Environmental impact assessment of the Saare Wind Energy **OFFSHORE WIND FARM**

ENVIRONMENTAL IMPACT ASSESSMENT PROGRAM

DRAFT (MARCH 30, 2021)

ABBREVIATED ENGLISH VERSION

Contracting Authority: Saare Wind Energy OÜ

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(EIA license No. KMH0131)

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1. Introduction

Saare Wind Energy OÜ (hereinafter SWE or SWE OÜ) is planning a wind power plant with a maximum of 100 wind turbines, i.e., an offshore wind farm with a capacity of up to 1,400 MW in the western coast of Saaremaa in the territorial sea and a transmission system until connected to the general electricity system (transmission network).

On 9 April 2015, Saare Wind Energy OÜ (registry code 12747106) submitted an application for a building permit to the Ministry of Economic Affairs and Communications together with an expert opinion for the encumbering of a public water body with a wind power plant.

The superficies license procedure and environmental impact assessment have been initiated by the Government of the Republic Order No. 183 of 28.05.2020. Pursuant to § 56 (12) of the Environmental Impact Assessment and Environmental Management System Act (hereinafter EIAEMSA), the wording of the Environmental Impact Assessment and Environmental Management System Act in force at the time of submission of an application for development consent applies to the application submitted before 13.07.2017, whereby no decision has been made on the initiation or refusal to initiate an environmental impact assessment. At the same time, the EIA is aimed at reducing the administrative burden, i.e., so that the results of the EIA can be used as a basis for issuing both superficies license and further permits necessary for the establishment of the wind farm (water permit and building permit) and avoiding initiation of duplicate environmental impact assessments in the future, the EIA program and report are prepared in terms of content requirements using the best possible knowledge and taking into account the valid requirements of the wording of the EIAEMSA. At the same time, in the case of procedures, the wording of the version of the EIAEMSA valid at the time of submission of the application for a superficies license (09.04.2015) shall be followed.

The purpose of the EIA is to assess the environmental impacts that may result from the implementation of the proposed activity and its alternatives. The EIA covers both the areas covered by the proposed activity and its real alternatives, as well as the surrounding or associated areas, including an assessment of the spatial extent of the various impacts and their significance.

Environmental impact is the direct or indirect impact of an activity on human health and well-being, the living and natural environment, cultural heritage, or property. An environmental impact is significant if it is likely to exceed the site's environmental tolerance, cause irreversible changes in the environment or endanger human health and well-being, cultural heritage, or property.

The developer of the proposed activity is Saare Wind Energy OÜ. The environmental impact assessment is performed by OÜ Roheplaan, and the lead expert of EIA is Riin Kutsar (EIA license no. KMH0131).

2.
Proposed activity

2.1. Purpose and need of the proposed activity

Saare Wind Energy OÜ (hereinafter SWE or SWE OÜ) is planning a wind power plant with a maximum of 100 wind turbines, i.e., an offshore wind farm with a capacity of up to 1,400 MW in the western coast of Saaremaa in the territorial sea and a transmission system until connected to the general electricity system (transmission network).

The purpose of the construction of an offshore wind farm is to produce electricity from renewable energy sources in an environmentally friendly manner and to direct it to the general electrical system.

The need for the proposed action stems from the set climate goals to increase the production of renewable energy sources, including offshore wind energy, the introduction of energy efficiency, and other sustainable solutions that will help to reduce carbon emissions.

2.2. Location of the proposed activity

The location of the offshore wind farm is the area of the wind farm located in the territorial sea west of Saaremaa and the areas of the transmission system (different variants) in the marine area and on the land of Saare County and Pärnu County.

The offshore wind farm is located in the basic area defined in the national plan for the construction of Estonian 2030+ [1] wind farms as a preferred area. The thematic plan of the Maritime Spatial Plan of the National Plan [2] (in preparation, expected implementation date autumn 2021) specifies the use of marine areas, and the proposed SWE offshore wind farm is located in the area defined in the thematic plan of the Marine area as suitable for the development of wind energy.

Nature reserves and known natural values, shipping lanes, radars, sufficient distance from the coast (>10 km), etc., were taken into account already in the initial location selection of the offshore wind farm (application 2015). The depth of the sea in this area is about 20 - 35 meters.

Due to the specified information, SWE is applying for the adjustment of the superficies license area[3] to correspond more fully to the areas defined as wind energy areas in the thematic plan of the national plan and to the optimal solution of the offshore wind farm.

1 https://www.rahandusministeerium.ee/sites/default/files/Ruumiline_planeerimine/eesti2030.pdf

2 https://www.rahandusministeerium.ee/et/planeeringud (in preparation)

3 Pursuant to the Water Act, the area of a public water body to be encumbered may be shifted or increased by up to 33 per cent compared to the encumbered area specified in the decision to initiate the superficies license procedure when processing a superficies license, based primarily on the results of studies and environmental impact assessments. The encumbered area can be reduced by more than 33 percent. The encumbered area may not be shifted or increased to an area where another superficies license procedure has been initiated.

Figure 2-1 provides an extract of the area defined as wind energy areas in the draft Estonian Maritime Spatial Plan, the area of superficies license of SWE in accordance with the decision to initiate the superficies license procedure (alternative 1) and the adjusted area of the SWE superficies license (alternative 2). SWE OÜ wishes to specify the area of the superficies license and increase it to ~196 km ^{2}.

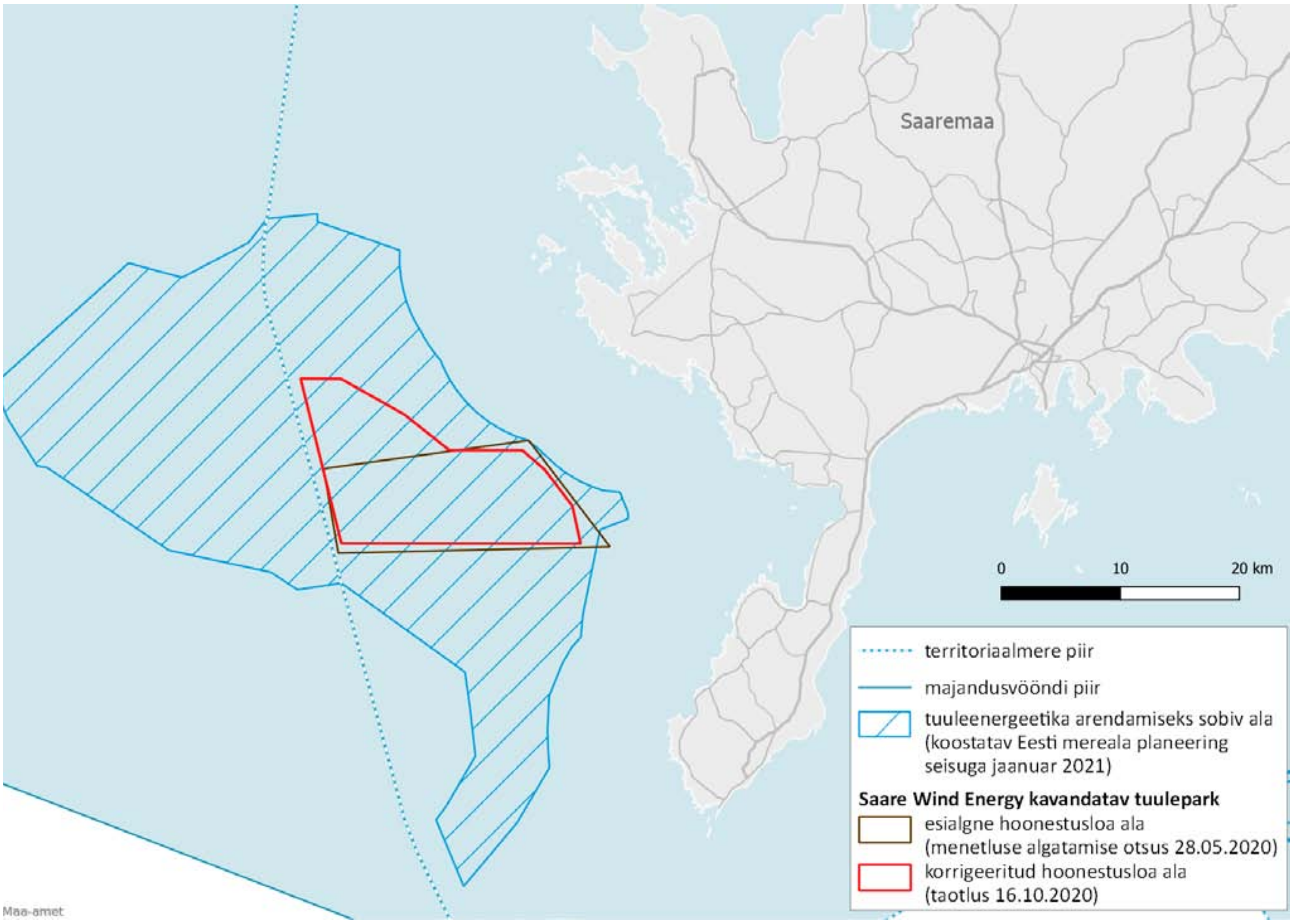

FIGURE 2-1. THE WIND ENERGY AREA PLANNED WITH THE DRAFT ESTONIAN MARITIME SPATIAL PLAN AND THE BOUNDARY OF THE BUILT-UP AREA INDICATED IN THE ORDER OF INITIATION OF THE SUPERFICIES LICENSE PROCEDURE, AND THE ENVIRONMENTAL IMPACT ASSESSMENT (28.05.2020 NO. 183) AND THE BOUNDARY OF THE ADJUSTED AREA ENCUMBERED BY THE SUPERFICIES LICENSE APPLIED FOR BY SWE (RED LINE) BACKDROP MAP: ESTONIAN MARITIME SPATIAL PLANNING PORTAL[4]

4 Extract of the Estonian Maritime Spatial Planning portal as of 02.10.2020 < link >

3. A brief description of the proposed activity and its realistic alternatives

Saare Wind Energy OÜ plans to develop an offshore wind farm in the area of the west coast of Saaremaa in the territorial sea and the transmission system in the marine area and the land of Saare County and Pärnu County until its accession to the general electrical system.

3.1. Realistic alternatives

The areas of the Saare Wind Energy offshore wind farm and possible cable connections are in line with the *Maritime Spatial Plan of Pärnu County*, and the thematic plan of the *Maritime Spatial Plan of the National Plan* under preparation and are in accordance with these plans (see also Chapter 4.2.3 for more details). Thus, it is a suitable location for the development of an offshore wind farm on a general scale (strategic/national level), and the national/regional selection of alternatives for the location of an offshore wind farm is not addressed in this specific project-level EIA.

Among the actual alternatives, the EIA considers the main alternatives, which is alternative 1- the area of the SWE building license in accordance with the decision to initiate the building permit procedure and alternative 2- the adapted area of the SWE building permit. The maximum number of wind turbines in the offshore wind farm is up to 100. The diameter of the wind turbine rotor is expected to be 250-280 m, which results in a maximum wind turbine height of up to 310 meters. The maximum approximate capacity of the offshore wind farm is up to 1400 MW[5].

In the course of the EIA, possible alternatives of the proposed activity are analyzed (incl. alternative 0), but alternative locations outside the location of the proposed activity are not considered.

As the so-called sub-alternatives of the main alternative of the proposed activity, various components are considered and assessed during the EIA: number of wind turbines, wind turbine rotor diameter, wind turbine hub height, foundation type, transmission system, locations of objects (cables) and other alternative technical solutions. The analysis and specification of alternative solutions will take place in the further EIA process and technical design in cooperation with the agencies involved in the process and experts in the respective field.

The offshore wind farm will be built with a long-term (decades) perspective and may be implemented in stages.

5 When submitting the application for a superficies license in 2015, 100 wind turbines were planned, each with a capacity of 6 MW (600 MW in total), which at that time was a modern and promising solution. Today, offshore wind energy technology has advanced. Therefore, the wind turbines used for the present time and by the expected start of construction of the offshore wind farm (minimum 5 years) are larger and more powerful. This EIA is based on the assumption that the rotor diameters of the wind turbines are 250-280 meters (wind turbines with an approximate capacity of 14-18 MW) instead of the 154 meters covered in the application of 2015, which means a maximum wind turbine height of approx. 310 meters (for a rotor diameter of 250 m, the maximum height of the wind turbine is approx. 280 m). There are no wind turbines of the indicated size today, but considering the time of construction and technological development, these parameters are realistic and it is wise to design the offshore wind farm based on the most modern and best possible technology.

An offshore wind farm is a sophisticated technological complex that also joins a sophisticated and multifaceted electrical system. Therefore, the proposed offshore wind farm has several technical and spatial alternatives/options inside the development area. The various alternative solutions to the proposed activity are described below. For the sake of better visibility, the overview has been made by different components (wind turbines, transmission system).

This EIA addresses, if necessary, the adaptation of the location and spatial configuration of the offshore wind farm proposed in the specific application for a building permit in accordance with the results of the studies and cooperation with various agencies and regional stakeholders.

This EIA also deals with the various technical solutions and spatial locations of the transmission system connecting the offshore wind farm to the general electricity system in the marine area.

3.2. Description of the offshore wind farm

SIZE AND NUMBER OF WIND TURBINES

The maximum planned number of wind turbines in the SWE offshore wind farm is 100. The specific brand of the wind turbine to be used in the SWE offshore wind farm has not yet been selected, nor is this specific EWC manufacturer or brand defined in this EIA. The EIA will address the maximum size of offshore wind turbine that is likely to be available during the construction of the offshore wind farm.

There are currently three offshore wind turbine models (Siemens Gamesa Renewable Energy, MHI Vestas Offshore Wind, and GE Renewable Energy) that meet the requirements currently in force in Europe and have the necessary certificates.

- The largest offshore wind turbine for Siemens Games, with series production projected for 2024, is the SG 14-222 DD. It is a 14 MW wind turbine with a rotor diameter of 222 m.
- The largest offshore wind turbine currently by Vestas is V236-15,0 MW, with a rotor diameter of 236 meters and a capacity of 15 MW.
- GE's largest offshore wind turbine currently produced is the Haliade-X 12 MW, with a rotor diameter of 220 meters and a capacity of 12 MW.

Offshore wind turbine technology continues to evolve, and Saare Wind Energy expects that the largest wind turbines with a rotor diameter of 250-280 meters will be ready for use by the time of the building of the offshore wind farm (wind turbines with an approximate capacity of 14-18 MW) and consequently the maximum peak height from the sea level is about 280-310 meters. If additional compliant manufacturers have joined the market during the construction of the offshore wind farm, they will, of course, also be considered. Consequently, the hub height of wind turbines up to 310 meters is estimated in the framework of this EIA.

The figure below (Figure 3-1) provides an initial sketch map of an offshore wind farm with a maximum number of wind turbines. Depending on the final solution and the circumstances that arise, the number of wind turbines may change (decrease).

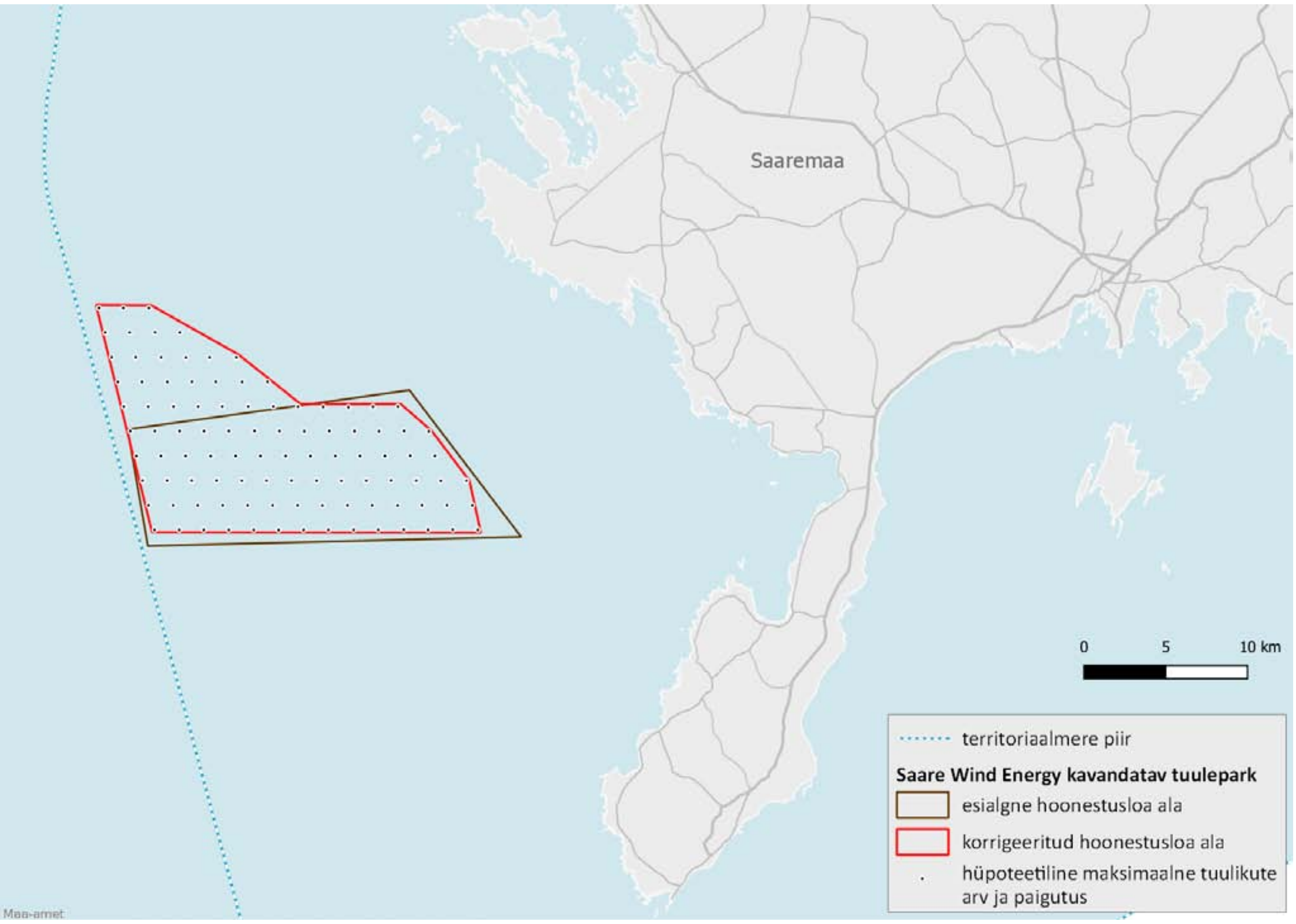

FIGURE 3-1. THE SKETCH MAP OF THE PROPOSED OFFSHORE WIND FARM WITH A LAYOUT OF THE HYPOTHETICAL MAXIMUM NUMBER OF WIND TURBINES (THE BOUNDARY OF THE BUILT-UP AREA INDICATED IN THE ORDER OF INITIATING THE SUPERFICIES LICENSE PROCEDURE AND ENVIRONMENTAL IMPACT ASSESSMENT (NO. 183 OF 28.05.2020) (GREEN LINE) AND THE BOUNDARY OF THE AREA ENCUMBERED WITH THE ADJUSTED SUPERFICIES LICENSE APPLIED FOR BY SWE (RED LINE). BACKDROP MAP: LAND BOARD, 2020).

TYPE OF FOUNDATION

Different types of foundations are used in the construction of offshore wind turbines. The most common are monopile foundation and gravity foundation, somewhat less used are tripod foundations and jacket foundations. See Figure 3-2.

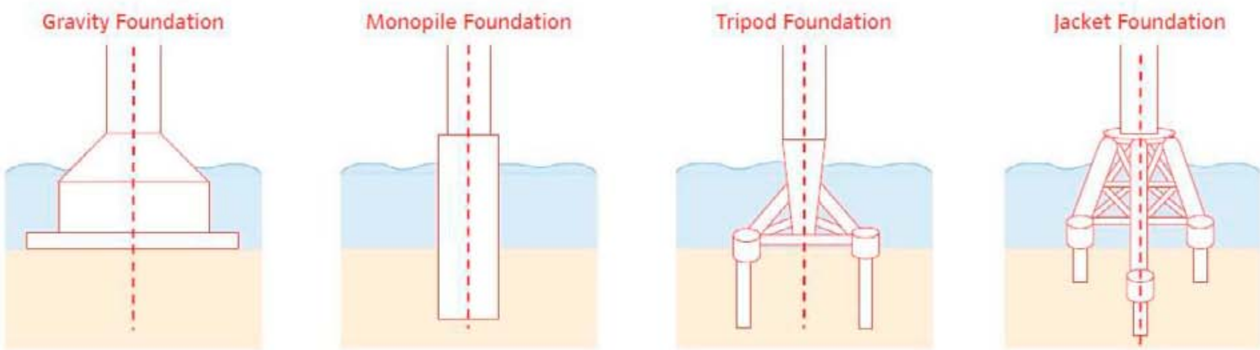

FIGURE 3-2. FOUNDATION TYPES OF WIND TURBINES USED IN OFFSHORE WIND FARMS[6].

6 *Miceli F. Offshore wind turbines foundation types; 2012.* < link >

The specific type of wind turbine foundation to be used in the SWE offshore wind farm has not yet been selected. The choice of the type of foundation is carried out within the framework of the EIA; it is expected that the main choice is the pile foundation and the gravitational foundation (but other variants are not excluded at the moment).

The choice of foundation type depends on the nature of the seabed (construction geology, etc.), depth, ice conditions, the size of the wind turbine, and many other factors; therefore, the type of foundation is selected on the basis of information collected by detailed studies (partly in the framework of an EIA) in a specific offshore wind farm and at a specific location.

The type of foundation may affect the nature and magnitude of the associated environmental impacts, but various mitigation measures can prevent or mitigate potential impacts during the construction and operation phases of the foundation.

In discussions on offshore wind farms in Estonia, it has often been argued that in these conditions, a gravitational foundation is preferred over a pile foundation due to the fact that ramming the pile foundation creates noise and a massive gravitational foundation is better suited to ice conditions. Due to technological developments, these views are no longer true in many cases, and considering the use of a pile foundation in the design of the Saare Wind Energy offshore wind farm is one of the most credible solutions.

In the construction of several offshore wind farms, Van Oord has used (partly uniquely developed by himself) noise abatement measures for ramming piles and for the preventive deterrence of marine biota before carrying out work (FaunaGuard system). In the case of strong subsoil, where direct ramming is not possible/reasonable, drilling is used, which has a significantly lower noise level.

FIGURE 6. EXAMPLE OF A NOISE-ABSORBING HSD (HYDRO SOUND DAMPER) DEVICE PLACED AROUND A SEABED PILE FOUNDATION DURING INSTALLATION (SOURCE: VAN OORD).

CONSTRUCTION OF AN OFFSHORE WIND FARM.

Wind turbines are manufactured in their assembly plants (probably outside Estonia) and transported to the offshore wind farm. Often, wind turbine components (foundations, tower, gondola, blades) are transported in the area of the offshore wind farm to be built to a suitable port (large and deep port prepared accordingly) and from there to the offshore wind farm as construction progresses.

Van Oord (https://www.vanoord.com/), a shareholder in SWE OÜ, is a reputable Dutch family-owned company of global reach with the history of operation of more than 150 years, engaged in dredging, marine construction, and offshore projects (oil and gas industry and offshore wind energy). In 2019, the company employed more than 5,200 people. The company owns more than 60 ships and other special technological equipment, which ensures the capability for building offshore wind farms.

The expected builder of the SWE offshore wind farm is Van Oord, which means that the potential of the technology (i.e., both Van Oord's resources and know-how in the sector as a whole) used is well known at an early stage in the development of the project.

Examples of Van Oord vessels used in the construction of an offshore wind farm for the transport of foundations, spacers, and wind turbines from the port to the offshore wind farm area and for installation in the offshore wind farm area are as follows, but the exact choice of vessels to be used will depend on the circumstances that will emerge during the further planning of the offshore wind farm. The Van Oord fleet may also change during the construction of the offshore wind farm.

- Aeolus
  A special ship for the construction of offshore wind farms, completed in 2014 and modified in 2018 (the ship has so-called outriggers/jacks, which, when pushed to the seabed, lift the ship out of the water during the work), 139.40 m long, 44.46 m wide and with the draught of 8.60 m. The Aeolus has a main crane with a lifting capacity of 1,600 tons, and the ship can be lifted out of the water, and work can be done in water up to a depth of 45 meters. See Figure 3-4.
- Svanen
  A special ship for the construction of offshore wind farms, completed in 1990 and modernized in 2017, with a length of 102.75 m, a width of 74.60 meters, and a draught of 4.50 meters. With cranes with a lifting capacity of 2000 tons (total lifting capacity 5705 tons), capable of installing pile foundations up to 11 meters in diameter and 90 meters in length. The "hammer" used for countersinking the piles weighs up to 1200 tonnes and is equipped with a noise reduction system. See Figure 3-5.

FIGURE 3-4. AEOLUS

FIGURE 3-5. SVANEN

3.3. Connection to the Estonian transmission network

Connection to the Estonian transmission network takes place in accordance with the technical conditions issued by Elering AS to SWE OÜ (by letter no. 2-7/2015/1-2 of 05.02.2015) in the Lihula - Sindi - Kilingi-Nõmme area at either the Sindi or Lihula substation. Elering AS has issued technical conditions for a wind farm with a capacity of up to 600 MW. In connection with the development of wind turbines and the more general transformation of the Estonian electricity system (incl. Green Deal), Elering AS is processing the renewal of technical conditions for SWE OÜ (application accepted for processing on 27.11.2020) to specify the connection point (various alternatives) and increase capacity to 1400 MW.

A solution covering the water cable line and the onshore electricity transmission system will be built from the offshore wind farm to the connection point, which will also be specified and supplemented with additional works separate from the application for a superficies license and the EIA (incl. onshore plans).

CABLING INSIDE THE PARK AND THE FIRST SUBSTATION

The electricity generated by the wind turbines is collected with cables inside the offshore wind farm (usually with a voltage of 66 kV AC) and routed to the first substation(s) (usually the standard solution 66/220 kV AC).

The first substation is located mostly within the wind farm in the sea, in the location which is optimized to minimize the length and the losses of the cables coming from the wind turbines. However, the first substation can also be located on land, which increases the path length and losses in 66 kV AC cables but simplifies the construction and maintenance of the substation and reduces its cost. Thus, the location of the first substation(s) in the initial concept has two variants: at sea in the wind farm or on land in Saaremaa as close as possible to the wind farm.

Special cable-laying vessels and additional special equipment, such as seabed dredging equipment, are used to install the cables. The main cable-laying vessel in the Van Oord fleet is the Nexus, completed in 2014 (122.68 meters long, 27.45 meters wide, draught 5.82 meters; see Figure 3-6). The ship has a special “carousel” for accommodating up to 5,000 tons of cable and powerful cranes for laying heavy cables on the seabed.

FIGURE 3-6. NEXUS CABLE-LAYING VESSEL AND OFFSHORE SUBSTATION.

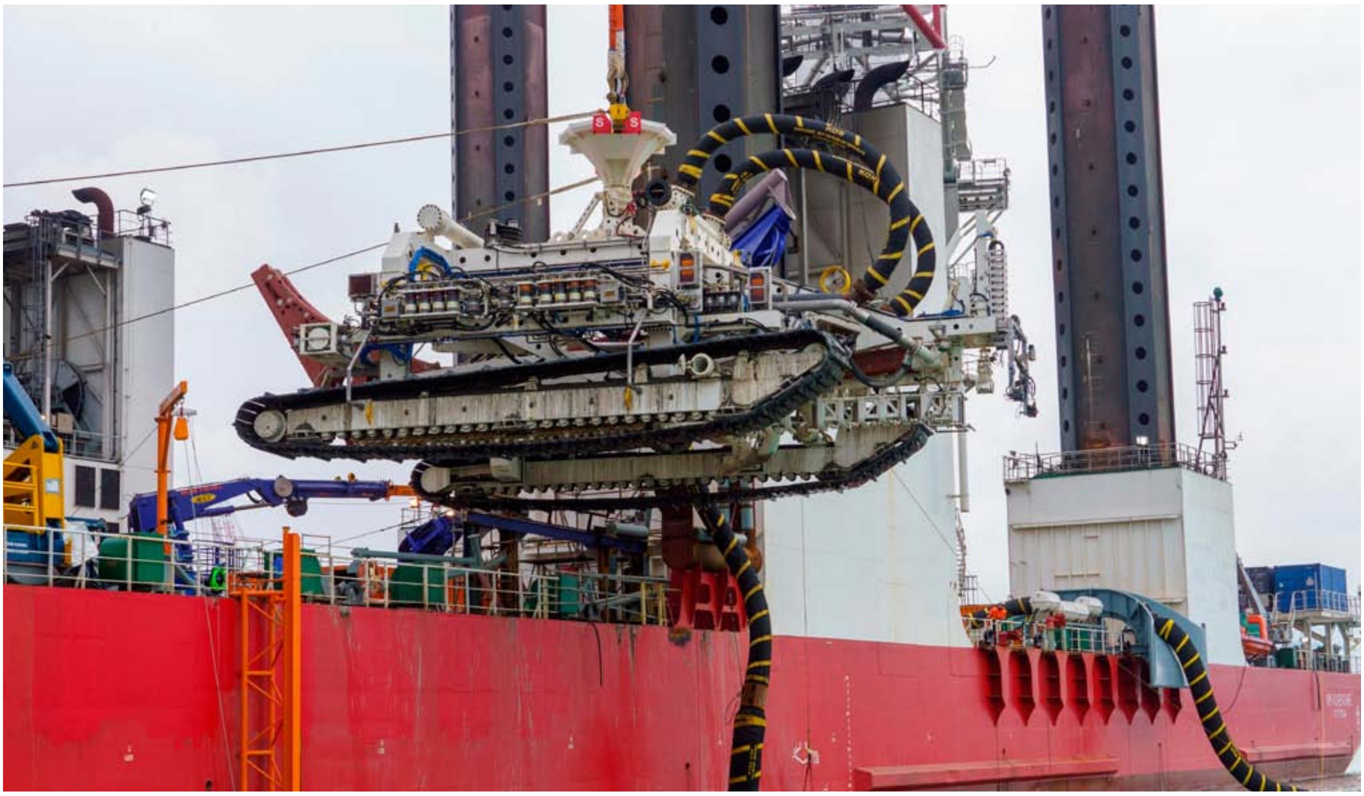

FIGURE 3-7. A SPECIAL DEVICE *DEEP DIG-IT*, WHICH SINKS THE CABLE TO THE SEABED, IS LAUNCHED FROM THE SHIP'S BOARD.

