Triton wind farm

Notification documentation pursuant to Article 3 of the Espoo Convention

October 2021

OX2

Operator

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Project information

Project Name Triton Wind Farm

Report Triton Wind Farm – Notification pursuant to the Espoo Convention

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About the notification

The Convention on Environmental Impact Assessment in a Transboundary Context ("the Espoo Convention") is an environmental protection convention for Europe, Canada and the United States focused on cooperation to prevent transboundary environmental impacts.

The Espoo Convention states that the proponent of an activity with the potential for transboundary impact is obliged to inform all parties likely to be affected by said activity (i.e. other countries) and invite them to participate in the environmental impact assessment (EIA) procedure.

The present notification has been prepared in order to present a general description of the project, to set out the area of the operation and to serve as a preliminary report for the scope and content of the forthcoming Espoo EIA, which focuses in particular on the anticipated transboundary impacts.

Contents

Summary

OX2 AB is one of the leading operators in the field of large-scale wind power in Europe and is planning to establish an offshore wind farm in the Swedish economic zone off the south coast of Skåne. The wind farm is to be named “Triton” and is expected to generate approximately 7.5 TWh of electricity annually, equivalent to the electrical consumption of around 1.5 million households. The plan is for the wind far to comprise a total of 68–129 wind turbines, as well as the associated installations, including substations, subsea cables and platforms. The maximum height of the wind turbines is 370 metres above sea level.

The project area, which covers approximately 250 square kilometres, is located around 22 km off the coast of Skåne. The distance from the wind farm to the Danish island of Bornholm is approximately 37 km, while the Danish island of Zealand is around 66 km away. The wind farm is located around 47 km from the German island of Rügen and approximately 80 km from mainland Germany. The distance from the wind farm to Poland is around 130 km, and it is around 375 km from the Russian exclave of Kaliningrad.

The Espoo Convention states that the proponent of an activity with the potential for transboundary impact is obliged to inform all parties likely to be affected by said activity (i.e.other countries) and invite them to participate in the environmental impact assessment (EIA) procedure. The present notification has been prepared in order to present a general description of the project, to set out the area of the operation and to serve as a preliminary report for the scope and content of the forthcoming Espoo EIA, which focuses in particular on the anticipated transboundary impacts.

The primary conclusion is that the impact caused by the planned activity within the Swedish economic zone is expected to be limited, which means that any potential transboundary impact can likewise be expected to be limited.

Concepts and definitions

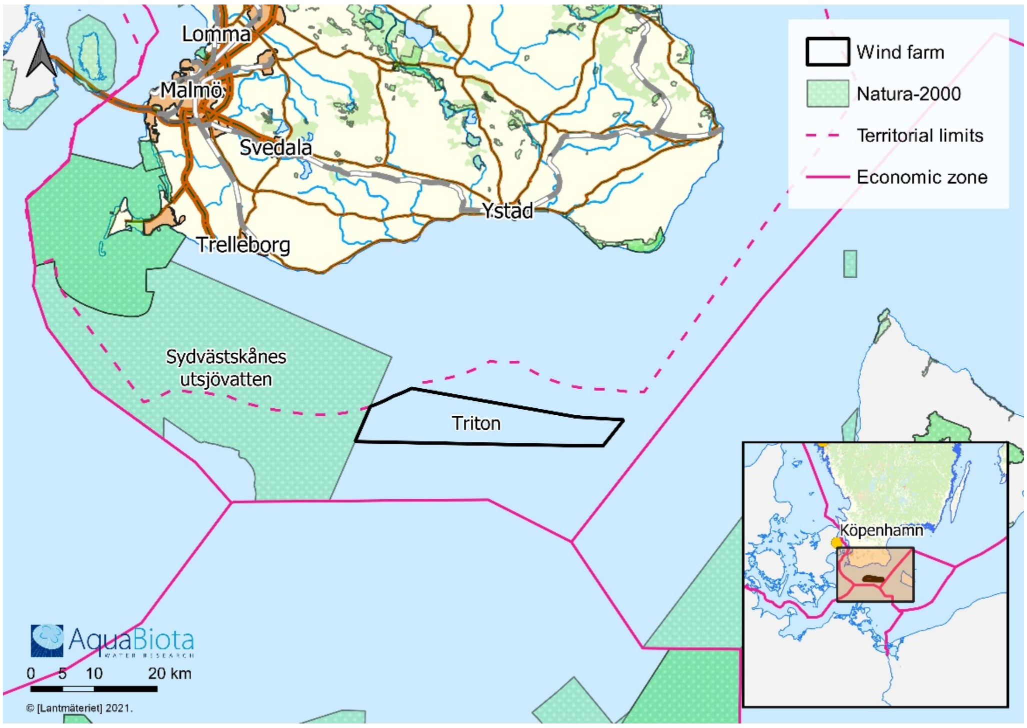
For the convenience of the reader, we have compiled a list of specific concepts and definitions that we use when describing the planned activity and setting out the conditions and expected environmental impacts of the project.

Capacity	The energy converted per time unit. Installed capacity is measured in units including kilowatts (kW) and multiples of same; 1,000 kW = 1 megawatt (MW), 1,000 MW = 1 gigawatt (GW) and 1,000 GW = 1 terawatt (TW).
Environmental Impact Assessment (EIA)	A document attached to permit applications. This document is to describe the direct and indirect impact on people's health and the environment, and to make possible an overall assessment of the consequences caused by the planned activity.
Project area	The area in which the wind farm – including the wind turbines, offshore substations and internal grid – is to be constructed.
Cable corridor	The area(s) in which the wind farm connection cables (also called "export cables") are located. These are the cables used to transfer the electricity generated from the wind farm to one or more onshore connection points.
Consultation document/basis	A document that contains information about the planned project and which, at a general level, sets out the environmental impacts that the planned activity is anticipated to cause.
Protective measure	In this context, "protective measure" refers to the measures implemented to minimise negative environmental impacts and to restore the area.
Maximum height	The hub height (tower height) of the wind turbine, plus the length of the rotor blade, i.e. the height of the wind turbine up to the tip of the blade at its highest point.

1. Background

1.1. Introduction

OX2 AB (hereinafter “OX2”) is planning to establish an offshore wind farm in the south-west section of the Baltic Sea (Bornholmsgatt), i.e. in the Swedish economic zone off the south coast of Skåne. The wind farm is to be named Triton and will border the deep-water Natura 2000 area off the coast of South-west Skåne, (Figure 1). The overarching purpose of the Triton wind farm is to generate renewable electricity and thus to assist Sweden in achieving its goals for energy and the climate, and to provide society and the business community – primarily in Southern Sweden – with competitively priced electricity. At full capacity, Triton has the potential to reach an annual production of approximately 7.5 TWh. This is equivalent to the annual electricity consumption of around 1.5 million households[1].



Applications for permits for the wind farm will be submitted pursuant to SEZ and KSL. As the wind farm borders a Natura 2000 area and potentially risks having an impact on same, OX2 also intends to apply for a Natura 2000 permit in accordance with Section 7(28a) of the Swedish Environmental Code (1998:808).

[1] Calculated at 5,000 kWh per household.

1.2. Regarding the need for offshore wind power

The energy political goals for Sweden state that Swedish electricity production is to be 100 percent renewable by 2040, and that the country is to have eliminated its net emissions of greenhouses gases into the atmosphere completely by 2045. Moreover, in order to function in a future market, more and more companies and industrial enterprises consider it essential to transition to fossil-free production. This tendency is leading to investments in large-scale fossil-free technology and production plants – fossil-free steel, for example – and rising demand for both renewable electricity and hydrogen produced using renewable electricity. Increased electrification of society, industry and the transport sector likewise demand greater access to electricity. Sweden's future electricity requirements are forecast to total between 200 and 310 TWh per year (for 2045 or 2050, depending on the scenario), compared to the current level of around 140 TWh per year. What is more, many of the electricity generating facilities that exist today are approaching the end of their working lives and will therefore need to be replaced. For example, electricity production is sure to dip in Southern Sweden when nuclear reactors are taken offline. At the same time, supplies of renewable electricity from Northern Sweden are limited by strained transfer capacity in the main grid, and by rising demand for renewable energy in the north.

Of those types of power that can accommodate the ever-increasing demand for electricity at a competitive price, wind power offers the greatest potential and is the most cost-efficient solution. All new electricity generating facilities face challenges. The installation of new large-scale wind power plants on land in Southern Sweden is complicated by high population density and competition for land use. Offshore wind power off the south coast of Sweden holds the greatest potential to contribute new capacity while simultaneously utilising the existing electricity grid as efficiently as possible. Compared with onshore wind farms, offshore installations can be built with much larger turbines and a higher capacity. The conditions for offshore wind power are also better given that wind speeds are higher and the wind blows more consistently at sea, contributing to more stable and efficient electricity generation.

Offshore wind power can make a powerful contribution to the opportunities to convert industrial processes that are currently dependent on fossil fuels to renewable alternatives. In addition to accommodating a direct need for electricity, the volume of electricity generated can also be used to produce hydrogen, for example, or e-fuels (such as ammonia and methanol) to supply power to industry, shipping and agriculture. The development and upscaling of such solutions is accelerating both in Sweden and globally. Offshore wind farms can also help assure a more stable and secure supply of electricity in the future by serving as geographical nodes for additional grid connections between countries. Offshore wind power can therefore contribute to the transition and electrification of industry, transport and society as a whole, and has a key role to play in ensuring a competitive business community in the southern part of Sweden.

1.3. About OX2

OX2 develops and sells wind- and solar farms, and the company's operations are contributing to the transition to a renewable energy system. Over the course of the past 16 years, OX2 has established a leading position in the field of large-scale onshore wind power through the development and installation of approximately 2.5

GW of capacity in Finland, Norway, Poland and Sweden, and currently commands a strong product portfolio. In the period 2014–20, OX2 established more onshore wind power in Europe than any other developer. Based in Stockholm, OX2 runs operations in Finland, France, Italy, Lithuania, Norway, Poland, Romania, Spain and Sweden. In 2020, the company generated a turnover of SEK 5.2 billion. OX2 is listed on the Nasdaq First North Premier Growth Market.

2. Permit reviews under Swedish law

The establishment and operation of wind turbines and the associated installations, including facilities for the production and storage of hydrogen in the Swedish economic zone require permits from the Swedish government, pursuant to the Act on Sweden's Economic Zone (1992:1140) (hereinafter "SEZ").

Permits from the government are also required under the Swedish Continental Shelf Act (1966:314) (hereinafter KSL), for the establishment of subsea cables and pipelines on the continental shelf, comprising both subsea cables within the wind farm itself and cable connections between the internal grid and the mainland, as well as pipelines for hydrogen gas.

For those measures to be implemented on Swedish territory, i.e., the establishment of cables and pipelines for linking the energy park to one or more connection points on land, permits are required pursuant to the Swedish Environmental Code (1998:808), the Swedish Electricity Act (1997:857) and the Swedish Certain Pipelines Act (1978:160).

Operations and measures which may have a significant impact on Natura 2000 areas also require a special Natura 2000 permit pursuant to Section 7 (28a) of the Swedish Environmental Code. For activities within Sweden's economic zone, the county administrative board in the county located closest to the proposed offshore activity is responsible for the assessment – in this case, the County Administrative Board of Skåne.

With regard to possible transboundary impact, information about the planned activity must also be communicated to neighbouring countries, and consultations must be held under the terms of the Espoo Convention.

3. Location

The planned Triton wind farm is located in the Swedish economic zone in the south-western section of the Baltic Sea, see Figure 2. Conditions in this area are considered favourable for the establishment of a wind power facility, as the area consists of purely open sea, with an average wind speed of 9.5 m/s (at a height of 100 metres above sea level). The planned wind farm is located approximately 30 km south of Ystad, and the nearest built-up areas are approximately 22 km from the wind farm areas, in Beddingestrand and Smygehamn on the south coast of Skåne. The wind farm area covers approximately 250 km^2 and the depth of the water varies between 43 and 47 metres.

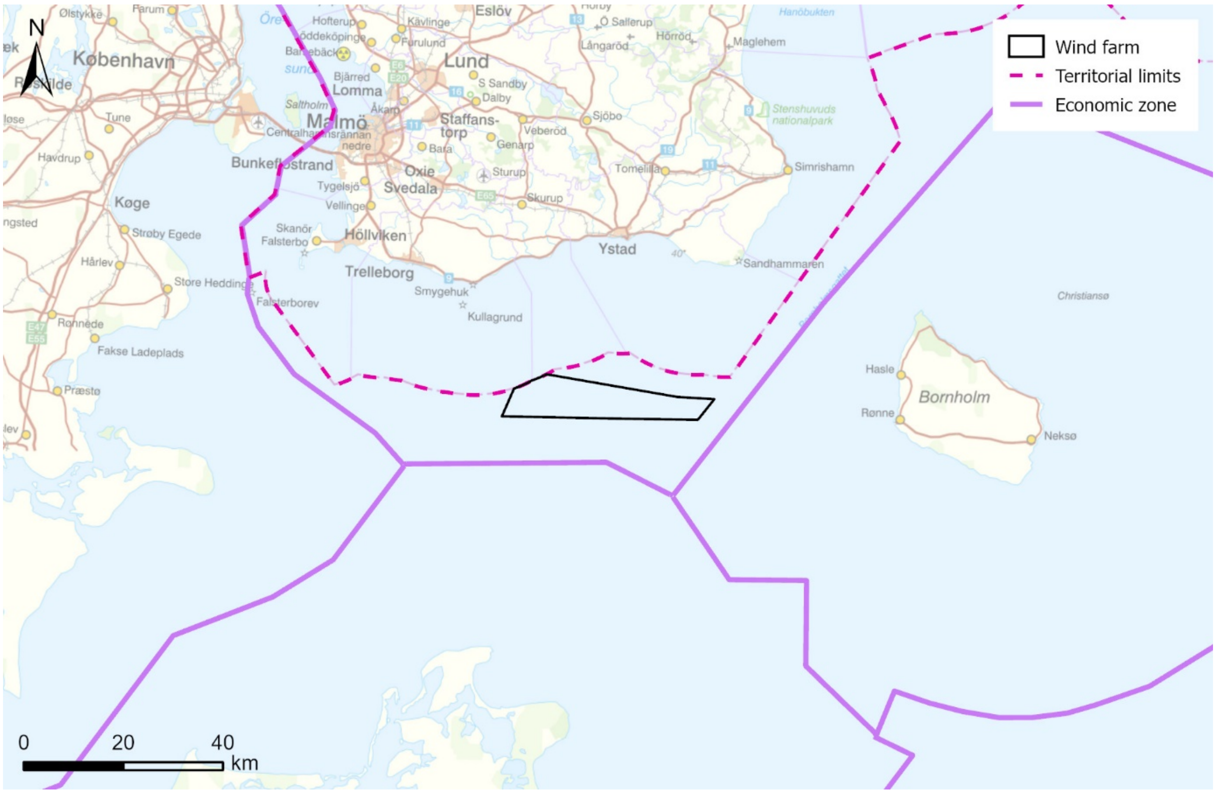


Figure 2. Location of Triton wind farm

The distance from the proposed Triton wind farm and the island of Bornholm (which is Danish territory) is approximately 37 km, measured from the easternmost tip of the wind farm. The distance from the wind farm to the Danish island of Zealand is approximately 66 km. The wind farm is located around 47 km from the German island of Rügen and approximately 80 km from mainland Germany. The distance from the wind farm to Poland is around 130 km, and the wind farm is around 375 km from the Russian exclave of Kaliningrad.

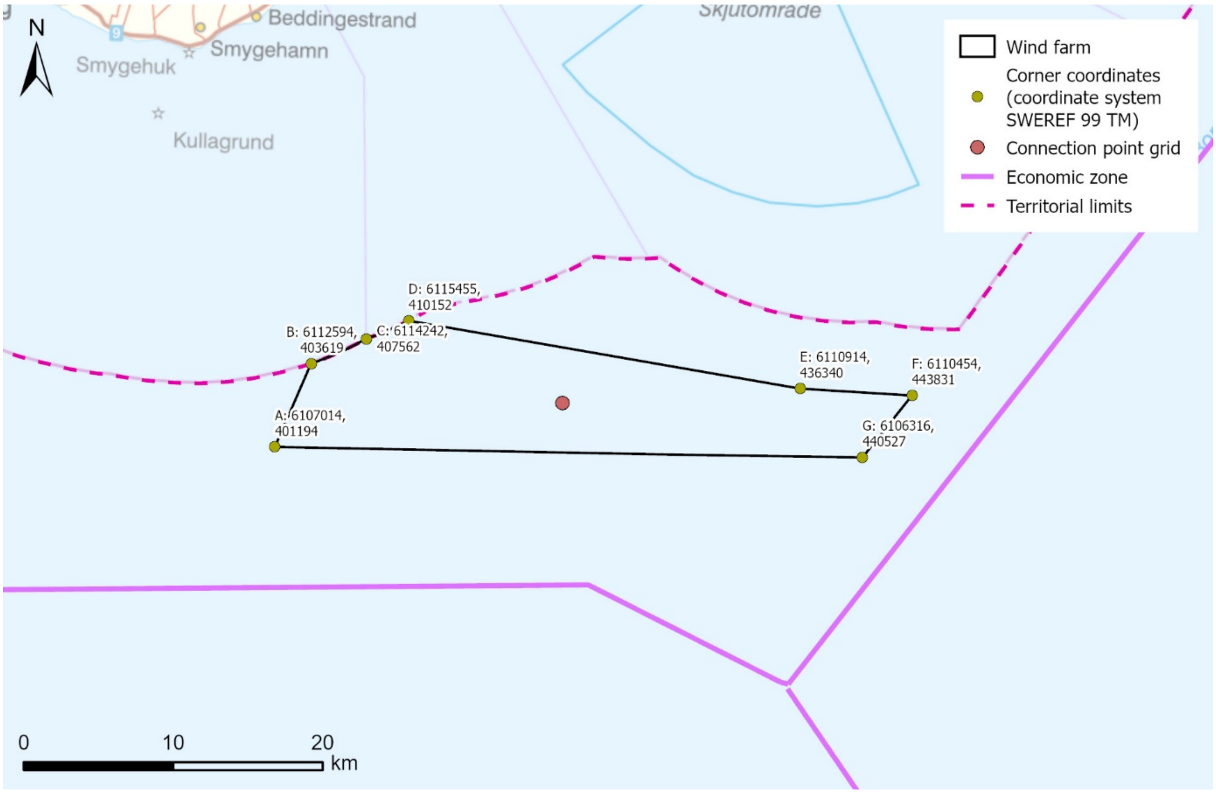


Figure 3. Project Triton with coordinates in the corners of the project area.

