat changes may result from sediment spill, which can affect the benthic communities as this increases light attenuation caused by increase in concentration of suspended matter. Especially eelgrass may be impaired and productivity reduced due to increased light attenuation. Sediment spill is evaluated based on modelling to be highest in the western part of the lagoon. Modelling shows for the Rødsand lagoon temporary losses of *Zostera* for the habitat types sandbank and shallow inlets and bays as below 5 % and non-significant for the bridge alternative. Geese in the Rødsand lagoon partly feed on *Zostera*, so this decline would affect their food resources. A decline of *Zostera* about 5 % could result in a decline in geese numbers as well, but as *Zostera* is not the main feeding plant and the decline is rather small, the impact for geese is assessed as low. Furthermore, most geese were observed in the inland areas of this SPA, thus, effects on eelgrass in the lagoon will be less serious as other food sources are used by the geese as well.

Overall estimation of impact of the conservation subject/objective

Pressures from structures and construction activities has no significant impact on geese.

Conclusion

The assessment shows that there is no significant impact on geese in this SPA for a bridge alternative.

Estimation of the relevance of other plans and projects

Two offshore wind farms are already in operation: Rødsand I also known as Nysted with 72 turbines and Rødsand II, which was recently finished, with 90 turbines. Four other wind farms are planned (Beltsee, Beta Baltic, GEOFReE) in the area east of Fehmarn, whereof GEOFReE is already authorised. If during construction works in this wind farms additional sediment spill will occur, it would lead to additional turbidity and could have cumulative effects on eelgrass. The operation of the wind farms is not considered to affect geese.

8.7.6.5 Impacts on A039 Bean Goose (*Anser fabalis*), A043 Greylag Goose (*Anser anser*), A046 Brent Goose (*Branta bernicla*) and A045 Barnacle Geese (*Branta leucopsis*) caused by immersed tunnel alternative

Construction related impacts

Habitat changes may result from sediment spill, which can affect the benthic communities as this increases light attenuation caused by increase in concentration of suspended matter. Especially eelgrass may be impaired and productivity reduced due to increased light attenuation. Sediment spill is evaluated based on modelling to be highest in the western part of the lagoon. Modelling shows for the Rødsand lagoon non-significant losses of Zostera for the type sandbanks, but for shallow inlets and bays modelling predicts significant losses of 10 – 48 % for the tunnel alternative. Geese in the Rødsand lagoon partly feed on Zostera, so this decline will affect their food resources and significant impacts thus cannot be excluded. It has to be considered that most geese were observed in the inland areas of this SPA, thus, effects on eelgrass in the lagoon will be less serious as other food sources are used by the geese as well.

Overall estimation of impact of the conservation subject/ objective

We conclude that significant impacts on this SPA due to the construction of a tunnel cannot be excluded, even though geese do not exclusively feed on *Zostera*, but use inland areas as well. The decline of the main feeding source for geese, *Zostera*, is of high importance.

Conclusion

Significant impacts of geese in the SPA due to the construction works for a tunnel alternative cannot be excluded.

Estimation of the relevance of other plans and projects

Two offshore wind farms are already in operation: Rødsand I also known as Nysted with 72 turbines and Rødsand II, with 90 turbines. Five other wind farms are planned or under construction (Arkona Becken Südost, EnBW Windpark Baltic II, Wikinger, Kriegers Flak II, GEOFReE) for in the area east of Fehmarn, Figure 10.2. If during construction works in this wind farms additional sediment spill will occur, it would lead to additional turbidity and could have cumulative effects on eelgrass. The operation of the wind farms is not considered to affect geese.

8.7.6.6 Impacts on *A039 Bean Goose (*Anser fabalis*), *A043 Greylag Goose (*Anser anser*), *A046 Brent Goose (*Branta bernicla*) and *A045 Barnacle Geese (*Branta leucopsis*) caused by a bored tunnel alternative

Construction related impacts

Habitat changes may result from sediment spill, which can affect the benthic communities as this increases light attenuation caused by increase in concentration of suspended matter. Especially eelgrass may be impaired and productivity reduced due to increased light attenuation. Sediment spill is evaluated based on modelling to be highest in the western part of the lagoon. FEMA (2013c) shows for the Rødsand lagoon losses of up to 20 % of *Zostera* in 2015 and up to 10 % in 2020. Geese in the Rødsand lagoon partly feed on *Zostera*, but use agricultural fields as well. Thus, a small decline of *Zostera* will be a tolerable impact for geese.

Structure and operational related impacts

No structure or operation related significant impacts will take place.

Overall estimation of impact of the conservation subject/ objective

Pressures from construction activities are shown to be low and has no significant impact on geese, because feeding sources will only be minor affected.

Conclusion

There will be no significant impacts of geese in the SPA due to the construction works for a bored tunnel alternative.

Estimation of the relevance of other plans and projects

One offshore wind farm is located in the direct vicinity of the SPA Hyllekrog-Rødsand: Rødsand II, with 90 turbines. This wind farm is specifically included, as this is a project that went into operation, while Fehmarn A/S conducted its environmental investigations, whereby a cumulative effect in principle cannot be excluded. As construction works are already finished and the operation of the wind farm is not considered to affect geese, there will be no cumulative effect.

8.7.6.7 Overall estimation of impact of the conservation subject/ objective

Significant impacts on geese can only be excluded for the bridge and bored tunnel alternatives as according to modelling for the immersed tunnel alternative significant losses of *Zostera* as feeding plant for geese cannot be excluded, Table 8.31.

Table 8.31 Comparison of the impacts on A039 Bean Goose (*Anser fabalis*), A043 Greylag Goose (*Anser anser*), A046 Brent Goose (*Branta bernicla*) and A045 Barnacle Geese (*Branta leucopsis*) caused by bridge and tunnel alternative.

A039 Bean Goose (*Anser fabalis*), A043 Greylag Goose (*Anser anser*),A046 Brent Goose (*Branta bernicla*), and A045 Barnacle Goose (Branta leucopsis)	Bridge alternative	Immersed tunnel alternative	Bored tunnel alternative
Degree of impact	Low still tolerable degree of impact.	High degree of impact.	Low still tolerable degree of impact.
Significance of impact	Impacts non-significant	Impacts significant	Impacts non-significant

8.7.7 Ducks

8.7.7.1 Conservation subject/ objective: A061 Tufted Duck (*Aythya fuligula*) and A059 Common Pochard (*Aythya ferina*)

In the standard data form, 22,000 wintering Tufted Ducks are listed for this area. Furthermore, there are 13,000 Common Pochards mentioned as conservation objectives for the area, but not listed in standard data form.

The mid-winter survey of 2008 in Denmark resulted in 392 Tufted Ducks recorded in the SPA Hyllekrog-Rødsand (Petersen, et al., 2010). The DOF database reports a maximum value (between 2000 and 2010) recorded for this SPA of about 17,500 birds in March 2006 (DOF 2010).

This SPA regularly supports more than 100 Common Pochard in spring and autumn periods. A maximum count of 1,800 birds (0.5 % of the biogeographic population) was reported for this area in March 2006 (DOF 2010).

8.7.7.2 Description of detailed conservation objectives

The condition and the total area of the habitat has to be stable or even increase, so that within the area at least 34,300 Tufted Ducks and 13,000 Common Pochards find resting and feeding grounds there.

8.7.7.3 Description of potential impact factors of bridge and tunnel alternative (caused by construction and structure) affecting Tufted Duck and Common Pochard

Table 8.32 Defining the potential impact factors of bridge and tunnel alternative (caused by construction and structure) affecting A061 Tufted Duck (*Aythya fuligula*) and A059 Common Pochard (*Aythya ferina*).

Bridge	Construction	Structure
Potential impact factors	Temporary change in density due to changed food supply and reduced visibility due to dredging and sediment spillage	Permanent change in density due to changed distribution of food supply due to changed seabed morphology
Level of impact	Low degree	No impact
Immersed and bored tunnel	Construction	Structure
Potential impact factors	Temporary change in density due to changed food supply and reduced visibility due to dredging and sediment spillage	Permanent change in density due to changed distribution of food supply due to changed seabed morphology
Level of impact	High degree	No impact

8.7.7.4 Impacts on A061 Tufted Duck (*Aythya fuligula*) and A059 Common Pochard (*Aythya ferina*) caused by bridge alternative

Construction related impacts

Habitat changes may result from sediment spill, which can affect the benthic communities. Modelling shows for the Rødsand lagoon only small-scale medium to minor impacts concerning benthivorous fauna during construction works for a bridge. As modelling predicts no significant reduction in benthic fauna for all habitat types of the Rødsand lagoon due to sediment spill, the result will be no significant changes in abundance of Tufted Duck and Common Pochard.

Overall estimation of impact of the conservation subject/objective

Pressures from structure or construction activities has no significant impact on Tufted Ducks and Common Pochards, because feeding sources will not be affected and seabed morphology will not change.

Conclusion

Significant impacts on Tufted Ducks and Common Pochards from construction, structure and operation of a bridge over Fehmarnbelt will not occur for this SPA as no possible impacts will occur.

Estimation of the relevance of other plans and projects

Two offshore wind farms are already in operation: Rødsand I also known as Nysted with 72 turbines and Rødsand II, with 90 turbines. Five other wind farms are planned or under construction (Arkona Becken Südost, EnBW Windpark Baltic II, Wikinger, Kriegers Flak II, GEOFReE) for in the area east of Fehmarn, Figure 10.2. If during construction works in this wind farms additional sediment spill will occur, it would lead to additional turbidity and could have cumulative effects on benthic fauna. The operation of the wind farms is not considered to affect ducks.

8.7.7.5 Impacts on A061 Tufted Duck (*Aythya fuligula*) and A059 Common Pochard (*Aythya ferina*) caused by immersed tunnel alternative

Construction related impacts

Habitat changes may result from sediment spill, which can affect the benthic communities. Modelling shows for the Rødsand lagoon high to minor degree of impact concerning benthivorous fauna during construction works for a bridge. Even though modelling predicts no significant reduction in benthic fauna for all habitat types of the Rødsand lagoon due to sediment spill, a significant impact of reduced benthic fauna on benthivorous diving ducks cannot be excluded.

Overall estimation of impact of the conservation subject/ objective

For Tufted Ducks and Common Pochards significant impacts cannot be excluded as benthic fauna will be affected by sediment spill.

Conclusion

Significant impacts on Tufted Ducks and Common Pochards from construction and operation of a tunnel over Fehmarnbelt cannot be excluded as impact may possible occur.

Estimation of the relevance of other plans and projects

Two offshore wind farms are already in operation: Rødsand I also known as Nysted with 72 turbines and Rødsand II, with 90 turbines. Five other wind farms are planned or under construction (Arkona Becken Südost, EnBW Windpark Baltic II, Wikinger, Kriegers Flak II, GEOFReE) for in the area east of Fehmarn, Figure 10.2. If during construction works in this wind farms additional sediment spill will occur, it would lead to additional turbidity and could have cumulative effects on benthic fauna. The operation of the wind farms is not considered to affect ducks.

8.7.7.6 Impacts on *A061 Tufted Duck (Aythya fuligula) and *A059 Common Pochard (Aythya ferina) caused by a bored tunnel alternative

Construction related impacts

Habitat changes may result from sediment spill, which can affect the benthic communities. Assessments cannot exclude significant impact on benthic fauna for the Rødsand lagoon during construction works for a bored tunnel. Thus, a significant impact of reduced benthic fauna on benthivorous diving ducks cannot be excluded.

Structure and operation related impacts

No structure and operational related significant impacts will occur.

Overall estimation of impact of the conservation subject/ objective

For Tufted Ducks and Common Pochard significant impacts cannot be excluded as benthic fauna will be affected by sediment spill.

Conclusion

Significant impacts on Tufted Ducks and Common Pochard from construction and operation of a bored tunnel cannot be excluded as impacts may possibly occur.

Estimation of the relevance of other plans and projects

One offshore wind farm is located in the direct vicinity of the SPA Hyllekrog-Rødsand: Rødsand II, with 90 turbines. This wind farm is specifically included, as this is a project that went into operation, while Fehmarn A/S conducted its environmental investigations, whereby a cumulative effect in principle cannot be excluded. As construction works are already finished and the operation of the wind farm is not considered to affect ducks, there will be no cumulative effect.

8.7.7.7 Overall estimation of impact of the conservation subject/ objective

Whereas a bridge alternative for a fixed link would have no significant effects on Tufted Duck and Common Pochard in this SPA, significant impacts on benthivorous diving ducks cannot be excluded for a tunnel alternative, which would cause higher sediment spills and a reduction of benthic biomass during the construction phase, Table 8.33.

Table 8.33 Comparison of the impacts on A061 Tufted Duck (*Aythya fuligula*) and A059 Common Pochard (*Aythya ferina*) caused by bridge and tunnel alternatives.

A061 Tufted Duck (*Aythya fuligula*) and A059 Common Pochard *(Aythya ferina)*	Bridge alternative	Immersed tunnel alternative	Bored tunnel alternative
Degree of impact	Low degree	high degree	high degree
Significance of impact	Impacts non-significant	Impacts significant	Impacts significant

8.7.7.8 Conservation subject/ objective: A067 Common Goldeneye (*Bucephala clangula*)

Up to 2,000 wintering Common Goldeneyes are listed in the standard data form. Data from flight surveys show a widespread distribution of Common Goldeneyes during winter months in the area. Based on the spatial distribution models, the estimate of wintering Common Goldeneye in the SPA Hyllekrog-Rødsand was about 1,100 – 1,200 birds. Overall estimates indicate that about 0.25 % of the biogeographic population of Common Goldeneye winters in the Fehmarnbelt. Modelled densities of wintering birds of this species were highest in the SPA Hyllekrog-Rødsand.

8.7.7.9 Description of detailed conservation objectives

The condition and the total area of the habitat has to be stable or even increase, so that within the area at least 9,000 Common Goldeneyes find resting and feeding grounds there.

8.7.7.10 Description of potential impact factors of bridge and tunnel alternative (caused by construction and structure) affecting Common Goldeneye.

Table 8.34 Defining the potential impact factors of bridge and tunnel alternative (caused by construction, structure, operation) affecting A067 Common Goldeneye (*Bucephala clangula*).

Bridge	Construction	Structure
Potential impact factors	Temporary change in density due to changed food supply and reduced visibility due to dredging and sediment spillage	Permanent change in density due to changed distribution of food supply due to changed seabed morphology
Level of impact	Low degree	No impact
Immersed and bored tunnel	Construction	Structure
Potential impact factors	Temporary change in density due to changed food supply and reduced visibility due to dredging and sediment spillage	Permanent change in density due to changed distribution of food supply due to changed seabed morphology
Level of impact	high degree	No impact

8.7.7.11 Impacts on A067 Common Goldeneye (*Bucephala clangula*) caused by bridge alternative

Construction related impacts

Habitat changes may result from sediment spill, which can affect the benthic communities. Modelling shows for the Rødsand lagoon only small-scale medium to minor impacts concerning

benthivorous fauna during construction works for a bridge. As modelling predicts no significant reduction in benthic fauna for all habitat types of the Rødsand lagoon due to sediment spill, the result will be no significant changes in the abundance of Common Goldeneye.

Overall estimation of impact of the conservation subject/objective

Pressures from structure or construction activities has no significant impact on Common Goldeneyes, because feeding sources will not be affected.

Conclusion

Significant impacts on Common Goldeneyes from construction, structure and operation of a bridge over Fehmarnbelt will not occur for this SPA as no possible impacts may occur.

Estimation of the relevance of other plans and projects

Two offshore wind farms are already in operation: Rødsand I also known as Nysted with 72 turbines and Rødsand II, with 90 turbines. Five other wind farms are planned or under construction (Arkona Becken Südost, EnBW Windpark Baltic II, Wikinger, Kriegers Flak II, GEOFReE) for in the area east of Fehmarn, Figure 10.2. If during construction works in this wind farms additional sediment spill will occur, it would lead to additional turbidity and could have cumulative effects on benthic fauna. The operation of the wind farms is not considered to affect ducks.

8.7.7.12 Impacts on A067 Common Goldeneye (*Bucephala clangula*) caused by immersed tunnel alternative

Construction related impacts

Habitat changes may result from sediment spill, which can affect the benthic communities. Modelling shows for the Rødsand lagoon high to minor degree of impact concerning benthivorous fauna during construction works for a bridge. Even though modelling predicts no significant reduction in benthic fauna for all habitat types of the Rødsand lagoon due to sediment spill, a significant impact of reduced benthic fauna on benthivorous diving ducks cannot be excluded.

Overall estimation of impact of the conservation subject/ objective

Significant impacts from pressures from construction activities cannot be excluded for Common Goldeneye, because feeding sources could be affected.

Conclusion

Significant impacts on Common Goldeneyes from construction and operation of a tunnel over Fehmarnbelt cannot be excluded, as possible impacts will occur.

Estimation of the relevance of other plans and projects

Two offshore wind farms are already in operation: Rødsand I also known as Nysted with 72 turbines and Rødsand II, with 90 turbines. Five other wind farms are planned or under construction (Arkona Becken Südost, EnBW Windpark Baltic II, Wikinger, Kriegers Flak II, GEOFReE) for in the area east of Fehmarn, Figure 10.2. If during construction works in this wind farms additional sediment spill will occur, it would lead to additional turbidity and could have cumulative effects on benthic fauna. The operation of the wind farms is not considered to affect ducks.

8.7.7.13 Impacts on *A067 Common Goldeneye (*Bucephala clangula*) caused by a bored tunnel alternative

Construction related impacts

Habitat changes may result from sediment spill, which can affect the benthic communities. FEMA (2013c) cannot exclude significant impact on benthic fauna for the Rødsand lagoon during construction works for a bored tunnel. Thus, a significant impact of reduced benthic fauna on benthivorous diving ducks cannot be excluded.

Structure related impacts

No structure or operational related significant impacts will occur.

Overall estimation of impact of the conservation subject/ objective

Significant impacts from pressures from construction activities cannot be excluded for Common Goldeneye, because feeding sources could be affected.

Conclusion

Significant impacts on Common Goldeneye from construction and operation of a bored tunnel cannot be excluded, as possible impacts will occur.

Estimation of the relevance of other plans and projects

One offshore wind farm is located in the direct vicinity of the SPA Hyllekrog-Rødsand: Rødsand II, with 90 turbines. This wind farm is specifically included, as this is a project that went into operation, while Fehmarn A/S conducted its environmental investigations, whereby a cumulative effect in principle cannot be excluded. As construction works are already finished and the operation of the wind farm is not considered to affect seaducks, there will be no cumulative effect.

8.7.7.14 Overall estimation of impact of the conservation subject/ objective

Whereas a bridge alternative for a fixed link would have no effects on Goldeneye in this SPA, significant impacts on benthivorous Goldeneye cannot be excluded from a tunnel alternative, which would cause higher sediment spills and a significant reduction of benthic biomass during the construction phase, Table 8.35.

Table 8.35 Comparison of the impacts on A067 Common Goldeneye (*Bucephala clangula*) caused by bridge and tunnel alternatives

A067 Common Goldeneye (*Bucephala clangula*)	Bridge alternative	Immersed tunnel alternative	Bored tunnel alternative
Degree of impact	Low degree	high degree	high degree
Significance of impact	Impacts non-significant	Impacts significant	Impacts significant

8.7.8 Coots

8.7.8.1 Conservation subject/ objective: A125 Common Coot (*Fulica atra)*

In standard data form up to 15,000 Common Coots are listed as staging birds in the area. For Common Coot high numbers were reported for this SPA, which regularly supports several thousand wintering birds of this species. Both, aerial mid-winter survey in 2008 (8,050 birds; Petersen et al. 2010) and maximum estimate reported in the DOF database (8,500 birds in

February 2006; DOF 2010) suggest numbers equalling to approximately 0.5 % of the biogeographic population within this SPA.

8.7.8.2 Description of detailed conservation objectives

The condition and the total area of the habitat has to be stable or even increase, so that within the area at least 40,000 Common Coots find resting and feeding grounds there.

8.7.8.3 Description of potential impact factors of bridge and tunnel alternative (caused by construction and structure) affecting Coots

Table 8.36 Defining the potential impact factors of bridge and tunnel alternative (caused by construction and structure) affecting A125 Common Coot (*Fulica atra*).

Bridge	Construction	Structure
Potential impact factors	Temporary change in density due to changed food supply and reduced visibility due to dredging and sediment spillage	Permanent change in density due to changed distribution of food supply due to changed hydrographical regime
Level of impact	Low degree	No impact
Immersed tunnel	Construction	Structure
Potential impact factors	Temporary change in density due to changed food supply and reduced visibility due to dredging and sediment spillage	Permanent change in density due to changed distribution of food supply due to changed hydrographical regime
Level of impact	high degree	No impact
Bored tunnel	Construction	
Potential impact factors	Temporary change in density due to changed food supply and reduced visibility due to dredging and sediment spillage	
Level of impact	Low degree	

8.7.8.4 Impacts on A125 Common Coot (*Fulica atra*) caused by bridge alternative

Construction related impacts

Habitat changes may result from sediment spill. Modelling shows for the Rødsand lagoon temporary losses of *Zostera* for the habitat types sandbank and shallow inlets and bays as non-significant for the bridge alternative, and only small-scale and non-significant impacts on fauna. The Common Coot is an opportunistic and omnivorous bird, so the decline of *Zostera* will be of minor importance for this species

Overall estimation of impact of the conservation subject/objective

Sediment spill due to construction work will affect benthic vegetation. The Common Coot is an opportunistic and omnivorous bird, so the decline of *Zostera* will be of minor importance for this species.

Conclusion

Significant impacts on Common Coot from construction, structure and operation of a bridge over Fehmarnbelt will not occur for this SPA as possible impacts would affect only benthic vegetation and this is just a part of food resources for Common Coot.

Estimation of the relevance of other plans and projects

Two offshore wind farms are already in operation: Rødsand I also known as Nysted with 72 turbines and Rødsand II, with 90 turbines. Five other wind farms are planned or under construction (Arkona Becken Südost, EnBW Windpark Baltic II, Wikinger, Kriegers Flak II, GEOFReE) for in the area east of Fehmarn, Figure 10.2. If during construction works in this wind farms additional sediment spill will occur, it would lead to additional turbidity and could have cumulative effects on benthic fauna and flora. The operation of the wind farms is not considered to affect Common Coots.