FROM THE FIRST SUBSTATION TO THE CONNECTION POINT (ELERING 330 KV SUBSTATION)

In the first substation, the voltage is raised to 220 kV. Then there are possible solutions:

- 220 kV AC cable (mostly submarine cable) up to the connection point located on the mainland[7], which is Elering's 330 kV substation. Before connecting at 330 kV, there is a substation that raises 220 kV to 330 kV. In the case of a long AC cable of more than 100 km, it is likely that a reactive energy compensation device will be required, consisting of the construction of a platform at sea.
- In the first substation, the voltage is immediately increased to 330 kV, and the cable goes to the mainland to Elering's 330 kV substation. This solution means that the first substation is essentially a 66/330 kV substation (or 66/220 and 220/330), which is expected to have a higher space requirement than the 66/220 kV substation. In addition, it is necessary to set up a reactive energy compensation device, which would consist of setting up a platform at sea.
- A converter station will also be built next to the first substation (at sea or on land), which will convert alternating current (AC) into direct current (DC), and a long DC cable will go to the mainland to Elering's 330 kV substation. A converter station will be built next to Elering's 330 kV substation, in which direct current (DC) will be converted into 330 kV alternating current (AC).

In the case of a direct current cable, it is not necessary to build a reactive energy compensation device in the middle of the cable route, but converter stations are required both in the offshore wind farm area (either offshore or onshore) and near the mainland connection point.

When constructing converter substations and 330 kV substations (which are larger in size and are unlikely to be built on one platform similar to a wind turbine foundation) at sea, it may be expedient to build an artificial island in an offshore wind farm (presumably in the middle) or by setting up a substation on a truss foundation.

7 One variant of the connection application is connection in Saaremaa (e.g., Sikassaare substation), which requires the reconstruction of the transmission network to a voltage of 330 kV in Saaremaa and Muhu, among others.

The route of the submarine cable is not yet precisely defined. The choice of the route is based on the provisions of the order for initiation of the superficies license procedure and the provisions of the Thematic Plan of the Maritime Spatial Plan of the National Spatial Plan (being prepared). It is also based on the specific locations of the onshore transmission system components (which are not defined in the superficies license but in the onshore plans and other relevant documents).

The preferred cable route is, of course, as short as possible, but avoiding nature-sensitive areas (or applying mitigation measures when carrying out work there) and technically complicated areas. For both environmental and technical reasons, the preferred sea depth on the cable route is 10-15 meters, and this is clearly not possible in nearshore and shallow sea areas. The cable is buried in the seabed sediments using a special technique. It is also possible to use directional cable drilling under the seabed to install cables in nature-sensitive areas. That is, before reaching the nature conservation sensitive area, the cable is brought to a depth of up to 10 m below the seabed, and in this way, it is possible to prevent negative effects on the seabed biota.

CONNECTION TO SWEDEN AND/OR LATVIA AND THE BALTIC SEA ENERGY NETWORK

In order to transform energy in Europe, including the Baltic Sea region, into an environmentally friendly and climate-neutral one, in addition to renewable energy power plants (including offshore wind farms), it is necessary to develop high-capacity transnational electricity connections. There are many projects and initiatives in this area, but with a unifying keyword, they can be called the development of the Baltic Sea energy network.

The strategic plans and more specific actions for the Baltic Sea energy network have not yet been finalized and will take years. However, considering only geography, natural conditions (incl. for the construction of offshore wind farms), and human settlements and economic centers, it is logical to expect the connection between Estonia and Sweden to be on the agenda. Also, the need for a connection between the westernmost regions of Estonia and Latvia, operating by sea.

The development of the Baltic Sea energy network is primarily the field of activity of national governments and national electricity system operators (Elering in Estonia). **SWE does not directly plan to develop the Baltic Sea energy network or international connections**, but as a large production unit and due to its suitable location, the proposed offshore wind farm may fit very well into the overall picture.

Therefore, the EIA will also consider the construction of a submarine cable to Latvia and Sweden, and when designing offshore wind farm substations, the possibility of using them in international connections as supportive of the system as possible will be considered. Cooperation with other offshore wind farms potentially being developed in the same area is also possible in the planning of substations and cables from there to the general electricity system (i.e., Elering's 330 kV substations). The exact corridor of the Estonian-Swedish and/or Estonian-Latvian connection is not addressed in this EIA, and its planning and detailed impact assessment will be solved with separate work(s), if necessary.

LAND CROSSING IN SAAREMAA

The electricity transmission system must cross the mainland part of Saaremaa. There are several options. The shortest possible land crossing on the Sõrve peninsula is about 2 km long.

A preliminary analysis of the possible locations of the land crossings takes into account the area bounded on the north by the general cable corridor in the thematic plan of the national plan and on the south by the southern part of the narrower central part of the Sõrve peninsula (see Figure 3-8). During the EIA, the location of the cable corridor will be specified. In order to avoid possible impacts on protected natural objects, directional drilling under the seabed is being considered for cable installation.

An appropriate land-based plan and other necessary documents shall be prepared for the land crossing part, as necessary. If necessary, further studies will be performed.

The land connection in Saaremaa may also include a substation and a converter station located on land.

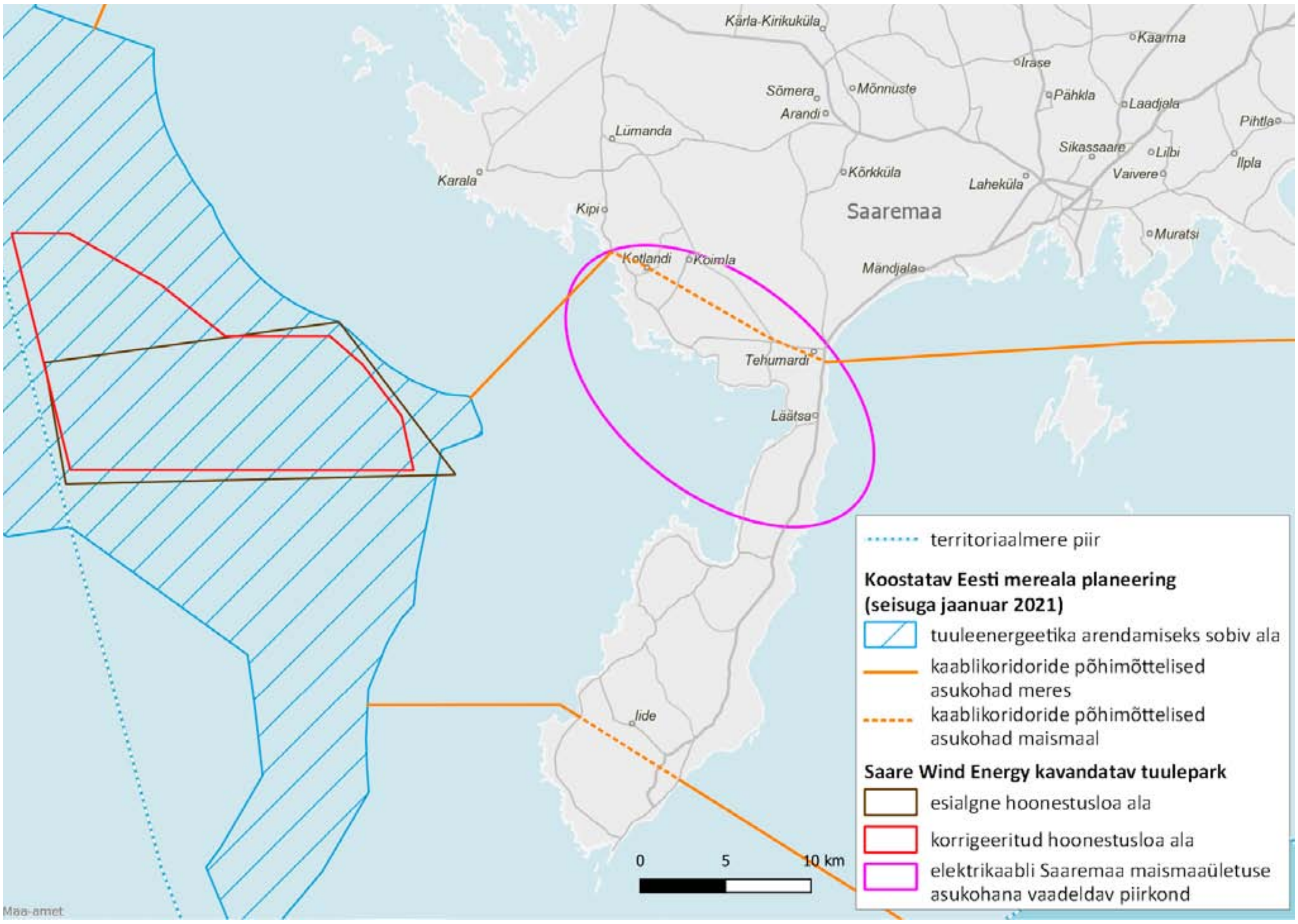

FIGURE 3-8. THE AREA CONSIDERED AS THE LOCATION OF THE SAAREMAA LAND CROSSING OF THE POWER CABLE (PURPLE OVAL - THE OBSERVED AREA WITHIN WHICH THE TRANSMISSION SYSTEM CORRIDOR WILL BE SPECIFIED DURING THE EIA; ORANGE LINE - THE BASIC LOCATION OF THE CABLE CORRIDOR OF THE WIND ENERGY DEVELOPMENT AREAS INDICATED IN THE DRAFT ESTONIAN MARITIME SPATIAL PLAN [8]).

CONNECTION TO THE TRANSMISSION NETWORK IN KURESSAARE

If possible, SWE wants to join Elering's transmission network in Kuressaare at Sikassaare substation. In order to technically implement this solution, it is necessary to bring the current 110 kV system of Lihula-Sikassaare to a voltage of 330 kV.

"Weak connection" between SWE substation and Läätsa (Sikassaare) substation. If there is a technically reasonable solution and in order to improve the electricity supply of Saaremaa, it may be expedient to establish an electrical connection between the SWE substation and the Läätsa (or Sikassaare) substation even if the Sikassaare substation remains at 110 kV (i.e., not suitable for SWE connection to the transmission network).

The idea of a so-called "weak connection" would be, if necessary (i.e., if the electricity system supplying Saaremaa needs additional capacity, but for some reason, it cannot be provided in the direction of transmission from the so-called conventional transmission from the mainland to the island of Muhu) to divert electricity from the SWE substation to the Läätsa (or Sikassaare) substation, which would essentially create alternative equipment and significantly increase the security of supply. Situations where a SWE-scale offshore wind farm does not produce electricity (e.g., due to low winds) to meet Saaremaa's consumption capacity, are very rare.

8 Extract of the Estonian Maritime Spatial Planning portal as of 02.10.2020 < link >

The general plan of Saaremaa municipality (under preparation, as of August 2020) sets out the following activities as planned network developments of electricity supply:

- Sikassaare-Leisi L175 line section of the 110 kV overhead line for separate masts, which is currently located on common masts with the Sikassaare-Valjala L176 overhead line. Width of the protection zone 25 m.
- Reconstruction of Leisi-Järise-Kihelkonna-Läätsa-Sikassaare 35 kV lines into 110 kV overhead lines. Width of protection zone 25 m;
- Laying of the strait dam overhead line into the ground.

FIGURE 3-9. EXTRACT FROM THE GENERAL PLAN OF SAAREMAA MUNICIPALITY, 110 KV OVERHEAD LINE WITH RED LINE (BEING PREPARED AS OF FEBRUARY 2021)

LAND CROSSING IN PÄRNU COUNTY

In Pärnu County, depending on the location of Elering's connection to the transmission network, there are two alternative cable landing areas: Virtsu region and Häädemeeste region (see Figure 3-10).

In the case of the overhead line on the land section after both landing sites, it is necessary to prepare a land plan and other necessary documents. If necessary, further studies will be performed.

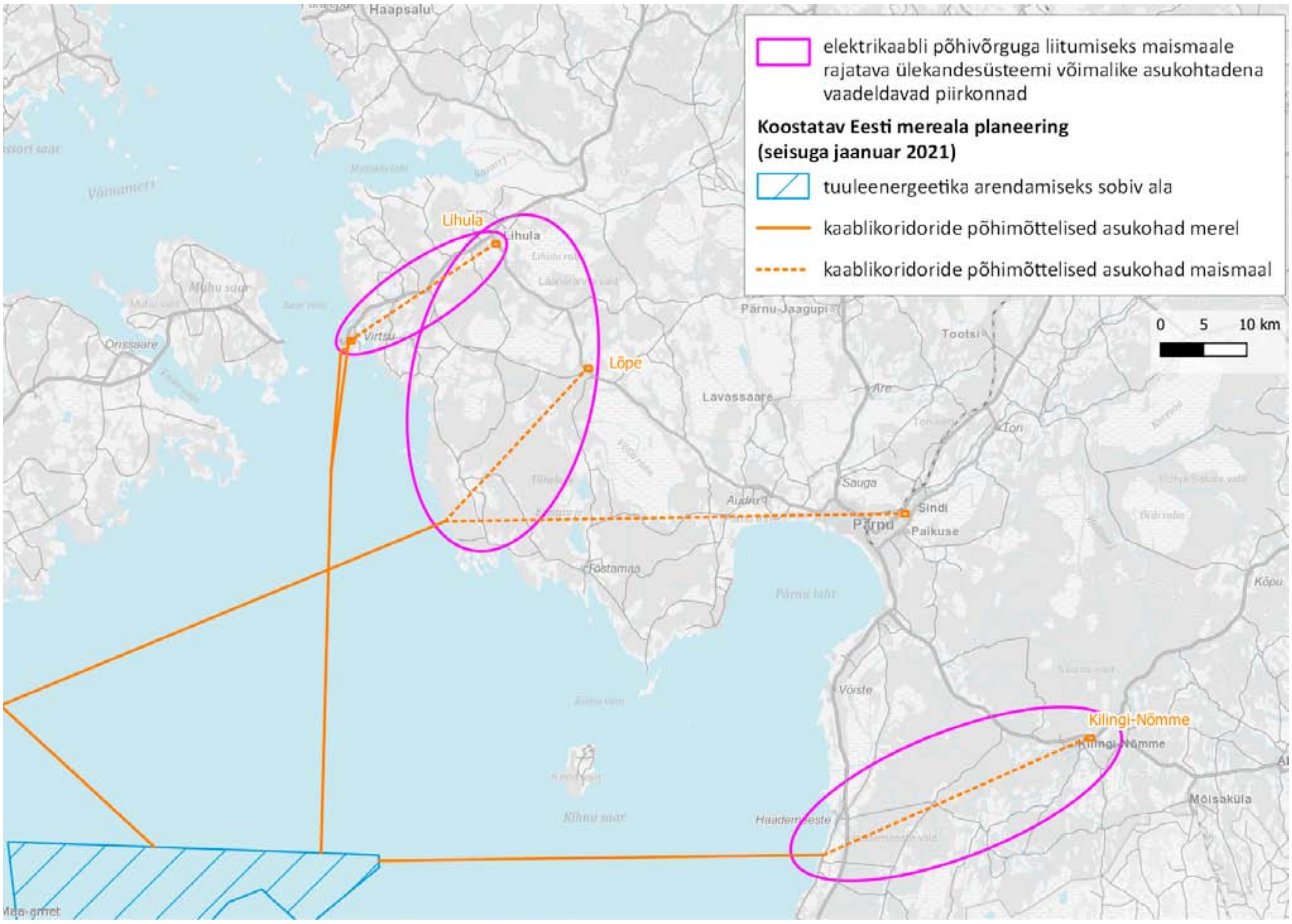

FIGURE 3-10. AREA CONSIDERED AS THE LOCATION OF THE ONSHORE TRANSMISSION SYSTEM TO BE ESTABLISHED FOR CONNECTION OF THE ELECTRICITY CABLE TO THE TRANSMISSION NETWORK (PURPLE OVAL - AREAS CONSIDERED, FROM WHICH ONE AREA IS SELECTED, WHERE THE TRANSMISSION SYSTEM CORRIDOR IS SPECIFIED IN THE COURSE OF THE EIA; ORANGE LINE - BASIC LOCATIONS OF THE CABLE CORRIDOR OF WIND ENERGY DEVELOPMENT AREAS INDICATED IN THE DRAFT ESTONIAN MARITIME SPATIAL PLAN [9]).

3.4. Hydrogen technology

There is currently very rapid development for the wider use of hydrogen in energy. Hydrogen is seen as a promising opportunity for energy storage and use as an energy-dense fuel. There is a huge potential for cooperation and close integration between hydrogen technology and the development of offshore wind energy. Electricity generated by offshore wind farms can produce large amounts of hydrogen both for energy storage (to ensure better integration of offshore wind farms with the electricity system) and for hydrogen fuel, as well as for the use of hydrogen in the gas grid (i.e., instead of or blended with natural gas).

Currently no specific (technical) solutions are planned for SWE offshore wind farms (e.g., hydrogen production in a wind farm and its transportation via pipelines to Saaremaa). At the same time, the SWE offshore wind farm will be developed in such a way that it can join the “hydrogen economy” solutions with minimal upgrades. The EIA report addresses specific development opportunities related to the hydrogen issue and their potential environmental impacts at a conceptual level (i.e., not detailed technical solutions).

9 Extract of the Estonian Maritime Spatial Planning portal as of 02.10.2020 < link >

4. Relationship of the proposed activity with strategic planning documents

The planned activity is the development of an offshore wind farm in the area of the west coast of Saaremaa in the territorial sea and the transmission system until its connection to the general electricity system (transmission network). Based on the nature of the planned activity, the related strategic planning documents can be conditionally divided into the following three groups. Of course, there is an overlap and intertwining between the strategic documents in these groups.

- Strategic energy planning documents.
- Strategy documents dealing with the use of marine waters.
- Strategic development documents deal with the development of Estonia as a whole both at the level of the European Union and at the national level of Estonia.
- Strategic documents on the development of Saaremaa.

4.1. Strategy documents at EU level

Short overview of European Union climate and energy strategic level documents. Not translated.

4.2. Estonian national strategic documents

4.2.1. Strategic development documents concerning the development of Estonia as a whole

4.2.2.Strategic planning documents in the field of energy, environment and climate policy

Short overview of Estonian climate and energy strategic level documents. Not translated.

4.2.3. Maritime Spatial Planning and Marine Strategy

The most recent strategic document on the use of marine waters and uniting all areas is the **Estonian Maritime Spatial Plan**. It is a thematic plan of the national plan, which covers the entire Estonian marine area, except for the marine areas in Pärnu County and Hiiumaa that have already been prepared as county plans. The plan is still being prepared.

The aim of marine area planning is to agree on the principles of the use of the Estonian marine area in the long term in order to contribute to the achievement and preservation of the good status of the marine environment and to promote the marine economy. The plan identified the areas and conditions under which activities in the marine area could be carried out. During the preparation of the marine area planning, the synergies between activities already underway and those planned to be carried out were considered. Furthermore, the impact on the marine environment and the economy, as well as the social and cultural impact of the activities, was also assessed. The plan defines, among other things, areas, guidelines, and conditions suitable for the development of wind energy.

Short overview of Estonian Marine Strategy. Not translated.

4.2.4. Strategic development documents concerning the development of Saaremaa

Short overview of Saaremaa strategic level documents. Not translated.

5.

Description of the environment expected to be affected

5.1 Natural environment

5.1.1 THE Baltic Sea [10]

The marine environment conditions in the offshore wind farm area are largely due to the general characteristics of the Baltic Sea.

The Baltic Sea, with an area of about 370,000 km^2 (including the Danish Straits and the Kattegat, about 415,000 km^2), is an inland sea in the western Atlantic, with a narrow and shallow connection to the world sea only through the Danish straits. The Baltic Sea is one of the largest brackish water bodies in the world.

Due to its relative closure, the Baltic Sea is one of the seas under the strongest human impact in the world. The state of the Baltic Sea environment is most affected by eutrophication, pollutant loads, fish catches, and the introduction of alien species. The main pressure factor for eutrophication both in the Baltic Sea as a whole and in the Estonian marine area is the excessive nutrient load from land, especially from the use of fertilizers, as a result of human activities. The main pressure factor for pollutant loads is the discharge of pollutants into water bodies or the atmosphere from industry, transport, or domestic use. One of the sources of pollutants is also precipitation, through which pollutants in the atmosphere enter and fall into the sea.[11]

The Baltic Sea is a shallow sea with an average depth of 50-55 meters, with about 20% of the Baltic Sea being less than 10 meters deep. The volume of water in the Baltic Sea is about 20,000 km^3 (including the Danish Straits and the Kattegat 21,000 km^3). The small connection of the Baltic Sea to the world sea causes low salinity, which decreases the farther away to move from the Danish straits. The average salinity of the World Sea is 35 per mille (3.5%), while in the Baltic Sea, it is only 0.9%. The salinity of the water decreases from the Danish straits towards the Gulf of Finland and the Gulf of Bothnia. The inflow of rivers and the fact that there is more precipitation on the sea surface than evaporation cause the total outflow of water from the Baltic Sea. To some extent (depending on weather conditions and water levels), there is also an inflow of brackish water of the order of 500 km^3 per year (but this varies considerably from year to year). The average water exchange in the Baltic Sea is only about 2-3% per year.

5.1.2. Geological conditions[12]

The geology of Saaremaa has been relatively well studied, especially with the geological mapping and specific scientific research carried out by the Estonian Geological Survey and the Institute of Geology of the Estonian Academy of Sciences over the decades. Marine geology has been directly studied to a significantly less extent. In the marine area, higher quality systemic seismic profiling was started in the 1990s in cooperation with Swedish

10 The county planning materials of the marine area bordering Pärnu County have been used in compiling the chapter (Pärnu County Government / Hendrikson & Ko 2016).

11 Ministry of the Environment, 2019. Environmental status of the Estonian marine area 2018 < link >

12 The book "Saaremaa" by the Estonian Encyclopaedia Publishers and TUT Kuressaare College (2002) is used as one of the sources for compiling the chapter.

geologists. Due to the focus of the studies, a technique was used that provides a deeper range of information but, therefore, a lower resolution (e.g., to characterize Quaternary sediments). However, some study profiles are also quite accurate in this respect.

Based on the information available today, the area of the SWE offshore wind farm is in the open area of the Jaagarahu, Rootsiküla, and Paadla deposits in the Silurian deposit, where various limestones have formed in low sea conditions. According to the available information, the limestone is covered with thin Quaternary sediments or even exposed on the seabed.

Baltic Sea-wide mapping, such as the EMODnet geology pilot project (Figure 5-1) and the Interreg project BALANCE, have mainly used existing data from previous surveys from archives to describe the nature of the seabed of the Estonian marine area. Based on the analysis and classification used within the EMODnet project, muddy sediments are the most abundant in the Estonian sea area. Till, sand, and coarse-grained sediments (pebbles) are also common. To a lesser extent, there are areas with rocky soils or areas are classified as areas with mixed sediments[13].

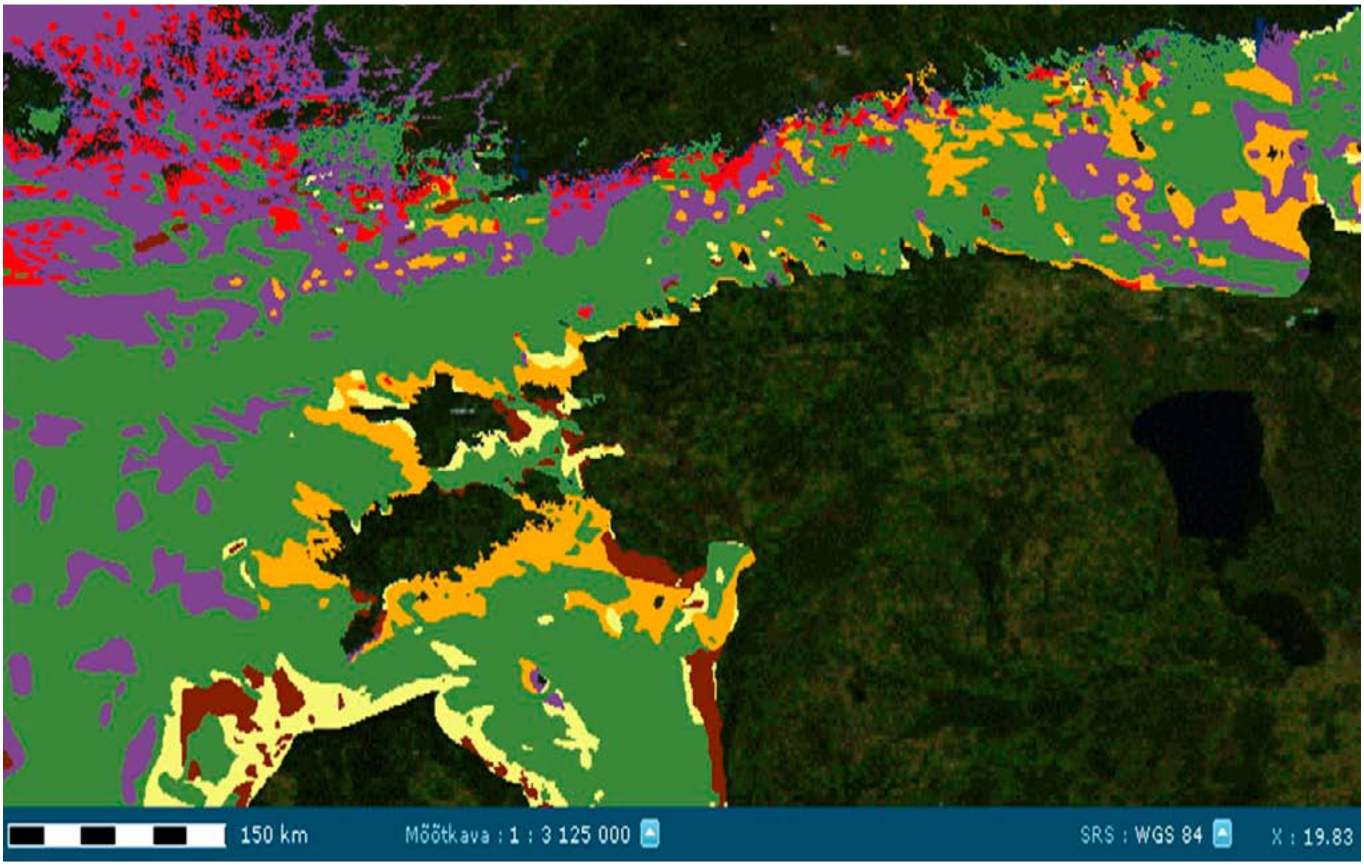

FIGURE 5-1. ACCORDING TO THE DATA OF THE EMODNET PILOT PROJECT, THE NORTHERN SUBSTRATE OF THE ESTONIAN MARINE AREA AND NEIGHBORING AREAS[14]. CLASSES: GREEN - MUD TO SANDY MUD; LIGHT YELLOW - SAND TO MUDDY SAND; BROWN - COARSE-GRAINED SEDIMENT; PURPLE - MIXED SEDIMENT; DARK YELLOW - TILL; RED - BEDROCK.

Based on this figure, mud and sand mud sediments and till sediments lie in the area of the SWE planned wind farm.

5.1.3. General climatic conditions[15]

Estonia is characterized by **a temperate climate with a transition from the maritime to the continental climate.** The western part of Saaremaa is one of the regions with the most explicit maritime climate in Estonia.

13 Tallinn University of Technology Marine Systems Institute, OÜ Alkranel) "Estonian Marine Strategy Action Plan for Achieving and Maintaining Good Environmental Status of the Estonian Marine Area and the Strategic Assessment of the Environmental Impact. Report 2015-2016 ".

14 < link > The map has been published by the Estonian Maritime Institute of the University of Tartu (2012) and has been used to achieve and maintain the good environmental status of the Estonian marine area in the SEA.

15 The Estonian Encyclopaedia Publishing House and TUT Kuressaare College (2002) have used the book "Saaremaa" and the draft impact assessment report of the Estonian Maritime Spatial Plan (OÜ Hendrikson & Ko, version 03.07.2020) as sources for compiling the chapter.

The characteristics of the maritime climate - long warm autumn, mild winter, late cool spring, strong winds, plenty of sunshine, and low rainfall, especially in early summer - are most evident on the west coast of Saaremaa and in Sõrve. Compared to mainland Estonia, the snow conditions in Saaremaa have been very variable over the years. In severe winters, when most of the coastal sea is covered by ice, the mitigating effect of the sea on the climate weakens, and disparities with the hinterland gradually begin to diminish. In mild winters, however, the coastal sea of Saaremaa does not significantly freeze.