Table 1. Coordinates for the corners of the Triton area according to SWEREF99TM.

Point	East (SWEREF99TM)	North (SWEREF99TM)
A	403619	6112590
B	407304	6114240
C	410152	6115460
D	401194	6107010
E	436340	6110910
F	443831	6110450
G	440527	6106320

4. Description of activities

4.1. Planned activities

The planned Triton wind farm will have an installed capacity of approximately 1,800 MW and will comprise 68–129 wind turbines, depending on the size of the turbines installed. The wind turbines will be built on foundations and linked together via an internal grid that will connect the turbines to one or more offshore substations. One or more links featuring export cables will transfer the electricity generated from the individual offshore substation to an onshore connection point. In addition, one or more masts may be established for the purposes of taking meteorological measurements, as well as buoys to measure waves and currents. Within the wind farm itself, accommodation platforms may be built, as well as platforms for energy storage and/or conversion, for example.

The grid connection point(s) for the Triton wind farm has/have not yet been finalised, as the Swedish TSO (Svenska kraftnät*)* has not yet identified suitable connection points. The project is examining various options for the most appropriate grid connection points for the wind farm, with the Municipalities of Ystad, Trelleborg, Svedala and Kävlinge identified as options. It may also be relevant to consider grid connection points in other local authorities.

An increased share of wind power in the North European power system also requires solutions to meet the challenges of uneven production and greater options for balancing, regulation and storage. Investigations are therefore under way to identify complements to conventional grid connection. OX2 is also looking into the possibility of constructing platforms for energy storage and/or conversion with a view to establishing technical solutions for converting the electricity generated into e-fuels such as hydrogen and ammonia, as well as other energy storage solutions. Such technology is the object of ongoing development within the industry. For example, the production of hydrogen gas can be used to store the energy and transport it via pipelines within the project area and to onshore facilities. This opens the door to efficient energy storage and improved balance in the electrical power system, and can function as an alternative or a supplement to conventional grid connection.

4.2. Scope and design

The permit application and construction processes for a wind farm are protracted (see the provisional timeframe in section 4.4). At the same time, technology is developing rapidly and continuously, which means that more cost-effective and eco-friendly technology is becoming available on an ongoing basis. In recent years, suppliers have progressively succeeded in increasing the size of a wind turbine's rotor diameter from around 170 metres to more than 235 metres, which translates into higher production and more efficient use of the installation area. By 2030, it is expected that the rotor diameter may be as much as 340 metres.

The design of the wind farm, including the placement of cables, substations and, if appropriate, other platforms, will be adapted to conditions at the site with regard to aspects such as wind, climate, waves, water currents, environmental impact and geological properties. The final design of the wind farm will therefore be decided on the basis of the technology available at the time of procurement and construction, and with regard to optimisation of energy generation. The size and number of wind turbines will present various options that will be elucidated and assessed on the basis of the available wind resources in the area.

Figure 4 and Figure 5 below present example of layouts for Triton consisting of small and large wind turbines, respectively. The number of wind turbines installed will not exceed 129. The layouts illustrate how the wind farm could be established in the project area. It should be emphasised that these layouts are intended as examples only and that the final design may take a different form.

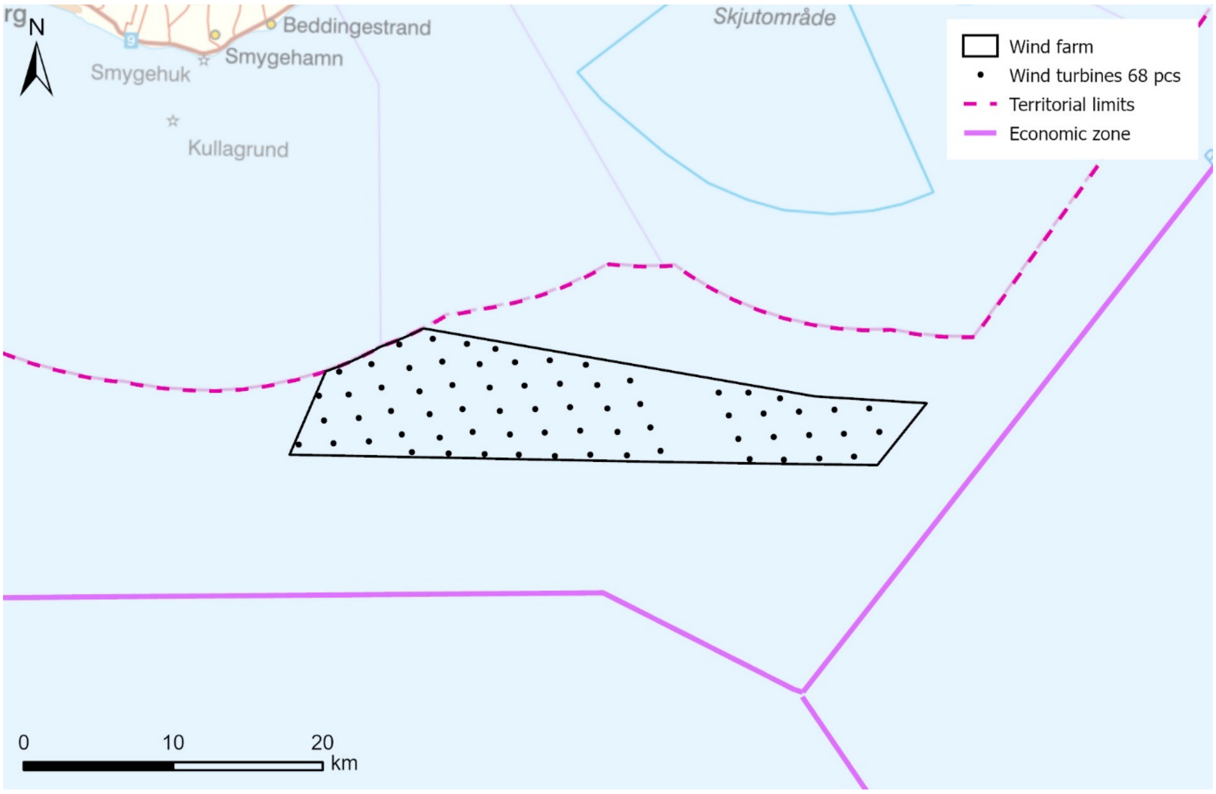


Figure 4. Example layout featuring 129 wind turbines, 15 MW models.

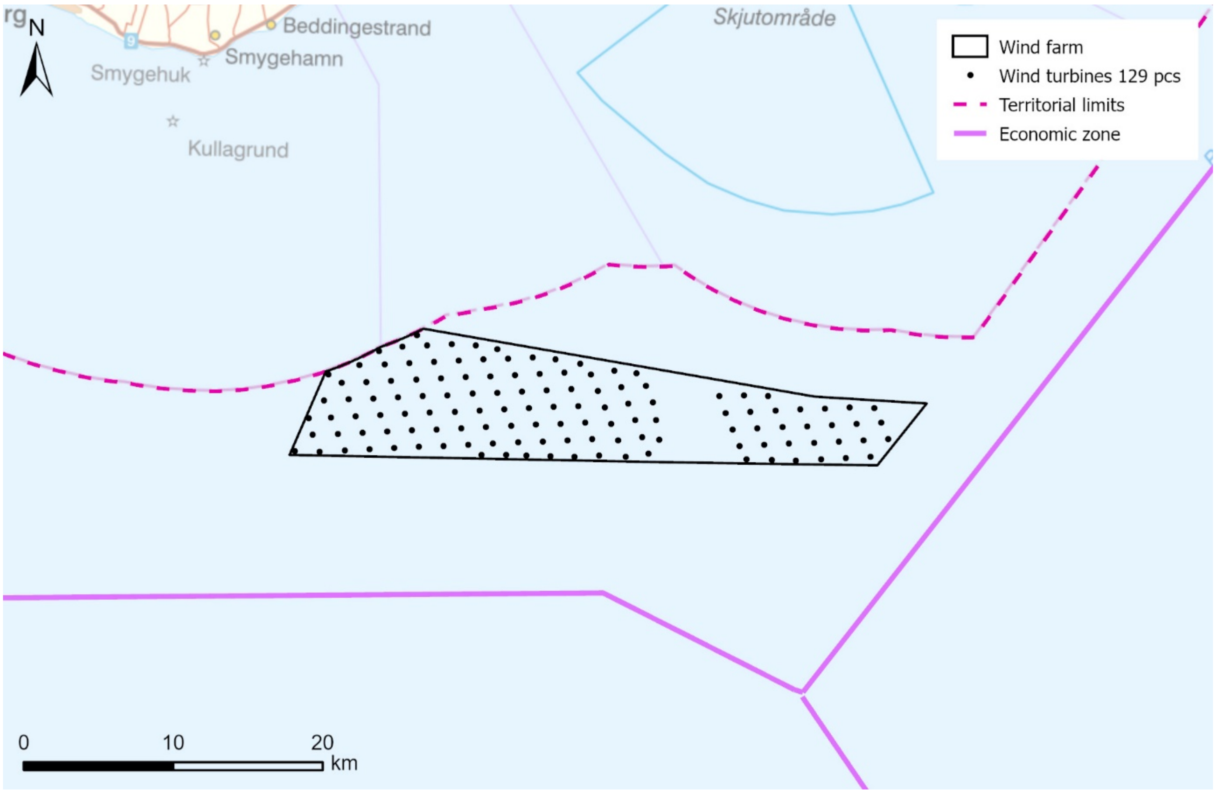


Figure 5. Example layout featuring 68 wind turbines, 25 MW models.

4.2.1. Wind turbines

Wind turbines can feature either vertical or horizontal axes, with two or three rotor blades. The type of wind turbine that has been developed most quickly and has been installed in most locations to date is the three-blade, horizontal axis model.

At a later state, the wind turbine model for the Triton facility will be selected on the basis of the site properties and the latest technological developments. It will likely be a conventional model featuring three rotor blades mounted on a horizontal axis. The rotor diameter is expected to be between 240 and 340 metres, and the maximum total height of the wind turbines will likely be 370 metres above sea level. The clearance between the tip of the blades and the water surface will be approximately 20–30 metres. Figure 6 presents examples of offshore wind turbines.

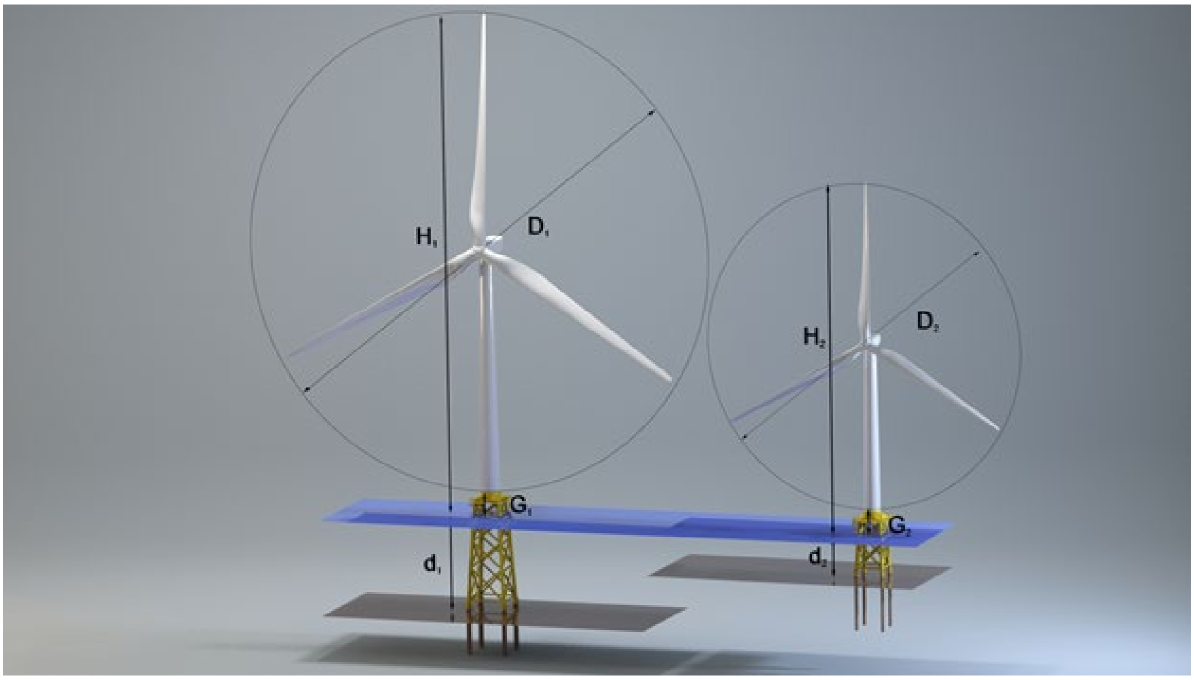


Figure 6. Examples of wind turbines. D = rotor diameter, H = total height, G = clearance , d = water depth.

Table 2. Examples of wind turbine dimensions.

	Example 1	**Example 2**
Wind turbine capacity	25 MW	15 MW
Rotor diameter D (m)	340	240
Total height H (m)	370	270
Clearance G (m)	20–30	20–30
Number of wind turbines	68	129

Wind turbine blades are generally made primarily of fibreglass- or carbon fibre-reinforced polymer composites, while the towers typically consist of sections of steel tube sections. Wind turbines are expected to generate electricity at wind speeds starting at 3 m/s, and to achieve maximum production at wind speeds of between 10 and 14 m/s. Wind turbines shut down when the wind speed exceeds approximately 30 m/s. They then restart automatically when the wind speed drops to safe levels once more.

The wind turbines and the measurement masts will be marked with lights to alert air and sea traffic pursuant to the Swedish Transport Agency's regulations and guidelines (TSFS 2020:88) on the marking of objects that may pose a hazard to air traffic. In addition, dialogue will be entered into with the Swedish Transport Agency and the Swedish Maritime Administration.

4.2.2. Foundations

The choice of foundation depends on several factors: primarily the wind turbine model chosen, water depth, geology, wind and wave conditions, environmental considerations and costs. Based on the technology available today and the geology in the project area, three different types of foundation are considered to be relevant for the Triton wind farm: gravity foundation, monopile foundation and what is known as “jacket foundation”. These three basic types can also be combined to create hybrid foundations. Jacket foundations can be anchored using piles or “suction buckets”. Monopiles can also be fitted with suction buckets, in which case they are referred to as “monobuckets”. Examples of the different foundation types are illustrated in Figure 7. The indicative dimensions of the foundations will be stated in the EIA.

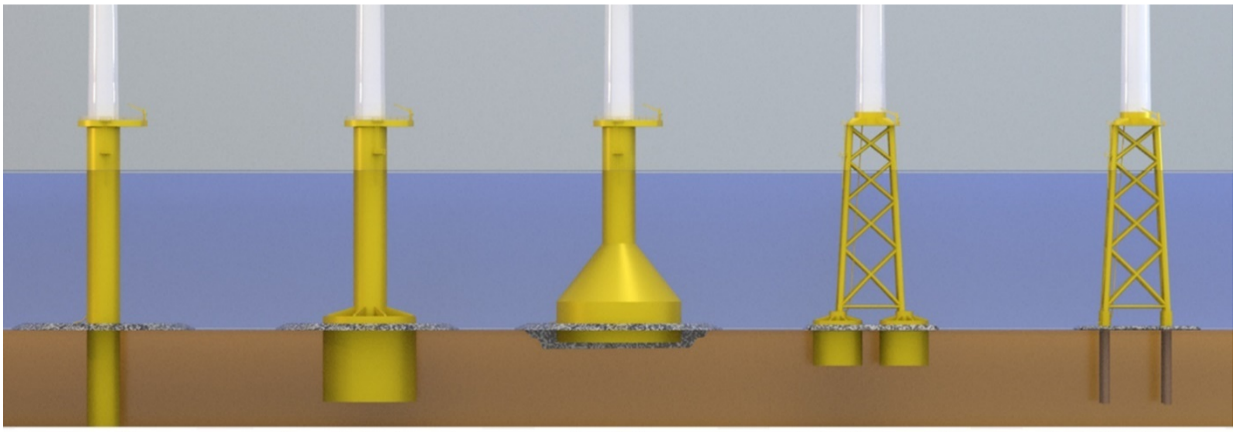


Figure 7. Examples of different types of foundation.

On top of the foundation, it is usual to fit what is known as a “transition piece”, to which the bottom of the wind turbine tower is then attached. A layer of erosion protection is established around the foundation on the seabed to protect the foundation against the formation of erosion holes. The need for erosion protection varies depending on the waves, currents and seabed sediment in the area. The most common type of erosion protection involves pouring layers of stones, gravel and sand in various sizes around the base of the foundation.

The following sections present a brief description of the types of foundation likely to be relevant for the Triton wind farm.

Gravity foundation

Gravity foundations are large structures that rest on the seabed and keep wind turbines upright on account of their size and weight. Gravity foundations are typically constructed in the form of concrete “buckets” or steel containers filled with ballast. Gravity foundations require a level seabed and are often a good solution on soils with good bearing capacity and in areas of relatively shallow water. At deeper depths, the structure tends to become large and heavy, especially given the ever-increasing size of wind turbines. The seabed surface needs to be dredged prior to installation, and a supporting layer has to be established in order to ensure a level bottom. The dredging process involves digging a pit in the seabed. Moreover, if large boulders are present, they may need to be removed. After dredging, a flat, even bed of crushed stone is laid for the foundation to rest on. Once the stone bed has been laid, the gravity foundation is placed in position using a floating crane and is then filled with ballast.

For the Triton wind farm, it is estimated that gravity foundations will require a bottom diameter of up to 45 metres. Erosion protection is established around the foundations.

Figure 8. Gravity foundation. Illustration COWI

Monopiles

Monopile foundations consist of a single steel cylinder (the pile) that is embedded deeply into the seabed through pile-driving, drilling or using a combination of the two techniques. The diameter of the foundation and the anchoring depth are dimensioned according to factors such as the load exerted by the wind turbine, geotechnical conditions, water depth and wind- and wave conditions.

The monopile technique is relatively simple and generally requires little or no preparation of the seabed; in contrast, vessels with appreciable lifting capacity are required during the installation process. Hydraulic hammers are used to drive the pile into the seabed and establish the foundation. The power and frequency of the hammer blows are adapted to match the prevailing conditions.

