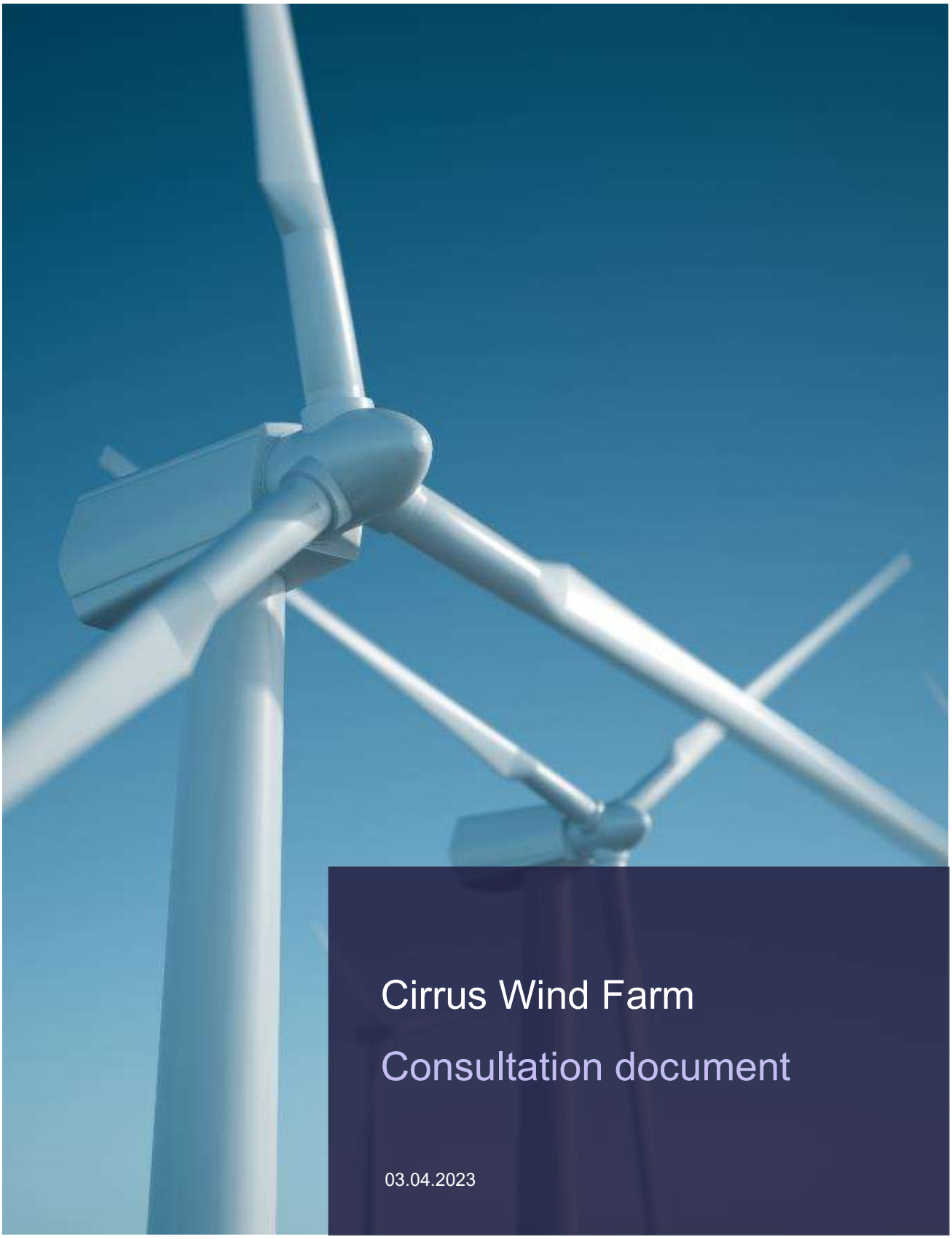

Cirrus Wind Farm

Consultation document

03.04.2023

Freja Offshore

frejaoffshore.com

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1 Introduction

Freja Offshore AB (Freja Offshore) intends to establish an offshore wind farm called Cirrus in the Southern Baltic Sea (see **Figure 1**) in Sweden's Exclusive Economic Zone, approximately 50 kilometres southeast of Karlskrona. The maximum height is set at 370 metres, the rotor diameter is to be 340 metres and installed capacity is to be 30 MW/wind turbine. The consultation covers a maximum farm size of 133 turbines.

It is estimated that the area will be able to accommodate approximately 85 turbines of the size 30 MW. In the event that smaller turbines with smaller rotor diameters are established, the maximum number will be higher: approximately 133 turbines if the capacity is 15 MW. The expected energy production from a wind farm of this size in the Baltic Sea, where 4,000 full-load hours per year are to be assumed, is approximately 10 TWh per year, equating to household electricity for approximately two million detached houses[1].

Under the Swedish Economic Zone Act (1992:1140) (SEZ) Freja Offshore intends to apply for a permit for the wind farm, with the aim of constructing and operating a wind-power facility within the specified project area. Under the Swedish Continental Shelf Act (1966:314) (KSL) an application for the internal cable grid and associated equipment has also been lodged. Proximity to Natura 2000 areas may mean that a Natura 2000 assessment in accordance with Chapter 7, §§ 28a-29b of the Swedish Environmental Code (1998:808) becomes relevant, thus this consultation document also includes such a permit review.

Ahead of the application for the aforementioned permit, Freja Offshore AB intends to implement a consultation process, and it is intended that this consultation document apply to the consultations concerning all the applications.

[1] We are assuming that a detached house consumes 5,000 kWh of household electricity per year if the heating uses another type of energy.

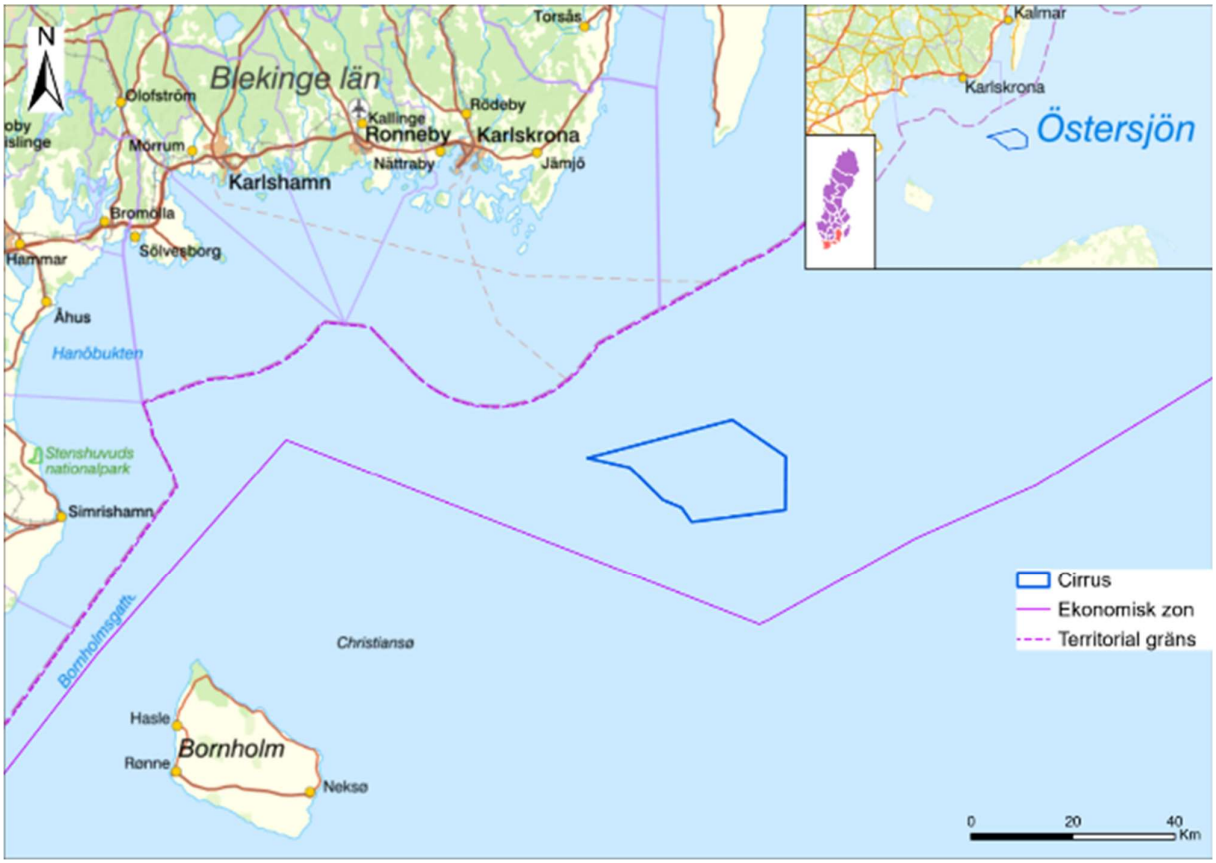


Figure 1. Map of the project area in the Baltic Sea. Legend: Ekonomisk zon = Swedish Exclusive Economic Zone. Territorial gräns = Territorial border.

1.1 Offshore wind power

Sweden has an ambitious climate programme, and the Swedish Parliament has set a target of 100% renewable electricity production by 2040. The Swedish Energy Agency and the Swedish Environmental Protection Agency have thus jointly initiated a national strategy for sustainable expansion of wind power (Swedish Energy Agency, 2021). The aim of the strategy is to manage the rapid expansion of wind power nationwide, whilst contributing to attainment of the political goals. The strategy will contribute to the energy transition by creating conditions for future expansion of wind power that is sustainable in the long term. Wind-power expansion is sustainable if:

- It contributes to the energy transition and attainment of energy-policy objectives.
- It is distributed evenly nationwide, both onshore and offshore, so as to contribute to a secure and robust electricity supply. This is because greater geographical spread of wind-power production reduces variations in electricity production levels.
- The wind power to a greater extent contributes reliability capacities in all system operating states, so the power system's reliability remains acceptable and contributes to delivery of a reliable power system.

- It takes place in such a way as not to impair attainment of the environmental goals, e.g. Oceans in Balance, Living Coast and Archipelago, Magnificent Mountain Environment, Excellent Built Environment and Abundant Flora and Fauna. This means minimising the adverse impact of wind power on ambitious conservation values and endangered species.
- It takes into account people's health and habitat as regards noise, experiences of the landscape and opportunities to lead an outdoor life.
- Wind-power installations are well established in the area where they are being built, and they generate added value for the local community.
- It is resource-efficient – this presupposes that good wind locations will be used. It is now largely a matter of utilising the best turbine technology. Use of good wind locations means fewer turbines need to be built, thus less land needs to be used, use of resources and production costs are lower and fewer people and animals are affected (Swedish Energy Agency, 2021).

The strategy is a well-developed planning process for wind power, involving regional expansion requirements, proposals for changed municipal approval and a national planning basis that will facilitate and inform the regional work. Through use of a national and a regional basis one can also contribute to a substantiated municipal master plan for the expansion of wind power (Swedish Energy Agency, 2021).

Expectations regarding the role of electrification in the climate transition have increased, thus we are anticipating a greatly increased demand for electricity. The situation is particularly urgent in southern Sweden, where there is the greatest need for electricity and the conditions for building onshore wind turbines are challenging. In recent years forecasts regarding the power balance in Sweden have been indicating an increasing risk of power shortages. The Swedish government has proposed a regulation (2007:1119) involving instructions for the Swedish National Grid (Svk), which by the 31st of May each year must issue the government with a special report on maintenance of the power balance over the preceding winter. This report must also include forecasts regarding the power balance during the coming winter and the balance in the longer term (Svk, 2022).

In the 2022 report Svk estimates that because of the increasing need for electricity nationwide the power balance over the next four winters will deteriorate. SvK is at the same time presenting its forecast regarding the power balance during winter 2022/2023, which is little different to the previous year's forecast, involving an increase of about 200 MW as a result of the increase in wind turbines.

The Swedish power system is divided in four bidding areas, SE 1-4. In the northenmost areas SE 1 – Luleå and SE 2 – Sundsvall there is expected to be an electricity surplus during winter 2022/2023. In SE 1 and SE 2 production is dominated by hydropower, for which availability is high. Total demand there is also lower than in SE 3 – Stockholm and SE 4 – Malmö, where the power balance is instead expected to be negative (Svk, 2022). Electricity must thus be transported to the south from SE 1 and SE 2 in the north, or electricity must be imported from abroad. The price of electricity therefore vary from area to area, and in general it can be said that electricity is more expensive in southern Sweden, where there is a production deficit. Svk's 2022 report assesses

that the big deficit in southern Sweden indicates a great need for imports. Offshore wind power thus represents an opportunity to meet increased demand for electricity throughout Sweden in general, and in particular on the Cirrus wind farm in southern Sweden, whilst at the same time contributing to the expansion of renewable energy, thereby reducing our dependence on imported energy from fossil sources (Swedish Energy Agency, 2023).

Freja Offshore's planned Cirrus wind farm has the potential to produce about 10 TWh annually. This corresponds to one year's electricity consumption for approximately two million households (based on consumption of 5000 kWh/year). The plan is for connection to the electricity grid to take place in the bidding area SE4-Malmö.

The Swedish Energy Agency believes that in the long term offshore wind power can play an important role in the Swedish electricity system, and that offshore wind power has great technical potential within Sweden. Planning and expansion of offshore wind turbines is in full swing in our region. The EU has made its climate targets much more ambitious, and the European Commission has presented a strategy for offshore wind power that calls for a 25-fold increase in offshore wind power in Europe by 2050. But Sweden is far behind countries such as the UK, Germany, the Netherlands and Poland, despite our long coastline and shallow waters (Swedish Wind Energy, 2022).

1.2 Administrative tasks and the company

Freja Offshore is a joint venture between Mainstream Renewable Power and Hexicon AB. With a great and longterm experience of offshore projects in the North Sea and around the world, the purpose of Freja Offshore is to develop offshore wind power in Sweden by building and operating large wind farms in the Swedish Exclusive Economic Zone. The aim is to contribute to the green energy transition towards a fossil free and climate neutral Sweden.

1.3 Consultation process

The forthcoming consultation cover the area of the wind farm with its turbines, foundations, inter array cables, substations and other infrastructure for the establishment and operation of the wind farm and also its dismantling at the end of their life span. To connect the wind farm to the onshore grid, an export cable and onshore power lines are needed. They will be examined separately, and will involve their own consultation and authorisation processes.

Planned wind farms are included in the activities that under § 3 of the Swedish Ordinance (1998:905) on Environmental Impact Assessments must always be assumed to entail a significant environmental impact. This means that delimitation consultation takes place as part of the specific environmental-assessment process in accordance with Chapter 6, §§ 29-34 of the Swedish Environmental Code.

This document forms the basis for delimitation consultations regarding the Cirrus wind farm. The purpose is to as soon as possible provide information on the project and gather viewpoints ahead of continued planning. The delimitation consultation is being carried out together with authorities,

associations, organisations and other stakeholders, as well as the members of general public who it is assumed will be affected by the activities.

2 Legislation and permit process

2.1 Appropriate provisions

The wind-power area is outside Swedish territorial waters in Swedish Exclusive Economic Zone. Wind farms in Sweden's Exclusive Economic Zone are reviewed in accordance with the Swedish Economic Zone Act (1992:1140), and the permit review is carried out by the government (Swedish Ministry of Climate and Enterprise) or the authority determined by the government. The cables connecting the wind turbines within the wind farm are deemed to be subject to review in accordance with the Continental Shelf Act (1966:314), and permits are granted by the government (Swedish Ministry of Climate and Enterprise). It is deemed appropriate that the consequences of the decommissioning of the cables be considered in a joint EIA (Environmental Impact Assessment), together with the consequences for the wind farm.

Proximity to Natura 2000 areas may mean that a special Natura 2000 review in accordance with Chapter 7, § 28a of the Swedish Environmental Code will also be relevant, in which case the review will be performed by the County Administrative Board. The initial assessment has, however, shown that there will be no significant consequences on Natura 2000 sites and that no review is required. If a review nevertheless becomes relevant, this consultation document will also form the basis of a permit review in accordance with Chapter 7, § 28a of the Swedish Environmental Code.

2.2 EIA (Environmental Impact Assessment)

In accordance with the Swedish Economic Zone Act, an Environmental Impact Assessment (EIA) must be prepared as part of the permit review. A specific environmental assessment must be carried out, with the aim of obtaining correct knowledge about the project, limiting the investigation work and the impact assessment so they include what is essential, and investigating various alternative locations and designs for the planned activities. A further aim of the specific environmental assessment is to obtain information on the prerequisites for planned activities, as well as their effects. The information will form a basis for decision-making during the planning and EIA process. As part of the specific environmental assessment, delimitation consultations are taking place together with the County Administrative Board, the supervisory authority and the individuals who are likely to be particularly affected, as well as other government agencies, organisations, the municipalities and the general public who it is assumed will be affected by the activities. During consultations information on planned activities will be provided, and everyone will be given the opportunity to comment on the EIA's focus and design.

Throughout the process there will be opportunities to comment on the EIA's focus and design. In an initial stage, consultations regarding the construction, operation and decommissioning of the wind farm are now taking place. Regarding the export cable from the wind farm, which also affects

coastal marine and land areas, consultations will take place at a later stage, when the connection point has been selected.

An overall assessment of the wind farm's impact is desirable. An EIA will thus be designed so that permit reviews in accordance with various parts of the legislation can relate to specific parts of the EIA.

The delimitation consultation will also concern expected changes in the environment, and the values that these changes may affect. By early analysis of the values and considerations that may be affected, relevant supporting material in the form of inventories and investigations can be introduced at the correct level. Early analysis of the expected environmental impact will also provide an overall picture of the project's consequences, which will allow for protective measures and adjustments to the wind-farm design.

2.3 Review

After an application concerning the EIA and a technical description have been submitted to the government, there will be a supplementary and consultation procedure, allowing the expression of opinions on admissibility, conditions for the activities etc. When the matter has been sufficiently investigated, the government will issue a decision.

3 Description of operations

3.1 Localisation

Freja Offshore AB is planning to apply for a permit to build a wind farm in the southern Baltic Sea, situated about 50 km south of Karlskrona and 50 km south of the island of Öland – see **Figure 2.** The planned location for the wind farm is in Swedish Exclusive Economic Zone.

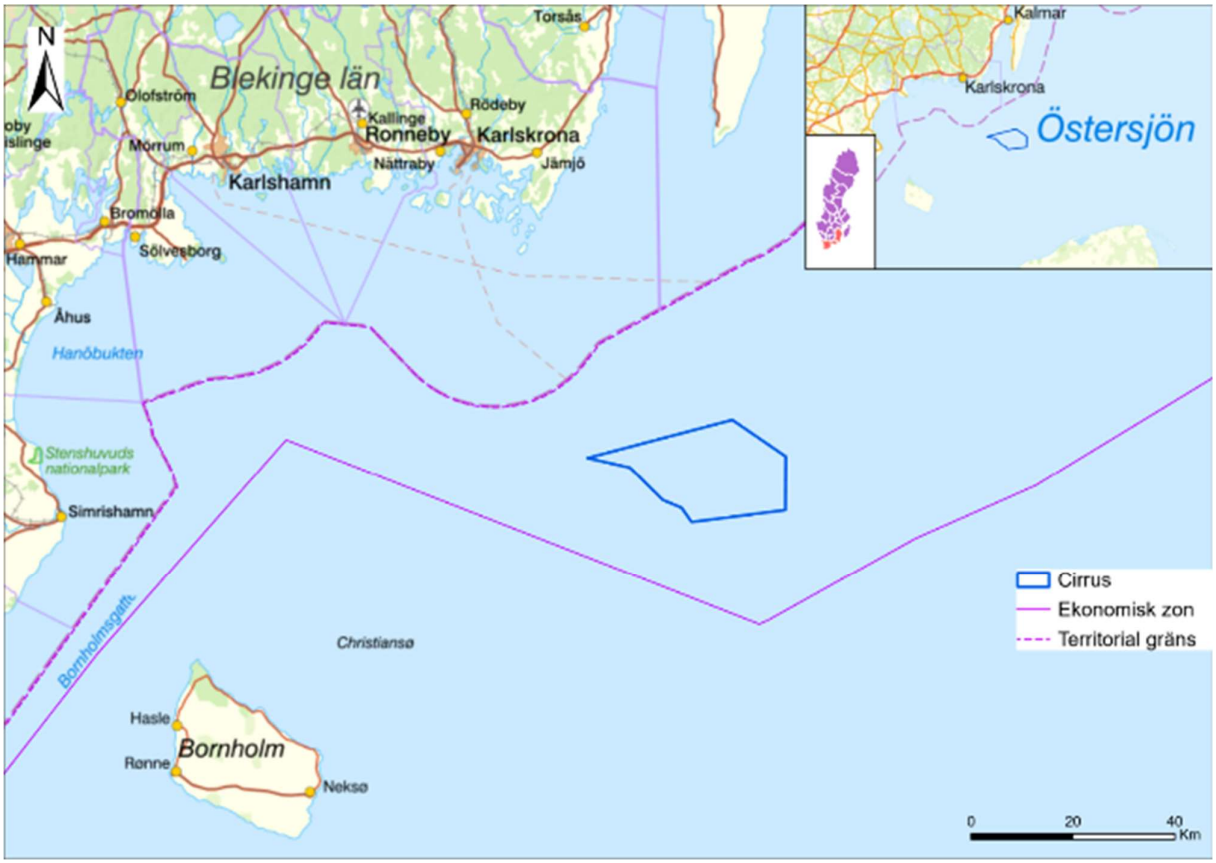


Figure 2 Map of the project area, located off the coast of Blekinge.

Translation of legend to english:
Ekonomisk zon = ***Economic zone***
Territorial gräns = ***Territorial border***

3.2 Wind turbine

A wind turbine converts the wind's kinetic energy into electrical energy. There are various wind-turbine designs, the distinguishing factor being the orientation of the turbine shaft. The most common type of turbine-axis orientation is horizontal – the design one usually imagines for a wind turbine.

Wind turbines with a horizontal-axis rotor are tower-shaped. At the top of the tower, the rotor and generator are housed in the nacelle. The height between ground/water level and the nacelle is called the hub height. The rotor is designed so it can follow the wind direction. The rotor blades are attached to the shaft rotor. Wind movement creates a rotational force on the rotor blades that causes the shaft rotor to rotate and bring about kinetic energy, which is converted into electrical energy. To sum up, the main components of a wind turbine are the tower, the foundations, the rotor, the nacelle and the control systems.

One of the dimensions of a wind turbine is its total height, i.e. the total distance between the ground/ocean surface and the highest point of the rotor blade. The rotor diameter is determined by the length of the rotor blades.
Figure 3 shows an illustration of a wind turbine, depicting the rotor diameter, the clearance and the total height.

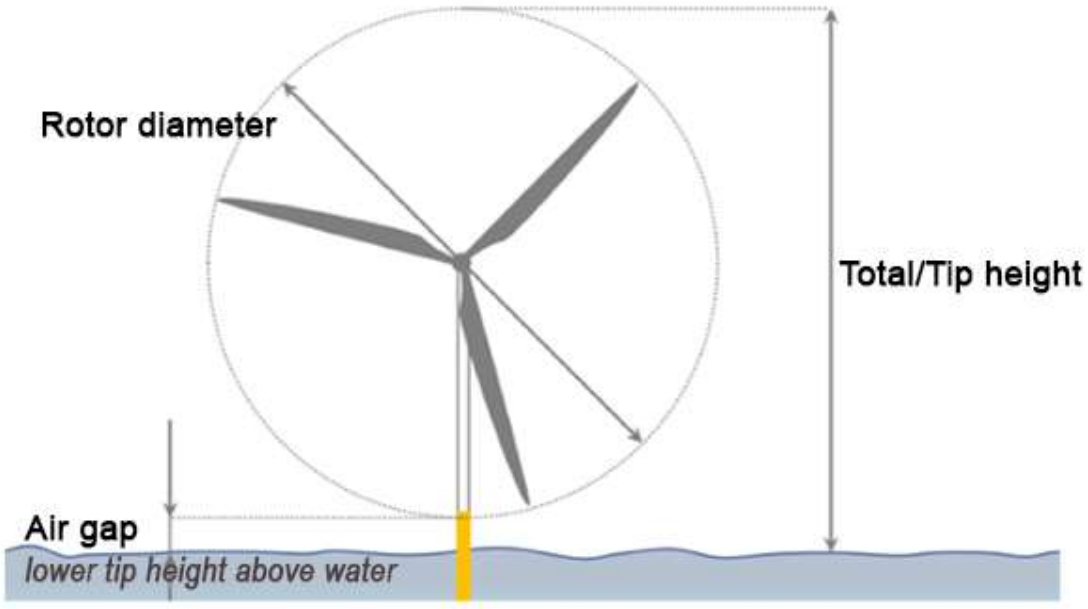


Figure 3 Illustration of a wind turbine with a horizontal axis.

The technical development of actual wind turbines in general and offshore wind turbines in particular is rapid. **Figure 4** shows the number and size of wind turbines required to produce 100 TWh. The figure illustrates onshore wind turbines, but the purpose is to demonstrate the principle that the number of turbines required for a specific amount of power is in inverse proportion to the

turbine size. The wind turbines of the future will probably be higher, their rotor diameter will be wider and they will generate more power. In February 2021 the world's largest wind turbine, with a rotor diameter of 236 metres and 15 MW of power generation, was commissioned. Before that the biggest wind turbines commissioned in 2011, with a rotor diameter of 164 metres and an installed capacity of 8 MW. Following on from these developments it is expected that 30 MW turbines with a rotor diameter of 330 metres will be commissioned between 2025 and 2030. This is an indication of the possible size of the turbines in the planned wind farm.

Table 1 shows the size of today's wind turbines (10 MW) compared with those expected to be in operation by 2025-2030 (30 MW).

Table 1 Size of wind turbines in relation to power

Power per turbine	10 MW	30 MW
Rotor diameter (m)	210	340
Clearance (m)	20	20
Total height (m)	230	370

The bigger the wind turbine, the fewer are required for the same total installed power. For 2 GW of installed electrical power one needs 200 wind turbines of 10 MW or 67 turbines of 30 MW, respectively.

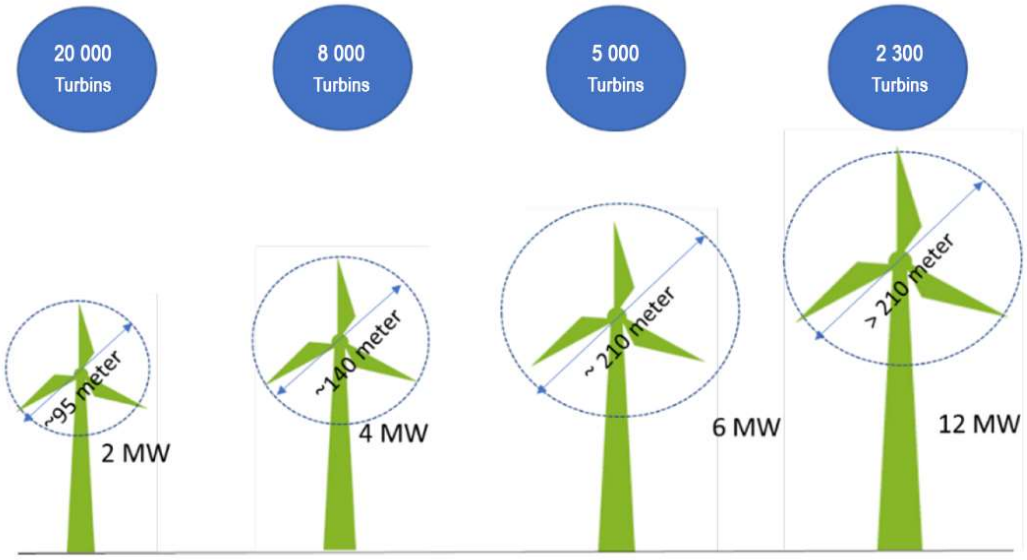


Figure 4. Number of wind turbines needed to produce 100 TWh, depending on the turbine size Image source: Swedish Energy Agency

3.3 Wind-farm design

As well as the turbine foundations, offshore installations also involve anchorage, an internal cable grid and substations – see **Figure 5**. The figure shows floating foundations, but the principles of an internal cable network, substations etc. are the same for bottom fixed foundations – see **Figure 6.**

However, use of floating foundations means the wind farm can be located in deeper water, thus allowing positioning further away from land than is customary for bottom fixed foundations. But there are also areas far out at sea where the depth allows bottom fixed foundations. The area for Cirrus is one such site, and the consultation thus covers both bottom fixed and floating foundations. A wind farm located further away from the coast and surrounding islands/archipelagos normally reduces disruption to bird life (foraging and nesting sites) and outdoor life, and has far less visual impact when seen from land.