HUMIDITY is always higher by the sea in warm weather than inland. For example, in May, when the relative humidity varies the most within Estonia, it reaches 65-70% in Saaremaa at noon, even over 75% directly on the coast, but remains at 50-55% in most of Inland Estonia. At the same time, Saaremaa is one of the regions with the lowest **rainfall in** Estonia. Early summer is especially dry. It rains the least on the coast.

THE WIND. The Estonian wind climate is shaped by the frequent low-pressure and high-pressure alternation, or cyclonic activity, characteristic of the northern part of the temperate zone, which causes windy weather. The strongest winds and more frequent storms are characteristic of the period from October to January; days with weaker winds and more calm usually occur between May and August. The average annual wind speed in the sea area west of the islands is 8.5-9 meters per second, with gusts of wind over 30 m/s. The average annual wind speed in the open middle part of the Gulf of Riga is 8 to 8.5 m/s with gusts of 26 to 28 m/s. The winds of the Väinamere Sea are heavily shaded by islands and the mainland, with annual average wind speeds of less than 8 m/s. However, gusts can still exceed 29 m/s. In the Gulf of Finland, both wind speed and gust strength are clearly decreasing in a west-east direction: in the open western part of the bay, the average wind speed is 8–8.8 m/s; in the east, only 7–7.5 m/s and gusts> 30 m/s and below 28 m/s, respectively. The climate of Saaremaa is characterized by strong winds. The average wind speed is much higher on the seashore than inland, with several times more frequent storms. In the windiest area, on the coast of Western Saaremaa, the average wind speed exceeds 6 m/s; in the inner part of Saaremaa, it is less than 5 m/s. Vilsandi has the most storm days (wind speed over 15 m/s) - 41 per year - while in Central Estonia, the number of stormy days is only 5.

The direct impact of the Baltic Sea on winds is mainly limited to islands and coastal areas (approximately 10 km from the coast to the sea and a 20 km wide zone inland), where the wind force that has accumulated speed over a wide water field decreases due to land obstacles.

According to the Estonian Maritime Spatial Plan Impact Assessment Report (Hendrikson & Ko, 2020), the long-term average wind energy (energy density, W/m ^{2}) at an altitude of 150 m in the central part of the Gulf of Riga on average 700–780 W/m^2 and west of Saaremaa 810–880 W/m^2, at Hiiumaa 800–840 W/m^2, in the Gulf of Finland, the energy density decreases from the western part (750 W/m^2) to the east (550 W/m^2).

The proposed SWE offshore wind farm area has good wind conditions. Southwest winds are the most common, and this direction is also the most energy-rich. The available wind data, both from the modeled databases and compared to the long-term data of Vilsandi weather station, are sufficient to plan the location of the wind turbines of the offshore wind farm within the framework of the EIA.

5.1.4. Seawater quality, waves, and currents [16]

Water temperature and salinity largely determine the ecosystem characteristics of the area, including, e.g., species composition. The temperature and salinity fields of the Baltic Sea are characterized by great variation in time and space, due to complex topography, strong gradients both horizontally and vertically, and great variability of the atmosphere at different time scales.

SALINITY AND TEMPERATURE. The Baltic Sea is characterized by very low water exchange with the world sea, which results in low salinity, which in turn decreases when moving away from the Danish straits. While the average salinity of the world's seas is 35 per mille, in the Baltic Sea it is usually less than 10 per mille. Salinity also varies at

16 The materials of the Estonian Maritime Spatial plan < link > and the draft reports of the impact assessment of the Estonian Maritime Spatial Plan (OÜ Hendrikson & Ko, version 03.07.2020) have been used in compiling the chapter.

different depths. The saltier water is in the deeper water layer, the steeper change in salinity usually takes place in the 50-80 meter zone or halocline. Saltier water flows deeper due to its higher specific gravity. Less salty surface water flows out of the Baltic Sea.

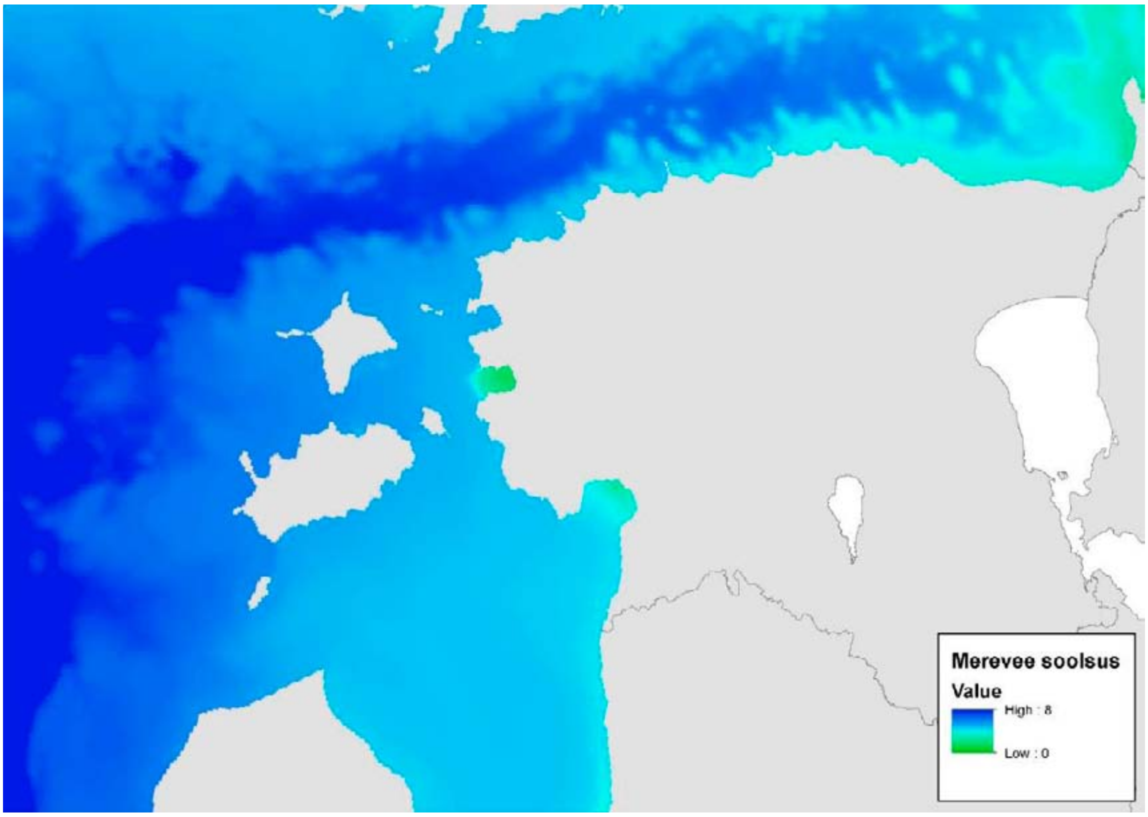

FIGURE 15-2. AVERAGE SALINITY OF SURFACE WATER IN THE ESTONIAN MARINE AREA. BASELINE SALINITY DATA COME FROM THE COPERNICUS PORTAL[17].

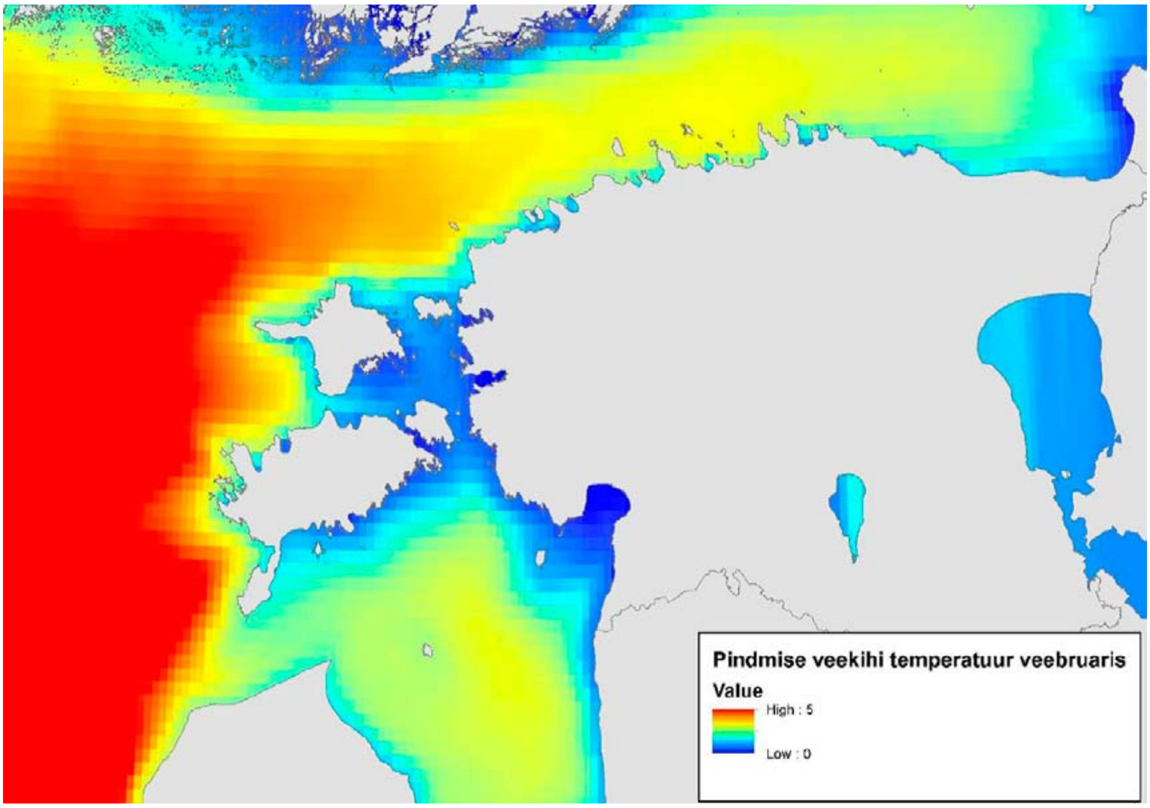

FIGURE 5-3. AVERAGE SURFACE WATER TEMPERATURE IN THE ESTONIAN MARINE AREA IN FEBRUARY. BASIC TEMPERATURE DATA ARE FROM THE COPERNICUS PORTAL[18].

17 Basic data and research in aquaculture in the Estonian marine area, University of Tartu Estonian Marine Institute 2020

18 Basic data and research in aquaculture in the Estonian marine area, University of Tartu Estonian Marine Institute 2020

WAVES, CURRENTS, AND WATER LEVEL CHANGES. The nature of the waves and currents in the Estonian marine area is shaped by the wind climate (direction and strength of the wind). Water flow along the Estonian coast in the eastern direction is more common. The characteristic current velocity in the surface layer of the Estonian marine area is 10–20 cm/s. However, currents are highly volatile and highly dependent on the local wind. Maximum current velocities in excess of 1 m/s have been recorded for occasional strong coastal jets in the straits (e.g., Suur Strait) and along the coast (e.g., Gulf of Finland). Intense currents with a speed of 40–50 cm/s can also occur in the deeper layers of the sea (incl. near the seabed).

Temporary, short-term elevations and decreases in water levels depend on the topography of the coast and local wind conditions. The changes in water level are smallest on the high seas coast and increase towards the eastern part of the Gulf of Finland and the bays on the west coast of the mainland: Gulf of Riga, more narrowly Pärnu Bay, as well as Haapsalu Bay. The water level is raised by strong western winds and lowered by east winds. In extreme cases, the fluctuations are 2–2.5 m above the average water level and 1.2 m below the average water level.

The wave height is usually 1-2 m, the offshore wave height is 5-6 m during a storm, and up to 10 m during an exceptional western storm. The wave height reaches 6 m in the Gulf of Finland and 3-4 m in the Gulf of Riga.

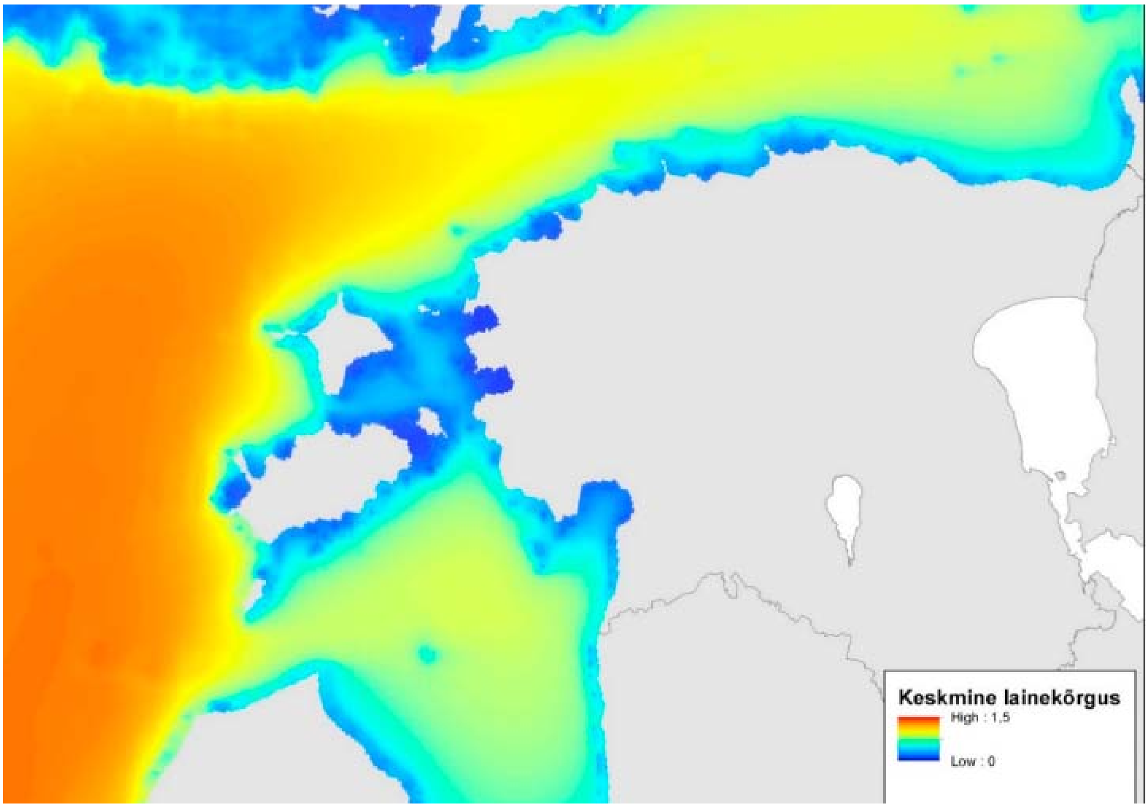

FIGURE 5-4. AVERAGE WAVE HEIGHT OF THE ESTONIAN MARINE AREA (M) THE WAVE DATA COME FROM THE COPERNICUS PORTAL[19].

ICE CONDITIONS. One of the basic studies in compiling the Estonian Maritime Spatial Plan was "Analysis of ice conditions and compilation of maps" (Institute of Marine Systems at TUT, 2016[20]). According to this study, ice cover occurs in the Estonian marine every year, at least in the Gulf of Pärnu and the Väinameri Sea. In extremely mild winters (e.g., 2007/2008), ice is only found in Pärnu Bay and the Gulfs of Väinameri. In severe winters (e.g., 2010/2011), the entire Estonian marine area is covered with ice, and even on the west coast of Hiiumaa and Saaremaa, ice occurs within 30 days (in terms of the number of days it is important to know the methodology used -the start and end days are the 10-day average ice concentration of at least 10% at the observed network point).

19 Basic data and research in aquaculture in the Estonian marine area, University of Tartu Estonian Marine Institute 2020

20 "Analysis of ice conditions and compilation of maps", Institute of Marine Systems at TUT, 2016

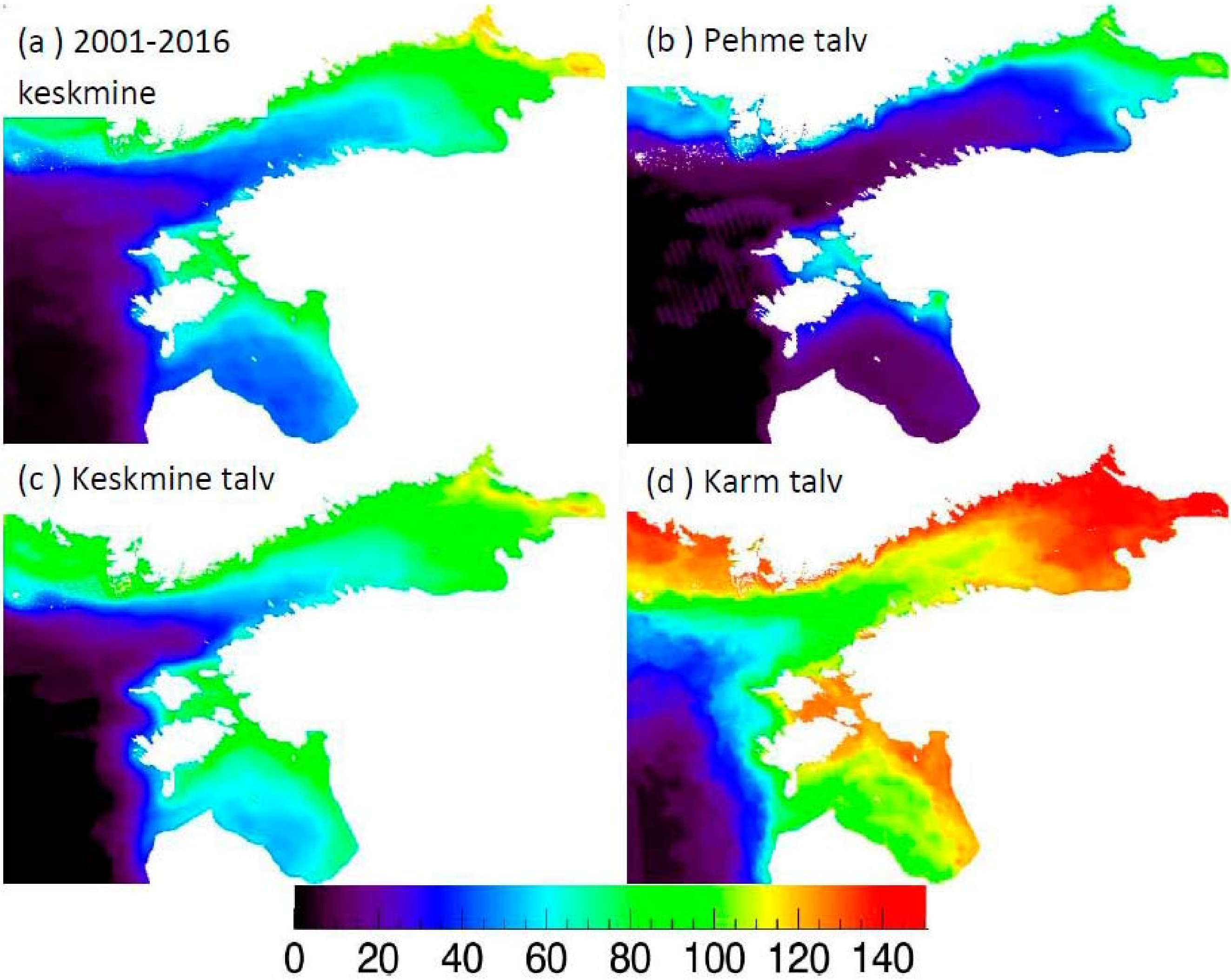

FIGURE 15-5. THE AVERAGE DURATION OF THE ICE SEASON (A) IN DAYS IN THE PERIOD 2000-2016 AT EACH NETWORK POINT. DURATION OF THE ICE SEASON IN DAYS FOR DIFFERENT WINTER SCENARIOS: (B) AVERAGE OF MILD WINTERS, (C) AVERAGE OF MEDIUM WINTERS, AND (D) AVERAGE OF SEVERE WINTERS[21].

Drifting ice occurs mainly in areas with a shorter average duration of ice cover - the western and central parts of the Gulf of Finland, the open part of the Gulf of Riga, and the western coast of Saaremaa.

Looking at the ice conditions in the Estonian sea area by region, the study points out that the western coasts of Saaremaa and Hiiumaa have the mildest ice conditions, where ice cover occurs only in severe winters for up to 30 days. Only in closed bays can the ice cover last for three months. Drift ice in the western part of Saaremaa in severe winters (average speed up to 0.03 m/s) may pose a threat to marine facilities.

SEAWATER QUALITY is a set of indicator values and status assessments used to assess the status of seawater. The composite status used to characterize coastal waters consists of two parts: ecological status and chemical status.

Transparency is an important indicator of the quality of the marine environment. The availability of light determines the possibility of primary water photosynthesis in the marine environment. In general, the transparency of water is higher on the high seas (in the Estonian marine area, for example, in the Eastern Gotland Basin and the northern part of the Baltic Sea) and lower in the Gulf of Riga and the Gulf of Finland.

The figure below shows the Estonian coastal water bodies and their aggregate status according to the 2019 assessment. The overall status class of the coastal water body of Kihelkonna bay is poor. Based on the status information of 2019 (Environmental Agency, 2020), the ecological status of the coastal water body of Kihelkonna is poor (due to nutrients, deficiency of the assessment system), and the chemical status is poor (Hg in fish).

21 "Analysis of ice conditions and compilation of maps", Institute of Marine Systems at TUT, 2016

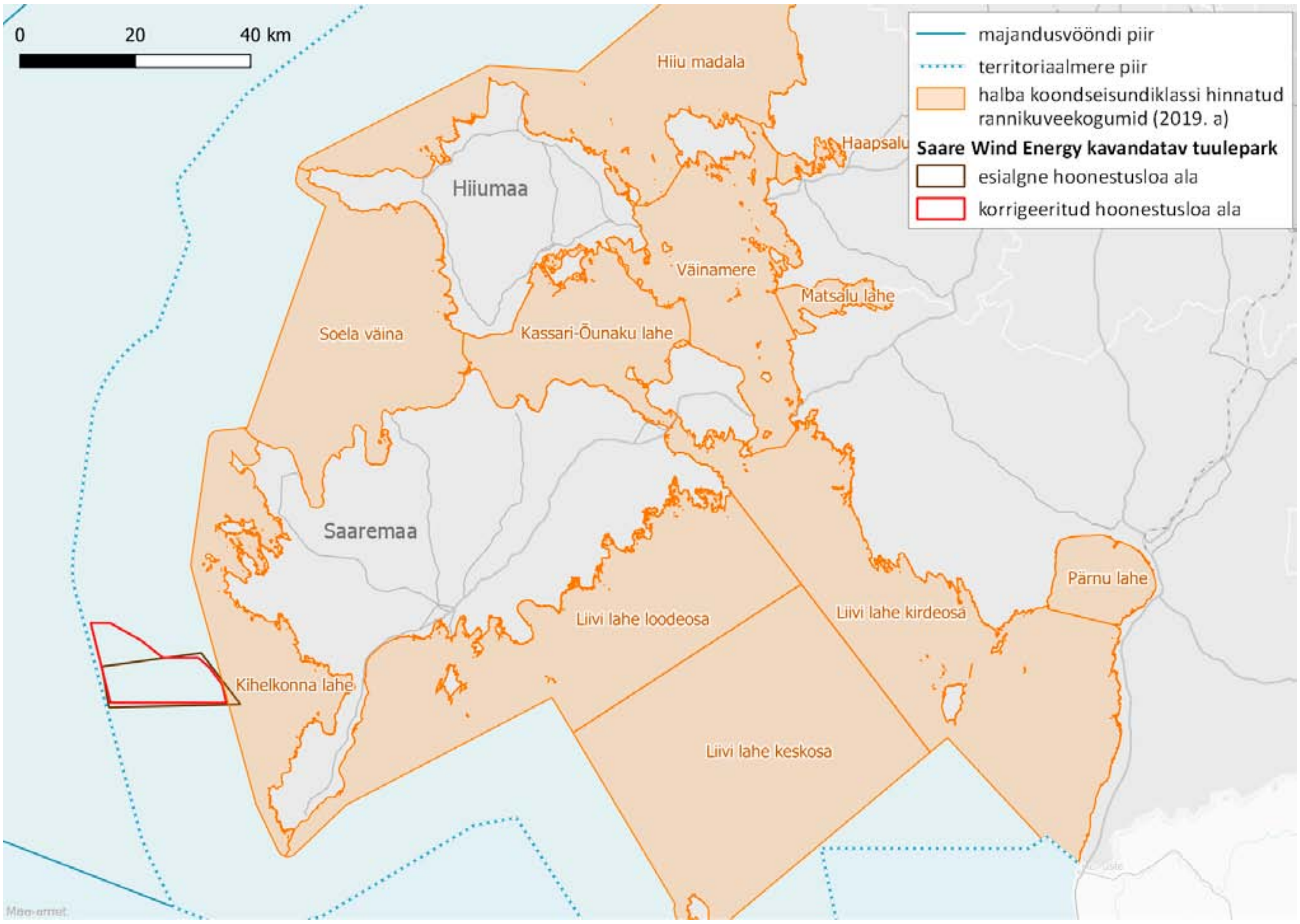

FIGURE 5-6. AGGREGATE STATUS OF ESTONIAN COASTAL WATER BODIES BASED ON THE 2019 ASSESSMENT[22].

According to the data of the Ministry of the Environment, according to the latest assessment of the environmental status of the marine area, the majority of Estonian marine areas have not reached the level of Good Environmental Status (GES). Good Environmental Status has only been achieved for the criteria "*Seabed Habitats*" and "*Change in Hydrographic Conditions*."[23] Data from the Estonian National Marine Environment Monitoring show that both the winter concentrations of inorganic nitrogen and phosphorus compounds and the summer average concentrations of total nitrogen and phosphorus are far above the desired level.

Hindamise kokkuvõte

SEISUND			**SURVE**
Bioloogiline mitmekesisus	HALB	HALB	Võõrliigid
linnud	HALB	HALB	Kalandus
kalad	HALB	HALB	eutrofeerumine
imetajad	HALB	HEA	Hüdrograafiliste tingimuste muutmine
Veesamba elupaigad	HALB	HALB	Saasteained
Mereökosüsteem ja toiduvõrgud	HALB	HALB	Mereprügi
Merepõhja elupaigad	HEA	N/A	Veealune müra

FIGURE 15-7. SUMMARY OF THE ASSESSMENT OF THE CONDITION OF THE ESTONIAN MARINE AREA BY COMPONENTS OF THE MARINE ECOSYSTEM[26]

22 Environment Agency, 2020. Surface water and groundwater status – interactive map < *link* *>*

23 Environmental status of the Estonian marine area 2018 < *link* *>*

PHYSICAL AND CHEMICAL CHARACTERISTICS OF WATER AT SAMPLING POINTS. Water samples have been taken from specific locations at sea, and the physical and chemical parameters of the water in the SWE offshore wind farm area and region have been determined in previous years, both as part of the marine monitoring program and in other studies. Indicators were determined at ten stations in the framework of the study "Seabed biota and habitat survey to assess the distribution of Natura and HELCOM habitat types and to elucidate the potential of marine CO_2 sequestration" (Estonian Marine Institute, University of Tartu, 2020). The vertical soundings of the water column showed that at the time of the measurements, on 22 July 2019, this was a situation stratified by both temperature and salinity. At all stations, all measured parameters showed quite similar depth curves.

At the time of the measurements, the temperature of the surface water layer was above 18° C, while the temperature of the bottom water layer was slightly above 4° C. The difference in salinity of seawater was also almost one unit of salinity (surface 6.8 and bottom 7.6) between the surface and bottom water layers. Fluorescence showed a peak at a depth of 5 m, after which the chlorophyll content in the water column gradually decreased. Oxygen saturation was 100% or more for the entire water column. CO_2 content and partial pressure increased with increasing depth. The pH dropped from 8.4 units on the surface to 7.6 in the bottom layer. All these indicators were characteristic of the mid-summer indicators of the open Baltic Sea, and no anomalies were found in the study area at the time of the observations.

5.1.5. Marine biota

SEABED HABITATS AND BIOTA [24]

SEABED BIOTA. In the Estonian marine area, macroscopic seabed biota is formed of flora (large algae and higher plants) and benthic fauna. In terms of species composition, the biota is quite diverse, with both marine and freshwater species.

SEABED VEGETATION. Based on the data of the years 1992-2018, 60 large plant taxa have been registered in the Estonian sea area (incl. 57 species and taxa *Ulotrix*, *Pseudolithodermaja Fontinalis* determined to the family level). The most frequently occurring species in the Estonian marine area are V*ertebrata fucoides*, *Cladophora glomerata,* and *Ceramium tenuicorne*. The species/ taxa of the brown algae are the most abundant in the Estonian marine area. The differences between vegetation species/taxa in the HELCOM sub-basins are relatively small, with the Gulf of Riga being the most abundant in species.

LARGE INVERTEBRATES. Based on the data of the years 1992-2018, 92 benthic taxa (including 73 species and 19 taxa) have been registered in the Estonian marine area.

The most frequently occurring invertebrates in the Estonian marine area are the blue mussel (*Mytilus trossulus*), Baltic clam (*Limecola balthica*), and barnacle attaching to the substrate (*Amphibalanus improvisus*). 59% of the benthic species/taxa belong to the arthropod family. Species diversity is highest in the Gulf of Riga lower basin and lowest in the eastern Gotland Basin.