8.7.8.5 Impacts on A125 Common Coot (*Fulica atra*) caused by immersed tunnel alternative

Construction related impacts

Habitat changes may result from sediment spill, which can affect the benthic communities. Modelling shows for the Rødsand lagoon non-significant losses of *Zostera* for the type sandbanks, but for shallow inlets and bays modelling predicts significant losses of 10 – 48 %for the tunnel alternative. Additionally modelling shows for the Rødsand lagoon high to minor degree of impact concerning benthivorous fauna during construction works for a bridge. Even though modelling predicts no significant reduction in benthic fauna for all habitat types of the Rødsand lagoon due to sediment spill, a significant impact of reduced benthic fauna on benthivorous Common Coot cannot be excluded.

Overall estimation of impact of the conservation subject/objective

Sediment spill due to construction work will affect benthic vegetation and fauna and may thus lead to reduced food supply for Coot. Significant impacts thus cannot be excluded.

Conclusion

Significant impacts on Common Coots may occur in relation to sediment spill during the construction period.

Estimation of the relevance of other plans and projects

Two offshore wind farms are already in operation: Rødsand I also known as Nysted with 72 turbines and Rødsand II, with 90 turbines. Five other wind farms are planned or under construction (Arkona Becken Südost, EnBW Windpark Baltic II, Wikinger, Kriegers Flak II, GEOFReE) for in the area east of Fehmarn, Figure 10.2. If during construction works in this wind farms additional sediment spill will occur, it would lead to additional turbidity and could have cumulative effects on benthic fauna and flora. The operation of the wind farms is not considered to affect Common Coots.

8.7.8.6 Impacts on *A125 Common Coot (*Fulica atra*) caused by a bored tunnel alternative

Construction related impacts

Habitat changes may result from sediment spill, which can affect the benthic communities. As sediment spill in the Rødsand lagoon will be small and Common Coot is an opportunistic feeder, there will be no significant impact.

Structure and operational related impacts

No related significant impacts will occur.

Overall estimation of impact of the conservation subject/objective

Pressures from construction activities has only minor and no significant impact on Common Coot, because feeding sources will only be minor affected.

Conclusion

There will be no significant impacts on Common Coot in relation to sediment spill during the construction period.

Estimation of the relevance of other plans and projects

One offshore wind farm is located in the direct vicinity of the SPA Hyllekrog-Rødsand: Rødsand II, with 90 turbines. This wind farm is specifically included, as this is a project that went into operation, while Fehmarn A/S conducted its environmental investigations, whereby a cumulative effect in principle cannot be excluded. As construction works are already finished and the operation of the wind farm is not considered to affect Common Coot, there will be no cumulative effect.

8.7.8.7 Overall estimation of impact of the conservation subject/ objective

Whereas a bridge and bored tunnel alternatives for a fixed link would not have significant impacts on Common Coot in this SPA; significant impacts cannot be excluded from an immersed tunnel alternative, which would cause higher sediment spills and a significant reduction of phytobenthic and zoobenthic biomass in the SPA during the construction phase, Table 8.37.

Table 8.37 Comparison of the impacts on A125 Common Coot (*Fulica atra*) caused by bridge and tunnel alternatives.

A125 Common Coot (*Fulica atra*)	Bridge alternative	Immersed tunnel alternative	Bored tunnel alternative
Degree of impact	Low degree	high degree	Low degree
Significance of impact	Impacts non-significant	Impacts significant	Impacts non-significant

8.7.9 Cormorants

8.7.9.1 Conservation subject/ objective: A214 Great Cormorant *(Phalacrocorax carbo*)

2,815 Great Cormorants are listed as staging birds in the area. According to data of DOF database, the SPA Hyllekrog-Rødsand regularly supports high numbers of Great Cormorants, especially during autumn months. Sand banks of this area are an important resting site for Great

Cormorants in the Fehmarnbelt area with regularly numbers observed of about 2,000 birds. The DOF database reports an observation of 6,500 Great Cormorants for this area, indicating this SPA supporting internationally important numbers of the species (DOF 2010).

8.7.9.2 Description of detailed conservation objectives

The condition and the total area of the habitat has to be stable or even increase, so that within the area at least 2,800 Great Cormorants find resting and feeding grounds there.

8.7.9.3 Description of potential impact factors of bridge and tunnel alternative (caused by construction and structure) affecting Cormorants

Table 8.38 Defining the potential impact factors of bridge and tunnel alternatives (caused by construction, structure, operation) affecting A214 Great Cormorant (*Phalacrocorax carbo*).

Bridge	Construction	Structure
Potential impact factors	Temporary change in density due to changed food supply and reduced visibility due to dredging and sediment spillage	Permanent change in density due to changed distribution of food supply due to changed hydrographical regime
Level of impact	Low degree	No impact
Potential impact factors	Temporary reduction in density due to disturbance from construction work	Permanent change in density due to changed distribution of food supply due to changed seabed morphology
Level of impact	Low degree	No impact
Potential impact factors	Temporary change in density due to barrier effects due to construction activities	Permanent change in density due to disturbance from the superstructure
Level of impact	Low degree	No impact
Potential impact factors		Permanent change in density due to barrier effects (bridge pillars and pylons)
Level of impact		No impact
Immersed and bored tunnel	Construction	Structure
Potential impact factors	Temporary change in density due to changed food supply and reduced visibility due to dredging and sediment spillage	Permanent change in density due to changed distribution of food supply due to changed hydrographical regime
Level of impact	Low degree	No impact
Potential impact factors	Temporary reduction in density due to disturbance from construction work	Permanent change in density due to changed distribution of food supply due to changed seabed morphology
Level of impact	High degree	No impact
Potential impact factors	Temporary change in density due to barrier effects due to construction activities	
Level of impact	Low degree	

8.7.9.4 Impacts on A214 Great Cormorant (*Phalacrocorax carbo*) caused by bridge alternative

Construction related impacts

Habitat changes may result from sediment spill, which can affect the benthic communities and fish. Pelagic and semi-pelagic fish will react to water turbidity due to dredging and sediment spillage, but only temporally and locally, in most cases the concentration of suspended sediment will be below the indicative threshold. Fish species spawning and breeding in vegetation of shallow waters could be affected due to temporary loss of spawning and nursery grounds, but effects are not assessed as significant. As the sediment spill for the tunnel alternative will be of greater extent than for the bridge alternative a significant impact for fishing species like Great Cormorants cannot be excluded.

Overall estimation of impact of the conservation subject/objective

Sediment spill due to construction works will affect fish communities temporarily and locally; therefore a significant impact on Great Cormorant cannot be excluded.

Conclusion

Significant impacts on Great Cormorants from construction of a tunnel over Fehmarnbelt cannot be excluded for this SPA as possible impacts on fish communities will occur temporarily and locally.

Estimation of the relevance of other plans and projects

Two offshore wind farms are already in operation: Rødsand I also known as Nysted with 72 turbines and Rødsand II, with 90 turbines. Five other wind farms are planned or under construction (Arkona Becken Südost, EnBW Windpark Baltic II, Wikinger, Kriegers Flak II, GEOFReE) for in the area east of Fehmarn, Figure 10.2. If during construction works in this wind farms additional sediment spill will occur, it would lead to additional turbidity and could have cumulative effects on fish. The operation of the wind farms is not considered to affect Great Cormorants.

8.7.9.5 Impacts on A214 Great Cormorant (*Phalacrocorax carbo*) caused by immersed tunnel alternative

Construction related impacts

Habitat changes may result from sediment spill, which can affect the benthic communities and fish. Pelagic and semi-pelagic fish will react to water turbidity due to dredging and sediment spillage, but only temporally and locally, in most cases the concentration of suspended sediment will be below the indicative threshold. Fish species spawning and breeding in vegetation of shallow waters could be affected due to temporary loss of spawning and nursery grounds, but effects are not assessed as significant. As the sediment spill for the tunnel alternative will be of greater extent than for the bridge alternative a significant impact for fishing species like Great Cormorants cannot be excluded.

Structure and operation related impacts

No related significant impacts will occur.

Overall estimation of impact of the conservation subject/objective

Sediment spill due to construction works will affect fish communities temporarily and locally; therefore a significant impact on Great Cormorant cannot be excluded.

Conclusion

Significant impacts on Great Cormorants from construction of a tunnel over Fehmarnbelt cannot be excluded for this SPA as possible impacts on fish communities will occur temporarily and locally.

Estimation of the relevance of other plans and projects

Two offshore wind farms are already in operation: Rødsand I also known as Nysted with 72 turbines and Rødsand II, with 90 turbines. Five other wind farms are planned or under construction (Arkona Becken Südost, EnBW Windpark Baltic II, Wikinger, Kriegers Flak II, GEOFReE) for in the area east of Fehmarn, Figure 10.2. If during construction works in this wind farms additional sediment spill will occur, it would lead to additional turbidity and could have cumulative effects on fish. The operation of the wind farms is not considered to affect Great Cormorants.

8.7.9.6 Impacts on *A214 Great Cormorant (*Phalacrocorax carbo*) caused by a bored tunnel alternative

Construction related impacts

Habitat changes may result from sediment spill, which can affect the benthic communities and fish. Pelagic and semi-pelagic fish will react to water turbidity due to dredging and sediment spillage, but according to assessment for fish species there will be no or only very small impact on fish. Thus, the impact on piscivorous species will be low as well.

Structure and operation related impacts

No related significant impacts will occur.

Overall estimation of impact of the conservation subject/objective

Pressures from construction activities has only minor and no significant impact on Great Cormorant, because feeding sources will only be minor affected.

Conclusion

There will be no significant impacts on Great Cormorants in relation to sediment spill during the construction period.

Estimation of the relevance of other plans and projects

One offshore wind farm is located in the direct vicinity of the SPA Hyllekrog-Rødsand: Rødsand II, with 90 turbines. This wind farm is specifically included, as this is a project that went into operation, while Fehmarn A/S conducted its environmental investigations, whereby a cumulative effect in principle cannot be excluded. As construction works are already finished and the operation of the wind farm is not considered to affect Great Cormorant, there will be no cumulative effect.

8.7.9.7 Overall estimation of impact of the conservation subject/ objective

As the sediment spill for the immersed tunnel alternative will be of greater extent than for the bridge and the bored tunnel alternatives a significant impact for fishing species like Great Cormorants cannot be excluded for this tunnel alternative, Table 8.39.

Table 8.39 Comparison of the impacts on A214 Great Cormorant (*Phalacrocorax carbo*) caused by bridge and tunnel alternatives

A214 Great Cormorant (*Phalacrocorax carbo*)	Bridge alternative	Immersed tunnel alternative	Bored tunnel alternative
Degree of impact	Low degree	High degree	Low degree
Significance of impact	Impacts non-significant	Impacts significant	Impacts non-significant

9 *Natura* 2000 site 177 Maribosøerne

In the middle of Lolland, Maribosøerne (Maribo Lakes) is situated in an undulating hilly landscape surrounded by the otherwise more flat Lolland dominated by agricultural land. The dead ice landscape has left four lakes: Søndersø, Røgbølle Lake and Hejrede Lake within the Natura 2000 site and Nørresø outside the area. The lakes are clean, shallow and with rich undergrowth of plants. They are rich in islands, islets and promontories. The lakes are surrounded for most of a magnificent manor landscape. It is situated between forests, bogs, open bogs and meadows and cultivated fields with old oaks. The land size and large variation offers countless opportunities for live animals and plants, and no lake area in Denmark contains a more rich and varied birdlife. It was opened in 1994 Denmark's first regional park.
The total area of 3,806 hectares, most of which are lake area. The most important natural values includes many aquatic plants, including Stonewort and Great Najade. The latter is found only here in Denmark and is prevalent in all three lakes with the fish species Spined Loach. There are quaking bogs in several places along the banks of Søndersø. Maribosøerne is also of international importance for a number of staging waterfowl. Reed beds and islands form nationally important breeding sites for birds. There are in addition ten species of bats, including barbastelle, which is on the reasons for designation.

The Natura 2000 site is included in this assessment as some waterbirds make regular foraging flights into the Fehmarnbelt area and could thus be affected by construction and operation of a fixed link.

9.1 SCI DK 006X87 Maribo lakes (Maribosøerne)

In relation to the habitats types 3140 Hard oligo-mesotrophic waters with benthic vegetation of chara species and 3150 Natural eutrophic lakes, no impact from the construction or operation of the Fehmarnbelt Fixed Link will take place for these specific habitat types. The SCI overlaps with the SPA Maribo lakes and no birds are listed in the standard data form of the SCI.

9.2 Spined Loach

9.2.1 Description of detailed conservation objectives 1149 Spined Loach (*Cobitis taenia)*

Only the spined loach is listed in the standard data form of the SCI DK 006X87.The spined loach is a common freshwater fish in Europe, and in Denmark, it is at its northern edge of distribution. Here, the spined loach is found in only a few river systems on Fyn, southern Zealand and Lolland, where it is present in slowly flowing streams, brooks or lakes. Studies have revealed this species has a subtle balance of environmental needs (Perrow and Jowitt, 1997). Habitat requirements for spawning are defined as sandy or soft substrate, clean water and stands of submerged water plants. Regulating and canalisation of streams and rivers, weed cutting and other disturbances have led to serious population declines throughout Europe. The spined loach appears on Annex II of the habitat directive among species requiring designation of special areas of conservation, which constitutes the conservation objectives for the species in the Natura-2000 site, the Maribo lakes (Miljøministeriet, 2009).

The spined loach is not listed in the revised Danish red list from 2010, it was listed on the previous. During the last century, only minor changes have been observed in the spreading of spined loach in Denmark (DMU, 2010b).

Fact box: The Spined Loach is a small bottom dwelling fish less than 12cm long with a patterned, laterally compressed body and six barbells around the mouth. It has a specialised feeding mechanism pumping fine material/sand through the mouth and out the gill slit extracting food particles with mucus. From here comes probably the German name Steinbeisser, “stone biter”. Optimal habitat for the species seems to be a mosaic of macrophyte beds and bare sand, providing opportunity for feeding, refuge and spawning. The spined loach has a short life cycle and consequently depends on good recruitment into the adult population each year.

In connection with the Danish National Fish Monitoring Programme (NOVANA), the spined loach has been found in all three lakes of the Maribo lakes site, i.e. Maribo Søndersø (latest in 2004), Røgbølle lake (latest in 2010, Miljøportalen) and Hejrede lake (latest in 2010, Miljøportalen). There are no estimates of abundance, but very sparse catches indicates only small populations in the lakes.

The three Maribo lakes form a total area of 1065 ha and are classified as nutrient enriched lakes (habitat type code 3150). The water quality, and the overall environmental state of the lakes, has improved significantly in the last decades due to enhanced sewage treatment in the hinterland. Hence, the reduction in nutrient loads, combined with biomanipulation in Maribo Søndersø, has significantly improved water clarity and macrophyte vegetation has spread in all three lakes (Fugl et al, 2006a,b,and c). This development is generally assumed to have enhanced the habitats required by the spined loach, although, the effect of a massive dispersal of macrophytes is uncertain.

The preliminary threat assessment of the three lakes is considered to be eutrophication, and for the spined loach, the result of eutrophication will lead to a decline in food availability (Miljøministeriet, 2009).

9.2.2 Defining the potential impact factors of construction works affecting 1149 Spined Loach

Disruption of habitats suitable for the spined loach will not, due to the distance to the construction sites of the Fehmarnbelt Fixed Link. The spined loach lives buried in sand during the daytime, and lives in habitats where mud layers are not too thick and cohesive. The Spined Loach will not be significantly affected by changes in foraging behaviour of resting or breeding waterbirds

9.2.3 Impacts on 1149 Spined loach

Due to the distance to the construction sites, neither the bridge nor the tunnel alternatives will significantly affect the river system of the site, including the three lakes and the connected streams housing the spined loach. In conclusion, any significant impacts on the spined loach from project alternatives can be excluded.

Table 9.1 Impact assessment of spined loach (*Cobitis taenia*) for a bridge or tunnel alternatives.

1149 Spined loach	Bridge alternative	Immersed tunnel alternative	Bored tunnel alternative
Degree of impact	No impact.	No impact	No impact.
Significance of impact	Non significant for 1149 Spined loach	Non significant for 1149 Spined loach	Non significant for 1149 Spined loach

9.3 SPA DK 006X87 Maribo lakes (Maribosøerne)

9.3.1 Overall description of the site

Table 9.2 Extracted table from the standard data forms. The number of resting Tufted Ducks during daytime is more than 1% of the European population.

Code	Species	Group	Connected to marine habitats especially Fehmarnbelt area?	Breed	Winter	Stage	Birds listed on Annex I
A021	Eurasian Bittern *Botaurus stellaris*	Herons	No, not assessed	11 – 49 p			Yes
A068	Smew (merganser) *Mergus albellus*	Mergansers	No, not assessed			78 – 264 i	Yes
A072	Honey Buzzard *Pernis apivorus*	Birds of prey	No, not assessed	P			Yes
A075	White-tailed Eagle *Haliaeetus albicilla*	Birds of prey	Yes	0 – 1 p			Yes
A081	Marsh Harrier *Circus aeruginosus*	Birds of prey	No, not assessed	15 – 30 p			Yes
A127	Crane *Grus*	Cranes	No, not assessed	0 – 1 p			Yes
A193	Common Tern *Sterna hirundo*	Terns	No, not assessed	56 p			Yes
A195	Little Tern *Sterna albifrons*	Terns	No, not assessed	2 p			Yes
A043	Greylag Goose *Anser*	Geese	No, not assessed			1.265 – 13.015 i	No
A056	Northern Shoveler *Anas clypeata*	Ducks	No, not assessed			130 – 2.210 i	No
A059	Common Pochard *Aythya ferina*	Ducks	No, not assessed			7,000 – 10,000 i	No
A061	Tufted Duck *Aythya fuligula*	Ducks	Yes		15,000 – 20,000 i		No
A070	Goosander *Mergus merganser*	Mergansers	No, not assessed		< 1.200 i		No
A214	Great Cormorant *Phalacrocorax carbo*	Cormorants	Yes	2.250 p			No

Furthermore in the last ten years the following Annex-I-species were observed resting or feeding within the area by voluntary bird watchers (in brackets no. of individuals, double-sightings cannot be excluded): *Alcedo atthis* (37), *Anser erythropus* (4), *Aquila chrysaetos* (15), *Aquila clanga* (32), *Aquila pomarina* (1), *Ardea alba* (28), *Aythya nyroca* (37), *Branta leucopsis* (12.546), *Branta ruficollis* (45), *Chlidonias hybrida* (30), *Chlidonias niger* (360), *Ciconia* (3),

Circus aeruginosus (415), *Circus cyaneus* (102), *Cygnus* (3.292), *Falco columbarius* (2), *Falco peregrinus* (66), *Falco vespertinus* (1), *Lanius collurio* (7), *Milvus migrans* (1), *Milvus* (67), *Pandion haliaetus* (96), *Philomachus pugnax* (54), *Pluvialis apricaria* (5.598), *Podiceps auritus* (2), *Recurvirostra avosetta* (2), *Sterna paradisea* (61), *Tringa glareola* (17).

The SPA Maribo Lake is included in this assessment as some species make regular foraging flights into the Fehmarnbelt area and could thus be affected by construction and operation of a fixed.

9.3.2 White tailed Eagle

9.3.2.1 Conservation subject/ objective: A075 White-tailed Eagle *(Haliaeetus albicilla*)

Listed with one pair in standard data form, breeds annually since 1995 (last published data from 2006) (Storstrøms Amt 2006). White-tailed Eagle regularly – though with a few individuals only - use the marine habitats to hunt for fish and waterfowl, especially in winter when inland lakes are frozen.

9.3.2.2 Description of detailed conservation objectives

The site and the quality of the habitat has to be stable or even increase, so that within the area sufficient breeding and feeding grounds are available

For the White-tailed Eagle, no impacts on abundance and availability of its food sources (waterfowl, fish) will take place, and there will be no significant impact on the breeding areas.

Table 9.3 Comparison of the impacts on A075 White-tailed Eagle (*Haliaeetus albicilla*) caused by bridge and tunnel alternatives

A075 White-tailed Eagle (*Haliaeetus albicilla*)	Bridge alternative	Immersed tunnel alternative	Bored tunnel alternative
Degree of impact	No impact.	No impact.	No impact.
Significance of impact	Impacts non-significant	Impacts non-significant	Impacts non-significant

Conclusion

Both bridge or tunnel alternatives of a fixed link would not lead to significant impacts on White-tailed Eagle in this SPA.

9.3.3 Tufted Duck

9.3.3.1 Conservation subject/ objective: A061 Tufted Duck (*Aythya fuligula*)

In standard data form between 15,000 and 20,000 wintering Tufted Ducks are listed for this area. The mid-winter survey of 2008 in Denmark resulted in 8,875 Tufted Ducks recorded in the SPA Maribo Lakes (Petersen, et al., 2010). The DOF database reports a maximum value (between 2000 and 2010) of 14,400 birds for the SPA Maribo Lakes in February 2007 (DOF 2010), but more than 20,000 Tufted Ducks have been reported (Jørgensen 1990), and at least some of these birds are expected to use Fehmarnbelt for night foraging (Skov, et al., 1998). For this species, the area is important, because more than 1 % of the biogeographic population is wintering here.

9.3.3.2 Description of detailed conservation objectives

The site and the quality of the habitat has to be stable or even increase, so that within the area at least 20,000 Tufted Ducks find resting and feeding grounds there.

9.3.3.3 Impact factors of all three alternatives (caused by construction, structure, operation) affecting A061 Tufted Duck (*Aythya fuligula*)

Tufted Ducks could be affected by changes in marine habitats from sediment spills or other factors from construction or operation of a fixed link, because birds from SPA Maribo Lakes are known to use the marine habitats around Lolland for nighttime foraging. According to modelling, Figure 7.12 (FEMA, 2013c), no significant impacts on benthic fauna will occur in this area, neither for the bridge nor for the tunnel alternatives. Therefore, no impacts concerning food sources will take place for Tufted Ducks from the SPA Maribo Lakes. Displacement and disturbance from construction works and structures will occur for these species, but at a scale where it will not be significant for Tufted Ducks.

Conclusion

Both, a bridge and tunnel alternatives for a fixed link would only result in minor and no significant effects on Tufted Ducks in this SPA.

Table 9.4 Comparison of the impacts on A061 Tufted Duck (*Aythya fuligula*) caused by bridge and tunnel alternatives

A061 Tufted Duck (*Aythya fuligula*)	Bridge alternative	Immersed tunnel alternative	Bored tunnel alternative
Degree of impact	Low degree of impact.	Low degree of impact.	Low degree of impact.
Significance of impact	Impacts non-significant	Impacts non-significant	Impacts non-significant

9.3.4 Great Cormorant

9.3.4.1 Conservation subject/ objective: A214 Great Cormorant (*Phalacrocorax carbo)*

2.250 breeding pairs are listed in standard data form; data from DOF show for 2005 a number of 1.806 breeding pairs (Storstrøms Amt 2005).