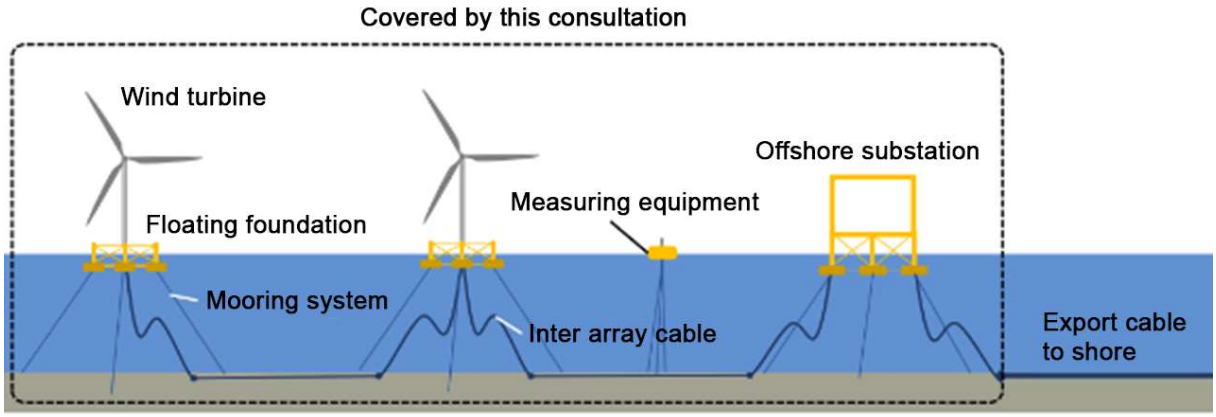


Figure 5 Schematic diagram of a wind farm equipped with floating wind turbines

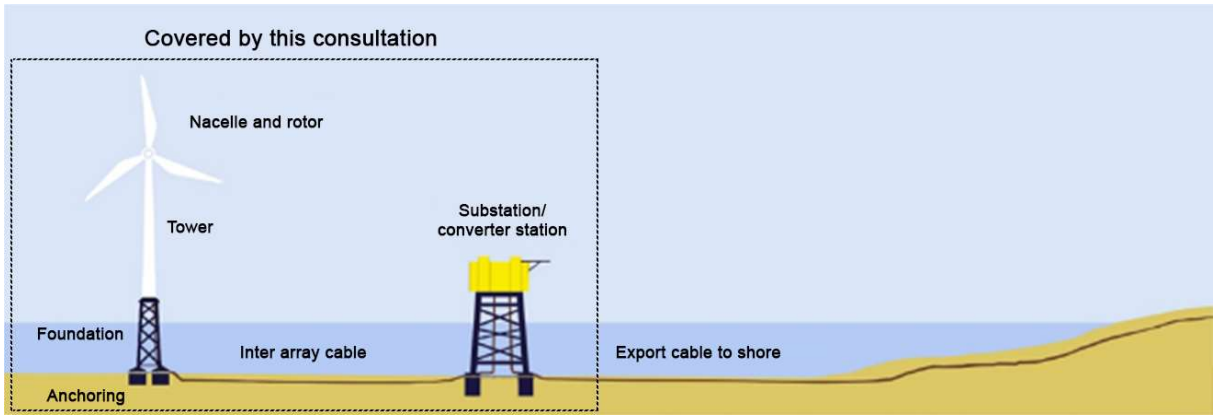


Figure 6 Schematic diagram of a wind farm equipped with bottom fixed wind turbines

3.4 Planned operations in figures

Designing and establishing an offshore wind farm is a long process, and the conditions will change before construction starts. Because of the current rapid pace of technical development, at the application stage it is not possible to determine the final choice and design of turbine model. The number of turbines and the size of the planned wind farm cannot thus cannot be specified precisely in this consultation. Freja Offshore is making an application based on the preliminary layout, and is taking into account the expected technical developments between consultations and the construction stage. The technical data being presented in **Table 2** is indicative – it should not be considered definitive.

Table 2 Summary of technical data regarding the planned wind farm

Parameters	
Number of wind turbines, max.	133
Wind farm's footprint	456 km²
Rotor diameter, max.	340 m
Clearance, approx.	20-30 m
Total height, max.	370 m
Estimated annual electricity production	Approx. 10 TWh

3.5 Foundations

It currently appears that bottom fixed foundations will be possible in most of the positions, but there may be locations where floating foundations are also a possibility. For this reason Freja Offshore wishes to hold consultations regarding both floating and bottom fixed foundations.

3.5.1 Bottom fixed foundations

The type of bottom fixed foundations chosen depends on a number of factors: primarily water depth, geology, wind and wave conditions, environmental considerations and costs. Since both water depth and geological conditions vary within the wind farm, different types of foundations may be needed.

Based on the technology currently available, three different types of foundations are deemed relevant: gravity-based, monopile and jacket. These three basic types can also be combined to form hybrid foundations. The foundations can additionally be anchored to the seabed using so-called suction buckets or piles. Examples of the different alternative foundation types are illustrated in **Figure 7**.

It is intended that the indicative dimensions of the foundations be reported in the Environmental Impact Assessment, but the detailed design and the exact scope will only become apparent at the time of procurement and investment decisions. In conjunction with this, the site conditions for the area will be investigated to the requisite extent.

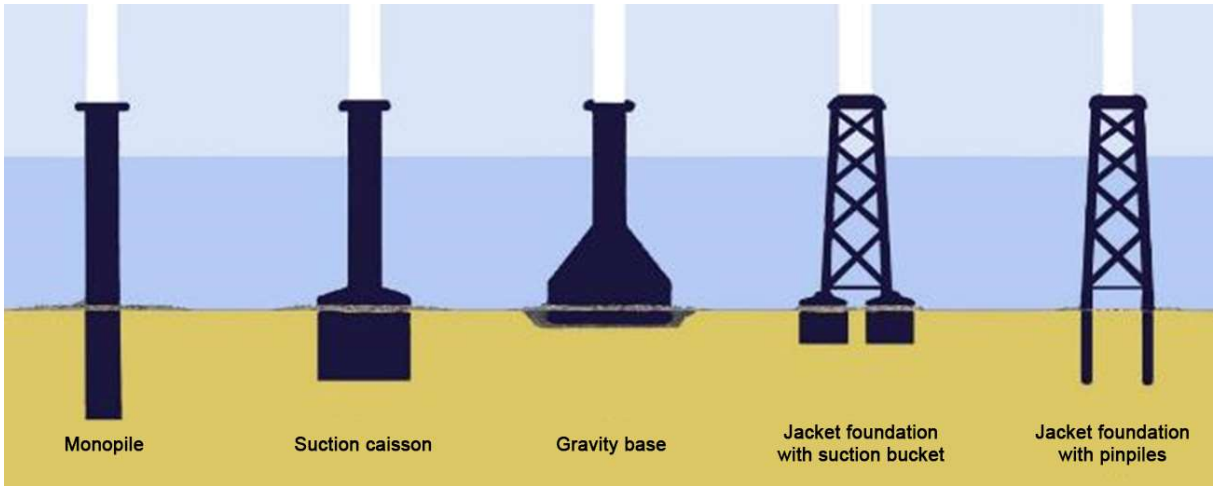


Figure 7 Different types of bottom fixed foundations.

3.5.2 Floating foundations with anchorage

Floating foundations can currently be divided into three main groups: spar, semi-floating and TLP (Tension Leg Platform). The most appropriate technology is chosen during the early design, following investigations of conditions in the area.

Bottom conditions are crucial to the choice of anchorage. **Figure 8** shows examples of different floating foundations, and **Figure 9** shows examples of anchor types that may work with floating foundations.

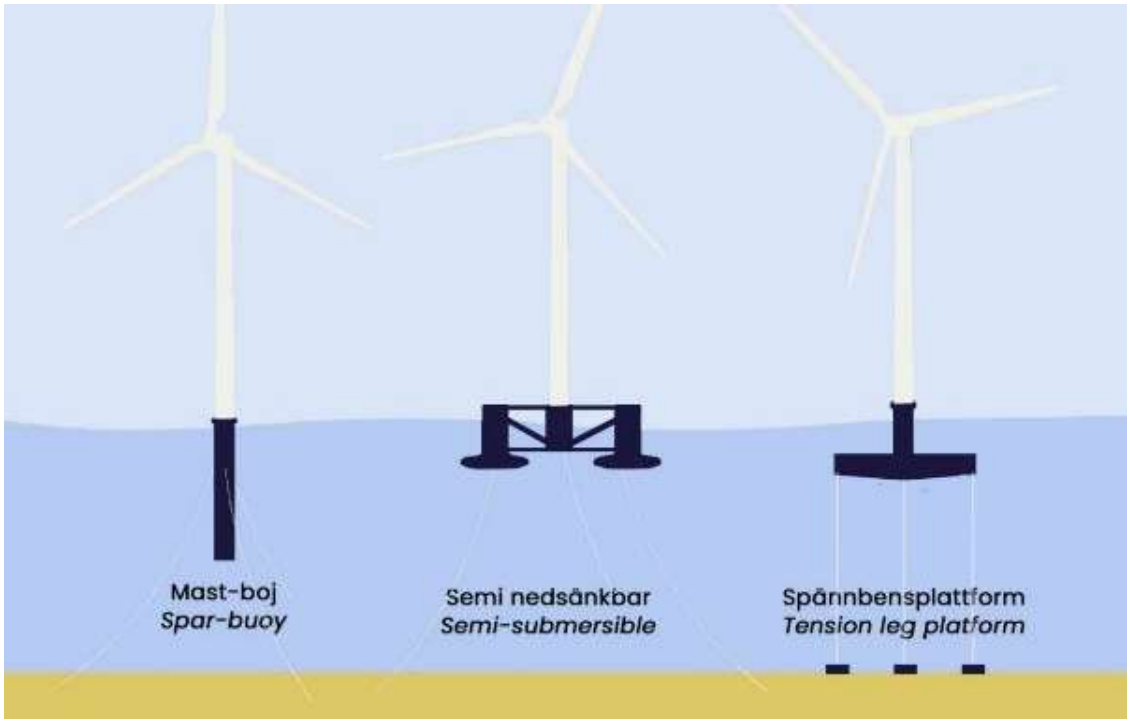


Figure 8 Different types of floating foundations: spar, semi-floating and TLP.

Anchoring systems and the dimensions of the foundations are planned in a way as to limit the drift of the foundations on the ocean surface under varying weather conditions. This is done so as to limit the length of the dynamic part of the electric cable that hangs between the foundations and the seabed. The tauter the moorings are, the less the floating foundations will move on the ocean surface. The actual tension of the moorings depends on the type of anchorage and foundations. For example, semi-floating foundations with chain lines involve hardly any pretensioning, whilst tethers for TLP foundations are tautened to a certain extent. Movement of the foundations is also affected by the number of anchoring lines and the local water depths.

In the event of drifting foundations, some vertical movement of the moorings is expected (not horizontal along the seabed), depending on the type of anchorage and the weather conditions.

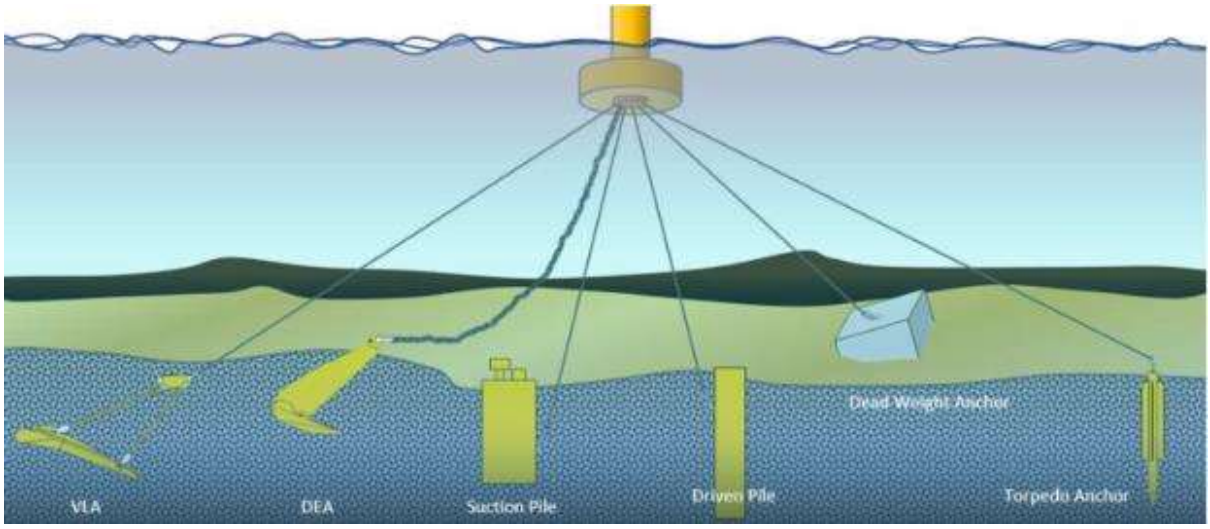


Figure 9. Examples of anchorage of floating foundations

The anchoring radius (horizontal distance between anchors and foundations) varies from one anchoring system to another. The tauter the lines, the smaller the anchoring radius is expected to be. Anchorage using chain lines at a water depth of 130 metres can be expected to have a radius of up to 950 metres, whilst the anchoring radius for TLP foundations can basically be non-existent – see **Figure 10.**

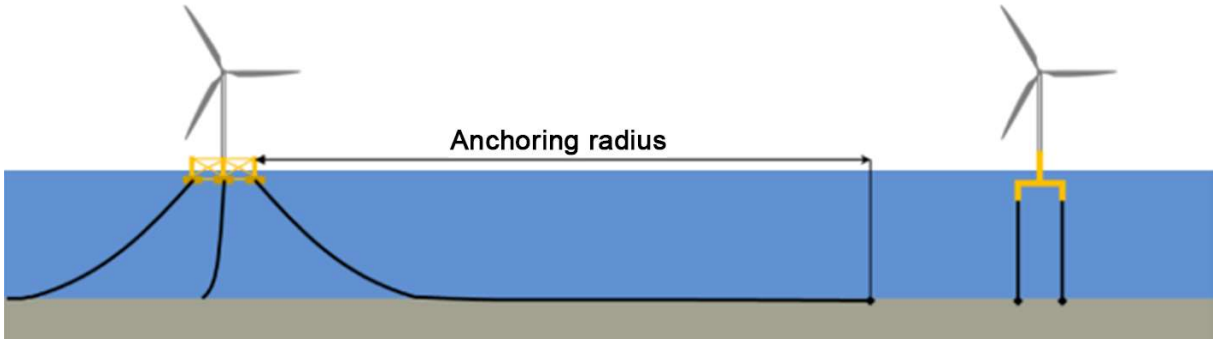


Figure 10. Illustration of anchoring radius for two different foundations, each with its own anchoring system: semi-floating (left) and TLP (right).

The foundation type and anchorage will be chosen during the design phase, following an investigation of the seabed conditions. Calculation of movement spans will be possible for the foundation type and the anchoring system chosen.

3.6 Overview of electricity transmission

Electricity transmission from the wind turbines to shore uses three main systems: an internal cable grid, substations and export cables to shore. The electricity from each turbine is transmitted via the internal cable to an offshore substation, where it is converted to a higher voltage, so as to minimise

losses when it is transferred to shore through the export cable. Depending on the design of the wind farm, its total capacity, the voltage level of the internal cable grid and the local electricity requirement on shore, one or more substations and export cables may be needed in a wind farm.

3.6.1 Internal cable grid

Within the area of the wind farm a number of cables will be laid that connect the wind turbines to each other – the so-called internal cable grid. This grid is used to transmit the electricity produced, and it also allows communication between the wind turbines as well as communication for operation monitoring and load control. The internal cable grid is interconnected at one or more offshore switching stations.

It is common for the internal cable network to be protected against damage from emergency anchoring and bottom trawling, e.g. through burial in the seabed. In places where this method is not applicable because of cables crossing each other or the bottom material not allowing burial, another method may be used. Possible alternative methods of protecting the cables are covering them with stones, concrete mattresses, concrete, artificial seaweed mats or sandbags. But as far as the cable is concerned it is best that it lie on top of the seabed, as protection causes an extra load on the cable and thus increased wear – but this presupposes an absence of any other activities in the area that may damage the cable.

The internal cable grid for floating foundations comprises two main types of cable: dynamic and static – see **Figure 11.** The dynamic cable is a hanging part of the cable between floating foundations and the seabed, and constitutes an important difference between bottom fixed and floating wind farms in terms of construction. The dynamic cable is designed to withstand the platform's movements and ocean-current forces during its service life.

The cable is normally hung in a 'lazy wave' configuration that uses buoyancy modules attached to the cable locally so it can be extended and shaped with the movements of the floating foundations. There are several possible designs for the dynamic cable, and the design is directly linked to the cable cross-section, the platform's dynamic movements, marine biological growth and currents.

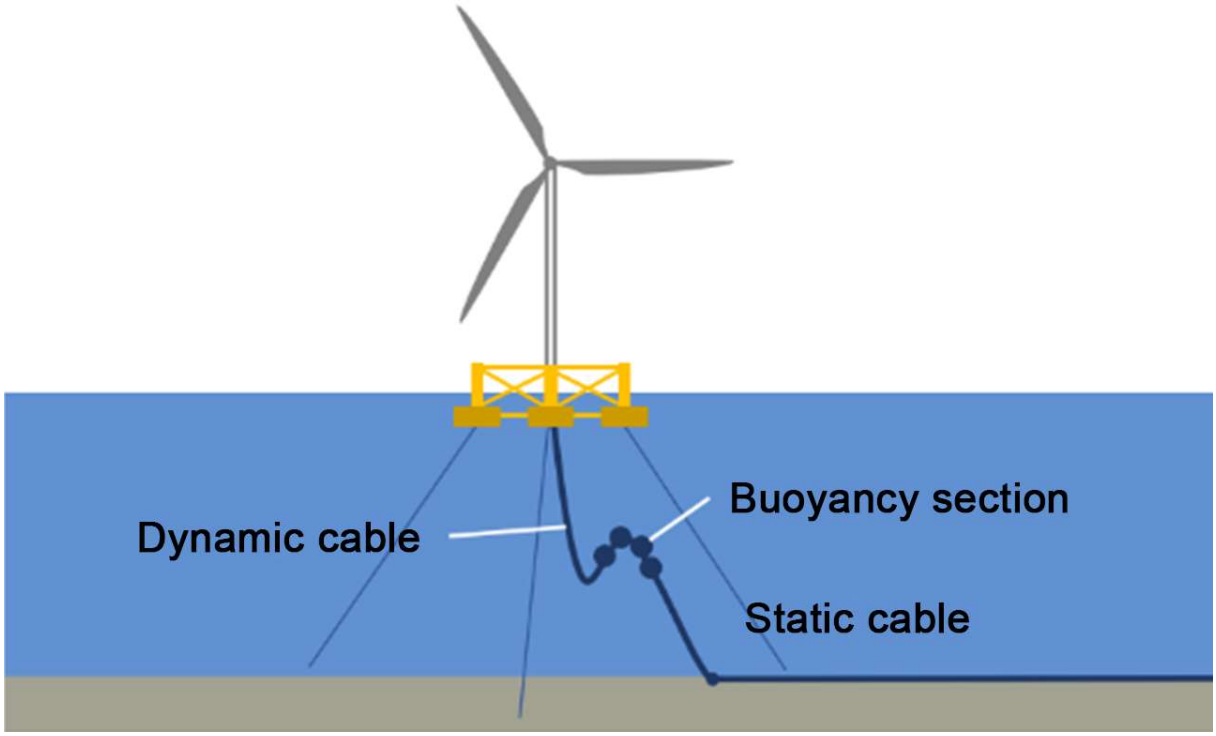


Figure 11 Internal cable grid for floating foundations – schematic diagram.

When the dynamic cable reaches the seabed it is normally connected to a less complex static cable in accordance with **Figure 11**.

The detailed design of the internal cable grid takes place later in the project, in order to achieve the most efficient layout in terms of power losses, cost and redundancy level.

3.6.2 Substation and connection cable

Like the wind turbines within the farm, the switching stations belonging to the farm are placed on solid or floating foundations. Examples of the solid foundations that can be used are monopile, jacket or gravity-based – see **Figure 7.** The requirements for switching stations and offshore substations (OSS) depend on the proximity to the onshore grid termination point and the total capacity of the wind farm. There are also stations that are totally underwater.

The bottom fixed foundation types available for the stations are largely the same as those available for the wind turbines, but dimensioned with regard to the loads resulting from the stations' design. The substations/inverter stations can also be placed on outrigger foundations. Depending on the choice of technology, it may also be possible to place equipment for transforming to a higher voltage on the same foundations as a wind turbine. Below are a couple of examples of how bottom fixed substations/converter stations can generally be designed - see **Figure 12**.

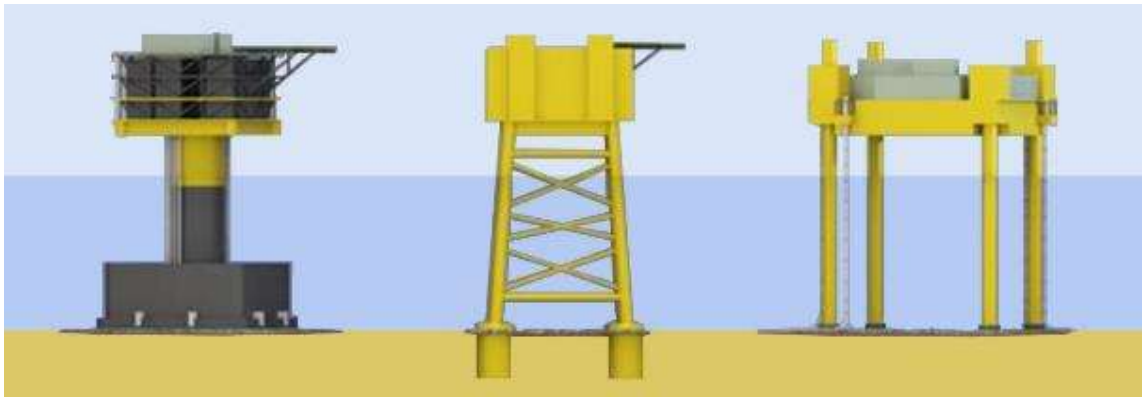


Figure 12 Example of offshore bottom fixed substations

The transmission of electricity from the wind farm to the onshore connection point is either via high-voltage alternating current (HVAC) or via high-voltage direct current (HVDC). The route and length of the connecting cables depend on the final connection point and the area conditions (e.g. geology, other activities and the environment).

The floating foundation types available for the stations are largely the same as those available for the wind turbines. A substation with floating foundations is tethered with anchors. The anchors can be pulling anchors, suction anchors or piles. The mooring lines comprise ropes, wires and chains, in either a catenary or a semi-tensioned configuration – see **Figure 13.**

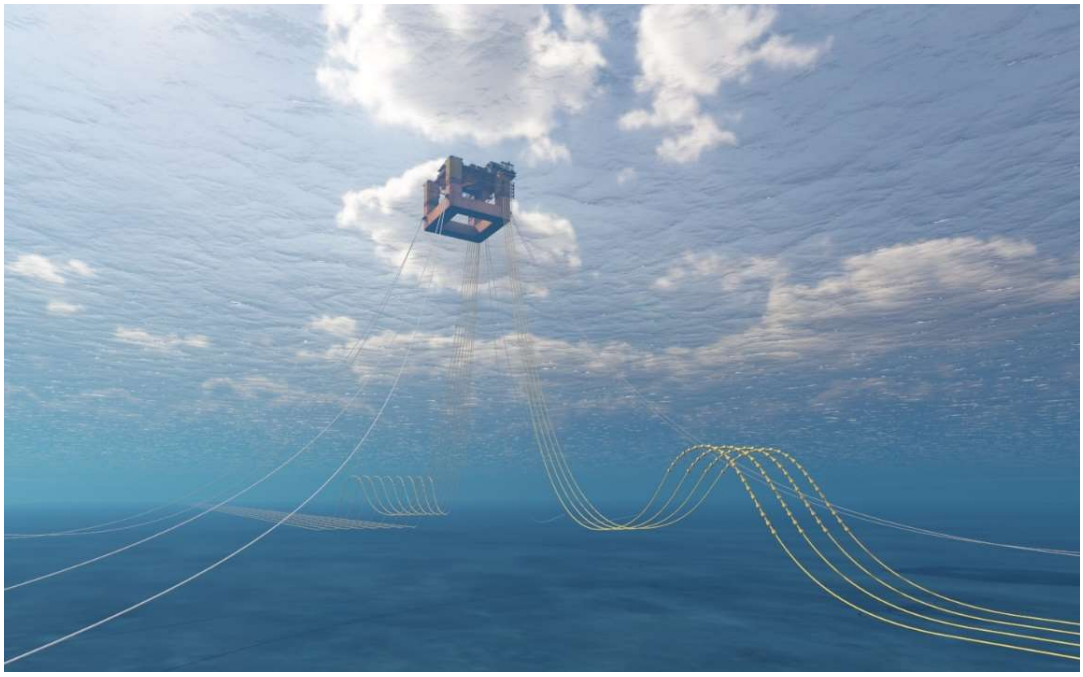


Figure 13 Example of an offshore floating substation, seen from below.

An underwater-based station comes as a standardised module. If necessary, several modules can be laid in parallel like building blocks that support more GW (more installed power). All the main electrical components of the wind turbines connect to structural foundations on the seabed. These foundations can either be 'suction piles' or a 'mudmat', depending on the bottom substrate and the seabed topology – see **Figure 14.**

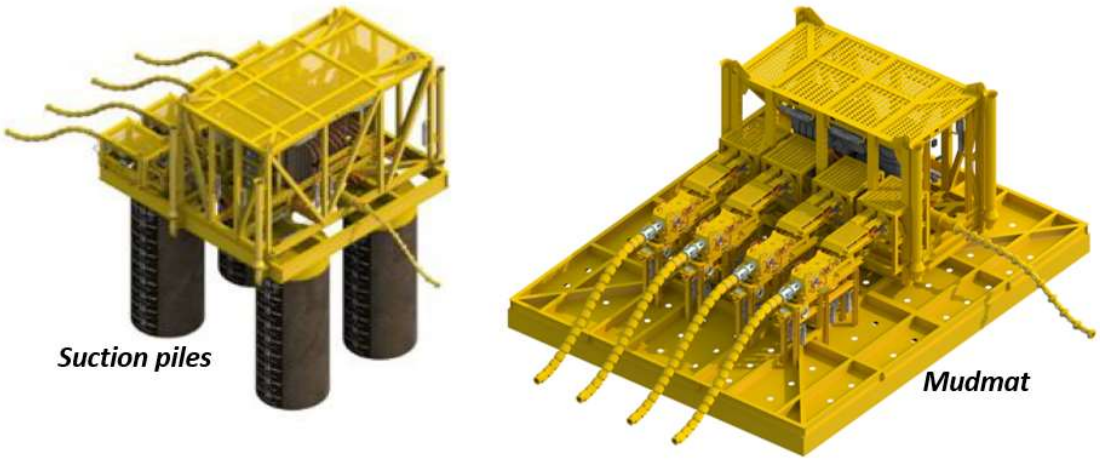


Figure 14 Example of underwater substations.

3.7 Measuring equipment

Although there is data on weather conditions at sea, there is a need for physical measurements during the course of the project. These measurements are partly to reduce uncertainties about the wind resource directly linked to electricity production, and partly to calibrate models and adapt the design of the plant (especially foundations, anchoring, cables) to the local conditions. These measurement campaigns usually last for 1-2 years early in the project.

An established method of measuring the wind resource is the use of anemometers on a measuring mast out at sea. The mast is mounted on the seabed and is on a level with the wind-turbine hub. In recent years there has been an increase in the use of floating buoys equipped with measuring equipment for offshore wind-power projects. These so-called Floating Lidars (F-Lidars) measure the wind resource at different heights above sea level with the aid of lasers (Lidar = Light Detection and Ranging). However, due to turbulence levels in the air there may be limitations with regard to F-Lidar's measurements.

These measurement methods will be evaluated during the course of the project. The choice of measuring-equipment type and the number of items of measuring equipment will take into account the available technology and on-site conditions.

3.8 Construction phase

The construction-phase activities differ depending on whether it's a floating or a bottom fixed wind farm.

Floating wind turbines are mounted on the foundations in a port or shipyard area. Installation of anchors, anchoring lines and/or chains is carried out at sea. Wind turbines mounted on foundations are towed out to the wind-farm area, where the anchoring lines are connected to the foundations and are pretensioned. Since floating wind turbines can be mounted on foundations in a port or shipyard area, heavy lifting operations are not usually necessary at sea, as in the installation of bottom fixed wind turbines.

With bottom fixed foundations, before installation of the wind turbine can begin, the foundations must first be built on location out at sea. The foundations must bear the weight of the turbine and act as a counterweight. How the foundations are to be constructed is determined by the nature of the seabed, the wind turbine's weight and the tower's size and height. When building foundations, a pit is first dug. The bottom of the pit is then levelled, to facilitate placing of reinforcing bars. In the middle of the pit a pillar is built, for use as a plinth for the wind turbine. The pit is then filled with concrete. After about a month, by which time the concrete will have hardened, the foundations are covered with filler to restore the seabed.

Bottom fixed foundations can also be installed by pile driving and/or by drilling (both for monopiles and pin piled jacket foundations), if the sediment layer isn't deep enough. Depending on the characteristics of the seabed it might be necessary to drive and/or drill about 80 meters below the surface of the seabed for monopiles and about 40 meters for the pin piles connected to the jacket foundations.

3.9 Operational stage

During a wind farm's operational phase, maintenance and repairs will be necessary.
The wind turbines will be marked and equipped with obstruction lights in accordance with the Swedish Transport Agency's regulation TSFS 2020:88. In accordance with TSFS 2020:88 § 23, wind turbines whose height including the rotor in its highest position is 150 metres above ground level and the water surface must be marked with white paint, and equipped with a high-intensity white flashing light on the nacelle.

On a wind farm, at least the wind turbines constituting the outer boundary of the wind farm must be marked in accordance with TSFS 2020:88 § 14. This also applies to wind turbines that are located inside the outer boundary of the wind farm and are not obscured by any of the wind turbines located in the outer boundary line. Other wind turbines forming part of a wind farm must be marked with white paint, and at least provided with low-intensity lights at the wind turbine's highest fixed point.

When the nacelle is over 150 metres above ground level or the water surface, the tower must also be equipped with at least three low-intensity lights halfway up to the nacelle. For wind turbines whose

height including the rotor in its highest position is over 315 metres above ground level or the water surface, additional markings and lighting may be required, in which case a decision must be obtained from the Swedish Transport Agency.

3.10 Decommissioning

Wind turbines' expected lifespan is approx. 30 years. The wind-farm plant will be decommissioned at the end of its service life, and the equipment will be taken care of. At the decommissioning stage the same principle is usually used as in construction, but in the reverse order. The intention is that cables, anchoring devices and any foundations on the seabed be disposed of onshore, and as far as possible recycled. This is in accordance with Freja Offshore's sustainability policy, with the goal of striving for zero waste generation through prevention, reduction, recycling and reuse of materials throughout Freja Offshore's value chain.

The floating foundations will be disconnected from the anchorage and towed back to shore, where they will be dismantled and/or renovated, recycled or safely disposed of. The mooring system including anchors and mooring lines will be disconnected and retrieved by anchor handling vessels.

4 Alternatives

4.1 Main alternative

The main alternative involves construction of the wind farm as described in Section 3. When fully built, Freja Offshore's planned Cirrus wind farm has the potential to produce approx. 10 TWh annually. The construction work is expected to take about 2 to 3 years.

The impact, effects and consequences are being assessed for the construction phase, and will be assessed during the operational phase and decommissioning.

4.2 Zero alternative

The zero alternative must describe the circumstances – both the positive and the negative effects – if the operations being applied for do not come to fruition. The zero alternative thus means that no wind farm will be built in the area. This avoids any impact on designated interests such as shipping, total defence and commercial fishing. There will thus be no impact regarding other aspects of the area. This option means that in order to attain the Swedish Energy Agency's strategy and goals for offshore wind power, the corresponding wind farm or other electricity production will need to be built elsewhere. It may also mean there will be no additional electricity production in Electricity Area S4 (Karlskrona).