MARINE PROTECTED HABITATS. In the European Union, habitat types important for nature conservation are listed in Annex I of the Habitats Directive (92/43/EEC on the conservation of natural habitats and of wild fauna and flora), which brings together habitat types from land, sea, and freshwater bodies. There are a total of eight marine habitat types in Annex I of the Habitats Directive, of which six occur in the Estonian marine area (in brackets the Habitats Directive Annex I code):

- sandbanks flooded with seawater (1110, hereinafter "sandbanks"),
- river estuaries (1130),
- mudflats and sandflats (1140, hereinafter "flats") expose with a low tide,

24 The materials of the Estonian Maritime Spatial Plan <link>, the study "Seabed biota and habitat study to assess the distribution of Natura and HELCOM habitat types and to elucidate the potential for marine CO_2sequestration", Estonian Maritime Institute of the University of Tartu, 2020 and Estonian Maritime Institute of UT, Institute of Marine Systems of TUT "Offshore Monitoring", 2016<link>.

- coastal lagoons (1150),
- wide shallow coves and bays (1160),
- reefs (1170).

Sandbanks and reefs can be considered seabed habitat types fully as they are not related to the shape of the coastline or the land. Offshore conditions in the high seas preclude the occurrence of estuaries, sandflats, coastal lagoons, and wide shallow coves and bays, as all these habitat types are directly linked to the coastline.

Mapping of seabed habitats was started in Estonia in 2005, and as of spring 2019, approximately one third (38%) of the entire Estonian marine area is covered by inventories. With regard to the extent of the marine area covered by the inventories, it should be borne in mind that the coverage estimate is obtained by summing the areas of the survey plots of all mapping areas, regardless of the specific mapping methods and the density of the sampling point network. In 2018, modeling of the distribution of reefs and sandbanks habitat types for the entire Estonian sea area was performed on the basis of available materials. During the review, a map was also compiled on the level of detail of previous studies. The density of the sample points determines the reliability of the models. According to the Marine Strategy Framework Directive (MSRD), large-scale habitats need to be taken into account when assessing the state of the environment. EU Commission Decision 2017/848 31, which establishes the main types of MSRD seabed habitats, has only recently been published, and therefore MSRD seabed habitats have not yet been mapped in Estonia. However, in 2018, modeling of the distribution of the main types of MSRD seabed habitats was carried out, which is based on the same raw data as the previous modeling of the Habitats Directive habitats. The mereRITA project "Innovative solutions for the assessment and monitoring of the Estonian marine environment and natural values" is underway[25], in the course of which a number of innovative solutions will be developed to enable the mapping and assessment of marine ecosystems and the development of the blue economy.

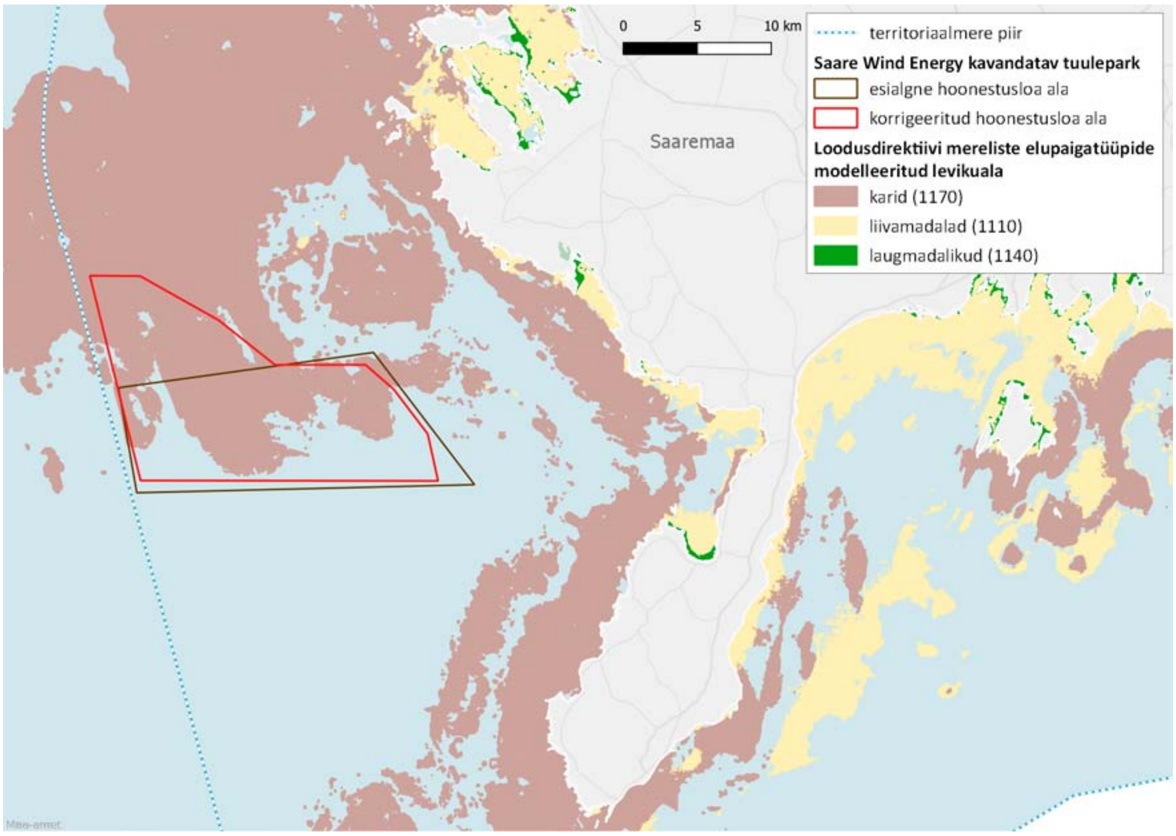

FIGURE 25-8. DISTRIBUTION OF HABITATS DIRECTIVE HABITAT TYPES[26].

25 < link >

26 Updating map data of Estonian marine habitats. Version 2: 05.04.2018. University of Tartu, 2018

The study "Seabed biota and habitat survey to assess the distribution of Natura and HELCOM habitat types and to elucidate the potential for marine CO_2 sequestration" completed in 2020 (Estonian Marine Institute of the University of Tartu, 2020) was an important additional work in the draft Estonian Maritime Spatial Plan to specify the environmental conditions of areas suitable for the development of wind energy in the west of Saaremaa

The SWE offshore wind farm area is located in the 2020 survey area, covering its southern part.

The study "Seabed biota and habitat survey to assess the distribution of Natura and HELCOM habitat types and to elucidate the potential for marine CO_2 sequestration" (Estonian Marine Institute, University of Tartu, 2020) found that there are no sandbanks in the study area (and thus in the SWE offshore wind farm). The presence of sandbanks was technically possible at six sampling points where the biomass requirements for substrate, footage zone, and sediment shellfish were met. However, as an expert opinion, it was decided not to classify them as a habitat for sandbanks, as it was often seen in the video that the sand swathes covered the limestone slab. Such sands in a thin and mobile layer on the bedrock do not form permanent habitats. The sampling points were located at a very large depth (23–32 m) in the sense of sandbanks, which is within the distribution range of benthic vegetation based on the video observations of this study. The Habitats Directive states that sandbanks should generally not be deeper than 20 m. In view of these circumstances - mobile sands on a limestone basement, high depth, offshore conditions - it was found that there are no areas classified as sandbanks in the study area.

Simultaneous fulfillment of the criteria for benthic substrate and biota is necessary for the assignment of the habitat type of reefs to the marine area. For the bottom substrate, a total proportion of> 50% of hard substrate types (small rocks 6.4-20 cm, large rocks> 20 cm, and rock) is required. For biota, total coverage of ≥ 10% for one or all bioindicators is required. Depth is not limited.

During the inventory, the distribution of habitat type 1170 (reefs) of the Habitats Directive was identified in the study area (in the total area of 228 km ^{2}, 48% of the study area). No other seabed habitat types or species referred to in the directives or other lists of natural values were found in the study area.

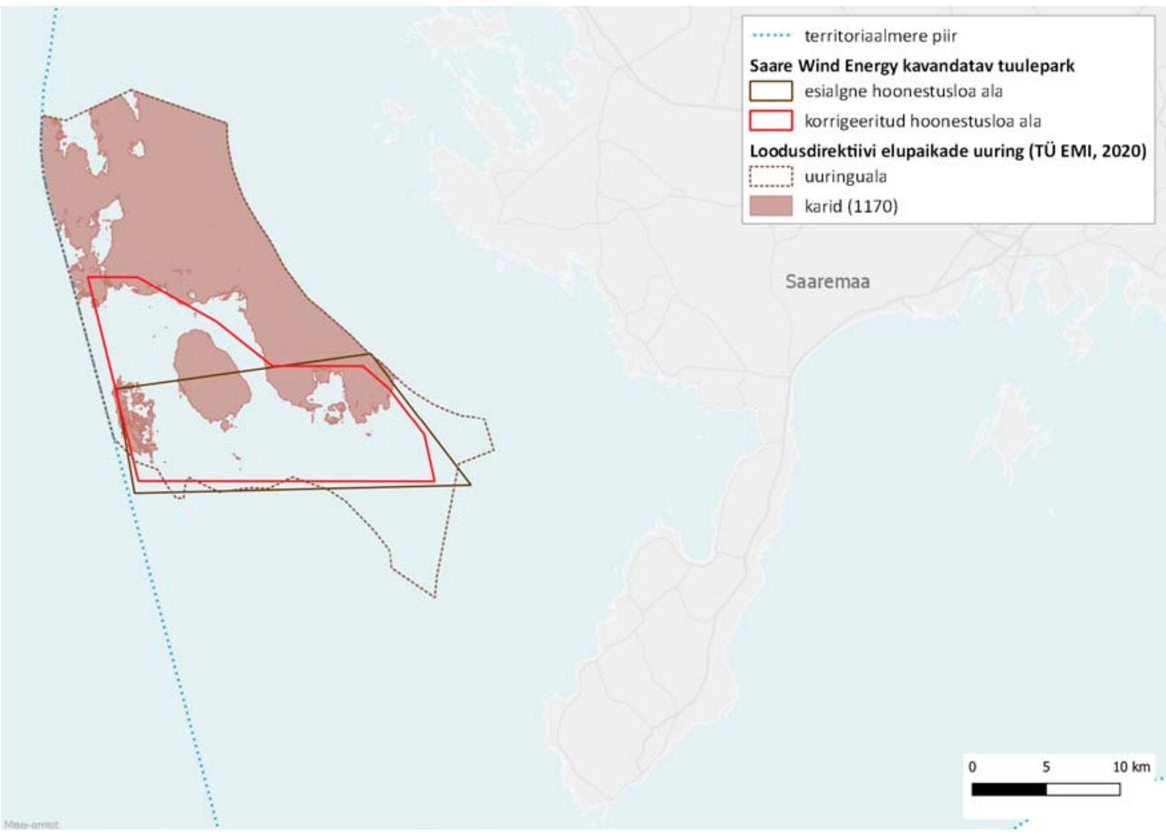

FIGURE 25-9. HABITAT DIRECTIVE 1170 (REEFS) DISTRIBUTION IN THE STUDY AREA [27]

27 "Study of seabed biota and habitats to assess the distribution of Natura and HELCOM habitat types and to elucidate the potential for marine CO_2 sequestration", Estonian Marine Institute, UT, 2020

The presence of a habitat type in the Habitats Directive in an area does not in itself require its separate conservation. According to the information available, the habitat type of reefs in the sea area under Estonian jurisdiction is 3421.3 km^2. The existing natural areas in Estonia cover 19.2% of this. The Estonian areas (including both sites of community importance and special protection areas) offered into the HELCOM network of marine protected areas cover 27.8% of the reef habitat type present in all Estonian marine areas. Estonia has reported that the reefs of the habitat type in the Estonian marine area are in a favorable nature conservation status.

There is currently no methodology to prioritize certain habitat fragments or components within the existing Habitats Directive from a nature conservation point of view. In the surveyed study area, prioritization was performed into four groups: the entire photic zone, depth less than 20 meters, depth less than 15 meters, and total benthic vegetation coverage of more than 10%.

The total coverage of benthic vegetation is best related to the species richness of seabed communities. In the study area, the cover rates of benthic vegetation were mostly quite low. Reefs with a benthic community cover of more than 10% made up 7.3% of the survey area and covered 34.4 km^2 of larger and smaller patches in the seabed area. The highest concentration of batches was in the north-eastern and northern parts of the study area. As a result of the prioritization, the presence of 1170 fragments of the biologically and ecologically more valuable habitat type 1170 is concentrated in the north-eastern and northern parts of the study area.

The conclusion of the study of the Estonian Maritime Institute of the University of Tartu (2020) was as follows: Considering that no sites of nature conservation importance other than the network were sufficiently identified in the study area, and having regard also to the two potential new marine protected areas in the immediate vicinity of the study area (the ongoing extension of Vilsandi National Park and the potential offshore protected area in the study area EEZ), there is no need to establish new nature conservation restrictions in the study area if the planned and pending conservation areas are also realized and ensure the preservation of the favorable status of habitat type 1170.

FISH FAUNA [28]

The Baltic Sea has a low and variable salinity, which prevents the spread of fish of both marine and freshwater origin, and therefore the number of species is lower than in a sea with normal salinity. At the same time, the fish populations in the Baltic Sea are numerous.

There are about 30 species of marine fish in Estonian waters, 10 species of migratory fish, and about 20 species of freshwater fish in the coastal sea. The preferences of fish for habitats and spawning grounds vary greatly from species to species: some species need the deepest areas of the Baltic Sea for spawning, depending on the oxygen and salinity conditions, others depend on free passage to freshwater spawning grounds or spawn at different depths in coastal areas having different temperature, salinity, substrate, and other preferences.

As in the rest of the world and in the Baltic Sea as a whole, Estonian fish stocks are mainly affected by human activities, as a result of which both species richness and the abundance of most fish species have decreased. In addition to fishing, there are other human activities that affect the number of fish in the Baltic Sea: for example, migration barriers in rivers flowing into the Baltic Sea and river pollution. Anoxia in the deeper areas of the Baltic Sea is primarily affected by nutrient inflows resulting from land use, and the proportion of the pollution load resulting from the use of marine is still low.

In general, shallow coastal waters (less than 15 m) and offshore sandbanks are more important for fish than marine areas. Most spawning grounds and juvenile fish breeding sites are located in the shallower coastal areas (up to 5 m), or they are crossed by species heading for spawning in freshwater. More open sea areas, with a depth of more than 5 m, can be spawning grounds for herring (spawning grounds depth preference grounds up to 15 m) and Baltic plaice (spawning grounds depth preference up to 30 m). The deepest areas of the Estonian EEZ are generally unsuitable for spawning because they lack the conditions - the required salinity and oxygen regimes - necessary for spawning sea fish (cod, flounder, sprat).

28 The materials of the Estonian Maritime Spatial Plan < link > and the draft impact assessment report of the Estonian Maritime Spatial plan (OÜ Hendrikson & Ko, version 03.07.2020) have been used in compiling the chapter.

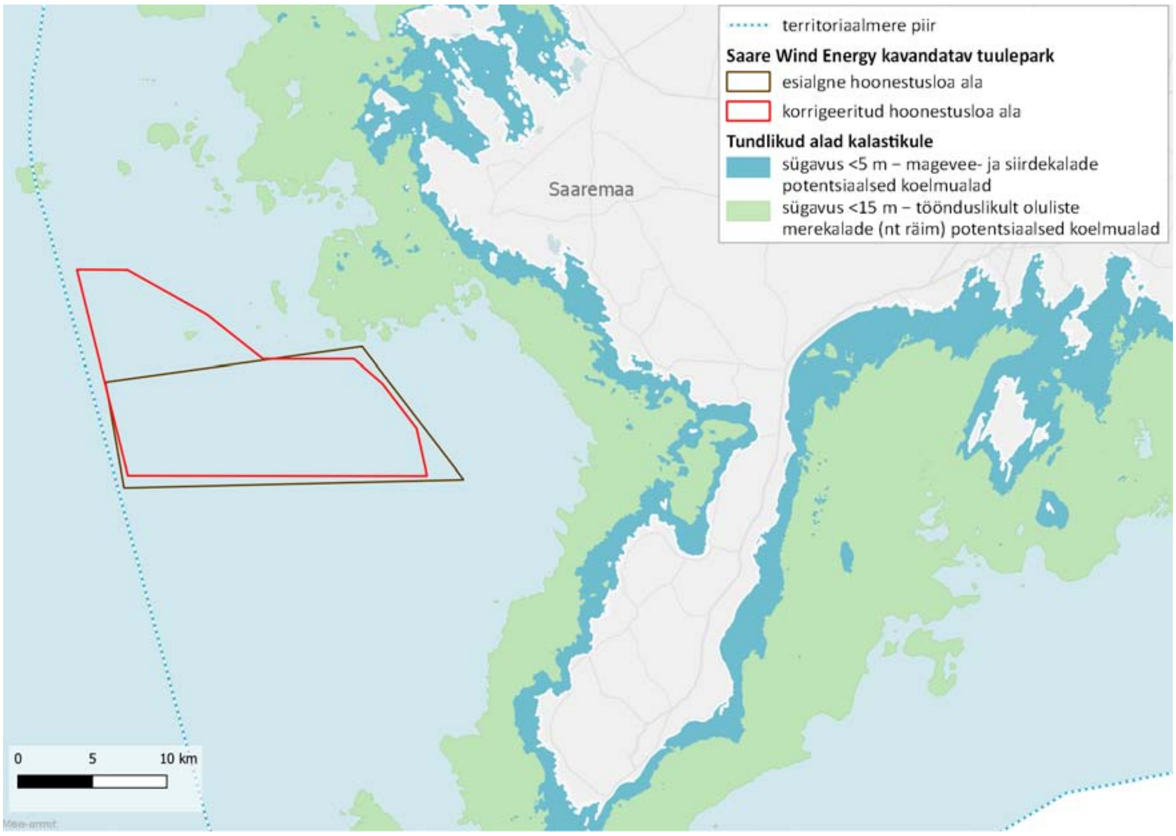

FIGURE 25-10. AREAS SENSITIVE TO FISH FAUNA: POTENTIAL SPAWNING GROUNDS AND IMPORTANT AREAS FOR JUVENILES OF MARINE FISH (EXTRACT FROM THE ESTONIAN MARINE SPATIAL PLAN).

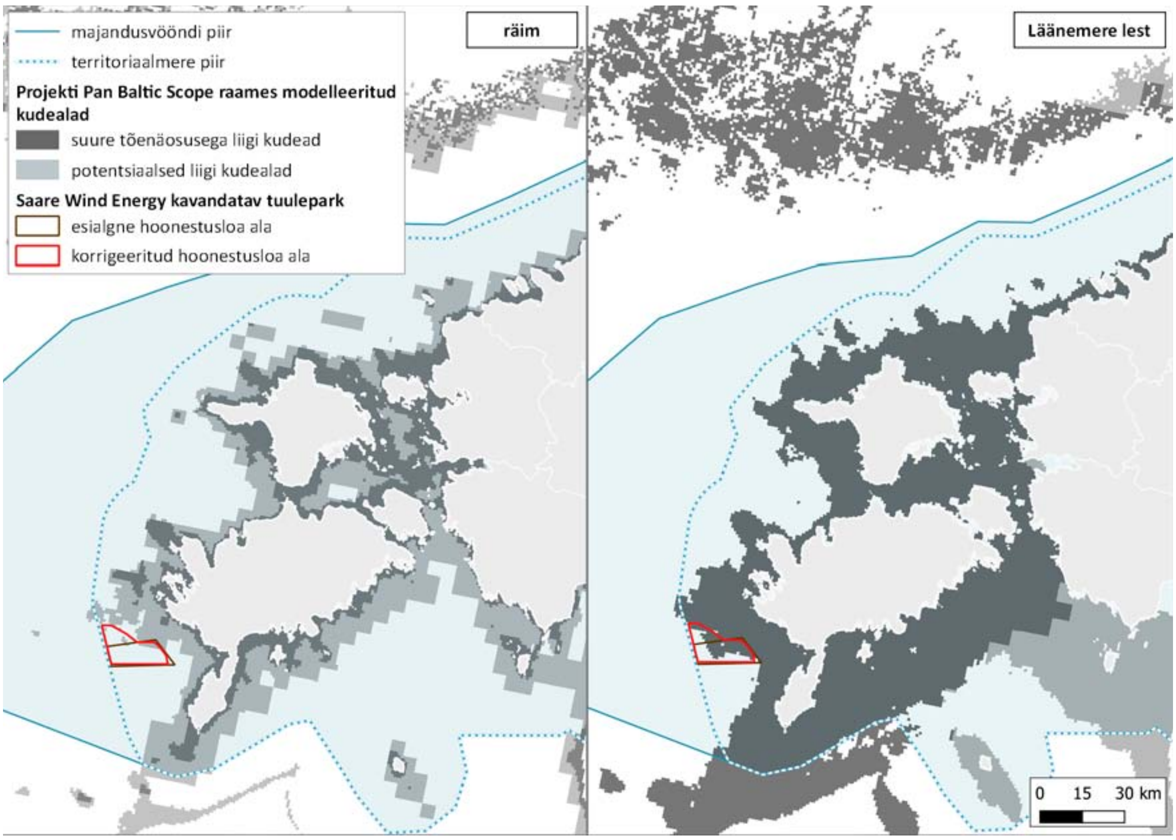

FIGURE 25-11. POSSIBLE SPAWNING GROUNDS FOR BALTIC PLAICE[29].

29 Project Pan Baltic Scope<link>

MARINE MAMMALS [30]

Two seal species are common among marine mammals in Estonia - gray seal (*Halichoerus grypus*) and ringed seal (*Pusa hispida*).

The good environmental status of the Baltic gray seal population in the Estonian marine area has been achieved by assessing it according to the criteria of abundance, distribution area, and distribution pattern. Good environmental status has not been achieved for ringed seals[31].

RINGED SEAL is a species with occasional distribution in the Baltic Sea, with subpopulations comprising the coasts of Estonia on the Väinameri Sea/Livonian Gulf and the Gulf of Finland. Animals move between different subpopulations rarely and rather at the level of individual specimens. In Estonia, the key habitats for ringed seals are the Väinameri Sea and the Gulf of Riga - wintering and breeding areas for seals are related to these areas. During the ice-free period, the main resting places of the animals are in the Väinameri and at the southern estuaries of the Väike and Suur straits. There is regular migration between these areas, in particular south of the Suur Strait, where a migration corridor of vital importance has developed. In addition, the existence of sea ice, whose types, extent, and location vary from year to year, is indispensable for the successful reproduction of animals.

Based on the data collected by telemetry, the feeding areas, resting areas, breeding and wintering areas, and migratory areas of ringed seals have been distinguished (2019).

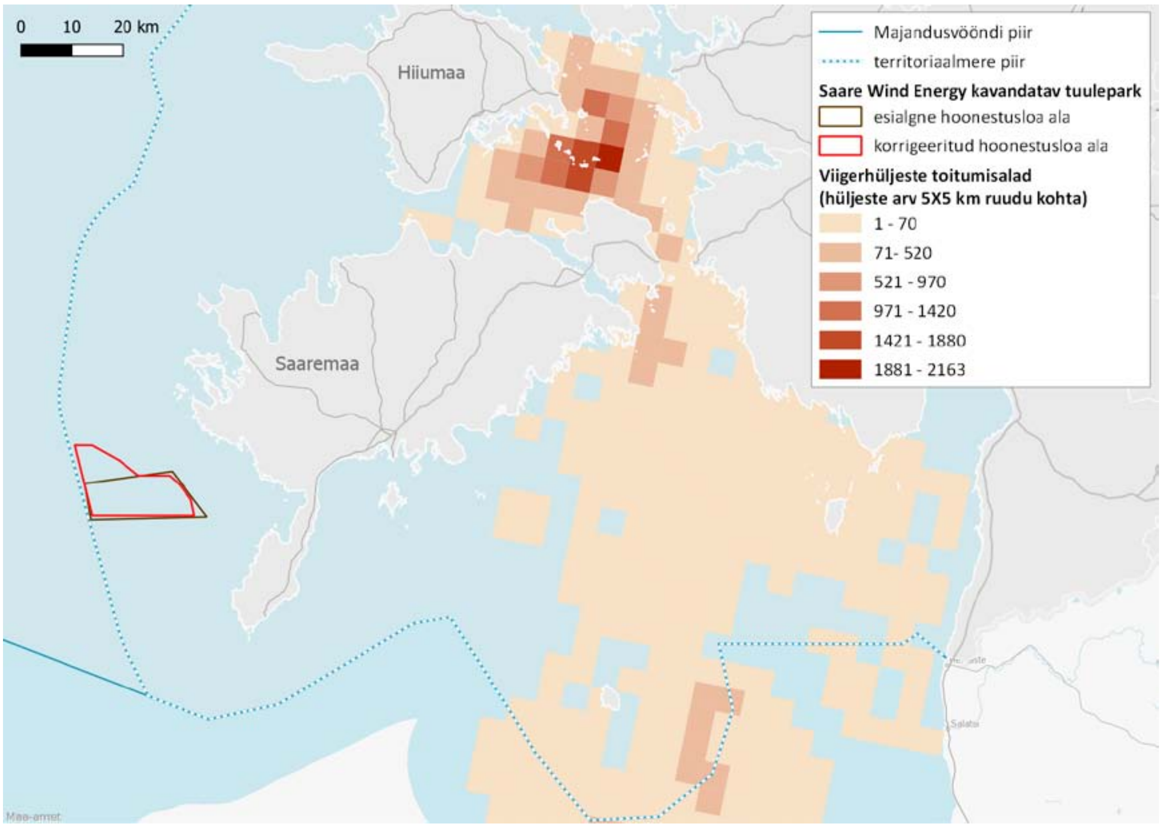

FIGURE 5-12. FEEDING AREAS OF RINGED SEALS IN WESTERN ESTONIA. ACCORDING TO TELEMETRY STUDIES, THE INTENSITY OF FEEDING BEHAVIOR IN A 5X5 KM NETWORK[32].

30 In compiling the chapter, the underlying research of the Estonian Maritime Spatial Plan “Estonian Maritime Spatial Plan: Assessment of the distribution of seals and use of marine waters”. Mart Jüssi, MTÜ Pro Mare, 2019.

31 Environmental status of the Estonian marine area 2018 < link >

32 “Estonian Maritime Spatial Plan: Assessment of the distribution of seals and use of marine waters”. Mart Jüssi, MTÜ Pro Mare, 2019

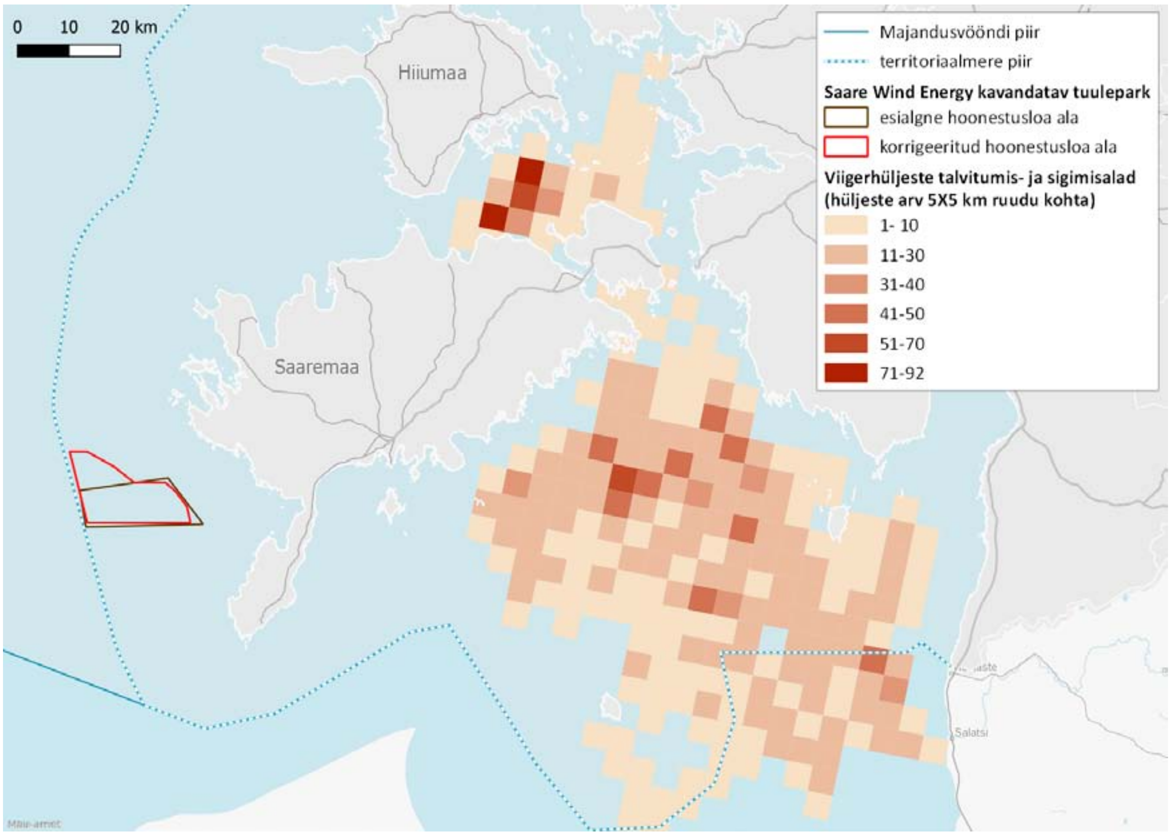

FIGURE 5-13. WINTERING AND BREEDING AREAS OF RINGED SEALS. ACCORDING TO TELEMETRY SURVEYS, WINTERING AND BREEDING AREAS IN A 5X5 KM NETWORK[33].