The monopile technique is thoroughly tried and tested, and the solution has commonly been used for offshore wind farms all over the world. In the vicinity of Swedish waters, the monopile system has been used at

Ørsted's Anholt wind farm and the Vattenfall project Kriegers flak in Danish waters, as well as at EnBW's Baltic 2 installation (part of Kriegers flak) in German waters bordering Swedish territory, and at RWE's Arkona wind farm, south-west of Rönne. The benefits of the monopile process is that it involves a tried and tested structure that is easy to manufacture, transport and install. In addition, the structure is simple to inspect during the operational phase. This type of foundation requires only limited preparation of the seabed prior to installation, takes up only a relatively small area and can be installed quite quickly.

For the Triton wind farm, the monopiles – which are slightly conical – are expected to have a top diameter of 8–10 metres and a base diameter of 12–14 metres. In order to achieve sufficient stability, monopiles can be driven 50–55 metres into the seabed. Erosion protection will be established around these foundations, to an expected extent of four times the diameter of the pile, i.e. approx. 50 metres.

Figure 9. Monopile foundation. Illustration COWI

Jacket foundation

A jacket foundation is a three- or four-legged truss construction of steel tubes/beams. The technique stems from the oil and gas industry and has been thoroughly tested in deep depths, typically in excess of 40 metres. The steel tubes in the lattice are generally attached to one another by welding or using moulded sleeves.

A jacket foundation with pin piles is secured to the seabed by driving three or four steel tubes into the seabed sediment, after which the entire steel structure can be fitted as a single piece. Some drilling may also be necessary in areas of hard seabed. Pile driving is carried out using a method similar to that used for monopiles. For the Triton wind farm, it is expected that the piles will be 3–4.5 metres in diameter, and that the penetration depth will be up to 100 metres.

Figure 10. Jacket foundation. Illustration COWI

Suction bucket foundation

Suction buckets are upside-down containers – hollow steel cylinders – that can be fitted either to monopiles ("monobucket") or on a jacket. On installation, the container is placed on the seabed, after which the water is pumped out, creating a vacuum. This vacuum results in the container being "sucked down" into the sediment. The establishment of suction buckets requires no pile driving or drilling, but a certain amount of sediment is required for it to be possible to use the technique at all.

Electrolyser in connection with foundations

The transition piece on the foundation can also be fitted with an electrolyser that converts the electricity generated into gas through electrolysis. This is a development that some wind turbine manufacturers are currently looking into. The electrolyser can, for example, be placed in a container-like solution, with the gas generated being carried away from the wind turbine foundation in pipes.

4.2.3. Internal grid

The internal grid links the wind turbines to the substations by connecting individual turbines together in groups (radials) that are then connected to the offshore substation.

The core of the cable is usually made of copper or aluminium, encased in an insulating material and a layer of reinforcement to protect the whole cable. On the basis of the cable technology available today, the internal grid could, for example, consist of 66 kV cables that have the capacity to transfer total output of around 80–90 MW per cable. This would mean that up to six 15 MW wind turbines could be connected along the same radial. The maximum voltage for internal grid cables is expected to increase to around 170 kV over the coming five to ten years. This would result in an increase in the total transfer capacity for each cable, thus reducing the number of radials and the total length of cable required. In addition to the cables that link the wind turbines together, it may be necessary to install other cables within the wind farm in order to create redundancy in the system and to supply power to any platforms constructed there.

Figure 11 and Figure 12 present examples of possible layouts of 66 kV internal grid cables for sixty-eight 25 MW wind turbines and for one hundred and twenty-nine 15 MW wind turbines.

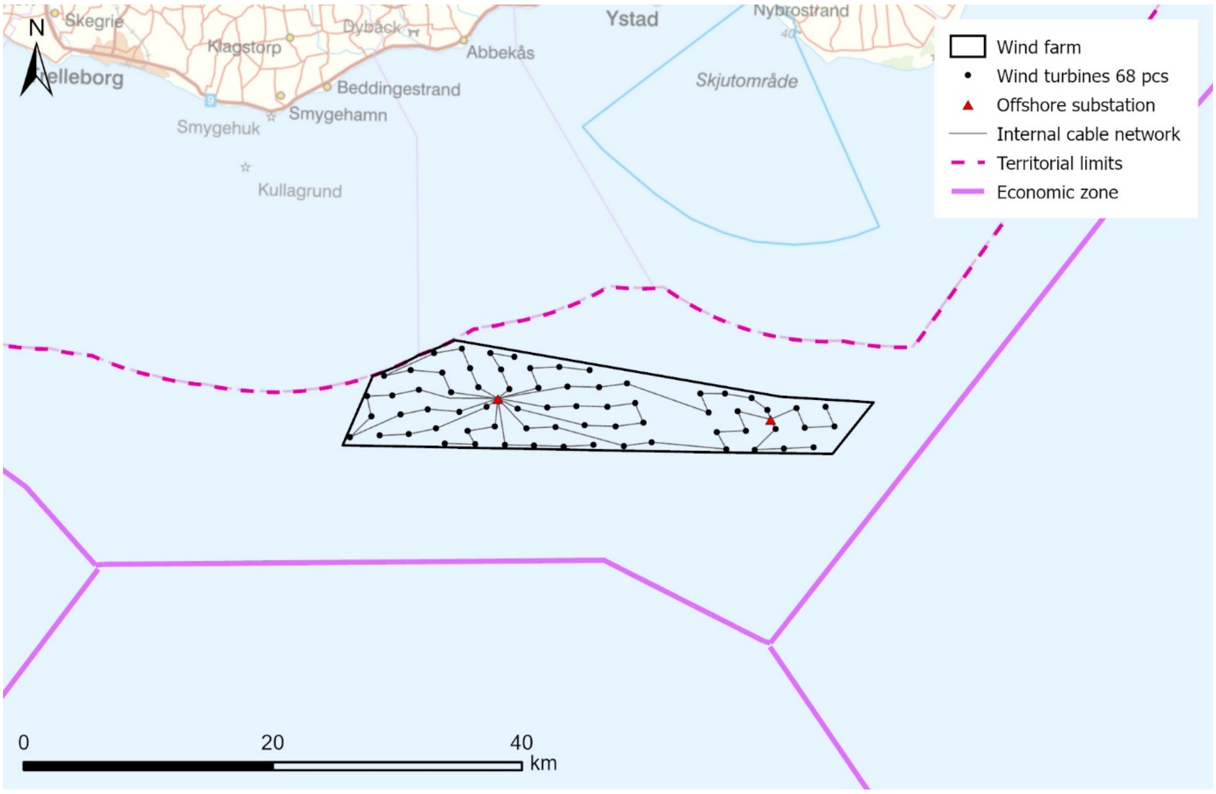


Figure 11. Example of internal grid for the wind farm if 68 wind turbines are installed.

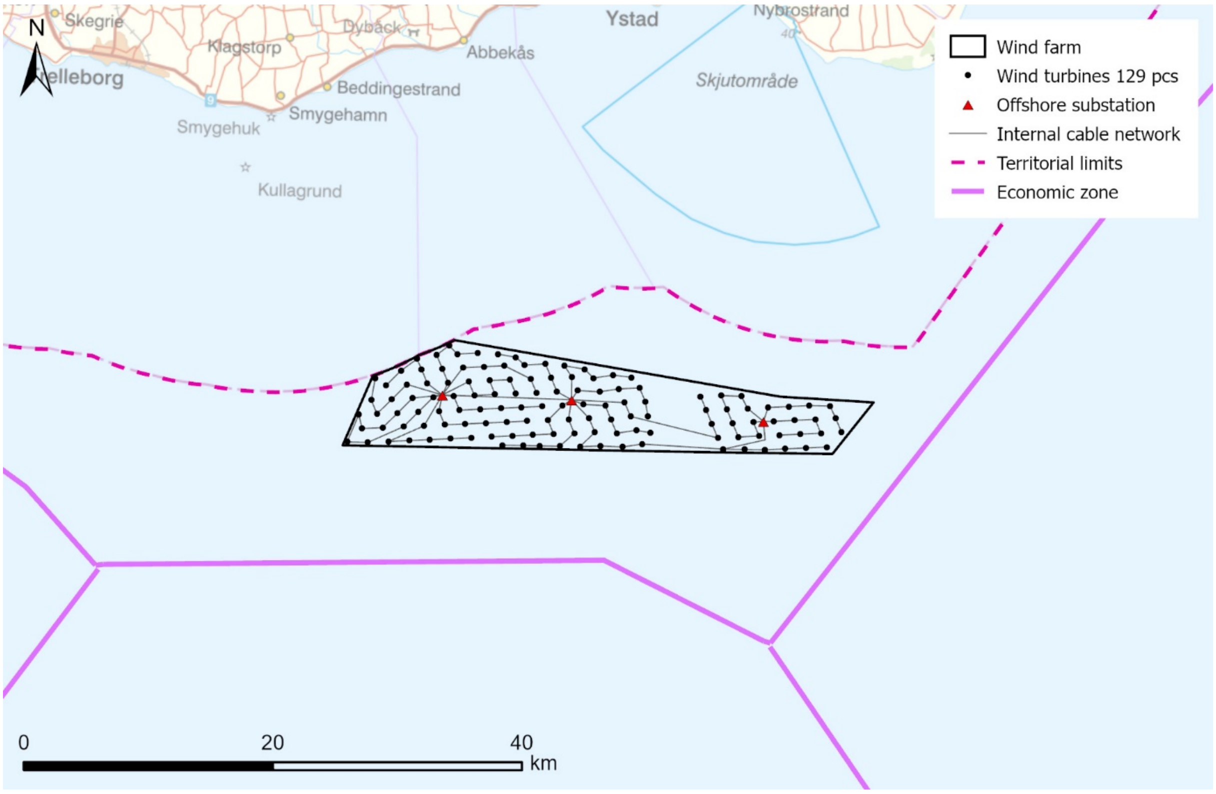


Figure 12. Example of internal grid for the wind farm if 129 wind turbines are installed.

A/C cables generate a magnetic field, which varies according to the instantaneous voltage in the cable. The magnetic field and its impact on the surrounding area are explained in the environmental impact analysis.

4.2.4. Offshore substations

At the wind farm, one or more offshore substations may be constructed and connected to the internal grid to receive the electricity generated by the wind turbines. These substations would also be the point of origin for the export cables used to transfer the electricity to connection points on land. The offshore substations contain electrical equipment including transformers that convert current from the internal grid to higher voltage. If the land connection is based on direct current, this electrical equipment also features converters, in which case the stations are often called converter stations.

The offshore substations take the form of a platform with one or more decks, sometimes with a helicopter landing pad as well. The platforms are prefabricated and installed in modules on one or more foundations.

The types of foundation used for offshore substations are basically the same as for the wind turbines, although they are dimensioned for the loads generated by the substation design. In practice, this can mean that multiple foundations are used for a single platform, or that a jacket foundation, for instance, may have a larger number of legs than a turbine foundation. Figure 13 presents several examples of possible designs for the foundations and platforms.

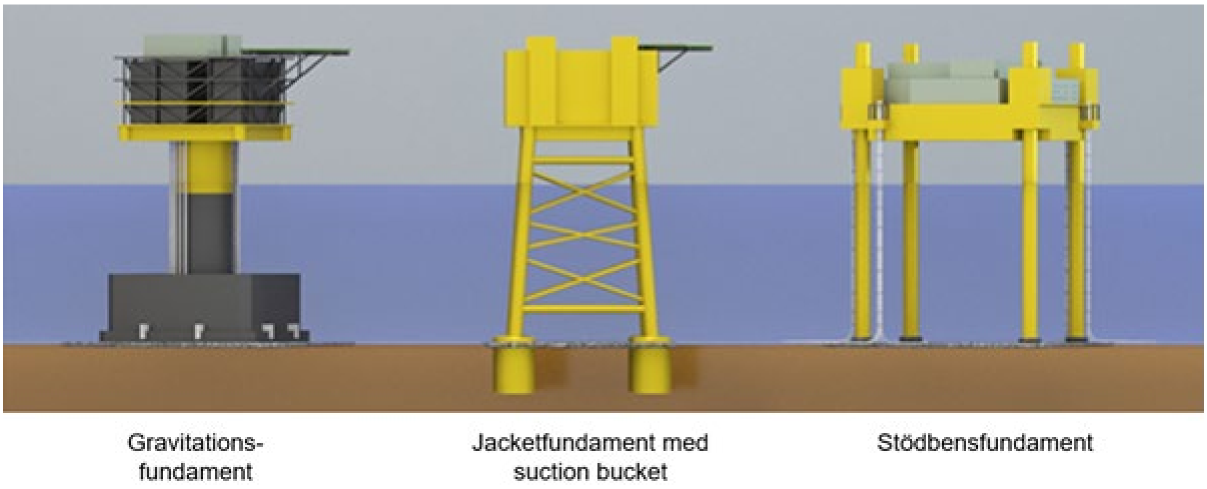


Figure 13. Examples of offshore substations.

The exact number, design and location of the offshore substations will be defined during the detailed project planning of the wind farm and will be based on the size and number of wind turbines, seabed conditions and optimal routing of the cables.

Platform dimensions vary from one supplier to the next and depend on capacity and the different components the platforms accommodate. The platform or platforms will be marked in accordance with the applicable regulations for sea and air traffic.

4.2.5. Export cables

Once the electricity has been transformed and, if necessary, converted from alternating to direct current, it will be carried through one or more export cables to an onshore connection point. The number and design of the cables will depend on factors such as the technology (HVAC – high-voltage alternating current; or HVDC – high-voltage direct current) utilised, as well as the voltage level.

The route and length of the export cables depends on the location of the final connection point, as well as on local conditions (the geology, for example, and a variety of both general and more specific interests). Notice that this consultation concerns the wind farm only, and the export cables will be tested in a separate application. Figure 14 shows some of the connection points and corridors that are currently being examined by OX2. Other connection points and corridors may become relevant – at Barsebäck or in north-eastern Skåne, for example.

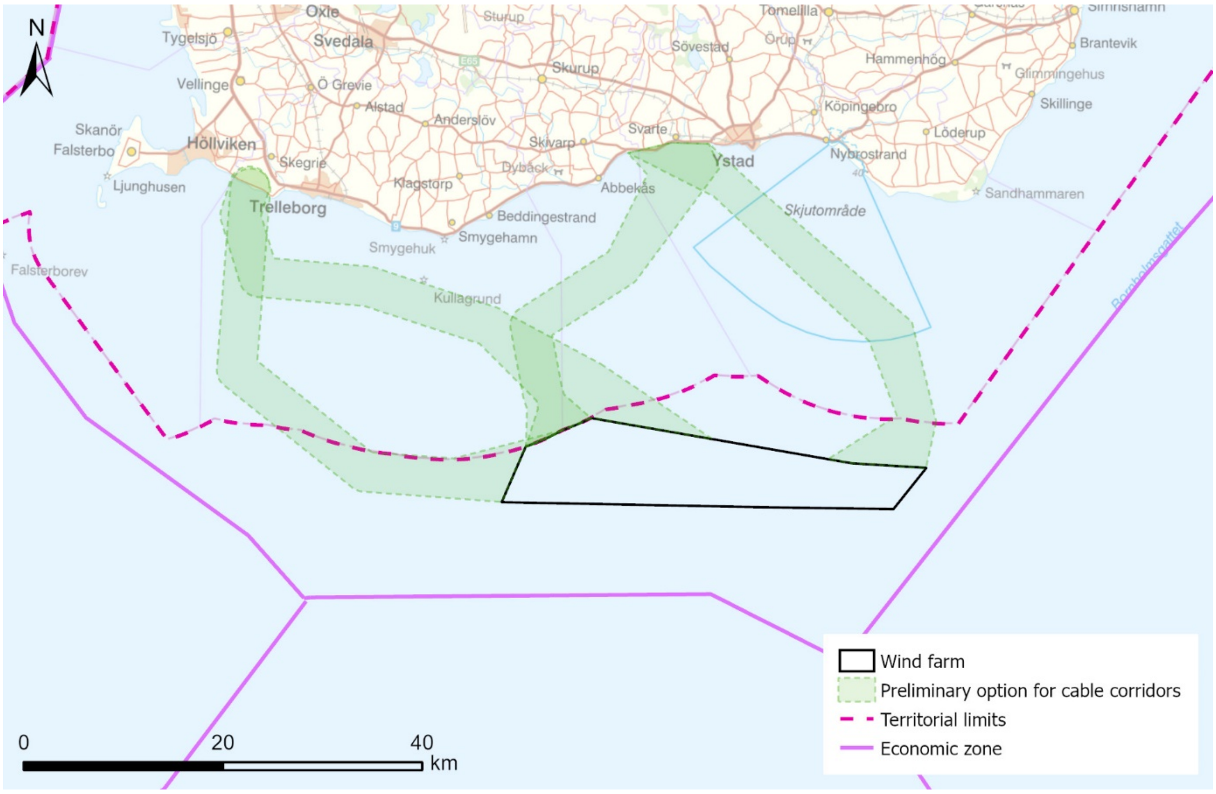


Figure 14. Potential connection points and corridors for the project.

4.2.6. Accommodation platforms

The wind farm may also include an accommodation platform for personnel working on the operation and maintenance of the wind farm. This platform will be equipped with facilities for preparing food and drinks, sleeping areas, laundry facilities, workshops, storage space and offices. The foundation types and installation procedures for accommodation platforms are the same as described for the substations, but they will be dimensioned to accommodate the loads generated by an accommodation platform.

4.2.7. Platforms for energy storage/conversion

As demand continues to rise for fossil-free fuels, combined with an increasing need to be able to store energy, it may be relevant to build platforms at the wind farm for the purpose of storing and/or converting energy. An energy conversion platform can convert electric power from the wind turbines into e-fuel such as hydrogen, ammonia or methanol (known as Power-to-X). These platforms are fitted with equipment including electrolysers. Transportation of the fuel from the platform can involve new or planned gas pipelines or seagoing vessels.

Energy storage platforms can, for example, be fitted with batteries for storing electricity. This would allow the wind farm to continue delivering electricity even during periods of low wind.

Foundation types and installation procedures for energy storage/conversion platforms correspond to those described for the wind turbines and the offshore substations, but are dimensioned to accommodate the loads caused by the needs of these platforms.

To the extent the activities described above are subject to special permit requirements, such permits will be duly applied for.