9.3.4.2 Description of detailed conservation objectives

No special conservation objectives for this bird species.

9.3.4.3 Impact factors of bridge and tunnel alternatives (caused by construction, structure, operation) affecting A214 Great Cormorant (*Phalacrocorax carbo*)

Cormorants could be affected if fish, which serves as a food, source for this species would be negatively affected from sediment spills or other factors from construction and operation of a fixed link. For the pelagic and semi-pelagic fish species (herring, sprat, cod) only local and small temporary displacement of feeding shoals will occur based on spill scenarios for the coast of Lolland (SCI Fehmarn Bælt (00VA260)). For more stationary species (flatfish, sandeels, gobies) a local and temporary impact (e.g. a decline in the abundance of gobies) is likely for sandbanks in this SCI (Fehmarn occur Bælt (00VA260)), but e.g. for sandeels the impact is considered as negligible. Temporary local decline in food sources, displacement and disturbance from construction works and structures will not significantly affect Great Cormorants, because

disturbances have very limited extent compared to the abundant resources and feeding areas available.

Conclusion

Both, a bridge and tunnel alternatives for a fixed link would only result in very minor effects on Great Cormorants in this SPA, and significant effects can be excluded.

Table 9.5 Comparison of the impacts on A214 Great Cormorant (Phalacrocorax carbo) caused by bridge and tunnel alternative

A214 Great Cormorant (*Phalacrocorax carbo*)	Bridge alternative	Immersed tunnel alternatives	Bored tunnel alternatives
Degree of impact	Low degree	Low degree	Low degree
Significance of impact	Impacts non-significant	Impacts non-significant	Impacts non-significant

10 Natura 2000 site 251 Femern Bælt

The Natura 2000 site has an area of 11,456 ha, with depths on 0-20 meters. The Natura 2000 site is only designated under the habitats Directive and contains only Harbour Porpoise in reasons for designation.

The Natura 2000 area is located in Lolland Municipality and within the main water catchment area Baltic Sea. Part of the area is within the 3-mile limit.

10.1 SCI Femern Bælt (00VA260)

The designation basis for this Natura 2000 area is Harbour Porpoise.

No habitats are included in the Natura 2000 designation of the SCI. However, based on the Fehmarnbelt Fixed Link EIA baseline results, two habitat types can be defined:

- 1110 Sandbanks which are slightly covered by sea water at all times, cf. Cpt. 5.1.1.1
- 1170 Reefs, cf. Cpt. 5.1.1.6

Figure 10.1 shows the distribution of the two habitats types based on information provided by the Fehmarnbelt Fixed Link baseline studies. The habitat types are expected to be included in the reasons for designation of the site and it has been decided to cover the two times by the present screening.

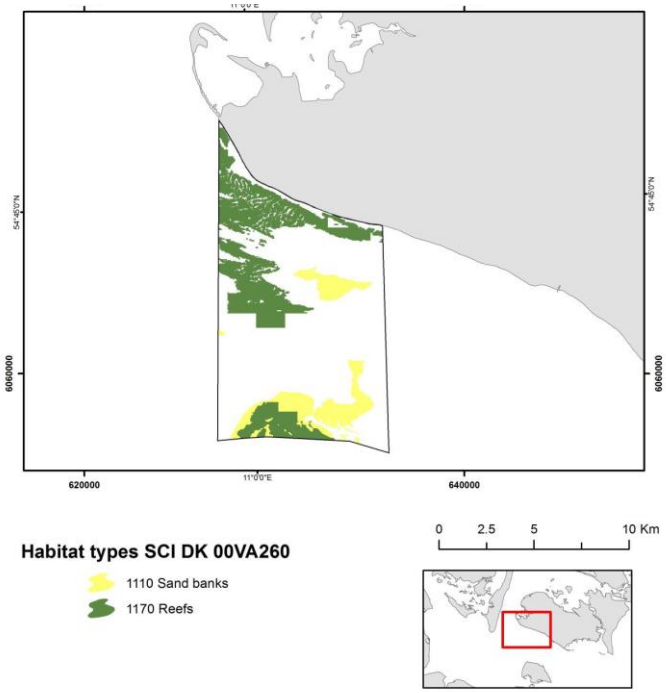

Figure 10.1 Distribution of habitat types 1110 and 1170 based on information developed in the Fehmarnbelt Fixed Link Project. According to the baseline investigations, the reefs are mainly mussel reefs while the occurrence of macroalgae is sparse.

Low cover of sensitive vegetation Figure 5.3, Figure 5.5 but high biomass near the shore of Lolland in within this in this SCI is found, Figure 5.6, Different benthic communities with different importance levels are found in this SCI, Figure 5.7, Figure 5.8. The SCI is as part of the Fehmarnbelt area of high importance for migrating herring and important for the shallow water fish communities, Figure 5.9, Figure 5.10.

No Annex II listed fish species are recorded, or are supposed to occur in the Natura 2000 site, (FeBEC, 2013a). Possible feeding grounds for Annex II species migrating through the Fehmarnbelt cannot be excluded

10.1.1 Sandbanks code 1110.

10.1.1.1 Impacts on 1110 Sandbanks, caused by the bridge alternative

Benthic flora and fauna

The temporary sediment spill during the construction phase is the only pressure caused by the bridge alternative, which may potentially have an impact on the sandbank habitat. The magnitude of the spill pressures for suspended sediment and sedimentation at the SCI is negligible and much less than for the immersed tunnel alternative, Figure 7.1 and Figure 7.4.

The structural functionality of sandbanks will not be significantly impacted by sedimentation or increased levels of suspended sediments see Cpt 7.4.4.1, Figure 7.7, , Figure 7.10, Figure 7.11 and Figure 7.12.

10.1.1.2 Impacts on 1110 Sandbanks caused by immersed tunnel alternative

Benthic flora and fauna

The sediment spill is larger for the immersed tunnel alternative than for the bridge alternative, Figure 7.3. At the SCI, the magnitude of the spill pressure is nevertheless low as the evaluated concentrations of suspended spilled sediment in the water and the sedimentation of spilled sediment is limited.

For the benthic flora and fauna of the habitat, no impacts of suspended matter and sedimentation will take place and the structural functionality of sandbanks will not be significantly impacted by sedimentation or increased levels of suspended sediments, see Cpt 7.4.4.1, Figure 7.7, Figure 7.10, Figure 7.11 and Figure 7.12

The dominant fauna in sandbanks (the Bathyporeia and Tanaissus communities) is not very sensitive to increased concentrations of suspended sediment and have a high tolerance for increase in sedimentation. So in conclusion no significant impact of the immersed tunnel alternative will take place for the habitat sandbanks in SCI Fehmarn Bælt (00VA260).

10.1.1.3 Impacts on 1110 Sandbanks, flora and fauna, caused by bored tunnel alternative

Benthic flora and fauna

The spill pressure at the SCI and thus the evaluated impacts is comparable to the bridge alternative, Figure 7.5. To the fauna, the magnitude of suspended sediment is low and within the natural variability, similarly the disposal of spill material is negligible and no impacts of sedimentation will take place in the habitat.

The structural functionality of sandbanks will not be significantly impacted by sedimentation or increased levels of suspended sediments see Cpt 7.4.4.1, Figure 7.7, Figure 7.10 , Figure 7.11 and Figure 7.12.

No significant impact of the bored tunnel will take place for the habitat sandbanks in SCI Fehmarn Bælt (00VA260).

10.1.1.4 Overall estimation of impact of the conservation subject/ objective

The structural functionality of sandbanks will not be significantly impacted by sedimentation or increased levels of suspended sediments, Table 10.1.

Table 10.1 Comparison of the impacts on the 1110 Sandbanks habitat (benthic flora and fauna) caused by the bridge and tunnel alternatives.

1110 Sandbanks	Bridge alternative	Immersed tunnel alternative	Bored tunnel alternative
Significance of impact	Impacts are not significant for 1110 Sandbanks.	Impacts are not significant for 1110 Sandbanks.	Impacts are not significant for 1110 Sandbanks.

10.1.2 Reefs code 1170

10.1.2.1 Impacts on 1170 Reefs caused by the bridge alternative

Benthic flora and fauna

The vegetation of the habitat is limited to the shallow waters in the eastern part of the reef area, Figure 5.3. On the remaining reef area benthic vegetation cover is low (< 10%). The spill scenario for the bridge alternative shows that at the reefs of the Fehmarn Bælt (00VA260) site, the reductions of light in the water due to suspended sediment from the spill will be inconsiderable, below 5%, Figure 7.6 and no reductions in the biomass of the vegetation will take place, Figure 7.7.

For the reef fauna, the magnitude of pressure for the suspended sediment is low and within the natural variability. Therefore, no significant impacts will take place.

In conclusion there will be no significant impact of the bridge alternative on the structural functionality of reefs by sedimentation or increased levels of suspended sediments, cf. Cpt 7.4.4.6, Figure 7.10 , Figure 7.11 and Figure 7.12 for the habitat reefs in SCI Fehmarn Bælt (00VA260).

10.1.2.2 Impacts on 1170 Reefs caused by immersed tunnel alternative

The vegetation in the habitat is limited to the shallow waters in the eastern part of the reef area, Figure 5.3. On the rest of the reef benthic vegetation cover is low (< 10%). The spill scenario for the tunnel alternative shows that in the worst case scenario of the construction phase there will be reductions of light in the habitat of 20-30 % due to suspended sediment from the sediment spill and small reductions in biomass of mainly <10% and in limited areas 10-20%, Figure 7.6, Figure 7.7. The vegetation is growing in the shallow water where light is plenty and the following years biomass reductions are insignificant (< 5%).

The described light and biomass reduction is within natural variability and will not cause significant impacts.

No significant impact from sedimentation will occur for the benthic flora, Figure 7.10.

For reef fauna, the impact of the pressure suspended sediment is in a restricted part of the area with only minor and not significant reductions in the biomass of mussels, Figure 7.9. Sedimentation is limited and pressures low, Figure 7.11, and do only impact the fauna in a very limited area and to an insignificant degree Figure 7.12. Therefore, there will be no significant impact on benthic reef communities.

The structural functionality of reefs will not be significantly impacted by sedimentation or increased levels of suspended sediments, Cpt, 7.4.4.6.

No significant impact of the immersed tunnel will occur for the habitat reefs in SCI Fehmarn Bælt (00VA260).

10.1.2.3 Impacts on 1170 Reefs caused by bored tunnel alternative

The spill scenario for the bored tunnel alternative shows that there will be reductions of light availability of app. 5-10% due to suspended sediment from the sediment spill, and that this reduction will result in <5% reduction in biomass of the reef vegetation less than for the immersed tunnel alternative, Figure 7.7

For fauna, the magnitude of pressure for the suspended sediment is very limited and well inside the natural variability. Therefore, no significant impacts will occur for the benthic flora and fauna due to suspended sediment. Similarly, the modelled disposal of spilled sediment is limited at the Fehmarn Bælt (00VA260) site, Figure 7.5 and no significant impacts of sedimentation will occur for the benthic flora or fauna.

The structural functionality of reefs will not be significantly impacted by sedimentation or increased levels of suspended sediments, see Cpt, 7.4.4.6,

The impact on benthic flora and fauna communities will be less than for the immersed tunnel alternative and there will be no significant impact of the bored tunnel alternative on the habitat reefs in SCI Fehmarn Bælt (00VA260).

10.1.2.4 Overall estimation of impact of the conservation subject/ objective

The structural functionality of reefs will not be significantly impacted by sedimentation or increased levels of suspended sediments, Table 10.2.

Table 10.2 Comparison of the impacts on 1170 Reefs habitat (benthic flora and fauna) caused by bridge and tunnel alternatives.

1170 Reefs	Bridge alternative	Immersed tunnel alternative	Bored tunnel alternative
Significance of impact	Impacts are not significant for 1170 Reefs	Impacts are not significant for 1170 Reefs	Impacts are not significant for 1170 Reefs

10.1.3 Harbour Porpoise (*Phocoena phocoena*) Conservation subject/ objective 1351

The area is an important area for Harbour Porpoises both as a living and feeding site and as an important corridor for migration into the eastern parts of the Baltic Sea, Figure 5.12, Figure 5.13, Figure 5.14.

Potential impact on Harbour Porpoise from activities and structures for the three different link solutions are identified, Table 10.3.

Table 10.3 Defining the potential impact factors of bridge and tunnel alternatives (caused by construction, structure, operation) affecting 1351 Harbour Porpoise

Bridge	Construction	Structure
Potential impact factors	Temporary reduction due to dredging /sediment spillage	Permanent change in density due to permanent changes in food supply or habitats due to changed hydrographical regime
Level of impact	Low degree	**Low degree**
Potential impact factors	Possible barrier effect due to construction works	Permanent change in density due to barrier effect
Level of impact	Low degree	**Low degree**
Potential impact factors	Temporary reduction in density or injuries due to piling during construction works	
Level of impact	Low degree	
Potential impact factors	Temporary reduction due to dredging /sediment spillage	
Level of impact	Low degree	
Potential impact factors	Possible barrier effect due to construction works	
Level of impact	Low degree	
Potential impact factors	Temporary reduction in density or injuries due to piling during construction works	
Level of impact	Low degree	
Potential impact factors	Temporary reduction due to dredging /sediment spillage	
Level of impact	Low degree	
Potential impact factors	Temporary reduction in density or injuries due to piling for construction harbours	
Level of impact	**Low degree**	

10.1.3.1 Impacts on 1351 Harbour Porpoises caused by bridge alternative

Construction related impacts

Habitat changes may result from sediment spill, which can affect the benthic communities and fish. Dredging operation may alter the structure of the seabed and thus lead to habitat changes and changes in food web structures. However, there are no significant impact on either fish communities or habitats from increase in suspended sediment or sedimentation in the SCI, cf. Cpt. 7.1.4, 10.1.1.110.1.2, why Harbour Porpoise will not be significantly affected.

A high intensity of activities during the construction phase and the associated sound and disturbance can cause a barrier effect and reduce the function of the Fehmarnbelt as part of a migration corridor, which could result in minor reduction or displacement of Harbour Porpoises in this particular area. However, impact on Harbour Porpoise from the combined pressures from noise and traffic show no significant effects, cf. Cpt. 7.2.1, Figure 7.16.

The construction of the ports on Lolland and Fehmarn, which are planned to host the construction operations, will be associated with sheet piling. The noise emissions will be mitigated by various measures and the emissions leads only to minor temporal disturbance at a range up to 10 km over the construction period of 4 – 6 weeks. The noise levels will not exceed the threshold for behavioural disturbance of Harbour porpoises, cf. Cpt. 7.2.1 and only a limited number of animals in the area will be affected. The disturbance from construction activities will not affect population levels of Harbour Porpoises significantly.

Structure related impacts

The superstructures of the fixed link will not result in significant changes in food availability or supply due to changes in habitat structure, (FEMM, 2013b).

Possible barrier effects due to bridge structures and traffic crossing the bridge have no significant impact on the migration or population of Harbour Porpoises in the Fehmarnbelt area cf. Cpt. 7.4.3.

Overall estimation of impact of the conservation subject/ objective

Construction works, will not result in significant behavioural responses of Harbour Porpoises in this SCI and changes in habitats due to bridge structures will not significantly have an impact on fish communities and the food source in the SCI, (FEMM, 2013b). There will be no significant barrier effect on migrating Harbour Porpoises.

Conclusion

Significant impacts on Harbour Porpoise from construction and operation of a bridge over Fehmarnbelt will not occur for this SCI.

Estimation of the relevance of other plans and projects

Two offshore wind farms are already in operation: Rødsand I also known as Nysted with 72 turbines and Rødsand II with 90 turbines. Five other wind farms are planned or under construction (Arkona Becken Südost, EnBW Windpark Baltic II, Wikinger, Kriegers Flak II, GEOFReE) for in the area east of Fehmarn, Figure 10.2. Even if founded on steel foundations, no spatial overlap of disturbance zones from noise emissions during pile driving from these offshore windfarms exist, which could result in significant cumulative effect on Harbour Porpoise behaviour, (FEMM, 2013b). The operation of the wind farms do not affect the population of Harbour Porpoise (FEMM, 2013b).

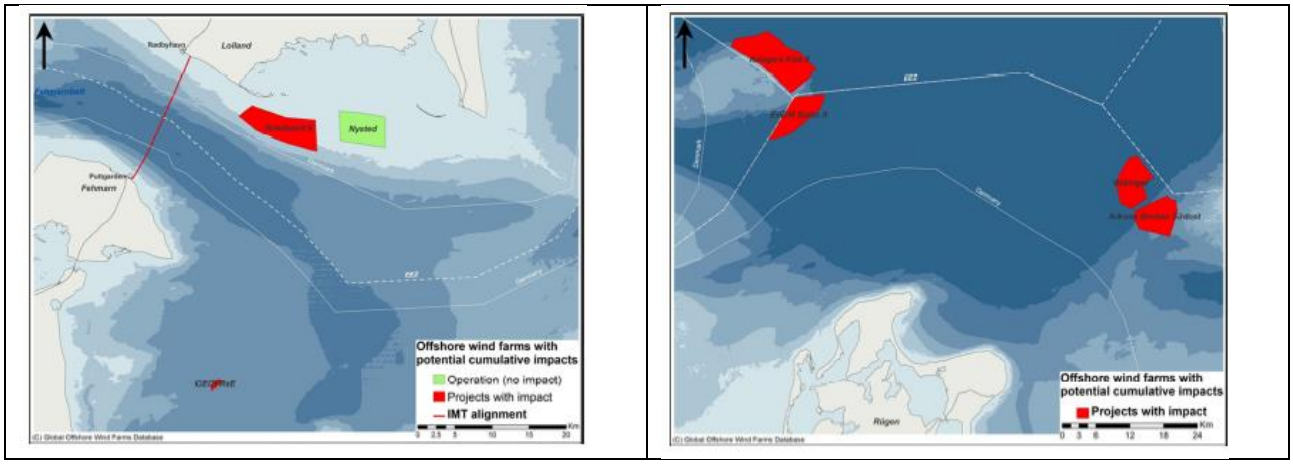

Figure 10.2. Offshore wind farms in operation or planned in the Fehmarnbelt area potential contributing to cumulative impact on Harbour Porpoise. After (FEMM, 2013b).

As the degree of impacts from a bridge alternative are assessed as being low and no more wind farms are planned in the direct vicinity of the SCI, no significant impacts on Harbour Porpoise will take place from cumulative impacts from other projects.

10.1.3.2 Impacts on 1351 Harbour Porpoises caused by immersed tunnel alternative

Construction related impacts

Habitat changes may result from sediment spill, which can affect the benthic communities and fish. Dredging operation may alter the structure of the seabed and thus lead to habitat changes and changes in food web structures. However, there are no significant impact on either fish communities or habitats from increase in suspended sediment or sedimentation in the SCI, cf. Cpt. 7.1.4, 10.1.1.110.1.2, why Harbour Porpoise will not be significantly affected

A high intensity of activities during the construction phase and the associated sound and disturbance can cause a barrier effect and reduce the function of the Fehmarnbelt as part of a migration corridor, which could result in minor reduction or displacement of Harbour Porpoises in this particular area. However, impact on Harbour Porpoise from the combined pressures from noise and traffic show no significant effects, cf. Cpt. 7.2.1, Figure 7.16.

The construction of the ports on Lolland and Fehmarn, which are planned to host the construction operations, will be associated with sheet piling. The noise emissions will be mitigated by various measures and the emissions leads only to minor temporal disturbance at a range up to 10 km over the construction period of 4 – 6 weeks. The noise levels will not exceed the threshold for behavioural disturbance of Harbour Porpoise, cf. Cpt. 7.2.1 and only a limited number of animals in the area will be affected. The disturbance from construction activities will not affect population levels of Harbour Porpoises significantly

Overall estimation of impact of the conservation subject/ objective

Construction works, will not result in significant behavioural responses of Harbour Porpoises in this SCI and there are no significant changes in habitat structures, which could result in significant permanent changes in fish communities and the food source in the SCI, (FEMM, 2013b).

Conclusion

Significant impacts on Harbour Porpoise from construction or operation of an immersed tunnel over Fehmarnbelt will not occur for this SCI.

Estimation of the relevance of other plans and projects

Two offshore wind farms are already in operation: Rødsand I also known as Nysted with 72 turbines and Rødsand II with 90 turbines. Five other wind farms are planned or under construction (Arkona Becken Südost, EnBW Windpark Baltic II, Wikinger, Kriegers Flak II, GEOFReE) for in the area east of Fehmarn, Figure 10.2. Even if founded on steel foundations, no spatial overlap of disturbance zones from noise emissions during pile driving from these offshore windfarms exist, which could result in significant cumulative effect on Harbour Porpoise behaviour, (FEMM, 2013b). The operation of the wind farms do not affect the population of Harbour Porpoise (FEMM, 2013b)

As the degree of impacts from the immersed tunnel alternative are assessed as being low and no more wind farms are planned in the direct vicinity of the SCI, no significant impacts on Harbour Porpoise will take place from cumulative impacts from other projects.

10.1.3.3 Impacts on 1351 Harbour Porpoises caused by bored tunnel alternative

Construction related impacts

Habitat changes may result from sediment spill, which can affect the benthic communities and demersal and semi-pelagic fish. However, there are no significant impact on either fish communities or habitats from increase in suspended sediment or sedimentation in the SCI, cf. Cpt. 7.1.4, 10.1.1.110.1.2, why Harbour Porpoise will not be significantly affected

The construction of the ports on Lolland and Fehmarn, which are planned to host the construction operations, will be associated with sheet piling. The noise emissions will be mitigated by various measures and the emissions leads only to minor temporal disturbance at a range up to 10 km over the construction period of 4 – 6 weeks. The noise levels will not exceed the threshold for behavioural disturbance of Harbour Porpoise, cf. Cpt. 7.2.1 and only a limited number of animals in the area will be affected. The disturbance from construction activities will not affect population levels of Harbour Porpoises significantly

Structure or operation related impacts

No significant impacts will occur.

Overall estimation of impact of the conservation subject/ objective

Construction works, will not result in significant behavioural responses of Harbour Porpoises in this SCI and there are no significant changes in habitat structures, which could result in significant permanent changes in fish communities and the food source in the SCI, (FEMM, 2013b).