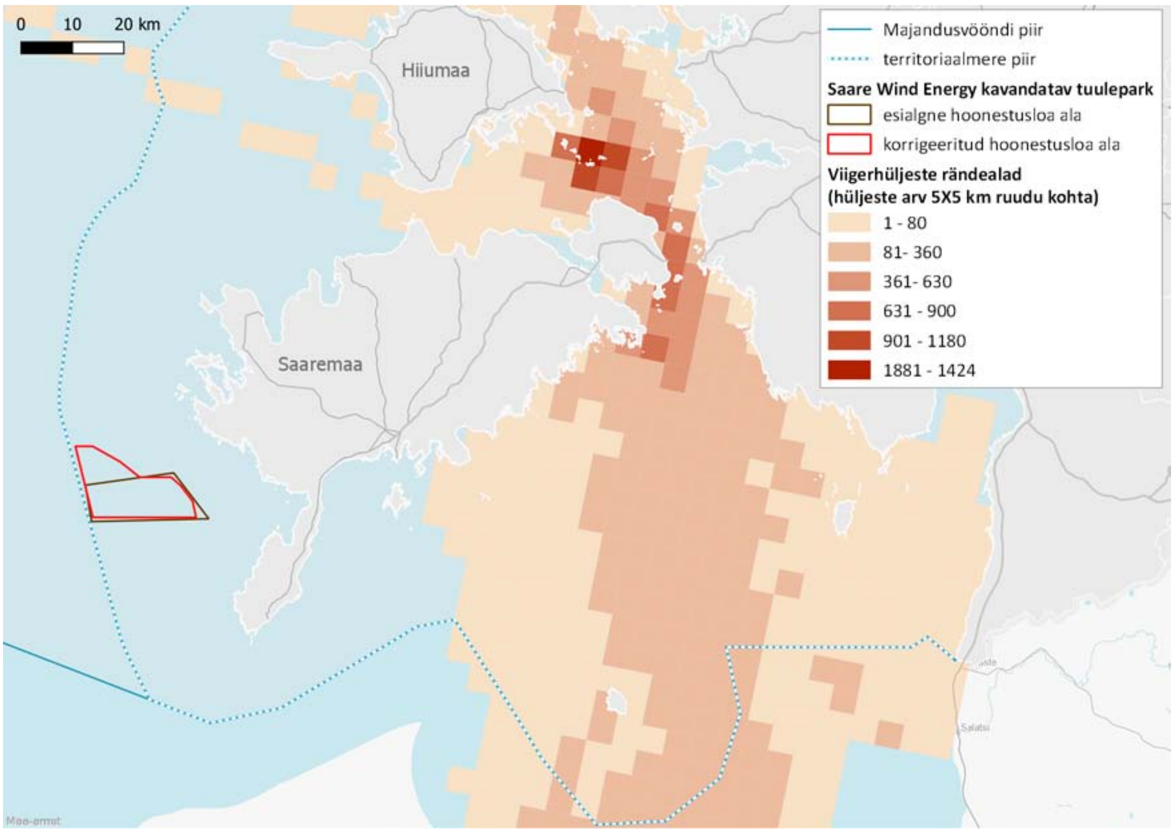

FIGURE 5-14. RINGED SEAL MOVEMENTS (NOT RELATED TO FEEDING)[34].

33 "Estonian Maritime Spatial Plan: Assessment of the distribution of seals and use of marine waters". Mart Jüssi, MTÜ Pro Mare, 2019

34 "Estonian Maritime Spatial Plan: Assessment of the distribution of seals and use of marine waters". Mart Jüssi, MTÜ Pro Mare, 2019

There are no telemetric studies on the **gray seal** in Estonian coastal waters analogous to the ringed seal. Between 1995 and 2000, a study of movement and spatial fidelity focused on adult female seals was conducted using the photo-identification method. As a result, it became clear that the species is free to move throughout the Baltic Sea, but during the ice-free period and over the years, it is associated with certain nesting areas and marine areas. The use of marine waters cannot be studied with this method.

A limited telemetry study indicates that the behavior of individuals caught at the same time from the same location can vary widely and is certainly associated with some marine areas that are used repeatedly for food.

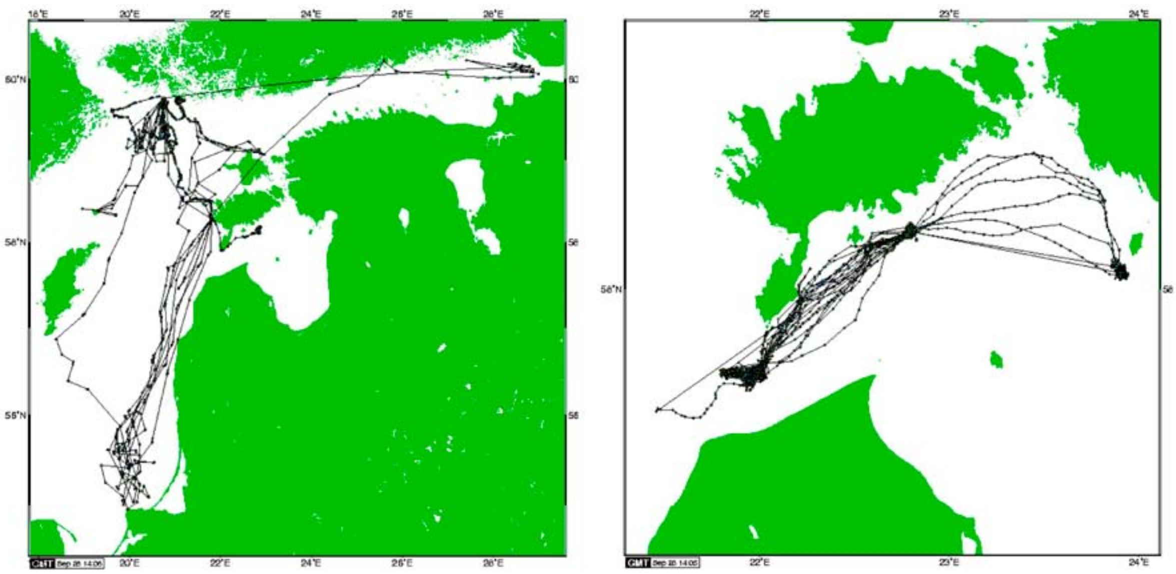

FIGURE 29. USE OF MARINE WATERS BY MALE (LEFT) AND FEMALE (RIGHT) GRAY SEALS MARKED IN THE SAME WIDOW IN 2007-2008[35].

When using the available data, the use of different marine areas cannot be unambiguously identified (distinguishing the nature of the use). However, considering the known behavior of the species, it can be stated that this species freely uses the entire Estonian coastal sea. The most important recreation areas are mostly covered by existing protection regimes. They are regularly monitored, and changes in numbers and use of sites are recorded in the national monitoring database.

It is generally known that this is a highly adaptable species that is accustomed to human activities and, unlike the ringed seal, even uses it to come to catch prey, e.g., in the vicinity of ports, fishing traps, and aquaculture facilities.

35 "Estonian Maritime Spatial Plan: Assessment of the distribution of seals and use of marine waters". Mart Jüssi, MTÜ Pro Mare, 2019

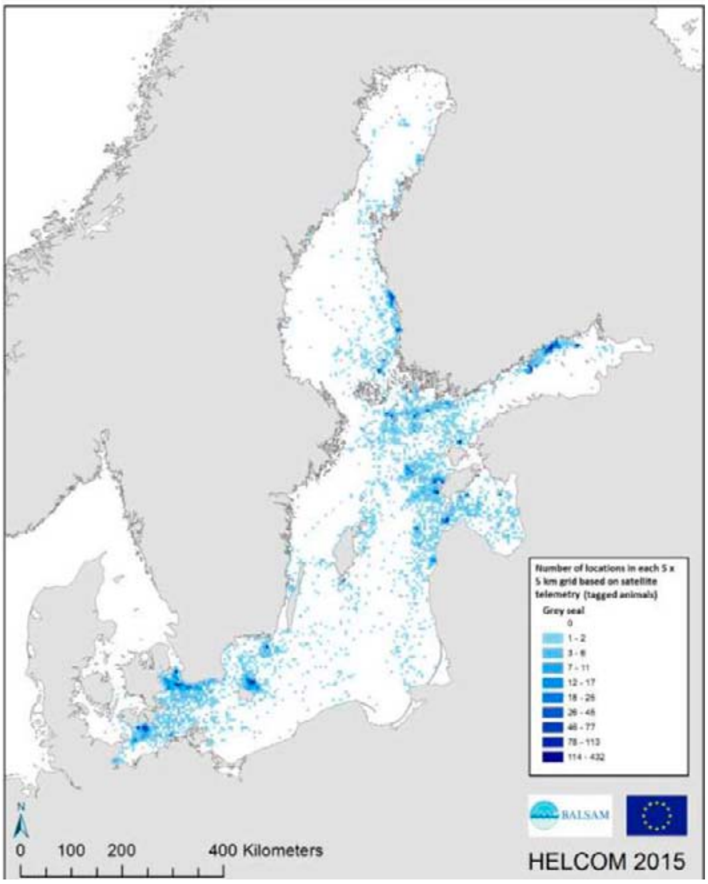

FIGURE 5-16. GRAY SEAL DISTRIBUTION PATTERN IN THE BALTIC SEA BASED ON TELEMETRY DATA ACCORDING TO HELCOM DATA[36].

BIRDS

More than 60 waterfowl species are associated with the Estonian marine area during their life cycle. Waterfowl stop in Estonian waters during different seasons for closure, wintering, and migration. Waterfowl nesting on the coast and on small sea islands feed and breed their younglings at sea. In addition, many terrestrial birds are linked to the sea through migration. The importance of the Estonian coastal sea for waterfowl is primarily due to its geographical location directly on one important branch of the East Atlantic migration route. This branch is used by most Arctic waterfowl species on their way from Eurasian Arctic breeding grounds to wintering areas extending to South Africa. Estonian sandbanks are suitable migration stops for them, where fat reserves are replenished for further migration, and these sandbanks are also used for wintering areas. Despite the relatively small area of our aquatic environment, a significant proportion of all birds of some species stop here. According to rough estimates, for example, 48% of the migratory populations of the scaup, 25% of the migratory populations of long-tailed ducks, and 20-22% of scoters can stage in our waters.

Within the framework of the preparation of the Estonian Maritime Spatial Plan, two in-depth reviews of sea-related birds and possible impacts that may be associated with different uses of marine waters were carried out. The above-mentioned studies are the basic research of the Estonian Marine Spatial Plan "Compilation of existing data on migration routes of birds in the Estonian marine area and compilation of map layers and analysis of the impact of wind farms on bird feeding areas" Estonian Ornithological Society 2016 and "Analysis of staging areas for birds" Estonian Ornithological Society 2019.

These are extensive studies that provide a comprehensive overview of the behavioral patterns of different bird species. In this EIA program, it is not necessary to duplicate a large amount of material describing the existing situation. The figure below shows, by way of example, the schematic migration routes of all migratory birds, the so-called "bottlenecks," and sensitive areas of water and land birds.

36 HELCOM, 2015

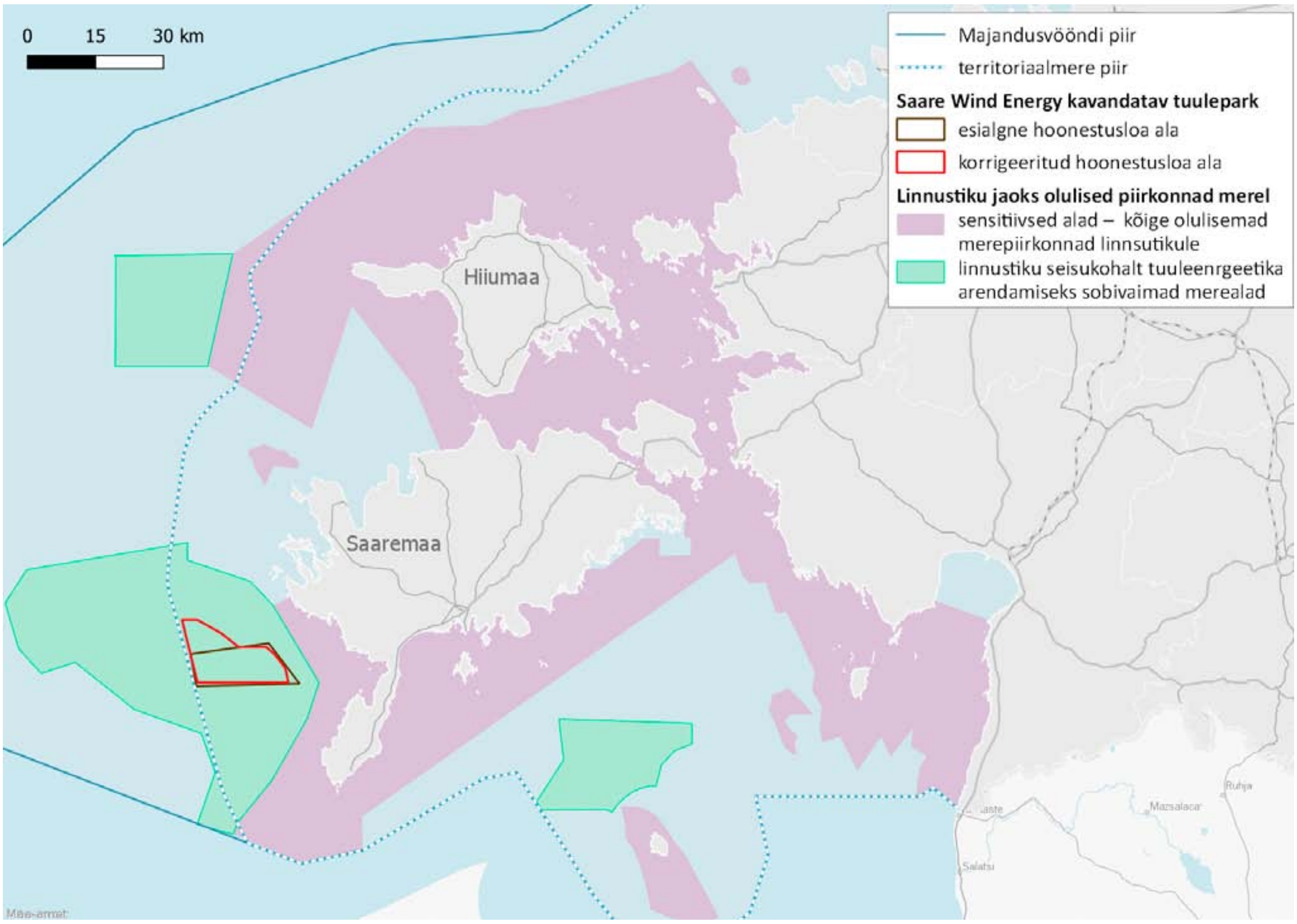

FIGURE 31. BIRD SENSITIVE AREAS OF THE ESTONIAN MARINE AREA AND AREAS MOST SUITABLE FOR THE DEVELOPMENT OF WIND ENERGY FROM THE STANDPOINT OF BIRDS [37].

BATS[38]

There are proven 14 species of bats in Estonia; 7 of them are also wintering, i.e., they are considered to be native species. There are 5 bat species (genus *Myotis*), the northern bat (*Eptesicus nilssonii*) and the brown long-eared bat (*Plecotus auritus*).

According to the Nature Conservation Act, 12 species are protected in Estonia as protected species of category II (i.e., all except the lesser noctule and the Western barbastelle). According to the Habitats Directive (Council Directive 92/43/EEC), all microbats (*Microchiroptera*), i.e., all bats that occur naturally in our country, need protection.

Bats are known to be able to cross large marine areas. Isolated bats that have arrived across the sea have been found in the Faroe Islands, Iceland, but also in oil rigs and ships in the North Sea; sometimes, the species even originate from America. To reach the Faroe Islands from the Shetland Islands, bats must travel at least 290 km above the ocean, and the distance from the Faroe Islands to Iceland is at least 430 km. In the Estonian context, for example, when crossing the Gulf of Riga, bats do not need to make such long flights. The distance covered is only 29 km at the narrowest point of the Irbe strait. It can be assumed that in such a place, the activity of bats during migration is higher than, for example, above the Baltic Sea between Hiiumaa and Sweden.

In Sweden, 11 species of bats have been observed above the sea, of which 10 species also occur in Estonia. In Estonia, previous surveys (before 2016) have shown that only the northern bat, the Nathusius' pipistrelle, and the unspecified bat (*Myotis*) fly above the sea at a distance of 1.5 km from the nearest beach. There are reports of bats flying above the sea from passenger ships and yachts in Estonian territorial waters.

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37 "Bird staging area analysis", Estonian Ornithological Society, 2019

38 In compiling the chapter, the basic research of the Estonian Maritime Spatial Plan "Bat survey in Veiserahu and Kerjurahu in August, September and October 2016" Lauri Lutsar, Estonian Fund for Nature, 2016, has been used.

Studies in Sweden have shown that bats can fly above the sea while migrating and hunting prey. Sometimes bats can combine these two activities and also catch prey when migrating. When flying above the sea, the flight height of bats is usually up to 10 m above sea level, but at lighthouses, wind turbines, and other vertical objects at sea, bats rise much higher, for example, flying also around the blades of wind turbines. Such observations suggest that offshore wind turbines may increase bat mortality. Bats are more likely to feed at sea in areas with high numbers of airborne insects or aquatic crustaceans. According to EUROBATS bat experts, the migration route of the Nathusius pipistrelle runs from the western islands of Estonia across the sea to the west-southwest and south.

Bats, especially migratory species, may congregate in certain places near the coast, where they are waiting for suitable weather to cross the sea. According to the data from Sweden, such a congregation takes place during the autumn migration at the end of the summer. During the spring migration, the bats arrive in Scandinavia scattered. In Estonia, it can be assumed that bats will congregate on the southern coast of Saaremaa in autumn, where they are waiting for suitable weather to cross the Gulf of Riga. Similar and supporting data (increase in the number of *Pipistrellus nathusii* at the end of August and the beginning of September) have been obtained from Hiiumaa from the land on Kõpu peninsula.

Numerous migrations of *Pipistrellus nathusii* across the sea have been shown by Swedish studies. According to the Danish bat atlas, the *Pipistrellus nathusii* is considered to visit the island of Bornholm,38 km off the Swedish coast, in small numbers during migration times.

In Estonia, bats have been studied above the sea in three areas: Around the Kõpu peninsula and in Revalsten, Kuradimuna and Uusmadala (Lutsar, 2012; Lutsar, 2013) and in 2016 in Saaremaa on the east of the Sõrve peninsula in Kerjurahu (islet) and Veiserahu (sea mark).

In Veiserahu, the recorder operated on 62 nights, and the *Pipistrellus nathusii* and the *Nyctalus noctula* were identified.

The recorder operated on Kerjurahu for 4 nights, and a *Pipistrellus nathusii*, a *Myotis sp.*, probably a *Myotis daubentonii*) were identified.

Thus, a 2016 survey identified the presence of three bat species at sea. Two of them, the *Pipistrellus nathusii* and the *Nyctalus noctula*, are migratory species that do not overwinter in Estonia.

Bats flew above the sea (data from Veiserahu) when the wind speed was 0.3...7.7 m/s (hourly average speed according to Sõrve weather station). No bats were observed at higher winds. The 2016 survey proved, for the first time in Estonia, the direct flying of a *Pipistrellus nathusii* far from the coast above the sea. Comparing the times of the observations with the times of sunset and sunrise, it became clear that at the end of the summer, the flight direction of the *Pipistrellus nathusii* from Saaremaa to Courland was probable.

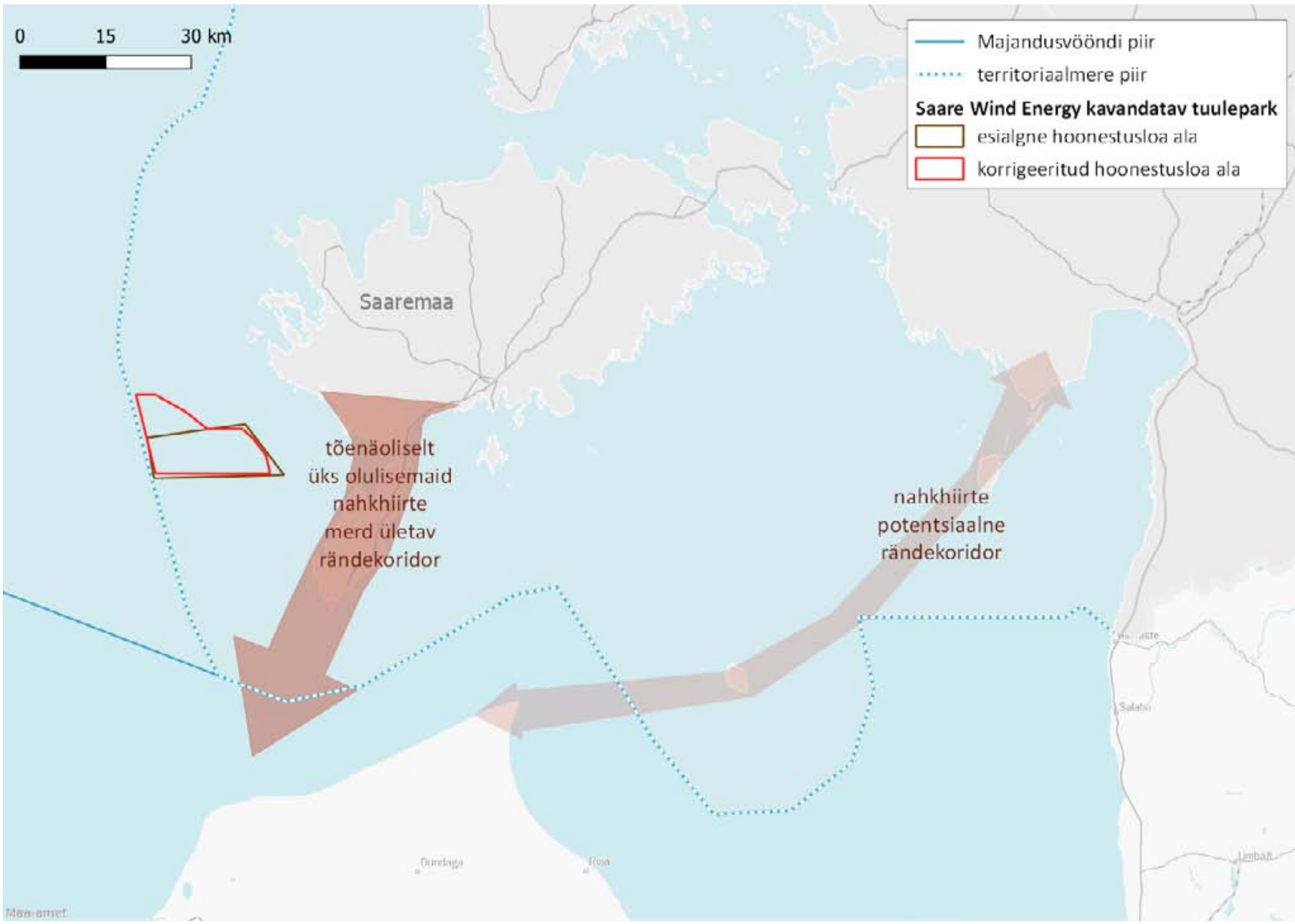

FIGURE 5-18. SENSITIVE AREAS FOR BATS[39]

5.1.6. Protected natural objects, including Natura 2000 network areas

PROTECTED NATURAL OBJECTS

According to the Nature Conservation Act (§ 4 of the LKS), the protected natural objects are:

- protected areas;
- limited conservation areas;
- protected species and fossils;
- species' protection sites;
- individual protected natural objects;
- natural objects protected at the local government level.

The following protected areas are located in the area affected by the proposed offshore wind farm: Irben Strait special conservation area, Kaugotoma-Lõu special conservation area, Rahuste nature reserves, Riksu coastal special conservation area, Karala-Pilguse special conservation area and Vilsandi nature reserves.

In December 2020, as a result of studies and activities of the project "Preparation of a proposal for offshore protected areas in the Estonian EEZ", a proposal to establish two protected areas in the Estonian EEZ was submitted to the Ministry of the Environment. One of the proposed protected areas to be established - the Kolgi Shallow Marine Protected Area - will be close to and within the impact area of the proposed wind farm.

In the case of cable corridors, the EIA program has been prepared on the basis of the basic locations of the cable corridors of the wind energy development areas provided in the draft Estonian Maritime Spatial Plan (Hendrikson&Ko,

39 Draft impact assessment report of the Estonian Maritime Spatial Plan. OÜ Hendrikson & Ko, version 03.07.2020

2020). Among the protected natural objects, the following above-mentioned areas will be in the potential cable corridors in the marine area and their impact area. In addition, the cable corridor runs near Saaremaa near the Kasti Bay Special Protection Area. Potentially affected protection and special conservation areas in the marine area in connection with cable connections in the direction of Virtsu-Lihula are the Väinameri Special Conservation Area and the Puhtu-Laelatu Nature Conservation Area.

During the EIA, the locations of cable corridors in the marine area may be specified.

In the case of onshore connections, this is a visualization of very initial basic cable solutions, showing a direct connection to the network connection points. Onshore protected natural objects will be specified in accordance with the further specification of onshore solutions for cable corridors during the EIA process.

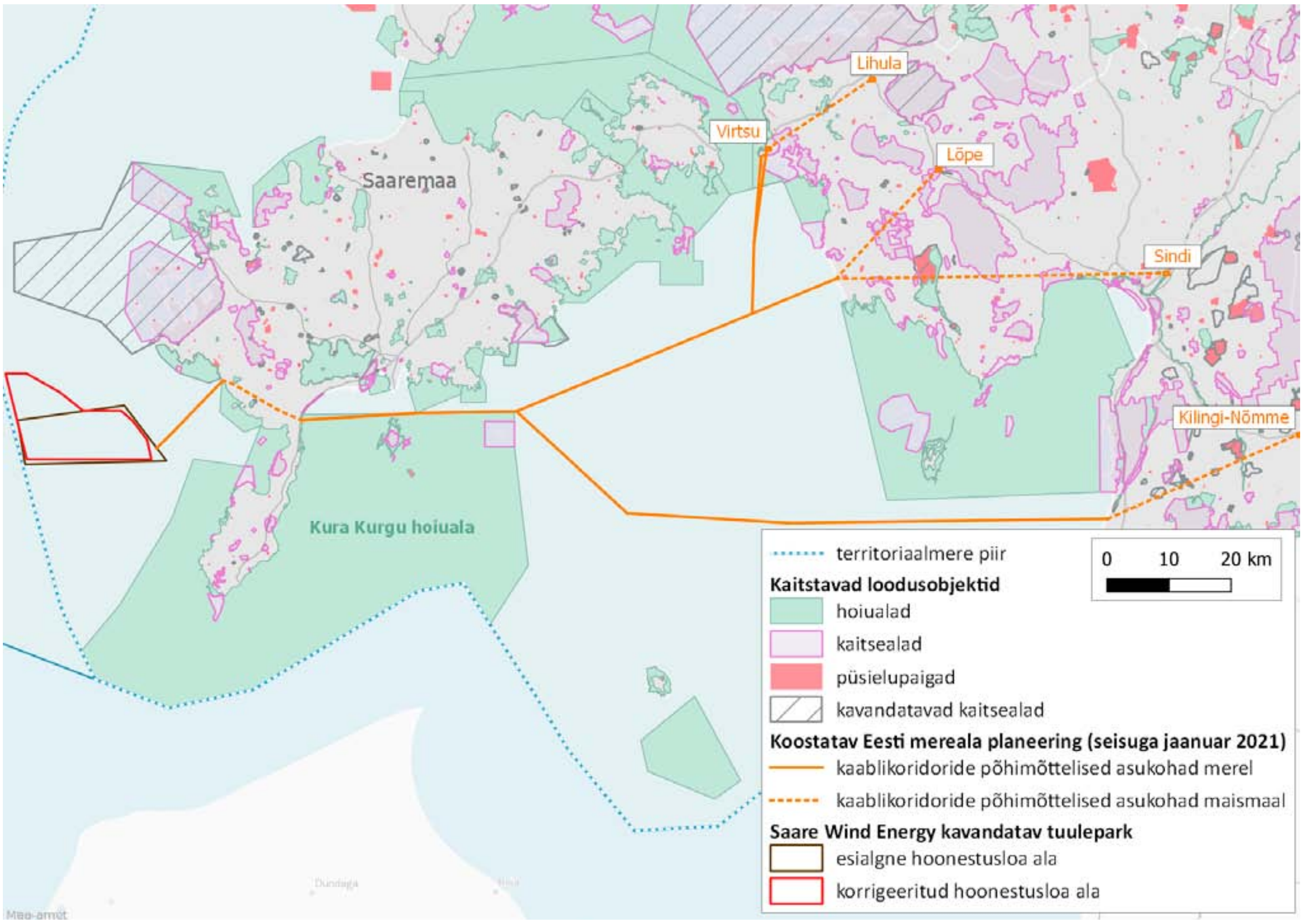

FIGURE 34. OVERVIEW OF PROTECTED NATURAL OBJECTS AREASIN THE AREA OF THE PROPOSED ACTIVITY AND CABLE CORRIDORS (BASIS: LAND BOARD, 2020)

TABLE 5-1. THE PROTECTION AND LIMITED CONSERVATION AREAS IN THE VICINITY OF THE PROPOSED OFFSHORE WIND FARM.