Within the wind farm trawl fishing will be limited, and fish stocks will somehow be protected; this may be of benefit to regrowth. If no wind farm is built, fishing will be able to continue unchanged. There will also be no reef effects that might benefit marine life.

In the EIA the consequences of the zero alternative will be compared with the consequences for the planned operations.

4.3 Alternative localisation

Freja Offshore has commissioned a localisation study that has evaluated a large number of locations where the electricity produced can be connected to Electricity Area 4. The evaluation has taken into account technical parameters and various interests in the marine areas. Examples of the parameters used in the evaluation are average wind speed, bathymetry, water depth, marine geology, shipping traffic, wrecks and fishing activity.

Based on the location investigation, Freja Offshore has identified a number of locations where the company intends to continue to investigate and test the possibility of operating wind farms. The planned Cirrus wind farm area is one of these sites, and it has been assessed that the site has excellent prerequisites for such a farm. Other locations are subject to their own permit processes, and are thus not under consideration as alternatives to of Cirrus.

Alternative localisation will be described in greater detail in the EIA.

4.4 Alternative design

An alternative design of the wind farm may be to build several turbines that are smaller than those planned. Within a park area, the number of turbines is governed by the rule of thumb for minimum mutual distances in relation to how much they interfere with each other. Within sea-based wind farms it is common to state a mutual distance in the prevailing wind direction of about 8 rotor diameters, and perpendicular to this direction about 6 rotor diameters. The bigger the turbines the greater the distance between them, and the bigger the turbine the greater the installed power, the higher the wind speeds and thus the greater the electricity production per turbine. The final choice of turbine thus involves an equation concerning wind speed, installed power, possible locations regarding bottom conditions and other considerations, as well as the cost of the turbine including assembly, operation and maintenance.

An alternative design and size of the wind farm will be highlighted in the EIA.

5 Planning conditions

The Swedish Agency for Marine and Water Management has prepared proposals concerning maritime spatial plans that will provide guidance on how marine areas in Sweden should be used. The aim of the plans is to provide guidance concerning the future use that is best suited to the different areas. On 10th February 2022 plans regarding the Baltic Sea and the North Sea were decided on. New maritime spatial plans will be drawn up by December 2024, and will be presented to the government by March 2023. The new areas will enable an additional 90 TWh of annual electricity production, in addition to the areas already designated in the existing maritime spatial plans.

The planned Cirrus wind farm is located within maritime spatial plans Ö249 and Ö246, both located in the Southern Baltic Sea area, see **Figure 15.** The Ö249 maritime spatial plan is designated for 'general use with particular regard to ambitious nature values', and Ö246 is designated for 'general use'. If maritime spatial plans stipulate 'general use', then no particular use takes precedence.

Total Defence is interested in this area in terms of naval training areas – see section 0.

The wind farm is partly located in an area designated for commercial fishing – see section 6.12

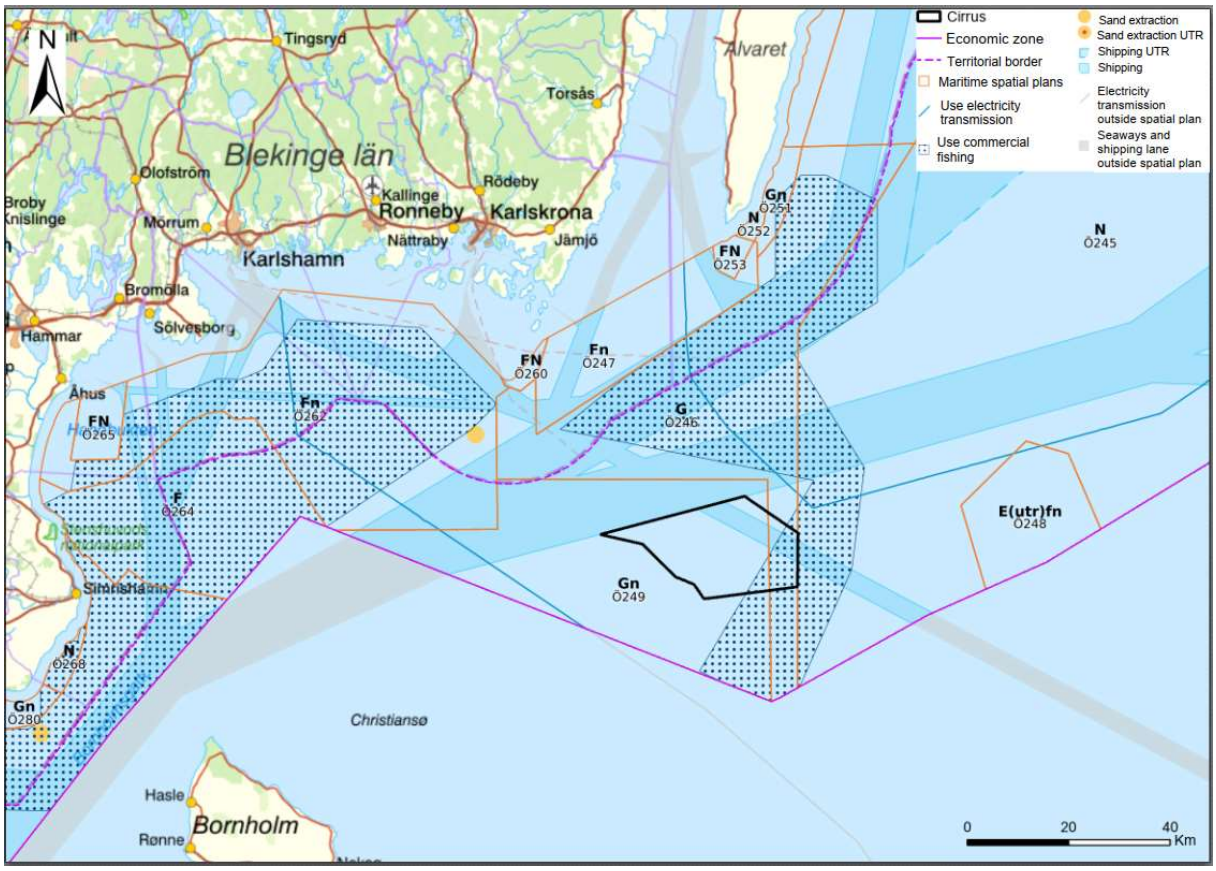


Figure 15 Map of maritime spatial-planning area, commercial fishing, shipping and sea routes. Source: Swedish Agency for Marine and Water Management

6 Environmental conditions and delimitation

Relevant environmental and socioeconomic parameters for the planned activities and the objective delimitation regarding the planned EIA process are described below. The impact on the surrounding environment during the project's construction phase arises during the construction work, thereby causing underwater noise and some turbidity in connection with the laying of cables and anchoring of foundations. The construction work is expected to take about 2 to 3 years.

During the operational phase environmental impacts from the wind farm on the surrounding environment, e.g. airborne noise and the possible danger the rotor blades pose for any bats and birds, will also have an effect in terms of the use of the marine area the park represents. Maritime traffic and fishing will be affected, as the park poses an obstacle.

There may be some impact in connection with repair and maintenance work, and turbidity and noise may occur during the decommissioning of the wind farm.
With bottom fixed and floating foundations, some permanent biotope loss occurs during expansion, anchoring, bottom-laying of cables etc. There is furthermore also a risk of some turbidity and underwater noise from anchoring chains and the installation of foundations. However, with both bottom fixed and floating foundations there may be a positive impact in the form of a reef effect.

In the upcoming EIA, Freja Offshore intends to describe and investigate the impacts, effects and consequences of the wind farm in greater detail. The consequences will be assessed on the basis of the current situation, but will also be compared with a so-called zero alternative, i.e. the situation if planned operations are not carried out. In the EIA, measures planned to prevent, obstruct or counteract the negative environmental effects will also be described in greater detail.

There are cumulative effects when several separate effects from past, present and/or future actions or projects interact. For example, other activities in the vicinity that, together with the planned wind farm, affect interests in a way that differs from the impact of the operations individually. Other possible operations are other wind farms, fishing and shipping traffic.

Cumulative effects from licensed operations and measures will be described in the EIA.

6.1 National interests and protection of the area

6.1.1 National interest regarding wind-energy harvesting

National-interest areas for wind-energy harvesting have been designated by the Swedish Energy Agency and are regulated in accordance with Chapter 3 § 8 of the Swedish Environmental Code. National interests regarding wind-energy harvesting are stated because there are particularly good conditions for wind-energy harvesting from a national perspective, because wind farms are needed for important or necessary functions in society, and because of the need for certain energy production (Swedish Energy Agency 2013). National-interest areas regarding wind power must be protected against measures that may significantly impede the creation or use of energy-production facilities.

Within the field of national interests regarding wind power, there may be national interests regarding the field of total defence that for reasons of confidentiality cannot be reported openly. If these national interests are mutually incompatible, the defence interest must be given precedence in accordance with Chapter 3 of the Swedish Environmental Code §§ 9-10. The fact that an area is designated as being of national interest regarding wind power means that the Swedish Energy Agency deems the area to be particularly suitable for electricity production from large-scale wind-power facilities on the basis of the following conditions (Swedish Energy Agency, 2013):
At sea:

- Wind conditions – In the area in question the average annual wind speed must be over 8.0 m/s 100 metres above sea level (MIUU 2011)
- The area must be over 15 km^2
- Water depth down to 35 metres

6.1.1.1 Description of the current situation

Within the area of the planned wind farm there are no areas designated as being of national interest as regards wind-energy harvesting. The closest national-interest area is approximately 14 km away, and is east of the project area. The area has an average annual wind speed of 9.0-9.2 m/s, thus there are good conditions for wind-power production. About 45 km northwest of the project area is another national-interest area with an average annual wind speed of 9.1 m/s (Figure 16). Both national-interest areas feature an average water depth of 20-35 metres (EMODnet, 2023).

Water depth is an important parameter for offshore wind farms with respect to choice of foundations. In 2013 the Swedish Energy Agency assessed that with the technology at the time a depth of 35 metres was an appropriate boundary (Swedish Energy Agency, 2013). Floating technology and bottom fixed foundations for greater depths have been developed in the interim, and it is thus likely that there are now more areas that can be deemed suitable for the establishment of wind-power facilities than with technology of that time.

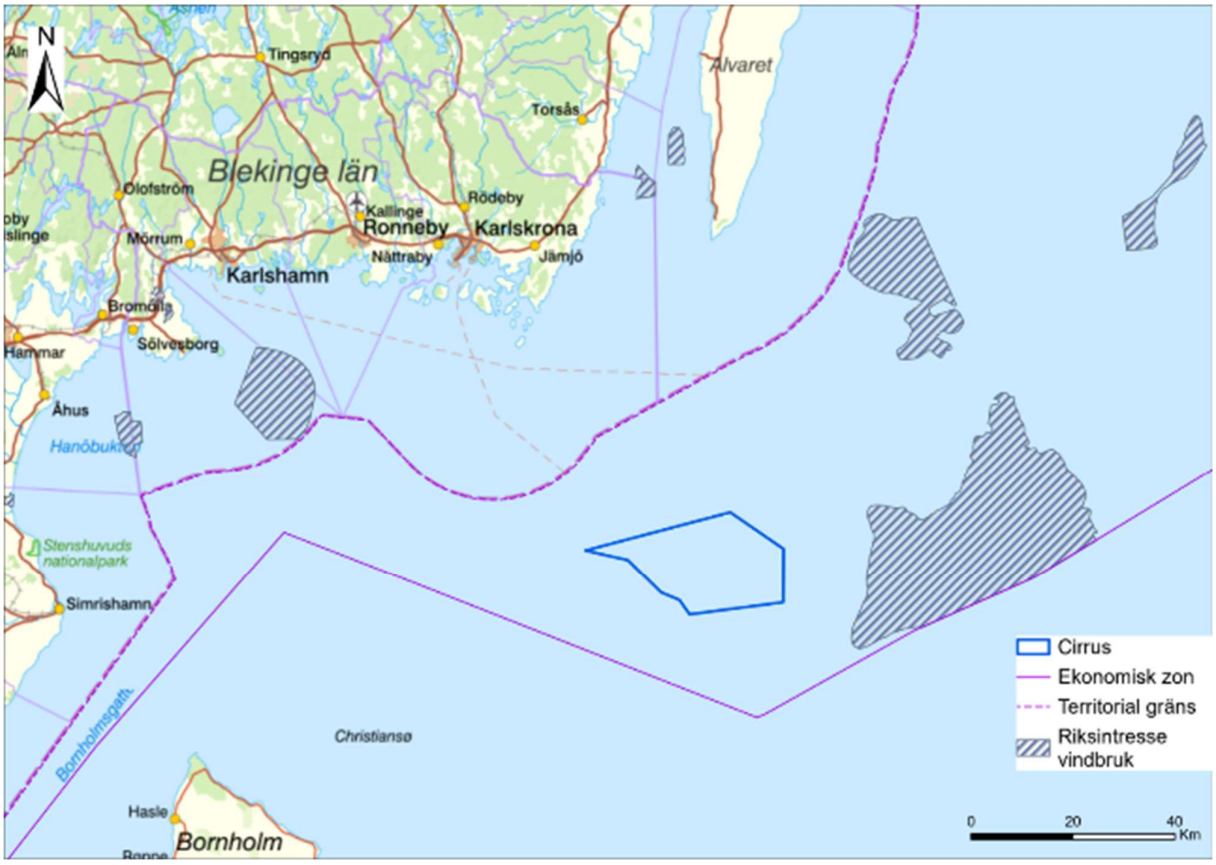


Figure 16 Map of national interest regarding wind farming Source: Swedish Energy Agency

Translation of legend to english:
Ekonomisk zon = ***Economic zone***
Territorial gräns = ***Territorial border***
Riskintresse vindbruk = ***National interest of wind farming***

6.1.1.2 Possible effects

The nearest area of national interest regarding wind power is 14 km east of the project area and features good conditions for wind power – in terms of wind conditions, water depth and the size of the area. As mentioned previously, this is based on the conditions and criteria regarding the technology at the time, and it thus does not go without saying that the project area for Cirrus would be less suitable for establishment of a wind farm than a wind farm within the area of national interest area. There is no formal obstacle to establishment of wind power both within the area of national interest area and in its vicinity.

6.1.1.3 Delimitation

Areas of national interest regarding wind power will be reported in the EIA. Possible projects in the national-interest area will be assessed in terms of cumulative effects.

6.1.2 Natura 2000

Natura 2000 is a network of protected areas throughout the EU, with valuable natural areas featuring species or habitat types considered to be particularly worthy of protection. Together with other EU countries Sweden must ensure that the necessary conservation measures be taken in the areas, in accordance with the Habitats Directive and the Birds Directive (Swedish Environmental Protection Agency, 2023).

The Habitats Directive lists species and habitat types that are of interest as regards preservation in order to safeguard biodiversity within the EU member states. The species listed in Annexe 2 of the Habitats Directive are ones whose habitat is to be protected. This means that Special Areas of Conservation (SACs) will be set aside to form part of the Natura 2000 network. (Swedish University of Agricultural Sciences {SLU}, 2022a).

The Birds Directive stipulates that we must protect all wild birds and their habitats and ensure that their environments within Sweden are preserved. The Birds Directive provides for Special Protection Areas (SPAs), where breeding species listed in Annexe 1 of the Directive are designated and included in the Natura 2000 network. (Swedish University of Agricultural Sciences {SLU}, 2022b). In Sweden the Environmental Protection Agency coordinates the work around Natura 2000, whilst each county administrative board is responsible for management, protection and supervision of the areas.

All Natura 2000 areas are of national interest pursuant to the Swedish Environmental Code, Chapter 4, § 1. Many of Sweden's Natura 2000 areas are also protected as national parks, nature reserves, biotope protection areas etc., and in these cases both legislations are applicable (Swedish Environmental Protection Agency, 2023). The Natura 2000 areas closest to the project area are Hoburgs bank and Midsjöbankarna, as well as the island group Utklippan.

6.1.2.1 Description of the current situation

Hoburgs bank and Midsjöbankarna (SE0330308)

Hoburgs bank and Midsjöbankarna constitute a Natura 2000 area bordering on the eastern side of the wind farm. The size of the Natura 2000 area is approx. 10,511.11 km², and it is for the most part situated within Sweden's Exclusive Economic Zone – see Figure 17**.** The area has been designated as a protected area in accordance with the EU's Habitats Directive (Site of Community Importance {SCI}) and the Birds Directive (SPA).

Under the Habitats Directive the habitat types within the area for which protection is intended are sandbanks and reefs. The sandbank Norra Midsjöbanken within the Natura 2000 area is approx. 40 km north of the project area. Approx. 20 km east of the project area is Södra Midsjöbanken. The sandbank is not located within the Natura 2000 site, but is immediately adjacent to it, and is important for its Natura 2000-area conservation values.

Sandbanks and reefs are chiefly found on Hoburgs bank and Norra Midsjöbanken, where the depth varies from 10 to 63 metres. Sandbanks are threatened by eutrophication, turbidity caused by shipping traffic, bottom trawling, oil spills and leakage from shipping traffic. Within the Natura 2000 site the sandbanks are deemed to have poor (unfavourable) conservation status. Just as with

sandbanks, the biggest threats are reef eutrophication, oil spills/leakages from ships, physical impacts of trawling and extraction of sand and rock. Reefs can occur on both soft and hard bottoms. Species found in the reefs include fish such as herring, sprat and cod, as well as blue mussels, long-tailed ducks, black guillemots and red algae. Long-tailed ducks have a direct link to the reefs, as blue mussels are their main food – see section 6.7.1.

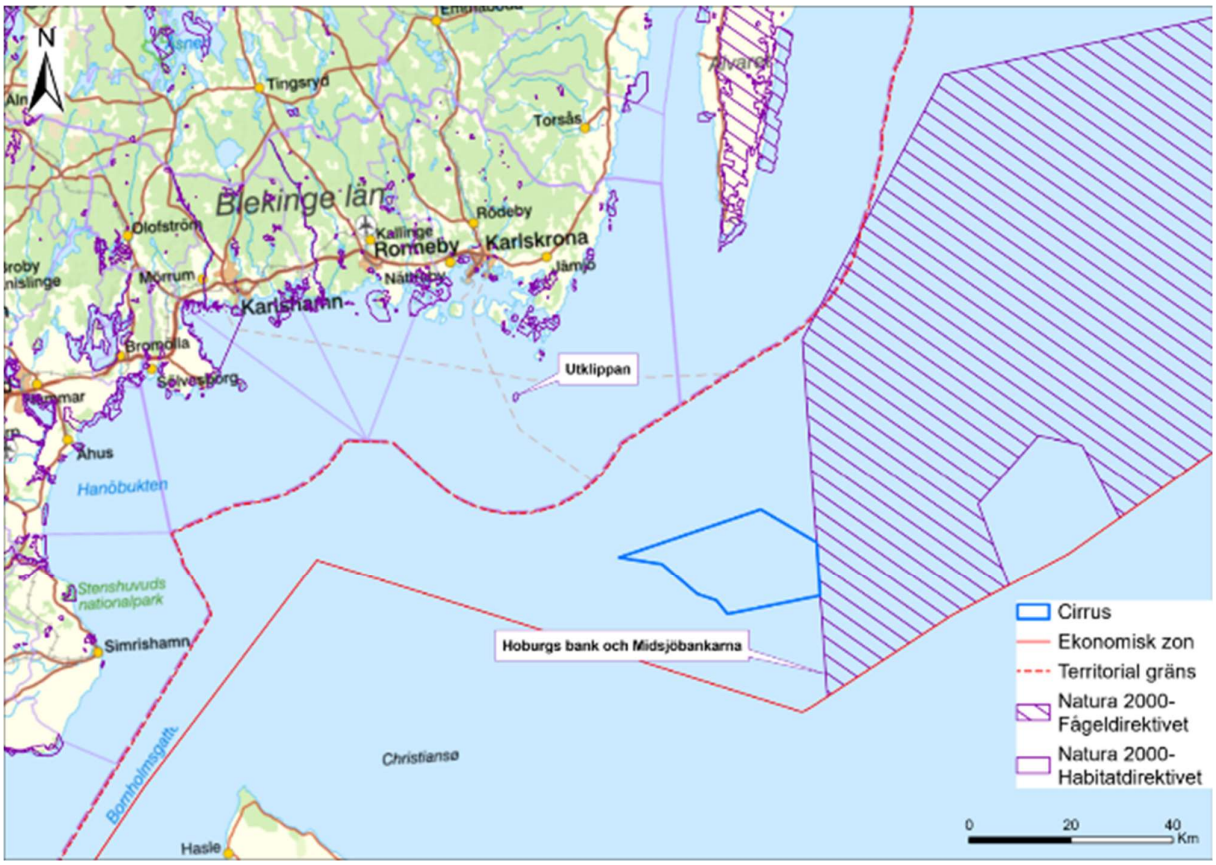


Figure 17 Map of Natura 2000 sites. Source: HELCOM

Translation of legend to english:
Ekonomisk zon = ***Economic zone***
Territorial gräns = ***Territorial border***
Natura 2000- Fågeldirektivet = ***Natura 2000- Bird Directive***
Natura 2000- Habitatdirektivet = ***Natura 2000- Habitats Directive***

Long-tailed ducks (*Clangula hyemalis*) and black guillemots (*Cepphus grylle*) are the species for which protection is intended under the Birds Directive, and the harbour porpoises (*Phocoena phocoena*) of the Baltic Sea population are protected under the Habitats Directive (County Administrative Board of Gotland, Kalmar County, 2021.)

The Natura 2000 site is very important for harbour porpoises, as it is where most of the Baltic Sea population is to be found during the period May to October. The area is important for harbour-porpoise reproduction. The harbour porpoise is deemed to have a poor (unfavourable) conservation status within the Natura 2000 area (County Administrative Board of Gotland, Kalmar County, 2021).

The conservation plan for the Natura 2000 area states that the impact on harbour porpoises within the Natura 2000 core area Hoburgs bank and Midsjöbankarna should be limited, and that sound levels should not exceed 40 dB above the harbour porpoise's auditory threshold. Within the project area the occurrence of porpoises is low – see section 6.6.1. The conservation plan for the Natura 2000 area states that long-tailed ducks should not be displaced from their wintering areas as a result of offshore wind-power production. By exploiting the offshore banks for wind-power production, the population may be excluded from important habitats. This also applies to black guillemots. Both long-tailed ducks and black guillemots are deemed to have a poor (unfavourable) conservation status within the Natura 2000 area Hoburgs bank and Midsjöbankarna (County Administrative Board of Gotland, Kalmar County, 2021)

Utklippan

Utklippan (SE0410040) comprises two larger islands and several smaller ones, and is Sweden's southeasternmost archipelago. Utklippan forms a Natura 2000 site, is situated approx. 40 km northwest of the project area and has an area of 118 ha.
The habitats within the area for which protection is intended are reefs, skerries and small islands. The animal species protected under the Birds Directive (SPA) is the Arctic tern (*Sterna paradisaea*), and the grey seal (*Halicheoerus grypus*) is protected under the Habitats Directive (SCI) (County Administrative Board of Blekinge County, 2017). The reef around the islands is deemed to have a good conservation status, and it features a large distribution of blue mussels and bladderwrack belts at depths down to 40 metres. The conservation status of skerries and small islands belonging to the Natura 2000 area is also deemed to be good, and they constitute important nesting sites for birds and haul-out sites for seals, as they are usually treeless. Within the Natura 2000 area the conservation status of grey seals and Arctic terns is deemed to be good (County Administrative Board of Blekinge County, 2017)

6.1.2.2 Possible effects

The Natura 2000 area Hoburgs bank and Midsjöbankarna is close to the project area. There may be effects on the Natura 2000 area during the construction phase, when there may be suspended sediment, sediment dispersion and release of pollutants as well as sedimentation. This may adversely affect benthic fauna and vegetation, as well as fish reproduction. It indirectly affects marine mammals.

During the operational and decommissioning phases, hanging cables and anchor chains/ropes may swirl up sediment from the bottom, but these effects will be limited, as all forms of movement cause wear on cables, chains and ropes, and plans are being made to minimise that risk.

Underwater noise during the construction phase may affect the behaviour of both fish and marine mammals. High noise levels may disturb any migratory animals, and underwater noise during the

construction phase is of increased significance during certain periods. Underwater noise may also occur during the operational and decommissioning phases, though probably not to the same extent as during the construction phase.

The degree of impact on the Natura 2000 area may vary, depending on the foundations used. Construction using monopile foundations (see section 0) causes a greater sound impact as a result of the piling than gravity-based foundations that are set down, but has less impact on the sea bottom, as the involvement of the natural bottom environment is negligible (Swedish Environmental Protection Agency, 2008).

In general, bottom fixed foundations take up a greater area of the seabed than floating foundations. During the construction phase the extent and effects of turbidity when laying bottom fixed foundations may be greater than with floating foundations, but turbidity mainly occurs when laying internal cables during the construction phase for both types of foundations, as well as during any drilling.

There is, however, a positive impact in the form of a new-reef effect and fouling that can occur with both bottom fixed and floating foundations. The conditions for a significant reef effect increase with the structural complexity of the foundations. The reef effect and fouling can contribute to beneficial changes in areas where biodiversity and increased numbers of fish are desirable. The reef effect can also mean the introduction of new species that change the site's natural ecosystem, and this can be deemed to be negative on soft sand or clay bottoms that are worthy of protection and where proximity to the hard bottom is lacking (Swedish Environmental Protection Agency, 2008).

Possible impacts on birds present in the area during the construction, operational and decommissioning stages may include disruption caused by construction vessels, suspended sediment (turbidity) and airborne noise, as well as collisions with wind turbines, effects on foraging and the creation of barrier effects – see section 6.7.

The Natura 2000 area Utklippan is situated at a distance from the project area where the impact of sedimentation, suspended sediment or releases during construction is limited. And because of the distance, underwater noise during the construction phase is not expected to affect the Natura 2000 area. Underwater noise associated with harbour porpoises is described in section 6.6.1.

Construction noise and sediment dispersion will have a temporary effect on the Natura 2000 areas during the construction phase, and it is deemed that during the operational phase the impact on the areas will be limited.

6.1.2.3 Delimitation

Freja Offshore intends to present results from modelling of sediment dispersion and investigations regarding noise and barrier effects, which will be produced as a basis for assessing the impact on designated species and habitats in the nearby Natura 2000. Effects and impacts on Natura 2000 areas will be reported in the upcoming EIA.

6.1.3 National interest Nature conservation and protected areas

Areas of national interest regarding nature conservation are dealt with in Chapter 3 § 6 of the Swedish Environmental Code, and have been designated by the Swedish Environmental Protection Agency. According to the Swedish Environmental Code, areas of national interest regarding nature conservation must be protected against measures that may significantly harm the natural environment. A national-interest area is a natural environment that is special or unique nationally, regionally or internationally.

A nature reserve is an area with high conservation values that is particularly important for flora and fauna. In Sweden and in many other countries, nature reserves are the most common way of protecting valuable countryside in the long term. Nature reserves are a strong form of protection that can be formed by both county administrative boards and municipalities.

Ramsar Sites are protected areas that can be designated based on the presence of representative, rare or threatened habitats and species, or on the importance of species during critical parts of their life cycle. Ramsar Sites can be valuable as resting or nesting areas for migratory birds, as important nursery areas for fish or as important water-supply resources.

6.1.3.1 Description of the current situation

National interest in nature conservation

National-interest areas regarding nature conservation are to be found approx. 30 km northwest of the project area. The area comprises the Torhamn archipelago (see **Figure 18**), and includes Sweden's southernmost archipelago. The Torhamn archipelago is an important link in the salinity gradient along the country's coast. Within the archipelago there are protected shallow areas and exposed deep areas. The shallow areas are considered to be important as spawning grounds for herring. Torhamns Udde is one of the country's most important habitats for migrating bird, and the entire archipelago area is deemed to be of great importance for nesting, resting and wintering birds.

Large parts of the island of Öland have identified national-interest areas for nature conservation. Along the east coast is an area comprising eastern Öland's coastal meadows, down to the southern tip of Öland. At the southern tip of Öland there is an area designated as a national-interest area for nature conservation, approx. 50 km north of the project area.

Along the east coast of Blekinge there are national-interest areas for nature conservation. Along the coast there are national-interest areas for nature conservation, in areas of water approx. 50 km north of the project area. The national-interest area is a continuous agricultural area featuring large areas of seashore meadows, low moraine islands and sandy fields. In the shallow bays and straits there are red-listed species of charophytes, and at Olsang there is one of the Baltic Sea's few harbour-seal colonies.

Nature reserves
The nature reserve nearest to the project area is within the area of the Torhamn archipelago. In the Torhamn archipelago there are five nature reserves: Utklippan (Obj. No. 10 02 058), which is described in greater detail in Section 5.1.2, Hästholmen - Ytterön (Obj. No. 10 02 030), Svenö (Obj. No. 10 02 028), Järkö (Obj. No. 10 02 029) and Torhamns udde (Ob.j No. 10 02 033).

Within Torhamns udde there are seven (7) further bird-protection areas: Hammaröra/Båtaskär, Ärlaskär, Eneskärsklips, Soneskären/Leragrund/Högaskär/Tvägölja/N. and S. Hylteskär/Stämmaskär/Kuggaskär/Gräsholmen, Kålleskär, Danaflöt, St Ören/Yttre Flisan/Ronnekläppen/Kvarken/Tvisnakläppen/Långören.

Around the southern tip of Öland is Ottenby Nature Reserve, which extends about 10 km southwards in the area of water from Öland – approx. 40 km from the project area – see **Figure 18.**

RAMSAR areas
The nearest Ramsar area is approx. 40 km northwest of the project area – see **Figure 18.** The Ramsar area comprises three separate islands, and is referred to as the Blekinge archipelago (Obj. No. 1115). It is important for wintering, and as a breeding and resting place for birds.

The southern tip of Öland forms a Ramsar area, situated approx. 50 km north of the project area and known as Ottenby (Obj. No. 17). The area is important for birds – both for migration and as a breeding ground. The area's sandbanks are also important for fish and molluscs.