Conclusion

Significant impacts on Harbour Porpoise from the construction of a bored tunnel over Fehmarnbelt will not occur for this SCI.

Table 10.4 Comparison of the impacts on 1351 Harbour Porpoises caused by bridge and tunnel alternatives

1351 Harbour Porpoises	Bridge alternative	Immersed tunnel alternatives	Bored tunnel alternatives
Degree of impact	Low degree	Low degree	Low degree
Significance of impact	No significance	No significance	No significance

Conclusion

A bridge alternative for a fixed link would only result in minor effects on marine mammals in this SCI. As there will be little to no impacts from a bridge as barrier, this would not affect the marine mammal population in this SCI. Construction works for the bridge have minor impacts on this SCI – construction works for the tunnel alternatives, will cause comparable higher sediment spill, but evaluation has found that it will not have a significant displacement effect on fish, which are an important food source for porpoises. Consequently, no significant impact is evaluated for either the immersed or bored tunnel alternative.

11 Natura 2000 site no. 126 Stenrev sydøst for Langeland

The area is only designated under the Habitats Directive and is located in the Great Belt East of the Southern tip of Langeland. The area is about 15 km² and appointed on the basis of reefs, making up an area of approximately 4.8 km². There is a stone reef running parallel to the coast with a peak of almost 6 meters water depth in the central part of the Natura 2000 area, but also stones are found in deeper waters in the northeast corner at 20.5 meters and in the southwest corner at approximately 13 meters water depth.

The most important natural values in the site is the reef structure. The algal vegetation on the reef is extremely sparse. There is a significant abundance of mussels on the reef, especially on the lower depths and other epifauna species. Occasionally, the area holds large concentrations of eiders and long-tailed ducks.

11.1 SCI DK 00VA200

The habitat type 1170 Reefs (4.6 km²) is the only habitat type in this Natura 2000 area, Table 11.1. Macroalgae cover approximately 3.2 km² of the reef habitat.

Table 11.1 Conservation objects / objectives assessed.

Object (habitat type)	Total area
1170 Reefs	4.6 km²

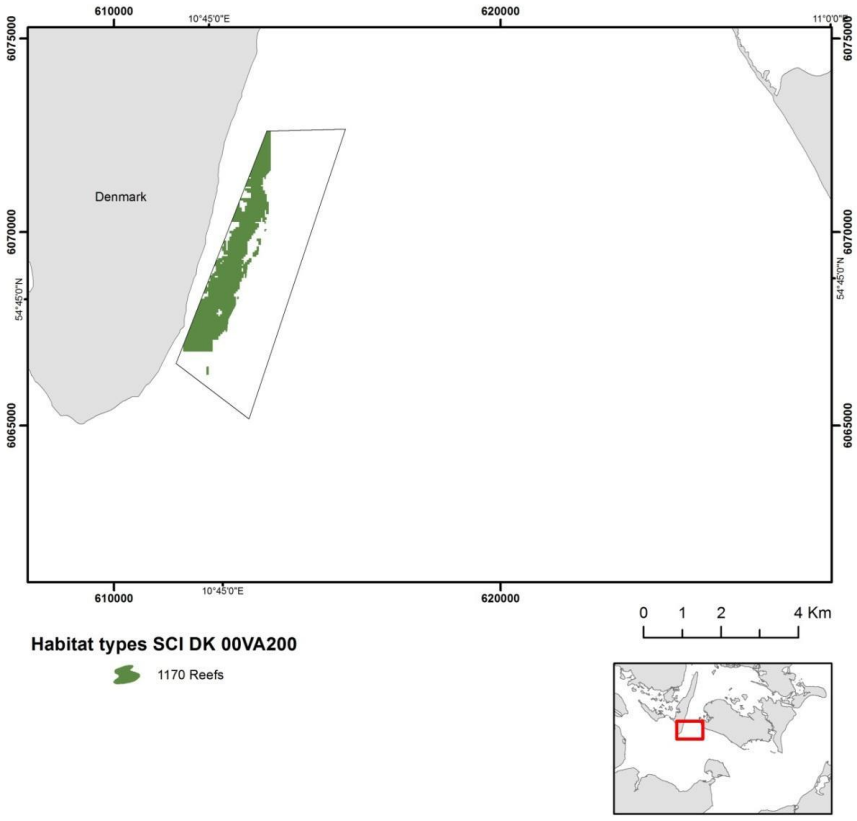

Figure 11.1 The geographic position of the site SCI DK 00VA200, with its characteristic habitat type 1170 Reefs. Map is based on information provided by the Fehmarn Fixed Link Project.

11.2 Reefs code 1170

For the habitat type 1170 Reefs in this Natura 2000 area the reported conservation status is unfavourable, due to eutrophication and consequences of fishery with trawl. The overall conservation goal is that all natural habitat types and species, which are listed as conservation objects, are to achieve a favourable conservation status in the area.

The overall objective for this Natura 2000 area is more detailed to:

- Ensure good water quality and species-rich benthic communities of benthic vegetation and fauna including characteristic reef species.
- Ensure restoration of favourable conservation status
- Ensure ecological integrity by low levels of nutrient loadings and toxic substances, and reduce physical disturbance.

The characteristic benthic fauna of the site is bivalves (e.g. *Modiolus modiolus, Mytilus* sp.*).*

Benthic vegetation on Langeland Reef: Three microalgae communities were identified in Langeland: the Fucus community, the Furcellaria community and the Phycodrys/Delesseria community. *Saccharina latissima* was also present, but it was not possible to define an own community. The reef is species-rich as 37 taxa of microalgae were found: 22 rhodophytes, 10 phaeophytes and 5 chlorophytes.

11.2.1 Impacts on 1170 Reefs caused by bridge alternative

Benthic flora and fauna

The temporary sediment spill during the construction phase is the only pressure caused by the bridge alternative, which may potentially have an impact on the reef habitat.

The spill scenario for the bridge alternative shows that there will be only small reductions of light availability near Langeland due to suspended sediment from the sediment spill (2-10%), Figure 7.6 and reductions in the biomass of the vegetation of less than 5%, Figure 7.7. This is inside the natural year-to year variability for the vegetation. There will be no significant changes in the biomass of benthic vegetation, Figure 7.12.

For the fauna, no pressures from suspended sediment will affect the stone reef, Figure 7.8, and the epifauna communities will not be affected. The reef is outside the sedimentation areas, Figure 7.2, and no significant impact will take place.

No significant impact of the bridge alternative will take place for the habitat reefs in SCI Stone reef southeast of Langeland (00VA200).

11.2.2 Impacts on 1170 Reefs caused by immersed tunnel alternative

The temporary sediment spill during the construction phase is the only pressure caused by the immersed tunnel alternative, which may potentially have an impact on the reef habitat, cf. Cpt. 7.4.4.6.

The spill scenario of the construction of the tunnel alternative shows a reduction in light availability of app. 10-20%, Figure 7.6 and a maximum reduction of the total macroalgae biomass of 0-15 % in the main part of the reef and in a smaller area 15 – 20 %, Figure 7.7.

It is assessed that the described light and biomass reduction is within natural variability and will not cause significant impacts, cf. Cpt. 7.1.1.

For the fauna, the magnitude of pressure from suspended sediment is low and the impact is consequently assessed to be low and insignificant, Figure 7.8.

Regarding the disposal of spilled sediment, the SCI is outside the range of sedimentation of spilled sediments from the construction, Figure 7.2, Figure 7.10 and Figure 7.11, and there will be no impact on the benthic flora and fauna.

No significant impact of the immersed tunnel alternative will take place for the habitat reefs in SCI Stone reef southeast of Langeland (00VA200).

11.2.3 Impacts on 1170 Reefs caused by bored tunnel alternative

The sediment spill scenario shows a reduction of the total macro algal biomass of 1 – 5% during the first year of construction and no impact in fifth year of the construction phase. As mentioned above a reduction in biomass of maximum 5% is within the natural year-to–year variability, and a significant impact can be excluded (FEMA 2013d).

As the evaluated concentrations of suspended sediment are low, compared to the worst-case scenario for the immersed tunnel,

Figure 7.8, there will be no impacts on the reef fauna.

Regarding the disposal of spilled sediment, the sedimentation is negligible and there will be no impact on the benthic flora and fauna, Figure 7.11.

No significant impact of the bored tunnel alternative will take place the habitat reefs in SCI Stone reef southeast of Langeland (00VA200).

11.2.4 Overall estimation of impact of the conservation object

The overall conclusion of the assessment is that there are no significant impact from the fixed link on the habitat type in the SCI, Table 11.2.

Table 11.2 Comparison of the impacts on 1170 Reefs caused by bridge and tunnel alternative

1170 Sandbanks	Bridge alternative	Immersed tunnel alternative	Bored tunnel alternative
Significance of impact	Non-significant impact for 1170 Reefs	Non-significant impact for 1170 Reefs	Non-significant impact for 1170 Reefs

11.3 Conservation subject/ objective: good water quality/diverse flora and fauna/ ecological integrity

11.3.1 Description of the impacts on the objective of achieving good water quality and a diverse flora and fauna having caused by bridge and tunnel alternatives

Both the bridge and tunnel alternatives affect the overall conservation subjects/objectives but the impact are limited and temporary and significant impacts on the natural range and areas of the habitat, the habitat structure and the functions that are important for the long-term maintenance are excluded.

The temporary sediment spill during the construction phase is the only pressure caused by the Fixed Link alternatives, which may potentially have notable impacts at the Langeland Reef site. Comparing the spill from the alternatives, the immersed tunnel causes the largest spill in amount and extent cf. Cpt. 7.1.

The sediment spill during the construction phase may result in small increases of the concentration of suspended sediment at Langeland Reef, and thereby in reductions in the light availability for phytoplankton and benthic flora (macroalgae). The reduction in Secchi depth during the first year of construction of an immersed tunnel (causing the relatively largest sediment spill) is predicted to be <5%, Figure 7.6, resulting in <1% reductions in the phytoplankton biomass (using chl-a as a proxy measure). Considering the natural variability, it can be excluded that such impacts deteriorate the water quality or pose a risk to the species diversity or ecological function of the phytoplankton and thereby to the higher trofic levels dependent on the phytoplankton.

The above screening of the potential impacts of the alternatives on the benthic habitat (benthic flora and fauna) show that no significant impacts will take place for the Langeland Reef habitat. Furthermore, the impact will be temporary and will be restored within few years. It is therefore evaluated that the biodiversity will not be deteriorated. The most notable effect is predicted for the benthic flora, i.e. the macroalgae of the reef, as a consequence to the sediment spill during the first year of construction of the immersed tunnel. The estimated reductions in biomass (0-10% in the major parts of the reef flora; in a smaller areas of 10 – 20 %) are within the natural variability and the flora will continue to be present. Consequently, there will be no significant impact on the overall biodiversity as well as the integrity of the ecosystem. The modelling shows that the restoration of the flora commence after the initial high pressure in the first year of construction (FEMA, 2013d).

In conclusion, the predicted pressures due the Fixed Link alternatives will not cause significant impacts on the SCI DK 00VA200 Stone Reef Southeast of Langeland (Stenrev sydøst for Langeland), Table 11.3.

Table 11.3 Impact in relation to water quality and biodiversity

Objective water quality / biodiversity	Bridge alternative	Immersed tunnel alternatives	Bored tunnel
Significance of impact	Non-Significant impact for objective water quality/ biodiversity	Non-Significant impact for objective water quality/ biodiversity	Non-Significant impact for objective water quality/ biodiversity

11.3.1.1 Harbour porpoise (*Phocoena phocoena*) Conservation subject/ objective 1351

Although no conservation objectives were formulated for this Natura 2000 site, the Harbour Porpoise is present in this area and the potential impacts on this species are discussed for this site. See Table 11.4 for the description of the potential impact on the conservation objectives for Harbour Porpoise.

Table 11.4 Defining the potential impact factors of bridge and tunnel alternative (caused by construction and structure) affecting 1351 Harbour Porpoise.

Bridge	Construction	Structure
Potential impact factors	Temporary reduction due to dredging /sediment spillage	Permanent change in density due to permanent changes in food supply or habitats due to changed hydrographical regime
Level of impact	Low degree	**Low degree**
Potential impact factors	Possible barrier effect due to construction works	Permanent change in density due to barrier effect
Level of impact	Low degree	**Low degree**
Potential impact factors	Temporary reduction due to dredging /sediment spillage	
Level of impact	Low degree	
Potential impact factors	Possible barrier effect due to construction works	
Level of impact	Low degree	
Potential impact factors	Temporary reduction due to dredging /sediment spillage	
Level of impact	Low degree	
Potential impact factors	Temporary reduction in density or injuries due to piling for construction harbours	
Level of impact	**Low degree**	

11.3.2 Impacts on 1351 Harbour Porpoises caused by bridge alternative

Construction related impacts

Habitat changes may result from sediment spill, which can potentially affect the benthic communities and fish. Dredging operation may alter the structure of the seabed and thus lead to habitat changes and changes in food web structures. However, there are no significant impact on either fish communities or habitats from increase in suspended sediment or sedimentation in the SCI, cf. Cpt. 7.1.4, 10.1.1.110.1.2, and the distance to the fixed link is higher than for SCI Fehmarnbelt cf. Cpt.10 why Harbour Porpoise will not be significantly affected.

Structure related impacts

Studies on the behaviour of Harbour Porpoises at the Great Belt Bridge and an analysis of porpoise movements based on data from satellite telemetry showed that existing bridges in the Baltic Sea do not result in a barrier effect, which could impair the function of straits as migration corridor.

Overall estimation and conclusion of impact of the conservation subject/ objective

Construction works, especially if high noise levels from piling operations may occur, could potentially lead to some disturbance. However, this SCI is about 30 km away from the

construction site so it is evaluated that both noise and sediment spill will not have significant impact on the species (FEMM 2013b, see also Figure 7.16).

Estimation of the relevance of other plans and projects

Two offshore wind farms are already in operation: Rødsand I also known as Nysted with 72 turbines and Rødsand II with 90 turbines east of the alignment. The operation of the wind farms do not affect the population of Harbour Porpoise (FEMM, 2013b).

11.3.2.1 Impacts on 1351 Harbour Porpoises caused by immersed tunnel alternative

Construction related impacts

Habitat changes may result from sediment spill, which can potentially affect the benthic communities and fish. Dredging operation may alter the structure of the seabed and thus lead to habitat changes and changes in food web structures. However, there are no significant impact on either fish communities or habitats from increase in suspended sediment or sedimentation in the SCI, cf. Cpt. 7.1.4, 10.1.1.110.1.2, why Harbour Porpoise will not be significantly affected.

Overall estimation and conclusion of impact of the conservation subject/ objective

Temporary construction work pressures, e.g. especially noise from piling operations and sediment spill, lead to some disturbance in the near project area. However, this SCI is about 30 km away from the construction site and significant impact from project pressures will not appear and can be excluded (FEMM 2013b, see also Figure 7.16).

Estimation of the relevance of other plans and projects

Two offshore wind farms are already in operation: Rødsand I also known as Nysted with 72 turbines and Rødsand II with 90 turbines east of the alignment. The operation of the wind farms do not affect the population of Harbour Porpoise (FEMM, 2013b).

11.3.2.2 Impacts on 1351 Harbour Porpoises caused by bored tunnel alternative

Construction related impacts

Habitat changes may result from sediment spill, which can potentially affect the benthic communities and fish. Dredging operation may alter the structure of the seabed and thus lead to habitat changes and changes in food web structures. However, there are no significant impact on either fish communities or habitats from increase in suspended sediment or sedimentation in the SCI, cf. Cpt. 7.1.4, 10.1.1.1, and 10.1.2, why Harbour Porpoise will not be significantly affected.

Overall estimation and conclusion of impact of the conservation subject/ objective

Construction works, especially if high noise levels from piling operations may occur, could potentially lead to some disturbance. However, this SCI is about 30 km away from the construction site so it is evaluated that both noise and sediment spill will not have significant impact on the species (FEMM 2013b, se also Figure 7.16).

Estimation of the relevance of other plans and projects

Two offshore wind farms are already in operation: Rødsand I also known as Nysted with 72 turbines and Rødsand II with 90 turbines east of the alignment. The operation of the wind farms do not affect the population of Harbour Porpoise (FEMM, 2013b).

11.3.3 Conclusion

Both the bridge and tunnel alternatives for a fixed link would only result in minor effects on Harbour Porpoise in this SCI, Table 11.5. Due to the high distance to the alignment, there will be no impacts from construction work or operation of the fixed link.

Table 11.5 Comparison of the impacts on 1351 Harbour Porpoises caused by bridge and tunnel alternatives

1351 harbour porpoises	Bridge alternative	Immersed tunnel alternatives	Bored tunnel alternatives
Degree of impact	Low degree	Low degree	Low degree
Significance of impact	No significance	No significance	No significance

12 Natura 2000 site no. 179 Nakskov Fjord og Inderfjord

The Natura 2000 area includes Nakskov Fjord, except the easternmost part, and a stretch of ocean just west of the inlet. It also includes Nakskov Inderfjord, a brackish lake south of Nakskov connected to the inlet through sluice gates. Nakskov Fjord are generally very shallow with a number of reefs and sandbars. The fjord is crossed by several deeper shipping channels. The Southern part of the fjord is a large shallow coastal lagoon, Søndernor. There are 10 islands and islets in the fjord, the largest of which is Enehøje. The long half island "the elbow" and low-lying partly diked areas along the south coast are included as land. The Natura 2000 area covers 8,526 ha, of which 7,574 hectares are marine areas. The most important natural values are especially a number of coastal and marine nature types and waterbirds including a number of swans, geese and ducks. The many islands in the fjord and Elbow tong allows many nesting coastal birds that breed on the ground as terns and waders. The internationally important coastal habitats such as dunes, beaches and lagoons, are constantly evolving, as the currents in the fjord causes rearrangement of gravel and sand.

12.1 SCI DK 006X242 Nakskov Fjord

12.2 Overall description of the site

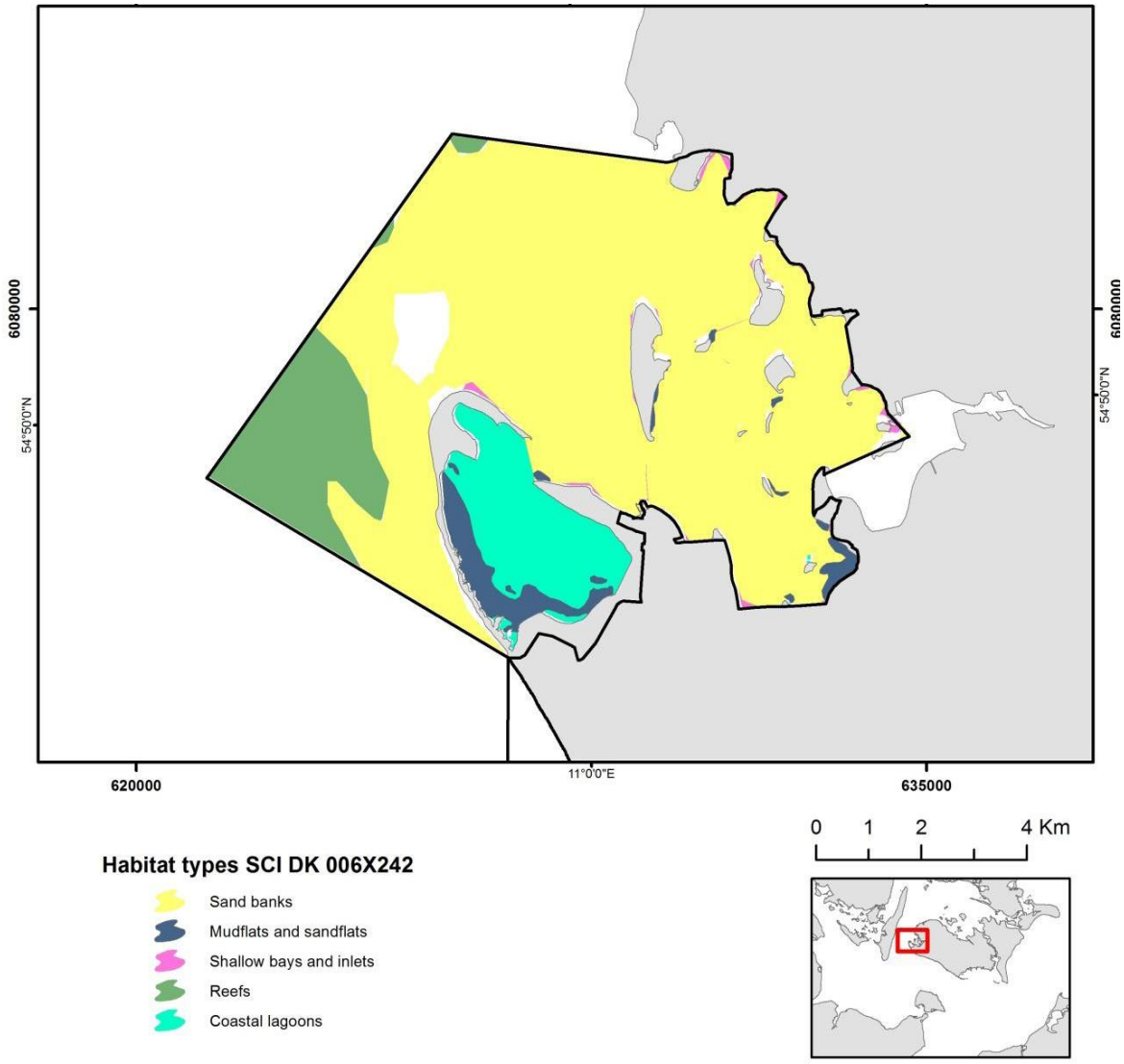

Figure 12.1 Map showing the SCI 006X242

The Ministry of Environment has defined five habitat types for the area:

- 1110 Sandbanks which are slightly covered by sea water at all times
- 1140 Mudflats and sandflats not covered by seawater at low tide
- 1150* Lagoons
- 1160 Large shallow inlets and bays
- 1170 Reefs

The designation maps from the ministry shows that this habitat type Sandbanks covers the major part of the outer central and inner part of the fjord.

Coverage of flowering plants has been investigated along three transects in the central fjord east of Slotø, Enehøje and Kåre Holm, respectively and one transect in the cove Sønder Nor. The available data on vegetation from the inner fjords and the cove show high coverage of 80–

100% and dominance of pondweeds *Potamogeton sp* in the most shallow parts from 0.5–2.0 m depth and high coverage of 80–100% and dominance of eelgrass *Zostera* in the deeper areas 2.0–(3.0–3.5) m depth.