PROTECTED NATURAL OBJECTS NAME IN ESTONIAN	PROTECTED NATURAL OBJECTS NAME IN ENGLISH	CODE
Kura Kurgu hoiuala	Irben Strait special conservation area	KLO2000316
Kaugotoma-Lõu hoiuala	Kaugotoma-Lõu special conservation area	KLO2000313
Rahuste looduskaitseala	Rahuste nature reserves	KLO1000305
Riksu ranniku hoiuala	Riksu coastal special conservation area	KLO2000327
Karala-Pilguse hoiuala	Karala-Pilguse special conservation area	KLO2000310
Vilsandi rahvuspark	Vilsandi nature reserves	KLO1000250
Kasti lahe hoiuala	Kasti Bay special conservation area	KLO2000312
Väinamere hoiuala	Väinameri special conservation area	Läänemaa - KLO2000241
Puhtu-Laelatu looduskaitseala	Puhtu-Laelatu nature reserves	KLO1000176

5.2. Cultural heritage

Underwater cultural heritage

Several wrecks are protected as cultural monuments in the Estonian marine area. Wrecks are part of the wider maritime cultural heritage, and their survival is in the wider public interest. Not all wrecks are recognized as cultural monuments, but this does not mean that wrecks have no cultural value.

According to the hydrographic database of the Maritime Administration (see Figure 12), one wreck (id 1150; unnamed-91) remains in the SWE proposed offshore wind farm area. The wreck is 28.87 m deep, 70.0 m long, 12.0 m wide and 3.31 m high. It is a steamer wreck (L-Est coordinates: 351554.90; 6447551.58).

There is also an underwater obstacle with a depth of 8.33 m (L-Est coordinates 366587.73; 6452577.33) at a distance of ~1km from the northeast corner of the proposed offshore wind farm area.

Based on the basic cable corridors of the wind energy development areas indicated in the draft Maritime Spatial plan, several wrecks are located in the vicinity of Abruka Island west of Abruka island and in the marine area between Abruka and Kuressaare.

As the exact locations of the cable corridors are not in place, the wrecks in the rest of the marine area will not be considered in the EIA program during the EIA program phase, but these locations will be taken into account in the planning of the cable corridors in the further EIA process.

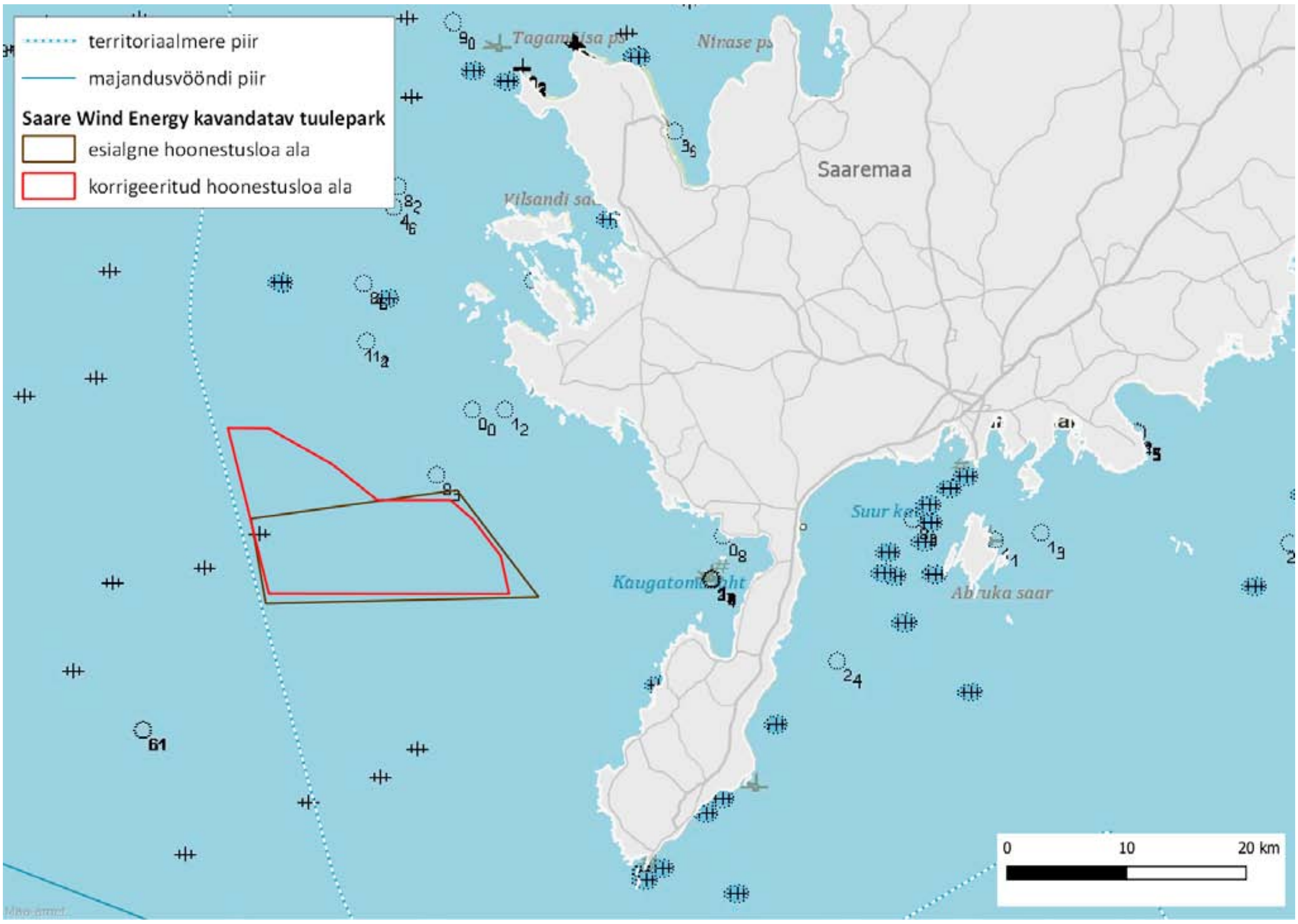

FIGURE 5-20. LOCALIZED WRECKS AND OBSTACLES IN THE AREA OF THE PROPOSED SWE OFFSHORE WIND FARM (KNOWN LOCALIZED WRECKS ARE INDICATED BY CROSSES OR SHIP SYMBOLS; UNDERWATER OBSTACLES ARE INDICATED BY CIRCLES WITH A NUMBER NEXT TO IT)[40].

CULTURAL HERITAGE IN THE AREAS OF ONSHORE CONNECTIONS OF POTENTIAL CABLE CORRIDORS

As the exact cable corridors of the onshore connection of the wind farm are not known at present, the EIA program has not provided an overview of the cultural heritage of the onshore connection area. Therefore, in the framework of the preparation of the EIA report, the cultural heritage in the area of the cable corridors and its possible impact in the area of possible cable corridors (incl. taking into account cultural monuments, cultural heritage sites, and other culturally important objects) is analyzed.

5.3. Socio-economic environment

POPULATION [41] AND EMPLOYMENT

Saaremaa rural municipality covers the whole of Saaremaa, and the rural municipality was formed in 2017 by merging 12 local governments, being the local government with the largest area of 2718 km2 and the largest rural municipality in Estonia. In Saare County, Saaremaa municipality does not include Muhu municipality and Ruhnu municipality. The center of Saaremaa municipality is located in the city of Kuressaare.

As of 01.01.2020, the population of Saaremaa municipality was 31,073. According to the development plan of Saaremaa municipality, one of the biggest challenges of local government is population decline. In 2001, 36,969 people lived in Saaremaa municipality. In the years 2008-2017, the population of Saaremaa municipality decreased

40 Base map Hydrographic database of the Estonian Maritime Administration < link >

41 The materials of the Saaremaa rural municipality development plan 2019 – 2030 and the general plan of Saaremaa rural municipality (in preparation) have been used in compiling the chapter.

by 2,500 inhabitants (approximately 250 inhabitants per year), and the population has decreased in the subsequent years as well. The reason for the decrease in the number of inhabitants is the negative birth rate and the negative migration balance.

Regionally, the population has been declining particularly fast in areas further away from Kuressaare - in Torgu, Kihelkonna, Mustjala, Orissaare, Pöide, and Laimjala. The general population dynamics refers to the marginalization of the county's edge areas and the suburbanization and urban sprawl taking place in the former Kaarma rural municipality in the vicinity of Kuressaare.

According to the Ministry of Finance, the average number of taxpayers in Saaremaa rural municipality in 2017 was 14,474, which accounted for 45.2% of the rural municipality population (32,007 people). The number of unemployed depends on the season: in the winter months, there are more registered unemployed, in the summer months their number decreases.

According to Statistics Estonia (Statistics Estonia, Statistics Database, 26.08.2020), the number of unemployed in Saaremaa rural municipality was 682 in January 2020, and it rose to 959 in May 2020 and decreased somewhat in July 2020 (922 unemployed). For comparison, the number of unemployed in the rural municipality as of January 2018 was 695 and as of July 2018 478, as of January 2019 566, and as of July 2019 546.

According to the Saaremaa rural municipality development plan 2019-2030, Saare County has the highest number of employees in the service sector, followed by industry and construction, and the least in agriculture, forestry, and fishing.

FISHERY

Fishing takes place in the entire Estonian marine area, except in areas with fishing restrictions. Fishing has always been an important source of livelihood for coastal populations. Fishing in the Baltic Sea is divided into trawling and coastal fishing. Coastal fishing at sea generally takes place within 12 nautical miles or up to 20 m isobath and small fishing ports and landing sites of local importance servicing the catch. According to the Government of the Republic Regulation No 65 of 16.06.2016 *The Fisheries Regulation* trawling may take place only in marine areas deeper than 20 meters.

The Maritime Spatial Plan portal (http://mereala.hendrikson.ee/) created within the framework of the Estonian Maritime Spatial Plan provides cartographic information on, among other things, the intensity of coastal fishing and trawling.

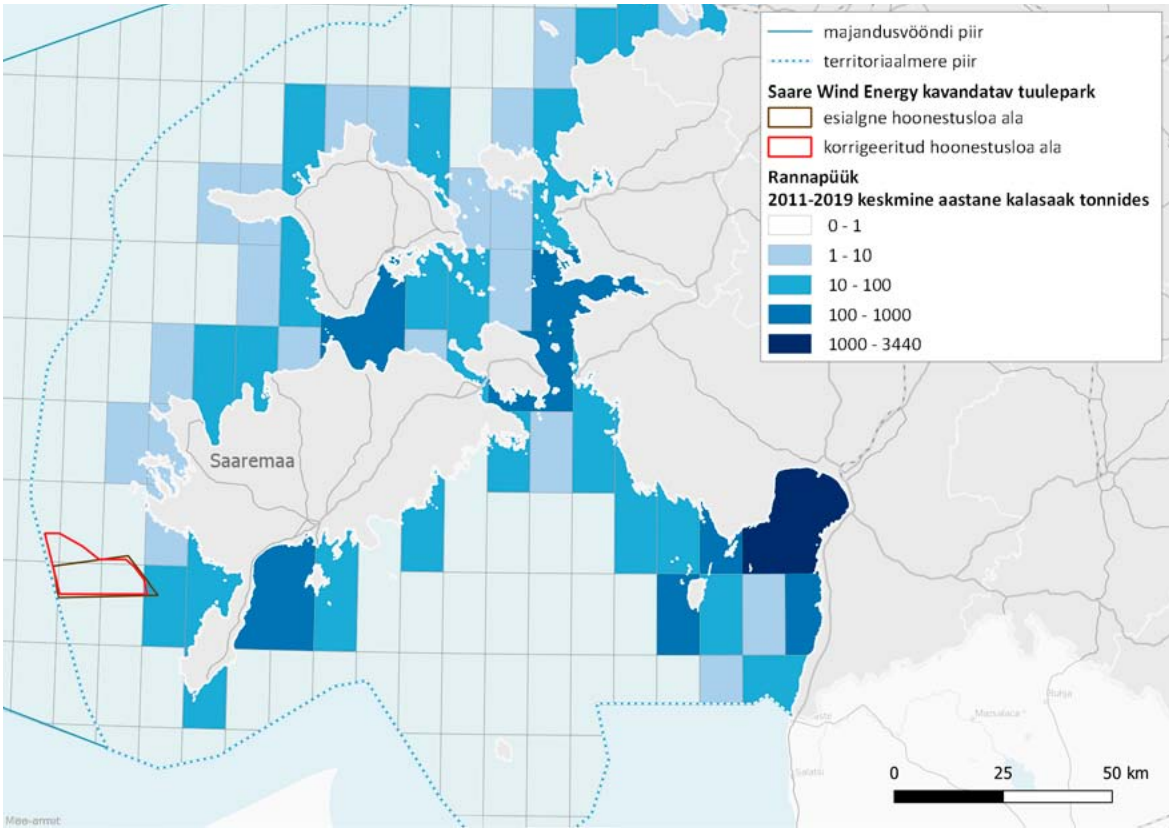

FIGURE 5-21. COASTAL FISHING 2011-2019. IN THE FISHING AREAS NORTHEAST AND EAST OF THE PROPOSED OFFSHORE WIND FARM (AREA 4), THE ANNUAL YIELDS WERE 1, 3, 13, AND 18 TONNES PER YEAR. LIGHT BLUE HATCHING - A WIND ENERGY AREA PLANNED BY THE DRAFT ESTONIAN MARITIME SPATIAL PLAN[42])

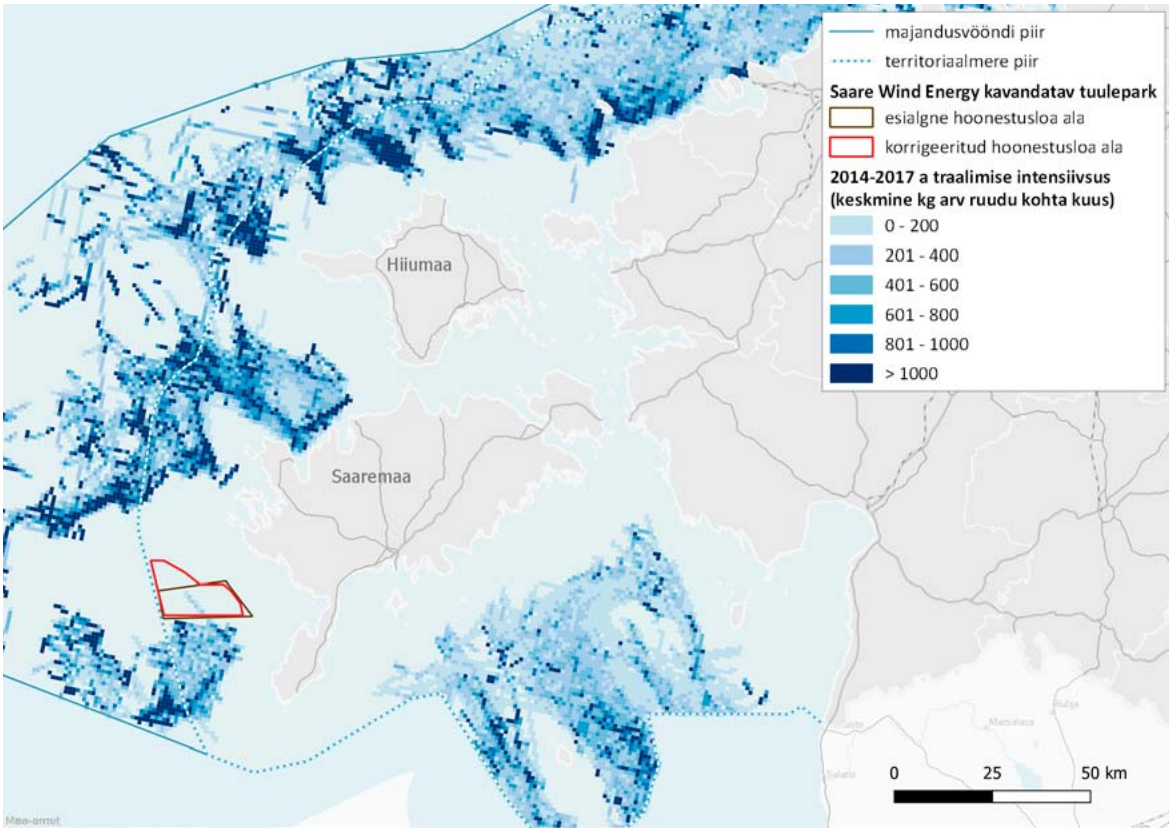

FIGURE 25. TRAWLING INTENSITY 2014-2017. THERE IS VERY LITTLE TRAWLING IN THE AREA OF THE PROPOSED OFFSHORE WIND FARM[43] .

42 Extract from the Estonian Maritime Spatial Plan Portal as of 02.10.2020 < link >

43 Extract from the Estonian Maritime Spatial Plan Portal as of 02.10.2020 <link>

6. Expected significant environmental impact of the proposed activity

The purpose of the environmental impact assessment is to assess and describe the expected significant environmental impact of the implementation of the proposed activity, to analyze the possibilities for preventing or mitigating its impact, and to propose the most suitable solution.

Table 6-1 below presents the environmental elements, sources of impacts, expected significant impacts (specifying the size of the impact areas), and methods for predicting these impacts that will be affected by the implementation of the proposed SWE offshore wind farm and related infrastructure.

The expected area of impact is the direct area of the wind farm development areas and the submarine cable route, i.e., the planned activity and its immediate surroundings. The size of the impact area depends on the specific impact factor (e.g., noise, disturbance, visual impact, etc.). The impact area also differs depending on the affected component of the natural environment (aquatic environment, fauna, etc).

TABLE 6-1. EXPECTED SIGNIFICANT IMPACT OF THE PROPOSED ACTIVITY, AND THEIR FORECASTING AND EVALUATION METHODS

NO IMPACT AREA (I.E., ENVIRONMENTAL ELEMENTS AFFECTED)	EXPECTED SIGNIFICANT IMPACTS (INCL. IMPACT AREA, SOURCES OF IMPACT)	IMPACT FORECASTING AND ASSESSMENT METHODS (INCLUDING THE NECESSARY STUDIES REQUIRED BY THE DECISION OF INITIATION)
1. Impact on the natural environment		
1.1. Impact on seawater quality, including effects on the spread of suspended solids	The impact of an offshore wind farm on the quality of seawater can be manifested primarily during the installation of wind turbine foundations and submarine cables during construction through the suspension of marine sediments in the water column. The amount of suspended solids depends primarily on the natural state of the seabed (geological construction conditions) and then on the number, size, type, and installation technology of the foundations and the length and installation technology of the submarine cables. The EIA analyzes the amount of suspended solids, the extent of their distribution, and other relevant factors. The impact is related to the area of the wind farm and its immediate surroundings. During the operation of an offshore wind farm, the rather theoretical impact is the effect of the warming of the submarine cables on the seabed sediments and thus on the water temperature. The cables are buried on the seabed, and the amount of heat released from the cables is also expected to be negligible at the local level, but the issue is addressed in the EIA report. The offshore wind farm does not affect the chemical composition (including nutrient load), salinity, or other physical and chemical parameters of the seawater. Seawater quality can also be affected in the event of a potential emergency, which could lead to a risk of oil pollution. The risk of oil pollution is in both the construction and operation phases of the wind farm. Safety rules must be observed during construction work to prevent oil contamination.	Expert assessment based on previous studies, scientific literature, and studies performed during this EIA. Studies performed under EIA: Seawater quality study in the wind farm area. Modeling of the spread of suspended solids. Modeling of the spread of a possible oil slick.
1.2 Impact on hydrodynamics (incl. currents) and waves, risks related to icing.		Expert assessment based on previous studies, scientific literature, and modeling performed during this EIA. “Study specifying wind conditions, waves and ice conditions”, including modeling of waves, currents, and their changes.

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1.3 Impact on seabed habitats and seabed biota.	The impact of an offshore wind farm on seabed habitats may be primarily in the form of wind turbine foundations and submarine cables. The foundation of the wind turbine will be placed on the seabed, and specifically, in the area of the foundation (and the material to be placed to protect it), the existing natural seabed will be made anthropogenic. The significance and magnitude of the impact depend in particular on the number, dimensions, and type of foundations (the gravitational foundation of the same wind turbine has a much larger seabed area than the pile foundation) and the natural state of the seabed (seabed type). The foundation is an artificial object with similar properties to the hard seabed (reefs). Therefore, the laying of such foundations on the seabed does not significantly change the nature of the seabed habitats. Of course, there will be a direct impact during construction, but then in a few years, the habitats on the new anthropogenic facility will be restored. In soft areas of the seabed (sand, mud, etc.), the foundation is a new and different structure on the seabed. Specifically, in the area the size of the foundation, the existing seabed habitat will be destroyed, but it will be replaced in a few years by a man-made hard substrate habitat (reef-like). The resulting habitat is three-dimensional, and thus the total area of habitats in the sea increases. As hard seabed habitat is widespread in the area, the additional anthropogenic creation of hard seabed habitat does not, for example, lead to an undesirable risk of the spread of alien species. At present, the most common method of installing submarine cables on soft-bottom substrates is to bury the cable in bottom sediments, which helps to prevent possible damage (economic impact) and also mitigates environmental impacts (reduction of electromagnetic radiation and possible heat transfer around the cable). When burying the submarine cables into the seabed, the existing seabed will be severely disturbed during construction, but since the seabed will remain in a situation similar to the previous one after the construction activities, the initial situation will be restored in a few years. In areas with a hard bottom substrate, it may also be necessary to protect the unsinked cable by burying it under a hard substrate. Various options are used for this, such as concrete mattresses, sand/gravel bags or stones, etc. This method is used both as a method of primary cable protection in riskier areas and, for example, when crossing with other cables. Such a method involves the installation of a new hard substrate to the seabed. The addition of a new hard substrate to the required locations on the cable route can be considered as an activity with a negligible environmental impact. Phytoplankton is an important food for shellfish, which in turn is an important food for many fish species as well as bird species. Zooplankton is an important food for many fish species (e.g., Baltic herring and sprat) and for many fish species in the Baltic Sea at an early stage. Thus, the impact on plankton communities may have an indirect impact on fish fauna and also on birds. The most important factor influencing phytoplankton is the enrichment of the marine environment with nutrients or eutrophication. Increased nutrient concentrations in seawater cause intense algal blooms, i.e., an increase in phytoplankton biomass. As the offshore wind farm does not affect the nutrient load of seawater, it is unlikely that the impact on phytoplankton will occur during the operation of the wind farm. Impacts on plankton communities may also be related to construction-time impacts through suspended solids discharged in the marine sediment water column during the installation of wind turbine foundations and submarine cables, which may temporarily alter, for example, lighting conditions in the water column. As this is a short-term effect, the likelihood of a significant impact is minimal. The EIA assesses the impact on benthos, including plankton communities and seabed habitats. The area of influence can be limited primarily to the development area of a specific wind farm and the locations of its cable corridors.	Expert judgment based on previous studies, scientific literature, and the study to be carried out during this EIA. A study will be carried out to determine the qualitative and quantitative parameters of benthic flora and fauna in the development area and in the area potentially affected.

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1.4 Impact on sediment movement and coastal processes.	A wind farm can affect storm wave regime and sediment dynamics. This is not expected to have a significant impact because: during the construction work for the construction of wind farms, the nature of the seabed relief in the marine area will not change (lowering/raising the relief), then no significant changes in the hydrodynamic regime are expected, which could affect the nature of the waves in the nearshore area. SWE offshore wind farm area Silurian deposit in the opening area of Jaagarahu, Rootsiküla, and Paadla deposits, where various limestones have formed in shallow sea conditions. According to the available information, the limestone is covered with thin Quaternary sediments or even exposed on the seabed, which reduces the possibility of large-scale sediments moving. The construction of a wind farm at a distance of 10 km or more from the coast does not affect the nature of coastal processes, their aggravation or weakening, as the wind farm to be built is located far enough away.	Expert assessment based on previous research, scientific literature, and the construction geological survey to be carried out during this EIA. Studies performed under EIA: A study specifying bathymetry around structures and cable lines. Seabed construction geological survey. The EIA will also include a “Study Specifying Wind Conditions, Waves and Ice Conditions”, the results of which will allow a more detailed analysis of the impact on sediment movement and coastal processes in the EIA report.

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1.5 Impact on fish fauna	During the construction of the offshore wind farm, there will be increased ship traffic in the area, and the installation of offshore wind farm foundations and submarine cables will take place in the aquatic environment. Depending on the nature of the seabed, the type of foundation, and the installation technology, the installation of the foundation involves noise emissions and the discharge of sediments into the water column (suspended solids). The issue of seabed sediment movement and noise is also important when installing submarine cables. During operation, offshore wind farms have often had a positive effect. The foundations provide habitat for marine biota, which is the food base for various fish. The level of underwater noise from operating wind turbines and the associated impact on the fish fauna has not proved to be significant or negative on the basis of studies performed on the basis of existing offshore wind farms. However, the EIA requires a more detailed analysis of the effects of underwater noise. The electromagnetic field around the cable during the operation of the submarine cable and its possible effects also need to be analyzed. In the case of an unfavorable technical solution, some effect of slowing down fish migration has been observed. Effective technical solutions (shielding/burial) are available to prevent impacts. Impacts during construction and operation can be avoided and significantly reduced by implementing appropriate measures. The most universal primary measure is to select the location of the proposed wind farm in a place causing the least possible extent of disruption; this task has been solved in the framework of the preparation of the National Maritime Spatial Plan - the SWE offshore wind farm is located in an area suitable for the development of offshore wind farms (as a result of a multi-criteria analysis, which also takes into account fish fauna and fisheries). Examples of technical and operational techniques are the adaptation of the construction period to the spawning of fish, the use of noise abatement measures when laying foundations (e.g., avoiding ramming or using silencing devices during ramming), dredging submarine cables into seabed sediments, etc. The occurrence, magnitude, and extent of impacts and appropriate mitigation measures will be developed during the further EIA process and recorded in the EIA report. It is expected that the impact area will be limited to the area directly covered by the offshore wind farm and its immediate vicinity in the marine area west of Saaremaa. Due to the possible spread of electromagnetic radiation, cable-laying corridors to be installed on the seabed may also be affected; moreover, cable corridors have a potential impact during construction. These impacts are analyzed during the EIA.	Expert assessment based on previous studies, scientific literature, and studies performed during this EIA. A survey of fish fauna and spawning grounds will be carried out. A study will be carried out on the possible impact of the wind farm and submarine cable electromagnetic fields on fish fauna. The EIA also includes an assessment of the underwater noise level in the existing situation and an assessment of the underwater noise level in both the construction and operation phases of the wind farm.

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1.6 Impact on birds	Different aspects of birds are related to the sea: hatchery birds (species that feed and raise their young at sea), staging places for migratory and wintering birds at sea, and overflights of migratory birds above the sea. The Estonian marine area exceeds to a significant extent the total population of some species, and the construction of high artificial objects in the sea can be a significant obstacle to migration and also cause the direct death of birds. Bird staging areas and overflight are closely related - in the vicinity of the staging areas, the density of flying birds is also higher due to birds descending and taking off. Spring migration of waterfowl begins in late February and ends in early June. The primary migration direction for most species is predominantly NE; the actual flight direction varies between NW…N…NE…E, depending on the terrain and wind direction. The autumn migration of most waterfowl begins in mid-August and lasts until winter (December), with some waterfowl remaining wintering in our seas. The primary migration direction is SW, and the actual flight direction varies in directions W…SW…SSW…S. The following general principles of bird migration are relevant for assessing the impact of offshore wind farms: Depending on the species, the time of day, and the weather conditions, migration, even in the same place, can take place at different altitudes. Much of the night migration, as well as a large part of the day migration in favorable weather conditions (no precipitation, clear or light clouds, and light to moderate tailwinds), takes place at high altitudes and may not be visually recorded. High migration often takes place on a broad front in the predominant so-called primary migration direction of the species and has little to do with the landscape below. In the case of low migration, birds prefer to fly above characteristic landscape characteristic to them (waterfowl above water bodies, terrestrial species above land). There, migration takes place predominantly on a broad front, while low migration is more concentrated on the directrix than high migration. Before leaving for landscapes not characteristic to them, birds often change direction, and there is a concentration of migratory birds and intensification of migratory flows along the directrix of such landscape. In Estonian conditions, the directrix on the sea is primarily the coast of the mainland and islands. When flying over terrain not characteristic to them, the flight altitude usually increases, and they try to cross the unfamiliar terrain by flying higher. Consequently, the most important possible negative impact is the impact on waterfowl migration, as they can migrate in masse at the low height (in the height zone of the wind turbines and thus in the area of direct impact). As part of the preparation of the Estonian Maritime Spatial Plan, two basic studies were carried out on sea-related birds and possible impacts: “Compilation of existing data on migration routes of birds in the Estonian marine area and compilation of map layers and analysis of the impact of wind farms on bird feeding areas” Estonian Ornithological Society 2016 and “Analysis of staging areas for birds” Estonian Ornithological Society 2019. As a result of extensive work, recommendations were made for the selection of offshore wind farm areas and areas that are not suitable for them. The wind farm proposed by SWE is outside the most sensitive areas for birds.	Expert judgment based on previous studies, scientific literature, and the study to be carried out during this EIA. A study of bird migration and feeding areas will be carried out.