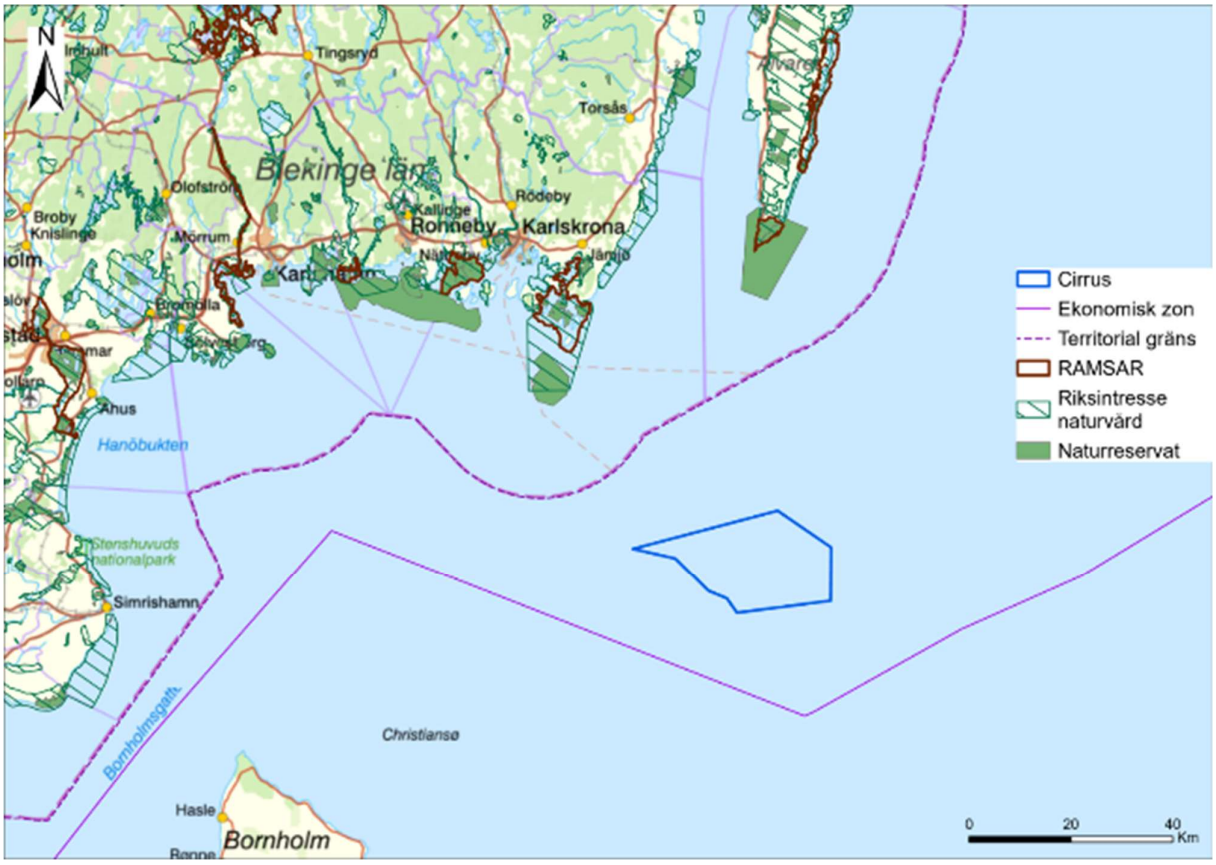


Figure 18 Map of national-interest areas regarding nature conservation, nature reserves and Ramsar areas. Source: Swedish Environmental Protection Agency

Translation of legend to english:
Ekonomisk zon = ***Economic zone***
Territorial gräns = ***Territorial border***
Naturreservat = ***Nature reserves***
Riksintresse naturvård = ***National interest areas regarding nature conservation***

6.1.3.2 Possible effects

The distance between the area of the planned wind farm and the nearest area of national interest regarding nature conservation, nature reserves and Ramsar areas is so big that no impact is likely to arise from sedimentation or release of pollutants. Nor will natural values in the national interest as regards nature conservation on land be affected by the planned wind farm.

6.1.3.3 Delimitations

National-interest areas for nature conservation and protected areas will be reported in the EIA, but it is deemed that the impact will be minor. The impact on the experience value in these protected areas will also be addressed in the EIA.

6.1.4 Marine protected areas

6.1.4.1 Description of the current situation

According to HELCOM's data there are no marine protected areas (MPAs) in the marine area for the planned wind farm. North of the planned wind farm there are three MPAs (Marine Protected Areas), designated in HELCOM's network for protection and conservation of species, habitats and ecosystems in the marine environment. These MPA areas overlap with the three Natura 2000 areas Norra Midsjöbanken, Hoburgs bank and Torhamns skärgård (see Section 6.1.2 and 6.1.3.1). The closest wind farm is the Torhamn archipelago, which is approx. 35 km from the project area – see **Figure 19.**

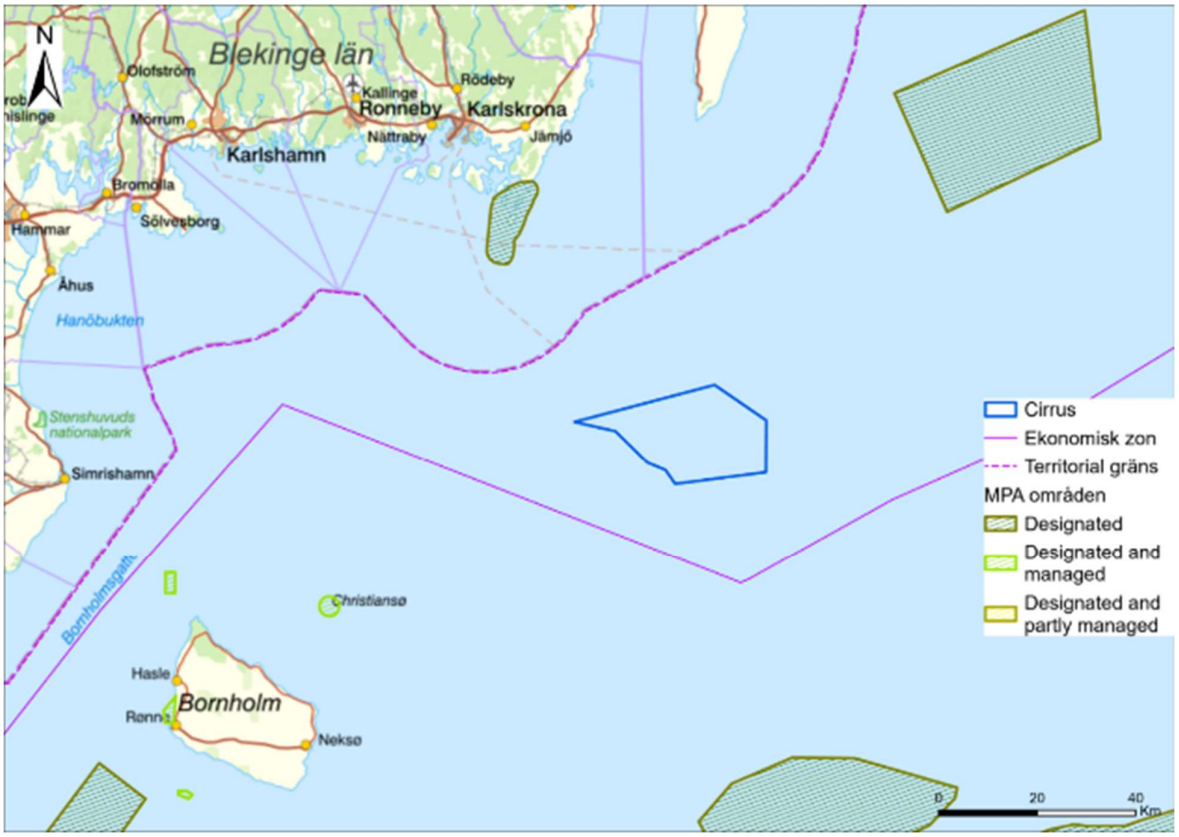


Figure 19 Map of MPA areas. Source: HELCOM

Translation of legend to english:
Ekonomisk zon = ***Economic zone***
Territorial gräns = ***Territorial border***

6.1.4.2 Possible effects

Limited effects are foreseen, or none at all, as there are no MPA areas at the planned wind farm.

6.1.4.3 Delimitation

Internationally protected areas and any impact on them will be described in the EIA.

6.1.5 National interest Cultural environment

National-interest areas regarding cultural heritage conservation have been identified by the Swedish National Heritage Board and are dealt with in Chapter 3. § 6 of the Swedish Environmental Code National-interest areas regarding cultural-heritage conservation are cultural environments that are unique or special regionally, nationally or internationally, and must be protected against measures that may significantly damage the cultural environment.

6.1.5.1 Description of the current situation

Within the project area there are no areas designated as national-interest areas regarding cultural-heritage conservation. The closest national-interest area regarding cultural-heritage conservation is approx. 40 km north of the planned wind farm – see **Figure 20**. The object is called the Eastern Archipelago (K17), and comprises an archipelago environment with ancient remains from the Late Neolithic period as well as Viking and mediaeval remains. The ancient remains include graves, boat moorings and seasonal settlements. The archipelago comprises several islands, and the national interest includes a merger of several original national-interest areas. The national interest lies in Karlskrona's eastern archipelago, and extends from the outer archipelago, with Utlängan as the southernmost island, to eastern Hästholmen/Ytterön in the northern part, closest to the mainland. There are several national-interest areas regarding cultural-heritage conservation to the north of the described object, as well as along the west and east coasts of Öland.

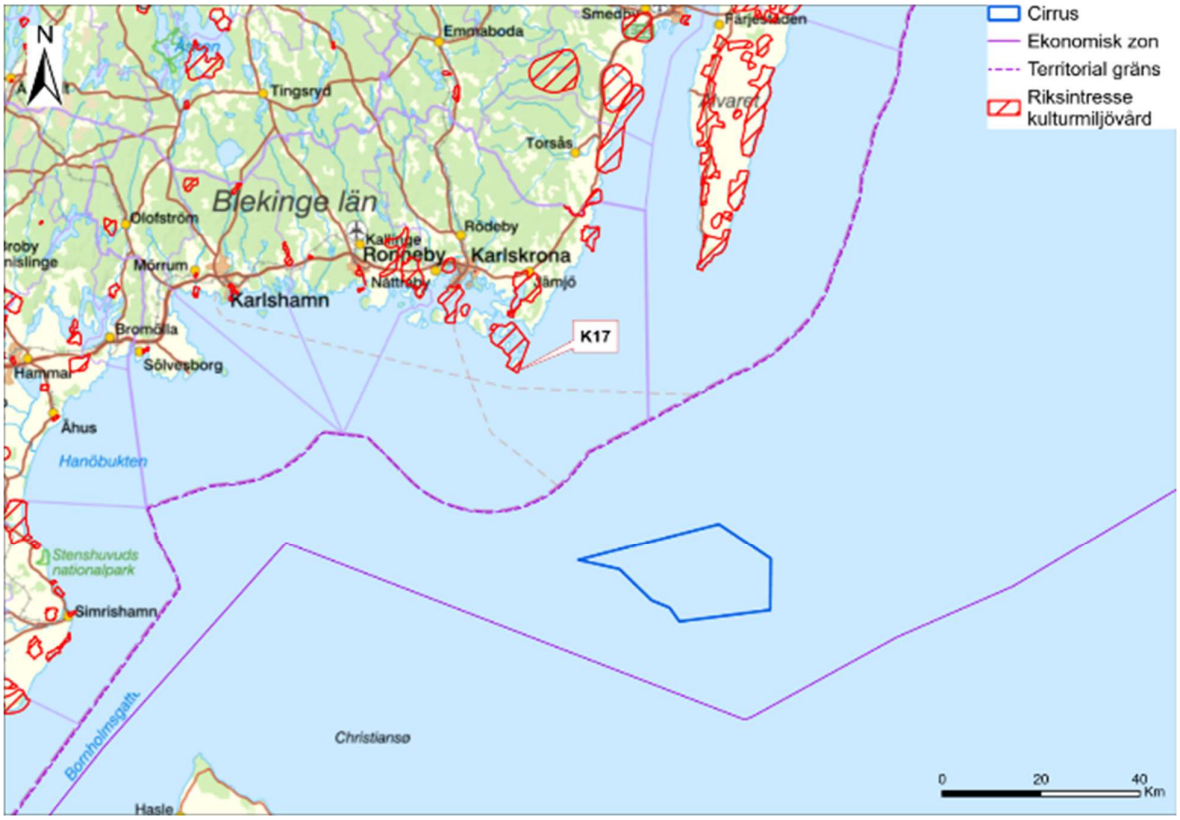


Figure 20 Map of national interest regarding cultural-heritage conservation in the area. Source: Swedish National Heritage Board.

Translation of legend to english:
Ekonomisk zon = ***Economic zone***
Territorial gräns = ***Territorial border***
Riksintresse kulturmiljövård = ***National interest regarding cultural heritage conservation***

6.1.5.2 Possible effects

It is a long way from the planned wind farm to national-interest areas regarding cultural-heritage conservation, and the wind farm is not expected to have an adverse impact on the cultural environment or people's experience of it.

6.1.5.3 Delimitation

National-interest areas regarding cultural environment will be reported in the EIA.

6.1.6 National interest Outdoor life

Areas of national interest regarding outdoor life have been designated by the Swedish Environmental Protection Agency and are regulated in the 3rd and 4th chapters of the Swedish Environmental Code, and they must be protected against measures that may significantly damage the natural and cultural environment.

6.1.6.1 Description of the current situation

Within the project area there are no areas designated as national-interest areas regarding cultural-heritage conservation. The nearest national-interest area is designated as a national interest regarding active outdoor life, and is approx. 25 km north of the planned wind farm – see **Figure 21.** The national-interest area covers the whole of Öland and continues about 10 km out into areas of water in the east and out to the boundary of Sweden's maritime territory in the south and east. Within the area, the interests of tourism and outdoor life must particularly be taken into account when assessing the admissibility of development companies or other interventions within the environment.

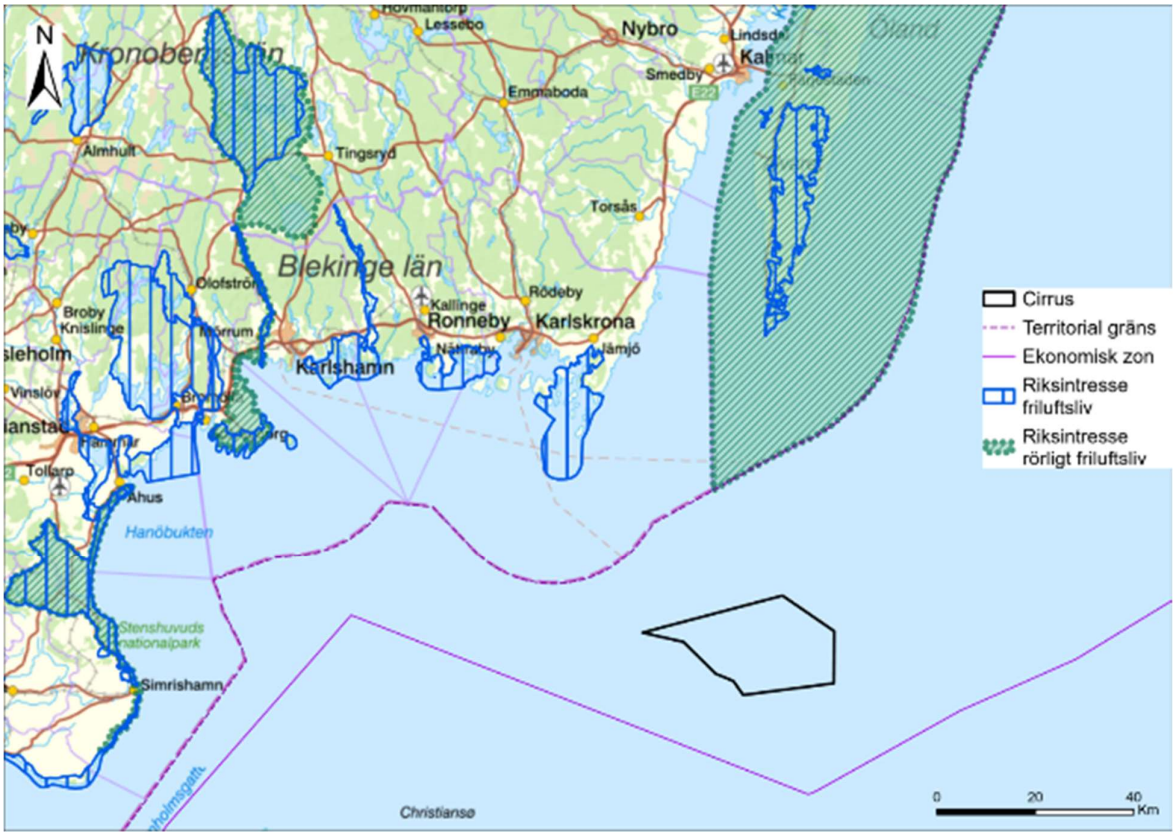


Figure 21 Map of national interest regarding outdoor life and active outdoor life. Source: The County Administrative Board and the Swedish Environmental Protection Agency

Translation of legend to english:
Ekonomisk zon = ***Economic zone***
Territorial gräns = ***Territorial border***
Riksintresse friluftsliv = ***National interest regarding outdoor life***
Riksintresse rörligt friluftsliv = ***National interest regarding active outdoor life***

The closest national-interest area regarding outdoor life is approx. 35 km northwest of the project area, namely the Torhamn archipelago. The area offers seal-watching, canoeing and boating in general. The area is stated as offering enriching experiences in natural and/or cultural environments.

Approx. 50 km north of the project area there is an area designated as being of national interest regarding outdoor life. The area covers Öland's southern cape and Ottenby nature reserve. The area is called Ottenby, and is a bird-watching locality that offers enriching experiences in the field of natural and/or cultural environments.

6.1.6.2 Possible effects

The planned wind farm will not have any adverse impact in the form of encroachment on the national-interest area regarding outdoor life – during either the construction phase or the operational phase. But the wind farm will be visible from the coasts along the southern part of the national-interest area in certain weather conditions. This may affect the experience values, which form part of what the national interest may be intended to protect.

6.1.6.3 Delimitation

National-interest areas regarding outdoor life will be reported in the EIA. The experience value will be described, in part using visualisations of the wind farm during the operational phase.

6.1.7 National interest Total Defence

National interests regarding total defence are regulated in Chapter 3. § 9 of the Swedish Environmental Code – comprising in part national interests reported openly and in part national interests that for reasons of confidentiality cannot be reported openly, pursuant to Chapter 15, § 2 of the Public Access to Information and Secrecy Act (SFS 2009:400).

The Swedish Armed Forces' national interests include firing and training fields, airports, naval training areas, technical systems and facilities. Areas that constitute national interests regarding the military part of total defence are areas that are deemed to feature nationally important values and qualities in terms of protecting Sweden. These can be areas or functions needed for implementation of live operations, as well as for training and exercising staff and functions. These areas should thus as far as possible be protected against measures that could significantly damage their values.

Areas affected by the environmental impact of military activities, which are of national interest, are reported as being impact areas. An impact area is one in which measures such as new housing developments may be affected by, or which may in turn affect, activities within the national-interest area.

All interests are reported in **Table 3** and **Figure 22.**

6.1.7.1 Description of the current situation

Open national interests

In the area of the planned wind farm there is nothing designated as being of national interest regarding total defence. There is an area approx. 20 km north and northwest of the project area that the Swedish Armed Forces have designated as being of national interest at sea. The national-interest area comprises a naval training area (TM0306). Another naval training area has been identified by the Swedish Armed Forces – approx. 70 km from the project area, along the east coast of Öland (TM0304).

About 60 kilometres northwest of the project area is an area designated as a national interest on land, comprising Södra Tjurkö and Bollö shooting range (TM0031). Another area designated as being of national interest on land is approx. 50 km northwest of the project area, and comprises Torhamn shooting range (TM0035).

Impact areas

A weather-radar impact area (TM0092), approx. 25 km northwest of the area of the planned wind farm, has been identified by the Swedish Armed Forces. Weather-radar impact areas are areas within a 50 km radius of the Swedish weather-radar stations (which are jointly used by the Swedish Meteorological and Hydrological Institute {SMHI} and the Swedish Armed Forces) where there is a need to secure the weather-radar function.

The weather-radar impact area (TM0092) overlaps with another impact area – an MSA area (TM0037) approx. 30 km northwest of the project area. The MSA area belongs to Ronneby Flotilla Airport. The MSA areas are located around flotilla and training airports, and enable safe flight into and out of the airport.

Approx. 60 km west of the project area is an impact area regarding noise and other risks (TM0039), and comprising the Ravlunda shooting range. The area is also designated as one with a particular need for freedom from obstacles.

Two additional impact areas regarding noise or other risks are located approx. 35 km and 40 km northwest of the project area respectively. The impact areas comprise southern Tjurkö, Bollö shooting range (TM0031), Torhamn shooting range and Öppenskär training field (TM0035).

The nearest area designated as a stopping area for high objects is approx. 40 kilometres northwest of the project area, and belongs to Ronneby Flotilla Airport (TM0037).
Approx. 50 km north of the project area is an impact area other (TM0515) that covers Öland's southern cape and Ottenby nature reserve.

Open areas of importance

A low-flying area with impact area overlaps with the two upper impact areas described, marked TM0352, about 40 km northwest of the project area. The area belongs to northern Blekinge - southern Småland. The area is adjacent to military air flotillas, and ensures exercises and training in low-flying training.

Approx. 50 km north of the project area there is an area designated as being of national interest on land. The area comprises Öppenskär training field (TM0035).

Table 3 Total defence's national-interest areas and impact areas in areas adjacent to the planned wind farm

Category	Subcategory	Object name	Object ID	Distance to Cirrus
Open national interests	National interest at sea (marine training area)	Hanö/Torhamn	TM0306	20 km
Open national interests	National interest at sea (marine training area)	Martin	TM0304	70 km
Open national interests	National interest on land	Southern Tjurkö and Bollö shooting range	TM0031	60 km
Open national interests	National interest on land	Torhamn shooting range	TM0035	50 km
Impact area	Weather-radar impact area	Karlskrona	TM0092	25 km
Impact area	MSA area	Ronneby Flotilla Airport	TM0037	30 km
Impact area	Impact area regarding noise or other risks	Ravlunda shooting range	TM0039	60 km
Impact area	Area with special need for freedom from obstacles	Ravlunda shooting range	TM0039	60 km
Impact area	Impact area regarding noise or other risks	Southern Tjurkö and Bollö shooting range	TM0031	35 km
Impact area	Impact area regarding noise or other risks	Torhamn shooting range and Öppenskär training field	TM0035	40 km
Impact area	Stopping area for high objects	Ronneby Flotilla Airport	TM0037	40 km
Impact area	Impact area other	-	TM0515	50 km
Open areas of importance	Low-flying area with impact area	Northern Blekinge - Southern Småland	TM0352	40 km
Open areas of importance	Area of importance on land	Öppenskär training field	TM0035	50 km

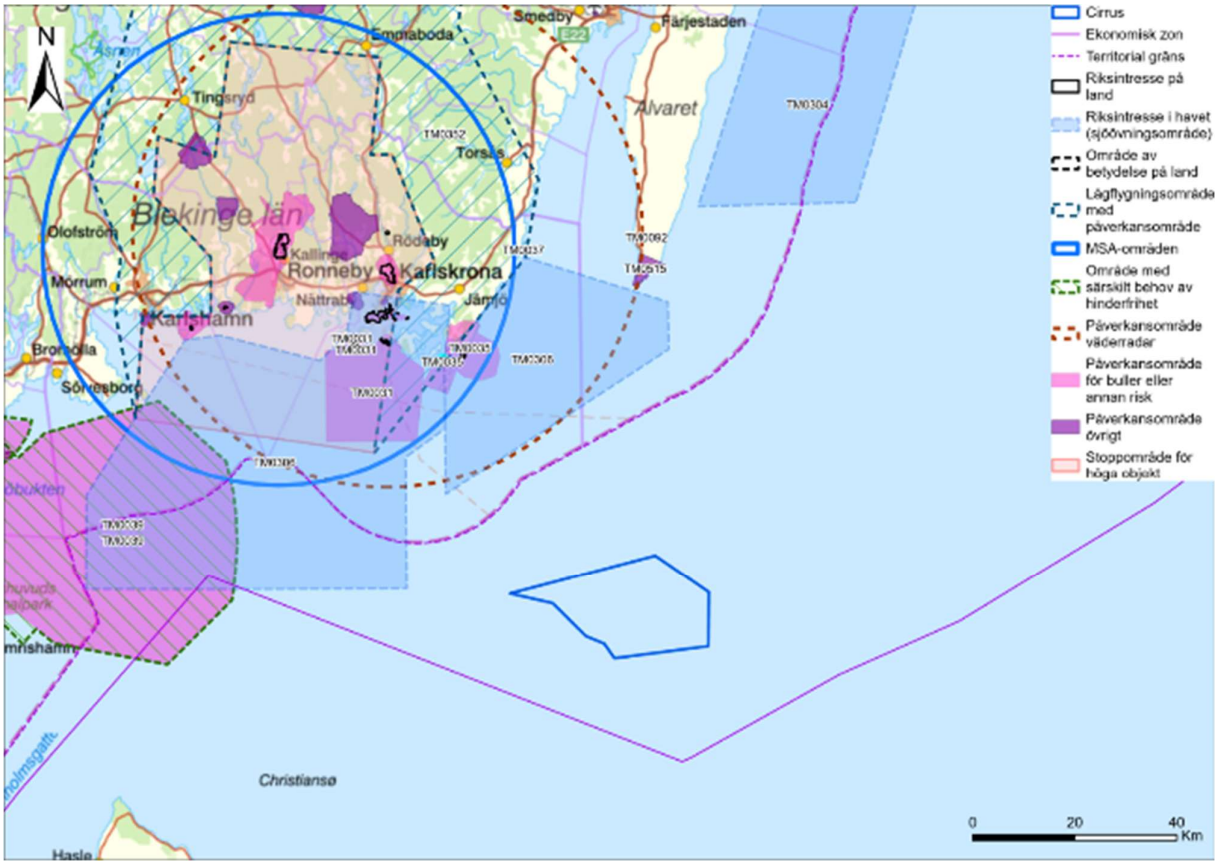


Figure 22 Map of total-defence interests. Source: Swedish Armed Forces

Translation of legend to english:
Ekonomisk zon = ***Economic zone***
Territorial gräns = ***Territorial border***
Riksintresse på land = ***National interest on land***
Riksintresse i havet (sjöövningsområde) = ***National interest at sea (marine training area)***
Påverkansområde väderrader = ***Weather-radar impact area***
MSA-område = ***MSA area***
Påverkansområde för buller eller annan risk = ***Impact area regarding noise or other risks***
Område med särskilt behov av hinderfrihet = ***Area with special need for freedom from obstacles***
Stoppområde för höga objekt = ***Stopping area for high objects***
Påverkansområde övrigt = ***Impact area other***
Lågflygningsområde med påverkansområde = ***Low-flying area with impact area***
Område av betydelse på land = ***Area of importance on land***

6.1.7.2 Possible effects

The possibility of the coexistence of Armed Forces operations and additional wind turbines varies, depending on the type of operations the Armed Forces are conducting in a particular location. With additional wind turbines there may be a risk of limiting some of the authority's areas of interest and thereby causing damage to the value of the national interest or the area of importance, whilst

for other areas coexistence may be possible. Within or in the immediate vicinity of the Armed Forces' operational sites, this can primarily entail a physical obstacle. With such a limitation there is above all a risk of affecting the flying activities taking place within the Armed Forces, as well as affecting technical systems such as weather radar, operations covered by defence confidentiality etc. (Swedish Armed Forces, 2022).

No interests have been identified within the area of the planned wind farm, and it is so far to the nearest flying operations taking place within the Armed Forces, as well as technical systems such as weather radar, that conflicts are unlikely.

6.1.7.3 Delimitations

Investigations of effects and impact on military interests need to be delimited in consultation with the Swedish Armed Forces. When assessing that effects may occur, this will be reported in the upcoming EIA.

6.1.8 National interest Aviation

In accordance with the provisions of Chapter 3, § 8 of the Swedish Environmental Code, an area of national interest surrounding an airport must be protected against measures that could significantly impede the creation or use of the airport. The national-interest area around an airport comprises land that is directly used or may in future be used for the needs of aviation. The airport operator is the stakeholder if a wind farm site is planned in the vicinity of an airport and may affect its operations. If a permit for the establishment of wind power facilities is required, the applicant must consult with the airport operator in accordance with Chapter 6 of the Swedish Environmental Code before the application is submitted, and the airport operator must be given the opportunity to comment during the permit process.

6.1.8.1 Description of the current situation

There are no designated national interests within the area of the planned wind farm – see **Figure 23.** There is an MSA area belonging to Ronneby Airport approx. 20 km northwest of the project area. Approx. 70 km east of the project area is an MSA area belonging to Kristianstad Airport, and approx. 50 km north of the project area is an MSA area belonging to Kalmar Airport. Within each MSA area there is a flight-obstacle area of influence for each airport.