The present map of the SCI indicates that reefs are present in the westernmost part of the habitat area. The habitat map, Figure 5.3, Figure 5.4 (FEMA, 2013a), only extend into the southernmost tip of the habitat area, but the bathymetric and hydrographic conditions and the substrate mapping indicates that the hard substrate extends northwards into the western part of the habitat area. The habitat mapping and sampling of mussels, infauna and benthic vegetation in the reef area just south of the SCI show that reef is dominated by mussels and the Bathyporeia communities, Figure 5.7. Benthic vegetation is sparse and predicted to have a cover at <10% of the hard substrates in that area. The deepest part of the reef is at about 9 m.

The dense mussel population south of the SCI extend eastwards towards the dredging area. Filter-feeders such as mussels clear the water efficiently and with high rates for suspended particles in the size range 1-100 µm (Møhlenberg & Riisgard, 1978) and they will ingest all particles including suspended sediment if total suspended solid (TSS) concentration is below 2-3 mg/l (Kiørboe, et al., 1980). Non-assimilated intake (e.g. including suspended sediment) is egested as feces. At increasing TSS concentrations – up to 30-50 mg/l - mussels will continue filtering at high rates but reject part of the filtered material as pseudofeces prior to ingestion (Kiørboe, et al., 1981). Compared to TSS particles such as spilled sediments, the feces and pseudofeces are much larger (mm-size), have much higher settling velocities and requires 5-10 times higher sheer stress for resuspension (Chamberlain, 2002; Chamberlain, et al., 2001; Callier, et al., 2006). Therefore, if suspended sediment has been filtered by mussels and been turned into feces or pseudofeces, the TSS in an area will decrease and the risk for resuspension will be much lower.

As the filtering capacity of the mussel population observed between the Fixed Link project and the Natura 2000 site, and this case in particular the dense population in the area south-southeast of the SCI, is not taken into consideration in the modelling of the spreading of the sediment spill, the estimated influence on the concentration of suspended material and sedimentation are conservative. This decision to omit mussel filtration was taken from a conservative point of view (precautionary principle) as there are no well-proven methods to include this process in the modelling. The effect of the conservative assumption, i.e. that the removal of spilled sediments by filtering is not accounted for in spill modelling, is a tendency to overestimate the concentration of suspended sediments in shallow waters (2-10 m) where mussels are abundant. Consequently, the simulated concentrations of spilled sediment in the Nakskov Fjord area are conservative estimates. The maximum pressures from suspended sediments and sedimentation of spilled sediments will only result in insignificant effects on benthic flora and fauna in the impacted areas during construction, Figure 7.7, Figure 7.8, Figure 7.9, Figure 7.10 and Figure 7.12.

12.2.1 Sandbanks code 1110

The major part of the SCI is covered by the sandbank habitats, Figure 12.1. The sandbanks in the area are exposed to waves and characterised by highly dynamic bed forms.

12.2.1.1 Impacts on 1110 Sandbanks caused by bridge alternative

The reduction in light availability due to suspended sediment in the water means that there will be no reduction in the potentially occurring eelgrass biomass after the second year of construction (worst year), Figure 7.7. As the modelled sediment spill furthermore is assessed to be conservative (see explanation above), the conclusion is that there will be no impact on benthic vegetation.

The pressure from suspended sediment on the fauna is assessed to be low and not affecting the viability and mortality of benthic fauna. The impact is therefore considered to be insignificant.

There will be no sedimentation of spilled sediment, Figure 7.4 and therefore no impact on the benthic flora and fauna for the sandbanks, Figure 7.11, cf. Cpt. 7.4.4.1.

In conclusion, no significant impact of the bridge alternative will take place for the habitat sandbanks in SCI Nakskov Fjord (006X242).

12.2.1.2 Impacts on 1110 Sandbanks caused by immersed tunnel alternative

The reduction in light availability indicates a reduction in the potentially occurring eelgrass biomass after the first year of 5 – 10 %, Figure 7.6, in the outer and northern part – north and east of Enehøje and vest of Vejlø and Slotø and lesser reduction in the inner fjord and Søndernor. The reduction is considered to be within the range of natural variability and only impacting an insignificant small part of the total area of sandbanks in the SCI. As the modelled sediment spill furthermore is assessed to be conservative (see explanation above), the conclusion is that the impact on benthic vegetation will be insignificant (FEMA, 2013d).

The pressure from suspended sediment on the fauna is assessed to be minor to medium,

Figure 7.8 and not affecting the viability and mortality benthic fauna significantly, Figure 7.12, cf. Cpt. 7.4.4.1. The impact will therefore be insignificant, (FEMA, 2013c).

The sedimentation of spilled sediment is low and has therefore no impact on the benthic flora and fauna for the sandbanks.

No significant impact of the immersed tunnel alternative will take place for the habitat sandbanks in SCI Nakskov Fjord (006X242).

12.2.1.3 Impacts on 1110 Sandbanks caused by the bored tunnel alternative

The reduction in light availability indicates a small (< 5%) reduction in the potentially occurring eelgrass biomass after the first year in the outer and northern part – north and east of Enehøje and vest of Vejlø and Slotø. The reduction is less compared to the immersed tunnel alternative and considered to be within the range of natural variability. As the modelled sediment spill furthermore is assessed to be conservative (see explanation above), the conclusion is that the impact will be lower compared to the immersed tunnel alternative and therefore non-significant.

The pressure from suspended sediment on the fauna is assessed to be low and not affecting the viability and mortality of benthic fauna. The impact is lower compared to the immersed tunnel alternative and therefore non-significant.

The sedimentation of spilled sediment is low, Figure 7.5, and result is no impact on the benthic flora and fauna for the sandbanks.

No significant impact of the bored tunnel alternative will take place for the habitat sandbanks in SCI Nakskov Fjord (006X242).

12.2.1.4 Overall estimation of impact of the conservation subject/ objective

No significant impact is will take place for 1110 Sandbanks, Table 12.1.

Table 12.1 Comparison of the impacts on 1110 Sandbanks caused by bridge and tunnel alternatives, benthic flora and fauna.

1110 Sandbanks	Bridge alternative	Immersed tunnel alternative	Bored tunnel alternative
Significance of impact	Impacts are not significant for 1110 Sandbanks.	Impacts are not significant for 1110 Sandbanks.	Impacts are not significant for 1110 Sandbanks.

12.2.2 Mudflats and sandflats code 1140

The habitat type is found in the inner part of Nakskov Fjord, Figure 12.1 and cove furthest away from the possible influence from sediment spill. The structural function of benthic vegetation and faunal communities in these tidal flats are not impacted significantly by sedimentation and impacts are similar to impacts on vegetation and faunal communities outside the lagoon, Figure 7.12.

None of the alternatives (bridge, immersed tunnel or bored tunnel) will have a significant impact on the habitat type.

12.2.3 Coastal lagoons code 1150

Coastal lagoons are part of the reason for the designation of the site and can be divided into smaller lagoons situated on land (on the isthmus Albuen) and the larger lagoon, Søndernor. The habitat type 1150 is prioritised in the directive.

12.2.3.1 Impacts on 1150 Coastal lagoons caused by bridge solution

The reduction in light availability indicates that the impact on vegetation biomass will be very small if detectable and that there will be no reduction in the potentially occurring eelgrass biomass at the end of the growing season, Figure 7.6.The impact on benthic flora will then be insignificant, Figure 7.7. The modelled sediment spill is furthermore assessed to be conservative (see explanation above).

The pressure from suspended sediment on the fauna is assessed to be low and not affecting the viability and mortality of benthic fauna. The benthic fauna in shallow waters is highly tolerant of suspended sediments and sedimentation and the recovery of the communities are fast (1-2 years), (FEMA, 2013c). The impact is therefore considered to be insignificant.

The sedimentation of spilled sediment is low and has therefore no impact on the benthic flora and fauna in coastal lagoons of the SCI.

No significant impact of the bridge alternative will take place for the habitat coastal lagoons in SCI Nakskov Fjord (006X242).

12.2.3.2 Impacts on 1150 Coastal lagoons caused by immersed tunnel solution

The reduction in light availability indicates a reduction in the potentially occurring eelgrass biomass after the first year of 4-8 % in the Søndernor, Figure 7.6. A temporary reduction of this magnitude followed by a full recovery will be insignificant. The modelled sediment spill is furthermore assessed to be conservative.

The pressure from suspended sediment on the fauna is assessed to be low and not affecting the viability and mortality of the benthic fauna. The benthic fauna in shallow waters is highly tolerant of suspended sediments and sedimentation and the recovery of the communities are fast (1-2 years), (FEMA, 2013c). Suspension and sedimentation of spilled sediments will only affect the benthic fauna temporarily and will only have insignificant impacts on the benthic faunal communities, Figure 7.12.

The sedimentation of spilled sediment is low (< 5mm) and has therefore no impact on the benthic flora and fauna or on the habitat type.

No significant impact of the immersed tunnel alternative is predicted for the habitats in SCI Nakskov Fjord (006X242).

12.2.3.3 Impacts on 1150 Coastal lagoons caused by bored tunnel solution

The reduction in light availability indicates a small (< 5%) reduction in the potentially occurring eelgrass biomass after the first year in the Søndernor area, Figure 7.6. The reduction is considered to be non-significant. The modelled sediment spill is furthermore assessed to be conservative. The pressure from suspended sediment on the fauna is assessed to be low and not affecting the viability and mortality of the benthic fauna. The impact is therefore insignificant.

The sedimentation of spilled sediment is low and has therefore no impact on the benthic flora and fauna or for the habitat type.

There will be no significant impact of the bored tunnel alternative for the habitat type in SCI Nakskov Fjord (006X242).

12.2.3.4 Overall estimation of impacts of the conservation subject/ objective

No significant impact is will take place for 1150 Coastal lagoons, Table 12.2.

Table 12.2 Comparison of the impacts on 1150 *Coastal lagoons caused by bridge and tunnel solutions.

1150 *Coastal lagoons	Bridge solution	Immersed tunnel solution	Bored tunnel solution
Significance of impact	Impacts are not significant for 1150 *Coastal lagoons.	Impacts are not significant for 1150 *Coastal lagoons.	Impacts are not significant for 1150 *Coastal lagoons.

12.2.4 Large shallow inlets and bays code 1160

Impacts on structural function of large shallow inlets and bays, which is very poorly represented in the SCI is on the same level as/equals to the impacts on benthic flora and fauna communities in sandbanks and lagoons of the site, cf. Cpt 12.2.1, 12.2.3, and Table 12.3. (FEMA 2013c).

Table 12.3. Comparison of the impacts on 1160 Shallow inlets and bays caused by the bridge and tunnel solutions.

1150 *Coastal lagoons	Bridge solution	Immersed tunnel solution	Bored tunnel solution
Significance of impact	Impacts are not significant for 1160 Large shallow inlets and bays.	Impacts are not significant for 1160 Large shallow inlets and bays.	Impacts are not significant for 1160 Large shallow inlets and bays.

Table 12.4 Comparison of tunnel and bridge alternatives in relation to the degree of impact for the protected habitat 1160 Shallow inlets and bays.

1160 Shallow inlets and bays	Bridge alternative	Immersed tunnel alternative	Bored tunnel alternative
Degree of impact	No significant impact. In small sections of the area along the western coast of Lolland the maximum average concentration of suspended sediment will only exceed the indicative threshold of 10 mg/l, impacting the migration of fish, in less than 5% of the time. It is assumed that sediment spill will not temporarily affect benthic vegetation or benthic fauna impacting spawning, breeding or nursery grounds for shallow water fish.	No significant impact. Net deposition of less than 10 mm is forecasted for some construction periods in small sections of the area. The sedimentation is far below the indicative threshold of a deposit of 50 mm for significant impacts on vegetation or eelgrass meadows. No changes in structural functionality are expected due to spilled sediment and no impact on fishes associated with vegetation or eelgrass meadows is expected.	No significant impact. Net deposition far below the indicative threshold for significant impacts on vegetation or eelgrass meadows. No changes in structural functionality are expected due to spilled sediment and no impact on fishes associated with vegetation or eelgrass meadows is expected. The concentration of suspended sediment in less than 10% of the time will be less than 10 mg/l. This is below the indicative threshold limit of 10 mg/l affecting migrating species. It is assumed that sediment spill will not temporarily affect benthic vegetation, eelgrass meadows or benthic fauna impacting spawning, breeding or nursery grounds for shallow water fish.
Significance of impact	Non significant for 1160 Shallow inlets and bays No significant impact of spawning and breeding grounds for shallow water fishes or nursery grounds is expected.	Non significant for 1160 Shallow inlets and bays No significant impact of spawning and breeding grounds for Shallow water fishes or nursery grounds is expected.	Non significant for 1160 Shallow inlets and bays No significant impact of spawning and breeding grounds for Shallow water fishes or nursery grounds is expected.

12.2.5 Reefs code 1170

Reef structures are found in the western and northeren part of the SCI, Figure 12.1.

12.2.5.1 Impacts on 1170 Reefs, caused by bridge alternative

For the fauna the magnitude of pressure is assessed to be low and the impact of suspended sediment on the fauna will be insignificant, Figure 7.8, Figure 7.12.

The spill scenarios and resulting reduction in light availability indicates a reduction in potential macro algal biomass after the second year of < 5%, Figure 7.7. Both light and biomass reduction is within the range of natural variability and in addition, the reef is located at a shallow location, where reductions can be expected to recover fast. The described impact is not considered to be significant for the habitat.

Sedimentation at the reef is negligible, Figure 7.4, and thus there will be no impact on the benthic flora and fauna from sedimentation, Figure 7.10 and Figure 7.11.

In conclusion, there will be no significant impact of the bridge alternative for the habitat type reefs in SCI Nakskov Fjord (006X242).

12.2.5.2 Impacts on 1170 Reefs, caused by immersed tunnel alternative

The impact assessment for the area just south of the SCI indicates that suspended sediment may cause a minor to medium impact on the benthic fauna, Figure 7.9. This impact reduces the biomass of mussels but result in only insignificant changes in the benthic fauna communities. Recovery from a reduced viability of the medium and minor impaired fauna will take place within a couple of months after the pressure has ended. The impact of suspended sediment on the fauna is therefore assessed to be low and insignificant.

As explained above the benthic vegetation is sparse and not an important structuring component of the reef area. The spill scenarios and resulting reduction in light availability, Figure 7.6, does not result in significant reductions in macro algal biomass or in the structural function of the reef in the SCI.

Sedimentation at the reef is negligible, Figure 7.3 and thus there will be no impact on the benthic flora and fauna from sedimentation, Figure 7.12.

In conclusion, no significant impact of the immersed tunnel alternative is assessed for the habitat type reefs in SCI Nakskov Fjord (006X242) (see also 7.2)

12.2.5.3 Impacts on 1170 Reefs, caused by bored tunnel

As explained above, the reef is dominated by benthic fauna. For the fauna the magnitude of pressure is assessed to be low, Figure 7.11 and the impact of suspended sediment on the fauna will be insignificant, less than for the immersed tunnel scenario.

The spill scenarios and resulting reduction in light availability indicates a reduction in potential macroalgae biomass of < 10 % after the first year of construction. Since the benthic vegetation is not an important structuring component of the reef area and the described light and biomass reduction is in the range of natural variability and the reef situated in shallow water, the impact will not be significant for the habitat.

Sedimentation at the reef is negligible and thus there will be no impact on the benthic flora and fauna from sedimentation.

In conclusion, no significant impact of the bored tunnel will take place for the habitat type reefs in SCI Nakskov Fjord (006X242).

12.2.5.4 Overall estimation of impact of the conservation object

No significant impact is will take place for 1170 reefs, Table 12.5.

Table 12.5 Comparison of the impacts on 1170 Reefs caused by bridge and tunnel alternative

1170 Sandbanks	Bridge alternative	Immersed tunnel alternative	Bored tunnel alternative
Significance of impact	Non-significant impact for 1170 Reefs	Non-significant impact for 1170 Reefs	Non-significant impact for 1170 Reefs

12.2.6 Harbour Porpoise (*Phocoena phocoena*) Conservation subject/ objective 1351

Harbour Porpoises is present within this SCI, Figure 5.12 and Figure 5.13.

Potential impact on Harbour Porpoise from activities and structures for the three different link solutions are identified, Table 12.6. Compared to the potential impact from construction activities in SCI Femern Bælt, cf. Cpt. 10 the noise impact from piling activities is not relevant due to the distance to construction sites. Potential barrier effects for migrating Harbour Porpoises and are of no relevance for the structure and function of habitats in the SCI.

Table 12.6. Defining the potential impact factors of bridge and tunnel alternatives (caused by construction, structure, operation) affecting 1351 Harbour Porpoise

Bridge	Construction	Structure
Potential impact factors	Temporary reduction due to dredging /sediment spillage	Permanent change in density due to permanent changes in food supply or habitats due to changed hydrographical regime
Level of impact	Low degree	**Low degree**
Potential impact factors	Temporary reduction due to dredging /sediment spillage	
Level of impact	Low degree	
Potential impact factors	Temporary reduction due to dredging /sediment spillage	
Level of impact	**Low degree**	

12.2.6.1 Impacts on 1351 Harbour Porpoises caused by bridge and tunnel alternatives

Construction related impacts

Habitat changes may result from sediment spill, which can affect the benthic communities and fish. Dredging operation may alter the structure of the seabed and thus lead to habitat changes and changes in food web structures. However, there are no significant impact on either fish communities or habitats from increase in suspended sediment or sedimentation in the SCI, cf. Cpt. 7.1.4, 10.1.1.110.1.2, why Harbour Porpoise will not be significantly affected.

The disturbance from construction activities or structures will not affect population levels of Harbour Porpoises significantly

12.2.6.2 Overall estimation of impact of the conservation subject/ objective

Construction works or structures will not result in significant impact of Harbour Porpoises in this SCI, Figure 7.16 and there are no significant changes in habitat structures, which could result in significant permanent changes in fish communities and the food source in the SCI, Figure 7.13 (FEMM, 2013b; FEBI, 2013b).

Estimation of the relevance of other plans and projects

Two offshore wind farms are already in operation: Rødsand I also known as Nysted with 72 turbines and Rødsand II with 90 turbines. The operation of the wind farms do not affect the population of Harbour Porpoise (FEMM, 2013b).

Conclusion

Significant impacts on Harbour Porpoise from construction and operation of a fixed link over Fehmarnbelt will not occur for this SCI, Table 12.7.

Table 12.7 Comparison of the impacts on 1351 Harbour Porpoises caused by bridge and tunnel alternatives

1351 Harbour Porpoises	Bridge alternative	Immersed tunnel alternatives	Bored tunnel alternatives
Degree of impact	Low degree	Low degree	Low degree
Significance of impact	No significance	No significance	No significance

12.2.7 Annex II listed fish species

Lampreys and twaite shad listed in Annex II are recorded from the Natura 2000 area SCI DK 00X242; and feeding migration of these and other listed Annex II species along the coast of Lolland are possible to take place (FeBEC, 2013a). Possible feeding and spawning migration of migratory species, including anadromous Annex II species, along the western coast of Lolland will not be significantly impacted in the SCI area due to only temporary exceedances of thresholds limits of 10mg/l of suspended sediments from construction works, Table 12.8.

No significant impacts on structural elements important for migrating fish species of benthic community or habitat elements are assessed for either of the fixed link alternatives. Therefore, the construction of the fixed link will have no significant impact on migrating Annex II species or important food sources – as sandeels and shallow water fish communities, Figure 7.13 - for marine mammals or waterbirds.

Table 12.8 Comparison of tunnel and bridge alternatives in relation to the degree of impact for protected fish species or fish communities.

1110 Sandbanks	Bridge alternative	Immersed tunnel alternative	Bored tunnel alternatives
Degree of impact	No significant impact. No significant changes in structural functionality due to spilled sediment. There is no net deposition of sediment is the SCI areas along the west coast of Lolland outside or inside Nakskov Fjord. The maximum average concentration of suspended sediment will only exceed the threshold of 10 mg/l, insignificantly impacting the migration of fish, in less than 5% of the time.	No significant impact. No significant changes in structural functionality due to spilled sediment. Net disposition of less than 10 mm, which is far below the indicative threshold limit of 50 mm impacting growth of benthic vegetation The maximum average concentration of suspended sediment will occasionally, in less than 5% of the time, be more than 50 mg/l insignificantly impacting migration of spawning of migratory species.	No significant impact. No significant changes in structural functionality due to spilled sediment. Net disposition of less than 1 mm, which is far below the indicative threshold limit of 50 mm impacting growth of benthic vegetation. The concentration of suspended sediment will not exceed 10 mg/l in more than 10% of the time insignificantly impacting migration of spawning of migratory species..
Significance of impact	Impacts Non-significant	Impacts Non-significant	Impacts Non-significant

12.3 SPA DK 006X088 Nakskov Fjord and Inderfjord (Nakskov Fjord og Inderfjord)

Table 12.9 Extracted table from the standard data forms.

Code	Species	Group	Connected to marine habitats? Impact possible?	Breed	Winter	Stage	Birds listed in Annex I?
A038	Whooper Swan *Cygnus cygnus*	Swans	Yes		< 700 i		Yes
A081	Marsh Harrier *Circus aeruginosus*	Birds of prey	No, not assessed	2 – 4 p			Yes
A132	Avocet *Recurvirostra avosetta*	Waders	Yes	30 p			Yes
A191	Sandwich Tern *Sterna sandvicensis*	Terns	Yes	0 – 62 p			Yes
A193	Common Tern *Sterna hirundo*	Terns	Yes	20 p			Yes
A194	Arctic Tern *Sterna paradisea*	Terns	Yes	225 p			Yes
A195	Little Tern *Sterna albifrons*	Terns	Yes	40 p			Yes
A036	Mute Swan *Cygnus olor*	Swans	Yes			< 8,000 i	No
A039	Bean Goose *Anser fabalis*	Geese	Yes		640 – 2,230 i		No
A061	Tufted Duck *Aythya fuligula*	Ducks	Yes		< 12,000 i		No
A069	Red-breasted Merganser *Mergus serrator*	Mergansers	Yes			< 500 i	No
A125	Common coot *Fulica atra*	Rails	Yes			< 19,000 i	No
A149	Dunlin *Calidris alpina*	Waders	Yes, but not assessed	1 – 2 p			No

Furthermore in the last ten years the following Annex-I-species were observed resting or feeding within the area by voluntary bird watchers (in brackets no. of individuals, double-sightings cannot be excluded): Alcedo atthis (3), Anser erythropus (2), Ardea alba (2), Asio flammeus (16), Aythya nyroca (1), Botaurus stellaris (12), Branta leucopsis (233.038), Branta ruficollis (1), Chlidonias niger (21), Ciconia ciconia (1), Circus cyaneus (38), Circus pygargus (1), Egretta garzetta (1), Falco columbarius (7), Falco peregrinus (8), Falco vespertinus (2), Grus grus (6), Haliaeetus albicilla (131), Lanius collurio (13), Larus melanocephalus (5), Limosa lapponica (83), Milvus milvus (16), Pandion haliaetus (42), Platalea leucorodia (1), Philomachus pugnax (40), Pluvialis apricaria (73.610), Podiceps auritus (1), Tadorna ferruginea (1), Tringa glareola (12)

12.3.1 Swans

12.3.1.1 Conservation subject/ objective: A036 Mute Swan (*Cygnus olor*) and A038 Whooper Swan (*Cygnus cygnus*)

Up to 700 wintering Whooper Swans and 8,000 staging Mute Swans are listed in standard data form. Data from DOF database (DOF 2010) show in January regularly flocks of up to 900 Whooper Swans in the area. The maximum number of observed Mute Swans was 2415 individuals in one flock in November 2009 (DOF 2010).