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1.7 Impact on marine mammals (Gray seal and ringed seal).	The main aspect that may affect the habitats of seals in the development of offshore wind farms for the gray seal is the underwater noise, especially during construction. In the Estonian Maritime Spatial Plan (which did not cover the marine areas of Pärnu County and Hiiumaa), the majority of the areas defined for the development of wind energy are outside the marine areas important for seals (both gray seals and ringed seals). Seals may also be disturbed by the temporary change in seawater quality associated with the movement of marine sediments when laying wind turbine foundations and submarine cables. The amount of suspended solids generated depends on the geology of the seabed, the type of foundation used, and the technological process of installing the foundation and laying the submarine cable. According to current knowledge, the SWE offshore wind farm area is predominantly a limestone plateau with no or very thin surface cover, so little suspended solids can be expected. During the operational phase of an offshore wind farm, disturbance to seals may be due to regular shipping traffic used for maintenance. In particular, the risks associated with the breaking of sea ice by ships. For example, in the condition of limited ice cover, seals may congregate for breeding on shipping lanes maintained by icebreakers or on wind farms with stagnant ice as a habitat with suitable ice. Normally, suitable ice occurs in very large areas of the high seas, or seals breed on islands covered by the existing protection regime. The SWE offshore wind farm area is located in an essentially ice-free marine area. Even in harsh winters, ice is formed only for a short time (and is therefore relatively thin). Therefore, the maintenance of a SWE offshore wind farm does not require the use of an icebreaker, but the maintenance vessels used must be of an appropriate ice class. During the EIA, a further process will assess the potential impacts of the offshore wind farm on seals. It is expected that the impact area will be delimited directly by the area covered by the offshore wind farm and its immediate surroundings in the marine area west of Saaremaa. Impacts related to cable corridors can only occur during construction. The extent of these impacts will be analyzed during the preparation of the EIA report.	Expert judgment based on previous studies, scientific literature, and the study to be carried out during this EIA. A study on "Impacts on seals at the local level, including possible effects from ice-breaking" will be carried out.

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1.8 Impact on bats	The impact of an offshore wind farm on bats can occur if the offshore wind farm is located in a feeding area or on a migratory route of bats. During the preparation of the draft Estonian Maritime Spatial Plan, the best available scientific information was taken into account, and on the basis of it, suitable areas for the development of wind energy at sea were determined (incl. suitable areas taking into account the topic of bats). According to the draft Estonian Maritime Spatial Plan, the possible conflict between wind turbines and bats is mitigated by the fact that the wind turbines operate at higher wind speeds (average wind speed in the wind farm area over 9 m/s) when bats have low or no flight activity. Wind turbines start working at wind speeds of about 5 m/s and taking into account the migratory speed of bats (about 5-6 m/s), migration usually occurs in relatively quiet weather when the wind turbines do not work or operate at low speeds with little risk to bats. Also, the altitude of bats generally does not coincide with that of wind turbine blades. This fact is likely to significantly reduce the likelihood of death and significant adverse effects on bats. SWE offshore wind farm is located in an area where current impacts are not expected to have a significant negative impact on bats. Bats are not likely to feed so far out to sea. Migration of bats across the sea between Estonia and Sweden and between Estonia and Latvia is not expected to take place directly through the SWE offshore wind farm area. In the further EIA process, the potential impacts of the offshore wind farm on bats will be assessed.	Expert judgment based on previous studies, scientific literature, and the study to be carried out during this EIA. A study of bat migration and feeding areas will be carried out.
1.9 Impact on protected natural objects	According to the draft impact assessment report of the Estonian Maritime Spatial Plan (OÜ Hendrikson & Ko, 2020), the spatial layout of wind energy areas has been based on the location of protected areas, and the protected areas have been taken into account as an exclusionary factor in order to exclude direct impacts on protected nature areas (e.g., physical changes to the seabed (including habitat destruction) and changes in waves, water movement, etc.). However, wind energy areas identified in the Maritime Spatial Plan may have indirect effects on adjacent parts of the protected area (e.g., suspended solids, noise during construction, etc.). Therefore, the impacts of the wind farm on protected natural objects in the marine area are assessed. The Maritime Spatial Plan also determines the locations of the main cable connections in the offshore area of the proposed wind farms, which are directed outside the protected areas if possible. However, some basic cable corridors also pass through protected areas (see Chapter 3.3). As the more specific cable corridors of the proposed SWE wind farm will be established during the EIA preparation process, this list may be supplemented during the EIA process, and the potential impacts of the cable corridors will be assessed during the EIA preparation.	Analysis of map layers and expert assessment on the basis of previous studies, the Estonian Nature Information System (EELIS), inventories carried out, species protection action plans, scientific literature, and studies carried out in the course of this EIA.

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1.10 Impact on the Natura 2000 network	Most protected objects on the marine area are also internationally protected within the Natura 2000 network of nature and/or special protection area. Possible Natura 2000 network sites of community importance and special protection areas affected by the proposed wind farm or its cable corridors are presented in Chapter 5.1.6. Impacts on Natura sites are assessed separately in the relevant Natura assessment, which is prepared as a separate chapter of the EIA report.	Analysis of map layers and expert assessment on the basis of previous studies, the Estonian Nature Information System (EELIS), inventories carried out, species protection action plans, scientific literature, and studies carried out in the course of this EIA. Natura assessments are carried out for all protection purposes of the Natura 2000 site within the impact area (see Chapter 7 Natura Pre-Assessment). All studies carried out under this EIA will be used in the assessment.

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1.11 Impact on climate change	The impact of the Saare Wind Energy offshore wind farm on the climate is positive. The magnitude of the positive effect depends on the final realizable capacity of the offshore wind farm and the amount of electricity produced. About 1,400 kg of oil shale[44] (1 TWh = 1.4 million tons of oil shale) is needed to produce 1 MWh of electricity from oil shale, and the specific consumption of oil shale ash is 700 kg/MWh. The specific CO_2emissions issued for electricity in 2012 were 1211 t_{CO2}/GWh_e[45]. Based on the data provided by Eesti Energia in 2018, the specific CO_2emissions of the Auvere power plant are 0.946 kg CO_2/kWh, for the fluidized bed boilers of Eesti Elektrijaam 1.035 kg CO_2/kWh and for the units with dust combustion boilers 1.328 kg CO_2/kWh, on average 1.270 kg CO_2/kWh[46]. Considering the capacity of the SWE offshore wind farm to be at least 5.0 TWh per year, CO_2 emissions would be 4.7 million tonnes lower per year compared to oil shale electricity generation (taking into account the specific CO_2 emissions of the Auvere power plant Of course, the development of renewable energy will not lead to a one-to-one reduction in oil shale energy and the accompanying negative environmental impact. Due to the complexity of energy, the connections are not so simple. However, it is clear that the electricity produced by the SWE offshore wind farm is an important element in moving towards Estonia's climate neutrality. <u>Local climate</u>. The offshore wind farm has a local effect on the wind: speed, turbulence, direction, and mixing of air layers in the near-surface layer, but the effect fades away a few kilometers from the wind farm (7-9 km from the extreme wind turbine according to the Estonian Maritime Spatial Plan). Inside the wind farm, the wind speed does not decrease by more than 20% (except immediately behind the wind turbine impeller in the range of about 100 m, where the reduction is up to 50%). The change in wind characteristics in the wind farm is negligible at mean wind speeds of 0-4 m/s and at speeds above 12 m/s, with the greatest changes at speeds of 7-10 m/s (just behind the wind turbine impeller), but due to the required distance between the wind turbines (distance minimum> 4 impeller diameters, typically 6-8 impeller diameters), the wind speed inside the wind farm will not decrease to such an extent as to significantly affect the movement of air or the distribution and deposition of pollutants. Recovery of wind speed and other features takes place due to a general regional air pressure gradient and over a very limited area (a few kilometers) and time (a few to tens of minutes). An offshore wind farm, as an obstacle in water, can directly affect waves, currents, and mixing of water in their immediate vicinity. Depending on the location of the wind turbines and the size of the wind farm, these effects may extend to a certain distance from the wind farm areas. Based on previous studies, the impact of wind turbines on water flow and currents has been considered insignificant and local.	Expert assessment will be performed based on previous research, scientific journalism, specialist literature, and expert knowledge. The fundamental issues of climate change are not analyzed in this EIA. The official position of the European Union and thus also the Republic of Estonia is based on the existence of climate change, the need to reduce it and adapt to it. The strategic documents on renewable energy highlight the key role of offshore wind energy in transforming energy into a more climate-friendly/climate-neutral energy - i.e., the need for offshore wind farms is obvious. . In addition to offshore wind farms, high-capacity electricity connections and storage technologies between countries are needed. According to the decision to initiate the EIA, it is necessary to carry out a "Detailed Study of Wind Conditions, Waves and Ice Conditions" within the EIA, which will be an input to the assessment of local climate impacts.

44 ÅF-Consulting AS, 2016. "Study of the best available techniques for the energetic use of Estonian oil shale" < link >

45 Ministry of the Environment, 2015. „National Development Plan for the Use of Oil Shale 2016-2030" < link >

46 Hendrikson & Ko, 2018-2019. "Supplemented report on the strategic environmental assessment of the detailed plan of the oil plant area" < link >

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2. Impact on cultural heritage		
2.1 Impact on heritage sites, including wrecks	According to the database of Estonian Transport Administration, one wreck (id 1150; unnamed-91) remains in the SWE proposed offshore wind farm area. Based on the basic cable corridors of the wind energy development areas indicated in the draft Maritime Spatial Plan, several wrecks are located in the vicinity of Abruka Island west of Abruka island and in the marine area between Abruka and Kuressaare. The construction of an offshore wind farm can have a direct physical impact on wrecks: e.g., activities can endanger the wreck's survival or good condition. This is expected to be a minor impact. Impacts can occur through the blocking of access and the transfer of sediments to heritage conservation values. To mitigate the impact, the locations of the wind turbines must be chosen in such a way as to ensure the preservation of valuable shipwrecks and public access. The impact is directly related to the wind farm area. During the preparation of the EIA, the presence of underwater wrecks in the area covered by the superficies license application and in the area of possible cable corridors will be determined. It is expected that the impact area will be delimited directly by the area covered by the offshore wind farm and its immediate vicinity and by the proposed cable corridors, the exact locations of which will become clear during the preparation of the EIA. As the exact cable corridors of the wind farm's onshore connections are currently unknown, then the preparation of the EIA report analyzes the cultural heritage in the area of the land connections of the cable corridors and its possible impact in the area of possible cable corridors (incl. taking into account cultural monuments, cultural heritage objects, and other culturally important objects).	The assessment is based on the State Register of Cultural Monuments and the Hydrographic Database of the Estonian Maritime Administration. Expert assessment based on previous studies, scientific literature, and studies performed during this EIA: An underwater archaeological study will be carried out. The impact on cultural heritage will be assessed in the framework of the "Study of Social and Cultural Impacts, Including Impacts on Local Governments and Coastal Communities". In addition, an underwater archaeological study will be carried out.
2.2 Impact of historic underwater explosives	Regarding the known locations of historical underwater explosives and their identification, co-operation is established with the Ministry of Defense (incl. the Estonian Navy) during the EIA process. Based on the information collected, the potential impacts related to historical explosives will be assessed during the preparation of the EIA report, and, if necessary, additional studies will be carried out in the area covered by the superficies license application. The impact area is directly related to the wind farm area.	Co-operation will take place with the Estonian Ministry of Defense regarding the known locations of historical underwater explosives and their identification during the EIA. A study will be conducted.

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3. Social and economic environment, including impact on human health, well-being, and property.		
3.1 Impacts of noise (including infrasound and low frequency sound).	The impact on human health is expected to be insignificant, as the distance of the nearest wind turbines of the proposed wind farm to the coast of Saaremaa is at least 10 km, as a result of which neither the noise levels exceeding the limit values nor the noise levels within the limit value but causing disturbance to the nearest dwellings are foreseen. During the preparation of the EIA report, the generation and magnitude of underwater noise are assessed.	Expert assessment based on previous research, scientific literature. The impacts are described on the basis of the scientific literature and previous studies. Given the distance of the proposed wind farm from the coast, it is not necessary to model the noise level reaching the coast from the wind farm. An assessment of the underwater noise situation of the existing situation and an assessment of the underwater noise level during both the construction and operation phases of the wind farm will be performed. The results of the study will be used in impact assessments for marine life.
3.2 Visual impact	Large offshore wind turbines are also visible from a distance of 10 kilometers with good visibility in case of weather, which is why the visuality of the wind turbines extends to Saaremaa. It is not possible to build an offshore wind farm in such a way that the offshore wind farm is not visible in the sea view. Thus, there will be a change in the sea view. The magnitude of the visual impact depends on the physical size, location, spatial solution of the offshore wind farm (e.g., placement of wind turbines in rows, etc.), and technical solutions (e.g., the color of wind turbines and marking with lights). There is a visual impact, but it is not negative for all people. For many people, an offshore wind farm has a visually positive effect. Considering that the nearest wind turbine is at least 10 km away from Saaremaa, the area of influence of visual impacts can be limited to a distance of ~10…15 km.	In order to find out the visual impact more objectively and to create additional information, a visualization of the offshore wind farm is performed from different points onshore. An overview of previous research and (scientific) literature and static visualization of the viewing sectors from different land viewing points. Visualization is performed from different points on land.

NO IMPACT AREA (I.E., ENVIRONMENTAL ELEMENTS AFFECTED)	EXPECTED SIGNIFICANT IMPACTS (INCL. IMPACT AREA, SOURCES OF IMPACT)	IMPACT FORECASTING AND ASSESSMENT METHODS (INCLUDING THE NECESSARY STUDIES REQUIRED BY THE DECISION OF INITIATION)
3.3 Impact on economic development and employment, incl. fisheries	Employment - An offshore wind farm needs systematic scheduled maintenance and the ability to perform emergency maintenance. The wind farm maintenance center could be in Saaremaa, creating additional jobs in the high value-added sector. In co-operation with Estonian educational and research institutions (incl. Kuressaare Maritime Management Center), a large part of jobs could be a future opportunity for islanders as well. The service center also needs a port, which could be developed on the basis of an existing port (in addition to the existing function) and thus contribute to the development of the port. The maintenance of the wind farm has very high safety standards, which means, among other things, the ability to use very high-capacity rescue equipment. In developing maritime rescue capabilities, it makes sense to co-operate with existing maritime rescue capabilities (national and voluntary) and thus create better support for all those in need of help at sea. In all stages of offshore wind farm development (planning, construction, operation), it is possible to find useful cooperation solutions between Saaremaa companies and offshore wind farm developer/operator. Examples of areas of co-operation may be the use of ports of the area for maintenance work and partly during construction, the use of accommodation and catering services in both the construction and operation phases, and so on. Saaremaa also has the skill and ability to build the ships necessary for the operation of an offshore wind farm - it is not possible here to give a promise to order the corresponding vessels from Saaremaa, but such a potential exists. Fisheries - An offshore wind farm can have an impact on fish fauna and thus on fisheries both during the construction of an offshore wind farm and during its operation. Impacts during construction may occur during the installation of foundations and submarine cables through discharging suspended solids of marine sediments into the water column. Another effect of the construction of the wind farm on the fish biota is the increase of the underwater noise level during the construction - the noise is generated during the installation of foundations and submarine cables and by ship traffic. It is expected that the impact area will be delimited directly by the area covered by the offshore wind farm and its immediate vicinity west of Saaremaa. The impact on fisheries during the operation is mainly due to restrictions on vessel traffic in the area of the offshore wind farm. The more detailed nature of the restrictions will be developed during the preparation of further EIA, as well as with procedures separate from EIA (i.e., the superficies license procedure) and in cooperation with relevant authorities (e.g., the Maritime Administration) and stakeholders. The electromagnetic field around the cable during the operation of the submarine cable and its possible effects also need to be analyzed. In the case of an unfavorable technical solution, some effect of slowing down fish migration has been observed. Effective technical solutions (shielding/burial) are available to prevent impacts.	Expert assessment based on previous studies, scientific literature, and studies performed during this EIA. Impacts will be assessed in the framework of the “Study of Social and Cultural Impacts, Including Impacts on Local Governments and Coastal Communities”. The issue of fish stocks goes hand in hand with the effects on fish fauna. The impact on fisheries will be assessed in the framework of the “Study of Social and Cultural Impacts, Including Impacts on Local Governments and Coastal Communities”. In addition, the impact on fisheries is linked to the impacts on fish fauna, which are in turn being studied (see list 1 in this table).

NO IMPACT AREA (I.E., ENVIRONMENTAL ELEMENTS AFFECTED)	EXPECTED SIGNIFICANT IMPACTS (INCL. IMPACT AREA, SOURCES OF IMPACT)	IMPACT FORECASTING AND ASSESSMENT METHODS (INCLUDING THE NECESSARY STUDIES REQUIRED BY THE DECISION OF INITIATION)
3.4 Impact on local authorities and coastal communities, including tourism.	Tourism - An important part of Saaremaa's economy is the tourism sector. An offshore wind farm affects the tourism sector in many ways and can have both negative and positive impacts. The negative impact on tourism may occur if the offshore wind farm to be built would have such a significant negative visual impact that it would affect the visiting decisions of tourists coming to Saaremaa who appreciate the wind turbine free sea view and nature tourism. The number of such a very specific target group is expected to be very small, and in reality, no significant negative impact on the tourism industry can be expected. Also, the wind farm is visually visible only from the coast of Western Saaremaa and, therefore, cannot in any way affect tourism in other parts of Saaremaa. The expected area of impact is primarily the western part of Saaremaa municipality and the marine area to the west of Saaremaa.	The decision to initiate the EIA requires a "Study of Social and Cultural Impacts, Including Impacts on Local Governments and Coastal Communities" to be carried out as one study and to be prepared as an expert assessment. This study provides input for analyzing the impacts on the tourism sector.
4. Other relevant impacts		
4.1 Electricity supply and security of supply in Estonia and Saaremaa	The electricity produced in the offshore wind farm will be routed to the general electricity network (Elering 330 kV substation), which according to the current most likely solution, will take place at the connection point in Lihula or in the Kilingi-Nõmme area. If there is a technically reasonable solution and in order to improve the electricity supply of Saaremaa, it may be expedient to establish an electrical connection between the SWE substation and the Läätsa (or Sikassaare) substation even if the Sikassaare substation remains at 110 kV (i.e., not suitable for SWE connection to the transmission network). The idea of a so-called "weak connection" would be, if necessary (i.e., if the electricity system supplying Saaremaa needs additional capacity, but for some reason, it cannot be provided in the direction of transmission from the so-called conventional transmission from the mainland to the island of Muhu) to divert electricity from the SWE substation to the Läätsa (or Sikassaare) substation, which would essentially create alternative equipment and significantly increase the security of supply. Situations where a SWE-scale offshore wind farm does not produce electricity (e.g., due to low winds) to meet Saaremaa's consumption capacity, are very rare. Such a solution would significantly improve Saaremaa's electricity supply and security of supply and would have a very large positive impact on Saaremaa's economy (both existing companies and possible new investment decisions) and some positive impact on the quality of life of the population. The expected area of influence is the entire Saaremaa municipality, but more broadly, the whole of Estonia through the security of electricity supply.	Expert assessment based on previous studies, scientific literature, and studies performed during this EIA. The study "Preliminary socio-economic analysis to determine the need to assess and improve the quality of electricity" is carried out as part of an EIA as an expert opinion and with the involvement of stakeholders.

NO IMPACT AREA (I.E., ENVIRONMENTAL ELEMENTS AFFECTED)	EXPECTED SIGNIFICANT IMPACTS (INCL. IMPACT AREA, SOURCES OF IMPACT)	IMPACT FORECASTING AND ASSESSMENT METHODS (INCLUDING THE NECESSARY STUDIES REQUIRED BY THE DECISION OF INITIATION)
4.2 Impact on national defense and maritime communication systems (radar and communication systems), impact on navigation systems (incl. aviation safety and maritime security)	As the proposed wind turbines are high, they may interfere with the radar of the PBGB's maritime surveillance system and/or the radars of the Ministry of Defense, creating a so-called dark area behind the wind turbines. The marine area must be observable from at least one radar position of the maritime surveillance system. As part of the EIA, a study "Impact on Marine Monitoring and ESTER Communication Systems" will be carried out. The construction of a wind farm may also involve difficult monitoring of navigation in the area of the planned wind farm. The use of the wind farm may also have a small impact on aviation, and co-operation with the Civil Aviation Administration will be taken into account when considering this impact.	Cooperation with the Estonian Maritime Administration and the Civil Aviation Administration. Cooperation with the Ministry of Defense. Cooperation with the Ministry of the Interior. The assessment is based on professional literature, and expert opinion, and the studies carried out in the course of this EIA: study "Impact on the distinction between navigational signs and lights by watercrafts" and study on "Impact on maritime surveillance and ESTER communication systems".
4.3 **Cumulative impacts**	Cumulative impacts are the combined effects of one or more activities, which can be manifested by the accumulation of similar effects of several activities, where there may be many activities, and an important aspect is that the addition of activities results in a change[47]. Cumulative impacts may occur when spatial or temporal overlaps, repeated removal or inflow of resources, or landscape changes occur due to the plan (s) and its intended activities[48].	Expert assessment based on previous studies, scientific literature, and studies performed during this EIA.
4.4 Transboundary impact		Chapter 11.3 deals with cross-border information and international cooperation with other countries.

47 Hendrikson & Ko, 2018-2019. "Supplemented report on the strategic environmental assessment of the detailed plan of the oil plant area" < link >

48 Cooper, L. M. 2004. Guidelines for Cumulative Effects Assessment in SEA of Plans. EPMG Occasional Paper 04/LMC/CEA. imperial College London.

7. Natura pre-assesment

Natura 2000 is a Europe-wide network of protected areas which aims to ensure the conservation of rare or endangered birds, animals and plants and their habitats, or to restore, if necessary, the favorable status of threatened species and habitats across Europe. Natura 2000 sites of community importance and special protection areas have been designated pursuant to Council of Europe Directives 92/43 / EEC and 2009/147/EC.

Natura assessments are carried out as part of the EIA. The assessment of Natura is a process carried out in accordance with Article 6 (3) and (4) of the Habitats Directive 92/43/EEC. The assessment outlined in this work will be based on the following guidance documents: "Evaluation of plans and projects that have a significant impact on Natura 2000 sites. Methodological guidance for the interpretation of Article 6 (3) and (4) of the Habitats Directive" [49]; "Guidelines for carrying out Natura 2000 assessments in the implementation of Article 6 (3) of the Habitats Directive in Estonia" (KeMÜ, updated 2017) and „Wind energy developments and Natura 2000" (European Union, 2011)[50].

On the basis of the EIAEMSA and the Nature Conservation Act, the Natura assessment takes place within the framework of the environmental impact assessment procedure. Pursuant to § 3 (2) of the EIAEMSA, an environmental impact assessment is carried out where the activity is proposed whereby it cannot be precluded that the activity alone or in conjunction with other activities may potentially significantly and adversely affect the protection purposes of a Natura 2000 site. Upon Natura's assessment, it is important that the likely impact is assessed solely on the basis of the site's protection purposes. The impacts of the activity are considered unfavorable if, as a result of the implementation of the activity, the status of the protection purposes of the Natura 2000 site(s) deteriorates or if the protection purposes cannot be achieved as a result of the implementation of the activity.

The first stage of the Natura assessment is the ex-ante Natura assessment, which aims to predict the likely impacts of the proposed activity, as a result of which it can be decided whether and to what extent it is necessary to move to the appropriate (i.e., full) assessment stage. The appropriate assessment shall include a detailed assessment of the likely adverse impacts on the Natura site and shall propose mitigation measures if necessary.

At this stage of the EIA program, Natura pre-assessment will be carried out in part, as the locations of the cable connections of the proposed wind farm, both offshore and onshore, will be specified during the EIA process.

This ex-ante assessment will be based on the information available. Existing materials on the Natura 2000 network area and protection purposes are used (Natura area standard data form information; Environmental Register databases, etc.).

THE RELEVANCE OF THE PROPOSED ACTIVITY TO THE MANAGEMENT OF PROTECTION

The proposed activities are neither related nor necessary to the management of any Natura 2000 site and do not contribute directly or indirectly to the conservation objectives of the sites.

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49 https://www.envir.ee/sites/default/files/naturam6ju_est.pdf

50 https://ec.europa.eu/environment/nature/natura2000/management/docs/Wind_farms.pdf

INFORMATION ON THE PLANNED ACTIVITY

Saare Wind Energy OÜ is planning a wind power plant with a maximum of 100 wind turbines, i.e., an offshore wind farm with a capacity of up to 1,400 MW in the western coast of Saaremaa in the territorial sea and a transmission system until connected to the general electricity system (transmission network). The purpose, location (incl. map of the location of the activity, Figure 2-1), and a more detailed description of the proposed activity can be found in Chapter 2 of the EIA program.

CHARACTERIZATION OF THE NATURA SITES AFFECTED BY THE PROPOSED ACTIVITY

Natura 2000 network areas in the impact area of the proposed offshore wind farm Kura kurk Special Protection Area, Kaugatõma-Lõu Site of Community Importance and Special Protection Area, Riksu coastal Site of Community Importance and Special Protection Area, Karala-Pilguse Site of Community Importance and Special Protection Area, Vilsandi Site of Community Importance and Special Protection Area and Tagamõisa Site of Community Importance and Special Protection Area (see Figure 7- 1).

The Natura 2000 network areas connected to the cable corridor in the marine area near Saaremaa (which have not already been mentioned in connection with the Natura 2000 network areas in the vicinity of the wind farm) are the Site of Community Importance and Special Protection Area of Kasti Bay. The areas of the Natura 2000 network related to the offshore cable corridor in the direction of Virtsu-Lihula are the Väinameri Site of Community Importance and Special Protection Area.

Figure 7-1. Overview of Natura 2000 network areas in the impact area of the proposed wind farm and the proposed cable corridors (Basis: Land Board and EELIS, 2021)

According to the proposal of the Republic of Latvia submitted in the framework of cross-border cooperation, the Natura 2000 Special Protection Area belonging to the Natura 2000 network in the territory of Latvia (LV0900300; see Figure 7-2) is also considered in the Natura assessment.

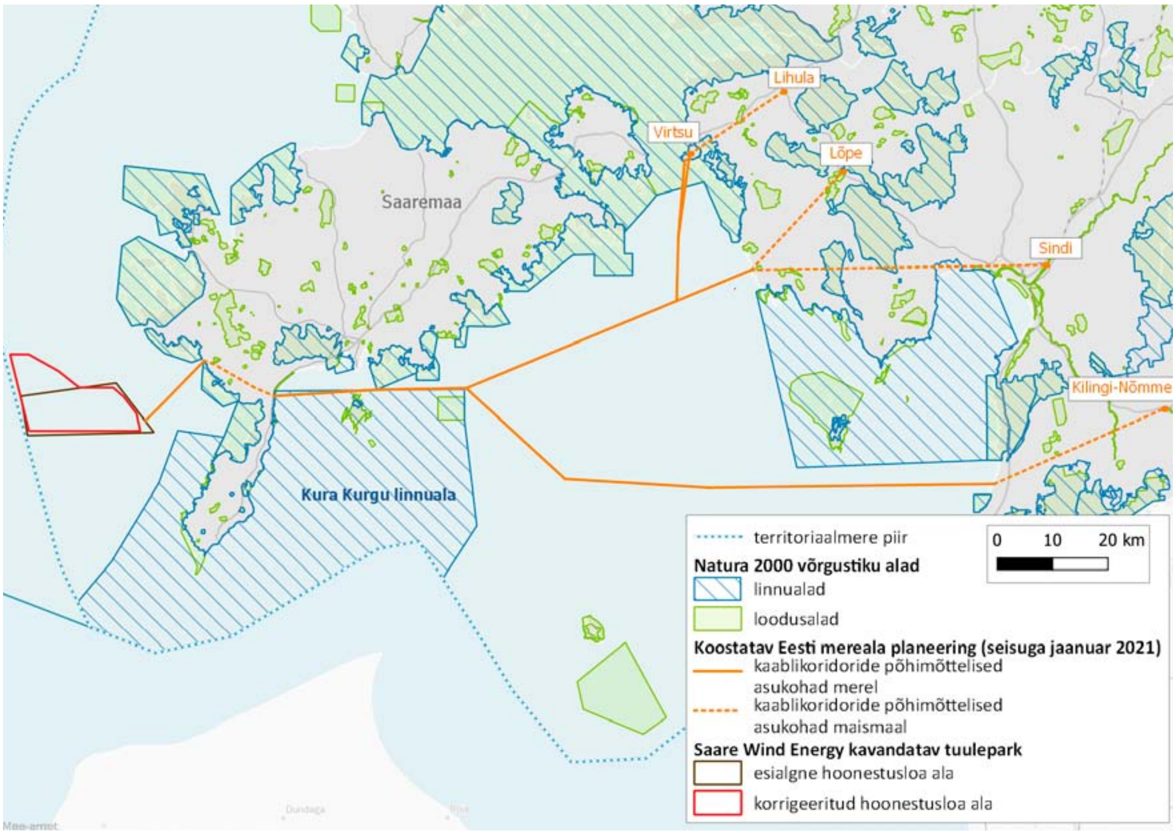

FIGURE 7-2. LOCATION OF IRBES SAURUMS SPECIAL PROTECTION AREA IN LATVIA[51]

51 Natura 2000 Network Viewer, European Environment Agency < link >, 10.11.2020

A more detailed description of the sites with a forecast of the expected impact for the protection purposes of Natura 2000 sites is provided in Table 7-1.