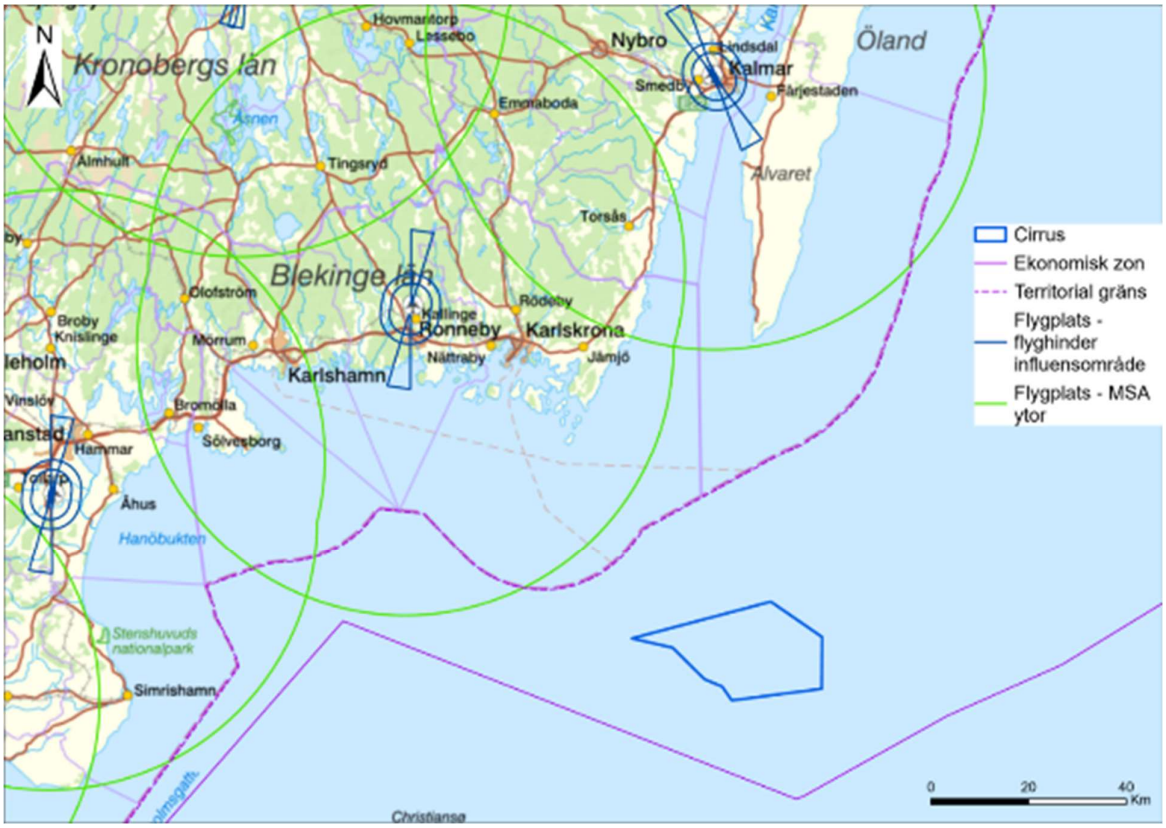


Figure 23 Map of areas of national interest for aviation. Source: Swedish Transport Administration

Translation of legend to english:
Ekonomisk zon = ***Economic zone***
Territorial gräns = ***Territorial border***
Flygplats – flyghinder influensområde = ***Airport - flight obstacle area of influence***
Flygplats – MSA ytor = ***Airport – MSA area***

6.1.8.2 Possible effects

No interests are identified at the site for the planned wind farm. MSAs are calculated on the basis of the highest obstacle in the sector in question and include a margin of about 300 metres. Wind turbines that have an altitude higher than 300 metres above the ground or water surface, including the rotor in its highest position, may have an impact on aviation activity, although the nearest MSA ends at a distance from the wind farm where conflicts are unlikely to occur. The airport operator is the stakeholder if a wind farm site is planned in the vicinity of an airport and may affect its operations. Applicants shall consult with the airport operator in accordance with Chapter 6 of the Environmental Code before submitting the application, and the airport operator shall be given the opportunity to submit an opinion during the permit process.

6.1.8.3 Demarcation

Potential effects and impacts on national interest for aviation will be investigated and described in an EIA.

6.1.9 National interest: commercial fishing

The Swedish Agency for Marine and Water Management will provide information on areas that are of national interest for commercial fishing according to the Environmental Code's provisions on national interest, Chapter 3 (5) of the EC. The national interest includes marine areas, inland waters and ports that are deemed to be of particular importance to the industry. The purpose of the provisions on national interests is to provide such areas with long-term protection against other activities that may have a significant negative impact.

6.1.9.1 Description of the current situation

The planned site for the wind farm is partly within an area designated as a national interest for commercial fishing: see
Figure **24.** The national interest area is a fishing area known as Södra Öland/Utklippan. The area is mainly fished for sprat and herring (Swedish Agency for Marine and Water Management. 2021a). An area of approximately 75 km2 of the project site lies within the national interest. There is an area designated as an area of national interest for commercial fishing approximately 40 km north-east of the project site. This is a fishing area known as Skåne/Bleking utsjöområde. Fishing activity in the Cirrus area is low: see section 6.12 and **Figure 38**.

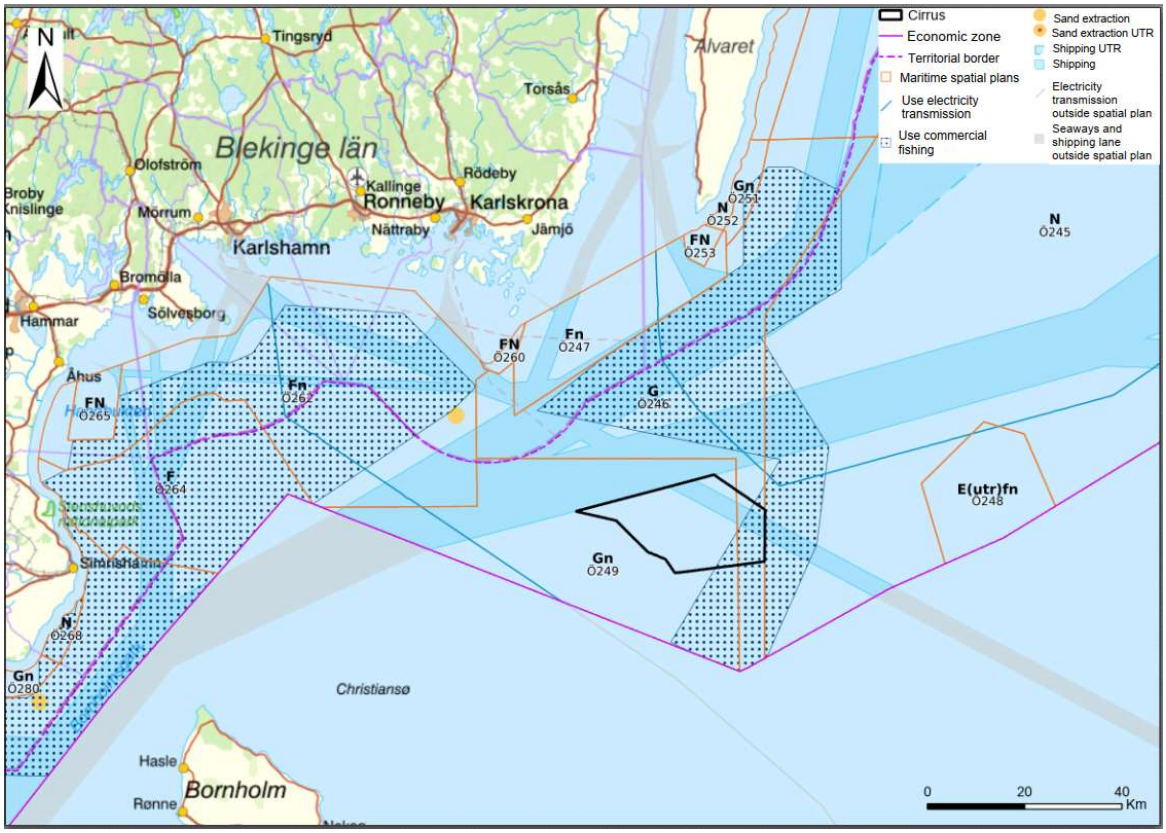


Figure 24 Map of national interest for commercial fishing, as well as marine spatial planning areas, seaways and shipping. Source: Swedish Agency for Marine and Water Management.

6.1.9.2 Possible effects

Possible effects on commercial fishing are described in section 6.12.2, which partly coincides with effects on the national interest for commercial fishing.

6.1.9.3 Demarcation

The impact on the national interest of commercial fishing during the construction phase and the operational phase will be further investigated and described in the EIA.

6.1.10 National interest: shipping and seaways

Land and water areas deemed to be of national interest for communication facilities according to Chapter 3 (8) of the Environmental Code are designated by the Swedish Transport Administration. The areas identified have special functions for the maritime transport system, such as ports and shipping lanes.

6.1.10.1 Description of the current situation

There is a national interest for shipping: an existing shipping lane that extends between Utklippan and Gdansk. This shipping lane crosses the northern part of the project site in a north-west to south-east direction towards Poland: see **Figure 25**. The shipping lane has shipping lane number 27, a protected height of 65 metres and a protected depth of 19 metres, according to the Swedish Transport Administration.

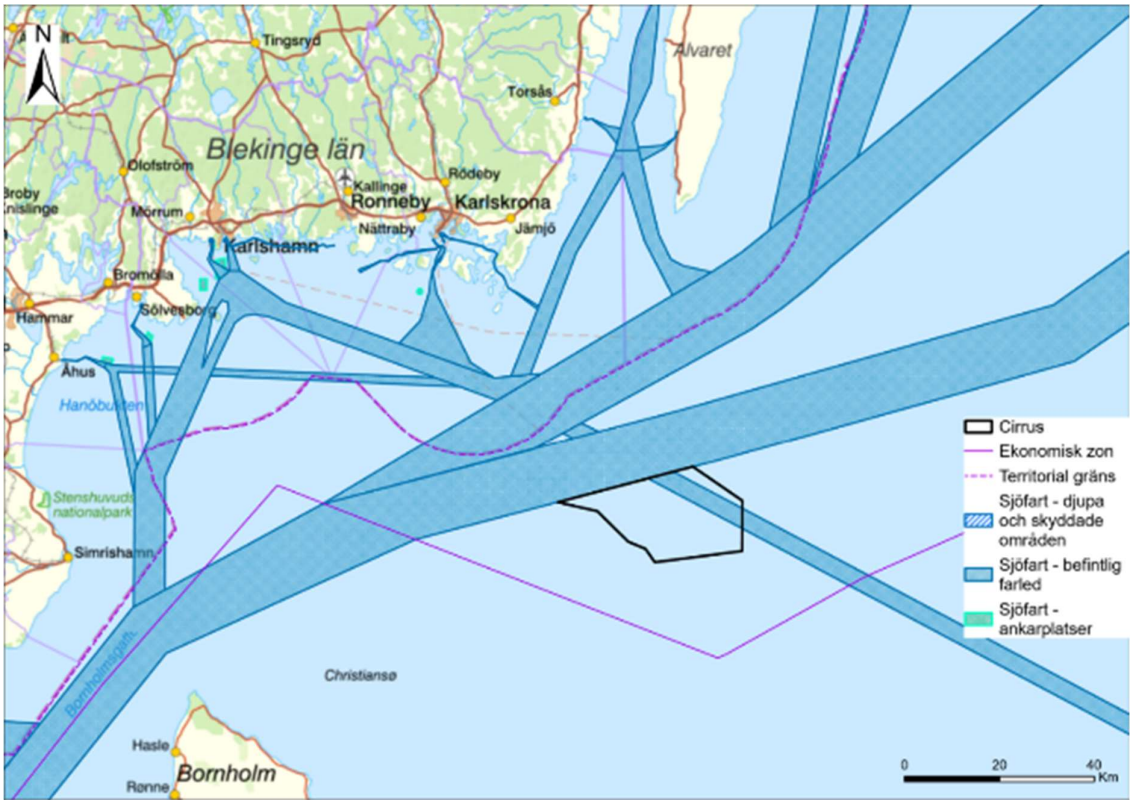


Figure 25 Map of national interest for shipping and seaways. Source: Swedish Transport Administration

Translation of legend to english:
Ekonomisk zon = ***Economic zone***
Territorial gräns = ***Territorial border***
Sjöfart - djupa och skyddade områden = ***Shipping – deep and protected areas***
Sjöfart - befintlig farled = ***Shipping - existing shipping lane***
Sjöfart - ankarplatser = ***Shipping - anchorages***

An area of national interest for shipping borders on the planned wind farm, along the boundary of the north-western part of the project site. This is an existing shipping lane that runs between Gedser and Svenska Björn and has shipping lane number 20. The area has a protected height of 65 metres and a protected depth of 19 metres.

6.1.10.2 Possible effects

Examples of impacts from wind turbines include obstruction of markings for shipping or reduced visibility, both optical and with radar, making navigation more difficult and making it harder to see other vessels. Possible effects may be that shipping may need to be diverted, or the design of the wind farm may need to be adapted. Any interference with existing markings (buoys, lighthouses or other markings) for shipping must be investigated; whether obstruction lights can interfere with lighthouse lights, for instance, or whether towers obscure markings or interfere with radar.

6.1.10.3 Demarcation

A risk analysis for shipping will be investigated and described in the EIA, as well as the impact on the national interest for shipping.

6.2 Depth conditions and hydrology

The sea depth in the area for the planned wind farm varies between 43 and 81 metres. The planned project site is located within an area in the north Bornholm Basin where the seabeds are periodically partly oxygen-free and oxygen-poor: see **Figure 26** (SMHI, 2020).

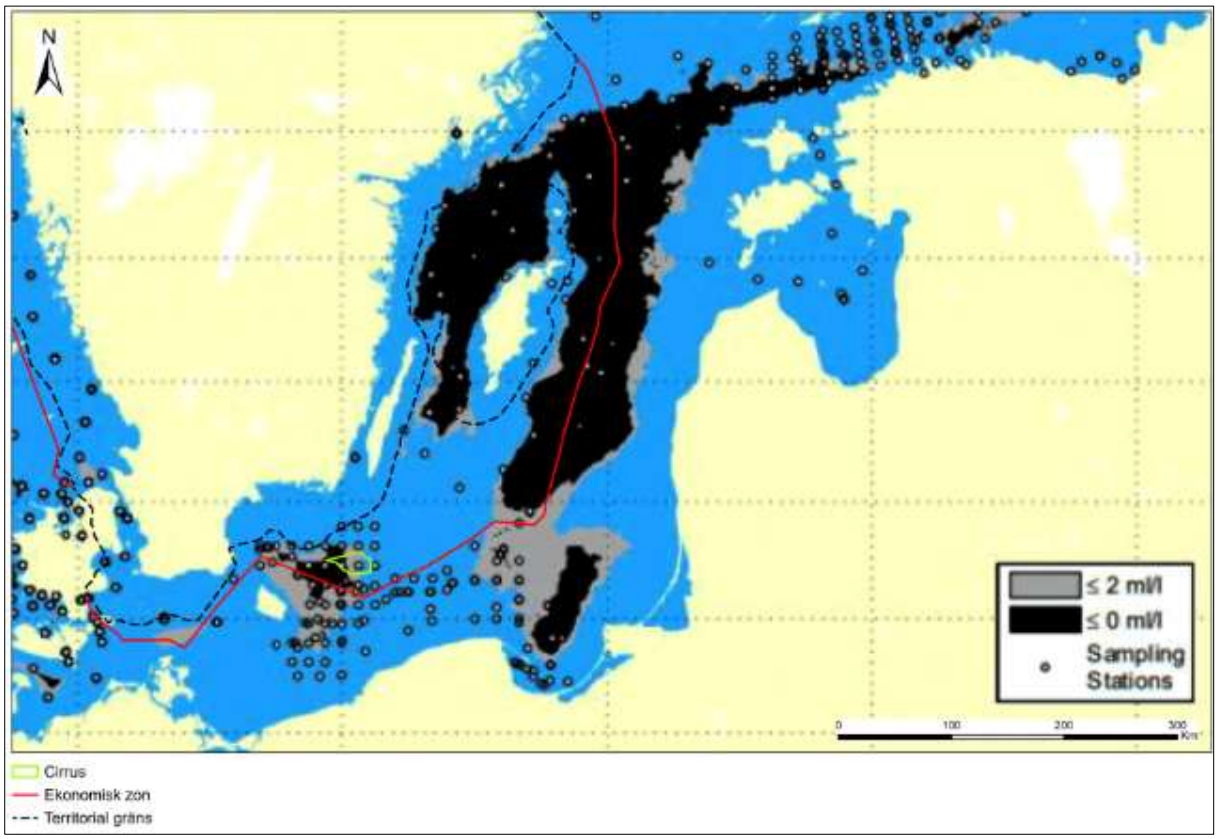


Figure 26 Oxygen mapping in the Baltic Sea, 2020. Source: SMHI

The Baltic Sea is a brackish inland sea affected by the inflow of freshwater from land and saltwater from the Belts and Öresund. The sea level varies along the Swedish coast of the central Baltic Sea and is mainly determined by air pressure, followed by wind and the inflow and outflow of water through the Danish Straits. Between 65 and 75 per cent of the inflow passes through the Danish Belts (SMHI, 2010).

The inflow of the new water is an important addition to the supply of oxygen to the deep seabeds of the Baltic Sea, where the water can otherwise become stagnant. This can lead to oxygen deficiency as oxygen is consumed during decomposition of organic material. If the oxygen runs out, the dead

organisms continue to be broken down by sulphur bacteria and hydrogen sulphide is formed. Hydrogen sulphide is a deadly poison, killing those animals that cannot escape. Fish eggs also die, with serious consequences for cod stocks in the eastern Baltic Sea (SMHI, 2022). The fact that the Baltic Sea periodically has dead seabeds is linked to a natural process, but humans affect the process through nutrient discharges that cause eutrophication, which stimulates growth and thus the deposition of materials that consume oxygen (SMHI, 2022).

Oxygen deficiency in the Baltic Sea has been observed since 1999; and according to SMHI's summary of measurements, the results for 2020 show that the extreme oxygen deficiency observed in the Baltic Proper is continuing. The extent of fully oxygen-free areas has decreased slightly compared to 2018–2019, while areas affected by oxygen deficiency remained roughly the same. The reduction in the extent of oxygen-free seabeds is most evident in the southern part of the Baltic Proper and the Gulf of Finland (SMHI, 2021). In the Baltic Proper, about 18 per cent of the seabeds are currently completely oxygen-free and about 31 per cent are suffering from oxygen deficiency (SMHI, 2021).

In the Baltic Proper, the halocline lies at a depth of about 80 metres. The halocline is a barrier layer due to differences in salinity, and can impede water exchange between older seabed water and new inflowing water (havetnu, 2021). In the Bornholm Basin, oxygen and salinity levels in the halocline in the deepest part are still favourable for cod to lay their eggs. There is almost no life below the halocline (SU, 2022).

6.3 Sediment and pollution

6.3.1 Description of the current situation

According to the Geological Survey of Sweden, seabed conditions in the planned area for Cirrus are dominated by postglacial clay, glacial clay, muddy clay and clay mud. The surface substrate consists of soft clay and smaller areas of mixed sediment made up of sand, gravel and stone (Geological Survey of Sweden, 2023): see **Figure 27**.

The Geological Survey of Sweden has two sampling sites in the southern part of the wind farm, one of which is just in the boundary zone to the project site (SE-11-ny), for organic environmental toxins and for metals and nutrients (Geological Survey of Sweden, 2023): see Figure 28. These stations are designated for national environmental monitoring of offshore sediments.

National environmental monitoring of offshore sediments is conducted by the Geological Survey of Sweden on behalf of the Swedish Environmental Protection Agency. These offshore sediments are sampled during the summer months, and to date this has been done on three occasions at five to six-year intervals. The samples are then analysed to identify levels of various elements, including carbon and nitrogen, and organic environmental pollutants.

In addition, extra measurements and analyses are carried out in different years, such as measurements of oxygen concentration, salinity and temperature in the seabed water at each sampling station. Samples are also saved to make it possible to carry out analyses of other substances that may be of interest to monitor (Geological Survey of Sweden, 2022). According to

results presented in the Geological Survey of Sweden's 2019 report, the greatest load of organic pollutants occurs in the Baltic Proper and the southern parts of the Baltic Sea.

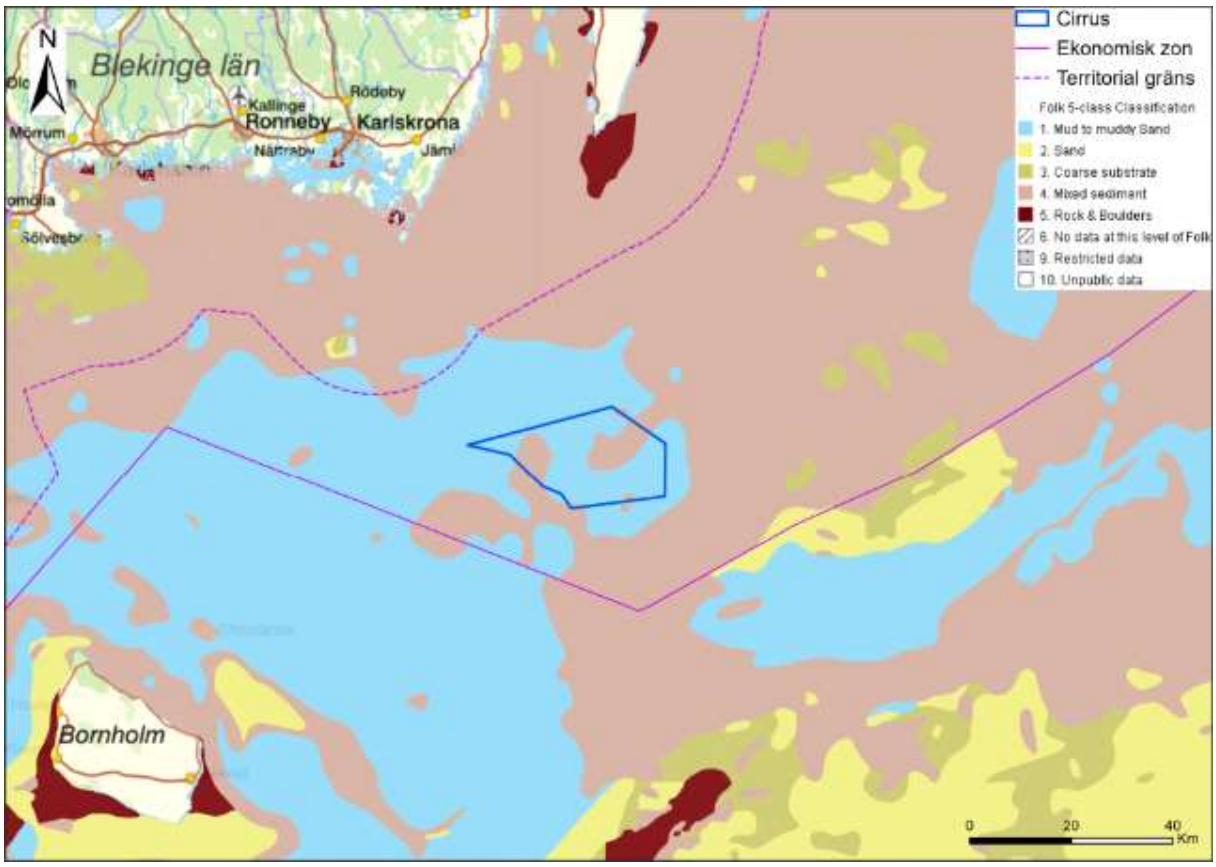


Figure 27 Map of bottom sediments in the area. Source: Geological Survey of Sweden

Translation of legend to english:
Ekonomisk zon = ***Economic zone***
Territorial gräns = ***Territorial border***

The concentrations of most substances are highest here, e.g. total DDT, PCBs, dioxins, PAHs, chlorinated paraffins, phthalates and octyl/nonylphenols. Concentrations of TBT have decreased since 2003, but the assessment basis is still exceeded in the Baltic Proper and the southern Baltic Sea, and concentrations no longer appear to be decreasing at the stations in the southern Baltic Sea. According to the report, lead levels at the station are high in comparison with the other 15 stations in the marine areas around Sweden (Geological Survey of Sweden, 2019).

All stations, including SE-11 new and SE-11 old, are located on accumulation beds. Accumulation beds consist of fine material that also has a naturally high content of organic matter. These may also contain contaminants to a greater extent (Geological Survey of Sweden, 2022).
This may provide an indication of a contamination situation in the site for the wind farm.

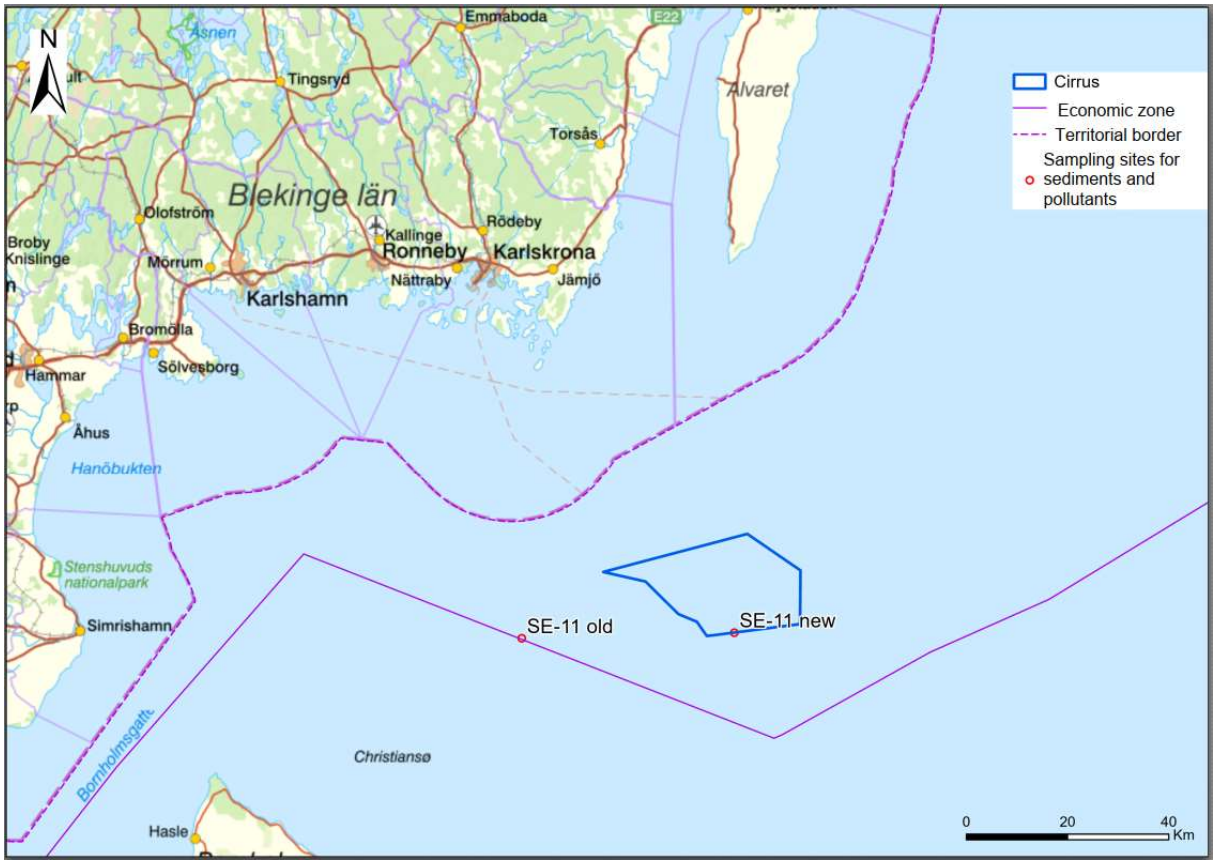


Figure 28 Map of sampling sites. Source: Geological Survey of Sweden

6.3.2 Possible effects

During the construction phase, turbidity may occur as sediments are released and dispersed in the water column. If the sediments are contaminated, this may help to increase the spread of pollution to adjacent areas. The magnitude of the effect caused by turbidity may differ depending on whether fixed or floating foundations are constructed.

6.3.3 Demarcation

Sediment modelling and investigations for benthic fauna and environmental toxins will be carried out and potential impacts on sediment and pollutants will be assessed in the EIA.

6.4 Benthic vegetation and fauna

6.4.1 Description of the current situation

The light zone in the Baltic Sea generally extends to a depth of about 20 metres. The distribution of vegetation is dependent on the availability of light for photosynthesis. Therefore, the great depth in the area means that significant distribution of vegetation such as photosynthesising algae or biologically valuable seabeds covered in plants is not expected. Nor are natural habitats considered to be undisturbed in areas where bottom trawling has been carried out.

The area consists of soft seabed, and so blue mussel beds are not expected to occur in the area. The benthic fauna in the area is dominated by animal species such as Monoporeia affinis, Harmathoe sarsi and Halicryptus spinulosus, but bottom-dwelling fish such as flounder and flatfish may also occur (Afry, 2022).

The site is partly within an area where oxygen-poor or oxygen-free seabeds occur periodically (SMHI, 2020): see section 6.2. The oxygen-poor and oxygen-free seabeds limit the species diversity of both plants and animals on the seabed. No valuable benthic flora or fauna are expected to be found, which is also expected to be confirmed by the surveys that will be carried out prior to the detailed design phase, but it cannot be ruled out completely.

6.4.2 Possible effects

The planned wind farm site is located within a larger area where the seabeds are now often oxygen-free and oxygen-poor, and hence no major effect is expected to occur as the benthic fauna and vegetation are expected to be so limited.

Provided that the planned surveys show that there are more benthic fauna and flora in the area than expected, the effects that arise may have an impact during the construction phase, the operational phase and the decommissioning phase. Benthic vegetation, benthic fauna habitat and behaviour may change during the construction and decommissioning phases due to turbidity caused by the whirling and spreading of sediments, as well as the construction of foundations. Suspended sediment may also cause pollutants to be released into the water, having an adverse impact on habitats (Swedish Environmental Protection Agency, 2008). Wind turbine foundations, on the other hand, can create turbulence in bottom currents that favour water mixing. Since bottom trawling cannot be conducted in the area, there are also opportunities for bottom-dwelling organisms and plants to recover and increase in both biomass and number of species (Swedish University of Agricultural Sciences, 2018a).

The construction of foundations requires the use of the seabed, which may affect any benthic vegetation and habitats for benthic fauna. Fixed foundations use more of the seabed and affect habitats to a greater extent than floating foundations. That said, there is a positive impact in the form of reef effects and fouling that can occur with both floating and fixed foundations – where the more complex the structure of the foundation, the more extensive the conditions for the reef – can constitute new habitats for hard bottom algae and animals: see section 6.1.2.2.

Floating wind turbines can be mounted on the foundations at a harbour or shipyard area and do not usually require heavy lifting operations at sea, as when installing fixed wind turbines. This reduces the local impact on the seabed as jack-up vessels, as they are known, are used for heavy lifting. These vessels have outriggers that cause temporary disturbance of the seabed and turbidity of sediments.

As large parts of the area consist of oxygen-free and oxygen-poor seabeds, the effects on benthic fauna and vegetation are deemed to be limited.

6.4.3 Demarcation

Investigations on benthic fauna and flora will be carried out to assess the impact on these organisms and validate the impact assessment. The effects will be reported in the EIA.

6.5 Fish

6.5.1 Description of the current situation

There are about 100 fish species in total in the Baltic Proper, 70 of which are marine. The remaining fish species are freshwater species found in river-influenced coastal waters. Fish in the Baltic Sea are an important part of the Baltic Sea ecosystem, but are affected by factors such as eutrophication, oxygen-free seabeds and high fishing pressure. Cod, herring, sprat and flounder are the most important fish species for the commercial fishing fleet, representing 90% of all catches.