12.3.1.2 Description of detailed conservation objectives

Table 15.2 Defining the potential impact factors of bridge and tunnel alternative (caused by construction) affecting A036 Mute Swan (*Cygnus olor*) and A038 Whooper Swan (*Cygnus cygnus*)

Bridge	Construction
Potential impact factors	Temporary change in density due to changed food supply and reduced visibility due to dredging and sediment Spillage
Level of impact	No significant impact
Immersed and bored tunnel	Construction
Potential impact factors	Temporary change in density due to changed food supply and reduced visibility due to dredging and sediment spillage
Level of impact	No significant impact

12.3.1.3 Impacts on A036 Mute Swan *(Cygnus olor*) and A038 Whooper Swan (*Cygnus cygnus*) caused by bridge alternative

Construction related impacts

Habitat changes may result from sediment spill, which can affect the benthic communities as this increases light attenuation caused by increase in concentration of suspended matter. Especially eelgrass may be impaired and productivity reduced due to increased light attenuation. Only insignificant reductions in light availability will be present during the construction of the bridge, Figure 7.6, and the benthic vegetation will not be impacted or reduced in biomass, Figure 7.7.

Overall estimation of impact of the conservation subject/ objective

No reductions in benthic vegetation within the SPA will be the result of the construction of the bridge alternative and hence impacts on the swans in the SPA can be excluded.

Conclusion

There will be no significant impact for swans in this SPA for a bridge alternative.

Estimation of the relevance of other plans and projects

No other plans or projects are foreseen to affect swans in this SPA.

12.3.1.4 Impacts on A036 Mute Swan (*Cygnus olor*) and A038 Whooper Swan (*Cygnus cygnus*) caused by immersed tunnel alternative

Construction related impacts

Habitat changes may result from sediment spill, which can affect the benthic communities as this increases light attenuation caused by increase in concentration of suspended matter. Especially eelgrass may be impaired and productivity reduced due to increased light attenuation. Modelling shows for the outer parts of SPA Nakskov Fjord maximum sedimentation rates of 2-10 mm for tunnel alternative, Figure 7.3. Due to the low sedimentation rate at this site, no significant impacts will take place, Figure 7.7, Figure 7.12.

Conclusion

There will be no significant impact for swans in this SPA for a tunnel alternative.

Estimation of the relevance of other plans and projects

No other plans or projects will significantly impact swans in this SPA.

12.3.1.5 Impacts on *A036 Mute Swan (*Cygnus olor*) and *A038 Whooper Swan (*Cygnus cygnus*) caused by the bored tunnel alternative

Construction related impacts

Habitat changes may result from sediment spill, which can affect the benthic communities as this increases light attenuation caused by increase in concentration of suspended matter. Especially eelgrass may be impaired and productivity reduced due to increased light attenuation. The reduction in light availability and the reduction in biomass of benthic flora will be less than for the immersed tunnel alternative due to lower sedimentation rates; Figure 7.6 and Figure 7.10 at this site and no significant effects on benthic flora and thus no significant impacts on food availability for swans will take place (FEBI, 2013b; FEMA, 2013d).

Structure related impacts

There will be no significant structure related impacts.

Operation related impacts

There will be no significant operation related impacts.

12.3.1.6 Overall estimation of impact of the conservation subject/ objective

Impacts will not be significant for these species.

Estimation of the relevance of other plans and projects

There is no present knowledge of plans or projects, which will affect swans in this SPA.

Conclusion

Both, a bridge and tunnel alternatives for a fixed link would only result in minor effects on swans in this SPA. Due to the high distance to the alignment, no significant impacts from construction work will take place.

Table 12.10 Comparison of the impacts on A036 Mute Swan (*Cygnus olor*) and A038 Whooper Swan (*Cygnus cygnus*) caused by bridge and tunnel alternatives

A036 Mute Swan (*Cygnus olor*) and A038 Whooper Swan (*Cygnus cygnus*)	Bridge alternative	Immersed tunnel alternative	Bored tunnel alternative
Degree of impact	Low degree	Low degree	Low degree
Significance of impact	Impacts non-significant	Impacts non-significant	Impacts non-significant

12.3.2 Waders

12.3.2.1 Conservation subject/ objective: A132 Avocet (*Recurvirostra avosetta*) and A149 Dunlin (*Calidris alpina*)

Thirty breeding pairs of Avocets and one to two breeding pairs of Dunlins are listed in standard data form. Breeding bird data from the Dansk Ornitologisk Forening (DOF) from 2009 showed still 23 breeding pairs of Avocets, but breeding Dunlins were no longer found (Miljøcenter unpub.).

12.3.2.2 Description of detailed conservation objectives

Table 12.11 Defining the potential impact factors of bridge and tunnel alternative (caused by construction, structure, operation) affecting A132 Avocet (*Recurvirostra avosetta*) and A149 Dunlin (*Calidris alpina*)

Bridge	Construction	Structure
Potential impact factors	Temporary change in density due to changed food supply and reduced visibility due to dredging and sediment spillage	Permanent change in density due to changed distribution of food supply due to changed seabed morphology
Level of impact	No significant impact	No significant impact
Tunnel alternatives	Construction	Structure
Potential impact factors	Temporary change in density due to changed food supply and reduced visibility due to dredging and sediment spillage	Permanent change in density due to changed distribution of food supply due to changed seabed morphology
Level of impact	No significant impact	No significant impact

12.3.2.3 Impacts on A132 Avocet (*Recurvirostra avosetta*) and A149 Dunlin (*Calidris alpina*) caused by bridge alternative

Construction related impacts

Habitat changes may result from sediment spill, which can affect food sources for Avocets and Dunlins such as benthic fauna and small fish. Modelling shows no significant changes in shallow water benthic fauna or the habitat suitability of shallow water fish communities outside the alignment, Figure 7.11and Figure 7.13; due to sedimentation. Thus, no significant impacts on food resources or populations of Avocets and Dunlins will take place.

Overall estimation of impact of the conservation subject/ objective

No significant impact for these species.

Estimation of the relevance of other plans and projects

There is no knowledge of plans or projects, which will affect waders in this SPA.

12.3.2.4 Impacts on A132 Avocet (*Recurvirostra avosetta*) and A149 Dunlin (*Calidris alpina*) caused by immersed tunnel alternative

Construction related impacts

Habitat changes may result from sediment spill, which can affect food sources for Avocets and Dunlins such as benthic fauna and small fish. Modelling shows no significant changes in shallow water benthic fauna or the habitat suitability of shallow water fish communities outside the alignment, Figure 7.9, Figure 7.11 and Figure 7.13; due to sedimentation. Thus, no significant impacts on food resources or populations of Avocets and Dunlins will take place.

Overall estimation of impact of the conservation subject/ objective

No significant impact will take place for these species.

Estimation of the relevance of other plans and projects

No other plans or projects are foreseen to affect waders in this SPA.

12.3.2.5 Impacts on *A132 Avocet (*Recurvirostra avosetta*) and *A149 Dunlin (*Calidris alpina*) caused by the bored tunnel alternative

Construction related impacts

Habitat changes may result from sediment spill, which could potentially affect the benthic communities. Due to low sedimentation rate (FEHY, 2013) at this site no significant impacts will take place.

Structure and operation related impacts

There will be no significant structure related impacts.

Overall estimation of impact of the conservation subject/ objective

No significant impact will take place for these species.

Estimation of the relevance of other plans and projects

There is no present knowledge of plans or projects, which will affect waders in this SPA.

12.3.2.6 Overall estimation of impact of the conservation subject/ objective

Both, a bridge and tunnel alternatives for a fixed link would only result in insignificant effects on breeding Avocet and Dunlin in this SPA, due to changes in shallow water benthic fauna communities and in the habitat suitability for shallow water fish communities (FEBI, 2013b).

Table 12.12 Comparison of the impacts on A132 Avocet (*Recurvirostra avosetta*) and A149 Dunlin (*Calidris alpina*) caused by bridge and tunnel alternatives

A132 Avocet (*Recurvirostra avosetta*) and A149 Dunlin (*Calidris alpina*)	Bridge alternative	Immersed tunnel alternative	Bored tunnel alternative
Degree of impact	Low-still tolerable degree of impact.	Low-still tolerable degree of impact.	Low-still tolerable degree of impact.
Significance of impact	Impacts non-significant	Impacts non-significant	Impacts non-significant

12.3.3 Terns

12.3.3.1 Conservation subject/ objective: A191 Sandwich Tern (*Sterna sandvicensis*), A193 Common Tern (*Sterna hirundo*), A194 Arctic Tern (*Sterna paradisea*) and A195 Little Tern (*Sterna albifrons*)

The standard data form lists up to 62 breeding pairs of Sandwich Tern, 20 pairs of Common Tern, 225 pairs of Arctic Tern and 40 breeding pairs of Little Tern for this area. The DOF breeding bird survey from 2009 provided no longer breeding pairs of Sandwich and Common Tern for this area and just 100 breeding pairs of Arctic Tern and 5 pairs of Little Tern (Miljøcenter unpub.).

Table 12.13 Defining the potential impact factors of bridge and tunnel alternative (caused by construction and structure) affecting A191 Sandwich Tern (*Sterna sandvicensis*), A193 Common Tern (*Sterna hirundo*), A194 Arctic Tern (*Sterna paradisea*) and A195 Little Tern (*Sterna albifrons*)

Bridge	Construction	Structure
Potential impact factors	Temporary change in density due to changed food supply and reduced visibility due to dredging and sediment spillage	Permanent change in density due to changed distribution of food supply due to changed hydrographical regime
Level of impact	No significant impact	No significant impact
Potential impact factors		Permanent change in density due to changed distribution of food supply due to changed seabed morphology
Level of impact		No impact
Immersed and bored tunnel	Construction	Structure
Potential impact factors	Temporary change in density due to changed food supply and reduced visibility due to dredging and sediment spillage	Permanent change in density due to changed distribution of food supply due to changed hydrographical regime
Level of impact	No significant impact	No significant impact
Potential impact factors		Permanent change in density due to changed distribution of food supply due to changed seabed morphology
Level of impact		No significant impact

12.3.3.2 Impacts on A191 Sandwich Tern (*Sterna sandvicensis*), A193 Common Tern (*Sterna hirundo*), A194 Arctic Tern (*Sterna paradisea*) and A195 Little Tern (*Sterna albifrons*) caused by bridge alternative

Construction related impacts

Habitat changes could potentially result from sediment spill, which can affect food sources for terns such as fish communities and the water transparency, which is of importance for foraging terns. Significant effects on habitat suitability for fish communities in this SPA, even in the worst-case scenario, will, however, according to the assessment not take place, Figure 7.13 and no significant changes in water transparency will be the result of construction activities, Figure 7.6.

Conclusion

There will be no significant impact on terns in this SPA for a bridge alternative.

Estimation of the relevance of other plans and projects

There is no knowledge of plans or projects, which will affect terns in this SPA.

12.3.3.3 Impacts on A191 Sandwich Tern (*Sterna sandvicensis*), A193 Common Tern (Sterna hirundo), A194 Arctic Tern (*Sterna paradisea*) and A195 Little Tern (*Sterna albifrons*) caused by immersed tunnel alternative

Construction related impacts

Habitat changes could potentially result from sediment spill, which can affect food sources for terns such as fish communities and the water transparency, which is of importance for foraging terns. Significant effects on habitat suitability for fish communities in this SPA will however according to the assessment not take place, Figure 7.13, and only negligible but no significant changes in water transparency affecting terns will be the result of construction activities, Figure 7.6 (FEBI, 2013b).

Conclusion

Significant impact on terns can be excluded in this SPA for a tunnel alternative

Estimation of the relevance of other plans and projects

No other plans or projects will affect terns in this SPA.

12.3.3.4 Impacts on A191 Sandwich Tern (*Sterna sandvicensis*), *A193 Common Tern (*Sterna hirundo*), *A194 Arctic Tern (*Sterna paradisea*) and *A195 Little Tern (*Sterna albifrons*) caused by a bored tunnel

Construction related impacts

Habitat changes could potentially result from sediment spill, which can affect food sources for terns such as fish communities and the water transparency, which is of importance for foraging terns. Significant effects on habitat suitability for fish communities in this SPA, even in the worst-case scenario, will however according to the assessment not take place, Figure 7.13 and no significant changes in water transparency will be the result of construction activities, Figure 7.6.

Structure and operation related impacts

No significant impacts will take place.

12.3.3.5 Overall estimation of impact of the conservation subject/objective

There will be no significant impact on terns

Estimation of the relevance of other plans and projects

There is no present knowledge of plans or projects, which will affect terns in this SPA.

Table 12.14 Comparison of the impacts on A191 Sandwich Tern (*Sterna sandvicensis*), A193 Common Tern (*Sterna hirundo*), A194 Arctic Tern (*Sterna paradisea*) and A195 Little Tern (*Sterna albifrons*) caused by bridge and tunnel alternative.

A191 Sandwich Tern (*Sterna sandvicensis*), A193 Common Tern (*Sterna hirundo*), A194 Arctic Tern (*Sterna paradisea*) and A195 Little Tern (*Sterna albifrons*)	Bridge alternative	Immersed tunnel alternatives	Bored tunnel alternatives
Degree of impact	Low degree.	Low degree	Low degree
Significance of impact	Impacts non-significant	Impacts non-significant	Impacts non-significant

Conclusion

Both, a bridge and tunnel alternatives for a fixed link would only result in minor and negligible effects on breeding terns in this SPA. Due to the high distance to the alignment, and no significant effects on fish communities or water transparency there will be no significant impacts from construction work.

12.3.4 Ducks

12.3.4.1 Conservation subject/ objective: A061 Tufted Duck (*Aythya fuligula*)

Up to 12,000 wintering Tufted Ducks are listed in standard data form. Data from DOFbasen show especially in February and March 2006 regularly flocks of 6000 till 8,000 birds. In other years, flocks up to 4,000 birds were seen (DOFbasen unpub.).

12.3.4.2 Description of detailed conservation objectives

Table 12.15 Defining the potential impact factors of bridge and tunnel alternative (caused by construction and structure) affecting A061 Tufted Duck (*Aythya fuligula*)

Bridge	Construction	Structure
Potential impact factors	Temporary change in density due to changed food supply and reduced visibility due to dredging and sediment spillage	Permanent change in density due to changed distribution of food supply due to changed hydrographical regime
Level of impact	No significant impact	No significant impact
Potential impact factors		Permanent change in density due to changed distribution of food supply due to changed seabed morphology

Bridge	Construction	Structure
Level of impact		No impact
Immersed and bored tunnel	Construction	Structure
Potential impact factors	Temporary change in density due to changed food supply and reduced visibility due to dredging and sediment spillage	Permanent change in density due to changed distribution of food supply due to changed hydrographical regime
Level of impact	No significant impact	No significant impact
Potential impact factors		Permanent change in density due to changed distribution of food supply due to changed seabed morphology
Level of impact		No significant impact

12.3.4.3 Impacts on A061 Tufted Duck (*Aythya fuligula*) caused by bridge alternative

Construction related impacts

Habitat changes could potentially result from sediment spill, which can affect the benthic communities. Due to low sedimentation rate modelling at this site, Figure 7.4 no significant impacts on neither benthic fauna nor vegetation communities used for foraging Tufted Ducks will take place, Figure 7.7, Figure 7.10 and Figure 7.11.

Estimation of the relevance of other plans and projects

There is no knowledge of plans or projects, which will affect Tufted Ducks in this SPA.

12.3.4.4 Impacts on A061 Tufted Duck (*Aythya fuligula*) caused by tunnel alternative

Construction related impacts

Habitat changes could potentially result from sediment spill, which can affect the benthic communities. Due to low sedimentation rate modelling at this site, Figure 7.3 no significant impacts on neither benthic fauna nor vegetation communities used for foraging Tufted Ducks will take place, Figure 7.7, Figure 7.9, Figure 7.10, Figure 7.11 and Figure 7.12 will take place.

Overall estimation of impact of the conservation subject/ objective

There will be no significant impact on Tufted Duck in this SPA for an immersed tunnel alternative.

Estimation of the relevance of other plans and projects

There is no knowledge of plans or projects, which will affect Tufted Ducks in this SPA.

12.3.4.5 Impacts on A061 Tufted Duck (*Aythya fuligula*) caused by the bored tunnel alternative

Construction related impacts

Habitat changes may result from sediment spill, which can affect the benthic communities (FEMA, 2013c; FEMA, 2013d). Predicts no significant impacts concerning benthic flora and fauna. Thus, no significant impacts will take place Tufted Ducks.

Structure related impacts

Structures will not significantly affect Tufted Ducks.

Operation related impacts

No operation related activities will significantly affect Tufted Ducks.

12.3.4.6 Overall estimation of impact of the conservation subject/ objective

There will be no significant impact on Tufted Duck in this SPA.

Estimation of the relevance of other plans and projects

There is no present knowledge of plans or projects, which will affect Tufted Ducks in this SPA.

Table 12.16 Comparison of the impacts on A061 Tufted Duck (*Aythya fuligula*) caused by bridge and tunnel alternative.

A061 Tufted Duck (*Aythya fuligula*)	Bridge alternative	Immersed tunnel alternative	Bored tunnel alternative
Degree of impact	Low-still tolerable degree of impact.	Low-still tolerable degree of impact.	Low-still tolerable degree of impact.
Significance of impact	Impacts non-significant	Impacts non-significant	Impacts non-significant

Conclusion

Both, a bridge and tunnel alternatives for a fixed link would only result in minor effects on Tufted Ducks in this SPA. Due to the high distance to the alignment, there will be no significant impacts from construction work.

12.3.5 Mergansers

12.3.5.1 Conservation subject/ objective: A069 Red-breasted Merganser *(Mergus serrator)*

In standard data form, 500 staging Red-breasted Mergansers are listed. Data from DOF database from the last ten years show just one aggregation with 175 individuals in December 2005. Since then no flock with more than 75 birds was recorded (DOF 2010).

12.3.5.2 Description of detailed conservation objectives

Table 12.17 Defining the potential impact factors of bridge and tunnel alternative (caused by construction and structure) affecting A069 Red-breasted Merganser (*Mergus serrator)*

Bridge	Construction	Structure
Potential impact factors	Temporary change in density due to changed food supply and reduced visibility due to dredging and sediment spillage	Permanent change in density due to changed distribution of food supply due to changed hydrographical regime
Level of impact	No significant impact	No significant impact
Potential impact factors		Permanent change in density due to changed distribution of food supply due to changed seabed morphology
Level of impact		No significant impact
Immersed tunnel	Construction	Structure
Potential impact factors	Temporary change in density due to changed food supply and reduced visibility due to dredging and sediment spillage	Permanent change in density due to changed distribution of food supply due to changed hydrographical regime
Level of impact	No significant impact	No significant impact
Potential impact factors		Permanent change in density due to changed distribution of food supply due to changed seabed morphology
Level of impact		No significant impact

12.3.5.3 Impacts on A069 Red-breasted Merganser (*Mergus serrator)* caused by all 3 alternatives

Construction related impacts

Habitat changes could potentially result from sediment spill, which can affect fish and benthic communities and reduce visibility for foraging Red-breasted mergansers. However, no significant effects on habitat suitability for fish communities in this SPA will take place, Figure 7.13. Although, the coastal areas are of high importance for Red-breasted mergansers, even in the worst-case scenario there will be no significant impact on the population of this species due to decreased water transparency, Figure 7.15 (FEBI, 2013b).

Overall estimation of impact of the conservation subject/ objective

Impacts will not be significant for these species.

Table 12.18 Comparison of the impacts on A069 Red-breasted Merganser (*Mergus serrator)* caused by bridge and tunnel alternative

A069 Red-breasted Merganser (*Mergus serrator)*	Bridge alternative	Immersed tunnel alternatives	Bored tunnel alternatives
Degree of impact	Low degree	Low degree	Low degree
Significance of impact	Impacts non-significant	Impacts non-significant	Impacts non-significant

Conclusion

Both, a bridge and a tunnel alternative for a fixed link would only result in minor effects on Red-breasted Merganser in this SPA. Due to the high distance to the alignment, no direct impacts from construction work will take place.

12.3.6 Coots

12.3.6.1 Conservation subject/ objective: A125 Common Coot (*Fulica atra*)

In standard data form, 19,000 staging Common Coots are listed. In DOFbasen, maximum numbers up to 6.100 birds are recorded from the last ten years (DOFbasen unpub.).

12.3.6.2 Description of detailed conservation objectives

Table 12.19 Defining the potential impact factors of bridge and tunnel alternative (caused by construction, structure, operation) affecting A125 Common Coot (*Fulica atra*)

Bridge	Construction	Structure
Potential impact factors	Temporary change in density due to changed food supply and reduced visibility due to dredging and sediment spillage	Permanent change in density due to changed distribution of food supply due to changed hydrographical regime
Level of impact	No significant impact	No significant impact
Immersed and bored tunnel	Construction	Structure
Potential impact factors	Temporary change in density due to changed food supply and reduced visibility due to dredging and sediment spillage	Permanent change in density due to changed distribution of food supply due to changed hydrographical regime
Level of impact	No significant impact	No significant impact

12.3.6.3 Impacts on A125 Common Coot (*Fulica atra*) caused by all three alternatives

Construction related impacts

Habitat changes could potentially result from sediment spill, which can affect the benthic communities. Modelling provides however an assessment where no significant impacts on food resources for the Common Coot – which means reduction in biomass of the benthic vegetation - will take place, Figure 7.7.