In the case of onshore connections, these are very initial basic cable solutions, which show a direct connection to the possible network connection points. Descriptions of Natura 2000 sites within the onshore cable connection area and/or its impact area shall be submitted together with the Natura assessment as part of the EIA report.

ASSESSMENT OF LIKELY ADVERSE EFFECTS ON THE INTEGRITY OF NATURA SITES AND ACHIEVEMENT OF CONSERVATION OBJECTIVES

Table 7.2 below presents the protection purpose of Natura sites and an estimate of the expected impact on them.

NATURA 2000 SITES	IDENTIFICATION OF IMPACTS	RESULTS OF THE NATURA PRE-ASSESSMENT
Kura kurgu SPA **Kaugatoma-Lõu SPA** **Riksu ranniku SPA** **Karala-Pilguse SPA** **Vilsandi SPA** **Tagamõisa SPA**	The proposed offshore wind farm area does not remain in the Natura 2000 Special Protection Area, and therefore there are no direct physical impacts on the site's protection purposes. However, given the mobile lifestyle of birds (e.g., migration), adverse impacts (obstacles/deaths during migration, etc.) on special protection areas, their coherence and birds can, in some cases, also occur in case of wind turbines planned outside Natura sites. The construction of a wind farm, as well as cable connections close to a Natura Special Protection Area in some cases, also have temporary/indirect impacts, such as temporary impacts during construction on the protection purposes of the Special Protection Area (suspended solids, noise disturbances during construction, etc.). This is likely to have a temporary and insignificant impact on the Special Protection Area, and the habitat conditions of the bird species to be protected will not change. Significant disturbances are unlikely to reach the Special Protection Area, and the likelihood of suspended solids from construction work carrying over into the area is negligible, and the potential impact will be negligible if technological precautions are taken. The only possible impact factor is the impacts of migration on bird species that are the protection purpose of the special protection area, which cannot be ruled out at this stage of the Natura pre-assessment.	An appropriate Natura assessment will be carried out during the EIA.

NATURA 2000 SITES	IDENTIFICATION OF IMPACTS	RESULTS OF THE NATURA PRE-ASSESSMENT
Kaugatoma-Lõu SCI **Riksu ranniku SCI** **Karala-Pilguse SCI** **Tagamõisa SCI**	The proposed offshore wind farm area and the submarine cable corridor provided for in the maritime spatial plan do not overlap with the Natura nature area and the protection purposes protected there, which excludes direct physical impacts on the nature area and the protection purposes of this area. Temporary/indirect impacts may also occur in the construction of cable connections planned close to the nature area and/or on the nature area, e.g., temporary impact during construction on the protection objectives of the nature area (suspended solids, etc.). These are likely to be temporary and insignificant impacts on nature.	An additional Natura pre-assessment will be carried out as part of the EIA report. If it becomes apparent that the site's protection purposes are likely to be adversely affected, an appropriate assessment will be continued.
Vilsandi SCI	The proposed offshore wind farm area and the submarine cable corridor provided for in the maritime spatial plan do not overlap with the Natura nature area and the protection purposes protected there, which excludes direct physical impacts on the nature area and the protection purposes of this area. Due to the long-distance, indirect impacts on the Vilsandi nature area are unlikely.	An additional Natura pre-assessment will be carried out as part of the EIA report. If it becomes apparent that the site's protection purposes are likely to be adversely affected, an appropriate assessment will be continued.
Kasti lahe SCI **Väinamere SCI**	The submarine cable corridor provided for in the maritime spatial plan do not overlap with the Natura nature area and the protection purposes protected there, which excludes direct physical impacts on the nature area and the protection purposes of this area. Temporary/indirect impacts may also occur in the construction of cable connections planned close to the nature area and/or on the nature area, e.g., temporary impact during construction on the protection objectives of the nature area (suspended solids, etc.). These are likely to be temporary and insignificant impacts on nature.	An additional Natura pre-assessment will be carried out as part of the EIA report. If it becomes apparent that the site's protection purposes are likely to be adversely affected, an appropriate assessment will be continued.

NATURA 2000 SITES	IDENTIFICATION OF IMPACTS	RESULTS OF THE NATURA PRE-ASSESSMENT
Kasti lahe SPA **Väinamere SPA**	The proposed offshore wind farm area does not fall within the Natura 2000 Special Protection area. Due to the long-distance, no significant adverse impacts on the protection purposes of the Special Conservation Area are likely. The construction of planned submarine cable connections to the Natura Special Protection Area near the Special Protection Area may, in some cases, also have temporary/indirect impacts, e.g., temporary impacts during construction on the protection purposes of the special protection area (suspended solids, noise disturbances during construction, etc.). This is likely to have a temporary and insignificant impact on the Special Protection Area, and the habitat conditions of the bird species to be protected will not change. Significant disturbances are unlikely to reach the Special Protection Area, and the likelihood of suspended solids from construction work carrying over into the area is negligible, and the potential impact will be temporary and insignificant if technological precautions are taken.	An additional Natura pre-assessment will be carried out as part of the EIA report. If it becomes apparent that the site's protection purposes are likely to be adversely affected, an appropriate assessment will be continued.
Irbes saurums SPA	The proposed offshore wind farm area does not fall within the Natura 2000 Special Protection area. Due to the long-distance, no significant adverse impacts on the protection purposes of the Special Conservation Area are likely. The construction of a wind farm close to a Natura Special Protection Area in some cases, also have temporary/indirect impacts, such as temporary impacts during construction on the protection purposes of the Special Protection Area (suspended solids, noise disturbances during construction, etc.). This is likely to have a temporary and insignificant impact on the Special Protection Area, and the habitat conditions of the bird species to be protected will not change. Significant disturbances are unlikely to reach the Special Protection Area, and the likelihood of suspended solids from construction work carrying over into the area is negligible, and the potential impact will be negligible if technological precautions are taken.	An additional Natura pre-assessment will be carried out as part of the EIA report. If it becomes apparent that the site's protection purposes are likely to be adversely affected, an appropriate assessment will be continued.

Results and conclusion of the Natura pre-assessment

The technical solution of the offshore wind farm will be specified in the further EIA process and technical design in cooperation with experts in the respective field. The aim is to build an offshore wind farm and associated infrastructure in such a way that it does not adversely impact the achievement of the protection purposes of Natura sites.

8. Description of the assessment methodology and studies to be carried out

In carrying out this EIA, the results of previous environmental monitoring, studies, assessments, and reference materials of similar situations found in the (scientific) literature are taken into account and used. Previous survey results are an important input for the preparation of this EIA report.

8.1. The assessment methodology

In assessing the environmental impact and compiling the report, the expert group shall proceed from the valid Environmental Impact Assessment and Environmental Management System Act (SG I 2005, 15, 87) and its implementing acts and shall follow the good practice of environmental impact assessment. When carrying out an EIA, the applicable environmental legislation and the restrictions provided therein are taken into account.

Environmental impact assessment is a public process. All stakeholders who feel that their interests may be affected by the proposed activity can intervene in the EIA process and submit reasoned recommendations, suggestions, and comments, at least during the publication of the environmental impact assessment program, the assessment process, and the publication of the report. Suggestions, objections, and questions can be addressed to the decision-maker, the developer, and the environmental impact assessor.

The environmental impact assessment process is divided into two phases: the preparation of the environmental impact assessment program and the conduct of the environmental impact assessment and the preparation of the report. The process steps and expected schedule arising from the Environmental Management System Act are presented in Chapter 9.

THE ENVIRONMENTAL IMPACT ASSESSMENT PROGRAM (this document) is a plan for how an environmental impact assessment is planned, including the expected areas of impact, a timetable for implementation, and a communication plan with the various parties involved in the impact assessment process.

THE EIA REPORT is the final document summarizing the entire process. In compiling the report, the requirements of the Environmental Management System Act and the decision to initiate the EIA are taken into account, as well as the environmental issues of the documents related to the offshore wind farm as a complete object (i.e., permits required for onshore facilities/structures, etc.).

The impact assessment is based on the principle that changes in the environment that result from the implementation of the proposed activity must be assessed. To do this, it is important to know the consequences (aspects) of the activity that may lead to changes in the environmental elements.

The spatial extent of the environmental impact is assessed not only in the area of the proposed activity but also in the surrounding area - and it is assessed in terms of different impacts to a different spatial extent, where the specific impact can be considered significant.

The environmental impact assessment also covers the activities required on land (at a more general level), in the course of which the principal locations of the activities taking place on land are identified. Since, based on §27 of the Planning Act, a national designated spatial plan and its strategic environmental impact assessment must be initiated when planning a high-voltage line starting from 110 kilovolts, the detailed impacts of terrestrial cable corridors will be assessed within the framework of the national designated spatial plan. Underground cables (i.e., high voltage lines/overhead lines that do not require special planning) are used at least in part on land, and substations may be necessary. Therefore, the need for design conditions and detailed plans for these objects (incl. environmental impact assessment and strategic environmental assessment) will be specified.

Where possible and appropriate, this environmental impact assessment will also be carried out, with an appropriate degree of precision, for proposed land-based activities. This avoids essentially unnecessary duplication of the same procedures, which requires unnecessarily burdensome administrative arrangements.

Compilation of EIA is guided by various and relevant sources, including:

- "Environmental Impact Assessment. Handbook"(Tõnis Põder, 2017);
- "Guidelines for the conduct of environmental impact assessment procedures" (Ministry of the Environment, September 2007).

Environmental impact assessment uses both quantitative and qualitative (comparative) analytical methods, according to which activities and mitigation measures are analyzed by different environmental elements (for example, compliance with a specific standard). If there are no objectives or indicators for the environmental elements, only subjective experiential (opinions of EIA expert group members, expert assessments) as well as objective assessment (results of studies, etc.) are used. The environmental impact assessment is based on the principle that changes in the environment that accompany the implementation of the proposed activity must be assessed. To this end, it is important to point out the consequences (aspects) of the activity, which may lead to changes in the environmental elements.

The EIA methodology consists of comparing the predicted environmental impacts of the proposed activity (incl. alternative solutions) with the limit values established in legislation and providing recommendations for the implementation of the optimal or best option. The EIA report is expected to use at least the Land Board's map applications and EELIS (Estonian Nature Information System - Environmental Register: Environmental Agency) data, professional literature, previously collected research data, analogies, strategic documents, and legislation of the Republic of Estonia, as well as other available (relevant) information that allows ensuring the adequacy of the conclusions. Various and relevant authorities, organizations, and individuals will be consulted. As part of the EIA, additional studies will be carried out, expert opinions will be prepared, and modeling will be performed, which is described in more detail in Chapter 8.2. The methods used to predict the impacts of each impact area (environmental element) are described in Table 6.1.

Natura assessments are carried out within the framework of the EIA, and this EIA work is based mainly on the guidelines "Guidelines for conducting Natura assessments in the implementation of Article 6 (3) of the Habitats Directive in Estonia". The Natura assessment process and the methodology used are described in more detail in Chapter 7.

8.2. Studies to be carried out

The EIA decision initiated by the Government of the Republic on 28.05.2020 (Annex 1) prescribes several studies/ topics. This EIA program takes full account of the list of studies provided for in the opening decision and has supplemented and specified the methodology and scope of the studies. The conduct of studies and the treatment of raised issues may also take place in the framework of other projects or activities (e.g., integration with other development projects, research programs, national monitoring, etc.) and as an integrated part of the EIA (i.e., not as a separate study). In carrying out different research, a collaboration between researchers and research groups takes place in order to create interdisciplinary added value and achieve the highest quality research results.

The following is a list of ongoing studies and topics that need to be addressed in more detail.

- Study of social and cultural Impacts;
- Electricity quality analysis;
- Visualization from different points on land;
- Analysis of the impact on marine surveillance and ESTER[52] communication systems;
- Determining the probability of the presence of historical explosives and other dangerous objects;
- Navigation risk analysis;
- A study specifying bathymetry around structures and cable lines;
- Underwater archaeological research;
- Seabed construction geological survey;
- Detailed study of wind, wave, and ice conditions;
- Seawater quality surveys in the wind farm area and in the marine area likely to be affected by construction activities and description of plankton assemblages;
- Seabed biota - the identification of qualitative and quantitative parameters of benthic flora and fauna in a development area and a potentially affected area;
- Study of fish fauna and spawning grounds;
- Study on the possible impact of the wind farm and submarine cable electromagnetic fields on fish fauna;
- Study of bird migration and feeding areas;
- Study of bat migration and feeding areas;
- Impacts on seals at the local level, including possible impacts from ice-breaking, and identification of necessary mitigation environmental measures for the impact of wind farms and cable connections on fisheries;
- Modeling of the spread of suspended solids and sediments;
- Modeling of the spread of a possible oil slick;
- Study of underwater noise.

52 The operational radio communication network service ESTER (ESTER service) is an electronic communication service that enables making and receiving intra-network group and individual calls and sending and receiving messages between user terminals at an unspecified location and time in the territory of the Republic of Estonia.

9. Environmental impact assessment process and schedule

Pursuant to § 56 (12) of the EIAEMSA, the wording of the Environmental Impact Assessment and Environmental Management System Act in force at the time of submission of an application for development consent applies to the application submitted before 13.07.2017 whereby no decision has been made on the initiation or refusal to initiate environmental impact assessment. Thus, in the case of procedures, the wording of the EIAEMSA valid at the time of submitting the application for a superficies license (09.04.2015) is used, and accordingly, this EIA is based on the stages of this version and the time requirements set therein (see Table 9-1).

It is difficult to record the exact time course of the EIA process during the preparation of the EIA program. Therefore the time schedule must be considered as the approximate time of the activities. Detailed information on public involvement events and the exact time of the public consultation of the EIA report shall be provided pursuant to the procedure prescribed by law. The stages of conducting EIA are presented in the table below.

Table 9-1. Stages and expected schedule of EIA

EIA STAGE	ACTION TO BE TAKEN	EXPECTED COMPLETION DATE
Submission of an application for an activity license		09.04.2015.
Initiation of the EIA		28.05.2020.
Preparation of the EIA program	Preparation of the program	June 2020 - January 2021
	Translation of the EIA program summary for cross-border proceedings and replies to Latvia, Lithuania, and Sweden	January - February 2021
	The Developer shall submit translations of the EIA program and summaries of the EIA program to the Decision Maker	March 2021
Cross - border cooperation	Transmission of the summary of the EIA program to Latvia, Lithuania, and Sweden by the Ministry of the Environment	March 2021

EIA STAGE	ACTION TO BE TAKEN	EXPECTED COMPLETION DATE
Monitoring the EIA program and informing the public of the consultation	Notification of the public consultation within 14 days of receipt of the program	March 2021
	The duration of the public display 28 days	March - April 2021
	Public consultation on the EIA program	April 2021
Cross - border cooperation	Receiving cross-border comments on the EIA program	May 2021
Supplementing the EIA program	Inclusion of proposals made in the public consultation and justification for taking them into account/ not taking them into account, responding to the proposals in writing within 30 days at the latest.	May 2021
	Supplementing the EIA program based on cross-border comments	May - June 2021
	Submission of the EIA program for compliance check (approval)	June 2021
Verification of the compliance of the EIA program and the decision to declare the program compliant (approval of the EIA program*)	Compliance check of the EIA program within 30 days	June 2021
	Decision of approving the program	July 2021
	Notification of the decision (within 14 days)	July 2021
Preparation of the EIA report	Preparation of the EIA report, including the performance of necessary studies	February 2021 - August 2022
	Translation of the extended summary of the EIA report for cross-border proceedings	September - October 2022
	The Developer shall submit the translations of the EIA report and the summaries of the EIA report to the Decision Maker	October 2022
Cross - border cooperation	Transmission of the extended summary of the EIA report to Latvia, Lithuania, and Sweden by the Ministry of the Environment	November 2022
	Public consultation on the EIA report in Latvia - in parallel with the public display in Estonia	November 2022
Public display and public consultation	Notification of the public consultation within 14 days	November 2022
	The duration of the public display 28 days	November 2022
	Public consultation on the EIA report	December 2022

EIA STAGE	ACTION TO BE TAKEN	EXPECTED COMPLETION DATE
Cross - border cooperation	Public consultation on the EIA report in Latvia	December 2022
	Receiving cross-border comments on the EIA report	January 2023
Supplementing the EIA report	Inclusion of proposals made in the public consultation and justification for taking them into account/ not taking them into account, responding to the proposals in writing within 30 days at the latest.	February 2023
	Supplementing the EIA report based on the consideration of the proposals	March 2023
	Submission of the report to the Decision Maker for compliance check	March 2023
Verification of compliance with the requirements of the EIA report	If necessary, return of the EIA report by the Decision Maker for supplementation.	April 2023
	If necessary, based on the proposals of the Decision Maker	May 2023
Approval of the EIA report	Decision of approval of the EIA report	June 2023
	Notification of the decision	June 2023

10. EIA parties and composition of the expert group

According to the Environmental Impact Assessment and Environmental Management System Act, the parties to the EIA process are the developer, expert, decision-maker (Table 10-1).

TABLE 10-1. EIA PARTIES

DECISION MAKER:	DEVELOPER:	EIA SUPERVISOR [53]:	THE ENVIRONMENTAL IMPACT ASSESSOR :
Consumer Protection and Technical Regulatory Authority Endla 10a, 10142 Tallinn	Saare Wind Energy OÜ[54] Tartu mnt 24-20, Tallinn 10115	Ministry of the Environment Narva maantee 7a, Tallinn 15172	Roheplaan OÜ Koidu 20, Tallinna 10316
Contact person: Liis Piper T: +372 667 2151 e-mail: liis.piper@ttja.ee	Contact person: Kuido Kartau T: +372 527 3671 e-mail: kuido@swe.ee	Contact person: Rainer Persidski T: 626 2973 e-mail: keskkonna-ministeerium@envir.ee; rainer.persidski@envir.ee	Contact person: Riin Kutsar e-mail: riin@roheplaan.ee

The environmental impact assessment is performed under the guidance of Riin Kutsar (license no. KMH0131), an EIA expert licensed by the environmental consulting company Roheplaan **OÜ. The expert group shall include at least the members listed in Table 10-2.**

53 As this EIA is prepared in accordance with the wording of the Environmental Impact Assessment and Environmental Management System Act valid at the time of submission of the application (09.04.2015) (SG I, 13.03.2014, 32; validity period 22.03.2014 – 30.06.2015), the EIA supervisor is the Ministry of the Environment (the Environmental Impact Assessment and Environmental Management System Act SG I, 13.03.2014, 32 §10 (1).

54 Saare Wind Energy is a company established in 2014 to develop a specific offshore wind farm. The company currently has three shareholders: Gottlieb OÜ (Veiko Väli), Kirsimäe OÜ (Kuido Kartau), and the Dutch company Van Oord Renewable Finance III BVWind.

TABLE 10-2. MEMBERS OF THE EIA EXPERT GROUP.

MEMBER OF THE WORKING GROUP	AREA OF RESPONSIBILITY	COMPETENCE OF THE EXPERT
Riin Kutsar	EIA leading expert (EIA license KMH01331) Process and team management, impact on the natural environment, Natura assessment.	Roheplaan OÜ, MSc, UT Environmental Technology.
Alar Noorvee	EIA leading expert (till January 2021) Impact on seawater quality, socio-economic environment (impact on human well-being, health, and property), impact on climate, cultural environment, including cultural heritage	Alranel OÜ, EIA expert (EIA program stage), Ph.D., UT Environmental Technology.
Veiko Kärbla	Visualization of wind turbines, visual impacts	Hendrikson&Ko, BSc, University of Tartu, Faculty of Physics and Chemistry, Environmental Technology
Kaile Eshbaum	Environmental specialist; zoologist. Impact on marine life, protected natural objects, Natura assessment. Cartographer.	Hendrikson&Ko OÜ, MSc, UT Biology
Georg Martin	Impact on benthic flora, benthic fauna, seawater quality, impact on plankton communities	Ph.D., University of Tartu, marine biology.
Redik Eschbaum	Impact on fish fauna and fisheries, including spawning grounds	MSc, University of Tartu, ichthyology, and fisheries
Markus Vetemaa	Impact on fish fauna and fisheries, including spawning grounds	Ph.D., University of Tartu, ichthyology, and fisheries
Leho Luigujõe	Effects on birds	Estonian Ornithological Society MSc, University of Tartu, Zoology and Animal Ecology
Lauri Lutsar	Impact on bats	Estonian Fund for Nature MSc, University of Tartu, Zoology
Mart Jüssi	Impact on seals	MTÜ Pro Mare Ph.D., University of Tartu, Zoology and Animal Ecology
Ivar Jüssi	Impact on seals	MTÜ Pro Mare MSc, University of Tartu Biology
Aleksander Klauson	Underwater noise	Ph.D., Tallinn University of Technology, Faculty of Civil Engineering, Institute of Mechanics, Chair of Technical Mechanics.
Taavi Liblik	Impact on hydrodynamics, waves, wind conditions, spread of suspended solids, ice risks, forecast of the spread of a possible oil slick	Ph.D., Tallinn University of Technology, specialty of marine physics.

MEMBER OF THE WORKING GROUP	AREA OF RESPONSIBILITY	COMPETENCE OF THE EXPERT
Igor Tuuling	Impact on seabed sediments, seabed geology,	Ph.D., Stockholm University, Geology and the Institute of Geochemistry of the Belarusian Academy of Sciences, Minsk.
Raimo Pirksaar	Electricity quality survey	MSc, Tallinn University of Technology, Electrical Engineering
To be specified	Navigation risks, including accidents and the navigation requirements of the Republic of Latvia	Estonian Maritime Academy
To be specified	Expert on social and economic impacts	

If necessary, additional experts/specialists will be involved in the work of the EIA process.

11. Overview of the organization and involvement of the impact assessment

11.1. Organization of impact assessment

11.2. Cooperation and inclusion

Not translated.

11.3. Transboundary impact

Given the size and location of the proposed wind farm, this may be an activity that may have a transboundary impact, and a cross-border environmental impact assessment must be carried out. The transboundary environmental impact assessment will be carried out in accordance with the international agreements, the Convention on Environmental Impact Assessment in a Transboundary Context (Espoo Convention), and the Environmental Impact Assessment and Environmental Management System Act. The process and involvement of the transboundary impact assessment are managed by the Ministry of the Environment.

In a letter sent on 05.06.2020, the Consumer Protection and Technical Regulatory requested the Ministry of the Environment to inform the expected affected countries about the project of Saare Wind Energy OÜ to build an offshore wind farm on the west coast of Saaremaa.

On 09.07.2020, the Ministry of the Environment sent a notice initiating the transboundary EIA process to Sweden, Finland, Latvia, and Lithuania.

Responses received (August-September 2020): Sweden, Latvia, and Lithuania want to participate in the EIA procedure, Finland does not. A summary of the feedback provided by neighboring countries to the EIA notification is provided in Table 11-2 and copies of the letters in Annex 2.

TABLE 11-2. FEEDBACK FROM NEIGHBORING COUNTRIES ON THE TRANSBOUNDARY ENVIRONMENTAL IMPACT ASSESSMENT TO THE EIA NOTIFICATION.

AN ISSUE THAT NEEDS ATTENTION	EIA RESPONSE (INITIAL)
LATVIA	
Navigation safety *and possible impact on the navigation (including air transport) Control and communication systems, other communication systems and devices*	Within the framework of the EIA, cooperation has already been and is being carried out with the Maritime Administration and the Ministry of the Interior. Cooperation is also being carried out with the Estonian Civil Aviation Administration. These authorities deal with shipping and air traffic in Estonian waters and on international territory in Estonia's area of responsibility. In the course of cooperation, possible negative effects are identified, and solutions are found to prevent and mitigate them. The impact of navigation systems, maritime communication systems, and aviation and maritime safety will be addressed as a separate issue in the EIA.
Possible impact on ***navigation regime****, impact on the accessibility of Latvian ports and the reserved navigation areas in the MSP of Latvia.* *Analyse … corridors of perspective* ***electricity cables*** *shown in MSP Latvia.*	The EIA assesses the impact on shipping traffic, including the impact on shipping traffic related to Latvian ports. Within the framework of the EIA, it is planned to conduct a study "Impact on the distinction of navigation signs or lights by watercrafts". In the course of the EIA, the possible additional connection of the electricity transmission system to the Latvian transmission network will also be considered, taking into account the Latvian MSP solution.
Intended ***security*** *and protection areas, planned/ potential facility service sites, fuel, and other facility supply and resource delivery routes.*	The respective areas and needs will be developed during the development of the wind farm in parallel with the EIA process. The topics are part of the EIA. Impact during construction Impact during operation
The ***danger area in the event of accident****, possible accident scenarios, their course, and planned countermeasures in the case of human search and rescue operations.*	The risk assessment is part of the EIA (but not in great detail). As part of the EIA, modeling of the spread of a possible oil slick due to accidents is performed. Detailed safety instructions are prepared for the construction and for the operating period. They depend in detail on the specific construction process and technical solution. The builder is the world's leading marine construction company Van Oord.

AN ISSUE THAT NEEDS ATTENTION	EIA RESPONSE (INITIAL)
Possible impact on the dynamics of ***sediment*** *flow and the regime of* ***current*** *flows.*	Various studies (seabed habitats, seabed geology, bathymetry, etc.) are carried out within the EIA, on the basis of which the dynamics of bottom sediments and the impact on sediment movement and coastal processes are assessed. Within the framework of the EIA, a study “Specifying study of wind conditions, waves and ice conditions” will be carried out, The impact on currents is also addressed in the EIA. Even more detailed studies (detailed construction geology at the location of each wind turbine) will be carried out in the design phase after the EIA.
Possible impact on ***underwater habitats, birds, and marine fauna****.*	Appropriate studies will be carried out as part of the EIA. The studies will be carried out by recognized Estonian professional experts/institutions. A survey of fish fauna and spawning grounds will be carried out. A study will be carried out to determine the qualitative and quantitative parameters of benthic flora and fauna in the development area and in the area potentially affected. A description of plankton communities will be performed. A study of bird migration and feeding areas will be carried out. A study of bat migration and feeding areas will be carried out. A study, “Impacts on seals at the local level, including possible effects from ice-breaking” will be carried out.
Possible impact on ***Natura 2000*** *“Irbes šaurums”*	Natura assessment is also part of the EIA. According to Latvia’s request, the impact on the **Irbes saurums special protection area** will also be assessed (SiteCode: LV0900300).
…. if Export Cable considered to “Kurzeme Ring”, please consult ***Latvian TSO****.*	Developer SWE will consult with the Latvian TSO.
LITHUANIA	
OWF may affect ***bird*** *species that overwinter in Lithuania and migrate through Estonian territorial waters. Possible impact on all wintering bird populations in the eastern Baltic.*	The EIA will include appropriate ornithological studies on the offshore wind farm (and reference area) and will assess, inter alia, the impact at the population level and the cumulative aspect.

AN ISSUE THAT NEEDS ATTENTION	EIA RESPONSE (INITIAL)
SWEDEN	
County administrative board of Gotland	
*Need to investigate how different species (**fish, birds, mammals**) that are protected in Swedish waters can be affected indirectly through loss or disturbances of growth/foraging areas. Cumulative effect.*	Appropriate studies will be carried out as part of the EIA. The studies will be carried out by recognized Estonian professional experts/institutions. A survey of fish fauna and spawning grounds will be carried out. A study will be carried out to determine the qualitative and quantitative parameters of benthic flora and fauna in the development area and in the area potentially affected. A description of plankton communities will be performed. A study of bird migration and feeding areas will be carried out. A study of bat migration and feeding areas will be carried out. A study, "Impacts on seals at the local level, including possible effects from ice-breaking," will be carried out. Cumulative impact assessment is a standard part of the EIA. This will be done to the required degree of accuracy.
Swedish Agency for Marine and Water Management	
Porpoises *Seabed* *Underwater noise*	A seal survey will be carried out; there are no porpoises in Estonian waters. (A study on "Impacts on seals at the local level, including possible effects from ice-breaking" will be carried out). A study will be carried out to determine the qualitative and quantitative parameters of benthic flora and fauna in the development area and in the area potentially affected. An assessment of the underwater noise level in the existing situation and an assessment of the underwater noise level during both the construction and operation phases of the wind farm will be performed. Addressing mitigation measures is a standard part of the EIA.

AN ISSUE THAT NEEDS ATTENTION	EIA RESPONSE (INITIAL)
Swedish Transport Administration	
Maritime traffic *route Almagrundet in the Stockholm archipelago and the Gulf of Riga. If maritime traffic is taken into consideration, STA has no further comments.*	Cooperation within the framework EIA has already been and is being performed with the Maritime Administration. The Maritime Administration (and the Ministry of the Interior) deals with the issue of shipping traffic in Estonian waters and in the international territory under Estonian responsibility. In the course of cooperation, possible negative effects are identified, and solutions are found to prevent and mitigate them. The impact on navigation systems, maritime communication systems, and aviation and maritime safety will be addressed as a separate issue in the EIA. Within the framework of the EIA, it is planned to conduct a study "Impact on the distinction of navigation signs or lights by watercrafts".
Bird Life Sverige	
Location of OWF in one of the most extensive routes for ***seabirds*** *in the whole of Eurasia. BLS encourages to contact the Estonian Ornithological Society for discussion.*	The EIA will include appropriate ornithological studies on the offshore wind farm (and reference area) and will assess, inter alia, the impact at the population level and the cumulative aspect. The study is carried out by the Estonian Ornithological Society.
FINLAND	
States that it will not participate in the EIA of the project.	-