4.2.8. Measuring masts

One or more meteorological masts may be installed for measuring wind speed and direction, temperature, humidity and other parameters. Equipment on the masts may also be used to measure oceanographic aspects such as waves, currents and water temperature. Masts for communication equipment may also be established in the project area.

4.2.9. Internal gas pipelines

Gas pipelines may be established within the project area in order to carry the gas that has been formed through the conversion of generated electricity. These gas pipelines may run between individual wind turbines if the electrolysers are positioned on the turbine foundations, or from an energy conversion platform if the electrolyser is positioned here.

4.3. Project activities

This section presents a summary of the activities that will take place during the establishment, operation and decommissioning of the wind farm. The impact that these activities may have on the nearby Natura 2000 area is detailed in chapter 7.

4.3.1. Preparatory studies

Prior to establishment of the wind farm and the associated cables, studies of the seabed conditions will be conducted to examine the seabed geology and sediment in more detail. The purpose of these studies is to obtain detailed information prior to deciding the final design of the foundations and the detailed design of the wind farm and cable routes, including the exact positioning of the wind turbines. Geophysical study technologies such as Sidescan Sonar (SSS) and Multibeam Echo Sounder (MBES) provide high-resolution bathymetric information about the seabed sediment, and about the occurrence of natural and man-made objects on the seabed. Different types of seismic studies (2D, 3D) are required to provide a holistic image of the upper layer of the seabed and its geological composition to a depth of approximately 70 metres below the seabed, and are used for purposes including designing foundations and identifying any gas pockets. The geotechnical studies include geotechnical drilling, core penetration testing and vibrocores, that are used to reach conclusions about aspects such as bearing capacity and thus the design of the foundations, and which provide information regarding the choice of installation methods. Magnetometry is required to ensure that the construction work can be carried out without the risk of encountering undetonated ordnance (known as UXO or OXA).

4.3.2. Construction phase

The construction phase includes aspects concerning the preparation and installation of the wind farm. The following sections present a general description of the installation phase of an offshore wind farm. It is common to attempt to complete the entire installation process in a single season (every attempt is usually made to avoid working at sea in the winter months), but in some cases the work may be divided up between several seasons. A usual approach to offshore installation is to start by establishing the foundations for the wind turbines and substation(s). The next phase involves installing the export cables and the internal electricity grid. The last stage is the assembly of the wind turbines themselves: towers, nacelles and rotor blades. In step with the installation of the wind turbines, the wind farm can be commissioned and test runs performed. On approval of the tests, the farm can then be handed over to the operating organisation.

Pre-assembly harbour

The principal components are shipped out from the various manufacturing harbours and transported either to a pre-assembly harbour or directly to the wind farm area. Daily transportation of personnel and small components is run from a nearby installation harbour. Helicopter transport can also be used as a supplement to the seaborne transports.

Sea traffic

In the installation phase, the main components of the wind farm (wind turbines, substations, platforms, measuring masts, foundations and cables) are transported to the area, positioned and installed.

During the installation of the wind farm, a variety of installation vessels and work platforms will be operating in the area. It is likely that multiple installation operations will take place in parallel, but in different areas of the project area. It may also be necessary to operate a number of auxiliary vessels for personnel and equipment, as well as several tugboats. All sea traffic is monitored by a marine coordinator. A safety zone can be established around the site of the installation work to minimise risks.

Some work may require the use of a jack-up vessel or jack-up platform. These vessels and platforms lower sets of support legs to rest on the seabed. With a bottom surface of approximately 10 x 10 metres, the support leg stands solidly on the seabed. Depending on the nature of the seabed, the support leg may even sink down into it. The actual vessel body or platform is then “jacked up” so that it stands clear of the highest waves, thus ensuring it is unaffected by the movement of the waves. As an alternative, what are known as semi-jack-up vessels can be used. When these are used, the hull remains afloat while support legs are lowered down to the seabed to provide stability.

What are known as Crew Transfer Vessels (CTV) will be used to transport personnel and small components. These vessels will sail from a nearby installation port.

In addition to the types of vessels mentioned above, it is likely that some other special vessels will operate in the area, tasked with performing different examinations or providing acute assistance, for example. During the construction phase, one or more small boats may be employed to secure the installation area from other traffic.

Foundations

On installation of a gravity foundation, the seabed is prepared in the place where the foundation is to rest. This may involve replacing existing material in the topmost layer of the seabed with a homogeneous and even layer of gravel. The foundation is then transported to the site by sea, using tugboats or a barge or ship.

The foundation is lowered onto the gravel bed using a winch or crane, or carefully filled with water, after which it is filled with ballast once its correct positioning has been confirmed.

Monopile foundations are transported out to the wind farm floating on the water or carried on an installation vessel or barge. They are positioned on the seabed from a jack-up platform or using a floating crane. They are then embedded in the seabed by pile-driving, vibration or drilling. Depending on the conditions at the site, the installation process may feature a combination of these methods.

Jacket foundations need to be installed on relatively flat stretches of seabed, which means that some levelling work may be required prior to installation. The foundation elements are transported to the site on a barge or installation vessel and then positioned on the seabed from a jack-up platform or floating crane. If pin piles are used, these steel tubes are pile-driven, vibrated or drilled into the seabed at the corners of the foundation area. The pin piles are then connected to the foundation by casting them together or through the use of mechanical anchoring. If the geology and other conditions allow, jacket foundations can be anchored to the seabed using suction buckets – i.e., steel or concrete cylinders that are “sucked” in place on the seabed using a vacuum technique.

After installation of the foundations, erosion protection may be added to prevent water currents flowing along the seabed from altering the conditions around the foundation elements and undermining the anchorage. This erosion protection typically consists of a lower layer of gravel and an upper layer of stones of various sizes. The final stage of the process involves installation of other subsidiary elements, such as the transition piece, ladders, railings, cranes, etc.

Internal grid

Cables, rolled onto giant spools, are transported to the project area using special installation vessels. The cables are simply laid out and then usually buried to a depth of 1–2 metres below the seabed to protect them from damage from fishing gear, anchors and the like. It is common to use techniques including flushing and ploughing to bury the cables. The final installation depth depends on the geological conditions and the level of protection desired.

Wind turbines

For the installation of wind turbines, it is usual to use jack-up vessels or a floating crane. The main components of the wind turbine can be transported out to the wind farm on the installation vessel or on board a separate transport vessel. The transportation itself may depart from a harbour close to the wind turbine manufacturer or from a dedicated installation harbour.

It is most common to transport the wind turbine to the wind farm area in sections and then assemble it on site. Wind turbine installation demands a high level of precision and is therefore heavily dependent on wind and wave conditions. Once the wind turbines have been installed, the components can be connected to the internal grid, after which the wind turbines can be test run.

Figure 15. Installation of a wind turbine using a jack-up vessel. Source: COWI

Substations, accommodation platforms and other platforms

In the same way as accommodation buildings and other superstructures, offshore substations are normally installed on their foundations using a floating crane. Depending on the design of the offshore substations and their foundations, they can also be floated out to the site or installed using other lifting methods, such as an integral set of supporting struts. Once substations have been installed, they can be connected to the internal grid.

Internal gas pipeline

Gas pipelines are installed using special vessels, which utilise different methods depending on the dimensions of the pipes in question. Gas pipelines can be laid directly on the seabed or in a trench excavated to contain the pipe.

4.3.3. Operational phase

Both the wind turbines and the substations/inverter stations are remotely monitored and unstaffed during normal operation. However, maintenance of the wind farm is an ongoing process which requires personnel and material to be transported out to the site on service boats, ships or helicopters. Alternatively, they may be transported to an accommodation platform, and from there to different locations in the wind farm area. Cables are inspected as required to check, for example that the cable protection at the foundation of the individual wind turbine remains intact. If any incidences of cable damage are identified, they are rectified by having a cable vessel lift the damaged section of cable up for repair and then relay it on the seabed using the same method as was employed in the installation phase. In order to protect the cables from damage, it is not appropriate to perform bottom trawling operations within the wind farm area.

The final strategy for operation and maintenance will be determined at a later stage. It is likely that an onshore operations and service base will be established, which will run the ongoing monitoring and serve as a warehouse for minor spare parts. Operation will probably involve the use of Crew Transfer Vessels (CTV), although a helicopter may be used as well. During major maintenance operations, Service Operation Vessels (SOV) may be used. These are hotel ships where personnel are stationed for extended periods. Some major maintenance tasks may require the use of a jack-up vessel as a platform. At some point during the life cycle of an installation of this kind, more comprehensive maintenance may be required, involving the replacement of major components. Jack-up vessels may be used for such procedures.

4.3.4. Decommissioning phase

It is anticipated that the wind farm will reach the end of its service life after around 45 years; it will then have to be decommissioned. Decommissioning will be performed in accordance with the practice and legislation in effect at the time of decommissioning. The wind turbines, foundations and substation(s) will be disassembled and the site where the foundations rested will be restored to the necessary extent. Generally speaking, the installation components are dismantled unless removal of the individual structures would cause a greater environmental impact than the effect of leaving them in place. Given that technology and the base of knowledge are developing rapidly, it is not certain precisely what form the decommissioning will take. The actual extent of the decommissioning work will be determined in dialogue with the supervisory authority.

It is most likely that the structures will be decommissioned above the level of the seabed. For example, gravity foundations will be lifted off, while monopile or jacket foundations will be cut a few metres below the seabed and the upper section removed. Some parts of the installation may be left in place after decommissioning – the internal cables and export cables, for example. One reason for leaving some of the structures behind is that they may already have become valuable artificial reefs. If it is necessary to remove the cables, they will be uncovered and then lifted out. Stones used to cover the cables probably be left in place on the seabed, as will the protection measures used at cable intersections. During decommissioning, a temporary safety zone will once more be established around the site where the activities are taking place, with a view to protecting personnel and equipment and ensuring the safety of third parties.

4.4. Preliminary timetable for the project

Figure 16 presents the timetable for the project. This timetable should be viewed as indicative and provisional. Multiple factors may affect the timetable and require it to be adjusted as the project progresses. According to the preliminary timetable, the permit application process should be so far advanced in 2024 that it is possible to commence financing, procurement and detailed design. It should be possible to complete establishment of the grid connection in 2026–29 and construction of the wind farm itself in 2028–30.

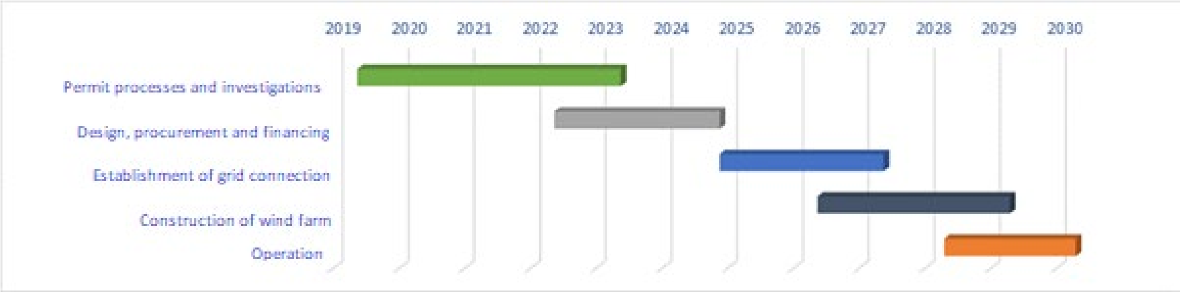


Figure 16. Provisional timetable for the project

5. Risks and safety

The establishment of an offshore wind farm makes great demands on safety, which is a prioritised issue in all phases of the project. Risks linked to a large-scale construction projects can be broadly divided into three categories: health, the environment and property. Risks to health must be viewed in relation to factors such as the fact that work is performed at elevated height, involves heavy lifts and the handling of electrical equipment. Risks to the environment can involve uncontrolled spillages of various kinds – oil, gas, chemicals, sediment, etc. – and excessive noise. Risks of damage to property can encompass the risk of collision and risks linked to the handling of heavy components. One particular risk has to do with undetonated ordnance, the presence of which must be determined through geophysical surveys.

The general management of risks can be described in what is known as a “hierarch of actions”. The first step is to eliminate risk through simply avoiding the risky work process altogether, or by replacing it with a less risky approach. The next step is to use technical or administrative measures to reduce the likelihood and consequences of a risk event, and to have measures in place to deal with the outcome if a risk should materialise. The final protection against workplace accidents is the personal protective equipment worn by personnel, which in no way should or can replace other measures.

The project will prepare what is known as an HSSE (Health, Safety, Security and Environment) Plan, which details how the project will plan, manage, monitor and coordinate issues to do with health, safety and the environment during the project planning, installation, operation and decommissioning phases.

Risk analyses will be conducted on an ongoing basis in all phases of the project, and any risks identified must be followed by an action. On procurement, steps will be taken to ensure that suppliers understand and respect the high level of risk awareness required by the project. Risks will be described in more detail in the environmental impact analysis.

6. Description of the area

As mentioned above, the Triton area comprises an open stretch of sea, without any islands. According to the sea charts that the Swedish Agency for Marine and Water Management submitted to the Swedish Government in 2019, the projected Triton wind farm is positioned within the area known as, Bornholmsgattet, Ö267. The area is designated G – "General usage" – where no special use takes precedence. Adjacent to the area in the north, and overlapping the eastern part of the wind farm, there is an area designated for shipping (Figure 17).

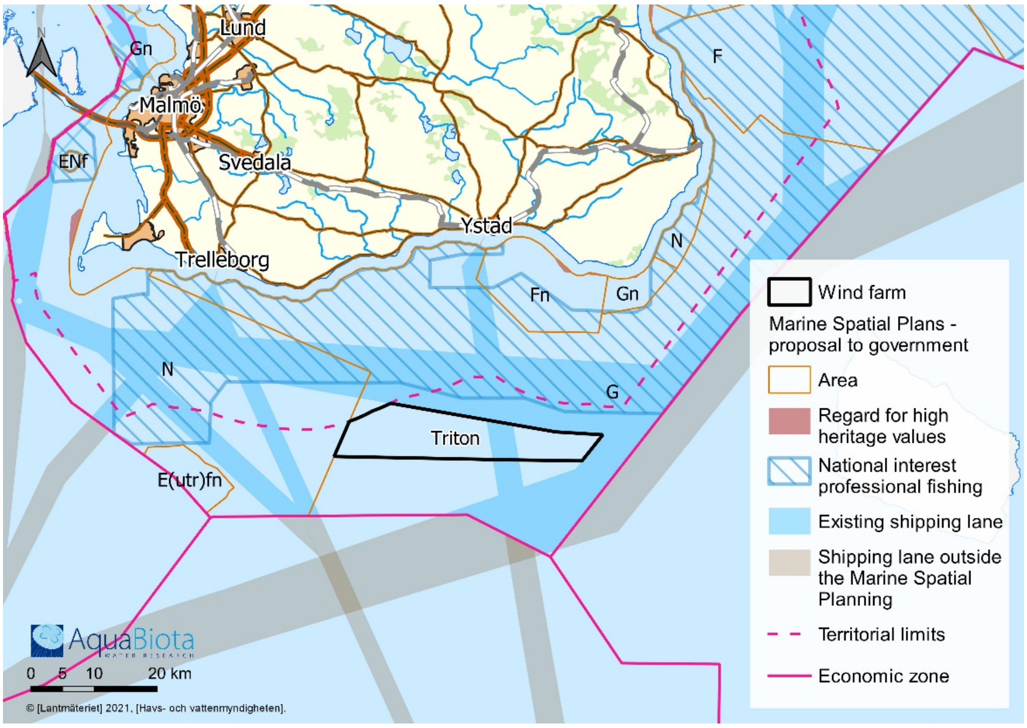


Figure 17. Marine plans (basis: Swedish Agency for Marine and Water Management). Explanation of abbreviations: Gn = General use, N = Nature, E = Energy extraction, Fn = Defence.

6.1. Geology and depth conditions

The planned Triton wind farm is located on a homogeneous stretch of seabed as regards both geology and depth conditions. The seabed consists exclusively of soft surface substrate in the form of post-glacial clay, clayey mud and gyttja clay (Figure 18). The depth conditions are likewise similar within the area, varying only between 43 and 47 metres, with an average depth of 45 metres (Figure 19).

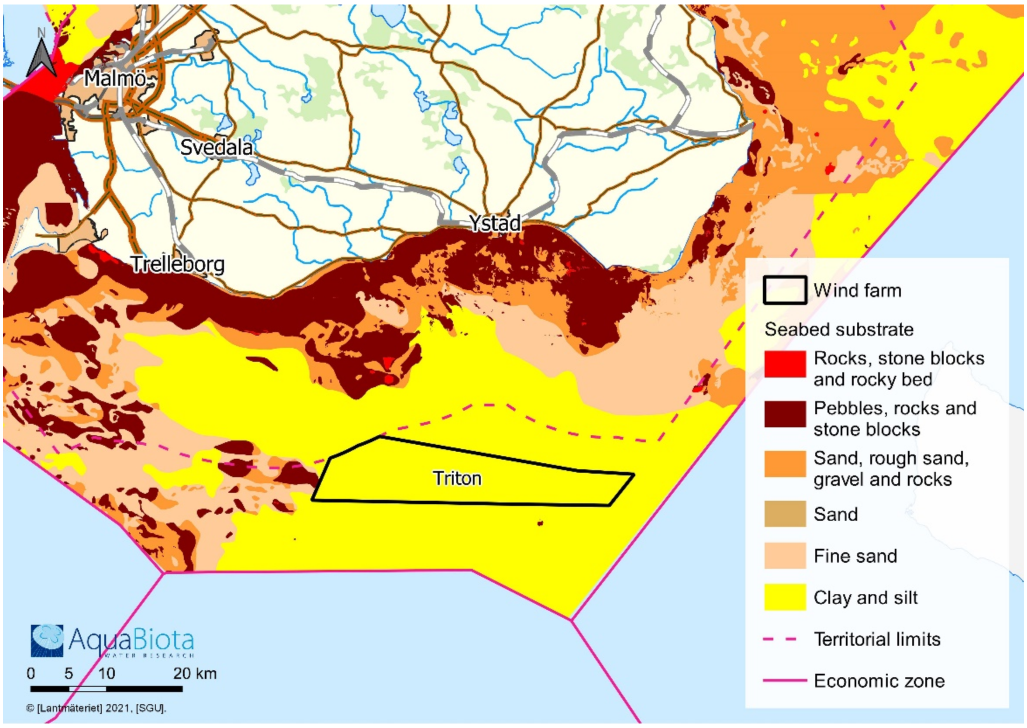


Figure 18. Geological map of the Triton area.