Conclusion

No significant impact for Common Coot will take place in this SPA for the three alternatives.

Estimation of the relevance of other plans and projects

There is no knowledge of plans or projects, which will affect Common Coot in this site.

Table 12.20 Comparison of the impacts on A125 Common Coot (*Fulica atra*) caused by bridge and tunnel alternatives

A125 Common Coot (*Fulica atra*)	Bridge alternative	Immersed tunnel alternative	Bored tunnel alternative
Degree of impact	Low-still tolerable degree of impact.	Low-still tolerable degree of impact.	Low-still tolerable degree of impact.
Significance of impact	Impacts non-significant	Impacts non-significant	Impacts non- significant

Conclusion

Both, a bridge and tunnel alternatives for a fixed link would only result in minor effects on Common Coot in this SPA. Due to the high distance to the alignment, no direct impacts from construction work will take place.

13 Conclusions

The report describes the results of a screening identifying the potential impact on Natura 2000 sites from construction of a fixed link between Denmark and Germany across the Fehmarnbelt. The screening covers the project in itself as well as the impact from the project in connection with other projects and plans. The screening further considers whether significant impacts can be excluded. The screening is assessing a bridge, a bored tunnel, and an immersed tunnel alternative.

The screening concerns five Danish areas designated under the Habitats Directive and three Danish areas designated under the Bird Protection Directive. The sites constitute in total 5 Natura 2000 areas. All sites are situated outside the area of the construction work for the fixed link.

Table 13.1 - Table 13.6 summarise the results from the screening. Table 13.1 - Table 13.3 describe the likely impacts on a short-term basis, and table Table 13.4 - Table 13.6 show the potential permanent impact. One main finding is that a significant impact on any of the prioritised habitats and species, listed in the annexes of the Habitats Directive, can be excluded. Except for N2000 173, all Natura 2000 sites potential affected by the construction of the Fehmarnbelt Fixed Link significant impact on the structural function or habitats or species listed in the standard data form for the sites can be excluded.

In the present screening short term is understood as the construction work period. Long term is understood as the operational phase after ending of construction work. Naturally, there will be a time delay after the construction activity is finished, before a new stable situation is reached for habitats and species. The time it will take to reach the new stable situation will depend on the conditions and details of the actual construction works. The meaning of “short term” and “long term” is described in further detail in the present screening. The main potential impact during construction consists of sediment spill reducing the growth of eelgrass and algae, because of reduced light penetration and temporary increases in sedimentation. The reduction in vegetation growth conditions will peak in the first year and decline thereafter. It is foreseen that within a shorter period, corresponding to a few years, full regeneration of vegetation will have taken place.

It is evaluated that eelgrass biomass at the end of the growth season of the first and second year of the tunnel constructions (2015 and 2016) can be reduced up to 20 % in the Rødsand Lagoon (part of N2000 site; Smålandsfarvandet N2000 173). In the following growth seasons (2017-2019) the eelgrass biomass recovers. Another smaller reduction of eelgrass will take place at the end of the construction phase in 2020, but in both cases recovery will take place inside a few years. For macro algae (associated especially with reefs) reduction in minor areas in both the indicated time periods could be up to 30 %, but again recovery will take place inside a few years’ time. It should be noted that for the sites Hyllekrog-Rødsand, Maribo Lakes and Nakskov Fjord covered by the present screening, the designation of the Natura 2000 sites under the Habitats and Birds Directives (SCIs and SPAs, respectively) uses the same boundaries. For this reason, the SCI and the SPA are treated together in the summary tables for these three areas.

In relation to the screening there has on the one hand been found some gaps and uncertainties in the available information, but on the other hand the work related to the EIA process has in several cases led to improved data concerning the distribution of habitats and species.

During seabed mapping, conducted in relation to the baseline process, deviations have been found in the distribution of habitats compared to the official maps used for reporting to the European Commission. The evaluation has been based on the latest available information on distribution based to a large extent on the investigations conducted in relation to the Fehmarn project. Knowledge on the barrier effect for birds, fish species and mammals of the fixed link is

somewhat limited because limited research has been focused on these aspects. This concerns naturally mainly a bridge alternative for the fixed link.

In relation to impact on coastal morphology, this is regarded as non-significant for both the immersed tunnel and the bored tunnel.

It should be emphasized that whenever there have been uncertainties in relation to lack of knowledge on potential impacts, a conservative approach has been used. This implies that evaluation and conclusions are based on the worst potential impact for the affected habitats and species (worst-case scenario). This follows the precautionary principle stressed by the EU Commission to be used in such cases.

Table 13.1 Table showing summary of screening results for the **bridge** alternative. The table covers likely impacts in **the period of construction work.** Explanation to the table: N-S = Non-significant, S = Significant impact cannot be excluded, N-R = not relevant. The results in the table are further described in the text.

	SCI DK 006X238 Hyllekrog-Rødsand et al (Smålandsfarvandet North of.....) and SPA DK 006X083 Coastal Zone Hyllekrog Rødsand	SCI DK 00VA200 Stone Reef Southeast of Langeland	SCI DK VA00260 Fehmarn Belt	SCI DK 006X087 Maribo Lakes and SPA DK 006X087 Maribo Lakes	SCI 006X242 Nakskov Fjord and SPA DK 006X088 Nakskov Fjord
1110 Sandbanks					
Marine biology	N-S	N-R	N-S	N-R	N-S
Fish species	N-S				
1140 Mudflats					
Marine biology	N-S	N-R	N-R	N-R	N-S
Fish species	N-S				
1150 Lagoons					
Marine biology	N-R	N-R	N-R	N-R	N-S
1160 Inlets and bays					
Marine biology	N-S	N-R	N-R	N-R	N-S
Fish species	N-S				
1170 Reefs					
Marine biology	N-S	N-S	N-S	N-R	N-S
Fish species	N-S				
1364 Grey Seal					
Mammals	N-S	N-R	N-R	N-R	N-R
1365 Harbour Seal					
Mammals	N-S	N-R	N-S	N-R	N-R
1351 Harbour Porpoise					
Mammals	N-S	N-S	N-S	N-R	N-S
Bird species	N-S	N-R	N-R	N-S	N-S
Fish species	N-S	N-S	N-R	N-S (1149)	N-S

Table 13.2 Table showing summary of screening results for the **immersed tunnel** alternative. The table covers the **likely impact in the construction period.** Explanation to the table: N-S = Non-significant, S = Significant impact cannot be excluded, N-R = not relevant. The results in the table are further described in the text.

	SCI DK 006X238 Hyllekrog-Rødsand et al (Smålandsfarvandet North of.....) and SPA DK 006X083 Coastal Zone Hyllekrog Rødsand	SCI DK 00VA200 Stone Reef Southeast of Langeland	SCI DK VA00260 Fehmarn Belt	SCI DK 006X087 Maribo Lakes and SPA DK 006X087 Maribo Lakes	SCI 006X242 Nakskov Fjord and SPA DK 006X088 Nakskov Fjord
1110 Sandbanks	N-S	N-R	N-S	N-R	N-S
Marine biology	N-S				
Fish species					
1140 Mudflats					
Marine biology	N-S	N-R	N-R	N-R	N-S
Fish species	N-S				
1150 Lagoons					
Marine biology	N-R	N-R	N-R	N-R	N-S
1160 Inlets and bays					
Marine biology	S	N-R	N-R	N-R	N-S
Fish species	N-S				
1170 Reefs					
Marine biology	S	N-S	N-S	N-R	N-S
Fish species	N-S				
1364 Grey Seal					
Mammals	N-S	N-R	N-R	N-R	N-R
1365 Harbour Seal					
Mammals	N-S	N-R	N-S	N-R	N-R
1351 Harbour Porpoise					
Mammals	N-S	N-S	N-S	N-R	N-S
Bird species	S	N-R	N-R	N-S	N-S
Fish species	N-S	N-S	N-R	N-S	N-S

Table 13.3 Table showing summary of screening results for the **bored tunnel** alternative. The table covers the **likely impact in the construction period.** Explanation to the table: N-S = Non-significant, S = Significant impact cannot be excluded, N-R = not relevant. The results in the table are further described in the text.

	SCI DK 006X238 Hyllekrog-Rødsand et al (Smålandsfarvandet North of.....) and SPA DK 006X083 Coastal Zone Hyllekrog Rødsand	SCI DK 00VA200 Stone Reef Southeast of Langeland	SCI DK VA00260 Fehmarn Belt	SCI DK 006X087 Maribo Lakes and SPA DK 006X087 Maribo Lakes	SCI 006X242 Nakskov Fjord and SPA DK 006X088 Nakskov Fjord
1110 Sandbanks					
Marine biology	N-S	N-R	N-S	N-R	N-S
Fish species	N-S				
1140 Mudflats					
Marine biology	N-S	N-R	N-R	N-R	N-S
Fish species	N-S				
1150 Lagoons					
Marine biology	N-R	N-R	N-R	N-R	N-S
1160 Inlets and bays					
Marine biology	S	N-R	N-R	N-R	N-S
Fish species	N-S				
1170 Reefs					
Marine biology	S	N-S	N-S	N-R	N-S
Fish species	N-S				
1364 Grey Seal					
Mammals	N-S	N-R	N-R	N-R	N-R
1365 Harbour Seal					
Mammals	N-S	N-R	N-S	N-R	N-R
1351 Harbour Porpoise					
Mammals	N-S	N-S	N-S	N-R	N-S
Bird species	S	N-R	N-R	N-S	N-S
Fish species	N-S	N-S	N-R	N-S (1149)	N-S

Table 13.4 Table showing summary of screening results for the **bridge** alternative. The table covers **the likely impact on a long-term basis.** Explanation to the table: N-S = Non-significant, S = Significant impact cannot be excluded, N-R = not relevant. The results in the table are further described in the text.

	SCI DK 006X238 Hyllekrog-Rødsand et al (Smålandsfarvandet North of.....) and SPA DK 006X083 Coastal Zone Hyllekrog Rødsand	SCI DK 00VA200 Stone Reef Southeast of Langeland	SCI DK VA00260 Fehmarn Belt	SCI DK 006X087 Maribo Lakes and SPA DK 006X087 Maribo Lakes	SCI 006X242 Nakskov Fjord and SPA DK 006X088 Nakskov Fjord
1110 Sandbanks	N-S	N-R	N-S	N-R	N-S
Marine biology	N-S				
Fish species					
1140 Mudflats					
Marine biology	N-S	N-R	N-R	N-R	N-S
Fish species	N-S				
1150 Lagoons					
Marine biology	N-R	N-R	N-R	N-R	N-S
1160 Inlets and bays	N-S				
Marine biology	N-S	N-R	N-R	N-R	N-S
Fish species					
1170 Reefs					
Marine biology	N-S	N-S	N-S	N-R	N-S
Fish species	N-S				
1364 Grey Seal					
Mammals	N-S	N-R	N-R	N-R	N-R
1365 Harbour Seal					
Mammals	N-S	N-S	N-R	N-R	N-R
1351 Harbour Porpoise					
Mammals	N-S	N-S	N-S	N-R	N-S
Bird species	N-S	N-R	N-R	N-S	N-S
Fish species	N-S	N-S	N-R	N-S	N-S

Table 13.5 Table showing summary of screening results for the **immersed tunnel** alternative. The table covers **the likely impact on a long-term basis.** Explanation to the table: N-S = Non-significant, S = Significant impact cannot be excluded, N-R = not relevant. The results in the table are further described in the text.

	SCI DK 006X238 Hyllekrog-Rødsand et al (Smålandsfarvandet North of.....) and SPA DK 006X083 Coastal Zone Hyllekrog Rødsand	SCI DK 00VA200 Stone Reef Southeast of Langeland	SCI DK VA00260 Fehmarn Belt	SCI DK 006X087 Maribo Lakes and SPA DK 006X087 Maribo Lakes	SCI 006X242 Nakskov Fjord and SPA DK 006X088 Nakskov Fjord
1110 Sandbanks	N-S	N-R	N-S	N-R	N-S
Marine biology	N-S				
Fish species					
1140 Mudflats					
Marine biology	N-S	N-R	N-R	N-R	N-S
Fish species	N-S				
1150 Lagoons					
Marine biology	N-R	N-R	N-R	N-R	N-S
1160 Inlets and bays					
Marine biology	N- S	N-R	N-R	N-R	N-S
Fish species	N-S				
1170 Reefs					
Marine biology	N-S	N-S	N-S	N-R	N-S
Fish species	N-S				
1364 Grey Seal					
Mammals	N-S	N-R	N-R	N-R	N-R
1365 Harbour Seal					
Mammals	N-S	N-R	N-S	N-R	N-R
1351 Harbour Porpoise					
Mammals	N-S	N-S	N-S	N-R	N-S
Bird species	N- S	N-R	N-R	N-S	N-S
Fish species	N-S	N-S	N-R	N-S	N-S

Table 13.6 Table showing summary of screening results for the **bored tunnel** alternative. The table covers **the likely impact on a long-term basis.** Explanation to the table: N-S = Non-significant, S = Significant impact cannot be excluded, N-R = not relevant. The results in the table are further described in the text.

	SCI DK 006X238 Hyllekrog-Rødsand et al (Smålandsfarvandet North of.....) and SPA DK 006X083 Coastal Zone Hyllekrog Rødsand	SCI DK 00VA200 Stone Reef Southeast of Langeland	SCI DK VA00260 Fehmarn Belt	SCI DK 006X087 Maribo Lakes and SPA DK 006X087 Maribo Lakes	SCI 006X242 Nakskov Fjord and SPA DK 006X088 Nakskov Fjord
1110 Sandbanks	N-S	N-R	N-S	N-R	N-S
Marine biology	N-S				
Fish species					
1140 Mudflats					
Marine biology	N-S	N-R	N-R	N-R	N-S
Fish species	N-S				
1150 Lagoons					
Marine biology	N-R	N-R	N-R	N-R	N-S
1160 Inlets and bays					
Marine biology	N- S	N-R	N-R	N-R	N-S
Fish species	N-S				
1170 Reefs					
Marine biology	N-S	N-S	N-S	N-R	N-S
Fish species	N-S				
1364 Grey Seal					
Mammals	N-S	N-R	N-R	N-R	N-R
1365 Harbour Seal					
Mammals	N-S	N-R	N-S	N-R	N-R
1351 Harbour Porpoise					
Mammals	N-S	N-S	N-S	N-R	N-S
Bird species	N- S	N-R	N-R	N-S	N-S
Fish species	N-S	N-S	N-R	N-S	N-S

The main basis for the conclusions in the tables is, based on the assessment, whether a significant negative impact from the fixed link on designated habitats and species in the sites can be excluded. The foreseen impact may be on a short term and/or long-term basis.

The conclusions in the tables can be described as follows:

A. SCI DK 006X238 Hyllekrog-Rødsand et al (Smålandsfarvandet North of.....) and SPA DK 006X083 Coastal Zone Hyllekrog Rødsand

On short term basis

It is concluded for a number of habitats and species that a significant impact cannot be excluded for the immersed and the bored tunnel alternative.

For the bridge alternative, no significant impact has been found in the assessment. The sediment spill is considered to be on a level where the impact is non-significant, implying that an impact can be excluded.

The **habitats** affected for both tunnel alternatives are1160 Inlets and bays, and 1170 Reefs, and for the **immersed tunnel** the following **bird species** that are included in the reasons for designation of the SPA DK 006X083 Coastal Zone Hyllekrog Rødsand: A036 Mute Swan (*Cygnus olor)*, A038 Whooper Swan (*Cygnus cygnus),* A068 Smew (*Mergus albellus)*, A191 Sandwich Tern (*Sterna sandvicensis)*, A193 Common Tern (*Sterna hirundo)*, A194 Arctic Tern (*Sterna paradisea)*, A195 Little Tern (*Sterna albifrons),* A039 Bean Goose (*Anser fabalis)*, A046 Brent Goose *(Branta bernicla)*, A067 Common Goldeneye (*Bucephala clangula)*, A125 Common Coot (*Fulica atra)*, and A214 Great Cormorant (*Phalacrocorax carbo*). For the **bored tunnel** alternative the affected bird species, that are included in reasons for designation, are: A036 Mute Swan (Cygnus olor), A038 Whooper Swan (Cygnus cygnus), and A067 Common Goldeneye (Bucephala clangula).

Further bird species concerned are for the **immersed tunnel**: A069 Red-breasted Merganser (*Mergus serrator)*, A070 Goosander *(Mergus merganser),* A043 Greylag Goose *(Anser anser)*, A045 Barnacle Goose (*Branta leucopsis)*, A061 Tufted Duck (*Aythya fuligula)*, and A059 Common Pochard (*Aythya ferina*), These six bird species are included in the reasons for designation of other SPAs situated inside the larger Natura 2000 site 173 “Smålandsfarvandet North of Lolland…”. For the **bored tunnel** two additional species concerned are; A061 Tufted Duck (Aythya fuligula) and A059 Common Pochard (Aythya ferina). They are likewise included in the reasons for designation of other SPAs situated inside the larger Natura 2000 site 173 “Smålandsfarvandet North of Lolland…”

The main factor rezoning that a likely significant impact cannot be excluded in the screening is the modelled sediment spill in relation to construction work. The spill may lead to a reduction of eelgrass biomass in the habitat type “Shallow inlets and bays” because of increased light attenuation. It may also cause a reduction of algae biomass for the habitat type “Reefs”. The sediment spill may also reduce visibility and influence feeding opportunities for designated bird species. The assessments for the mentioned bird species are based on these impacts and are further described in the report.

On long term basis

It is concluded for both the **bridge** and the **immersed and bored tunnel** alternatives that a significant impact **can be excluded**. This is shown in tables Table 13.4 - Table 13.6.

Based on the screening an appropriate Natura 2000 assessment shall be conducted for this site for the immersed and for the bored tunnel alternative.

B. SCI DK 00VA200 Stone Reef Southeast of Langeland

For all habitats and species assessed, it is concluded that no significant impact is foreseen in relation to the project, i.e. a significant impact can be excluded. This concerns both the bridge and the tunnel alternatives. Based on the screening an appropriate Natura 2000 assessment shall not be conducted for this site.

C. SCI DK VA00260 Fehmarn Belt

A bridge alternative for a fixed link would only result in non-significant effects on marine mammals within this SCI. As little to no impacts from a bridge as a barrier are will take place, this would not affect the marine mammal population in this SCI. Construction works for the bridge have minor impacts on this SCI. Construction works for the tunnel alternatives, however, will cause sediment spill, which might cause a temporary displacement effect on fish, which are an important food source for porpoises. The evaluation on the impact on fish species for this site has however concluded that such a displacement is not significant. Following this, significant impact of Harbour Porpoise populations can be excluded for both the immersed and the bored tunnel alternative. For the habitats 1110 and 1170 it is concluded that no significant impact is foreseen in relation to alternatives, i.e. a significant impact can be excluded.

Based on the screening an appropriate Natura 2000 assessment shall not be conducted for this site.

D. SCI DK 006X087 Maribo Lakes and E. SPA DK 006X087 Maribo Lakes

For all habitats and species assessed, it is concluded that no significant impact is foreseen in relation to the project, i.e. a significant impact can be excluded. This concerns both the bridge and the immersed and bored tunnel alternatives. Based on the screening an appropriate Natura 2000 assessment shall not be conducted for this site.

F. SCI 006X242 Nakskov Fjord and SPA DK 006X088 Nakskov Fjord

For all habitats and species assessed, it is concluded that no significant impact is foreseen in relation to the project, i.e. a significant impact can be excluded. This concerns both the bridge and the immersed and bored tunnel alternatives. Based on the screening an appropriate Natura 2000 assessment shall not be conducted for this site.

14 Literature

The assessment is based on the following reports, scientific papers and data:

Callier, M., Weise, A., McKindsey, C. & Desrosiers, G., 2006. Sedimentation rates in a suspended mussel farm (Great-Entry Lagoon, Canada): biodeposit production and dispersion. *Mar. Ecol., Prog. Ser.*, Issue 322, p. 129–141.

Chamberlain, J., 2002. *Modelling the Environmental Impacts of Suspended Mussel (Mytilus edulis L.) Farming,* s.l.: Napier University, UK,.

Chamberlain, J. et al., 2001. Impacts of biodeposits from suspended mussel (Mytilus edulis L.) culture on the surrounding surficial sediments. *ICES J. Mar. Sci.*, Volume 58, p. 411–416.

EU, 2000. *Managing Natura 2000 sites. The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC,* Luxemburg: European Communities.

EU, 2001. *Assessment of plans and projects significantly affecting Natura 2000 sites,* Luxemburg: European Commission Environment DG.

FeBEC, 2013a. *Fish Ecology in Fehmarnbelt. Baseline Report E4TR0038,* s.l.: Femern A/S.

FeBEC, 2013b. *Fish Ecology in Fehmarnbelt. Environmental Impact assessment Report. Report no. E4TR0041 – Volume I,* s.l.: Femern A/S.

FeBEC, 2013c. *Natura 2000 Screening Report for the Danish Natura 2000 sites. Report no E4TR0062,* s.l.: Femern A/S.

FEBI, 2013a. *Fehmarnbelt Fixed Link EIA. Bird Investigations in Fehmarnbelt – Baseline. Volume I. Baseline Investigations and Evaluations. Report No. E3TR0011,* s.l.: Femern A/S.

FEBI, 2013b. *Fehmarnbelt Fixed Link EIA. Fauna and Flora – Birds. Birds of the Fehmarnbelt Area – Impact Assessment. Report No. E3TR0015,* s.l.: Femern A/S.

FEHY, 2013. *Fehmarnbelt Fixed Link EIA. Marine Soil - Impact Assessment. Sediment Spill during Construction of the Fehmarnbelt Fixed Link. Report No. E1TR0059 – Volume II,* s.l.: Femern A/S.

FEMA, 2013a. *Fehmarnbelt Fixed Link EIA. Marine Fauna and Flora – Baseline. Benthic Fauna of the Fehmarnbelt Area. Report No. E2TR0020 – Volume II,* s.l.: Femern A/S.

FEMA, 2013b. *Fehmarnbelt Fixed Link EIA. Marine Fauna and Flora – Baseline. Benthic Flora of the Fehmarnbelt Area. Report No. E2TR0020 - Volume I,* s.l.: Femern A/S.

FEMA, 2013c. *Fehmarnbelt Fixed Link EIA. Marine Fauna and Flora – Impact Assessment. Benthic Fauna of the Fehmarnbelt Area. Report No. E2TR0021 - Volume II,* s.l.: Femern A/S.