Cod

There are two reproducing cod stocks in the Baltic Sea. The eastern one, which is in the applicable wind farm area, and the western one. The eastern stock has previously had spawning grounds in the Gotland Deep, the Gdansk Deep and east of Bornholm. The planned wind farm is located in an area where the probability of spawning is high (see **Figure 29**), but a lack of oxygen means that for the most part, the deep area at Bornholm serves as a spawning ground at present. Cod lay eggs that float freely in the water mass on account of the salinity, and the fry are transported by currents in the open water. This is why cod remain in the deeper parts of the basin, where salinity levels are higher, but they appear in the upper water layers in search of food (Swedish University of Agricultural Sciences, 2020a).

The eastern stock makes up about 81 per cent of the cod around Sweden's coasts. Cod are strongly affected by commercial fishing and changes in the aquatic environment. In recent years, the eastern stock has declined by about 50 per cent in both numbers and spawning biomass compared to the 1980s. This has resulted in a sharp decline in the proportion of individuals reaching spawning maturity (Swedish University of Agricultural Sciences, 2020a).

In the Baltic Sea, cod is fished with bottom trawls and pelagic trawls, but fishing for cod in the Cirrus area is very limited as there is a ban on targeted fishing, which means that all fishing in the core cod area is prohibited during periods when cod are spawning (Swedish Agency for Marine and Water Management, 2021b): see section 6.12.

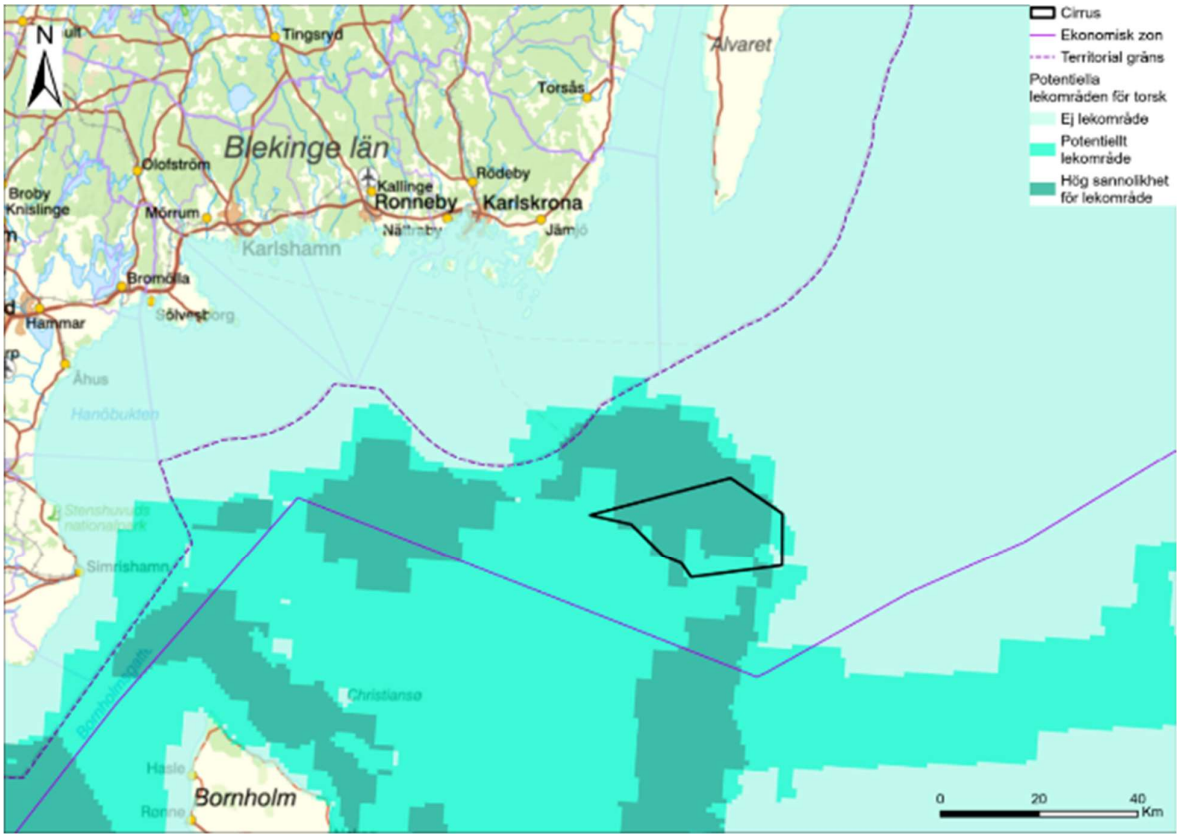


Figure 29 Map of potential spawning grounds for cod. Source: HELCOM

Translation of legend to english:
Ekonomisk zon = Economic zone
Territorial gräns = Territorial border
Potentiellt lekområde = Potential spawning ground
Hög sannolikhet för lekområde = High probability for spawning ground
Ej lekområde = No spawning ground
Torsk = Cod

Herring

Herring *(Clupea harengus)* are found all around the Swedish coast. Spawning occurs in spring, summer and autumn, but mainly in spring. In the Baltic Sea, spawning takes place on banks or the coast, usually in surface waters down to a depth of about 10 metres. The eggs then sink to the bottom, where they attach to plants or rocks (Swedish University of Agricultural Sciences, 2020b). The Cirrus area has a soft seabed and great depths with limited distribution of vegetation, and so spawning is unlikely to occur in the area (see **Figure 30**). Fishing pressure in the area is low, indicating that herring are unlikely to be abundant.

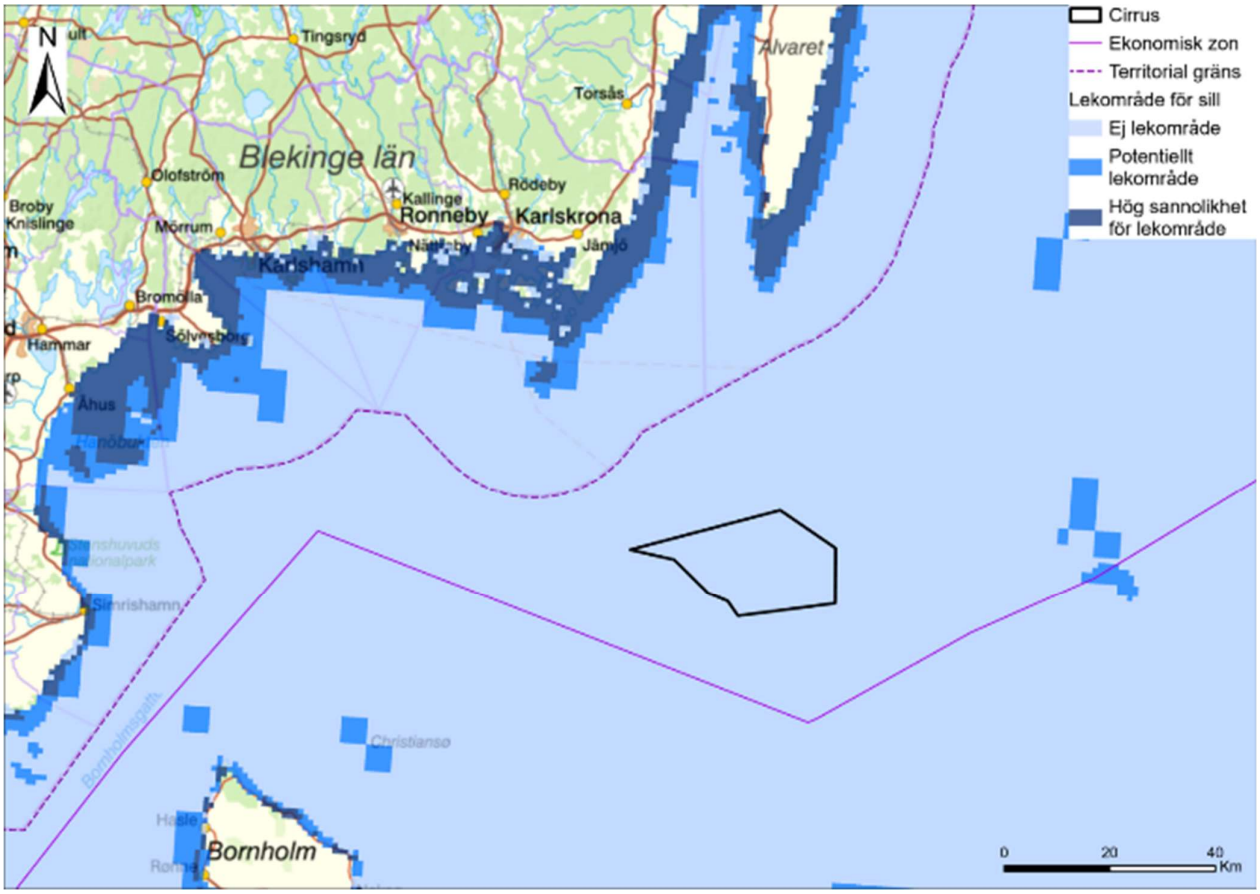


Figure 30 Maps of potential spawning grounds for herring. Source: HELCOM

Translation of legend to english:
Ekonomisk zon = Economic zone
Territorial gräns = Territorial border
Potentiellt lekområde = Potential spawning ground
Hög sannolikhet för lekområde = High probability for spawning ground
Ej lekområde = No spawning ground
Sill = Herring

Sprat

Sprat *(Sprattus sprattus)* occur around all the seas surrounding Sweden, apart from the Gulf of Bothnia. There are no signs of significant population changes, but there are large annual variations in the size of spawning populations (Swedish University of Agricultural Sciences, 2020c). There is a high probability of spawning west and south-west of the Cirrus area: see **Figure 31.** Only a small part of the project site is affected. The remainder of the project site is described as potential spawning grounds. Fishing pressure is low within the Cirrus area: see section 6.12 and **Figure 38**.

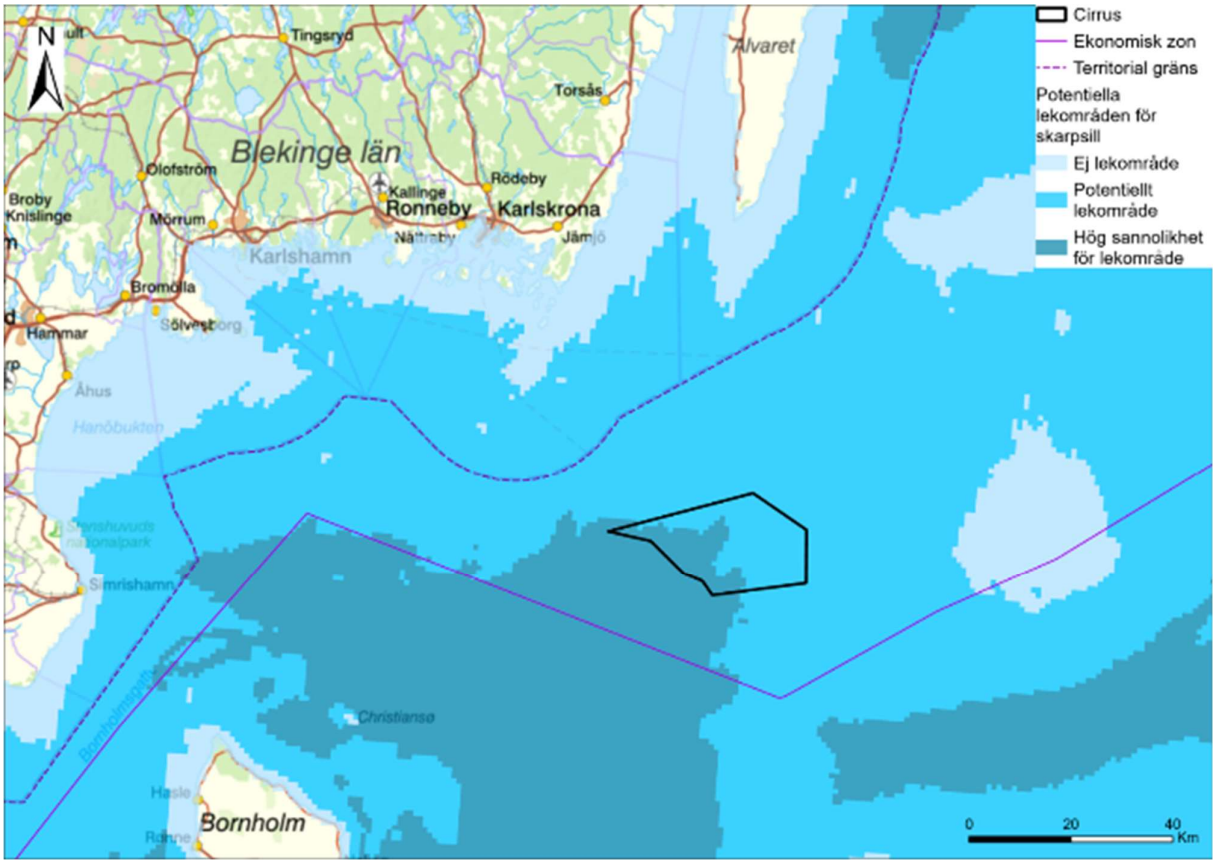


Figure 31 Map of potential spawning grounds for sprat. Source: HELCOM

Translation of legend to english:
Ekonomisk zon = Economic zone
Territorial gräns = Territorial border
Potentiellt lekområde = Potential spawning ground
Hög sannolikhet för lekområde = High probability for spawning ground
Ej lekområde = No spawning ground
Skarpsill = Sprat

Flounder

Flounder (*Platichthys flesus*) is Sweden's most common flatfish. It is likely that flounder are limited in numbers within the project site due to the periodic low oxygen levels that result in the area being unable to sustain benthic fish communities. Flounder usually live on shallower seabeds, both soft and hard, but can be found at depths down to 250 metres. The flounder is deemed to be of Least Concern (LC) in the Swedish Red List (Swedish University of Agricultural Sciences, 2020d). Flounder are mainly fished in the southern parts of Poland, Latvia and Germany. In Sweden, fishing pressure on flounder in the Baltic Sea is low.

6.5.2 Possible effects

During the construction phase, changes in water quality may occur due to offshore sediment and the release of pollutants. This may affect the behaviour of fish in various ways, as well as their reproductive capacity, as the development of eggs and larvae can be disrupted by sediments adhering to them.

Anchoring the wind farm to the seabed in combination with internal cables may also affect fish habitats. That said, the site of the planned wind farm has seabeds that are periodically oxygen-poor and oxygen-free, and thus the impact is less than if the seabed were stably oxygen-rich with a large distribution of bottom-dwelling fish.

Underwater noise mat cause damage and behavioural changes in fish during the construction, operational and decommissioning phases. Impacts are greatest during the construction phase, when higher levels of underwater noise can occur and disrupt the spawning of fish species. However, noise levels from shipping often exceed the noise levels generated by wind turbines during the operational phase.

The electromagnetic field (EMF) generated around power cables can affect benthic organisms locally, as well as eels' sense of direction. Eels *(Anguilla anguilla*) use the Earth's magnetic field to navigate over large areas to the Sargasso Sea, where they spawn. The power cables could therefore affect the eels' sense of direction, and delay or prevent eel migration. However, the magnetic field around the power cable decreases very quickly over distance, and the strength is zero after just a few metres (Lagenfelt, Andersson & Westerberg, 2012). There are also studies that have shown that the magnetic field occurring around power cables does not affect eel migration (Westerberg, Lagenfelt, Andersson, Wahlberg & Sparrevik, 2006). This is also supported by laboratory studies where magnetic fields of 95 μT (50 Hz)1 showed no effects on eel swimming behaviour (CSA, 2019).

The wind turbines help to create moving shadows in its vicinity which can affect fish in the local area. Shadows are formed by the turbines themselves, but also by the rotor blades which move according to the wind speed.

The establishment of the wind farm means that commercial fishing in the area will largely be restricted, and bottom trawling will not be possible in the area: see section 6.12, which will provide better conditions for fish stocks to recover (Swedish University of Agricultural Sciences, 2018a)

6.5.3 Demarcation

A study of the impact and potential effects on fishing will be carried out and reported in a future EIA.

6.6 Marine mammals

6.6.1 Description of the current situation

In the Baltic Sea, harbour porpoises and seals are the only stationary marine mammals.

Harbour porpoises

Harbour porpoises (*Phocoena phocoena*) in Swedish waters can be divided into three subpopulations: the Skagerrak population, the Danish Straits population and the Baltic Sea population. The subpopulation found around the wind farm site is the Baltic Sea population, which is classified as Critically Endangered (CR) in the Swedish Red List. A number of threats, including entanglement in fishing nets and drowning, have led to a sharp decline in harbour porpoise numbers. Around 500 individuals are estimated to comprise the Baltic Sea population (Swedish University of Agricultural Sciences, 2020e).

The harbour porpoise is protected under the EU Habitats Directive, which means that the harbour porpoise must maintain a favourable conservation status and that special areas of conservation must be established for the species (Natura 2000). The closest Natura 2000 site from the project site offering protection for harbour porpoises is Hoburgs Bank och Midsjöbankarna, which is in close proximity to the planned wind farm: see section 6.1.2.1. The Baltic Sea population of harbour porpoise is deemed to have a poor (unfavourable) conservation status within the Natura 2000 site (Gotland County Administrative Board, County of Kalmar, 2021).

Harbour porpoise numbers and reproduction are generally low throughout the year within the site for the proposed wind farm. Reproduction may occur in a small part of the eastern part of the project site, but not regularly: see **Figure 32.**

According to SAMBAH (2016), the probability of detecting harbour porpoise in the project site between May and October is 0.4 to 1 per cent in half of the study area and about 1 to 17 per cent in the north-eastern part. Between November and April, the corresponding figure is about 0.1 to 11 per cent in most of the study area and about 12 to 19 per cent in the north-eastern part of the study area (SAMBAH 2016; Afry 2022).

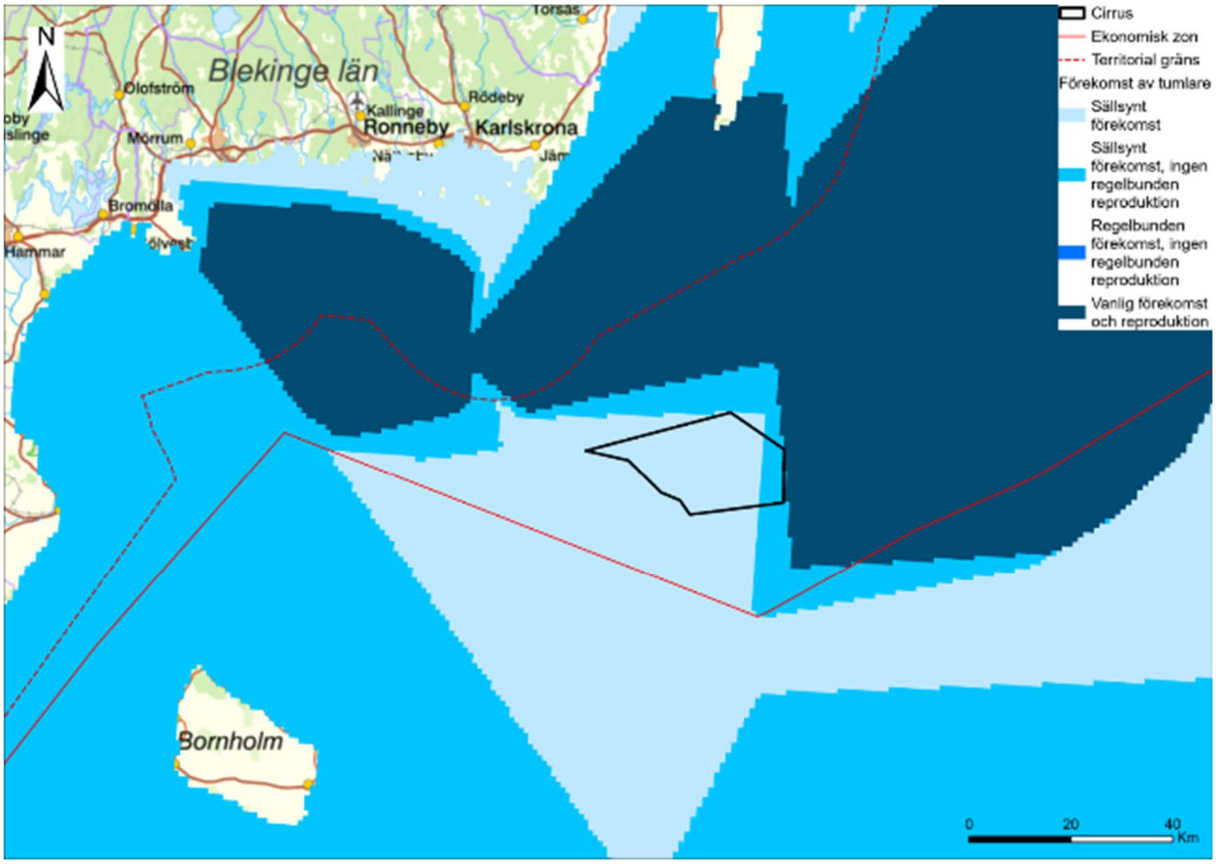


Figure 32 Map of areas where harbour porpoise are found. Source: HELCOM

Translation of legend to english:
Ekonomisk zon = ***Economic zone***
Territorial gräns = ***Territorial border***
Sällsynt förekomst = ***Rare occurance***
Sällsynt förekomst, ingen regelbunden reproduktion = ***Rare occurance, no regular reproduction***
Regelbunden förekomst, ingen regelbunden reproduktion = ***Regular occurance, no regular reproduction***
Vanlig förekomst och reproduktion = ***Common occurance and reproduction***
Tumlare = ***Harbour porpoise***

Grey seals

The grey seal *(Halichoerus grypus)* is found in the Baltic Sea and is the largest of the seal species found in Sweden. The grey seal has a population level estimated at around 12,000 individuals, most of which are found in the Stockholm archipelago and around Åland. The grey seal is deemed to be of Least Concern (LC) in the Swedish Red List (Swedish University of Agricultural Sciences, 2020f). According to the Swedish University of Agricultural Sciences' species database, there are no registered occurrences in the project site, which may be due to the fact that there are no suitable foraging and reproduction sites for the species in the area. However, it is not unlikely that grey seals may be found in the project site: see **Figure 33**.

The grey seal is protected under the EU Habitats Directive, which means that the species must maintain a favourable conservation status and that special areas of conservation must be established for the species (Natura 2000). The closest Natura 2000 site to the project site offering protection for grey seals is Utklippan: see section 6.1.2. The conservation status is deemed to be very good within the Natura 2000 site (Blekinge County Administrative Board, 2017).

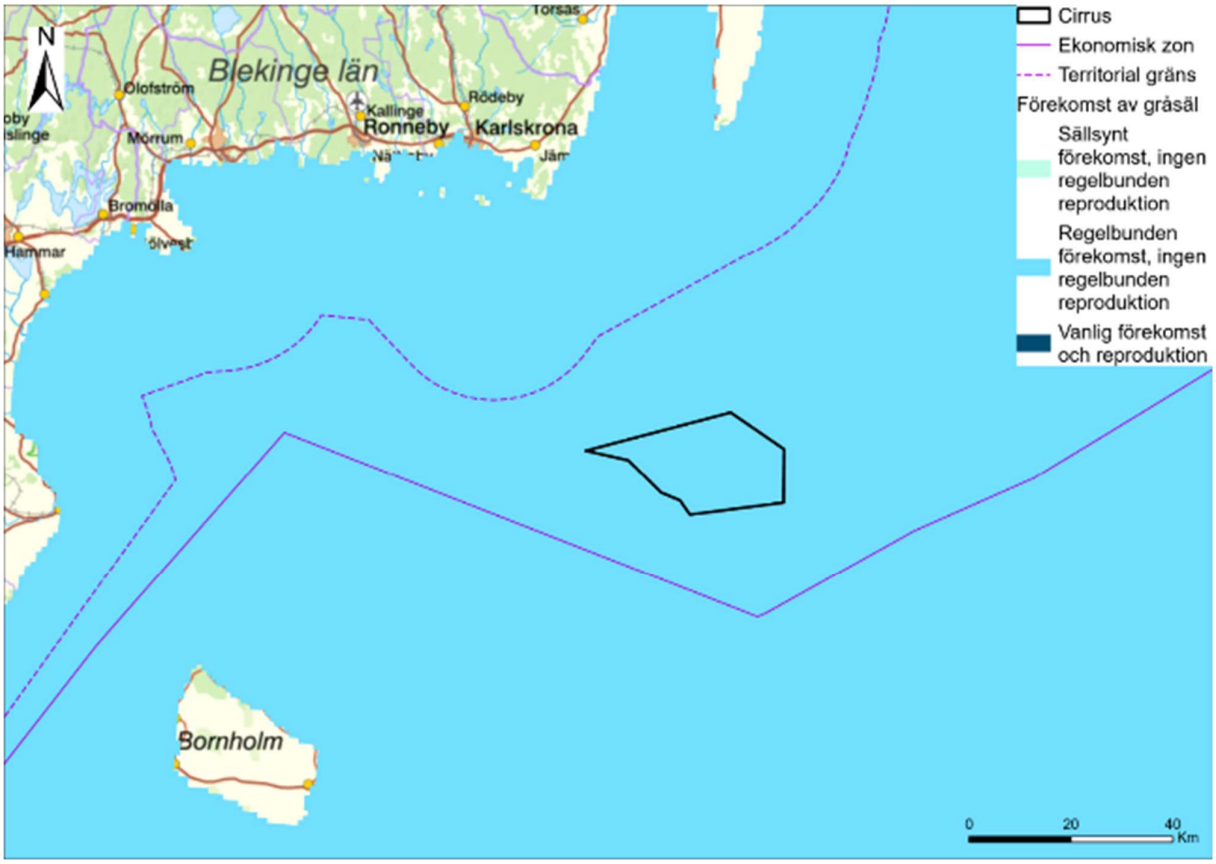


Figure 33 Map of areas where grey seals are found. The map shows that the entire Cirrus area has *Regular occurrence, no regular reproduction* status for grey seals. Source: HELCOM

Translation of legend to english:
Ekonomisk zon = ***Economic zone***
Territorial gräns = ***Territorial border***
Sällsynt förekomst = ***Rare occurance***
Sällsynt förekomst, ingen regelbunden reproduktion = ***Rare occurance, no regular reproduction***
Regelbunden förekomst, ingen regelbunden reproduktion = ***Regular occurance, no regular reproduction***
Vanlig förekomst och reproduktion = ***Common occurance and reproduction***
Gråsäl = ***Grey seal***

Harbour seals

Harbour seals *(Phoca vitulina)* are found in the southern Baltic Sea, but are more common on the west coast. The Baltic Sea population was estimated at 1375 individuals in 2017, with about 50 per cent sexually mature individuals (WWF, 2022). The harbour seal can dive to depths of more than 200 metres, but diving is more common at depths of less than 50 metres. Most of the harbour seal diet is made up of species that live on the seabed, making shallower areas better for foraging. The wind farm site is more than 50 metres deep, which, together with oxygen-poor and oxygen-free seabeds, does not provide optimal foraging habitat for harbour seals. Therefore, harbour seals are unlikely to be present in the area: see **Figure 34**.

Threats to harbour seals in the Baltic Sea include benthic mortality and overfishing, which reduces the availability of food. The harbour seal is deemed to be Vulnerable (VU) in the Swedish Red List (Swedish University of Agricultural Sciences, 2020g).

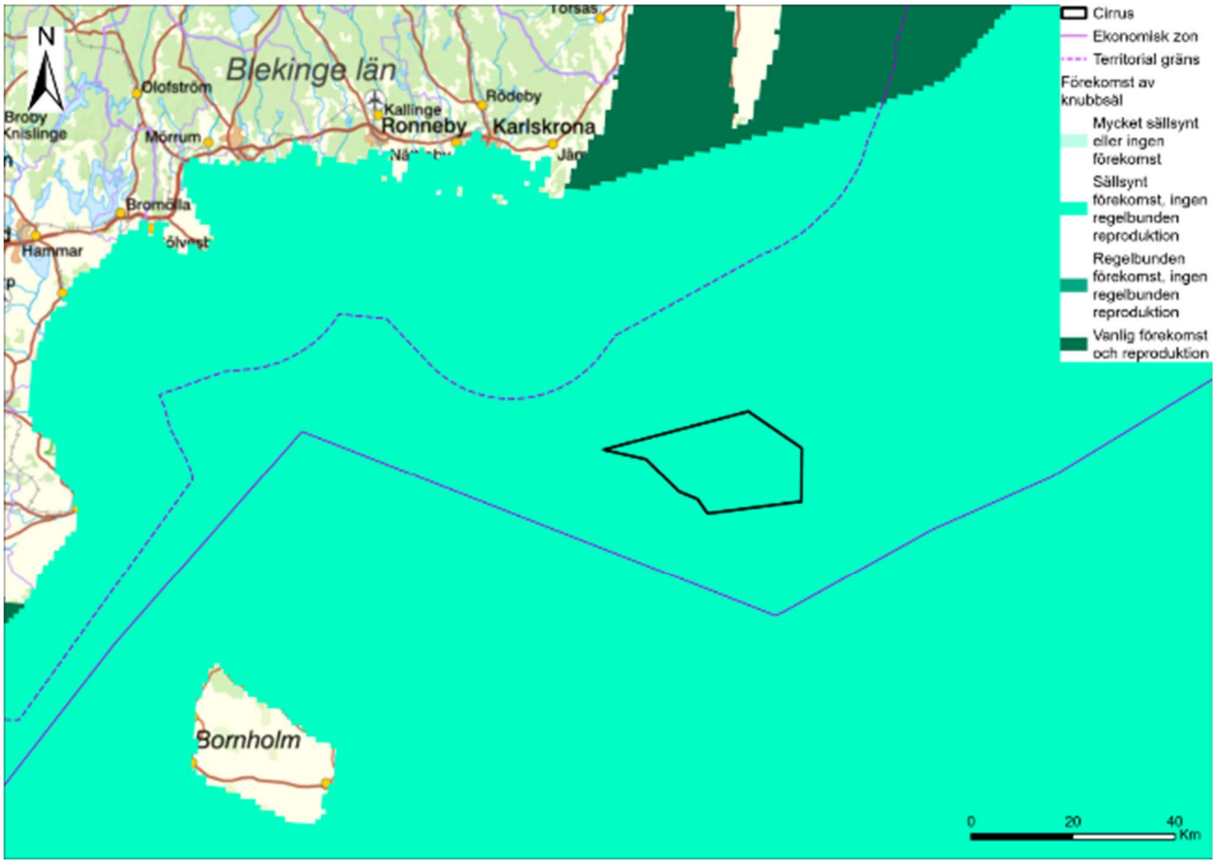


Figure 34 Map showing the presence of harbour seals in the area. The map shows that the entire Cirrus area has *Rare occurrence, no regular reproduction* status for harbour seals. Source: HELCOM

Translation of legend to english:
Ekonomisk zon = ***Economic zone***
Territorial gräns = ***Territorial border***
Sällsynt förekomst = ***Rare occurance***
Sällsynt förekomst, ingen regelbunden reproduktion = ***Rare occurance, no regular reproduction***
Regelbunden förekomst, ingen regelbunden reproduktion = ***Regular occurance, no regular reproduction***
Vanlig förekomst och reproduktion = ***Common occurance and reproduction***
Knubbsäl = ***Harbour seal***

6.6.2 Possible effects

Marine mammals will mainly be affected by underwater noise during the construction phase. This is why offshore wind farm construction and decommissioning should be avoided during the sensitive reproductive periods of marine species. Consideration must also be given to early breeding and mating areas.