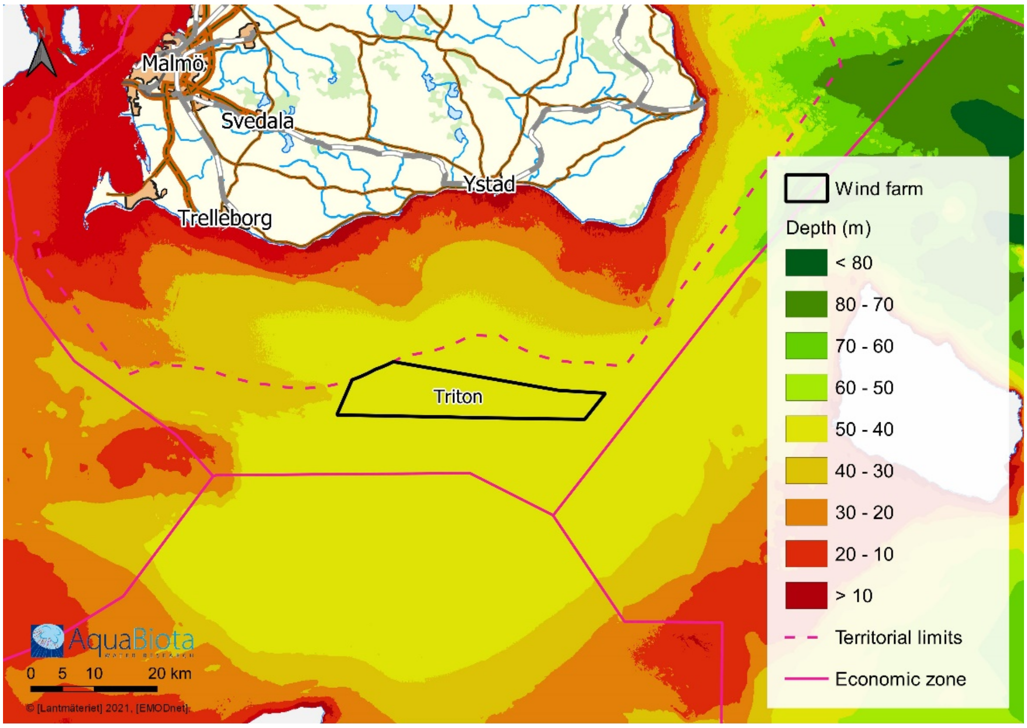


Figure 19. Water depth map of the Triton area.

6.2. Hydrography

The Baltic Sea is a brackish inland sea, largely distinguished by a north-south salinity gradient driven by an influx of salt water from the Danish straits and Öresund in the south-west, and an influx of freshwater from watercourses in the extensive Baltic Sea catchment area. The salinity gradient, with fresher water in the north becoming increasingly salty as it progresses south, is reflected in the spread of species, with more typically freshwater species in the north and more saltwater species in the south.

In the project area, an influx of saltwater flows closes to the seabed in an easterly direction from Öresund and the Danish straits, while fresher surface water is transported in a westerly direction on the Baltic surface current. This similarly produces a stratification – also called a “halocline” – between the slatier water close to the seabed and fresher water near the surface. In the Arkona Basin, where Triton is located, the halocline is to be found at a depth of 30–40 metres, where the salinity of the water close to the seabed is in the range of 10–13 ‰ (SMHI 2021).

Variations in the water level are primarily caused by wind conditions and the influx and outflow of water via the Danish straits. The influence of the moon and sun is considered negligible. In normal circumstances, the water level varies between +1.5 and -1.5 metres from the median water level, but in extreme circumstances, it may exceed these variations.

In the same way as the wind conditions, the wave conditions are dominated by waves from westerly and south-westerly directions (between 225° and 285°), which is also the range comprising the largest waves. The average significant wave height is approximately one metre, with an annual max. value of over six metres (ERA5). In contrast to the wind and waves, which primarily come from the west, the current flows towards the west for 47% of the time. The current speed is low – less than 0.1 m/s on average – with an annual maximum speed of around 0.5 m/s (ERA5).

Sea ice can form during hard winters when the temperature drops to between -5 and -10 degrees Celsius for long periods. The thickness of the ice depends on the salinity of the surface water, which varies between 6 and 8 ‰ in and close to the wind farm area. However, SMHI’s maps of maximum ice extent indicate that the area has not been covered by ice at any time in the past decade.

6.3. Natural environment

6.3.1. Swedish Natura 2000 area

To the west, the project area borders a Natura 2000 area, the offshore waters of south-west Skåne (Figure 20). The principal purpose of Natura 2000 areas is to provide favourable conditions for the habitats and species that constitute the basis for the designation of the site.

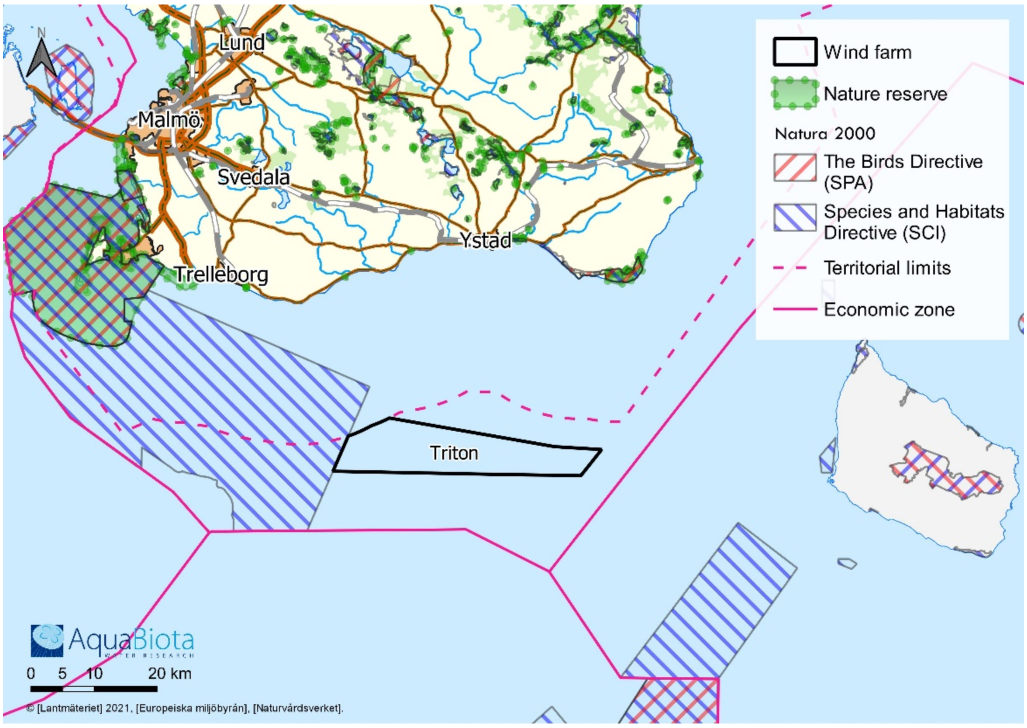


Figure 20. Natura 2000 areas and nature reserve (basis: the Swedish Environmental Protection Agency).

The Natura 2000 area in the offshore waters off South-West Skåne (SE0430187) is located west of the planned wind farm, see Figure 20. The Natura 2000 area comprises a large stretch of water measuring 115,130 hectares, where the depth varies between 10 and 44 metres. The area principally features soft seabed consisting of sand clay, but there are patches of hard seabed, mainly in the shallower, western parts of the area. There is no actual conservation plan for the area, but information about the designated habitats and species is available via the Swedish Environmental Protection Agency tool "Protected Nature" (Swedish Environmental Protection Agency, 2016). The Natura 2000 area has been established to protect specific species and habitats pursuant to the Species and Habitat Directive (SCI) (Table 3).

Table 3. Designated habitats and designated species according to the Species and Habitat Directive for the offshore waters off south-west Skåne (Swedish Environmental Protection Agency).

Habitats	Species
Reef (1170)	Common porpoises (1351)
Sandbanks (1110)	Grey seals (1364)
	Harbour seals (1365)

The Natura 2000 area features a relatively homogeneous benthic environment with a small number of dominant species of algae and animals that are indigenous to the Baltic Sea. However, the proximity to the Öresund means that the appearance of additional marine species is to be expected. The north-west section of the area is of significance as a wintering/resting area for several species of duck. During the winter months, it is likely that the area will be used by the populations of porpoises from both the Baltic Sea and the Danish straits, while it is only used by the Danish straits' population in the summer. Harbour and grey seals are present, and the area is potentially of significance as a foraging area for both species.

6.3.2. Natura 2000 areas belonging to other countries

Natura 2000 areas belonging to countries that border the Baltic Sea are to be found both at sea and on the coasts of the different countries (Figure 21). The Natura 2000 area off the coast of Sweden is the area closest to the planned wind farm. This area comprises Adler Grund and Rönne Bank and lies approximately 25 km south-east of the wind farm. Other Natura 2000 areas belonging to countries that border the Baltic Sea are located at greater distances from the wind farm.

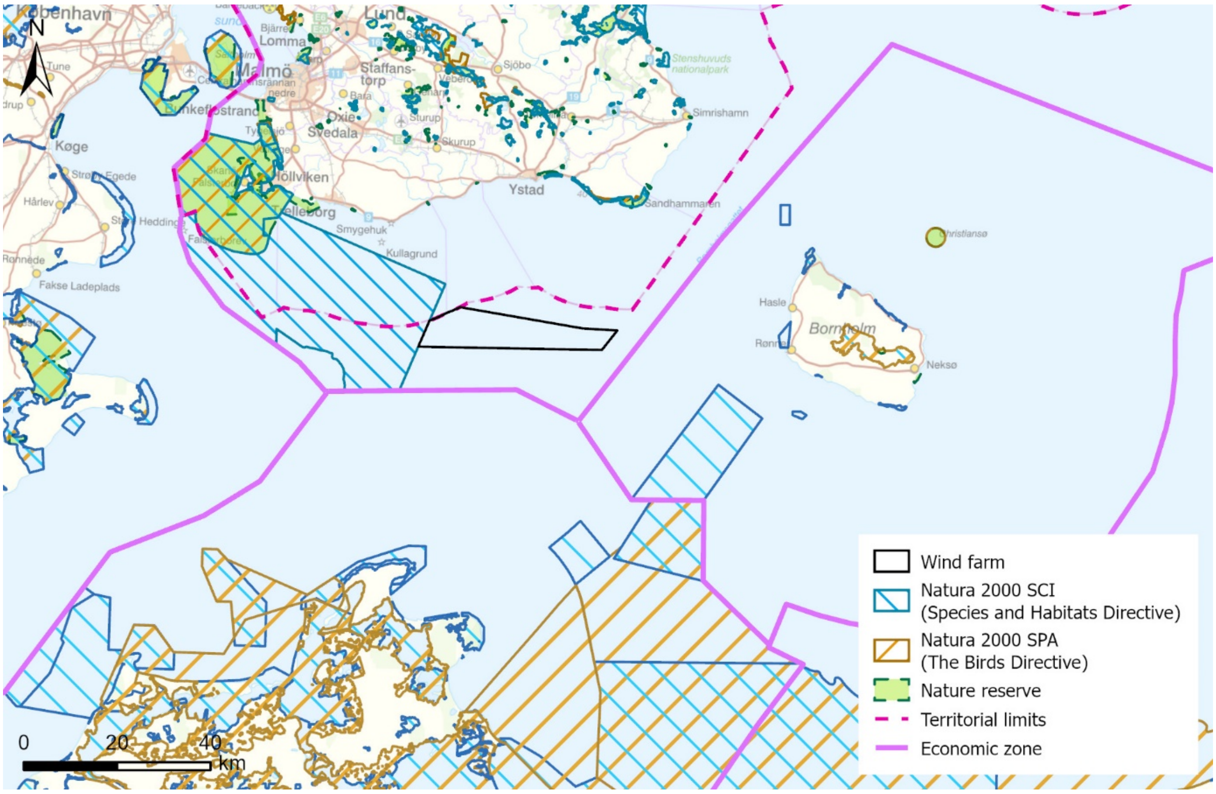


Figure 21. Natura 2000 areas belonging to countries bordering the Baltic Sea.

6.3.3. Seabed flora and fauna

The composition of the plant and animal communities that live on and in the seabed depends on factors such as water depth, salinity, acidity and seabed substrate (soft seabed, mixed seabed, hard seabed, etc.). The principal species to be found in the Baltic Sea are a limited number of oligochaeta and polychaeta (bristle worms). In addition, this sea is home to several species of mussels and crustaceans that live on and in the seabed sediment. Hard and soft areas of seabed and bottom vegetation all serve as the habitat – and provide protection – for a wide variety of aquatic organisms. Bottom-dwelling plants and animals are, directly or indirectly, an important source of food for fish, mammals and birds.

Within the area of the planned wind farm, the seabed is mainly soft – consisting of silt and clay – and the bottom-dwelling community therefore consists principally of creatures that live buried in the sediment (infauna). Surveys of the animal communities on seabeds of similar sediment type and depth (for example, parts of the nearby Danish and Swedish Kriegers flak area) have revealed a predominance of Baltic Macoma, as well as various annelids and priapulids (MariLim 2015; IFAÖ 2004). As the project area is located in the South Baltic Sea, the fauna is also affected by the influx of saltier water from the Kattegatt. This means that additional marine species such as common starfish and shore crabs may be found in the deeper areas. On account of the great depth of the water in the wind farm area (>43 metres), light conditions at seabed level are poor, so there is probably very little or no bottom vegetation in the area. Some red algae can, however, exist at depths of up to 40 metres or so, but they need hard substrate to attach to, so it is not expected that they will be found in great numbers in the Triton area.

6.3.4. Fish

On account of the brackish water, the Baltic Sea is home to a mix of freshwater and saltwater species. The influx of saltwater from the North Sea produces a north-south salinity gradient that is also reflected in the spread of species, with more typical saltwater species in the south-western sections of the Baltic Sea and greater numbers of freshwater species further north. The seabed types in the project area for the Triton wind farm, consisting of soft sediment in the forms of sand, silt and clay, are favoured by flatfish including flounder and plaice, as well as cod, which often eat bottom-dwelling creatures when they are young. Pelagic species[2] such as herring, sprat and even whiting are common catches for commercial fishing operations in the area. Rarer species including the red-listed eel, salmon, garfish and trout are occasionally to be found here as well.

The project area is located in the middle of the Arkona Basin which, together with the Bornholm Basin to the east, constitutes an important spawning area for the eastern and western cod populations (Figure 22). Cod spawn in the Baltic Sea during the summer months, and in the waters of the Öresund and Kattegat in January–February.

[2] Species that live in open water.

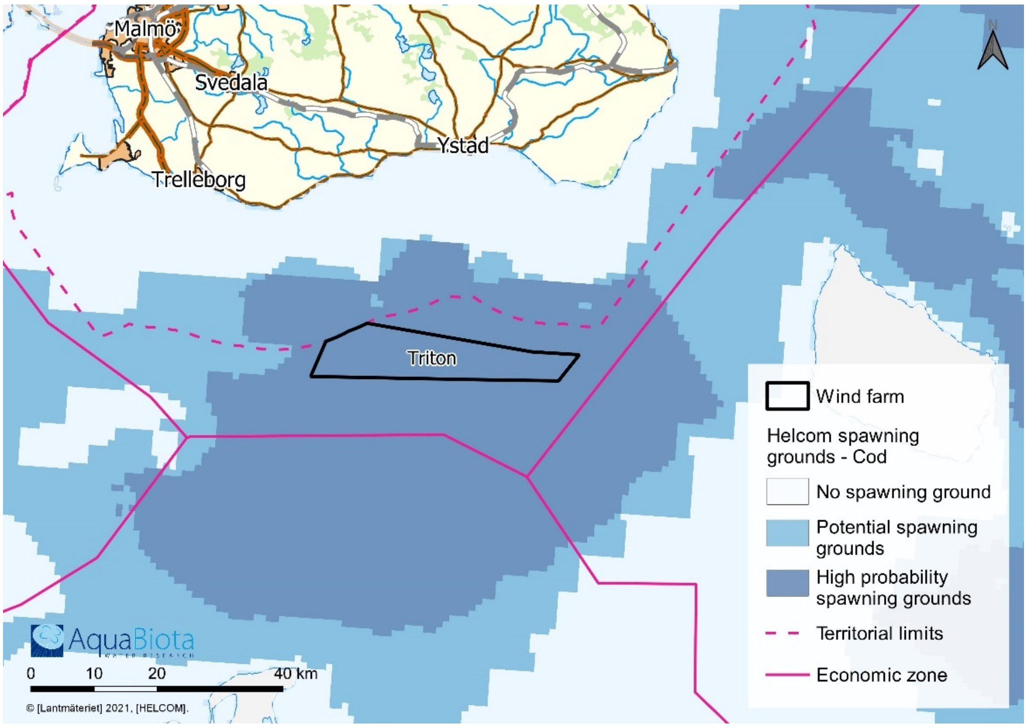


Figure 22. Map of the likelihood of cod spawning.

6.3.5. Birds

The Arkona Basin, where the wind farm is to be located, is considered to be an area important to the spring and autumn migrations of several species of birds. For example, the area is part of a major migration route between the continent and Scandinavia for the Norwegian and Swedish populations of cranes. Results from GPS-tagged cranes, completed as part of the preparation of the environmental impact analysis for the nearby offshore wind farm at Kriegers flak (OWF), indicate that this species migrates directly through the Triton project area. The Arkona Basin is also on some routes taken by birds of prey that fly the shortest route across the sea between their breeding grounds and wintering areas. Examples of other species of birds that pass through the area in large number are the eider, the barnacle goose and the common scoter (Energinet.dk 2015).

The region is of significance as a resting place for many species of birds. The long-tailed duck, common scoter and velvet scoter in particular can periodically be seen here in concentrations of international importance. Diving ducks principally live off bottom-dwelling animals such as mussels and hunt their prey in relatively shallow water. As a result, the Triton project area is not considered to constitute an area of significance to resting birds on account of the relatively deep water that makes the area unsuitable for foraging. In support of this finding, the expected density of three species of diving ducks in the area was estimated as low. This estimation was performed as part of a study carried out for the preparation of the environmental impact analysis for the wind farm at Kriegers flak, OWF (Energinet.dk 2015).