FEMA, 2013d. *Fehmarnbelt Fixed Link EIA. Marine Fauna and Flora – Impact Assessment. Benthic Flora of the Fehmarnbelt Area. Report No. E2TR0021 - Volume I,* s.l.: Femern A/S.

FEMA, 2013e. *Habitat Mapping of the Fehmarnbelt Area. Report No. E2TR0020 – Volume III,* s.l.: Femern A/S.

Femern A/S, 2013. *VVM-redegørelse for den faste forbindelse over Femern Bælt (kyst - kyst). 17 Natura 2000,* København: Femern A/S.

FEMM, 2013a. *Fehmarnbelt Fixed Link EIA. Marine Mammals - Baseline. Report no. E5TR0014,* s.l.: Femern A/S.

FEMM, 2013b. *Fehmarnbelt Fixed Link EIA. Marine Mammals – Impact assessment. Report no. E5TR0021,* s.l.: Femern A/S.

Kiørboe, T., Møhlenberg, F. & Nøhr, O., 1980. Feeding, particle selection and carbon adsorption in Mytilus edulis in different mixtures of algae and suspended bottom material. *Ophelia*, 19(2), pp. 193-205.

Kiørboe, T., Møhlenberg, F. & Nøhr, O., 1981. Effects of suspended bottom material on growth and energetics in Mytilus edulis. *Marine Biology*, Volume 61, pp. 283-288.

Lundqvist, D. P. et al., 2003. 210Pb based deposition rates in the North Sea-Baltic Sea transition - A summary. *Danish Journal of Geography*, 103(2), pp. 99-109..

Møhlenberg, F. & Riisgard, H., 1978. Efficiency of particle retention in 13 species of suspension feeding bivalves. *Ophelia*, Issue 17, pp. 239-246.

Naturstyrelsen, 2011. *Natura 2000-plan 2010-2015. Flensborg Fjord, Bredgrund og farvandet omkring Als. Natura 2000-område nr. N197. Delplan for Habitatområde H173,* s.l.: Miljøstyrelsen, Naturstyrelsen.

Naturstyrelsen, 2011. *Natura 2000-plan 2010-2015. Natura 2000-område nr. N197, Flensborg Fjord, Bredgrund og farvandet omkring Als. Delplan for Fuglebeskyttelsesområde F64 Flensborg Fjord og Nybøl Nor,* s.l.: Miljøministeriet, Naturstyrelsen.

Naturstyrelsen, 2014. *Natura 2000.* [Online]
Available at: http://naturstyrelsen.dk/naturbeskyttelse/natura-2000/

Petersen, I. et al., 2010. Landsdækkende optælling af vandfugle i Danmark, vinteren2007/2008. *Arbejdsrapport fra DMU,* p. 78.

Skov, H. et al., 1998. *Fehmarn Belt feasibility study. Investigation of Environmental Impact. Birds and marine mammals, Baseline Investigation. Technical Note, Phase 2,* s.l.: Femern AS/.

Natura 2000 basis analyses, plans and other information:

- Forslag til Natura 2000-plan 2009-2015 Stenrev sydøst for Langeland. Natura 2000-område nr. 126 (Proposal for Natura 2000 plan 2009-2015 southeast of Langeland. Nature 2000 area no. 126)
- Forslag til Natura 2000-plan 2009-2015. Smålandsfarvandet nord for Lolland, Guldborgsund, Bøtø Nor og Hyllekrog-Rødsand. Natura 2000 område nr. 173. Habitatområde H152, Fuglebeskyttelsesområde F82, F83, F85, F86. (Proposal for Natura 2000 plan 2009-2015 for Smålandsfarvandet. Nature 2000 area no. 173)
- Basisanalyse for Natura 2000 område 173, Smålandsfarvandet og Guldborgsund med kyster Miljøministeriet, By- og Landskabsstyrelsen 2010. (WFD Initial assessment for Natura 2000 area 173 Smålandsfarvandet)
- Natura 2000- Basisanalyse for området: Stenrev sydøst for Langeland, H 110 (N126). (WFD Initial assessment for Natura 2000 area H 110 Stone Reefs southeast of Langeland)
- Supplementary Natura 2000 information and maps (GIS): www.blst.dk/Natura2000plan and http://www.blst.dk/NATUREN/Natura2000plan/Natura2000omraader/Habitat/Marine_habitater/Marine_gisfiler.htm
- http://www.bfn.de/habitatmare/de/schutzgebiet-fehmarnbelt.php

Scientific literature, reports and other data:

- Arbeitskreis an der staatlichen Vogelschutzwarte (AKVSW) 2010. Internationale Wasservogelzählung Fehmarn, 16.-18.01.2009. http://www.ornithologie-hamburg.de/images/_projekte/wvz_fehmarn/fehmarn_iwz_2009_internet.pdf (accessed on September 7, 2010).
- Arndt, G.M. 2010. Fish und Umwelt www.fischumwelt.de (Pers.com.)
- Arndt, G.M.; Gessner, J.; Anders, E. (2010):
- Aktueller Stand und Perspektive für die Wiedereinbürgerung der Störe in Deutschland und Mecklenburg-Vorpommern. Fischerei & Fischmarkt in Mecklenburg-Vorpommern, 3/2010 – 10. Jahrgang, 27-37.
- Brandt,M. A. Diederichs, K. Betke & G. Nehls (in press): Responses of Harbour Porpoises (Phocoena phocoena) to pile driving at the Horns Rev II offshore wind farm in the Danish North Sea. Mar. Ecol. Prog. Ser.
- Brøker, Niemann and Sørensen (2010). FEHY, "Fehmarnbelt Fixed Link, ATR ENV010027, Hydrographic Assessment of Bridge Variant 1 vs. Basic Bridge Layout", Doc No E1TR0046, Technical Note, Hørsholm, August 2010
- Buttenschøn, R.M., Fredshavn, J., Aude, E. & Nygaard, B. 2005: Kriterier for gunstig bevaringsstatus. Naturtyper og arter omfattet af EF-habitatdirektivet & fugle omfattet af EFfuglebeskyttelsesdirektivet. 3. udgave. Danmarks Miljøundersøgelser. 462 s. - Faglig rapport fra DMU, nr. 457. http://faglige-rapporter.dmu.dk
- Cabaco, S., Santos, R. & Duarte, C.M. (2008). The impact of sediment burial and erosion on seagrasses: a review. Estuarine, Coastal and Shelf Science 79: 354-366
- Carl, H., Nielsen, J.G. & Møller, P.R. (2004). En kommenteret og revideret oversigt over danske fisk. Flora og Fauna 110(2): 29–39.
- Carstensen J, Henriksen OD, Teilmann J (2006) Impacts of offshore wind farm construction on harbour porpoises: acoustic monitoring of echolocation activity using porpoise detectors (T-PODs). Marine Ecology Progress Series 321:295-308
- Chandrasekara,W.U., Frid, C.L.J., 1998. A laboratory assessment of the survival and vertical movement of two epibenthic gastropod species: Hydrobia ulvae (Pennant) and Littorina littorea (Linnaeus), after burial. J. Exp. Mar. Biol. Ecol. 221, 191–207.
- Clausager Rasmussen, P. 2003. Stamsild i Randers Fjord, 2003. The County of Aarhus 2004, ISBN 87-7906-288-1.
- Dahl, J., 1961. Sabelkarpe (Pelecus cultratus (L.)) første gang i Danmark. – 67: 163-164
- Danmarks Miljøportal 2010. Data from FiskBase.
- Dansk Ornitologisk Forening (DOF) (unpubl.) 2010. http://www.dofbasen.dk. Data from Nakskov Fjord, Hyllekro-Rødsand, Maribosøerne, Smålandsfarvandet nord for Lolland, Guldborg Sund, Bøtø Nor (accessed on October 6, 2010).
- DMU 2003. Kriterier for gunstig Bevaringsstatus. Faglig 457 rapport. 2nd udgave.
- DMU 2010b. Carl H, Berg S, Møller P R, Rasmussen G H and Nielsen J G. http://www.dmu.dk/udgivelser/dmunyt/2010/5/rodlisteuddybning/
- DMU, 2010. Den danske rødliste. http://www2.dmu.dk/1_om_dmu/2_tvaer-funk/3_fdc_bio/projekter/redlist/gpdata2.asp?ID=12
- Drønen, Gro Jensen and Bundgaard (2004). DHI. "Nysted Offshore Wind Farm at Rødsand. Morphological Study." Final Report, Hørsholm, November 2004.
- Edren, S., Wisz, M., Teilman, J., Dietz, R., Söderkvist, J. (2010) Modelling spatial patterns in harbour porpoise satellite telemetry data using maximum entropy, Ecography 33(4): 698-708
- Essink, K. (1999) Ecological effects of dumping of dredged sediments; options for management. *Journal of Coastal Conservation 5: 69-80*

- Fehmarnbelt Fixed Link EIA. Fauna and Flora – Benthic Marine Biology. Volume III. Habitat Mapping of the Fehmarnbelt Area - Baseline. Report No. E2TR0020. 123 pp.(Femern 2011)
- FEMA (2011a). Fehmarnbelt Fixed Link EIA. Fauna and Flora – Baseline. Benthic Marine Biology. Benthic Flora of the Fehmarnbelt Area. Report No. E2TR0020 Volume I 158 pp.
- FEMA (2011b). Fehmarnbelt Fixed Link EIA. Fauna and Flora – Baseline. Benthic Marine Fauna of the Fehmarnbelt Area. Report No. E2TR0020 Volume I. 170 pp.
- FEMA (2011c). Fehmarnbelt Fixed Link EIA. Fauna and Flora – Impact Assessment. Benthic Flora of the Fehmarnbelt Area. Report No. E2TR0021 Volume I. 156 pp
- FEMA (2011d). Fehmarnbelt Fixed Link EIA. Fauna and Flora – Impact Assessment. Benthic Fauna of the Fehmarnbelt Area. Report No. E2TR0021 Volume II, 184 pp
- Fishbase (2011). http://www.fishbase.org
- Fricke, R., Berghahn, R., Rechlin, O., Neudecker, T., WIinkler, H., Bast, H.-D. & E. Hahlbeck (1998): Rote Liste der in Küstengewässern lebenden Rundmäuler und Fische (Cyclostomata & Pisces). - In: Binot, M., R. Bless, P. Boye, H. Gruttke & P. Pretscher (Hrsg.), Rote Liste gefährdeter Tiere Deutschlands. Schriftenreihe für Landschaftspflege und Naturschutz 55. Bundesamt für Naturschutz, Bonn: 60-64. (not cited in text)
- Fugl, K., Grøn, P., Klaustrup, M., Mikkelsen J., Moeslund, B. and Myssen, P. 2006a. Maribosøerne, Miljøtilstanden 2006, Udvikling og Status siden 1989, Hejrede Sø. Report, Storstrøms Amt.
- Fugl, K., Grøn, P., Klaustrup, M., Mikkelsen, J., Moeslund, B. and Myssen, P. 2006b. Maribosøerne, Miljøtilstanden 2006, Udvikling og Status siden 1989, Maribo Søndersø og Nørresø. Report, Storstrøms Amt.
- Fugl, K., Grøn, P., Klaustrup, M., Mikkelsen, J., Moeslund, B. and Myssen, P. 2006c. Maribosøerne, Miljøtilstanden 2006, Udvikling og Status siden 1989, Røgbølle Sø. Report, Storstrøms Amt.
- Gibbs M. and Hewitt J. (2004). Effects of sedimentation on macrofaunal communities: A synthesis of research studies for Arc. Prepared by NIWA for Auckland Regional Council. Auckland Regional Council Technical Report 2004/264.
- Gilles, A., Herr, H., Risch, D., Scheidat, M., Siebert, U. (2006) Erfassung von Meeressäugetieren und Seevögeln in der deutschen AWZ von Nord- und Ostsee (EMSON), Teilvorhaben: Erfassung von Meeressäugetieren, Endbericht für das Bundesamt für Naturschutz, F + E Vorhaben FKZ: 802 85 260, pp101
- Gilles, A., Herr, H., Lehnert, K., Scheidat, M., Kaschner, K., Sundermeyer, J., Westerberg, U., Siebert, U. (2007) MINOS 2 – Weiterführende Arbeiten an Seevögeln und Meeressäugern zur Bewertung von Offshore – Windkraftenergieanlagen (MINOS plus), Schlussbericht: Teilvorhaben 2, „Erfassung der Dichte und Verteilungsmuster von Schweinswalen (Phocoena phocoena) in der deutschen Nord- und Ostsee“, pp67
- Gosselck, F.; Brosda, K.; Hübner, J.; Kube,J. (2005). Beschreibung und Identifizierung mariner FFH-Lebensraumtypen und gesetzlich geschützter mariner Biotoptypen in den Küstengewässern Mecklenburg-Vorpommerns. Bericht im Auftrag des Landesamtes für Umwelt, Naturschutz und Geologie Mecklenburg-Vorpommern. (not cited in text)
- Hansen MM, Fraser DJ, Als TD, Mensberg KLD (2008). Reproductive isolation, evolutionary distinctiveness and setting conservation priorities: The case of European lake whitefish and the endangered North Sea houting (*Coregonus spp.).* Evolutionary Biology 8:137.
- Hinchey, E.K., Schaffner, L.C., Hoar, C.C., Vogt, B.W., Batte, L.P., 2006. Responses of estuarine benthic invertebrates to sediment burial: the importance of mobility and adaptation. Hydrobiologia 556, 85–98.
- (not cited in text)

- Hvidt, C.B., M. Klaustrup, S.B. Leonhard. 2005. Monitoring Programme – Final Report 2004. Fish at the cable trace. Nysted Offshore Wind Farm at Rødsand. Bio/consult. Commissioned by ENERGI E2: 1-51.
- IUCN (2010). http://www.iucnredlist.org/
- Klaustrup, M. Pers. Com. 2008. Orbicon
- Kenyon (1970), Sand Ribbons of European Tidal Seas. Marine Geology 9, 25-39.
- Kloppmann, M.H.F, Böttcher, U., Damm, U., Ehrich, S., Mieske, B., Schultz, N. & Zumholz, K. (2003). Erfassung von FFH-Anhang II-Fischarten in der deutschen AWZ von Nord- und Ostsee. Final report for the German Federal Agency of Nature Conservation. Krappe, M. 2007. Erhaltungszustand von Neunaugenpopulationen in Mecklenburg-Vorpommern, Teil 2: Aktuelle Vorkommen und ihre Bewertung im Rahmen der FFH-Richtlinie. Naturschutzarbeit in Mecklenburg- Vorpommern 50 (1): 3-17.
- Koop, B. (2008): SPA "Östliche Kieler Bucht" (DE 1530-491) – Brutvogelmonitoring 2008.
- Koop, B. & B. Struwe-Juhl (2008): SPA „Ostsee östlich Wagrien" (1633-491) – Monitoring 2008.
- Kottelat M & Freyhof J (2007). Handbook of European freshwater fishes. Berlin.
- Krappe M (2007). Erhaltungszustand von Neunaugenpopulationen in Mecklenburg-Vorpommern, Teil 2: Aktuelle Vorkommen und ihre Bewertung im Rahmen der FFH-Richtlinie. Naturschutzarbeit in Mecklenburg- Vorpommern 50 (1): 3-17.
- Lambrech, H. & Trauter, J. (2007). Fachinformationssystem und Fachkonventionen zur bestimmung der erheblichkeit im rahmen der FFH-VP - Endbericht zum teil fachkonventionen, Schlusstand Juni 2007. FuE-Vorhaben im rahmen des umweltforschunsplanes des bundesministeriums für umwelt, naturschutz und reaktorsicherheit im auftrag des bundesamtes für naturschutz FKZ 804 82 004, (unter mitarb. Von K. Kockelke, R. Steiner, R. Brikmann, D. Bernotat, E. Gassner & G. Kaule. Hanover, Filderstadt
- Lelek, A. 1987. Threatened Fishes of Europe. The Freswater Fishes of Europe vol 9. AULA Wiesbaden: 1-343
- Lisbjerg, D., J.K. Petersen & K. Dahl (2002). Biologiske effekter af råstofindvinding på epifauna. Faglig rapport fra DMU, nr. 391 (in Danish).
- Lumborg (2007). DHI. "Rødsand 2. Waves and sediment transport. Littoral Transport and Coastal Morphology." Final Report, Hørsholm, January 2007.
- Maitland PS and Hatton-Ellis TW (2003). Ecology of the Allis and Twaite shad. Conserving Natura 2000 Rivers Ecology Series No. 3.English Nature, Peterborough.
- Mills, K.E & Fonseca M.S. (2003) Mortality and production of eelgrass
- Miljøcenter F., Denmark (unpub.): Overvågning af ynglende fugle på øer og holme 2009 i Miljøcenter Nykøbings landsdel.
- Miljøministeriet 2009. Forslag til Natura 2000-plan 2009-2015. Maribosøerne, Natura 2000-område nr. 177.
- *Zostera marina* under conditions of experimental burial with two sediment types. Marine Ecology Progress Series 255: 127-134
- Nabe-Nielsen, J., Tourgaard, J., Sveegard, S., Dromph, K., Teilmann, J., Dietz, R. (2010) Modelling the effect of bridges on porpoise behaviour, Draft Report, NERI, Aarhus University, p5-15
- Navarro, J..M., Widdows, J., 1997. Feeding physiology of Cerastoderma edule in response to a wide range of seston concentrations Mar. Ecol. Prog. Ser. 152: 175-186.
- Niemann et al (2010). FEHY,"Fehmarnbelt Fixed Link, ATR ENV010018/ENV010038, Sediment Transport, Bed forms and Backfilling"', Doc. No. E1TR0040, Draft report, Hørsholm July 2010

- Ornithologische Arbeitsgemeinschaft Schleswig-Holstein (OAG) 2010. Results of waterbird surveys 2008/09 and 2009/10.
- OSF 2004. Bericht über die 528. Reise des FFS“Solea“ vom 1.07. bis 12.07.2004. Untersuchungen zur demersalen Fischfauna in den für den Naturschutz bedeutsamen Gebieten vor der deutschen Ostseeküste mittels Grundschlepnetz. 6 p.
- OSPAR (2009) Overview of the impacts of anthropogenic underwater sound in the marine environment, Vol. OSPAR Convention for the Protection of the Marine Environment of the North-East Atlantic (www.ospar.org)
- Pedersen, S.A., J. Støttrup, C.R. Sparrevohn and H. Nicolajsen, 2005. Registreringer af fangster i indre danske farvande 2002, 2003 og 2004 – Slutrapport. DFU-Rapport nr. 155-05. 149s. Perrow M.R. and Jowitt, A.J.D. 1997. The habitat and management requirements of spined loach Cobitis taenia. English Nature Research Report. No 244 English Nature Peterborough.
- Petersen, A.H. (Ed.) 2010. EIA Scoping Report. Proposal for environmental investigation programme for the fixed link across Fehmarnbelt (cost-coast). Femern Sund & Bælt: 1-149
- Popper AN, Hastings MC (2009). The effects of anthropogenic sources of sound on fishes. Journal of Fish Biology 75:455-489
- Powilleit, M. *et al.* (2009) Experiments on the survival of six brackish macro-invertebrates from the Baltic Sea after dredged spoil coverage and its implications for the field. *Journal of Marine Systems 75; 441-451*
- Powilleit, M. *et al.* (2006) Impacts of experimental dredged material disposal on a shallow, sublittoral macrofauna community in Mecklenburg Bay (western Baltic Sea). *Marine Pollution Bulletin 52: 386-396*
- Rasmussen, J. Pers. Com 2008. Fisherman Lolland.
- Skov- og Naturstyrelsen, 2010. http://www.skovognatur.dk/DyrOgPlanter/Artsleksikon/Fisk/
- Storstrøms Amt – Teknik- og Miljøforvaltningen (2006) (Editor): Ynglende rovfugle i Storstrøms Amt 2006.
- Storstrøms Amt – Teknik- og Miljøforvaltningen (2005) (Editor): Maribosøerne. Ynglefugle 2005 – Status og udvikling siden 1977.
- Teilmann, J., Sveegard, S., Dietz, R., Petersen, I., Berggren, P., Desportes, G. (2008) High density areas for harbour porpoises in Danish waters, NERI, Technical Report No. 657, pp40
- Svegaard, S., Teilmann, J., Tougaard, J., Dietz, R. Mouritsen, K., Desportes, G., Siebert, U. (2010) High-density areas for harbor porpoises (*Phocoena phocoena*) identified by satellite tracking, Marine Mammal Science, DOI: 10.1111/j.1748-7692.2010.00379.x, in press
- Thiel, R. & I. Backhausen (2006). Survey of NATURA 2000 fish species in the German North and Baltic Seas.
- Thiel, R., Riel, P., Neumann, R., Winkler, H.M., Böttcher, U., Gröhsler, T. 2008. Return of the twaite shad Alosa fallax (Lacépède, 1803) to the southern Baltic and the transitional area between the Baltic and the North Seas. Hydrobiologia 602:161-177.
- Thiel, R. & H. Winkler – Projektleiter (2007): Erfassung von FFH-Anhang II-Fischarten in der deutschen AWZ von Nord- und Ostsee -(ANFIOS). Schlussbericht über das F+E-Vorhaben für das BfN (FKZ: 803 85 220). Stralsund und Rostock. Mai 2007.
- Thomsen F, Lüdemann K, Kafemann R, Piper W (2006) Effects of offshore wind farm noise on marine mammals and fish, biota, Hamburg, Germany on behalf of COWRIE Ltd, Vol, Newbury, UK
- Tougaard J, Carstensen J, Wisz MS, Jespersen M, Teilmann J, Ilsted Bech N, Skov H (2006) Harbour Porpoises on Horns Reef - Effects of the Horns Reef Wind Farm. Final Report to Vattenfall A/S. Final Report to Vattenfall A/S. NERI, Roskilde, Denmark

- Verfuß, U., Honnef, C., Meding, A., Dähne, M., Mundry, R., Benke, H. (2007) Geographical and seasonal variation of harbour porpoise (Phocoena phocoena) presence in the German Baltic Sea revealed by passive acoustic monitoring, J. Mar. Biol. Ass. U.K., 87: 165-176
- Walter, U. 1997. Fische, Fischerei und Garnelenfang in der Wismar-Bucht. Meer und Museum 13: 53-61.
- Widdows, J., Fieth, P., Worral, C.M., 1979. Relationship between seston, available food and feeding activity in the common mussel *Mytilus edulis*. *Mar. Biol.* 50: 195-207.