High noise levels, such as those generated by piling foundations, may cause permanent hearing damage or temporary hearing loss in marine mammals. This may also cause behavioural reactions of two different types: panic-like escape behaviour, or avoidance.

High noise levels can also mask other sounds, which can lead to animals losing information from the environment that could otherwise trigger behaviour (Swedish Agency for Marine and Water Management, 2022a).

Harbour porpoises are very sensitive to loud noises. Harbour porpoises take their bearings, communicate and hunt using echolocation based on click sounds. That is why hearing is very important for harbour porpoises: they are entirely dependent on it for survival (Swedish Agency for Marine and Water Management, 2022a).

The noise levels from the wind turbines will not exceed the already existing noise levels from shipping in the area during the operational phase.

During the operational phase, turbidity may occur due to hanging cables and anchor chains/lines that stir up sediment from the seabed. This may affect the adjacent Natura 2000 site Hoburgs Bank och Midsjöbankerna, where the intention is to protect harbour porpoises (see section 6.1.2). These effects may also occur during the construction and decommissioning phases.

6.6.3 Demarcation

As marine mammals may be affected during the construction phase, marine mammals will be further addressed in the EIA, where factors such as noise from the construction phase will be investigated and described.

6.7 Birds

6.7.1 Description of the current situation

The Baltic Sea is home to important areas for birds which are used for resting, foraging, breeding, rearing and wintering. A large proportion of Nordic bird species are migratory.

Some species remain in the Baltic Sea all year round, while others migrate to or from the area in winter. Different species/species groups use different migration routes and strategies as they migrate. Many species migrate mainly overland and tend to follow coastlines as far as possible in the direction of their migration. This prevents them from flying longer distances over the open sea. There are other migration strategies, however, with species that do not seem to adapt their flight path significantly to land masses and open water and species that avoid flying over land masses.

There are a number of areas within the southern Baltic Sea that are considered important for birds during breeding and wintering periods. The Utklippan Natura 2000 site is an important breeding site, and the Natura 2000 site Hoburgs bank och Midsjöbankarna attracts fish that are attracted to the shallow mussel beds, which in turn attract birds.

Utklippan is situated about 40 km from the project site, and Hoburgs bank och Midsjöbankarna is adjacent to the project site: see section 6.1.2. Bird species that are protected by species protection in Natura 2000 sites are the long-tailed duck, the black guillemot and the Arctic tern. These species are associated with habitats found specifically within the Natura 2000 site, but may migrate, reside and forage outside the site.

Long-tailed duck

The long-tailed duck is found in the Arctic and High Arctic regions. In Sweden, it is found in small numbers in upland mountain areas, from Härjedalen to northernmost Lapland. Very large numbers of long-tailed ducks, mainly from the Russian tundra, winter in the Baltic Proper. The wintering birds remain in a small number of shallow areas and offshore banks, which means that the species has been very badly affected by offshore oil spills. The main wintering areas of the long-tailed duck in Sweden are Hoburgs Bank and the Northern and Southern Midsea banks, and its main food is blue mussels and so it is dependent on biogenic reefs consisting of blue mussels (Swedish University of Agricultural Sciences, 2020h). The long-tailed duck is therefore unlikely to use the project site for foraging, and occurrence within the project site can be expected to be limited or low.

Long-tailed ducks are listed as Near Threatened (NT) on the Swedish Red List and is considered to have an unfavourable conservation status within the Natura 2000 site (Gotland County Administrative Board, County of Kalmar, 2021).

Black guillemot

In Sweden, the black guillemot breeds exclusively along coasts and islands. Like the long-tailed duck, the black guillemot winters at Hoburgs Bank and the Northern and Southern Midsea banks. The black guillemot lives on offshore banks at a depth of 10 to 30 metres and feeds mainly on bottom fish, but also on crustaceans. Thus, it is unlikely that black guillemots are present to any great extent in the greater depths of the project site. The main threats to the black guillemot are oil spills and being caught in fishing nets as by-catch. The black guillemot is classified as Near Threatened (NT) according to the Swedish Red List (Swedish University of Agricultural Sciences, 2020i) and is considered to have an unfavourable conservation status within the Natura 2000 site (Gotland County Administrative Board, County of Kalmar, 2021).

Arctic tern

The Arctic tern is part of the gull family and is a migratory bird. These birds migrate southwards in July and August and return in late April and May. The species breeds along the Swedish coast from Norrbotten down to Skåne and winters in the drift ice belt off Antarctica (Swedish University of Agricultural Sciences, 2020j). Around 10 pairs nest at Utklippan, and the species regularly appears around the archipelago during migration. Arctic terns mainly feed on small fish, insects and

crustaceans. The Arctic tern is deemed to be of Least Concern (LC) according to the Swedish Red List: the population in the area is stable and the conservation status is deemed to be good within the Natura 2000 site (Blekinge County Administrative Board, 2017).

6.7.2 Possible effects

During the construction phase, work on the seabed may cause sediment to be stirred up and dispersed in the water column. This may have a direct or indirect impact on birds that forage in water. Also, the presence of the construction vessels and increased shpping may cause temporary visual disturbance and airborne noise that may disturb the birds in the area.

Effects during the operational phase may include birds avoiding the wind turbines and their surroundings and thus being excluded from potential foraging areas, birds colliding with the wind turbines and a barrier effect as birds avoid passing through the project site.

6.7.3 Demarcation

Birds may be affected during both the construction and operational phases. Impacts on relevant migratory birds and seabirds will be assessed and addressed in the EIA.

6.8 Bats

6.8.1 Description of the current situation

Bats are represented by 19 species in Sweden, and there is a wide variation in how the species are distributed geographically throughout the country and how they behave. Many species migrate in autumn and spring, but only a few are generally considered to leave the country in autumn to move to the continent. The species that leave Sweden often do so in the same way as birds, following the land and coast as far as possible. Bats can also hunt over the sea, even when they are not migrating, as has been observed in several locations.

In Sweden, only two bat monitoring programmes have been carried out for offshore wind power, according to the Swedish Environmental Protection Agency. Both cases are relatively close to land (within 8 km). However, there is evidence that bats also occur in places much further offshore (Swedish Environmental Protection Agency 2017).

The two monitoring programmes show that high-risk bat species are present at the height of wind turbine rotors, even several kilometres from land. There is nothing to indicate that the species are at risk of being killed by offshore wind power, and the Swedish Environmental Protection Agency is not of the opinion that there is a need for special considerations on the part of wind power (Swedish Environmental Protection Agency 2017).

All bat species are protected under Section 4 of the Species Protection Ordinance, which means a general ban on deliberately capturing, killing, harming or disturbing the animals. The prohibition in the Species Protection Ordinance also includes damage to animal habitats. A dozen of the Swedish species are red-listed according to the Swedish Red List.

6.8.2 Possible effects

Potential impacts on bats at sea are linked to collision with wind turbine rotor blades.

There is also a risk of internal haemorrhaging caused by pressure changes if they are sucked in behind the rotor blades. High-risk species often hunt insects at high altitudes and have migration routes that bypass wind farm areas. The risk of bats being killed by wind turbines varies greatly between species, with many rarely killed while others are high-risk species. High-risk species are those that frequently hunt insects over open areas and those that have migration routes that pass wind farm sites.

6.8.3 Demarcation

Bats may be affected primarily by the planned wind farm during the operational phase. This is why disturbance to bats will be addressed and assessed in the EIA in greater detail.

6.9 Cultural environment and marine archaeology

The Cultural Heritage Act (KML) applies in Swedish waters in order to protect and preserve the cultural heritage of the Baltic Sea. The cultural environment includes valuable environments, buildings and ancient remains and is recorded in the Swedish National Heritage Board's register. Underwater archaeological sites are protected by law, just like archaeological sites on land. For the remains of ships or boats, legal protection is applicable if the shipwreck occurred before 1850. This is why many wrecks of cultural and historical interest lack formal protection: they are not as old. In such cases, the county administrative board can decide to declare an ancient monument (Swedish National Heritage Board, 2021).

6.9.1 Description of the current situation

There are no designated ancient and cultural remains in the site for the planned wind farm: see **Figure 35.** A number of ancient and cultural historical remains have been identified in the water area north-west of the project site, as well as in the water area around Öland and the Blekinge coast, and consist mainly of the remains of ships or boats. The Swedish National Heritage Board's mapping tool Fornsök includes a number of wrecks that have been registered without antiquarian assessment in and around the Cirrus project site (Swedish National Heritage Board, 2023).

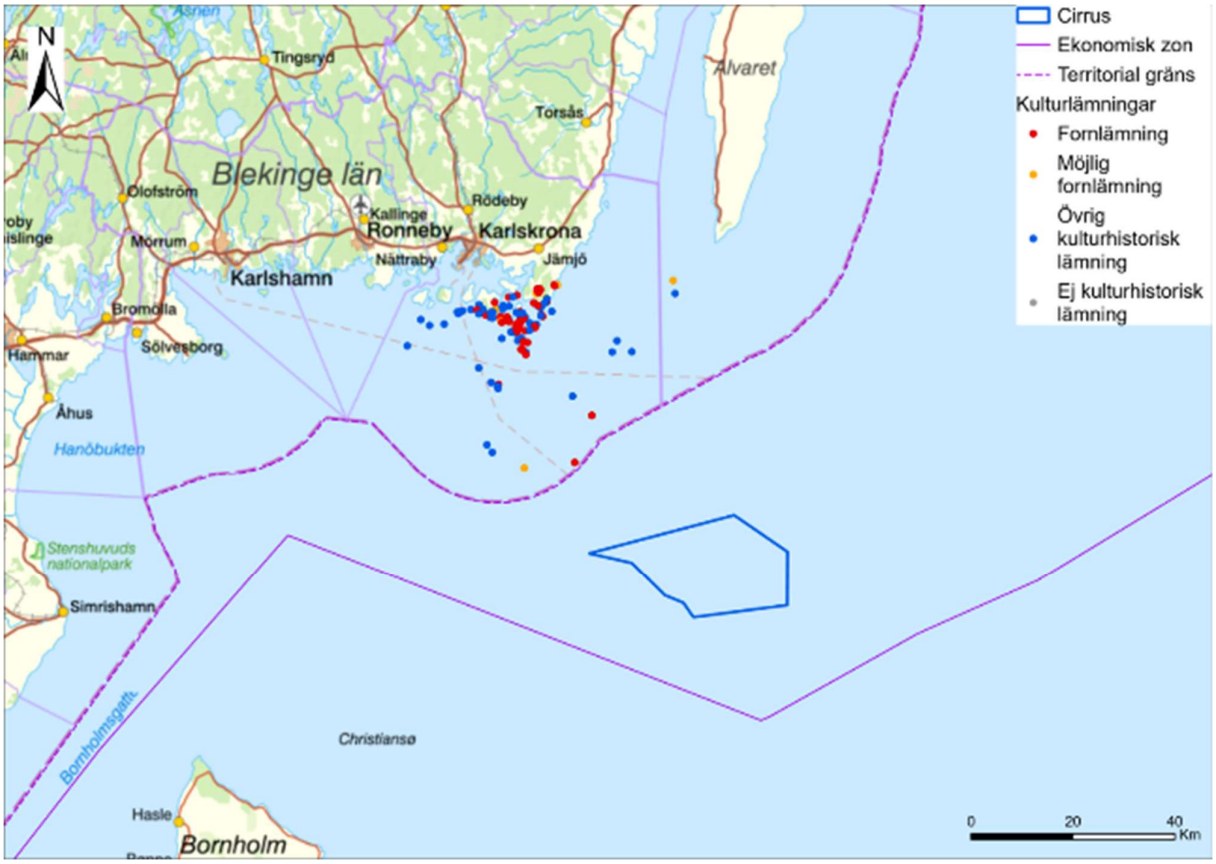


Figure 35 Map of ancient and cultural remains within a 50 km buffer zone from the project site. Source: Swedish National Heritage Board.

Translation of legend to english:
Ekonomisk zon = ***Economic zone***
Territorial gräns = ***Territorial border***
Sällsynt förekomst = ***Rare occurance***
Fornlämning = ***Relic of antiquity***
Möjlig fornlämning = ***Possible relic of antiquity***
Övrig kulturhistorisk lämning = ***Other cultural historical remain***
Ej kulturhistorisk lämning = ***No cultural historical remain***

6.9.2 Possible effects

No cultural environments have been identified at the site for the planned wind farm, and thus the wind farm is not deemed to have any impact or effects on the cultural environment.

Seabed surveys will be carried out prior to the construction of the wind farm to further investigate whether any marine archaeological finds are present in the area. If the finds identified have ancient monument status, and the establishment is deemed to want to use the area for the remains, permission under the Cultural Heritage Act (KML) will be sought before the final layout is completed and establishment begins.

If marine archaeological finds are initially encountered during the construction phase, the construction work will be suspended so as not to damage the site. An application for a licence under the Cultural Heritage Act (KML) will then be required to place works or equipment in the area.

6.9.3 Demarcation

A marine archaeological survey will be carried out and described further in the EIA, as well as potential impacts and precautionary and protective measures during the construction phase.

Carrying out a survey of cultural historical remains on the seabed is proposed at the planned wind farm site in connection with seabed surveys.

6.10 Outdoor activities

6.10.1 Description of the current situation

Outdoor areas are often subject to national interest. The project site is a very limited place for outdoor activities and recreation as it is situated far from the coast. However, the coastal, archipelago and marine areas in the vicinity of the planned wind farm are important places for human for recreation and outdoor activities. Öland is a popular destination for nature experiences and outdoor recreation all year round. Fishing and boating are other outdoor activities. Outdoor recreation is of great importance to people, and marine environments are important for nature experiences and well-being.

6.10.2 Possible effects

The impact on recreation and outdoor activities in the project site is not considered to be great, mainly because the project site is so far from the coast: see section 6.1.6. The planned wind farm is situated about 55 km south of the southern tip of Öland and about 45 km from the Torhamn archipelago. The wind farm will be visible from those locations under certain weather conditions. The wind farm will generate airborne noise during the operational phase. The distance from the project site to land is so great that it will not be audible or cause disruption to outdoor recreation. The wind farm may become a tourist destination.

6.10.3 Demarcation

Impacts and effects on outdoor recreation during both the construction phase and the operational phase will be described further in the EIA. A study on airborne noise will be carried out and reported in the EIA.

6.11 Shipping and shipping lanes

6.11.1 Description of the current situation

Both the Swedish Transport Administration and the Swedish Maritime Administration are responsible for maritime issues. Essentially, it can be said that the Swedish Transport Administration deals with strategic issues and the Swedish Maritime Administration deals with operational issues (Swedish Maritime Administration, 2020).

The Swedish Maritime Administration can provide operational comments on matters such as the accessibility, marking and capacity of a maritime traffic route or shipping lane. There may also be other issues such as how maritime traffic is affected by planned construction in the vicinity of shipping lanes (Swedish Maritime Administration, 2020).

There is an existing shipping lane that crosses the project site in a northwesterly-southeasterly direction and is designated as being of national interest, and there are two major shipping lanes to the north of the project site that are also of national interest: see section 6.1.10. AIS transmissions show that a certain proportion of ships also pass south of the planned project site: see **Figure 36.**

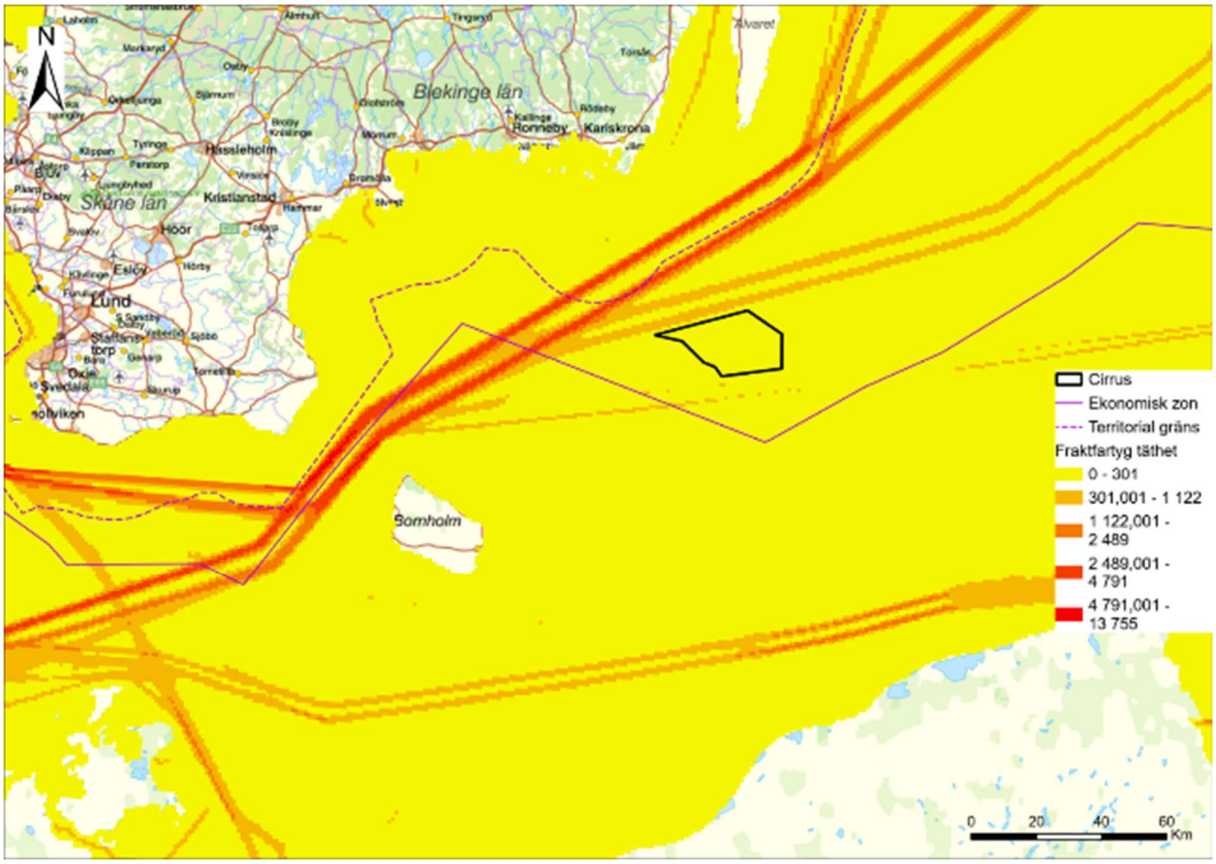


Figure 36 Map showing freight vessel density. Source: HELCOM

Translation of legend to english:
Ekonomisk zon = ***Economic zone***
Territorial gräns = ***Territorial border***
Fraktfartyg täthet = ***Freight vessel density***

6.11.2 Possible effects

The project site is located in an area with a shipping lane and right next to shipping lanes, which results in a small increase in the risk of collision. Possible effects may be that shipping may need to be diverted, or the design of the wind farm may need to be adapted. Possible disruption to shipping may occur: see section 6.1.10.2.

6.11.3 Demarcation

Impacts on shipping and shipping lanes will be further evaluated by means of a nautical risk analysis in the EIA.

6.12 Commercial fishing

6.12.1 Description of the current situation

The Swedish fishing fleet generally consists of a larger number of smaller vessels using passive gear such as nets, cages, pots, fyke nets and traps, and larger vessels using active gear, mainly trawls (Swedish University of Agricultural Sciences, 2018b). Commercial fishing in the Baltic Sea has a major impact on fish stocks and is currently heavily regulated. The fishing carried out must be sustainable in order to ensure fishing in the future, and is a step towards achieving the environmental objective "Balanced sea, plus living coastline and archipelagoes". Mainly sprat was fished in the Baltic Sea in 2022, followed by herring (Swedish Agency for Marine and Water Management, 2023). Due to the deteriorating condition of cod stocks in the Baltic Sea, this has resulted in implementation of a spawning closure and a ban on targeted fishing, which means that all fishing in the core cod area is prohibited during periods when cod are spawning (Swedish Agency for Marine and Water Management, 2021b). Such a time-limited conservation area exists within marine spatial planning area Ö249, and most of the Cirrus area: see **Figure 37.**

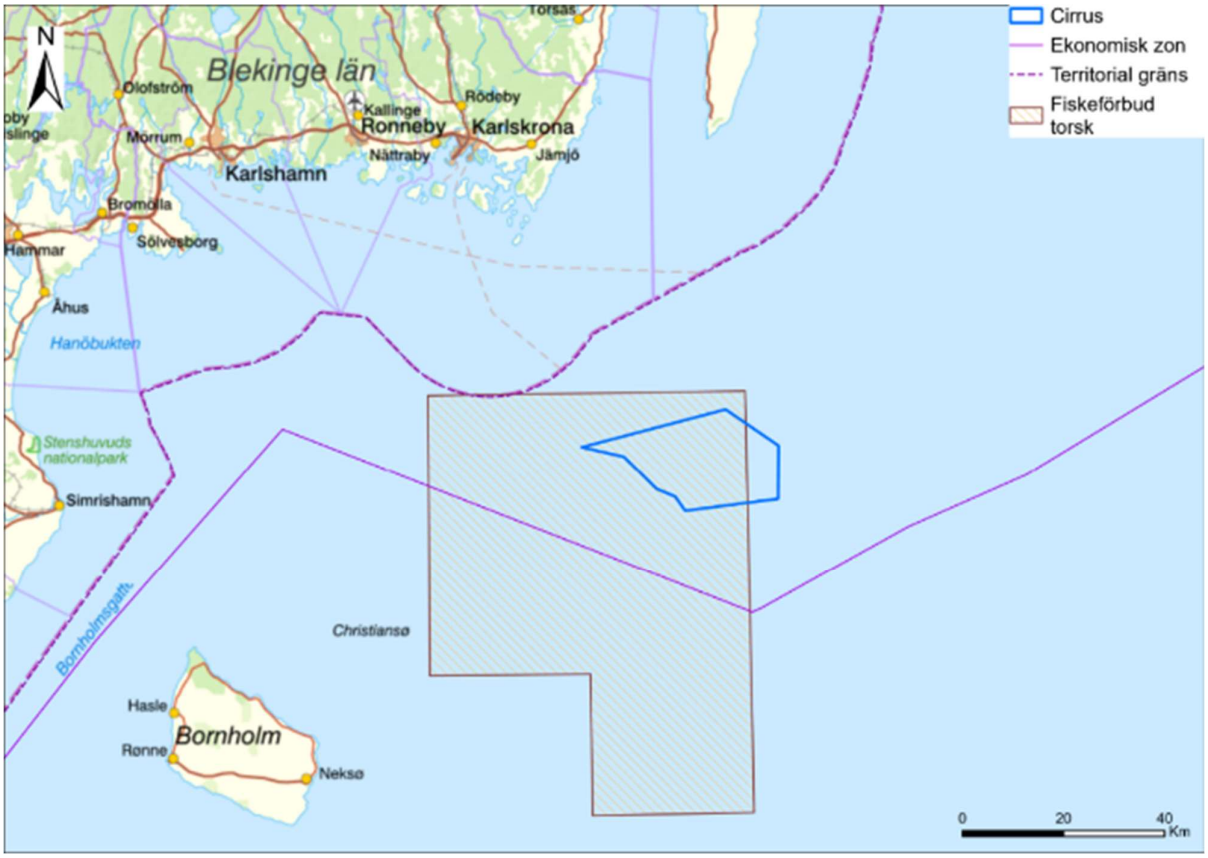


Figure 37 Map showing where cod fishing is prohibited. Source: HELCOM

Translation of legend to english: Ekonomisk zon = ***Economic zone*** Territorial gräns = ***Territorial border*** Fiskefartyg täthet = ***Fishing vessel density***

The likelihood of bottom-dwelling fish is not very high within the site for the planned wind farm, as parts of the area currently have oxygen-poor and oxygen-free seabeds. However, sprat and cod fish species may be present in the area. The site lies within potential spawning grounds and areas with high sprat and cod spawning probability: see section 6.5.1. The project site lies partly within a site of national interest for commercial fishing, which consists of a catch area: see sections 6.1.9.1 and Figure **24**, where fishing for sprat and herring is conducted for the most part.

Fishing activity throughout the Cirrus area has been recorded as low, based on AIS transmissions between 2019 and 2020: see **Figure 38.**

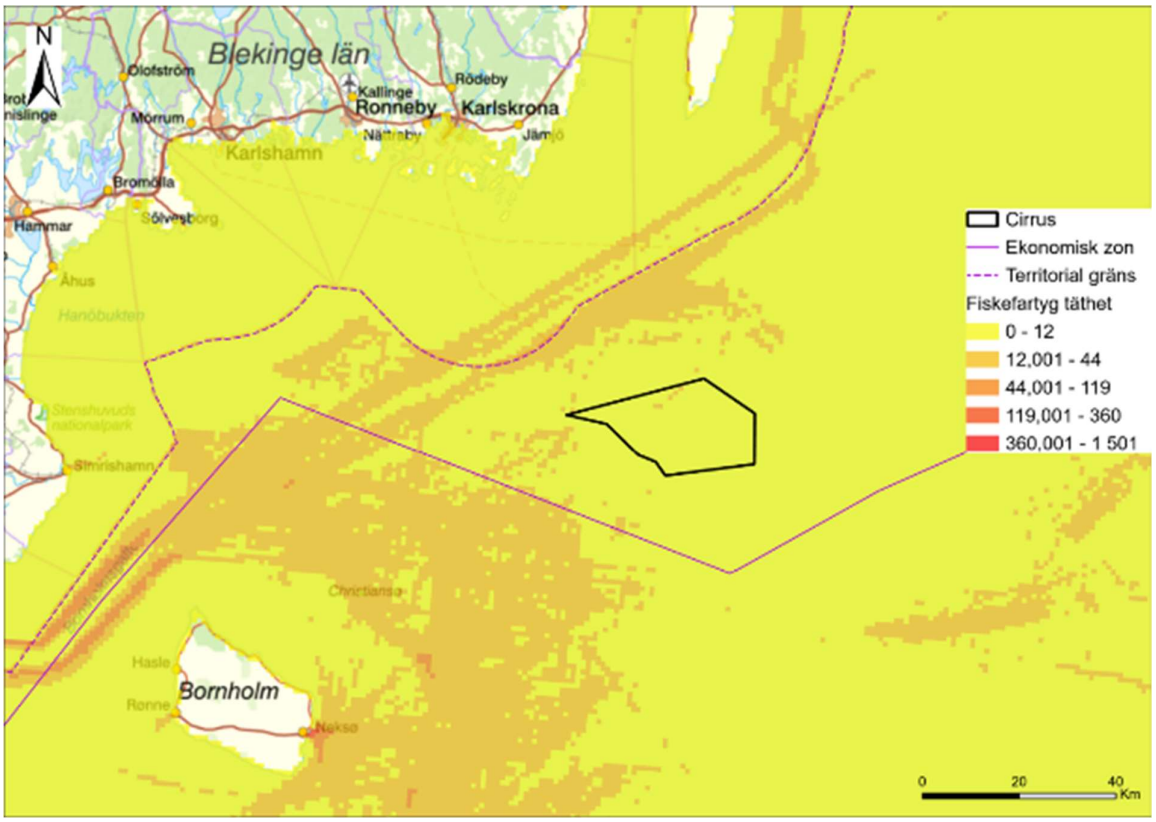


Figure 38 Map of fishing vessel density, 2019–2020. Source: HELCOM

The project site is partly within marine spatial planning area Ö246 – see section 5– which is within the trawl limit (Swedish Agency for Marine and Water Management, 2022b). Inside the trawl limit, there are several trawl areas, as they are known, or areas of entry where vessels under 24 metres are still frequently allowed to trawl. According to the Swedish Agency for Marine and Water Management's map service via WMS, the nearest trawl area is within marine spatial planning area Ö247 - see **Figure 15.**

6.12.2 Possible effects

Commercial fishing may be affected during the construction phase by the presence of construction vessels in the area, as well as a change in fish movement patterns. It may also be necessary during the construction phase to restrict access to the area for safety reasons, which may affect commercial fishing. However, AIS data shows little activity by commercial fishing boats in the Cirrus area.

During the construction phase, changes may occur in water quality due to offshore sediment, which in turn will affect fish behaviour and catchability.

Higher underwater noise levels may occur, especially during the construction phase, which may cause damage and behavioural changes in fish. The noise levels generated by wind turbines during the operational phase do not normallt exceed the noise caused by shipping.

Individual fishermen may be affected during construction and operation of the Cirrus wind farm as bottom trawling will not be possible in the area.

6.12.3 Demarcation

The impact on the national interest of commercial fishing during the construction phase and the operational phase will be further investigated and described in the EIA.

6.13 Military areas

6.13.1 Description of the current situation

Section 0 describes areas of national interest and impact areas for total defence.

It is estimated that around 40,000 mines from the two world wars remain in the Baltic Sea. These are mainly anchored mines, but there are also smaller quantities of mines that lie directly on the seabed, known as bottom mines (Swedish Coast Guard, 2023). There are no registered occurrences of Second World War mines in the site for the planned wind farm: see **Figure 39.**

However, the site is adjacent to a dumping area for chemical warfare agents and munitions. The munitions may have drifted away during the dumping process and may be present in the project site, but according to the Swedish Coast Guard's map of risk zones, the presence of mines, exploded ammunition and chemical warfare agents is low (Swedish Coast Guard, 2023). Further information on military interests is expected to be obtained during consultations.