6.3.6. Bats

Bats can be found far out at sea in connection with their seasonal migration (Hatch, *et al.* 2013) and have been observed foraging up to 14 km from the coast (Ahlén, *et al.* 2009) The Triton project area is located centrally in the Arkona Basin, which is crossed by bats migrating between Scandinavia and Europe. No observations have been recorded of migrating bats within the wind farm areas, but studies of migrating bats conducted in connection with the nearby Kriegers flak area, approximately 17 km west of Triton, recorded observations of four species. The most common species was the Nathusius' pipistrelle, which, like birds, can migrate in large numbers. The other species of bats observed were the common noctule, the parti-coloured bat and the serotine bat (Energinet.dk 2015). These four species of bats can also be expected to migrate through the Triton project area

6.3.7. Marine mammals

The three most common species of marine mammals in the area are the porpoise, the harbour seal and the grey seal. These species are present in the area all year round and are designated species in the neighbouring Natura 2000 area, i.e. the deep sea waters off south-west Skåne. See section 6.3.1 for additional information about these species.

6.4. Landscape image

The "landscape image" can be defined as people's visual impression of the landscape. This visual impression is, in turn, influenced by emotional aspects as well as previous associations, which means that any such assessment will, by definition, be highly subjective. The landscape image offshore is distinguished by flat, horizontal surfaces with few colours and little variation, where what little structure that does exist generally consists of small, forest-clad islands, islets and waves. The Triton project area is dominated by open sea. The nearest development is in Smygehuk on the south coast of Skåne, approximately 22 km from the wind farm area. The larger towns of Ystad and Trelleborg are located approximately 30 and 33 km, respectively, from the wind farm area. The distance from the wind farm area to the Danish island of Bornholm is approximately 37 km.

6.5. Cultural heritage

Human operations and activities over the years that have left their mark on the physical environment can be termed a "cultural heritage". This heritage may comprise physical objects left in the countryside in the form of old buildings, ancient monuments and wrecks, or it may involve different activities that were previously linked to specific places (Swedish National Heritage Board, 2016).

A marine archaeological preliminary study has been carried out to compile a list of known shipwrecks and to identify previously unregistered remains in the project area. According to the Swedish National Heritage Board's cultural heritage register (KMR), which contains information about all known and registered remains and other cultural heritage objects in Sweden, there are eight known remains in the project area (Figure 23), as well as one shipwreck 100 metres south of the wind farm. All these are recorded as ship/boat wrecks, of which one has been assessed as being a potential ancient wreck.

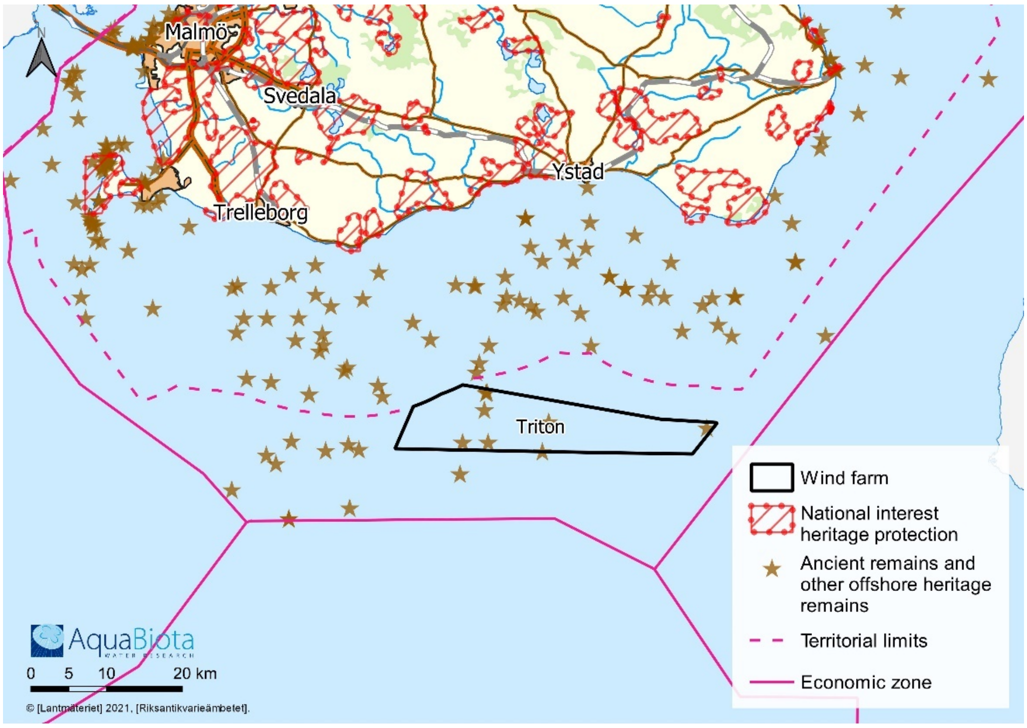


Figure 23. National interest in cultural heritage preservation and existing ancient remains in the immediate area.

6.6. Natural resources management

6.6.1. Commercial fishing

Commercial fishing in the Baltic Sea is primarily focused on a limited number of target species. Cod, herring and spat account for up to 95% of the total catches (ICES 2018). The pelagic fishery (primarily pelagic trawling) which takes place throughout the Baltic Sea is predominantly targeted at herring and sprat. It is this type of fishery that contributes the biggest catches by weight in the Baltic Sea region. The most significant form of seabed fishery is bottom trawling for cod and flatfish – principally flounder and plaice – centred around the south and west sections of the Baltic Sea. Other target species of local and seasonal financial importance include salmon, dab, brill, turbot, zander, perch, houting, eel and sea trout.

The information presented above also applies to the waters in and around the project area. According to landing data reported to the International Council for the Exploration of the Sea (ICES), fishermen from Denmark, Germany, Poland and Sweden fish in and around the Triton project area. The average annual catch (2010–2016) in the ICES quadrants that coincide with the wind farm area (39G3 and 39G4) totalled approximately 2,400 and 6,800 tonnes, respectively, for the Swedish and Danish fleets. Catches in the immediate area predominantly comprise herring and sprat caught using pelagic trawls, as well as cod and flatfish such as flounder, plaice and turbot, principally caught using bottom trawls and bottom set gillnets. Generally speaking, it can be said that the pelagic fishing for herring and sprat is large scale, while the demersal fishery of cod and flatfish tends to be small scale (Swedish Board of Fisheries, 2010).

VMS (Vessel Monitoring System) data from 2019 and AIS data from 2020, which indicate where fishing vessels >12 metres are located, confirm that fishery operations – principally using trawls – take place both within the project area and in the surrounding areas (Figure 24; Figure 25). The area immediately north of the wind farm also contains areas of national interest for commercial fishing.

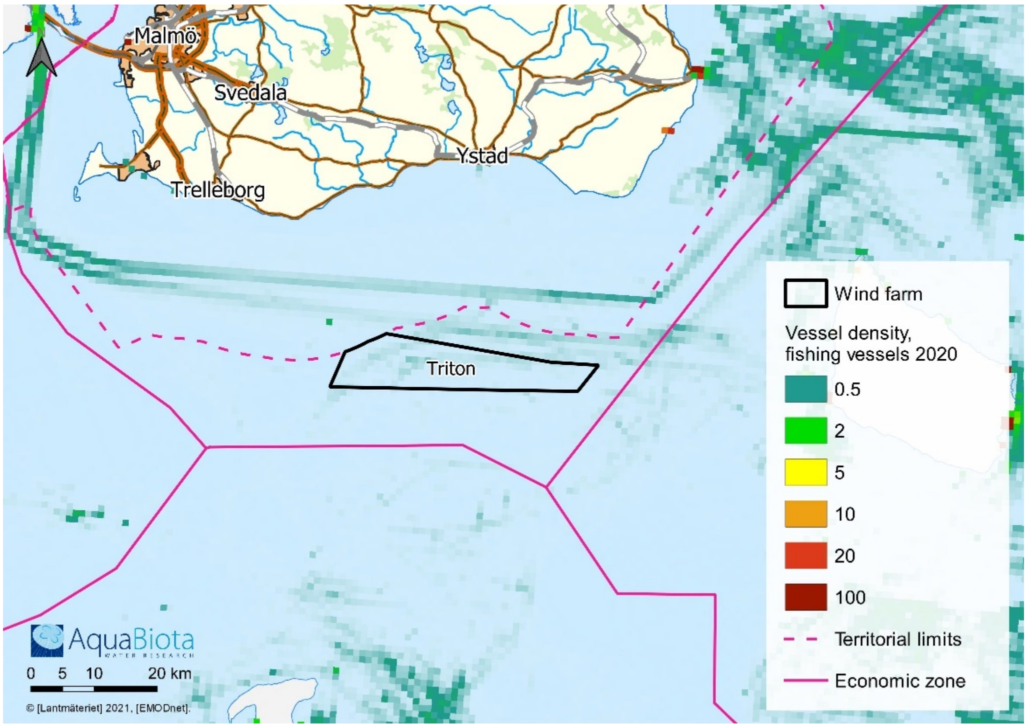


Figure 24. AIS data of vessel density in 2020 from all European fishing vessels in hours, in 1 x 1 km quadrants per month.

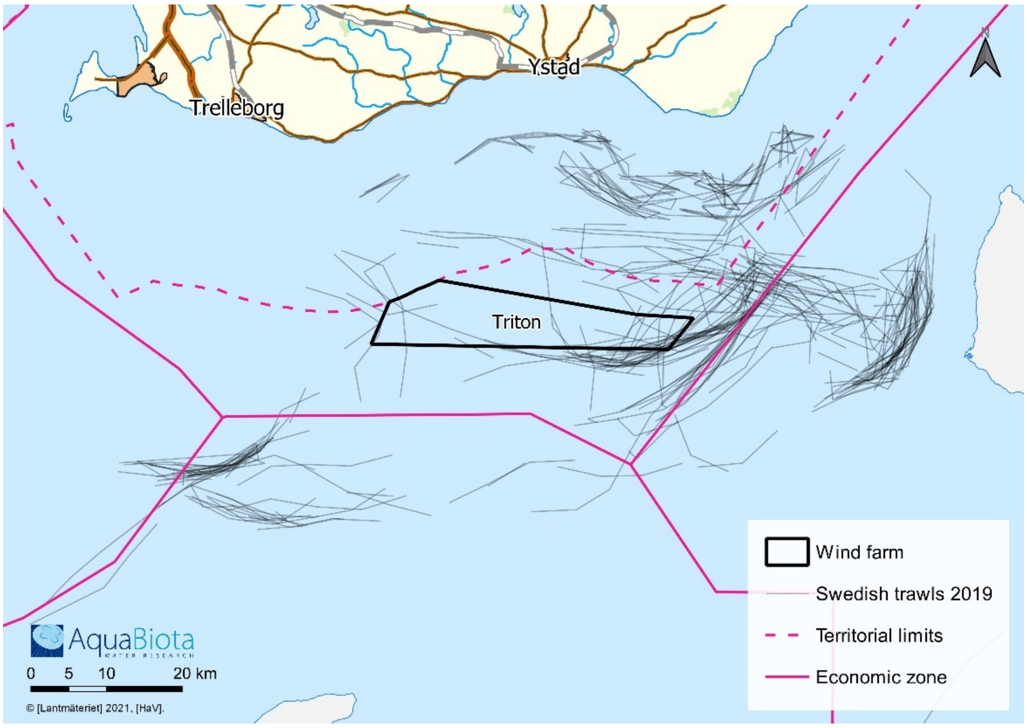


Figure 25. Swedish VMS data in the area from 2019.

6.7. Climate

With temperatures rising on account of climate change, it is expected that the living conditions for a variety of organisms will change. Both sea levels and temperatures are expected to rise in the long term, and the acidity of the water will increase as its salinity decreases (Herr *et al*. 2014; Laffoley and Baxter 2016). For organisms that are already living on the limits of their reproductive ranges, these changes may result in the eradication of whole species. Wind power has a key role to play in the national programmes aimed at limiting imminent climate change and helping Sweden to achieve its goal of generating no net emissions of greenhouse gases in 2045. The planned wind farm thus makes a significant contribution to limiting the effects that climate change has at global level, and thus to influence the development of multiple species in this specific area as well.

6.8. Geological carbon storage

Storing carbon geologically in rock formations is one way to reduce emissions of carbon dioxide into the atmosphere, and this technology is being highlighted in contexts such as the action plans for achieving climate goals. No offshore storage has yet been established in Sweden, but certain areas have been identified as suitable for this measure. One of these – *Arnagergrönsand* – is located in south-west Skåne and overlaps the Triton project area (Mortensen, *et al*. 2017).

6.9. Infrastructure

6.9.1. Shipping

Shipping in this area of the Southern Baltic Sea is largely constant, with minor seasonal variation. The movements of a large volume of vessels (cargo, container, fishing, passenger and service vessels, tankers, etc.) are tracked using AIS (Automatic Identification System). AIS data reveal that major shipping routes for vessels pass along the wind farm area on their way in and out of the Baltic Sea. Ferries from Trelleborg and Ystad in Sweden to Sassnitz in Germany and Swinoujscie in Poland also pass by the western corner of the project area and through its eastern part (Figure 26). However, only an extremely small number of vessels actually pass through the wind farm area.

That said, the project area is adjacent to a number of routes identified as being of national interest, including Falsterbo–Bornholmsgatt, Gedser–Svenska Björn and Anholt–Svartgrund. Heavy sea transport accounts for a significant proportion of the traffic. Movement patterns of fishing vessels are more greatly dispersed, given that these vessels typically travel to and from different fishing areas, which change according to the target species and season.

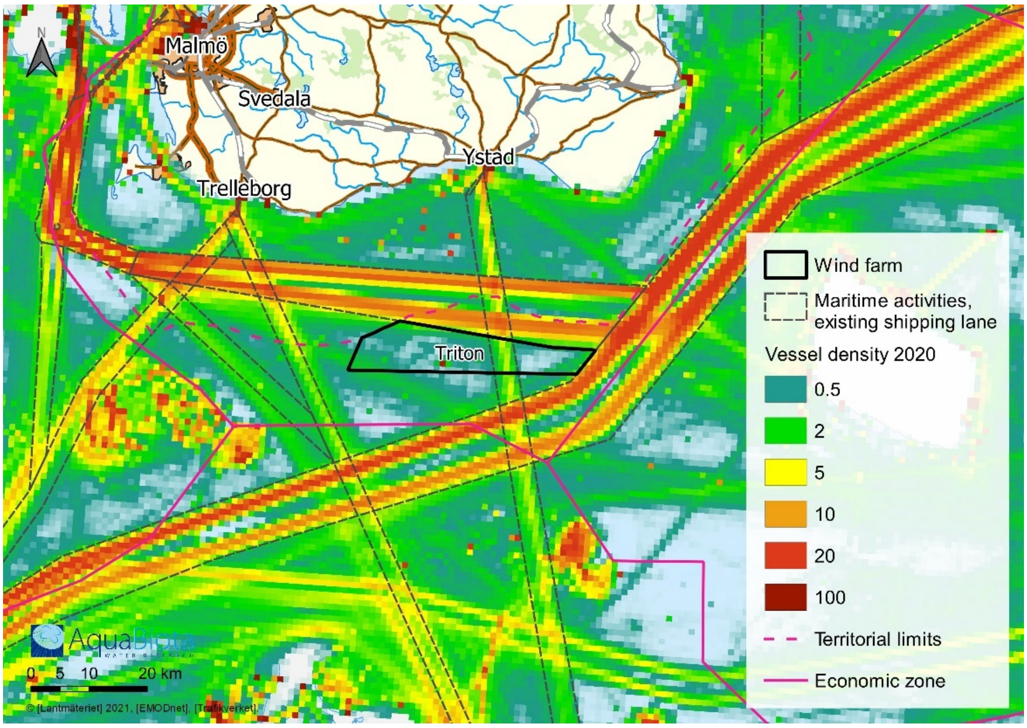


Figure 26. Map of all shipping in 2019 in hours, per 1 x 1 km quadrant per month, as well as shipping routes in the vicinity of the wind farm.

6.9.2. Air traffic

The closest airports to Triton are Malmö Airport (approx. 52 km north of the wind farm) and Bornholm Airport (approx. 39 km east of the wind farm). Malmö Airport has an MSA (Minimum Sector Altitude) area designated as being of national interest to the airport, which the project area overlaps to some extent. Bornholm Airport also has an MSA area that overlaps the eastern section of the project area. An MSA area consists of a circle with a diameter of 55 kilometres, with the airport at the centre. MSA circles are further divided into four sectors, where the lowest permitted flying altitude is 300 metres above the highest point in each individual sector. In other words, aircraft have a safety margin of 300 metres to the top of the highest object in each sector.

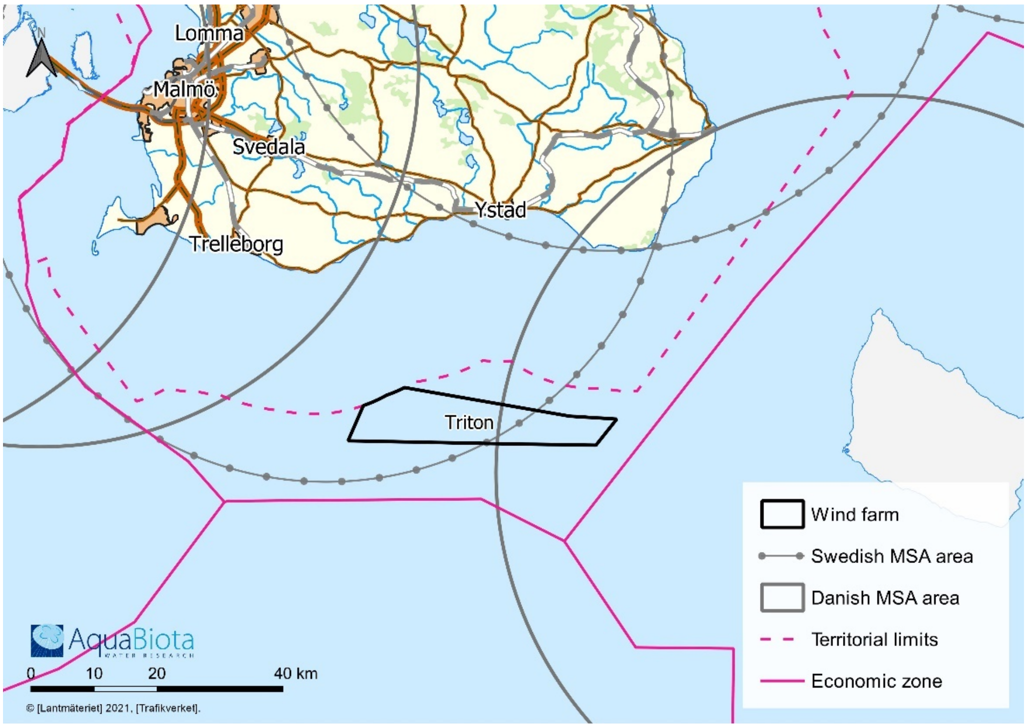


Figure 27. The MSA areas of Swedish and Danish airports.

6.9.3. Military areas

Triton does not touch any of the Swedish Armed Forces' military areas, although the southern part of the wind farm is adjacent to an area used by NATO for military exercises (Figure 28figure 28). Additional NATO areas are located further south of the wind farm and east of Bornholm.

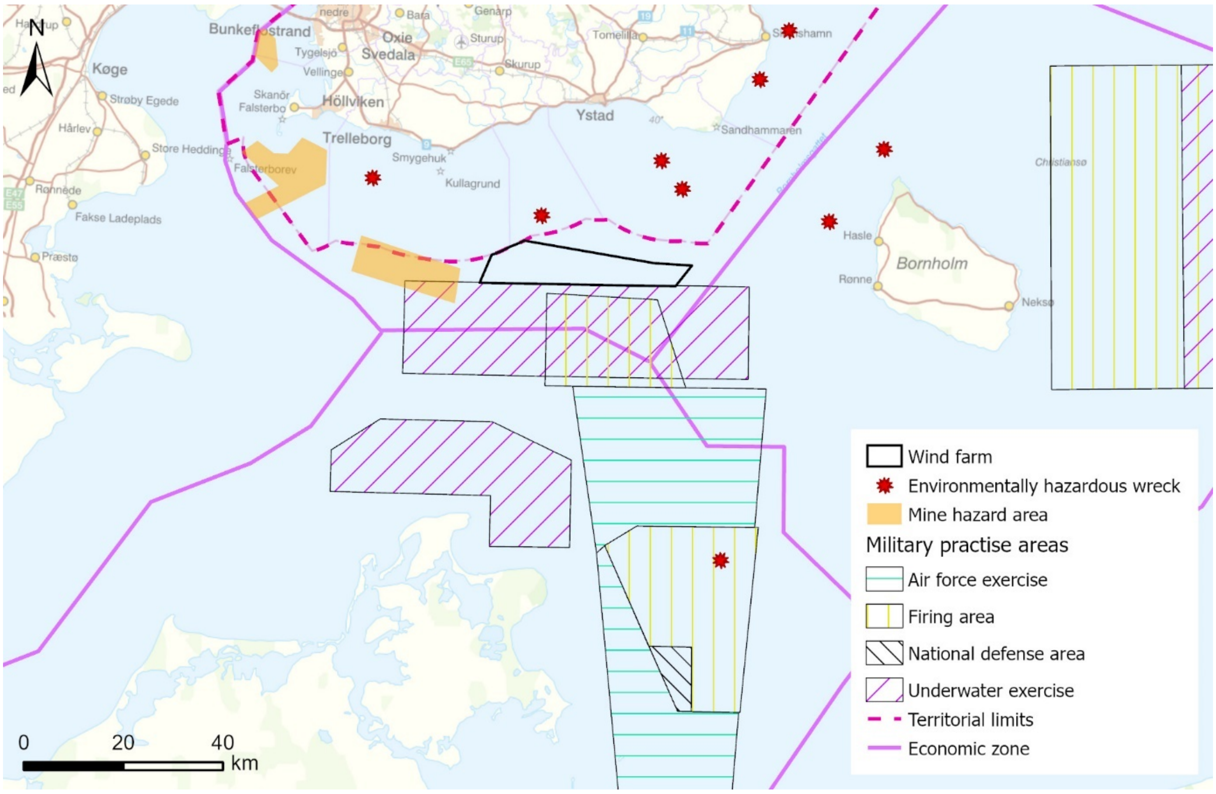


Figure 28. NATO naval exercise areas (BSH CONTIS), mine risk areas and acutely environmentally hazardous wrecks.

6.9.4. Environmentally hazardous objects and dumping areas (mine risk areas)

There are a number of acutely environmentally hazardous wrecks north of the project area (Figure 28figure 28). There are no known dumping areas within the boundaries of the Triton wind farm, and Helcom classifies the area as low risk for sea mines.

6.9.5. Other activities

<u>Existing wind farms</u>

Three existing German offshore wind farms – Baltic 2, Wikinger and Arkona – have been established in the vicinity of the project area. Baltic 2 is approximately 10 km west of the project area and consists of 88 wind turbines with a total capacity of 288 MW. Wikinger is located around 24 km south-east of Triton and comprises 70 wind turbines with a total capacity of 350 MW. Finally, Arkona is sited around 30 km south-east of the project area and features 60 wind turbines with a total capacity of 385 MW (Figure 29). The Danish wind farm Kriegers flak, with a total capacity of 600 MW, came online in September 2021. See Figure 29 for the locations of the wind farms.

<u>Planned wind farms</u>

Plans have already been drawn up for additional wind farms in the immediate area. The permit for the Swedish Kriegers flak wind farm is old, so an application is currently being submitted for a modification permit. A decision about this project has already been made in the Natura 2000 review. Within the German economic zone, the Baltic Eagle (476 MW) and Wikinger Süd (10 MW) wind farms are scheduled for commissioning between 2022 and 2025. Another wind farm – Arcadis East 1 (247 MW) – is likewise planned for the same period, but this farm is sited within German territorial waters. One more wind farm, named O-1.3 (300 MW) will be commissioned in 2026. See Figure 29 for the locations of the planned wind farms.

Other activities

A stretch of the projected subsea Baltic Pipe gas pipeline – a connection between Denmark and Poland – runs through the southern part of the wind farm area. This pipeline will be laid on the bottom of the Baltic Sea and will pass through the area between Denmark, Poland and Sweden. The total length of the gas pipeline is estimated at around 275 km. Baltic Pipe was licensed in Denmark in autumn 2019, and permits were issued in Sweden and Poland in 2020. It is expected that the pipeline will start transporting gas as early as 2022.

The Swedish TSO (Svenska kraftnät) planned electricity connection “Hansa PowerBridge” is located west of the wind farm area. The plan is to construct this cable as a 700 MW direct current cable, which is to run between Hurva in the Municipality of Hörby (Skåne), Sweden, and Güstow in Northern Germany. The licence application was submitted in autumn 2020. If the license is granted in 2022, construction can commence in 2024 and the connection should then come online in 2026.

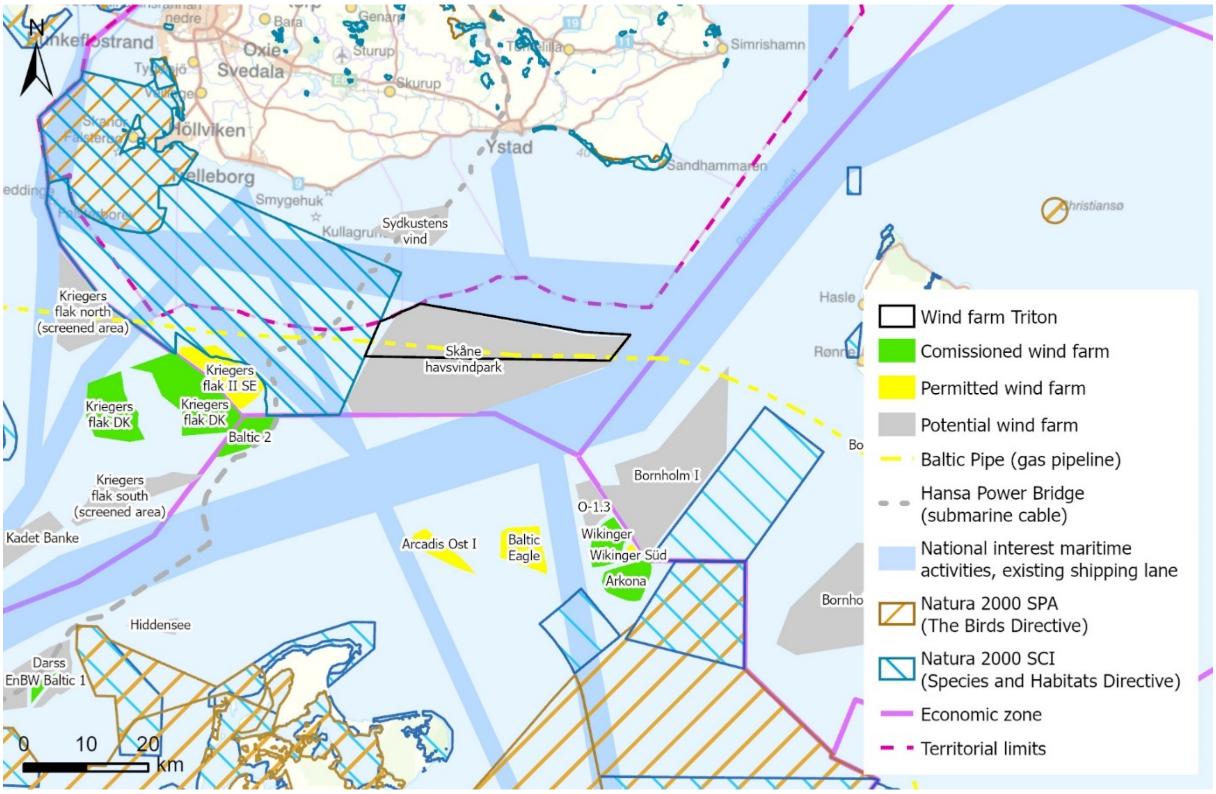


Figure 29. Wind farms and other installations in the area.

7. Provisional environmental impact

This section centres on the different potential environmental impacts that the planned Triton wind farm may generate, and which must therefore be taken into account in the forthcoming process. The upcoming environmental impact assessment will describe and assess potential environmental impacts and consequences in more detail. Moreover, these assessments will be based on the worst-case scenario for each group. By way of an example: the effects of noise on marine mammals will be assessed on the basis of the type of foundation whose establishment generates the most noise – in this case, monopile foundations. Similarly, the environmental impact on seabed flora and fauna stemming from the dispersion of sediment will be based on the use of the type of foundation that generates the highest concentration of suspended solids.

It should be mentioned that the impact on protected species and habitats within the adjacent Natura 2000 area (see section 6.3 above), i.e. in areas outside the actual wind farm area, will be described and evaluated within the framework of the Natura 2000 permit, and is reported in section 7.1 below.

The potential transboundary effects stemming from the Triton wind farm are examined in more depth in chapter 8 below.

7.1. Natural environment

7.1.1. Seabed flora and fauna

The impact on seabed flora and fauna primarily consists of the physical disruption of the seabed that occurs through the installation of the foundations, erosion protection and the internal grid. Above all, stationary creatures that cannot move from the site risk being damaged or removed in connection with the excavation and drilling work. The surface areas in question constitute only an extremely small part of the total seabed area (approx. 0.1%) and it should be possible to re-establish the bottom-dwelling organisms on those areas directly affected by the construction work.

Establishment of the wind turbine foundations will cause some sediment dispersion and will temporarily increase the content of suspended solids in the water. The actual scope of sediment dispersion will largely be defined by factors such as the composition of the seabed substrate, water currents, the type of foundation selected and the installation technique applied (Hammar 2009). The installation of the internal grid may also cause some local dispersion of sediment in those cases where the cables need to be buried or flushed down into the sediment.

When the suspended solids dispersed in connection with the establishment of the wind farm fall to the seabed once more (i.e. when the sediment settles), bottom-dwelling organisms may be covered in sediment. The impact of sedimentation on the seabed fauna varies depending on several factors, of which the most significant are the volume of sedimented material, the total time during which the organisms are covered (exposure time) and the grain size of the sediment particles (Hutchison, *et al.* 2016). The area intended for the planned Triton wind farm consists almost entirely of deep, soft seabed, where creatures that live buried in the sediment are the most dominant type. Creatures adapted to a life buried in the seabed normally fare better than sessile (anchored) organisms that live on top of the bottom surface (Essink 1999). If an area of hard seabed is covered in sediment, this may make it difficult for algae spores and larvae to attach to the rocks and stone, which may affect the formation of new colonies of algae and creatures (Berger *et al.* 2003; Vaselli *et al.* 2008). The risk of this having an impact in the area around the Triton site is low, taking into account the extremely limited extent of hard bottom surfaces and algae.

Once the foundations and erosion protection have been established, they will provide access to a hard surface to which algae and sessile organisms can attach. These foundations will thus create conditions for what is known as a “reef effect”, where hard seabed species such as common mussels can establish local colonies in conjunction with the wind turbines (Dong Energy 2006; Degraer *et al*. 2020). Studies have demonstrated that wind turbine foundations densely covered with common mussels create surfaces distinguished by high levels of biological activity which, in turn, attract fish (Maar *et al.* 2009). The decommissioning of foundations and cables may cause some sediment dispersion, although not to the same extent as during installation.

Going forward, the work will involve modelling the benthic habitat and organisms within the project area. Sediment dispersion models will be prepared for estimating the dispersion pattern in connection with the establishment of the foundations. These sediment dispersion models will form the basis for more detailed analyses of the effects of sediment dispersion on seabed flora and fauna in the forthcoming environmental impact assessment.

7.1.2. Fish

Suspended sediment occurs naturally for long or short periods. During the construction phase, sediment dispersion may have an impact on fish (especially fish roe and fry), as in certain conditions, suspended particles can cover eggs, become stuck in gills and result in worsened conditions for survival. The content of suspended material from activities such as drilling can be reduced in several ways, for example by releasing the material that will become suspended from close to the seabed rather than from the upper strata of the water. The effect of this technique is that the material settles much more quickly.

The construction phase may also give rise to higher levels of noise, which may impair fish orientation, prey location, communication and gathering. Some surveys prior to the construction phase may result in temporarily evasive behaviour in certain species such as cod in the immediate vicinity of the survey vessel. In the operational phase, some noise (<700 Hz) will be emitted from the turbines, which may cause certain behaviour reactions in fish, and may mask the sounds made by the fish themselves (Popper and Hawkins 2019). However, the accumulation of fish around the foundations on establishment (see the description of the reef effect below) indicates that the potential impact of noise during the operational phase is of little significance. If necessary, technical protective measures or other precautions may be taken to minimise impacts on fish. These could include avoiding muddy and noisy work during spawning periods in the construction phase (Anon 2001).

The establishment of foundations may entail changes to habitat that could have a positive effect on the composition of the fish population, known as the “reef effect”. Fish are generally attracted to structures (Wright, *et al.* 2020) and a positive correlation has been demonstrated between the complexity of the structure and the volume of fish accumulated (Hammar *et al.* 2008b). An increased accumulation of fish during the operational phase may be due to a redistribution of fish in the area and/or to increased production of new fish (Andersson and Öhman 2010; Bergström *et al.* 2012). Several studies have been conducted which demonstrate that protecting marine areas from fishing produces measurable effects involving increased numbers of fish (Öhman *et al.* 1997; Roberts *et al.* 2001; Kamukuru *et al.* 2004; White *et al.* 2008). The wind farm should also, to some extent, protect fish populations within the adjacent Natura 2000 area, which is not subject to fish regulation (Swedish Agency for Marine and Water Management 2017).

During the operational phase, electromagnetic fields will be generated around subsea cables which may affect fish such as eel, rays and sharks (Öhman *et al.* 2007; Rølvåg *et al.* 2020). Studies of the effects of cables on eel in the Lillgrund wind farm were unable to demonstrate any change in behaviour in practice, although a tendency towards increased masked time was observed in connection with higher current in the cables. Other studies were likewise unable to prove any significant effect of subsea cables on fish (Dunlop *et al.* 2016). The total impact of subsea cables on fish is therefore considered to be limited.

A major report into the potential environmental effects and consequences of the activities on the fish population has been commenced and will be included in the forthcoming environmental impact assessment.

7.1.3. Marine mammals

Underwater noise can affect marine mammals. Precisely how they are affected depends on several factors including the intensity and frequency of the noise, whether the source of the noise is impulsive or continuous, the salinity and temperature of the water, the seabed conditions and the distance to the source of the noise, as well as the animal's hearing spectrum and sensitivity.

It is during the construction phase that most noise will be generated. Before and during the construction phase, noise may be emitted from a variety of sources including vessels, surveys and preparatory work in the form of pile driving.

Porpoises have a finely developed sense of hearing which makes them particularly sensitive to audio disturbances. This applies especially to strong, impulsive noises such as the noise of pile driving, which may arise in connection with the establishment of wind turbine foundations. The distance at which porpoises can detect sounds depends on the source strength and frequency of the sound in question. The dispersion of the noise correlates in part with the source strength and in part with the frequency, with low frequencies carrying further in the water. Different levels are used to describe the extent to which porpoises are affected by underwater noise. The higher the noise level, the greater the influence. At the first level, the porpoise detects the noise, but the noise will not necessarily affect its behaviour. Higher noise levels can have an impact on behaviour, with the porpoise being disturbed by the noise and distancing itself from the area. In cases where porpoises do not move away from the noise but remain exposed to continuous high noise levels, there is a risk of physical impact on the individual porpoise in the form of temporary damage to hearing (temporary threshold shift, TTS) followed by permanent damage to hearing (permanent threshold shift, PTS). In addition, loud noise can also disrupt porpoises' foraging capacity and ability to communicate (Villadsgaard *et al.* 2007).

During the construction phase, porpoises may be forced away from the immediate area. However, the construction phase will only last for a limited period and the work will be carried out in small, local areas, which means that large areas without porpoise-displacing activities will exist throughout this phase. A variety of measures can be applied to minimise disruption and prevent adverse impact on the marine mammals' hearing, by limiting the dispersion of noise from the construction work, for example. The application of appropriate protection measures can help prevent a significant impact on the survival and reproductive success of porpoises.

Seals are not as sensitive to subsea noise as porpoises (Kastelein *et al.* 2013) and no major, long-term impact on seals has been observed in connection with the establishment of wind power (Tougaard *et al*. 2003; Edren *et al.* 2004). It can also be stated that, unlike porpoises, seals can hold their auditory organs above the water surface. Nevertheless, noise from the construction phase may also disturb seals, not only forcing them away from the area, but also having a direct impact on their hearing. The protective measures that will be applied for the benefit of porpoises are also considered to lessen the impact on seals.