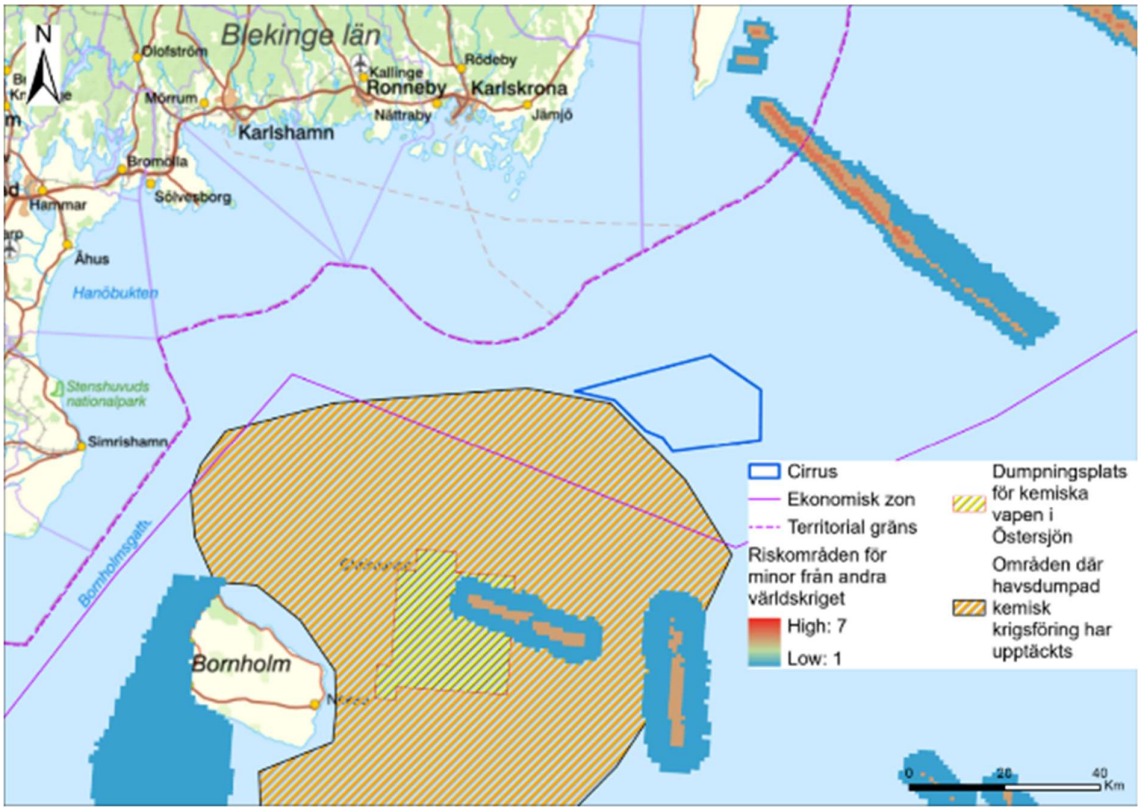


Figure 39 Dumping grounds for chemical weapons in the Baltic Sea, areas where chemical warfare agents dumped at sea has been detected and risk zone for the presence of Second World War mines. Source: HELCOM

Translation of legend to english:
Ekonomisk zon = ***Economic zone***
Territorial gräns = ***Territorial border***
Riskområden för minor från andra världskriget = ***Risk zone forthe presence of second world war mines***
Dumpningsplats för kemiska vapen i Östersjön = ***Dumping grounds for chemical weapons in the Baltic Sea***
Områden där havsdumpad kemisk krigsföring har upptäckts= ***Areas where chemical warfare agents dumped at sea has been detected***

6.13.2 Possible effects

There are no areas or interests identified within the site for the planned wind farm. There is a naval training area about 20 km north and north-west of the project site: see section 0. Possible effects may include disturbance of the sea exercise area by construction traffic during the construction phase. No impact on total defence areas or interests is deemed to exist during the operational phase of the wind farm.

6.13.3 Demarcation

Impacts on total defence areas and interests, and investigation of mines and UXO will be addressed further in the EIA.

6.14 Infrastructure

6.14.1 Description of the current situation

Cables, pipelines and existing wind farms are existing infrastructure that can be found at or near the site for the planned wind farm. The Cirrus project site includes the Nordstream 1 and 2 gas pipeline, which consists of two parallel steel pipes and is 1220 km long. A communication cable runs parallel to Nordstream 1 and 2 through the project site (c-lion) between Finland and Germany.

There are currently no existing wind farms in the Cirrus area. That said, three wind farm planning areas are under consideration. OX2 AB is planning to construct the Neptunus wind farm, which overlaps with the Cirrus project site. Njordr Offshore Wind AB is planning to construct the Baltic Offshore Beta wind farm, which partially overlaps the project site. RWE Renewables Sweden AB is planning to construct the Södra Victoria wind farm to the east of the project site, about 25 km from Cirrus: see **Figure 40**.

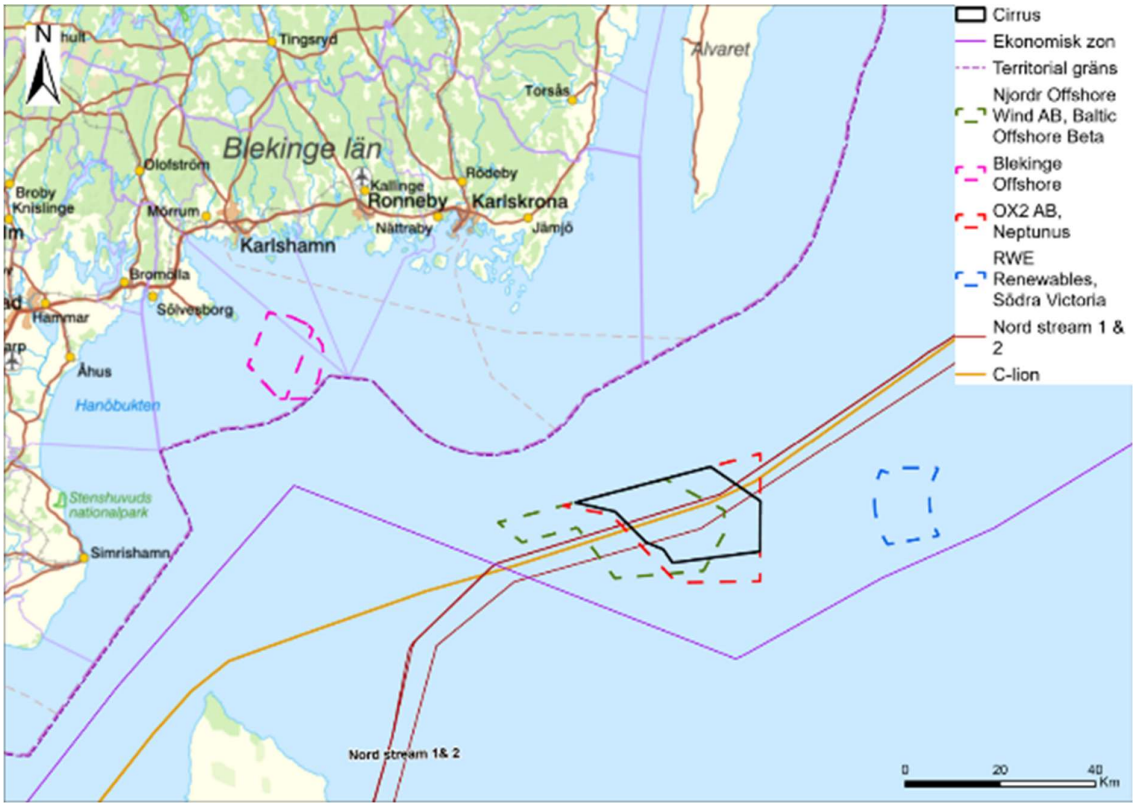


Figure 40 Map of lines and cables in the area and project sites for other planned wind farms. Source: EMODnet, HELCOM, Vindbrukskollen.

Translation of legend to english:
Ekonomisk zon = ***Economic zone***
Territorial gräns = ***Territorial border***

6.14.2 Possible effects

Precautions need to be taken during the construction phase to ensure that any cables and lines are not damaged. Maintenance work on nearby cables and lines may also be limited during the wind farm construction and decommissioning phases.

There may be cables, radio links or lines within the project site that are not openly displayed to the general public. Wind turbines risk interfering with radio links. For this reason, further investigation and consultation will take place with the Swedish Armed Forces, the Swedish Civil Contingencies Agency (MSB) and the Swedish Post and Telecom Authority.

The wind farm may pose a safety risk to aviation as the wind turbines may impede aircraft: see 6.1.8. Sweden is a member of the UN's International Civil Aviation Organization (ICAO) and is therefore obliged to establish an electronic terrain and obstacle database for buildings and installations that may pose a threat to aviation safety. An obstacle notification must be submitted to the Swedish Armed Forces some time before the installation is completed. The Swedish Civil Aviation Administration manages the Swedish Armed Forces' obstacle database.

6.14.3 Demarcation

Potential impacts on cables and lines during the construction phase, as well as coexistence with other projects in the area, will be further investigated and assessed in the EIA. Further investigation and consultation will take place with the Swedish Armed Forces, the Swedish Civil Contingencies Agency (MSB) and the Swedish Post and Telecom Authority.

6.15 Sites for extraction and raw materials

6.15.1 Description of the current situation

Extraction of materials from the seabed mainly involves sand and gravel, which are used mainly for the production of building materials. The Geological Survey of Sweden, together with the Swedish Agency for Marine and Water Management, has pointed out four areas on the Swedish seabed that have been identified as potential extraction sites for marine sand and gravel for three Swedish regions. One of the four areas is Klippbanken, located south-west of the Natura 2000 site Utklippan, and about 30 km from the project site (Geological Survey of Sweden, 2017), see **Figure 41.**

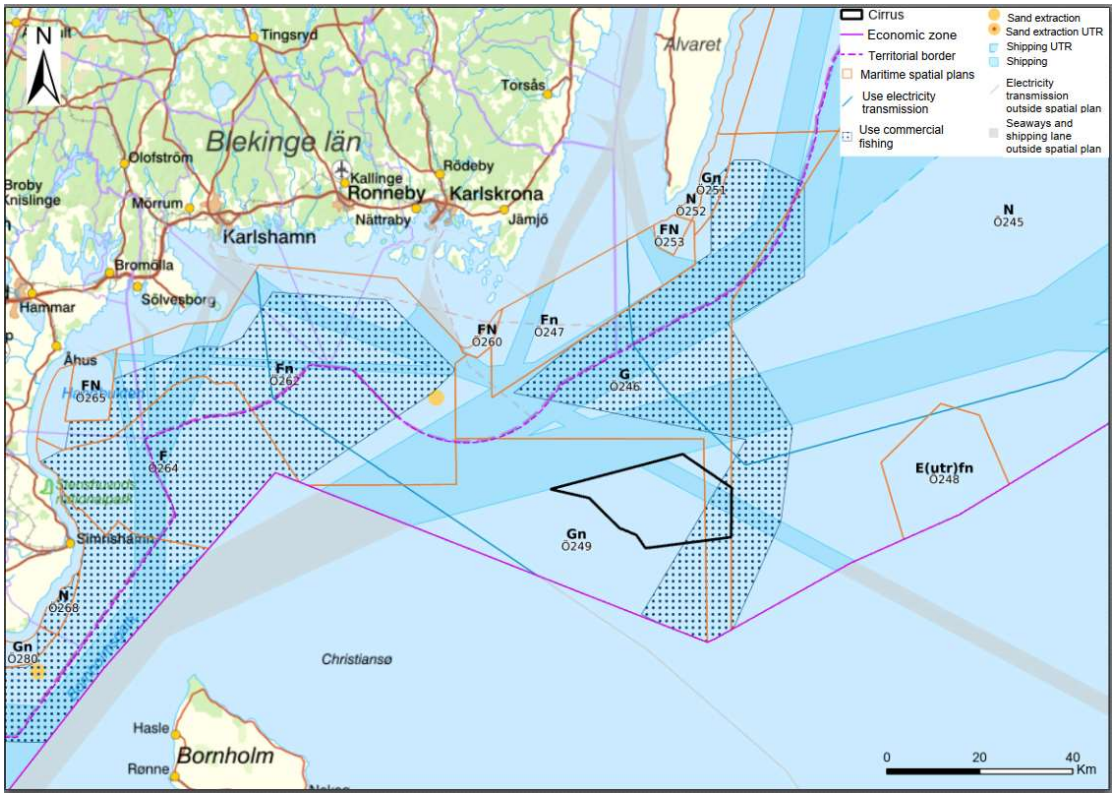
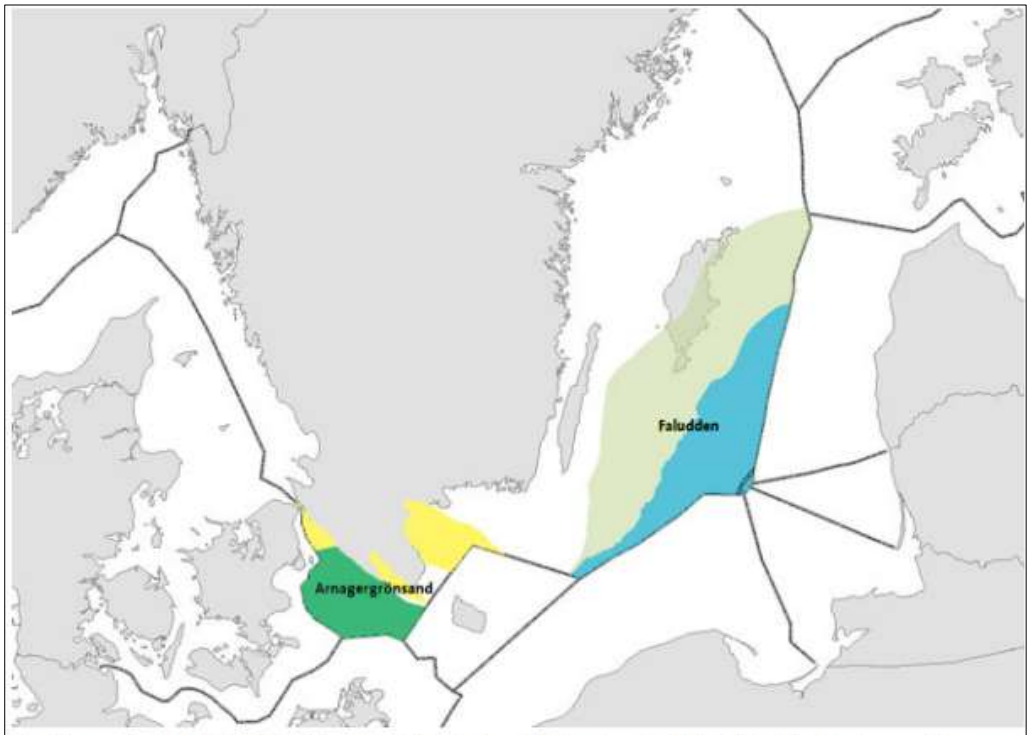


Figure 41 Map of sand extraction areas, marine spatial planning areas, shipping lanes and shipping, and commercial fishing. Source: Geological Survey of Sweden

Material extraction may also include carbon dioxide storage, whereby carbon dioxide from air emissions is captured and stored in geological formations deep in the seabed. In Sweden, mainly the sea areas in the south-east Baltic and adjacent to south-west Skåne are considered to be suitable for the storage of carbon dioxide: see **Figure 42** (Geological Survey of Sweden, 2021)



Områden med potential för koldioxidlagring i södra Sverige. På bilden visas i sydöstra Östersjön Faluddensandstenens utbredning (ljusgrön) med den potentiella lagringsenheten (turkos), och i sydvästra Skåne utbredningen av Amagergrönsanden (gul) och dess potentiella lagringsenhet (grön).

Figure 42 Areas with geological conditions for carbon dioxide storage. Source: Geological Survey of Sweden.

Meaning of colors in map:
Light green = Spread of Faludden sandstone
Turquoise = The potential storage unit of Faludden sandstone
Yellow= Spread of the americ greensand
Green= The potential storage unit of the americ greensand

6.15.2 Possible effects

No area for sand or gravel extraction is located within the planned wind farm site. The offshore cables could hinder the extraction of raw materials and the storage of carbon dioxide, Depending on how they are laid.

6.15.3 Demarcation

No area designated for sand and gravel extraction is located within or adjacent to the project site. Potential impacts will not be examined further in the EIA, therefore.

7 Good marine environment and environmental quality standards

Europe's marine environment is valuable and must be protected and preserved. The Marine Strategy Framework Directive (2008/56/EC) is the EU's common framework for the marine environment. "Good Environmental Status" is defined by the Marine Strategy Framework Directive as a condition whereby the seas are healthy and productive, and where use of the marine environment is sustainable. The marine ecosystem must be protected and preserved, and human needs for resources must to be met (Swedish Agency for Marine and Water Management, 2014).

7.1 Good environmental status

Good Environmental Status is an overall environmental quality standard for the Baltic Sea and is the desired state of the marine environment. The Marine Strategy Framework Directive defines good environmental status as a condition where the seas are healthy and productive and where the use of the marine environment is sustainable. The marine ecosystem's species, communities, habitats and functions must be protected and conserved, while also meeting human needs for resources. What characterises good environmental status, as well as environmental quality standards with indicators for the North Sea and the Baltic Sea, is set out in the Swedish Agency for Marine and Water Management's regulations HVMFS 2012:18. The indicator fact sheet sets out the criteria that are to be taken into account when formulating good environmental status.

The description of good environmental status is structured into 11 thematic areas (descriptors in the Marine Strategy Framework Directive) which have associated criteria (see **Table 4**). To assess whether the desired state has been achieved, a number of indicators are required which indicate the environmental quality and level of impact consistent with good environmental status. Indicators used to assess the status are described in Swedish Agency for Marine and Water Management report 2012:20 "God havsmiljö 2020 – Marin strategi för Nordsjön och Östersjön, Del 2: God miljöstatus och miljökvalitetsnormer" [Good marine environment 2020 – Marine strategy for the North Sea and the Baltic Sea, Part 2: Good environmental status and environmental quality standards]. Indicators must be updated at least every six years with the characteristics of good environmental status.

Table 4. Descriptors of good environmental status.

	Good environmental status
1.	Biodiversity
2.	Non-indigenous species
3.	Commercially exploited fish and shellfish
4.	Marine food webs
5.	Eutrophication
6.	Sea floor integrity
7.	Permanent alteration of hydrographical conditions

8.	Concentrations and effects of hazardous substances
9.	Hazardous substances in fish and other marine foods
10.	Marine litter
11.	Underwater noise

The Swedish Agency for Marine and Water Management has assessed whether we have achieved good environmental status in Swedish marine areas. This assessment was conducted in 2018 as an update of the first initial assessment produced in 2012 (Swedish Agency for Marine and Water Management, 2018). The site for the planned wind farm is located within the sea basin Bornholm Sea and Hanöbukten, where most of the descriptors for good environmental status are deemed not to have been achieved.

The impact on the environmental status of the marine environment and the descriptors will be addressed in the EIA.

7.1.1 Environmental quality standards for the marine environment

Eleven Swedish environmental quality standards for the marine environment have been established in order to achieve good environmental status. Environmental quality standards act as instruments to ensure that good environmental status is achieved or maintained. These environmental quality standards are a qualitative description of the desired environmental quality. The standards are linked to indicators that show the current status in order to assess whether they are being met. Environmental quality standards with indicators must be updated at least every six years.

The Swedish Agency for Marine and Water Management has devised eleven standards. The environmental quality standards are sorted according to the environmental stresses reported in **Table 5**.

Table 5 Stresses on the marine environment

Stresses
Supply of nutrients
Supply of hazardous substances
Biological disturbance
Physical disturbance

The impact on the environmental quality standards for the marine environment will be described and addressed further in the EIA.

8 Risk assessment

Risks associated with the construction and operation of the wind farm will be analysed. These risks include navigation risks and risks related to factors such as Nordstream 1 and 2, unexploded ordnance (UXO), accidental spills and fire.

8.1 Navigation risks

The construction and operation of the wind farm may pose risks to shipping. This is why a risk analysis is planned and is expected to include the following activities:

- Traffic analysis – which will form the basis of the risk analysis
- Risk analysis for third-party vessels during the construction phase
- Risk analysis for third-party vessels during the operational phase

8.1.1 Traffic analysis

A survey of shipping in the wind farm area will form the basis for the quantitative analysis of the collision risk during the construction phase. This will also ensure a common basis for the entire risk analysis. The analysis will include, as a minimum

- A map showing traffic intensity
- Identification of the main shipping lanes
- Calculation of traffic on the main routes
- Analysis of the vessels and their size (length, width, draught)
- Identification of anchorages and other areas with special rules for shipping
- The new traffic routes that may result from any traffic restrictions and safety zones at the wind farm

8.1.2 Risk analysis for third-party vessels during the construction phase

The risk analysis for third-party vessels during the construction phase is based on the traffic analysis and knowledge of the construction vessels and work schedule. The risk analysis will include:

- An estimation of the collision frequency between the construction vessels and third-party vessels
- A description of risk mitigation measures such as safety zones around the construction vessel and the construction area
- Recommendations for the implementation of risk mitigation measures

There will be a comparison against risk acceptance criteria. Risks where spills of environmentally harmful substances can occur are primarily during the construction phase, when collisions between ships and construction vessels can occur. Preparations will be made before and during the construction phase to avoid damage as far as possible, such as by establishing safety zones around construction vessels and wind turbine sites.

8.1.3 Risk analysis for third-party vessels during the operational phase

Cables will be buried under the seabed or protected by rock placement, depending on the seabed structure. Hence the likelihood of an anchor or trawl gear getting caught in a cable on the seabed is low. Cables and anchoring lines will hang freely in the water mass at each wind turbine, however, which means that tools – for instance – may get trapped. An assessment of the risk to third-party vessels during the operational phase will be performed in the EIA.

The likelihood of ships colliding with wind turbines is considered to be small, but the negative consequences would be enormous if an accident were to occur.

8.2 Other risks

Risks in all phases of the wind energy project will be identified in the upcoming EIA. Possible measures to eliminate risks will be examined and evaluated. What is known as an HSSE (Health, Safety, Security and Environment) plan will be developed for the project to systematically manage risks. Risks in addition to navigation risks identified to date are listed below.

- Unexploded ordnance (UXO) in the form of mines, torpedoes and the like may be encountered during construction. Surveys will be carried out in order to identify UXO and clear t if there is any conflict with construction work
- Leaks of oils and similar, in the form of lubricating greases and oils, from work vessels during construction and during operation of the wind turbines may occur. Protective measures to reduce risks are available
- Electrical components used for works can be a fire hazard. Systems can be installed to reduce the risks and consequences of a fire
- Risks associated with Nordstream 1 and 2. Includes maintenance and monitoring of the lines as well as damage to the wind farm in the event of any leaks.
- Sabotage

An environmental and rescue plan will also be established to manage risks during operation.

9 Surveys and investigations

Table 6 provides a brief summary of the field surveys and investigations currently planned and carried out prior to the EIA.

An application for a permit for surveying of the seabed was made on 30 November 2022.

Table 6 Planned and completed/ongoing investigations and surveys prior to the environmental impact assessment

Surveys and investigations	
Planned	Ongoing and completed
Geophysical and geotechnical survey	Aircraft obstacle analysis
Sediment modelling	Bats
Marine archaeology	Localisation study
Fish survey	Commercial fishing
Bird survey	Nautical risk analysis
Marine mammals	Underwater noise and airborne noise
Sampling of bottom sediments	Electromagnetic fields
CO2, ecosystem services and social effects	Landscape analysis
Benthic fauna and environmental toxins	

10 Ongoing process

10.1 Schedule for the planned activities

The following summarises the preliminary time required for the wind farm during the permit process and its lifetime:

- Permit review to permit coming into force 2-3 years
- Surveys: 1-2 years
- Construction: 2-3 years
- Operation: about 30 years
- Decommissioning: 1-2 years

10.2 Continued consultation process and reviews

10.2.1 Windfarm tests

This consultation document relates to consultation on the processes required for permits within the project site to enable coordination of the permit process as far as possible. This also means that the EIA that is produced will cover the tests that are carried out in parallel regarding permits to build and operate a wind farm within the project site for the wind farm, such as tests under the Swedish Economic Zone Act, the Continental Shelf Act and the Environmental Code. This coordination will make the overall picture of the project clearer.

Before the wind farm is established, further consultations will be carried out with relevant stakeholders and authorities after the current delimitation consultation has been completed.

Geophysical and geotechnical surveys of the seabed at the wind farm require permits under the Continental Shelf Act. Freja Offshore has applied for a survey permit (30 November 2022).

10.3 Consultation

Freja Offshore has initially assessed that, in addition to the general public, the following relevant authorities (see **Table 7)**, other stakeholders (see **Table 8)** and organisations and associations (see
Table 9) should be included in the consultation circle. Freja Offshore welcomes tips on additional consultation parties that may be of relevance to the Cirrus wind farm.

The intention is for the municipalities and county administrative boards with coastline adjacent to the wind farm to be invited to a digital consultation meeting and to submit comments as part of the consultation. However, the Blekinge County Administrative Board is dealing with the case. The general public will be invited to the consultation exhibition via an advertisement in the daily press. Other stakeholders are invited to a written consultation and may be invited to separate consultation meetings at the request of Freja Offshore.

Table 7. Authorities in the consultation circle

Authorities	
Kalmar County Administrative Board	Northern Baltic Water Authority
Blekinge County Administrative Board	Southern Baltic Water Authority
Skåne County Administrative Board	Southern Baltic Water Delegation
Municipality of Kalmar	Swedish Museum of Natural History
Municipality of Torsås	Swedish University of Agricultural Sciences
Municipality of Mörbylånga	Swedish National Maritime and Transport Museums
Municipality of Karlskrona	Swedish Geotechnical Institute (sig)
Municipality of Ronneby	Swedish National Board of Housing, Building and Planning
Municipality of Karlshamn	Swedish Meteorological and Hydrological Institute (SMHI)
Municipality of Kristianstad	National Defence Radio Establishment
Municipality of Sölvesborg	FOI Swedish Defence Research Agency
Municipality of Simrishamn	Swedish Board of Agriculture
Swedish Agency for Marine and Water Management	Swedish Institute for the Marine Environment
Swedish Transport Administration	Swedish Energy Markets Inspectorate
The Swedish Maritime Administration	Swedish Coast Guard
Swedish Civil Aviation Administration	Legal, Financial and Administrative Services Agency
Swedish Post and Telecom Authority	Swedish Environmental Protection Agency
Swedish Transport Agency	Swedish Energy Agency
Swedish Armed Forces	Swedish Civil Contingencies Agency
Svenska kraftnät	Swedish National Heritage Board
Geological Survey of Sweden	

Table 8 Other stakeholders in the consultation circle

Other stakeholders	
E.ON Energidistribution	3GIS
Nordstream AG	Hi3G Access AB (Three)
Association Ports of Sweden	Telenor
Stena Line	Telia
Viking Line	Tele2
Tallink Silja	Teracom Mobil (Net1)
DFDS Seaways	Sveriges Fiskares Producentorganisation
Polferries	Havs- och Kustfiskarnas Producentorganisation
Karlshamn Energi Elförsäljning AB	Swedish Pelagic Federation PO
Kalmar/Öland Airport	Wind Farms Götaland Svealand AB
Ronneby Airport	Ekovind AB
Kristianstad-Österlen Airport	Bornholm Airport

Table 9 Consultation circle organisations and associations

Organisations and associations	
Swedish Society for Nature Conservation in Blekinge (county association)	Coalition Clean Baltic
Local associations of the Swedish Society for Nature Conservation	Greenpeace
Local associations of the Swedish Outdoor Association	World Wide Fund for Nature WWF
Birdlife Sverige	
Local ornithological associations	
Other associations and clubs with maritime interests	

10.4 Adaptations and protective measures

A picture of the wind farm's expected environmental impact and assessed consequences will emerge during the consultation phase and through investigations and surveys, mapping the conditions for relevant aspects. This will provide a basis for defining the application area and the design of the park prior to the permit application. It will also form the basis for proposing appropriate and necessary adaptations and protection measures in the EIA, and then be planned and designed gradually as the project progresses. The environmental adaptation carried out in the project through the environmental assessment process will be described collectively in the EIA.

A monitoring programme for the construction work and then a programme for the operation of the wind farm will be drawn up before construction begins. This programme will be prepared in accordance with the specific conditions for the wind farm, national permit requirements and legislation. Moreover, the programme will be developed so that adaptation and mitigation measures are highlighted and observable and their effectiveness is clarified. The programme will also describe the preventive measures that can be implemented to minimise environmental impact.

10.5 Environmental Impact Assessment

Chapter 6 (35) of the Environmental Code states what an environmental impact assessment (EIA) has to include. The information to be included in an EIA must be of a scope and level of detail that is reasonable in the light of current knowledge and assessment methods and that is necessary to provide an overall assessment of the significant environmental effects that the activity or measure is likely to have (Environmental Code, Chapter 6 (37).

To summarise, the following is proposed for inclusion in the EIA document:

1. Non-technical summary
2. Introduction
3. Permit process and legislation
4. Demarcations
5. Consultation
6. Alternative location
7. Site description, planning conditions, national interests and protected areas
8. Natura 2000 sites
9. Description of the current situation, environmental impacts and protective measures
    - 9.1 Bathymetry
    - 9.2 Water quality and hydrography
    - 9.3 Sediments
    - 9.8 Benthic fauna
    - 9.9 Fish
    - 9.10 Marine mammals
    - 9.11 Birds
    - 9.12 Bats
    - 9.13 National interests
    - 9.14 Landscape
    - 9.15 Cultural environment
    - 9.16 Recreation and outdoor activities
    - 9.17 Commercial fishing
    - 9.18 Shipping and shipping lanes
    - 9.19 Aviation
    - 9.20 Military areas
10. Cumulative effects
11. Transboundary impacts
12. Consequences of decommissioning
13. Overall assessment
14. Follow-up and monitoring
15. Uncertainty
16. Bibliography

10.6 Permitting of the export cable

Testing under the Continental Shelf Act for the construction of the export cable within the economic zone and territorial waters is deemed necessary at a later stage. This assessment will probably include water activities requiring a permit under the Environmental Code, but may also include other parts of the Environmental Code depending on where the cable is laid on land. The export cable also requires a network licence in territorial waters and on land under the Electricity Act.

Here, too, it will be necessary to apply for a survey permit under the Continental Shelf Act.

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