At four out of five wind turbines examined, porpoises returned to the area during the operational phase in the same numbers as previously (Vallejo *et al.* 2017). It is likely that the low frequency noise that wind turbines generate when in operation can be detected by porpoises and seals, but studies have shown varying impact on behaviour. In some cases, porpoise density has been higher in the wind farm area during the operational phase than it was prior to operation, probably on account of increased availability of food given that the foundations attract fish (Scheidat *et al.* 2011). A reduction in shipping traffic may also have a positive effect. As regards seals, they have been documented actively hunting fish around the foundations (Russel *et al.* 2014).

The decommissioning activities will also cause noise emissions into the air and the water, for example in connection with cutting operations to remove wind turbines and foundations. These noise emissions may potentially disturb porpoises, but are expected to be more limited than those generated during the construction phase.

Work to inventory porpoises in the Triton area using porpoise detectors (F-pods) was commenced in March 2021 and will, together with modelling of sound dispersion scenarios in connection with construction operations, serve as the basis for an assessment of the effect and the definition of appropriate protective measures in the forthcoming environmental impact analysis.

7.1.4. Birds

During the construction phase and in connection with surveys, if any, birds may be displaced from the area as vessel traffic and noisy work may both increase in the area. However, the disruption will only last for a limited period and take place in small, local areas, which means that large areas without bird-displacing activities will exist throughout this entire process.

The effects of operating wind power plants on birds can generally be divided into three categories: displacement effects, barrier effects and collision risks.

A "displacement effect" means that birds avoid the wind farm and/or its immediate area. A comparison conducted between different wind farms reveals displacement effects at some wind farms, while no impact has been observed at others; in fact, the number of birds has actually increased in some places (Dierschke *et al.* 2016). In connection with bird migrations in spring and autumn, birds may rest temporarily in the area, but the project area is not generally expected to be of particular significance to seabirds, given how far below the surface the soft seabed lies.

Offshore wind power may obstruct the movement of birds, causing what is known as a “barrier effect”. With regard to the project area, the risk of barrier effects is considered to be only small as the wind farm area does not contain – nor is it close to – any colonies of breeding seabirds. Moreover, the extra distance birds will have to fly to avoid the wind farm is considered negligible in relation to the total distance flown. Cumulative barrier effects of multiple wind farms in the area will be considered in the forthcoming environmental impact analysis.

Collisions with rotor blades are generally considered to be a risk to birds in connection with wind farms. A study conducted into collisions between birds and the offshore wind farm in Kalmarsund indicates a low risk of collision. Of 130,000 eider that passed through the area during the period of the study, only four collisions between eider and wind turbines were observed (Pettersson 2005). Marine diving ducks normally fly low over the water surface when they cross open water and are therefore likely to avoid collisions.

Work to inventory birds is under way to establish the significance of the area to different species, and the forthcoming environmental impact analysis will include a more detailed analysis of the impact on birds in the area, using models of collision risk, for example.

7.1.5. Bats

As the project area is located more than 22 km from the coast, it is considered unlikely that the area is used by foraging bats. However, bats can be expected to pass through the area during their migrations (Hatch *et al.* 2013). Experience from different studies nevertheless indicates that bat migration primarily takes place during limited periods of low wind speed, when the wind turbines will either be stopped or operating at low speed (Ahlén *et al.* 2001). The findings from a study of bat movements across the sea demonstrated that wind farms established farther than approximately 20 km from the coast should have little impact on bats (Sjollema *et al.* 2014).

An evaluation completed by experts in the field will provide a deeper analysis of the potential effects on bats, and will be included in the forthcoming environmental impact analysis.

7.2. Geology and seabed conditions

The impact is considered to be only limited, given that the area in question is extremely small in relation to the total park area. The establishment of gravity foundations is the method that takes up the largest area of seabed and involves the greatest addition of hard substrate and structure. Monopile and jacket foundations do not take up as much space on the seabed, but they do require anchoring in the seabed, where they naturally have a vertical impact on the geology.

Moreover, the project area comprises accumulation seabed, distinguished by natural sedimentation of clay particles and organic material. Given that the hydrographical conditions are not expected to be affected to any great extent during the operational phase, the sedimentation conditions are likewise expected to remain relatively unaffected.

The provisional evaluation is that the total impact on the geology and seabed conditions of the site during the construction, operational and decommissioning phases will be negligible as the total area of seabed affected by the foundations is extremely small.

7.3. Hydrography

A wind farm can affect the hydrography in the area by changing the current, mixing and wave patterns.

Several hydrographical studies have been carried out in connection with the establishment of marine structures in Sweden, including the Lillgrund wind farm and the Öresund Bridge (Øresundskonsortiet 2000; Møller and Edelvang 2001; Karlsson *et al.* 2006). Overall, wind power is not adjudged to affect hydrographical conditions except in small areas of water and narrow passages (Hammar *et al.* 2008a). The changes in wave and current patterns that have been observed around wind turbines have been marginal (Hammar *et al.* 2008a). As Triton is located far from the coast, the impact on the hydrography during installation, operation and decommissioning is assessed as being extremely limited.

The impact of establishing wind power on hydrography will be described in more detail in the forthcoming environmental impact analysis.

7.4. Recreation and outdoor activities

As extremely little use is made of the area for recreation and outdoor activities, the impact on same is expected to be negligible. During the construction and decommissioning phases, leisure vessels may be required to make detours due to certain areas being closed off, but as no foundations will be established in any decided waterways, this impact is likewise considered limited. The small amount of amateur fishing in the area will also be hindered to some extent during the construction and decommissioning phases, but not to any great degree during the operational phase.

7.5. Landscape image

Wind turbines have an impact on the visual impression of the landscape in which they are erected. How this actually affects the landscape image and the individual observer does vary, however, and it is largely linked to subjective emotions and assessments. In order to demonstrate the expected landscape image following establishment of the Triton wind farm, visualisations and photo montages will be prepared from several points along the south coast of Skåne. These will be presented and explained during the forthcoming consultation meetings and environmental impact analysis. In Sweden, the wind turbines will be visible from land, whatever design is chosen and regardless of the total height of the turbines (270 or 320 metres). From the Danish island of Bornholm, the wind turbines will likewise be visible, irrespective of whether their total height is 270 or 320 metres.

Within the framework of the environmental impact analysis, what are known as “visibility analyses” will be prepared, showing the sites in the surrounding landscape from which the wind turbines will be visible.

7.6. Cultural heritage

Sonar and magnetic field surveys will be conducted prior to establishment of the wind farm to identify any wrecks and/or ancient remains. The information gathered from these surveys will be analysed by expert marine archaeologists to pinpoint any marine archaeological objects, with a view to avoiding potential impact on same in connection with the construction and decommissioning work. The operational phase is not expected to have any effect on marine archaeological finds, as these will already have been avoided during construction.

If previously unknown shipwrecks or other cultural historical remains are found during the surveys, a report will be submitted to the Swedish authorities pursuant to the Swedish Historic Environment Act (1988:950).

7.7. Commercial fishing

During the operational phase of the wind farm, it is likely that bottom trawling will be regulated within the wind farm boundaries so as to protect cables, fishing boats and equipment. In addition, boat traffic is expected to increase during the construction and decommissioning phases of the wind farm. All in all, this is expected to have an impact on commercial fishing in the area, such that it will probably not be possible to fish here to the same extent as today. The regulation of trawling operations within the limits of the wind farm need not necessarily mean a complete cessation of fishing. Other fishing methods can be applied within a wind farm, such as the majority of methods involving passive equipment.

The combination of wind turbines creating a reef effect with the associated rise in fish production (Andersson and Öhman 2010; Reubens *et al.* 2011) and having the area protected from certain types of fishing should have a positive effect on fishery in the long term (Fayram and Risi 2007). A number of studies have demonstrated that if an area is protected from fishery for a given period, this can result in both an increase in fish biomass and, in the long term, produce greater benefits for the fishing industry (Roberts *et al.* 2001; Gell and Roberts 2003; White *et al.* 2008; Lester *et al.* 2009; Gaines *et al.* 2010).

A major report into the potential effects and consequences of the activities on commercial fishing has been commenced and will be included in the forthcoming environmental impact analysis.

7.8. Climate

The establishment of the wind farm will entail a certain climate footprint in the form of production of the wind turbines themselves and other components, as well as the transport and installation work. The decommissioning phase will have an impact on the climate linked to boat traffic and the like. However, these activities will be limited in both time and scope. During the operational phase, in contrast, the wind farm will help Sweden to achieve its climate ambition of becoming a net zero emitter in 2045. The annual production of the wind farm is calculated at around 7.5 TWh, which corresponds to the annual consumption of around 1.5 million households. In other words, wind power has a key role to play in the national measures to limit future climate change, and to transition to a renewable electricity system. The impact of the wind farm on the climate will be presented in more detail in the environmental impact analysis.

7.9. Geological carbon storage

At present, there are no actual or planned projects involving carbon storage in the area. An assessment of the possible impact on the opportunity for future carbon storage will be completed within the framework of the environmental impact analysis.

7.10. Risks and safety

OX2 will comply with the OSPAR convention linked to the handling and elimination of chemical substances in marine environments (OSPAR 1992), which is intended to protect the environment in the North Atlantic. The company will do so even though the Baltic Sea is not officially covered by OSPAR (which encompasses the North Sea, Skagerrak and some parts of Kattegatt). The convention has been prepared jointly by Belgium, Denmark, Finland, France, Germany, Iceland, Ireland, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, the UK and the EU.

Particularly during the construction phase of wind farms, there is a risk of spillages of fuel and lubricants as a result of increased transport, as well as risks of collision stemming from an increase in maritime traffic. During the operational phase, there are also environmental risks linked to the fact that wind turbines contain grease and oil in their nacelles. In the event of emission, leakage or breakdown, these chemicals may enter the water and affect the marine organisms.

Generally speaking, environmental risks will be managed through the preparation of risk protocols and environmental plans during the upcoming detailed planning phase, as well as through the application of the precautionary measures described in the Swedish Environmental Code, combined with state of the art technology and techniques, and by complying with the provisions of the OSPAR convention during the performance of the work.

A risk analysis concerning vessel collisions associated with the increase in traffic in the area to and from the wind farm during the construction phase, and additional sea traffic in the nearby sailing lanes as a result of the planned wind farm and export cable corridor will be attached to future applications.

7.11. Infrastructure and planning conditions

7.11.1. Shipping

The region contains a number of key nodes for the transport of people and goods between Denmark, Sweden, Germany and Poland, for instance. The ferry routes are therefore important connections in the area, while the nearby shipping lanes are also of significance to accessing harbours around the Gulf of Bothnia, i.e. ports in Finland, Russia and the three Baltic States in addition to those in Sweden. The turbines in the Triton project are located outside the sea routes. During the construction phase, boat traffic will increase both to and from and within the project area. Some work processes will require special vessels, and on some occasions, it will be necessary to establish safety zones within the construction area. This may have a temporary impact on passing maritime traffic in the form of changes to navigation, etc.

During the operational phase, too, there will be some increase in boat traffic, primarily for the transportation of personnel to, from and within the project area, although the effect of this on shipping in the main sea routes will be extremely limited.

In order to assess the impact of the project on shipping, risk analyses will be completed prior to the construction and operation of the wind farm. Risks in the context of shipping will be analysed through calculation of the likelihood of grounding, collisions between vessels and the probability of vessels sailing or drifting into the wind farm. The impact on sea traffic will be described in the environmental impact assessment. Protection measures will be suggested following consultation with the authorities and as required.

7.11.2. Air traffic

As there is air traffic in the area, given the proximity to several airports, the MSA (Minimum Sector Altitude) of the aircraft must be taken into account. Establishment of wind power in the area may change flight procedures to and from the airports. Given that the Triton wind farm partially overlaps the MSA areas of both Malmö and Bornholm Airports, it is possible that the flight altitude in the sector in question may have to be revised during the construction, operational and decommissioning phases. In this context, it is relevant to note that the majority of Southern Sweden is actually covered by MSA zones. The project will inform and consult with the Swedish Civil Aviation Administration (*Luftfartsverket* – LFV) to investigate the potential impact and the need for any protective measures.

The Triton project area does not overlap any designated low-fly areas, so the Swedish Armed Forces' aviation activities should not be affected during the different phases of the establishment. Potential impact and interaction with affected parties will be examined in more detail in the forthcoming environmental impact assessment, in dialogue with the Swedish Armed Forces.

7.11.3. Defence interests and military areas

The Swedish Armed Forces' areas of military interest are generally located both on land and at sea, and can include infrastructure and sea routes. The project area does not affect any designated areas of national interest for total defence, although there may be areas and interests that are classified. That said, objects higher than 20 metres do risk affecting the interests of national total defence. Wind turbines can, for example, have a negative impact on the Swedish Armed Forces' radar system, radio links, signals intelligence, air operations, exercises and firing drills. Tall objects in the proximity of weather radar installations risk disrupting the production of reliable weather forecasts, which means that wind turbines may not be erected within five kilometres of a weather radar facility, and that special analyses must be performed for wind power installations within 50 km. Triton is located outside both these boundaries and is therefore not considered likely to affect the Swedish Armed Forces' weather radar system.

The project area has been adapted and positioned outside the maritime exercise area used by NATO for international naval manoeuvres. The preliminary assessment is that the wind farm will not have an impact on military exercises. This will be verified within the framework of this consultation and the planned Espoo consultation, where additional information about military interests and any need to show special consideration will be obtained from the Swedish Armed Forces and other relevant authorities.

7.11.4. Environmentally hazardous objects and dumping areas (mine risk areas)

Sonar and magnetic field surveys will be conducted to search for any environmentally hazardous objects such as wrecks, mines and other undetonated ordnance. The information collected from these surveys will be analysed by expert marine archaeologists in order to identify any environmentally hazardous objects, with a view to avoiding potential impact of same in connection with the construction and decommissioning phases. The operational phase is not expected to have any impact, given that any such risks will have been avoided during construction.

7.12. Cumulative effects

"Cumulative effects" refers to effects from other activities or measures which, together with the project in question, may give riser to environmental impact within the area of influence of the project in question. Cumulative effects may arise when multiple different effects interact with each other – both different types of effect from one and the same activity, and effects from different activities. Cumulative effects may, for example, take the form of impact on birds, fish and marine mammals from different types of activity within a given geographic area. The environmental impact analysis will identify and assess cumulative effects based on existing and licensed installations and activities in the area, see section 6.9.5.

8. Potential transboundary impacts

The environmental impact assessment prepared in accordance with Article 4 of the Espoo Convention will describe and assess the anticipated transboundary impacts. The principal transboundary impacts that might arise are presented in this chapter.

8.1. Birds

The potential impact concerning birds detailed in section 7.1.4 may extend beyond the boundaries of the Swedish economic zone, for example taking into account the fact that certain species of birds fly across extremely large areas, thus entering the maritime territories and zones of multiple countries. The impact on birds within the Swedish economic zone is expected to be limited, which means that any transboundary effects will likewise be limited. The impact on birds will be described in the forthcoming environmental impact assessment.

8.2. Bats

The expected impact of the project on bats has been described above in section 7.1.5, and the effects may potentially also apply outside Swedish territory. As stated above, however, it is considered unlikely that the area will be used by foraging bats, given that the project site is located more than 20 km from the coast. Migrating bats may move through the area, as mentioned in the previous section, but studies indicate that such movement is limited to periods of low wind, and that the establishment of offshore wind power has only low impact on bats. The forthcoming environmental impact assessment will include the transboundary impact on bats.

8.3. Marine mammals

Porpoises, grey seals and harbour seals are designated species in several Danish, German, Polish and Swedish Natura 2000 areas. The potential impact described in section 7.1.3 may extend across the Swedish border, as the areas to which the species are indigenous may encompass parts of the territories of several other countries. The impact on marine mammals within the Swedish economic zone is expected to be limited, which means that any transboundary effects will likewise be limited. The impact on marine mammals will be described in the forthcoming environmental impact assessment.

8.4. Fishery

The potential impact on fishery described in section 7.7 above may also apply to commercial fishery operators from other countries. The impact on fishery within the Swedish economic zone is expected to be limited, which means that any transboundary effects will likewise be limited. The impact on fishery will be described in the forthcoming environmental impact assessment.

8.5. Shipping

The potential impact stated in section 7.11.1 above may also have a transboundary effect, primarily in the form of temporary disruption to shipping in the area on account of increased boat traffic and possible closures of lanes, etc. within the construction area. The nearby sea routes that may be affected by the wind farm include the ferry connections from Ystad in Trelleborg in Sweden to Sassnitz in Germany and Swinoujscie in Poland, as well as the Falsterbo–Bornholmsgattet, Gedser–Svenska Björn and Anholt–Svartgrund connections.

As mentioned above, however, the planned wind farm is located away from designated sea routes, so the anticipated impact during the operational phase will likely be limited. The impact on shipping within the Swedish economic zone is expected to be limited, which means that any transboundary effects will likewise be limited. The impact on shipping will be described in the forthcoming environmental impact assessment.

8.6. Air traffic

The potential impact on air traffic presented in section 7.11.2 above may also have a transboundary effect. As there is air traffic in the area, given the proximity to several airports, the MSA (Minimum Sector Altitude) of the aircraft must be considered. Establishment of wind power in the area may change flight procedures to and from the airports. As the Triton wind farm overlaps the MSA areas of both Malmö and Bornholm Airports, it is possible that the flight altitude in the sector in question may have to be revised during the construction, operational and decommissioning phases.

8.7. Military areas

There is a military exercise area nearby (under the auspices of NATO), see section 6.9.3. The boundaries of the project areas have been adjusted during the process with respect to the exercise area so as not to affect the activities conducted there.

8.8. Landscape image

The potential impact on the landscape image presented in section 7.5 above may also have a transboundary effect. Triton is located offshore, more than 23 km from the Swedish coast and over 35 km from the Danish island of Bornholm. It is expected that the effects on the landscape image within the Swedish economic zone will be limited, which means that any transboundary effects will likewise be limited.

8.9. Cumulative effects

The potential cumulative effects presented in section 7.12 above may also have a transboundary effect. The cumulative effects within the Swedish economic zone are expected to be limited, which means that any transboundary effects will likewise be limited. The cumulative effects will be described in the forthcoming environmental impact assessment.

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